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Pre-print version

Reference:

Trouillet, B., Bellanger, L., El Ghaziri, A., Lamberts, C., Plissonneau, E., & Rollo, N. (2019). More than maps: Providing an alternative for fisheries and fishers in marine spatial planning. Ocean & Coastal Management, 173, 90-103. https://doi.org/10.1016/j.ocecoaman.2019.02.016

More than maps: providing an alternative for fisheries and fishers in marine spatial planning.

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Abstract: Although a necessary approach in many cases, implementing Marine Spatial Planning (MSP) reveals discrepancies between theory and practice. These discrepancies include the major importance given to technical issues along with the role and meaning ascribed to the "spatial" dimension at the expense of the "strategic" one. This gives rise to questions especially from the point of view of fisheries that invite to develop a more in-depth critical analysis of MSP. Far from considering the technical and political dimensions in opposition, the goal is to find out whether the reasoning used can be turned around, or in other words, whether the potential of a mapping instrument can be used to give greater importance and more visibility to strategic questions in MSP processes. Our reflection is based on methods used to map fisheries. It is also enhanced by notions such as empowerment and asserting the value of non-scientific knowledge *in-situ*. To test the strengths and shortcomings of this idea, it was applied in the context of an ongoing 2010 experiment between scientists (geographers and statisticians), fishers and fishers' representatives in metropolitan France. They have been working together for several years and have gradually expanded their scope to now include almost three-quarters of French metropolitan fleets (around 3,250 vessels). This experiment shows that fishers and their representatives are not only able to generate spatial data using robust methods (almost 6,000 surveys have already been conducted), but more importantly that they are also able to draw on this knowledge and participate in debates in a more effective manner, taking on the role of "real actors". This has enabled a more political alternative to take shape, full of promise and giving rise to new questions.

Keywords: Marine Spatial Planning, Fishers' knowledge, Mapping, Power, Critical approach

Highlights:

- A summary of methods used to map fisheries was established,
- A method that enables fishers to assert their knowledge themselves was developed,
- Data (6000 surveys) on fishing areas was collected using this method,
- This data allowed fishers to participate in the discussions concerning sharing maritime space,
- This experiment proved the existence of possible alternatives for rethinking MSP.

1. Introduction

Although the overall idea of (integrated) sea use management is no longer very new (e.g., Fricke, 1975; Eisma et al., 1979; Smith, 1991; Smith et al., 2011), putting it into practice through Marine Spatial Planning (MSP) is a more recent development (Douvere, 2008). Today, there are around 60 plans implemented worldwide (IOC-UNESCO and EC-DG Mare, 2017). In theory, MSP is a much-needed approach that takes into consideration global social and economical requirements, as well as the protection of the marine environment. It enables an overall strategy to be defined all while avoiding "patchy and uncoordinated decisions" (Kannen, 2014). Beyond these commendable principles, it seems obvious that there are several discrepancies between the theory and practice of MSP. Fisheries are often at the meeting point of some of them.

Firstly, MSP debates have mainly revolved around the “technical” aspect of implementing an MSP (data, geotechnologies, etc.) at the expense of the “political” dimension. In fact, the latter, far from being at the heart of MSP processes, is still side-lined for the most part (Kidd and Ellis, 2012). This situation is not specific to MSP since technical devices and other technological artefacts have appeared more broadly in the field of democracy (e.g., Akrich, 1987; Akrich, 1989; Latour, 1999, 2005; Law, 1999; Callon et al., 2001; Callon and Ferrary, 2006). While technical work in MSP often leads to mapping and zoning, it is important to remember that technical choices (e.g., the role given to the “spatial” aspect in MSP, data, metrics and analysis tools used, the map-making choices, etc.) are inevitably somewhat political in nature, as they guide decision-making and influence the end result. Furthermore, fisheries are highly sensitive to data and maps by their intrinsic characteristics (scattered, temporary, variable in time and space, etc.), as well as sensitive to any change in the distribution patterns of species, notably due to climate change (Janßen et al., 2018). One should pay attention to the risk of fisheries being “pushed off” the map, or at least to be incorrectly or partially taken into account. This is particularly true for small-scale fisheries for which lack of data is patent.

Secondly, the pre-existence of national or supranational strategies in the domain of marine conservation as well as “blue growth” (marine energy, mining, shipping, offshore aquaculture, etc.) questions the capacity of MSP to incorporate the different stakes *a posteriori*, and consequently, its ability to actively carry strategies rather than simply act as a receptacle for multiple strategies (Qiu and Jones, 2013; Jones et al, 2016). Also, despite an apparent paradox, the two coexistent approaches of sustainability in MSP, soft and hard (Qiu and Jones, 2013; Frazão Santos et al., 2014), mainly converge on the important role assigned to spatial matters, especially zoning: zones for protecting nature and zones for developing uses. By its very nature, fisheries are resistant to zoning (Jentoft and Knol, 2014). The zoning option is therefore not just a technical choice with no political stakes; one should be wary of any cartographic determinism that would make a shortcut between mapping and zoning.

