

1 „Overarching sustainability objectives overcome incompatible 2 directions in the Common Fisheries Policy“

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7 **Abstract**

8 The lack of clarity in the objectives of the Common Fisheries Policy (CFP) must be addressed to create
9 a more efficient balance across diverse ecological, economic and social dimensions. Particularly
10 economic and social objectives present at an overarching level must be made explicit and addressed
11 in lower level management measures, in order to link them to biological objectives and allow policy
12 to build a balance across types of objectives. Selecting clear objectives is essential, particularly for
13 policy impact assessment. The aim of this paper is to demonstrate how more specific high level
14 objectives to managing fisheries can be derived from stakeholders. The paper first reviews the
15 definition of objectives, from a historical and conceptual perspective. Secondly, it discusses the
16 issues of manageability and acceptability, and finally describes an articulation of the high level
17 objectives derived from extensive stakeholder consultations at European and regional level. The
18 results from workshops at the European level to identify objectives were further examined at
19 regional level for the Baltic and North Seas in additional individual consultations. The German case
20 addresses two seas (Baltic and North Seas), has a complex governance structure (due to federalism)
21 and significant roles for the three types of actors (industry, government and environmental NGOs).
22 The analysis suggests that establishing higher level sustainability objectives within the CFP can help
23 diverse interest groups to develop a consensus on management actions to meet complex social
24 goals.

25 **Keywords:** Common Fisheries Policy; high level objective; sustainability goal; participatory
26 method; EU fisheries management; impact assessment

27 **Highlights**

- 28 • High level policy objectives allow for synergies that are lost at lower level
- 29 • Manageability and acceptability of objective is key for implementation and
30 compliance
- 31 • Limit values of some objectives can restrict the speed at which others are achieved
- 32 • Participation of stakeholder in drafting objectives can lead to innovative approaches

33

1 Introduction

34 Article 2 of the Common Fisheries Policy (CFP) [1] contains a series of overarching objectives. These
35 tend to focus on core fisheries management issues, such as Maximum Sustainable Yield (MSY) and
36 the Landing Obligation (LO), but also include very high level objectives for sustainability in an
37 ecological, economic and social context – the three pillars of sustainability. Across the different
38 framework regulations for fisheries issued in Europe since 1983 the description of objectives has
39 changed from the conservation of fishing grounds to the restructuring of the sector or the
40 conservation of the resource, and in the same way the scope of the policy has been modified to
41 include fisheries, aquaculture and EU registered vessels fishing abroad.
42

43 Little prioritization between objectives can be discerned in the latest policy, which includes all three
44 aspects of sustainability. It ranges from high level, and quite vague, objectives covering all three
45 aspects, to specific objectives, such as for coastal activities (Article 2.5i). Prioritization has been
46 demanded at the higher level, for example setting conservation over other goals and also creating a
47 distinction between principles and technical implementation to avoid micro-management and a
48 short term focus [2].

49 Clear objectives are critically important for the evaluation of the impact and success of any proposed
50 management measure [3],[4]. This includes the outcomes in terms of changes in the fishery and
51 incentives for that, changes in the ecosystem (for example, progress towards Good Environmental
52 Status (GES) under the MSFD[5]), and changes in the social and economic indicators chosen to
53 represent those two pillars.

54 The aim of this paper is to demonstrate how clear high level objectives [6] can be derived with
55 stakeholders to effectively and efficiently manage fisheries across a range of sustainability criteria.
56 The paper addresses this first by reviewing the definition of sustainability objectives, from a historical
57 and conceptual perspective. Secondly, we discuss the issues of manageability and uncertainty and
58 finally describe an articulation of the high level objectives derived from extensive stakeholder
59 consultations at European, regional and local levels from two research projects, as described in
60 Marchal et al [7] and Rindorf et al. [8].

2 The problem of defining objectives

2.1 Sustainability objectives in context

62
63
64 The sustainability objectives of the Common Fisheries Policy cannot be considered in isolation, as
65 they exist under a wider suite of global and European objectives. The most widely used definition of
66 a sustainability objective promoted by the United Nations at a global level was developed by the
67 Brundtland Commission in 1987[9], stating that “*sustainable development is development that meets
68 the needs of the present without compromising the ability of future generations to meet their own
69 needs.*” This statement is completed by an emphasis on its two main elements. The “needs”, with
70 priority given to the needs of the poor, representing a social objective, and the “limitations” imposed
71 by the need to maintain a healthy environment, representing an ecosystem objective. With respect
72 to fisheries, the United Nations Convention for the Law of the Sea in its Article 61 states that
73 conservation measures should be designed to “*maintain or restore populations of harvested species
74 at levels which can produce the maximum sustainable yield, as qualified by relevant environmental*

75 *and economic factors, including the economic needs of coastal fishing communities and the special*
76 *requirements of developing States*". This qualifies a primarily technical indicator (maximum
77 sustainable yield, MSY) to include social, economic and ecological factors, in a very similar fashion to
78 Article 2.1 of the CFP. This demonstrates how the objectives of conservation and social and
79 economic development are tightly connected in international policies. Finally, Sustainable
80 Development Goals (SDG) were also defined by the UN [10], and in particular SDG 14 - Conserve and
81 sustainably use the oceans, seas and marine resources for sustainable development. In terms of
82 fisheries SDG 14 states: "*By 2020, effectively regulate harvesting and end overfishing, IUU and*
83 *destructive fishing practices and implement science-based management plans, in order to restore fish*
84 *stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as*
85 *determined by their biological characteristics*", again focusing on MSY, but with a wider scope. SDG
86 14 further states: "*By 2020, prohibit certain forms of fisheries subsidies which contribute to*
87 *overcapacity and overfishing*" which can be seen as a specific governance measure. SDG 14 also
88 emphasizes social and economic sustainability, especially for developing countries, but in very
89 general terms. The UN Conference to Support the Implementation of Sustainable Development Goal
90 14 in New York, 2017, set out a "Draft call for action" but without stating any specific objectives
91 beyond those from 2015.

