

Manuscript Details

Manuscript number	JMPO_2017_761
Title	Do fisher associations really represent their members' needs and opinions? The case study of the octopus fishery in the Algarve (south Portugal)
Article type	Full Length Article

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

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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

1 **Abstract**

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3 particularly in small-scale fisheries (SSF). Within the overarching goal of improving fisheries
4 governance, fishers' participation is crucial. Yet, how can fishers participate in the decision-
5 making processes which affect their actions, and to what extent do fisher associations represent
6 their interests? These questions were tackled by means of an empirical case study in the "Tertúlia
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8 octopus fishery is managed top-down with sporadic participation of fishers. During the study
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21 governance.

Acknowledgements

The authors wish to thank all fishers who participated in the questionnaire survey, as well as fishers, representatives of fisher associations, and all stakeholders who took part in the workshops. MR would like to acknowledge the Portuguese National Foundation for Science and Technology (FCT) for funding (grant SFRH/BPD/116307/2016). CS would like to acknowledge the financial support of FCT through doctoral grant SFRH/BD/51274/2010. CP would like to acknowledge FCT/MEC national funds and FEDER co-funding, within the PT2020 partnership Agreement and Compete 2020, for the financial support to CESAM (Grant No. UID/AMB/50017/2013). CP and GJP would also like to acknowledge the financial support of Caixa Geral de Depósitos (Portugal) and the University of Aveiro. MHG would like to acknowledge the Portuguese National Foundation for Science and Technology for funding (grant SFRH/BPD/95556/2013) and the National Funds through FCT – Foundation for Science and Technology under the Project UID/AGR/00115/2013. Authors would like to acknowledge the DGRM for providing the data on the octopus fishery. This research was supported by the PROMAR Portuguese Programme under the Project Tertúlia do Polvo (31-03-01-FEP-200), and received funding from the European Commission's Horizon 2020 Research and Innovation Programme under Grant Agreement No. 634495 for the project Science, Technology, and Society Initiative to minimize Unwanted Catches in European Fisheries (MINOUW). This work also received national funds through FCT - Foundation for Science and Technology through project CCMAR/Multi/04326/2013. The funding sources played no part in the design, analysis, interpretation or writing-up of the study or in the decision to publish.

1 Do fisher associations really represent their members' needs and 2 opinions? The case study of the octopus fishery in the Algarve (south 3 Portugal)

6 1. Introduction

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

13 In fact, stakeholder participation has long been a part of the EU fisheries governance debate, as a
14 way to encourage inclusion of multiple perspectives in defining management goals [3]. The
15 involvement of stakeholders in the decision-making process is considered nowadays to be an
16 essential element of good governance [4-6] and is gaining momentum in the public agenda [7].
17 Including stakeholders in the decision-making process leads to the integration of local knowledge
18 [8], inclusion of different points of view and values [5], generation of trust and cooperation [5, 9-
19 12], reduction in the likelihood and gravity of conflict situations [4, 10], increasing likelihood of
20 compliance with rules and regulations, enhancing transparency in the fishery management
21 process, and promoting the legitimacy of policies and decisions [4, 5, 8, 9, 11].

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

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

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

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62 44 implement new management measures based on the opinions of fishers' representatives rather
63 45 than accounting for the opinions of the fishers themselves.

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65 46 The Portuguese octopus trap and pot fishery is managed at the national level, mostly through a
66 47 centralized top-down decision-making process, with sporadic participation of fishers, and is
67 48 characterized by a low level of compliance with rules and regulations [11]. The Algarve region
68 49 (south Portugal) was responsible for around 35% of the total national landings of octopus (which
69 50 amounted to 7,692 t in 2015) [20, 21]. Considering the overall importance of the Algarve octopus
70 51 trap and pot fishery in the region and the country, this fishery was selected as a case study to
71 52 implement a bottom-up participatory approach aimed at improving the fishery governance
72 53 system. The project, designated "Tertúlia do Polvo", included a multi-stakeholder participatory
73 54 process consisting of a series of workshops involving the octopus fishers' associations in the
74 55 Algarve, the public administration in charge of policy-making, and researchers [12, 20]. This
75 56 participatory process was the first step in analysing the possibility of implementing a management
76 57 system defined by the EU H2020 EcoFishMan Project as a Responsive Fisheries Management
77 58 System (RFMS) [7, 22, 23]. Although the process was widely advertised and open to all interested
78 59 individuals, fishers were represented by their associations rather than attending individually. This
79 60 participatory process resulted in a list of management actions, and assignment of priorities to
80 61 them, as suggested by representatives of the fisher associations [12].