Thirdly, initiatives leaning either towards economic growth or towards conservation also limit the extent to which social stakes are taken into consideration. This is particularly critical for fisheries because they are spread out over a wide spatial area and have been present in seas and oceans for longer than other activities currently under development, although they do not have any property or use rights on space. As a result, the question of sharing maritime space and its practicalities from a fisheries point of view is raised differently than for other users. Because fisheries are mostly viewed from an essentially bioeconomic angle (Urquhart et al., 2011), the weak consideration given to social and cultural aspects in classical fisheries approaches (cultural dimension, identity, heritage, contact to nature, food provision, lifestyles, etc.) raises particular questions. In this context, providing that a rationalism that favours prevailing interests takes precedence (Flannery and Ellis, 2016; Tafon, 2017), questions of social justice can come to the fore (Qiu and Jones, 2013), along with questions of spatial justice in the sense suggested by Young (1990), which may lead to the processes of ocean-grabbing (Bennett et al., 2015) or sea-sparing (Wolff, 2015).

Of course, this is without considering the variety of situations in which the fisheries find themselves, depending on their type (vessel size, gear, targeted species, small or large scales, etc.), the historical and geographical context in which they work (the more or less strong presence of competing activities, the level of internal competition, etc.), the level of structuring in the sector, their capacity to adapt, or even the environmental, social, cultural and food related stakes in their situation.. Within fishing activities on a general basis, small-scale fisheries are even more vulnerable when it comes to an overly-spatial approach dominated by technical considerations. Their case is all the more conspicuous for four reasons: (i) a high dependency on the coastal zone, where competition for space is potentially stronger, (ii) a weaker capacity to spatially adapt, (iii) an almost non-existent availability of data enabling them to be taken into account (e.g., in most cases, Vessel Monitoring System (VMS) or Automatic Information System (AIS) data only exists for vessels more than 12 or 15 metres long, depending on the system), and (iv) a characterisation of their importance that is hard to measure against economic metrics solely (Agapito et al., 2018).

Accordingly, a more in-depth critical analysis of MSP is needed, especially in regard to data collection and mapping processes which constitute the basements of the MSP technical frame. Far from considering the technical and political dimensions, and relying on the example of fisheries, we see that the idea examined in this paper proves to us that mapping as a technical instrument can play a role in transforming MSP as a political and technical "device" (in reference to Foucault French word "dispositif" (1980)). In other words, by adopting the idea of Flyvberg (1998) that "power defines what counts as rationality and knowledge and thereby what counts as reality", our aim is to examine the potential of geotechnologies (i.e., mapping instrument) when it comes to strategy. The idea is to enhance or even de-construct the "reality" on which the sharing of space between different uses is based – a "reality" that stems from a balance of power which takes place in mapping design. Thus, the question would no longer be of knowing what data to use and how to map it, but rather of how to turn these issues into an opportunity to promote other "realities" that are not captured by techno-managerial instruments and more globally, science and technology (Whatmore, 2009), thus enabling MSP to be more firmly anchored in the political field. In other words, a matter of testing if fishers could be empowered through mapping in MSP processes. Therefore, we question the interest to move from a view where spatial data have primacy to another where fishers' empowerment in spatial data and map production is just as much as central to engage political debates in MSP. To tackle this, we begin by looking at the literature of mapping fisheries in the context of MSP. That would allow us to develop and strengthen the theoretical frame about the potential of mapping as an empowerment lever for reinforcing the political dimension of MSP (2). On this basis, we present an experiment in progress in France since 2010. The goal of this experiment is to help fishers to be fully able to collect their data and to spatialize their activity. The experiment relies on collaborations with several researchers in geography and mathematics fields making the whole procedure of data collection and treatment scientifically well founded. . Since it is strongly context-related, the French situation of fisheries and of MSP is presented. Additionally, it is at the heart of the empowerment process, thus we precisely describe data collection and mapping features (3). Then, we expose the results produced by this experiment, both in terms of data produced and in terms of potential of the mapping exercise to place political considerations at the heart of MSP (4). Finally, we discuss the many questions raised by this experiment, while hoping it can contribute to further critical thought on the sharing of marine space, the integration of scientific and non-scientific knowledge, and participatory mechanisms (5).