92
93 At the European level, the fundamental aim of the European Union is asserted in the Treaty of Lisbon
94 where, in Article 2, it is formulated as "*to promote peace, its values and the well-being of its*
95 *peoples*". The same Article states sustainability as an aim of the internal market, detailing aspects of
96 economic growth, employment and social progress and, finally, protection and even improvement of
97 the environment. Within the European legislative framework fisheries are included under the same
98 section as agriculture, both using similar economic measures such as subsidies and price support
99 mechanisms, despite having objectives that differ substantially [9]. Again, all three pillars of
100 sustainability are represented, but without detail.

101
102 Further at the European level, the Marine Strategy Framework Directive MSFD [5],[11] refers to
103 "*enabling the sustainable use of marine goods and services by present and future generations*"
104 (Article 1.3). Regarding social and economic aspects, Article 1.2 refers to human health and
105 "*legitimate uses of the sea*". Another aim of the MSFD is to coherently integrate environmental
106 aspects into other policies affecting the marine environment¹, most pertinently, the CFP, whose first
107 objective is specified in the current regulation Article 2.1 [1] as "*The CFP shall ensure that fishing and*
108 *aquaculture activities are environmentally sustainable in the long-term and are managed in a way*
109 *that is consistent with the objectives of achieving economic, social and employment benefits, and of*
110 *contributing to the availability of food supplies*". Therefore, the objective includes sustainability and
111 the three pillars concept (environmental, economic and social) in an explicit way.

112
113 The history of the CFP provides an alternative way to understand how objectives have evolved. A
114 framework regulation on the European fisheries sector dates back to 1983, with successive reforms
115 in 1992 and 2002. In the first framework regulation for fisheries [12] the first element of the

¹ This is a slightly different approach than fulfilling the three pillars of sustainability equally in every sector or activity. It hopefully gives clearer priorities as the MSFD defines ecosystems with good environmental status as a necessary basis for every activity.

116 statement of objectives was *“the protection of fishing grounds”*, mirroring the discussion at the time
 117 over the sovereignty of territorial waters.

118
 119 In the second framework regulation in 1992 [13], the scope was increased to include aquaculture,
 120 processing and marketing, as well as to EU vessels operating beyond EU waters. The preamble of the
 121 regulation mentions the existence of new fishing opportunities and a need to restructure the sector,
 122 increasing the complexity as new issues shift the focus beyond the original objectives. The third
 123 framework regulation from 2002 [14] introduced the integrative concept of ecosystem management.
 124 An analysis of the implementation of ecosystem based management in the CFP can be found in [15].

125
 126
 127 The most recent reform process (completed in 2013) has also gone through several stages of
 128 development, with a corresponding evolution of objectives. The Green Paper on the reform of the
 129 CFP [2] mentions the lack of prioritization of objectives in the previous regulations, considering that
 130 the three types of objectives are compatible in the long term, but not in the short term. At the same
 131 time, and in more practical terms, the document highlights the fact that in the CFP both principles
 132 and instruments to achieve them are decided at the same level (the Council of Ministers), promoting
 133 inappropriate high level micro-management as issues that could be managed at a lower level need to
 134 go through the Council of Ministers and in many cases also the European Parliament². The
 135 communication from the European Commission on the reform of the CFP from 2011 [16] includes a
 136 broad section on objectives, many of which can be categorized as social. In addition to a first
 137 objective on improved status of the stocks, the other proposed objectives include *“a future for
 138 fisheries and aquaculture industry and jobs”*, *“thriving coastal communities”*, *“satisfying the real
 139 needs of informed consumers”* and *“better governance through regionalization”*. A summary of the
 140 evolution of the objectives in the different versions of the CFP is given in Table 1 below.

141

142 **Table 1. Sustainability objectives in the CFP across time.**

143

Definition of ecological, economic and social sustainability objectives	Additional objectives	CFP version reference
<i>“conservation of the biological resources [...] in appropriate economic and social conditions”</i>	<i>“the protection of fishing grounds”</i>	(EEC) No 170/83 of 25 January 1983, Art.1
<i>“protect [...] living marine aquatic resources [...] in appropriate economic and social conditions for the sector”</i>	<i>“implications for the marine ecosystem”</i> <i>“the needs of both producers and consumers”</i>	(EEC) No 3760/92 of 20 December 1992, Art.2
<i>“ensure exploitation of</i>	<i>“providing a fair standard of living for those who depend on</i>	(EC) No 2371/2002 of 20

² In the new CFP a co-decision process was introduced for certain decisions while in some other cases regionalization is a priority. For some issues, like discard plans, Member States in a certain region can agree on measures, which after approval by the EC clarifying whether the proposals fulfill the requirements, go into force without a decision in Council or Parliament (delegated acts).