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83 62 The objective of the present study is to identify the extent to which the results from the workshops
84 63 are aligned with the overall interests of the fishers. This question is relevant for several reasons.
85 64 On the one hand, participatory approaches are promoted with the premise that the decisions made
86 65 will be implemented with greater acceptance than if the decisions are made by a centralized public
87 66 authority [1, 14]. On the other hand, a multi-stakeholder approach implies negotiations, trade-offs
88 67 and the achievement of a compromise and, in the case of the Algarve octopus fishery, trade-offs
89 68 were made between social and economic and conservation and ecological objectives. Therefore,
90 69 the outcomes might not fully reflect the interests of all stakeholder groups, individual fishers or
91 70 associations. Since fishers are the actors who will need to comply with the new, improved
92 71 management actions, it is important to understand whether the compromises reached during the
93 72 workshops are all acceptable to fishers.

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96 73 To the best of our knowledge, only a few scientific studies have evaluated whether a participatory
97 74 decision-making approach to fisheries management is in accordance with the interests and
98 75 perspectives of the overall fishing community (e.g. de Vos and van Tatenhove [18] who studied
99 76 the Dutch industry, or Lleonart et al. [24] who studied the sand eel fishery of Catalonia). The
100 77 present analysis contributes with empirical data to the overall discussion regarding the importance
101 78 of the use of participatory decision-making in fisheries management. Furthermore, by providing
102 79 a step-by-step description of the approach we aim to contribute with an example of how
103 80 collaborative management can be implemented.

104 105 106 81 107 82 **2.Methodology**

108 109 83 **2.1 The case study: Algarve octopus fishery and management**

110
111 84 In Portugal, the *Octopus vulgaris* (from here on referred to as octopus) is targeted almost
112 85 exclusively by the licenced small-scale fishery (SSF: vessels employing static gears and <12m in
113 86 total length), which is a major component of the Portuguese fleet which, in 2015, employed 70%
114 87 of all fishers and accounted for 90% of registered vessels (12.9% of the total Gross Tonnage (GT)

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121 88 of fishing vessels, and 41.0% of the total fishing power (kW)) [21]. Octopus is fished throughout
122 89 the year and is the most important landed species in terms of value (35,823,000 euros in 2015),
123 90 and fourth most important fished species in terms of weight of landings (7,675 t in 2015), after
124 91 chub mackerel, horse mackerel and sardine [25]. The Portuguese octopus SSF is especially
125 92 important in the Algarve region (south of Portugal), where it provides employment and income
126 93 to many fishers [11]; in 2015, 1719 octopus fishers (or related activities) were employed in this
127 94 region (according to the Portuguese Government's Directorate General for Natural Resources,
128 95 Safety and Maritime Services; DGRM).

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131 96 Official data from DGRM indicates that the largest octopus SSF fleet is that of the Algarve (548
132 97 fishing vessels in 2014 and 570 in 2015), where octopus is the most important species in landings,
133 98 both in terms of quantity and value (1,995 t in 2015), regardless of the high variability in landings
134 99 registered in these years. Most of the octopus is caught using traps and pots, with only around
135 100 10% of landings attributed to bottom trawling [26].
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138 102 [FIGURE 1. ABOUT HERE]
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142 104 Octopus fisheries are not managed under the Common Fishery Policy (CFP), and each EU
143 105 Member State is responsible for managing its own fishery [11]. In Portugal, the legal framework
144 106 for this fishery is mainly defined by the regulatory decree n° 1102 - D/2000, and management is
145 107 carried out by DGRM, with scientific support provided by the Portuguese Institute for the Sea
146 108 and Atmosphere (IPMA) [11, 12].

147
148 109 There have been several attempts since the late 1990s to regulate the small-scale pot and trap
149 110 fishery fleet, with various legislative ordinances put in place (Table 1), driven mainly by fishers'
150 111 demands [11, 27]. This is still considered a top-down management process since consultation with
151 112 fishers is sporadic, not structured, and decision-making is centralized within public authorities.
152 113 Pita et al. [11] described this process, summarizing the existing regulations and technical
153 114 measures regarding gear design, bait used and the definition of a Minimum Landing Weight
154 115 (750g).