2. Mapping fisheries for MSP

2.1. From the primacy of data…

Since the mid-2000s, an increasing number of research works are dealt with the mapping of human activities. In fact there has been a growing need for spatial data fostered by the development of MSP in the past years. Additionally, technological progresses allowed the improvement of spatial data supply. Such circumstances explain this increasing number of research work during the recent period. Where the mapping of fishing grounds is concerned, several studies based on a wide range of methods have emerged and several attempts at providing a synthesis have been made (e.g., Ben Rais Lasram and Cruz Folch, 2007; ERG, 2010; Daw et al., 2011; MMO, 2014; Janßen et al., 2018). Protocols for acquiring spatial data on fishing activities around the world fall into two broad categories. Firstly, there are those which rely on data collected on a continuous or regular basis, often through automated methods primarily linked to regulatory systems for monitoring fishing vessels:

- logbooks and Vessel Trip Reports (VTR) (e.g., Breeze and Horsman, 2005; St Martin, 2005; Simms et al., 2007; St Martin and Hall-Arber, 2008a; Jin et al., 2013),
- sometimes combined with automatic monitoring systems such as VMS (e.g., Fock, 2008; Stelzenmüller et al., 2008; Pedersen et al., 2009a; Pedersen et al., 2009b; Bastardie et al., 2014; Bastardie et al., 2010; Jennings and Lee, 2012; Campbell et al., 2014) or AIS (e.g., Natale et al., 2015).

Secondly, there are those which rely on data collected on a one-off basis using different means:

- GPS (e.g., Valdés-Pizzini et al., 1997; Sidi Cheikh et al., 2009; Daw et al., 2011),

- observations and counts made from a fixed point on land or through overhead flights (e.g., Léauté, 1998; Dalton et al., 2010),
- individual or collective interviews, sometimes supported by participatory GIS (e.g., Close and Hall, 2006; Hall and Close, 2007; des Clers et al., 2008; St Martin and Hall-Arber, 2008b; De Freitas and Tagliani, 2009; Hall et al., 2009; Lieberknecht et al., 2011; Maes et al., 2012; Moreno-Báez, 2010; Pascual et al., 2013; Leite and Gasalla, 2013; Yates and Schoeman, 2013; Kafas et al., 2014a; Purroy et al., 2014; Léopold et al., 2014; Sullivan et al., 2015; Kafas et al., 2017)
- feasible combinations which are sometimes tested, namely by Daw et al. (2011).

The instances where these two broad data categories are brought together are few, but the authors who explored this possibility agree that the triangulation of several methods would certainly bring added value (e.g., St Martin and Hall-Arber, 2009; Woolmer, 2009; Scottie et al., 2012; Kafas et al., 2014b; Turner et al., 2015). Furthermore, approaches to spatialising functional fisheries zones and habitats of certain species on the one hand (e.g., O'Sullivan et al., 2013; Lelièvre et al., 2014; Le Pape et al., 2014; Orio et al., 2017), and regulatory approaches on the other (e.g., Norwegian Ministry of the Environment, 2014) are also sometimes mobilized together when considering the stakes involving fisheries in MSP.

All this data inevitably reveals benefits and limitations, which need to be viewed in relation to initial objectives (evaluation of stocks, maritime security, fisheries inspection, etc.) and in our case, in relation to MSP requirements – here we are essentially referring to:

- spatial VMS or AIS data, which is highly precise but gathered from an overly reduced portion of fleets (e.g., according to the Fleet register system [1], only 11,5% ships in Europe in January 2018 are followed by the VMS) and raising post-processing issues (e.g., how to select the speed thresholds to identify when fishing is underway) or issues linked to the lack of data-related information (e.g., gear used);
- pertinent attribute data from logbooks (e.g., gear used) and a good coverage of fleets, but a spatial granularity which is too broad (e.g., International Council for the Exploration of the Sea (ICES) statistical rectangles);
- data acquired on a one-off basis, which is often more adapted but provides restricted geographic and/or temporal coverage (data from one-off surveys, counts or observations).

Therefore, although this data is ever more readily used today, it does not seem altogether adapted in its current state to get a spatial overview of fishing practices for the needs of MSP. Nevertheless, as there is no better alternative, it continues to be increasingly used. To remedy this, several MSP experiments (e.g., in the UK, Scotland, Massachusetts, Oregon, etc.) have highlighted both the relevance and difficulty of combining standard monitoring data with data acquired through fishers' interviewees. Additionally, Woolmer (2009) illustrated that data collected from fisher surveys could be as precise as that obtained through automated monitoring. It is also worth noting that the choice of metrics used is rarely discussed. For instance, when dealing with metrics, the implications of the observation period and scale are ultimately hardly questioned (e.g., a zone may have a weak or moderate economic value on the scale of the plan but could be very crucial for a small fishing community). In addition, it is striking to see that ethical questions are rarely discussed, even if they concern an individual-based data. The use of this data should have been limited to the context in which it was collected (e.g., maritime surveillance, management of fisheries resources, etc.). If we step back a little, it becomes glaringly obvious that reflection on the advantages and shortcomings of different data sets revolves again mainly around technical questions (i.e., access to data, cost of acquiring data, processing time and costs, data quality and type, pre- and post-processing, etc.). These reflections may well be necessary but are probably not sufficient.