<i>living aquatic resources that provides sustainable economic, environmental and social conditions”</i>	<i>fishing activities and taking into account the interests of consumers.”</i>	December 2002, Art.2
<i>“environmentally sustainable in the long-term and [...] consistent with the objectives of achieving economic, social and employment benefits”</i>	<i>“and of contributing to the availability of food supplies”</i>	(EU) No 1380/2013 of 11 December 2013, Art. 2

144

145

146 The objectives of the CFP and MSFD cover most Member States and regional differences, for example
 147 between the Baltic and Mediterranean areas, are critically important for the discussion of objectives.
 148 The context here includes the different economic, social and cultural importance of fishing for areas
 149 that are considered “most fishery dependent regions”. There are also regional objectives outside of
 150 EU regulations that affect fisheries, such as the environmental objectives in regional organizations
 151 (such as the Helsinki Commission or the Barcelona Convention) or economic and social objectives
 152 (such as in the Bergen Statement of the OSPAR Commission). At a more local level there will be
 153 regional and sub-regional differences in the importance of small scale coastal fisheries, in attitudes of
 154 those fishing, and in Member State choices of GES indicators and targets. More specifically, some
 155 multiannual management plans include similar, but not identical, objectives to the high level aims in
 156 the CFP. For example, the management plan for Baltic cod mentions social and economic incentives
 157 only implicitly by stating that sustainability will be attained by “*gradually reducing and maintaining*
 158 *fishing mortality rates*” thus allowing industry to adapt and plan in the longer term.

159

160 **2.2 Priorities between the three pillars of sustainability**

161

162 The three pillars of sustainability were introduced in the 2002 Johannesburg Declaration [18] “*the*
 163 *interdependent and mutually reinforcing pillars of sustainable development - economic development,*
 164 *social development and environmental protection - at the local, national, regional and global levels*”.
 165 The interdependence of those pillars is clear, but with regard to fisheries objectives, it is less clear
 166 that these have equal priority or importance.

167 The assumption of three equal pillars is that no priority exists between them and the text avoids
 168 explicit statements about that balance [19]. However, some approaches to objective prioritization
 169 have been carried out [20]. In the case of fisheries objectives, there can be different levels of
 170 importance attached to each of the pillars, either due to specific social values or due to practical
 171 constraints. We detail examples of this below.

172 The pillar of ecological sustainability in some cases constitute a clear priority in fisheries
 173 management. In the Green Paper on the CFP Reform [2], it states “*Ecological sustainability is*
 174 *therefore a basic premise for the economic and social future of European fisheries*”, which implies a
 175 long time horizon, long enough for ecological feedback processes. Conservation of stocks, while a
 176 clear ecological objective, is also important for a sustainable industry, and hence has both economic
 177 and indeed social connotations, suggesting a sequential priority between pillars. The stock

178 conservation advice is provided by the International Council for the Exploration of the Sea (ICES),
179 dating from 1902. This advice is further refined by the EC Scientific, Technical and Economic
180 Committee for Fisheries (STECF), which may add an economic context. STECF was not founded until
181 2002, again suggesting the evolving importance of the economic pillar catching up with the ecological
182 pillar. Further, there are particular situations where there is a clear asymmetry towards conservation
183 objectives, such as where stocks are managed under an explicit recovery plan. An example of a
184 recovery plan is that for the stock of Irish Sea cod [22], among many other European stocks. In these
185 cases, the ecological pillar is given priority, but again, with expected benefits under the other two
186 pillars. The Green Paper formulates it as "*the economic and social viability of fisheries can only result*
187 *from restoring the productivity of fish stocks*". . Sometimes this asymmetry is incorporated into
188 harvest control rules, as for example in the Baltic Sea long term management plan for cod, where
189 higher restrictions in fishing mortality are foreseen in cases of particular danger for the stock (when
190 stock spawning biomass is below the stock specific reference point[23]).

191 The pillar of economic sustainability is often not a high priority in conventional fisheries
192 management. But economic factors can still act as a clear limit or constraint that needs to be given
193 some consideration even in what appears, at first glance, to be a simple conservation issue (e.g.[24]).
194 Fisheries are an economic activity and there may be market constraints that make fishing
195 economically difficult or impossible under some conservation measures. The price and availability of
196 fish, together with the dependence on the processing industry as the main market, are issues that
197 may bring economic sustainability to the forefront. This was the case for the closure of the anchovy
198 fishery in the Bay of Biscay in 2005. Most of the catch was used in the processing industry and the
199 closure of the fishery created the risk that the processing industry would look for another source of
200 supply [25]. Fishers may thus prefer to reduce their catches to a minimum TAC for a faster re-
201 opening of the fishery so that they can more effectively serve the needs of the processing industry
202 [25]. They may also introduce individual daily limits to influence prices [26]. In this way the market
203 (the processing industry in this case) may set the speed of the stock recovery. Therefore, a temporal
204 and a sectoral scale are used to emphasize the economic pillar.

205 Finally, social objectives could also alter the equilibrium of the three pillars model. A possible social
206 objective might be ensuring the survival of local fish processing firms. A good, if negative, example of
207 this was the gradual disappearance of the filleting industry on the German Baltic Sea coast since the
208 1990's[27]. Only one firm now remains, and the catches of herring are generally trucked to other
209 countries due to the lack of processing capacity. Fishing cooperatives in such areas can employ in
210 fishing and processing in a ratio of 4:3. This added social value to the local community is lost when
211 most of the catch is exported [27]. Demographic factors may be a clear limiting factor in certain
212 fisheries, especially where fishing is a part-time occupation. In these cases, a closure in certain
213 fisheries breaks the income stability of a community, causing emigration of the young and loss of
214 training of local fishermen [28]. The breakdown of social sustainability can thus have irreversible
215 consequences, which may make it worthwhile to reconsider alternative management targets when
216 dealing with the biological pillar. In general, however, social objectives are not strongly emphasized
217 in fisheries management [29] and yet, understanding of social and economic dimensions can impact
218 on the success or failure of a simple conservation policy [30].