156 116 Although the involvement of fishers in the decision-making process is still limited, it has
157 117 increased over the last 15 years as they became more organized, forming associations. Belonging
158 118 to an association is not compulsory, and fishers can belong to one or more associations, usually
159 119 because of harbour/neighbourhood proximity and/or market agreements. Associations have
160 120 become increasingly professionalized (e.g. hiring trained administrative staff to deal with
161 121 bureaucratic problems experienced by the members, or to manage first sale auction markets), and
162 122 have developed a greater capacity to lobby and defend their interests [11]. Furthermore, the wide
163 123 year-to-year fluctuations in octopus landings have alarmed the fishing community, resulting in
164 124 increasing pressure from the associations on the public administration to act (even though this
165 125 fluctuation is probably mainly environmentally driven) [11]. Formal participation of fishers in the
166 126 decision-making process started in 2010 [11]. In this regard, the southern region of Portugal
167 127 played an important role in defining regulations at the national level, as most of the changes in
168 128 regulations were a direct result of pressure from Algarve octopus fishers on the fisheries
169 129 administration. In fact, of the 14 published octopus fishery regulations, eight were implemented
170 129 solely for the Algarve (Table 1).
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180 132 [TABLE 1. ABOUT HERE]
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183 134 The Portuguese trap and pot octopus fishery faces several important management and governance
184 135 challenges. These are mostly related with the excessive fishing effort due to the use of far more
185 136 gear than allowed by law, the landing of undersized octopus, unpredictable revenue generated by
186 137 the octopus fishery, and environmentally driven fluctuations in recruitment [11, 28]. Pita et al.
187 138 [11] also report other types of challenges connected with social interactions between
188 139 communities. The existence of 14 octopus fisher associations along the Algarve region [12]
189 140 indicates high organizational capacity, but also reflects lack of trust and cooperation among
190 141 associations [11] and highlights the challenges of putting forward any management measures
191 142 based on collaboration.

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194 143 **2.2. The collaborative methodological approach**

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196 144 The methodological approach in the present study included five phases (Figure 2). In the first
197 145 phase, management actions considered necessary to improve the current management of
198 146 this fishery were compiled. In the second phase the analysis and systematization of phase
199 147 1 outcomes was developed. Phase 2 outcomes were discussed during phase 3, which
200 148 corresponded to workshops based on participatory tools and skilled facilitation. In phase 4,
201 149 the overall fishery community was consulted to understand their reaction to what was
202 150 concluded during the phase 3 workshops. In the final phase a comparative analysis of the
203 151 results obtained during phase 3 and 4 was undertaken.

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207 153 [FIGURE 2. ABOUT HERE]
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210 155 The compilation of management actions considered to be useful for improving the management
211 156 of the octopus fishery in the Algarve region, collected in phase 1, was carried out through a
212 157 consultation process with fishers' representatives, researchers and authorities. An open-ended
213 158 questionnaire was designed to identify the most important management actions to
214 159 change/implement in the management of the octopus fishery in the Algarve. At this stage
215 160 stakeholders were identified using the research team's knowledge of the community; the
216 161 questionnaire was sent by email to every fishing association in the region, as well as to the public
217 162 administration with fisheries management responsibilities and to the research community
218 163 involved with the octopus fishery. All entities replied to the questionnaire by email or telephone
219 164 and a list of 51 management actions was compiled. Taking into consideration the large number
220 165 of actions identified and the overlap between some of those actions, Phase 2 consisted of a review
221 166 of all actions and a systematization of information, which resulted in the identification of 17
222 167 management measures (some comprising several actions). This process was validated by all
223 168 participants during Phase 3, which included seven workshops that took place from April 2014 to
224 169 April 2015. Each workshop aimed at discussing a subset of the 17 management measures,
225 170 so that all measures were discussed. Each workshop lasted for three hours and was
226 171 structured and led by a skilled facilitator. In each workshop, there were periods of
227 172 discussion in small groups, production of factsheets for summarizing the main points, and
228 173 a plenary session was held to present and discuss the conclusions of the small groups. All
229 174 sessions were video-recorded and transcribed. The number of workshops was determined
230 175 based on the final goal, which was to detail how the 17 management measures could be put
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176 into action and which ones were more consensual and relevant for the workshop
177 participants.

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

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

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

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

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

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

203 The analysis of the data collected by the questionnaire survey, related to the answers
204 regarding the importance given to the 17 management measures (further detailed in section
205 3.3), included the recoding of data to a three-point scale: agree (1 and 2 from the 5-point
206 scale), neutral (3) and disagree (4 and 5). This recoding improved the internal consistency
207 of the answers, tested afterwards using a reliability analysis [29, 30]. The analysis was
208 based on the calculation of a correlation using Cronbach's α [31] of 0.5, following the
209 assumptions of Hair et al. [32] and considering the data and the sample size [33]. This test
210 is needed to confirm the internal consistency required to apply Principal Component Analysis
211 (PCA). The PCA summarises the information content n original variables in a smaller number,
212 q , of derived variables, the principal components, which are linear combinations of the original
213 variables. In the present case PCA was undertaken to classify the 17 management measures
214 ranked by level of importance by the respondents of the questionnaire to a smaller number
215 of factors or components. Factor loadings $\geq |0.45|$ were considered for the classification.
216 Additionally, Pearson's chi-squared test (χ^2) was used to evaluate the independence of specific
217 answers considered relevant for further discussion.