In contrast to numerous fisheries science studies on mobilising fishers' knowledge for management purposes (e.g., Hind, 2015), there is little literature on the mapping of fisheries for marine spatial planning. Aside from generating data, this mapping also examines the role that fishers' knowledge could play in contributing to MSP (e.g., Olson, 2010; Strickland-Munro et al., 2016). This is doubly surprising. On the one hand, this type of data collected for fisheries management purposes is sometimes used for

MSP, as is the case for routine (e.g., logbooks, VTR) or one-off (i.e., surveys) data. On the other hand, "the commitment of stakeholders" is presented as being a key aspect in the "success" of MSP approaches (Pomeroy and Douvere, 2008). In any event, even if we suppose that this data is pertinent in this context, standard spatial data does not enable fishers to exist in the same way as other maritime actors to the extent that they are excluded from nonetheless important technical choices (Jentoft and Knol, 2014). We need to turn our attention to the relevance of an approach to mapping fisheries which would enable fishers to contribute or even generate data themselves, in addition to existing instruments. In other words, their contribution would give them the means to become fully-integrated marine *actors*.

This overall idea falls into the scope of asserting the value of non-scientific knowledge *in-situ* (Agrawal, 2012). That is to say knowledge can be asserted by the holders themselves. In doing so, it would mean going beyond the standard *ex-situ* approaches which have evolved anyway, as revealed by the four waves described by Hind (2015) by reducing the gap between scientific and non-scientific knowledge to integrate fishers more effectively into a co-management approach (e.g., Armitage et al., 2009; Berkes et al., 2000; Olsson et al., 2004). In other words, we could posit that mobilising and formalising "non-scientific knowledge" (geospatial in this case) *in-situ* could contribute to a "repositioning" of fishing actors, thus enabling socio-technical controversies to exist, to quote Callon et al. (2011). In any case, this idea is worth developing.

2.2. …to the primacy of fishers' empowerment

This aforementioned idea can be associated with that of empowerment. Nevertheless, this notion needs to be handled with care, given its many meanings which are inextricably linked to contextual use (discipline, field of application, etc.), and whose use needs to be "historically situated, depending on the relationship between the government and civil society" (Jouve, 2006). It is clear that the different attempts at defining this term cast far and wide. Finally, the notion of empowerment is easier to define by its absence than its presence (Rappaport, 1984). Without going into too much detail, different authors generally agree a minimum common basis: it provides a given entity (a person, group or community) with the sufficient strength and autonomy to acquire the power to act, enabling them to control their destiny (Torre, 1986; Rappaport, 1987; Breton, 1989; Le Bossé, 2003). At this stage, it is worth noting that empowerment does not only stand for "the power over", but also for "the power within", "the power with" and the "power to" (Parpart et al., 2002).

Beyond the fuzzy boundaries of this somewhat "catch-all" notion, its popularity as well as the distrust it triggers (especially when misappropriated as a "liberating empowerment" or a "liberal empowerment", endowing it with an instrumental vision more interested in "how the poor can contribute to development, rather than how development can contribute to giving more power to the poor" (Calvès, 2009)) point to three different possible interpretations of it: optimistic, sceptical and critical (Jouve, 2006). These respectively refer to issues of overthrowing power relations and the transfer of power, the effect of social dynamics calling to question relations between civil society and the state, and the government's self-organised disempowerment; three interpretations that inevitably relate to changes in political order (forms of participation, types of democratic process, new public management, etc.). From our point of view, this is an additional reason for using this notion, as it refers to the demand for "a commitment from stakeholders" in the management of public affairs, with different possible levels of involvement that have been theorised since Arnstein (1969).