3 Managing fisheries to meet the overarching principles of the CFP

3.1 The problem: manageable and acceptable objectives

A common description for a good objective in management is expressed by the acronym SMART: Specific, Measurable, Achievable, Relevant and Time-bound [31],[32]. However, in the case of fisheries this may not be so simple to achieve. Fisheries management is largely based on objectives for stock biomass (B) achieved by controlling fishing mortality (F). So, while an objective can be specific, for example, to recover a stock to a given biomass, a measure to achieve the objective may not be. This would be most obvious in mixed fisheries where a measure specific to one species, say reduce F, could also impact on many other species via food web interactions, but also fishing opportunities where fish are caught together. Equally, while we can *estimate* fish stocks, monitoring them is more difficult, and often lags by one or more years behind the current situation in the ocean. Whether an objective is achievable depends on many factors in addition to fisheries management, most obviously those factors that affect recruitment. Even the best management is ineffective in the face of a persistent stock recruitment failure, such as that of North Sea herring in the early 2000s [33]. F and biomass (B) objectives can probably always be seen as relevant. As B is the ecologically relevant objective and F is relevant for economic and social dimensions. F may also affect other species through ecological interaction with the target species. Finally, it is very difficult to have time bound objectives in a complex ecosystem where many factors interact to drive fish abundance over different time scales. As an example, the target of the Johannesburg Summit, which set 2015 as a time limit for reaching MSY, was already postponed by the Green Paper of the CFP to 2020 to allow more time to develop management. While recognizing the value of SMART objectives, we would suggest evaluating the objectives for the Common Fisheries Policy in terms of two key characteristics: manageability and acceptability. Policy objectives clearly need to be manageable. However, there will be complex environmental, ecosystem, technical, geographical and cultural factors that make manageability in fisheries a complex issue. An additional difficulty is the existence of elements outside human control, illustrated by the use of biomass as an objective. Biomass is something that cannot be tightly controlled by management due to the diverse array of uncontrolled natural environmental and ecosystem factors that interact, so management needs to be adaptable and resilient. Objectives of fisheries management regulations have consequently moved from highly dynamic and hard to measure biomass objectives (e.g. the Bay of Biscay plaice long term management plan) to fishing mortality targets (e.g. the Baltic Sea cod long term management plan), a variable that can be directly influenced by management. This is not the only source of complexity of fisheries that makes manageability a key issue. Fisheries regulations need to devise mechanisms to manage a wide array of fishing techniques, from artisanal gillnets to the latest satellite technology used by high sea trawlers. Geography is an issue when we consider the different areas where European fisheries occur, and the implications of spatial issues and climate, for example for seasonal or area closures. Finally, setting up the needed governance mechanisms is a challenge when we consider the cultural diversity of the EU, which also faces different time horizons from international framework policies, the activity of a commercial sector or the life of a fishing community. A set of objectives needs to consider these factors, at least at a later stage of development, if it is to be manageable.

263 Management of fisheries comprises four basic stages; policy design, implementation, monitoring and
264 enforcement. All of these phases present challenges that should be foreseen when drafting the
265 objective of the policy. First, in the design phase, information is needed, in at least the three basic
266 aspects of biologic, economic and social data. None of these data will be simple to obtain. As an
267 example, economic data for fishing firms or individual fishers is not readily available, as there are
268 confidentiality issues in many fleets, an informal economy in subsistence sectors with low data
269 availability and in general a fear of control that often creates an incentive to misreport. Second, in
270 the implementation phase there are elements that create costs both to the management and to the
271 fishers, and this can create negative incentives towards these objectives. Examples include changes
272 in mesh size, which for the fishers means buying new nets, or the setup of a license system, which
273 entails administrative costs for the management authority involved. Thirdly, monitoring progress
274 towards the objectives is costly, from creating and using Vessel Monitoring Systems VMS (both for
275 the vessel owners and for the management authority) to analyzing the vast recordings from onboard
276 cameras. Finally, while the enforcement of the management system is already very expensive, it is
277 still considered insufficient [2], [4].

278 The Marine Strategy Framework Directive is an example of a related policy that is more recent than
279 the original CFP and is more management-oriented. It incorporates many of the elements described
280 above. The directive uses the DPSIR (Driver, Pressure, State, Impact, Response) framework and sets a
281 series of descriptors with associated indicators, where particular values can be considered as
282 objectives [5]. In this way the objectives are intrinsically linked to the management measures, as they
283 have been designed based on those criteria. The CFP on the other hand tends to describe objectives
284 that lack manageability. For example, the CFP suggests that "*Measures are needed to reduce the*
285 *current high levels of unwanted catches and to gradually eliminate discards*". But it does so without
286 specifying the type of discard (landable target species, small individuals of target species or non-
287 commercial species, etc...) or the way in which their reduction or elimination is to be achieved. Such
288 an objective is likely to be very difficult to manage, or needs very careful specification in order to be
289 manageable [35],[36].

290 In addition to being manageable, the objectives of the CFP need to be acceptable to fishers simply
291 because the cost in terms of compliance of not being so is too high. If an objective, and the measures
292 adopted to achieve it, lack acceptability, legitimacy and credibility, it is highly unlikely there will be
293 full compliance. Lack of compliance will lead to conflict between fishers and managers and indeed
294 between different groups of fishers who view the measures as more or less acceptable [37],[38],[39].
295 On one side, there is the cost of conflict, with cases such as the strikes in the brown shrimp fishery in
296 Germany due to low product prices in 2011 or the blocking of the port of La Rochelle in France in
297 2008 due to high fuel costs. On the other, there are the particularly high costs of enforcement, due
298 to the complexity of surveillance of many vessels, across wide areas and throughout the year.
299 Participation (in the objective setting and measures process) has been reported to improve
300 compliance [40]. Nevertheless, there are critics of the value of participation in improving social
301 outcomes of fisheries management, based on its potential to allow powerful vested interest to
302 further entrench inequality in management regimes [42].