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298 218 All statistical analysis was undertaken using the software IBM SPSS® Statistics, version 21.
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302 220 **3. Results and Discussion**

304 221 **3.1. Participants of the workshops**

305 222 Figure 3 shows the number of participants in each of the seven workshops. The average
306 223 participation was 20 persons, with a minimum of 11 and the maximum of 24.
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310 225 [FIGURE 3. ABOUT HERE]
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313 227 While a core group of representatives of the fishing industry participated in almost all
314 228 workshops, the number of participants varied between workshops, probably due to the wide
315 229 public dissemination, which may have led some participants to choose to attend a specific
316 230 workshop, according to their particular interests. As each workshop was independent, with
317 231 specific measures discussed, the variability in participation between sessions does not
318 232 influence the conclusions attained. When previously discussed issues were brought up, the
319 233 conclusions from previous sessions were presented and discussed, but on no occasion was
320 234 there any disagreement with the conclusions attained in the previous session(s).
322 235

324 236 **3.2. General descriptive statistics on the questionnaire results**

325 237 A total of 121 fishers was interviewed. A majority of the respondents were older than 40
326 238 years old (62.7%), with 21 to 40 years fishing experience (61.2%), married or co-habiting
327 239 (72.7%). Most fishers had a low formal education level, consistent with the findings of Pita
328 240 et al. [6] in Fuzeta (Algarve) and Tzanatos et al. [34] in Greece.

330 241 The majority of fishers interviewed belonged to at least one fisher association (71.1%) and
331 242 believed that they were properly represented by their organization (91.1%). With regard to
332 243 knowledge of the existence of the project “Tertúlia do Polvo”, only 33.9% knew about the
333 244 workshops.

335 245 A majority of fishers also indicated an interest in having a Management Plan (MP) for the octopus
336 246 Algarve fishery (71.9%), stating that this would improve their activity by providing a more
337 247 focused and long-term plan for the fishery. Therefore, these results indicate that a MP developed
338 248 with the fishing community would probably have good chances of being accepted by the fishers
339 249 (Table 2).
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343 251 [TABLE 2. ABOUT HERE]
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346 253 Pearson's chi-square tests of independence were used to test for a relationship between the
347 254 acceptance of a Management Plan for the Algarve octopus fishery and being part of or being
348 255 well-represented by a fisher association. Results show that there is no relationship between
349 256 these replies ($p > 0.1$). Therefore, the willingness to accept more organized management of
350 257 this fishery appears to be transversal among octopus fishers and independent of membership
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357 of (or satisfaction with) a fishery association. In fact, fishers seem to see a Management
358 259 Plan as a positive and important measure, independently of belonging to an association.

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362 **261 3.3 The proposed management measures: combined analysis of the workshops**
363 **262 and questionnaire results**

365 263 The 17 management measures identified during the “Tertúlia do Polvo” project are
366 264 presented in Table 3, where the degree of consensus on the importance of each measure
367 265 achieved during the participatory workshops and the degree of importance attributed to each
368 266 measure by the local fishers who responded to the questionnaire are shown. Results indicate
369 267 that the measures considered consensual (and important) during the workshops by all the
370 268 participants were also ranked as important by fishers responding to the questionnaire.
371 269 Definition of an exclusive working group for a future Management Plan (MP), creation of
372 270 a label, improving communication among associations and introduction of on-board
373 271 monitoring were all considered important by over three-quarters (76% to 87%) of the
374 272 interviewed fishers and also by all the participants of the workshops. The fact that these
375 273 measures were consensually important (among fishers and in the workshops) indicates an
376 274 alignment between the interest of fishers and the associations that represent them.
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380 276 [TABLE 3. ABOUT HERE]

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383 278 Of all the proposed measures, the implementation and enforcement of a Closed Season,
384 279 with duration and timing defined according to expert knowledge, was consensual and
385 280 considered the most important measure by the workshop participants [12, 20]. Interestingly,
386 281 a substantial majority of interviewed fishers also agreed with the implementation and
387 282 enforcement of a Closed Season (83% and 85%, respectively). In fact, a formal request for
388 283 the definition of a Closed Season for the octopus fishery in the Algarve was prepared during
389 284 the workshops and sent to the Portuguese fisheries authority [12, 20]. Although the
390 285 administration indicated interest in the proposed Closed Season, it has yet to be
391 286 implemented.