The fact that social sciences have had a weak role to play in fisheries sciences (Urquhart et al., 2011) is probably partly why the notion of empowerment has not been very present in the fisheries sector (Jentoft, 2005). When it has been explicitly used, the optimistic interpretation of the notion has largely taken precedence, pushing towards the idea of participation or even co-management (see for example, Pomeroy et al., 2003; Béné and Neiland, 2004; Nunan, 2006; Wiber et al., 2009; Jacobsen et al., 2012; Constantino et al., 2012; Tsai et al., 2013; Johnsen and Hersoug, 2014). The empowerment of fishers has subsequently been viewed as a pre-condition for co-managing fisheries (Jentoft, 2005). Even when it is not explicit, the notion of empowerment in the fisheries sector comes to the fore via issues of knowledge and how fishers can participate. In our case, the field of application is a little different because the subject is no longer the management of fisheries resources but MSP. In this very specific context, the notion of power is understood as a relational one (Hinchliffe, 2000). That is to say as the ability to contribute to shape the relational environment here based on mapping's discourses. In other words, power is seen as the capacity to contribute to shape the technical frame (data and maps) in which MSP will be done; then, within this frame, as the capacity to express its own interests. Basically, MSP does not disempower fishers, but the technical conditions could disadvantage fisheries if fishers if fishers were not part of what constituted technical conditions. However, these two topics (fisheries management, spatial planning) should converge as the development of marine spaces is likely to have more and more implications for fisheries resource management. In any case, it would seem that the question is taking shape at the interfaces between fishers' knowledge, empowerment and participation. This will prove useful for making a critical revaluation of MSP.

Under this triple entry, we rather consider empowerment as a kind of positive sum game at a certain level and a zero-sum game at an infra-level. That is to say a game in which the collective as a whole gains knowledge and capacity to act, but also in which some ones win more than others or more at the expense of the others. We thus go back to the original concept of empowerment as simultaneously politicised, collective and centred on "horizontal" relationships. Through this, we turn more towards the idea of a weak or strong actor as described by P. Bourdieu, i.e., relatively independent concepts as opposed to the dominant/dominated relationship structure (Payet and Laforgue, 2008). In our case, the fishers' increased power to act within the scope of MSP does not consist of climbing up a rung in Arnstein's participation ladder (1969) to share in the decision-making process. Instead, the aim is rather to contribute to enable the expression of naturally diverse interests (including those of fishers) in the construction of a strategy that promotes the public interest. Thus, the issue is more about knowledge and power that *complement* each other to improve collective knowledge and, consequently, the quality of the decision taken and the reasoning, which is what is at stake. In more linear terms, increased knowledge provides empowerment, which in turn enables real participation beyond pretexts or tokenism.

This triple approach forms an interesting prism for understanding the relationships between knowledge and power – relationships that often underpin critical approaches (Peet, 2000; Harvey, 2001), in a manner Foucault (1980) considered inextricable. Formalising the geographical knowledge of fishers is thus regarded as a *strategic lever*, or even a precondition that enables them to acquire the power to act on the political scene: "It appears the old adage 'knowledge is power' gains plausibility if knowledge is conceived strategically, one might say 'pragmatically', and power is understood as the ability to control." (Flynn, 2007). We therefore suggest that an increase in the fishers' power to act by better asserting the true value of their knowledge and better handling it would contribute to reintroducing some political content into debates on MSP. To be more precise, it would help bring the political dimension of debates to the fore, given that this dimension has always existed just below the surface – as is already the case with Marine Protected Areas (MPAs) (see Caveen et al., 2013). Furthermore, as far as fishing is concerned, this may also provide the means for being more mindful about the missing layer (St Martin and Hall-Arber, 2008b), with the goal of reinstating not only the areas occupied by fisheries, but more importantly, a set of currently-absent values linked to fishing.

The fact that fishers can be empowered by formalising their geospatial knowledge *in-situ* (themselves) is likely to become a priority as a study subject inasmuch as, the power relations between fishers, scientists and managers usually "shifts dramatically once the data have been collected" (Jacobsen et al., 2012). Although mapping and being mapped are not the same things, as Jentoft and Knol (2014) remind us, the capacity to formalise this geospatial knowledge through maps can be viewed as an expression of the power/knowledge relationship (Kitchin and Dodge, 2007).

3. Method

An experiment being conducted in (metropolitan) France provided food for thought on the potential of a fisheries mapping instrument for bringing out the political dimension in MSP. The experiment is being conducted in the framework of collaborative research bringing together professional fishers' representatives and scientists (mainly geographers and statisticians).

3.1. Case-study

3.1.1. The situation of French fisheries in MSP

It is important to properly understand the context in which this experiment was conducted. We will first discuss the elements that are an intrinsic part of the fishery system and then look at the system's environment.