303 Overall, manageability and acceptability are two clear requisites for objectives when dealing
304 specifically with fisheries management. Manageability is necessary, given the perspective of fishing
305 as an economic activity dealing with a highly variable resource and with an already over-complex
306 fisheries management system. Acceptability is also a requirement, as this should lead to better

307 compliance and a reduced control and enforcement burden. Manageability should thus be taken into
308 account when designing management actions to meet objectives and acceptability, to have those
309 management actions successfully implemented.

310 3.2 Management under lack of clear objectives

311

312 The above discussion illustrates the need for careful consideration in the setting of objectives, and in
313 the measures taken to achieve them. One further critical factor that should be considered is the lack
314 of clarity in the objectives themselves, and hence in the information needed to evaluate them.

315 The problem of the definition of objectives in an uncertain world has been identified in the literature
316 [2] and defining management objectives is one of the key challenges. To improve the clarity on what
317 constitutes an objective we approach the definition by considering the social objective that we want
318 to achieve (such as in the social utility function) as conceptually separated from restrictions (the
319 “resource constraint”). Objective definitions of the social utility function that fall into this conceptual
320 characterization are sustainable development as in the Brundtland Report (meet the needs of the
321 people) and the overarching objective in the Lisbon Treaty (promote peace and well-being). The
322 study of well-being (for instance [44]) has recently been developed in economics and other social
323 sciences, where it is well known that money has a decreasing influence on feelings of “well-being”
324 above a certain level of income. So the capacity of individuals to work to achieve their goals by their
325 own effort is key to well-being. This provides a guide to why the Brundtland wording of “*without*
326 *compromising the ability of future generations to meet their own needs*” is quite appropriate. This
327 type of objective was also found in the documents of the CFP reform [16] as “*take into account the*
328 *interests of both consumers and producers*” or “*projecting the principles of the CFP internationally*”.
329 As to the restrictions, those suggested in section 3.1 above, present circumstances under which
330 social, economic and biological factors can be limiting. Higher level restrictions are not normally
331 considered in fisheries, but an example of such conceptual restrictions can be found in the idea of
332 planet boundaries [45], which are a minimum threshold to keep the biophysical characteristics of the
333 planet, such as marine biodiversity or the nitrogen and phosphorus cycles.

334 There is also a confusion between intermediate and final objectives making it unclear what needs to
335 be achieved within particular time frames. In the general hierarchy of objectives of society there is
336 welfare as a very high goal, and the objective of fisheries policy is not to fish, to keep the ecosystem
337 healthy or to provide employment, these become all subordinate objectives or tools to achieve the
338 higher objective of welfare. The difference can be seen, for example, inside the hierarchy of
339 objectives of fisheries policy, when a technical innovation is used to catch more fish in an overfished
340 stock or to improve the working conditions of fishers using a sustainable gear. This distinction is also
341 important because in the last CFP reform discussion there was a tendency to define objectives as the
342 avoidance of a problem, for example to decrease impact on the ecosystem or to reduce overcapacity.
343 These are not objectives per se, but results, either of fishing or of the management process itself,
344 which we then seek to restore by setting these objectives. Effort and resources may also be wasted
345 due to an inappropriate conceptualization of an objective. Overall, the building of a structure
346 composed of clear objectives, from higher goals to management strategy and control measures and
347 further to their incorporation to regulations is key to success. Therefore, once objectives are clear,
348 we need to look at other knowledge limitations, mainly those related to lack of knowledge about the
349 future and the ecosystem and future socioeconomic mechanisms, as for example economic crises

350 (e.g.[46]). From there, it should be possible to try to derive the complementarities between
351 objectives that could be useful for assessing hypotheses, as will be shown in sections 4.1 and 4.2
352 below.

353 For the lack of clarity in the time horizon of objectives, there are two main issues, one internal and
354 one external. For internal issues the need to consider time comes from the manageability of
355 objectives: the inherent complexity of resource management systems that, in order to avoid harmful
356 generalizations in management design need a longer period of time for an analysis and learning
357 process [47]. Another cause of this internal need to consider time comes from management
358 implementation. Co-management, defined from a scientific point of view, is a process that requires
359 knowledge acquisition and, as such, is progressive [42]and requires a longer time horizon than other
360 ways of meeting objectives. For external issues the need to consider time comes from the longer
361 time horizons of stock and ecosystem functions themselves, and in a similar way to addressing the
362 likely impacts of climate change, it requires a sequential planning of objectives. As new aspects like
363 ecosystem interactions and new modeling capabilities [48] are being incorporated into management,
364 the target for management may need to be more adaptive. Following Lind [49]the question might be
365 *“what should we be doing over the next ten years to position ourselves to act on new information and*
366 *new technological developments?”*.