393
394 287 It must be emphasized that, in the case of the Algarve octopus fishery, a formal
395 288 experimental closure was implemented in August 2005, as a regional ordinance, but it was
396 289 removed soon afterward by the administration [12]. The willingness of workshop
397 290 participants and fishers to repeat such a management action reinforces the likelihood of
398 291 successful implementation. Nonetheless, in the current format of governance, management
399 292 actions need to be regulated by the public administration, and the lack of action so far may
400 293 indicate the absence of conditions which would allow the combination of the current top-
401 294 down policy-making system with collaborative approaches, where fishers contribute to the
402 295 creation of the necessary management actions.

404 296 Regarding the increasing of Minimum Landing Weight, consensus was reached during the
405 297 workshops regarding the importance of this measure but not about its implementation.
406 298 Nevertheless, some reluctance was disclosed by representatives of fishers regarding the
407 299 implementation of this measure, mainly due to their uncertainty about how it would be
408 300 accepted by the fishing community they represented. Also, “maintaining a Minimum
409 301 Landing Weight” was considered as a measure “needing further discussion” during the

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416 302 workshops, and it was acknowledged that this measure is currently not adequately enforced.
417 303 The worries of fishers' representatives seem to have been justified as 74% of the fishers
418 304 surveyed disagreed with increasing the Minimum Landing Weight, while 75% agreed with
419 305 maintaining the current Minimum Landing Weight. These workshop results highlight the
420 306 importance given by the participants to the fishing community's opinions and concerns,
421 307 since despite the consensus on increasing Minimum Landing Weight for octopus, it was also
422 308 clearly stressed that to promote such a measure, the favourable opinion of the fishing
423 309 community was essential.

426 310 In fisheries management, the definition of a Minimum Landing Size/Weight is a commonly
427 311 used measure to ensure reproduction before capture and is generally based on the length
428 312 (L_{50}) or biomass (W_{50}) at which half of the females are mature [27, 35]. For the octopus this
429 313 measure should be carefully considered, as this species is a terminal breeder and
430 314 reproduction thus does not usually happen before capture (unless a female is taken while
431 315 she is guarding her eggs). Moreover, the legal Minimum Landing Weight (750g) seems to
432 316 be inadequate considering the W_{50} concept. In fact, Pereira [27] reported that, considering
433 317 that most octopus survive capture and release, the Portuguese Institute for Fisheries and
434 318 Atmosphere (IPMA) had already proposed a Minimum Landing Weight of 1500g for the
435 319 Portugal octopus fishery, although the W_{50} calculated at the time was 2259g. Nevertheless,
436 320 the measure was considered unacceptable by fishers' representatives because, in their
437 321 opinion, the resulting short-term decrease in catches would have a negative impact on
438 322 fishing communities which are highly dependent on this resource. A Minimum Landing
439 323 Weight of 750g was then legislated. This outcome suggests an inability or unwillingness to
440 324 consider the likely long-term benefits of management measures which would result in a
441 325 short-term decline in catches.

444 326 Jouffre and Caverivière [36] proposed the combination of a Minimum Landing Weight and
445 327 a Closed Season for the common octopus fishery of Senegal (350g or 500g and a closure of
446 328 two months from July to August) as an acceptable management strategy. The authors
447 329 emphasised that this combined strategy (Minimum Landing Weight and Closed Season)
448 330 seems better than the implementation of each measure separately, based on results of
449 331 previous studies simulating the effects of these separate measures on catches [37, 38]. The
450 332 importance of using combined measures as a strategy for improving the management of this
451 333 fishery in the Algarve was also discussed during the workshops [12, 20] and one of the final
452 334 conclusions of the workshops was the recognition that only the combination of several
453 335 measures would promote profitability and sustainability in this fishery.