Concerning the elements inherent to the fishery system, official statistics (i.e., FranceAgriMer, 2017; European Commission, 2018) show first and foremost that:

- France is a small fishing country (with only 0.5% of the world's capture fisheries),
- it has fleets mainly comprised of small vessels (two-thirds of the 4,400 vessels in metropolitan France measure less than 10 m, and 80% of them less than 12 m, whereas only 1% of vessels measure more than 40 m),
- fleets have primarily adopted an "artisan model" (e.g., almost three-quarters of vessels are part of "small-scale fisheries", which means vessels are out at sea for less than 24 hours),
- their activity revolves around exploiting a wide variety of species, using a broad range of techniques (even if trawling is the predominant practice),
- and the sector provides 13,400 full-time sea-based fisher jobs (not including in overseas territories), two-thirds of which are in "small-scale fisheries".

Subsequently, in keeping with the situation at a European level, French fisheries are in a transition phase, as demonstrated by the dip in several indicators according to the same sources: overall production has decreased by 20% over 20 years (and by as much as a third in volume where fish market sales are concerned), a third of vessel crews have disappeared over 20 years, and a quarter of jobs over 15 years. However, after years of effort, marked by several fleet reduction plans to reduce fishing capacity and the ensuing above-mentioned losses, the state of exploited stocks seems to be improving in the North-East Atlantic (STECF, 2017; Jayasinghe et al., 2017; see also [2]). On a national level, the most recent assessments indicate that almost two-thirds of stock landed in France and fished in the North-East Atlantic now come from stocks considered as "sustainably exploited" in terms of volume and value (Biseau, 2017). In contrast, the situation is much less encouraging in the Mediterranean (Vasilakopoulos et al., 2014; STECF, 2017; Piroddi et al., 2017), despite a reduction in European catches (Colloca et al., 2017). However, it is also more difficult to evaluate for French fisheries due to the small space it occupies in French national fishery statistics. As a result, the aforementioned improvement remains fragile, but it is also more striking than it seems given the tightening of the objective over the last few years (F_{msy}).

Concerning the consumption of seafood products, the trend is on the increase in France while the consumption is already higher than the European average. In other words, if we look at France, the contribution of fishing to domestic supply is modest and falling regularly in favour of fishery and aquaculture produce imports (the trade balance deficit for seafood products was -3.7 billion Euro in 2016), 40% of the value of which comes from countries outside of the European continent (Ecuador, China, Vietnam, India, Morocco, etc.) (FranceAgriMer, 2017). This means that other than resorting to aquaculture (despite it seeming a limited option), the pressure placed on fish stocks by French consumers (and more widely, European consumers) has simply extended to other countries' waters.

Lastly, when it comes to the representation of fishers in France, two main structures emerge. On the one hand, we find EU-recognised Producer Organisations (POs), generally set up as associations and whose main role is to manage the quotas attributed to France as well as any issues concerning the marketing of products. On a national scale, although fisher's membership of these 16 POs (European Commission, 2018) is optional, the majority of fishers are members. On the other hand, there are Fishery Committees (at national and regional levels, and sometimes on a *département* level) to which fishers belong as a rule. These private-sector bodies, which are financially and legally autonomous, have public-service missions:

representing the interests of fishers; participating in developing regulations (resource management, gear use, cohabiting); partaking in economic and social actions; participating in regional public policies on protecting and promoting the environment; and providing their members with scientific and technical support. They also have the human resources to fulfil their role: just over 160 employees spread across 27 committees at national, regional and *département* levels (de Menthière et al., 2015). These committees are managed by elected boards, with seats reserved for employees and company managers, the composition of which is decided by the administrative authority in charge of fisheries.

As for the elements concerning the environment of the fishery system, two drastic shifts occurring almost simultaneously have profoundly changed fishing conditions over recent years. Firstly, in the wake of the commitments made by France at the 2010 Nagoya conference (Aïchi Target 11), a network of MPAs has been developed in under ten years, covering 23.6% of the surface area of French metropolitan waters at the end of 2016 (or a surface area of about 88,000 km²) (AAMP, 2016). Most MPAs have taken the form of Natura 2000 sites and marine natural parks, mainly spread along the coastal band. Other large sites off the coast recently appeared at the start of 2018, bringing the surface area of MPAs to about half that of French metropolitan waters. At the time being, these MPAs still have only a limited effect on fishing (especially in the interim period while management plans are established and the resources for implementing them made available). However, fishers are worried that the conditions placed on exercising their activity will gradually become more restrictive, despite their strong involvement in the creation of MPAs and sometimes active work on behalf of the government within Natura 2000 sites at sea. Around the same period, fishers were also confronted with the creation of conservation areas in the waters of neighbouring countries (e.g., analysis and creation of Marine Conservation Zones in the UK in 2011-2012).