367 Another source of confusion when setting the objectives for fisheries management, would be limited
368 knowledge about the real needs of consumers and citizens. On a lower level in the hierarchy of
369 objectives, the available options for management would also be a source of confusion. Meeting the
370 needs of consumers is limited in fisheries policy to one part of the supply chain of fish as a product.
371 For example, the idea that discards need to be minimized or eliminated to achieve stock
372 conservation ignores the fact that more is lost in the distribution and processing of the fish than is
373 discarded; approximately 9% of catch is discarded compared to approximately 13% wasted in
374 distribution and processing [50]. To be consistent with an aim to protect the stock, a proportionate
375 emphasis should be given to avoiding the removal of wasted fish from the sea. Another issue arises
376 with consumption, where increasing consumption of fish is not differentiated from social well-being,
377 considering both real needs for overall food consumption (see for example,[51]) and for a balance in
378 the diet (as has been done with meat, see [52]). Therefore, setting the objective at the level of
379 satisfying human needs fosters a more global view that can reduce fish demand in a greater
380 proportion, by considering the whole food supply and consumption cycle. When considering this,
381 avoiding discards is no longer a high level objective but just a part of a larger objective. In addition to
382 this, limitations of knowledge often constrain management actions where the different levels of
383 targets are more aligned. An example of this would be management measures that foster synergies
384 between objectives, for example practices that improve both production and good environmental
385 effects. Examples for fisheries would include some forms of results based management [53]. In a field
386 where so many external uncertainties exist, aligning economic and conservation outcomes is a way
387 to work towards higher level objectives. Hence, a proposal could be to assign fishing rights to fleets
388 that are more sustainable (as suggested by environmental NGOs and small scale fisheries
389 associations [54] and to relate fishing rights concessions to compliance [55]. The gradual and
390 adaptive learning process that occurs during participatory management and research allows time to
391 tackle questions as the in depth definition of objectives, the time horizons required for their
392 achievement and at the same time opens a wider array of management options.

393

394 4 Lessons from participatory research

395

396 It is the role of scientists to evaluate how well management measures meet objectives with the best
 397 scientific and social knowledge available. For this there is a need to design an effective analytical
 398 framework, which includes not only appropriate models but also consideration of wider hypotheses
 399 about the relevant scenarios, states of the world and management options.

400

401 4.1 Participatory definition of management objectives in research projects

402

403 Investigating the socioeconomic effects of the current Common Fisheries Policy requires targets
 404 against which the effects of the policy can be assessed, including the identification of high level policy
 405 objectives. The focus in the SOCIOEC project was on objectives that can be dealt with through the
 406 use of management measures and which are relevant to stakeholders.

407 To derive the high level objectives the project team used the results of a combined workshop with
 408 the MYFISH EU research project held at Vigo, Spain, in 2012 and several interviews (see section 4.2
 409 below) to test the applicability of the objectives in a regional context. The workshop gathered
 410 representatives from different stakeholder groups, geographic regions and potential objective sets
 411 [56]. These inputs from stakeholders were analysed to produce a narrower set of objectives that
 412 could be used in the SOCIOEC project to study the impact of fisheries management measures under
 413 the CFP [56]. The results from this process of identification of objectives are shown in Table 2.

414 As with any objective in fisheries, the chosen examples (see Table 2 below) present challenges when
 415 defining associated indicators. To achieve MSY it is judged more convenient to set fishing mortality as
 416 a management target instead of stock biomass, as, in contrast to fishing mortality, the stock level is
 417 driven by many factors outside the control of management. Target species discard as well as bycatch
 418 still present challenges with respect to reliable data collection, while the impact on bottom habitat
 419 requires a combined indicator that maps fishing effort (including gear and size) to habitat types
 420 through empirical and modelled relationships. The economic objectives also present challenges, such
 421 as showing the difference between societal and company interests, or including externalized costs in
 422 the net present value to be optimized for the whole society. Finally, the social objectives require the
 423 collection of composite indicators (employment and opportunities, hours at work and number of
 424 accidents, etc) and an evaluation of not only the presence or absence of co-management processes,
 425 but also their inclusiveness.

426

427 **Table 2. High level objectives for fisheries management developed from the combined SOCIOEC-**
 428 **MYFISH workshop.**

429

Sustainability pillar	Population level	Short/ long term	High level objective
Ecological	Society	Long term	Maximize yield in tonnes of commercial species

Ecological	Society	Long term	Gradually eliminate discards on a case-by-case basis
Ecological	Society	Long term	Minimizing bycatch of vulnerable and protected species
Ecological	Society	Long term	Minimizing negative impact on seabed habitats
Economic	Society	Long term	Maximization/optimization of present value
Economic	Society	Short term	Maximization/optimization of gross value added (or rent)
Economic	Firm/Individual	Short term	Maximization of profits (within ecological and social constraints)
Social	Society	Long term	Ensure viable coastal communities
Social	Society	Long term	Improve policy and decision making through improved inclusive governance structures
Social	Individual	Long term	Ensure fair living standard, improved working and security conditions on board of fishing vessels

430

431 More relevant with respect to the management of fisheries policy objectives is the study of how
432 objectives influence each other, in order to avoid unintended effects due to policy [47]. A practical
433 way to do this is to identify management measures for each objective that are compatible (at least
434 partially) with the other objectives. There might be a negative effect from some measures on some
435 objectives and this should be clearly shown [57]. Ideally the partial or complete fulfillment of other
436 objectives would be reinforced, or the effect should be neutral. Examples of how objectives are
437 compatible within various management measures are given below.

438 A first example would be to move towards MSY in a socially proactive way by promoting (through
439 quota or marketing incentives) the fishing gears that have a catch composition appropriate to a
440 relevant multispecies MSY. This may imply social decisions, like deciding on trade-offs between
441 species: consume more cod or more pelagic species [58][59]. Another socially and economically
442 compatible measure to implement this objective would be to promote responsible consumption
443 patterns, regarding for example the minimization of fish waste across the supply chain [50] to raise
444 awareness on excess catch. The elimination of discards can also be promoted by fostering fishing
445 techniques that have sustainable catch composition, to then promote the marketing of those less
446 valued discard species [50] either as standard or sub-standard products.