456 336 Decreasing fishing effort was unanimously considered important during the workshops, but
457 337 participants could not find a consensual way to achieve a reduction, even though several
458 338 methods were proposed and discussed, such as the individual tagging of fishing traps or
459 339 sets of traps, as already implemented in the Experimental Plan for Octopus Management in
460 340 Galicia (Spain) [39, 40]. During the workshops and the questionnaire survey, participants
461 341 and fishers both recognized that this is a very sensitive issue, since the number of traps used
462 342 is often far greater than that permitted by law [12, 20]. Pita et al. [11] observed that, in fact,
463 343 the excessive number of traps deployed in the Algarve waters is a problem that causes
464 344 and/or increases conflicts, raising important issues regarding social justice. In relation to
465 345 this point, 54% of fishers surveyed acknowledged the importance of reducing fishing effort,
466 346 with 44% thinking otherwise. Taken together, these observations highlight doubts about the
467 347 ability of fishers to cooperate with each other.

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348 During the workshops the only management measure considered as “not consensual”
349 concerned the use of live bait. This is in fact the most controversial issue, with some fishers
350 strongly in favour of using live bait and others having the opposite opinion [20]. Ordinance
351 230/2012, which prohibits the use of live bait in the Algarve (Table 1), explicitly mentions
352 that this is an indirect measure to try to control the excessive number of traps being
353 deployed in the Algarve. This is because the use of live green crabs (*Carcinus maenas*) as
354 bait instead of dead small pelagic fish such as Atlantic Chub Mackerel (*Scomber colias*)
355 removes the need for daily re-baiting of traps, which arises when using dead bait due to
356 scavenging of the bait by amphipods [29]. Thus, using live crabs allows for the use of more
357 lines of traps at the same time. Interviewed fishers were also split regarding this issue, with
358 52% agreeing with the prohibition of live bait (Table 3).

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

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

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

391

392 **3.4. A combined view of the questionnaire results**

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533
534 393 The PCA analysis classified the 17 management measures into five management action
535 394 groups, and allows us to improve our understanding of which management actions could be
536 395 combined in a Management Plan and which measures would not be accepted. Table 4 shows
537 396 the existence of five factors that explain 59.3% of total variance. For the purposes of
538 397 analysis, names of each factor were given according to corresponding measures.

540
541 398 Factor 1, explaining 14.5% of the variance, was named “Participation”, considering that the
542 399 combined measure was strongly related to certification of the fishery, communication within
543 400 the sector, and definition of an exclusive working group, which seem to be major issues for this
544 401 fishing community. These management measures were extensively discussed during the
545 402 workshops and identified as consensually important measures for this fishery.

546 403
547 404 The second factor (explaining 12.1% of the variance) was designated “Fishing effort”. This factor
548 405 includes the issue that causes the highest degree of conflict in this fishing community. Although
549 406 reduction of fishing effort was agreed to be important at the workshops, only 54% of the fishers
550 407 supported it – this is perhaps the main point on which fisher associations and individual fisher
551 408 opinions seem to diverge. The second factor also included the concern for keeping the prohibition
552 409 of using live bait (again something on which fishers were divided). In fact, it includes the
553 410 consensual reduction of fishing effort, but also the concern for keeping the prohibition of using
554 411 live bait. The implementation of local legislation for the Algarve octopus fishery is also taken into
555 412 consideration in Factor 2 (in line with the regional bait restrictions).

556
557
558 413 The third factor was labelled “Effort, Control and Quotas” since it includes actions related with
559 414 surveillance, schedules and days-at- sea, vessel quotas and maintaining the ordinance that
560 415 prohibits the use of live bait. The factor integrates most of the measures considered as “needing
561 416 further discussion” during the workshops and questionnaire (Table 3).

562
563 417 The fourth factor was named “Closed Season” and accounts for 11% of the sample variance. Its
564 418 designation was selected because it includes the implementation and reinforcement of a Closed
565 419 Season, which were considered the most important measures during the workshops and among
566 420 fishers (Table 3).

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569 421 The final factor was called “Collaborative management” and explains 11% of the variance. This
570 422 factor highlights the verified willingness of fishers to engage in a type of governance where
571 423 responsibilities are shared.

572
573 424 Thus the PCA highlights several sets of measures (factors 1,4 and 5) that might form part of a
574 425 consensual management plan as well as others (factors 2 and 3) that are generally not favoured,
575 426 because they include measures that are not consensual or are difficult to implement.

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578 428 [TABLE 4. ABOUT HERE]

579 429

580 581 430 **4. Conclusions**

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583 431 The “Tertúlia do Polvo” was a project focusing on the octopus fishery, promoted by the
584 432 research community, in which the overall process mimicked the typology of a collaborative
585 433 governance where management actions are collectively defined. The inclusion of a
586 434 consultation phase within the overall methodological approach was found to be useful since

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593 435 it allowed the validation of the outcomes developed in a participatory approach.
594

595 436 The results achieved indicate the usefulness of the combination of phases of co-construction
596 437 and of consultation. In the specific case study, a well-established relationship between the
597 438 outcomes of the participatory approaches and the views of the larger fishing community
598 439 that would be affected by the implementation of such decisions was highlighted.
599 440 Nonetheless, if this step-by-step process were to be replicated in another context, the same
600 441 might not be found and some modification of the process would then be needed. For
601 442 example, the participatory component could be reviewed to ensure that the interests that
602 443 were not represented would be present in a second iteration of the deliberation process.