On top of this, following the EU's Climate and Energy Package and the COP 21 held in Paris, France set out ambitious goals for marine renewable energy production (especially from wind farms), initially set at 6,000mW by 2020 (MEEDAT, 2009) and revised by France's 2015 Energy Transition Act to 500-6,000mW by 2023. As a result, in 2011, 2013 and 2016, calls for tenders were launched covering seven zones identified at the planning stage for offshore wind farms and spread over 700 km² of coastal fringe. Four other smaller zones were also identified for testing floating wind turbines. Other economic sectors have also benefited from reflection on their future and on marine development possibilities (e.g., regional schemes for developing aquaculture required by France's 2010 Act on modernising fishing and aquaculture). In just a few years, on top of the management measures – in the strict sense – applied to the fisheries sector, fishers have seen several fronts open up that may have a strong impact on their activity, especially in the coastal band, home to small-scale fisheries.

Finally, France's national strategy for the sea and coastal areas (MTES, 2017) has added the final touches to these two drastic shifts, which is to say this was only done very recently, despite its preamble stating that the "movement towards a national maritime target" was to begin in 2009. In compliance with the MSP (2014/89) and Marine (2008/56) Directives, this national strategy is built around four priorities (ecological transition; the blue economy; good environmental status; and the reputation and influence of France) and is supposed to be set out for metropolitan France via four marine planning documents (*Documents Stratégiques de Façade*) (Trouillet et al., 2011). The first two comprise the strategic component and are planned for 2019 (report on the current situation and definition of strategic objectives), and the last two set out the operational component and are planned for 2021 (methods for assessing the implementation of the strategic component and an action plan for Framework Directive 2008/56). Since 2016, several guides on the content and methods for drawing up plans in France have been issued to the government's technical experts in charge of steering MSP development. These guides take a very "spatial" approach to MSP, with the aim of defining zones with priorities for the coming years.

3.1.2. Launching of the experiment

In 2010, at a time when the presence of MSP was just beginning to be felt, the Fishery Committees (hereafter referred to as fishers' representatives) realised that they would have to defend the interests of fishers both in the moribund context surrounding fishing activities and in the face of an increasing number of sea areas initially earmarked for conservation, then very rapidly for developing new uses (see 3.1.1.). Given that the first marine spatial plans in France will not appear until 2019, this experiment actually began outside of an official MSP framework. Furthermore, in this study, MSP also refers to all the deliberations that contribute to the sharing of maritime space and not only the official process in response to the MSP Directive. Beyond the French case, it appears crucial to take a broad view of MSP because, firstly, it seems linked to sector-based strategies and planning and, secondly, no planning process operates within a vacuum or as though nothing preceded it.

At this moment, fishers' representatives in different regions understood well that if their role is simply to account for all the fleets they represent, without possessing any data, they will not have any reliable elements to back up their case on the nature of the interests at stake. Although the stakes are common for all kind of fisheries, they are even more vital for small-scale fishing fleets and "artisan-based" fishing more generally, as no data exists for these and they do not have the direct political lobbying power that some of the big industrial ship owners have. Consequently, with no other real alternative, fishers' representatives quickly realised that they had to build up a geodatabase relating to fishing practices. If some regional fishing committees engaged in a work to spatialize fishing activity in order to face the increasing challenge of MSP, fishers' representatives from the Pays de la Loire region decided to ask geographers to define an appropriate method for spatializing fishing activities. This has been the starting point of the experiment.

In 2010, the Pays de la Loire Fishery committee represented a little over 460 vessels at the time (compared with about 380 in 2018). From the outset, after reviewing the literature on all existing mapping tools, it was clear that it would be much more interesting and possible to design a method that fishers' representatives could make their own and turn into "a tool for fishers by fishers". With technology in crescendo mode, the underlying idea was that firstly, by understanding and controlling the way in which data was produced and mapped, they would benefit fully from the knowledge it generated; and secondly, a tool created and used by the fishers themselves would give them independence from third-party data to which access was not guaranteed (at this time, fishers' representatives tried without success to gain access to official data). So, from the beginning, this was a key element that has conditioned the whole experiment (Figure 1). In this logic, the role of scientists is only to design some methods and tools that are made available for fishers. Thus, fishers engage in a process that empowers them with their own valorisation of their geospatial knowledge, while benefiting from a scientific framework. This may potentially lead to reinforcing their position to seat at the table in MSP debates; and test this assumption is the reason to be of this experiment.

Figure 1 Here

3.2. Data collection and mapping features

3.2.1. Data format

By comparing the different data collection methods against human, technical and financial resources of fishers' representatives, the protocol quickly focused on using reporting to acquire mapping data. The basic principles are as follows.