447 The reduction of bycatch is compatible with using socially acceptable management measures specific
448 to each case, as short temporary closures that enable the fishers to have other sources of rent and
449 therefore allow for viable coastal communities [28]. Another way to improve management measures
450 to reach the bycatch objective is to benchmark different management measures employed in nearby
451 areas, and reach an agreement to implement similar measures regionally. This can prevent potential
452 problems of social acceptance due to a perception of unfairness when implementing different
453 measures in close by areas that share a bycatch problem. . An example of this is the different
454 measures to protect seabirds and harbour porpoises across the Danish-German border. In the
455 German Baltic coast gillnets are seen as harmful for harbour porpoises and seabirds and therefore
456 suffer restrictions, whereas in the close by Danish coast gillnets are seen as sustainable and harmless
457 and they are not restricted due to bycatch of those species. This is also influenced by the different

458 objectives of environmental NGOs in both countries [60]. An economically efficient way to achieve
459 this objective would be to promote sustainable seasonal consumption of regional fish to foster
460 ecological values, such as avoiding certain fish consumption in some periods to allow for undisturbed
461 seasonal presence of seabirds. Finally, the fishing activities that have low seabed impact could be
462 encouraged through targeted management measures based on detailed knowledge of fishing
463 operations, including high definition spatial and temporal data on gear operation, as well as through
464 support for operational (like real-time feedback mechanisms) and technical innovation (which also
465 supports the auxiliary industries through the development of new types of more sustainable gear).

466 There are also management measures that meet economic objectives as well as ecological and social
467 sustainability objectives. To increase the net present value of fisheries aspects such as food quality,
468 leisure value (fisheries attractive to tourism [61]), and environmental values (programmes such as
469 “fish for litter” or scientific cooperation) should be promoted. This can be done by identifying the
470 fleet segments that have significant contributions to these values and taking them into account when
471 proposing closures or quota or effort restrictions. Profits can be enhanced through the promotion of
472 higher value through certification, regional product status, higher quality fish through optimized
473 operations and technological improvements. Ecological sustainability is therefore indirectly improved
474 by measures that avoid higher catches, with an objective that lies at a higher level than, for example,
475 overcapacity reduction.

476 In a shorter term perspective, maximization of gross value added (GVA) could be pursued through
477 cost reduction, as well as through policies that optimize employment according to fair living
478 standards and improved working and security conditions on board. This has special importance when
479 referring to international fisheries (see section 4.2 below). At the firm level, improvement of profits
480 subject to ecological and social constraints is encouraged through the reduction of inefficiency costs
481 (as fuel costs of gear operation, vessel steaming to and from fishing areas and final product
482 transportation). A cost benefit approach that reduces negative externalities by minimizing fuel use
483 could reduce societal expenditure in the current implicit subsidy (as tax exemption [4]) for fuel. To
484 maximize long term net present value in a cost benefit approach the reduction of fuel use would not
485 only reduce subsidies, but also minimize the environmental cost in CO₂ from the catch sector and
486 from the transport sector from imported fish.

487 Some management measures may meet both the high level social sustainability objectives and
488 ecological sustainability goals, despite often being blamed for not meeting one of them. For example,
489 measures to soften TAC reductions to keep local employment have been blamed for jeopardizing
490 stock recovery [2]. To contribute to the viability of coastal communities there should be an
491 evaluation prior to any management measure of the total economic value of sustainable fisheries, to
492 avoid spatial developments that reduce the net value creation in a community [61]. Monitoring
493 potential problems with succession of fishers [28], building realistic mid-term expectations for the
494 return to fishing activity and investigating of alternative sources of income [27],[62] through longer
495 term policy coordination should also be incorporated into policy design, especially during fishery
496 closures and adaptation periods.

497 To improve policy and decision making processes it is important to identify the governance level at
498 which the objectives above can be more effectively implemented, referring to location of resources,
499 including knowledge, and incentives for action [63],[64]. To promote fair living standards and
500 improved working and safety conditions on board it is necessary to study the social impact of

501 combined management measures at the stage of design, for example in cases where combined effort
502 and quota limits drive fishers in small-scale fisheries to fish in bad weather conditions. Social
503 objectives are also important, for example during fishery closures or gear bans, where policy
504 coordination with other non-fishery policies becomes especially relevant. Finally, a current issue is to
505 monitor living conditions of non-EU workers in EU vessels, especially outside EU waters through
506 international agreements. Ecological and economic sustainability goals could also be met in
507 accordance with social objectives if special attention would be paid to the whole fish supply chain.
508 This would include living standards related to the provision of imported fish products as in life cycle
509 analysis for the full environmental and economic impacts of manufacturing processes.

510 Relating to the lack of clarity in models brought about by the existence of intermediate (even
511 implicit) and final objectives, further workshops and modelling exercises in the MYFISH project show
512 a clear example. The decision support tables resulting from the project within the example of the
513 North Sea [56] maximized the fleet catches or their revenue from fishing. Referring to the catch
514 maximization, a step following the approach described in our study would entail the analysis of food
515 security objectives in the area of origin and of consumption of the catches [65]. Beyond
516 enhancement of revenues, the overarching objectives approach would imply considering the fair
517 conditions of work in the area of origin of the catches including outside the EU as a minimum
518 constraint (as in the social utility function objective of “projecting the principles of the CFP
519 internationally”) or tackling the distributional aspects of optimized revenue from catches beyond
520 distribution between fleet segments (e.g. inside the affected fishing community, through social
521 capital that allows for participation and succession in the industry for future generations, see[41]).
522 Kempf et al [56] also show the distinction between objectives (e.g. promoting inclusive governance)
523 and restrictions (e.g. respecting good environmental status according to the MSFD) as already
524 assumed in our study. These perspectives on the definition of objectives open new options for the
525 design of indicators and modelling approaches, and would make the management conceptually more
526 coherent.