604 444 For the octopus fishery in the Algarve there seems to be a high degree of consensus regarding
605 445 measures that do not require changes in fishing strategies but that enhance communication within
606 446 the sector, valorisation of the resource and improved monitoring of the fishery. Also, measures
607 447 that were recognised to contribute to the common good, such as the implementation of a closure,
608 448 achieved general consensus among all interested parties and also amongst fishers. The measures
609 449 that would have a direct impact on the fishing activity and revenue generated by this fishery (such
610 450 as changing Minimum Landing Weight, decreasing fishing effort, or allowing the use of live bait)
611 451 have to be evaluated with caution, since there is a lack of consensus among fishers. These latter
612 452 measures are something of a “mixed bag”. An unwillingness to accept a higher MLW and divided
613 453 opinions about reduced fishing effort suggest that long-term gains may be of lesser interest than
614 454 short-term losses or perhaps that the potential long-term gains are not fully understood. In relation
615 455 to the use of live bait the issue seems to be that around half of the fishers were unwilling to give
616 456 up illegal practices.

619 457 For the specific case study, the basis for a change in the governance model appears to be in place
620 458 regarding willingness to participate, the capacity to represent collective interests and to negotiate
621 459 in a structured and constructive environment. The experiment presented here shows that in the
622 460 period of one year, 17 management actions were identified, detailed and prioritized in a dialogue
623 461 process that included divergent interests. Furthermore, we believe that the biggest obstacle that
624 462 was found was the incapacity or unwillingness of the current management authorities to change
625 463 legislation in accordance to management actions considered to be needed by all those consulted,
626 464 including the management body itself. In fact, during the “Tertúlia do Polvo” project, a formal
627 465 request for the implementation of a Closed Season was developed with the participation of the
628 466 authority’s representatives and formally sent to the national administration, but to date (formal
629 467 request made in July 2015), it has not yet been implemented.

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634 469 **5. References**

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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



37°30'0.0"

37°0'0.0"