527

528 **4.2 Adapting overarching objectives to regional context: a case study**

529

530 The SOCIOEC project involved stakeholders in several different ways, from analyzing incentives in
531 management measures to feedback on impact of measures to the participants who suggested them.
532 Stakeholders were consulted on both high level objectives and their implications at regional level,
533 giving them a unique opportunity to participate in a research exercise. This work on high level
534 objectives includes both group consultation (as presented in section 4.1 above) and also additional
535 individual consultation by means of semi-structured interviews. Five semi-structured interviews were
536 performed, with two fishing sector representatives, two environmental NGOs and one fisheries
537 manager. The case of Germany was found to be useful because it includes two seas (Baltic and North
538 Seas), it has a complex governance structure (due to federalism) and has a significant roles of three
539 types of actors (industry, governments and environmental NGOs).

540 For the ecological sustainability objectives there was agreement on MSY as a high level objective,
541 with the exception of an environmental organization representative that expressed the need to
542 consider a higher biomass value to provide an additional buffer for ecosystem and climate change
543 effects. The issue of manageability came across in a very clear manner in a statement by a producer

544 representative who said: *“I want the objective, but I think it is not achievable”*. An environmental
 545 representative also related objectives to the means to achieve them by saying *“When this is the*
 546 *objective, but the capacity to reach it is not given, then it is a political error”*. Additionally, other high
 547 level objectives in relation to ecological sustainability included the reduction of ghost nets (nets lost
 548 by fishing boats [66]) and the consideration of fuel consumption per unit of fish, which bring a wider
 549 perspective (ecosystems and economic efficiency) that can be better grasped by many actors. These
 550 measures could make different objectives compatible, as seen in the previous section 4.1, but note
 551 the fact that, as many objective delivered by policy makers and stakeholders, they imply defining a
 552 “consequence” of the fishing activity (losing nets or consuming fuel) as an “objective”.

553 Economic sustainability was judged by at least one representative of each group to be closely
 554 connected to the other types of objectives. A fisheries manager related it to regional development
 555 and jobs (objective of viable coastal communities) and with the carbon footprint of the fishing
 556 industry (ecological sustainability). The importance of fishing as an activity despite its environmental
 557 effects was also highlighted by an NGO representative: *“The question is where they fish, how and*
 558 *how much. This must be regulated, but it does not mean to say that there should not be any*
 559 *fisheries”*. A fisheries manager suggested that a more targeted approach through the European
 560 Maritime and Fisheries Fund (EMFF, an EU structural fund promoting sustainability and employment
 561 in fisheries) would strengthen both economic and social sustainability of the CFP.

562 Finally, the discussion on social sustainability objectives of fisheries also produced some ideas that
 563 simultaneously support (or do not hinder) other sustainability objectives. A producer representative
 564 proposed that management use cooperation and search for shared incentives instead of fines, while
 565 a fisheries manager suggested making regulations compatible with other regulations. These
 566 approaches could improve policy making and governance structures without necessarily reducing
 567 profitability or stocks, by incorporating more than one pillar in a single objective and through gains in
 568 efficiency of implementation. Education of both fish producers (on sustainability) and consumers (on
 569 effects of the whole fish supply chain) were also suggested by a representative of an environmental
 570 NGO to achieve high level objectives such as reducing discards.

571 A summary of useful inputs to the manageability of the objectives and the synergy between
 572 objectives can be found in the following quote from an environmental NGO representative, who
 573 pleaded to ensure that *“the fisher that goes fishing every day, is sustainable and works for the region,*
 574 *is the one that receives most advantage from the CFP”*. Without specifically asking for it, all
 575 stakeholders came up with relationships between the objectives presented, as well as other
 576 objectives at a higher conceptual level (such as ecosystem effects or supply chain aspects). This
 577 shows how clear it is that objectives of fisheries management should not be considered in isolation,
 578 and that high level perspectives can help to bring both consensus and practical inputs for policy.

579 **5 Conclusion**

580
 581 Working on policy objectives at a high level and observing the hierarchy among objectives both from
 582 a research perspective allows the perception of synergistic effects that may get lost when looking
 583 only at subordinate objectives. These effects are fundamental, given the ineffectiveness of the
 584 existing complex regulatory and micro-management approach, especially when facing the current
 585 poor state of some fishing communities and stocks.

586 Nevertheless, manageability and acceptability must be kept in mind when considering high level
 587 objectives in fisheries. Manageability is a prerequisite if the objectives are to be met, given the
 588 complexity of fisheries in the EU. Otherwise they will only be a paragraph in a regulation. On the
 589 other hand acceptability is a key factor for compliance, if the management actions are to be
 590 successfully implemented.

591 The approach presented here is useful because it allows the analysis of objectives in relative terms
 592 with respect to the time perspective over which risks occur. Issues such as the scale at which an
 593 objective is to be reached or the relative risk of disappearance (in terms of urgency of action) of a
 594 particular species, specific fishing community, ecosystem or industry, should be incorporated into the
 595 policy design discussion. The extension of the objectives to food security [65],[67], ecosystems [68]
 596 and community livelihoods would imply more coordination between policies outside the fisheries
 597 area (including international relations and regional development in the EU) and a more adaptive
 598 approach to take advantage of bottom up participatory arrangements, e.g. those started from fishing
 599 communities. As discussed by Kempf et al [56], *“inclusive governance can be seen as an essential part
 600 of fisheries management because of the need for a balanced and stable outcome on all three
 601 dimensions of sustainability – ecological, economic and social”*. The policy design process would
 602 benefit from a deeper conceptual analysis of objectives, and this study shows not only how this
 603 conceptual analysis is useful for the design of management measures, but also how certain processes
 604 of participation from stakeholders can contribute to deliver more coherent, manageable and
 605 acceptable fisheries management.

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