WINDWARD

LEEWARD

Lagos

Alvor Portimão

Albufeira

Quarteira

Faro

Olhão

Fuzeta

Sta. Luzia

-200

 **6 Nautical miles buffer**

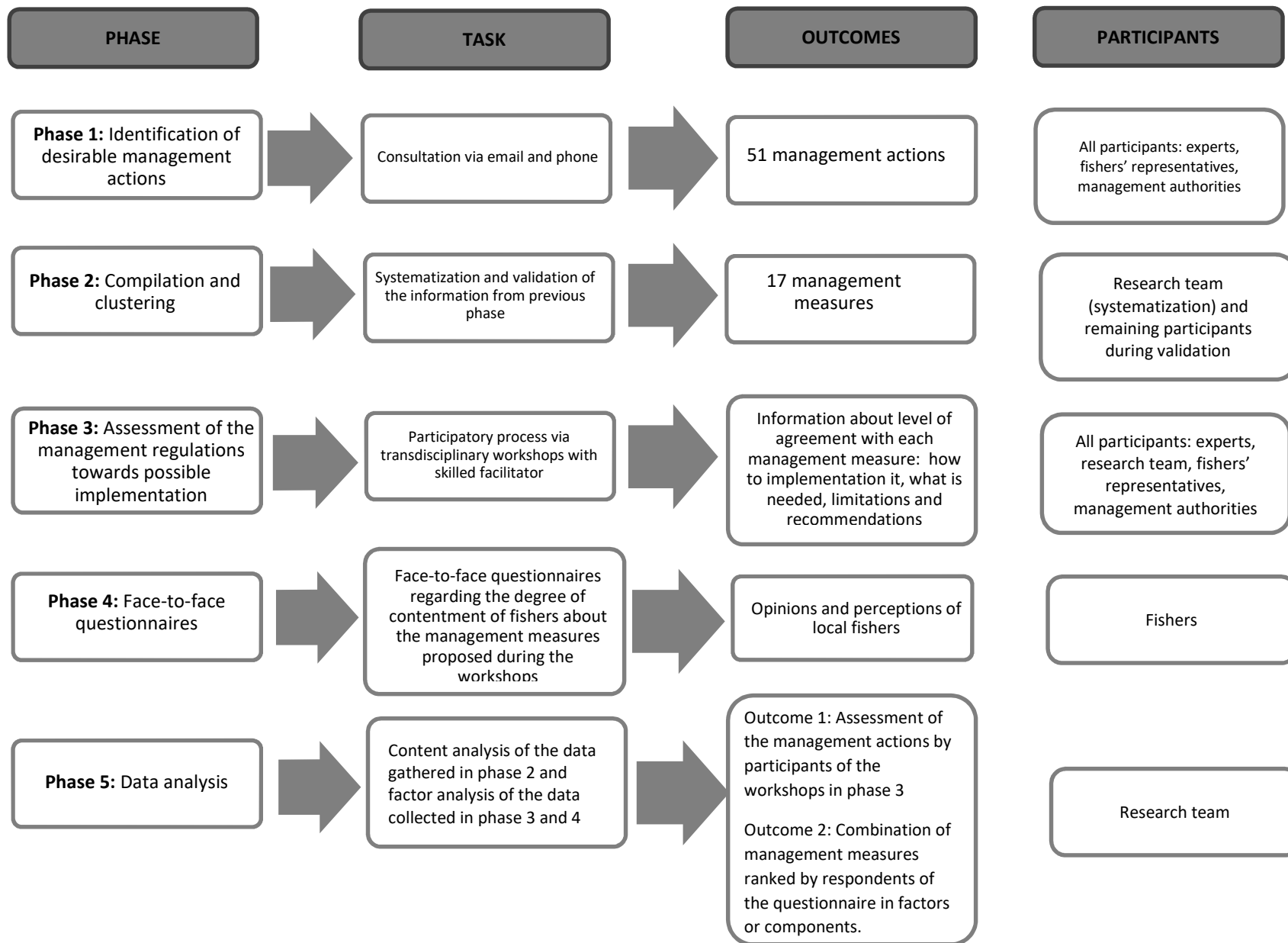
0 10 km


-9°0'0.0"

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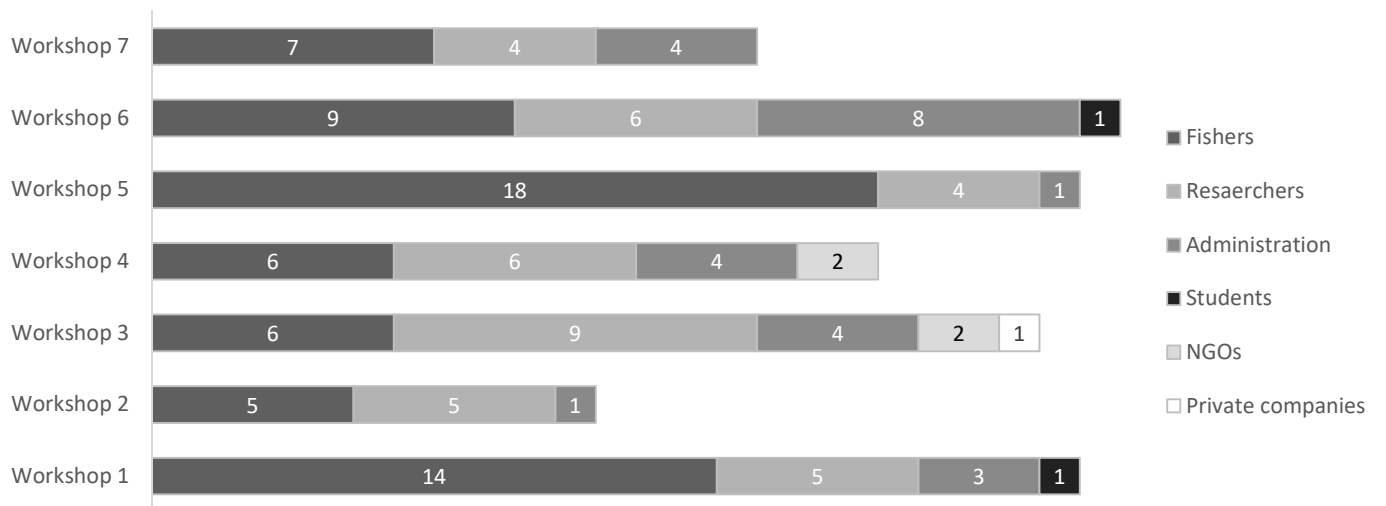


TABLE CAPTIONS

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”	WORSHOP 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).