Every year, the fishers' representatives use their own human resources to conduct surveys on fishing vessel skippers to reconstruct activity over last year's activity. The surveys developed consist of semi-structured, individual, face-to-face interviews of varying length (between 15 minutes and about two hours). To help with the interview, the interviewer and the responding skipper can use different aids to reconstruct fishing areas as precisely as possible (logbook data, data from on-board navigation systems, fishing logs, etc.). For each year, the collected data is always displayed in the format "vessel*month*gear*targeted species" (Table 1). Thus:

- for the same grid square, a vessel fishing for a given month (one or more days/fishing trips), with the same gear and targeting the same species gives rise to one occurrence only in the data table,

- for the same grid square, a vessel fishing for a given month (one or more days/fishing trips), with either another gear, or another targeted species gives rise to a number of occurrences in the data table equivalent to the number of gear/species combinations.

Table 1 Here

In other words, this table actually shows absence/presence data recorded for a vessel, a month (even for one day), a type of gear (even if it is used just once) and a species (even if targeted just once, out of the three main species fished; see hereafter). On this basis, it is evident that the data cannot be used to precisely describe fishing effort; they were not intended for this use. The individual data is collected for one grid square (representing about three nautical miles per side) based on the subdivision of ICES [3] statistical rectangles. The size of the grid square was determined empirically during a series of test surveys conducted in 2010 in a geographical sub-sector (47 vessels were surveyed), and was the result of three combined elements: (i) ensuring a certain level of confidentiality was maintained concerning fishing areas (especially for passive gear), (ii) finding a compromise between precision/accuracy linked to the memory of the responder and the aids s/he used to help reconstruct his/her activity, (iii) accounting for the time it took to conduct the survey and aiming for the financial sustainability of the experiment. To further allow for interoperability, gear typology was based on the EU's Data Collection Framework (DCF) [4] and the nomenclature for names of species came from the Aquatic Sciences and Fisheries Information System (ASFIS) database of the Food and Agriculture Organization (FAO) [5]. The established protocol enables an unlimited number of gear types to be entered, but only a maximum of three targeted species were selected in the surveys. The data characteristics enable fishing areas to be mapped for a vessel or a group of vessels, depending on different parameters that offer several combinations: the gear used, the targeted species, the month and other vessel-related parameters (home port, length, etc.). As a result, both fleets (defined in several ways) working in a given area and spatial-temporal dynamics can be identified. To attain the study's original objective, it is agreed that the data produced belongs both to the fishers (respondents) and their representatives.

As with any data from reported surveys, this data has limitations that are difficult to quantify due to the context of the survey (current relevance, tiredness of respondents, etc.) or inaccurate reports (intentional or not). To reduce the impact of such factors, the protocol planned for data to be double-validated by the respondents: on an individual basis by sending the maps summarising individual reports to each respondent; and on a collective basis through meetings where maps combining individual reports from each port (or group of ports in some cases) are presented and discussed. Although not a failproof guarantee, an important awareness-raising effort is made before conducting the surveys to explain that an inaccurate report can have a real impact on a respondent (e.g., a vessel could be excluded from a group of vessels affected by this or that project, or the impact could be underestimated if a fishing area was reported as being broader than it was in reality).

3.2.2. Options to reduce risks

From a data collection viewpoint, three main risks were identified:

- the uncertainty that fishers' representatives would have the resources over time to survey all the vessels every year;
- the possibility of fishers growing tired of being surveyed every year, especially as numerous surveys are already conducted on them;
- a human error committed by the interviewers during an interview and/or when recording data.

To minimise the first two risks, in 2012, it was decided that surveys would be conducted according to a sampling design. After revising the sampling strategy several times, and with the support of statisticians who joined the other scientists in this experiment, surveying activities are now implemented as follows:

- To begin with, two years of "exhaustive" surveying (i.e., conducting surveys with the aim of surveying all fleets, although in reality this thoroughness goal is obviously never reached), principally to establish the most solid baseline possible;

- Then, two years of surveying following a sampling plan designed after performing several statistical tests – based on re-sampling without replacement (Monte-Carlo method) – on the exhaustively-collected data. The chosen sampling design is a stratified random sampling one with proportional allocation. It is based on three principles:
    - Stratification: this is one of the most powerful tools in sampling design. Here we stratified our population on the primary gear (category and type), a geographical criterion (port or group of ports) and the length segment,
    - Simple random sampling (without replacement) from the sample of vessels per stratum: each vessel has the same probability of being surveyed,
    - Proportional allocation: the number of vessels to be allocated per stratum is proportional to the sample size of vessels in the fleet. This is determined using sampling survey theory (Tillé, 200; Ardilly, 2006; Lumley, 2010), depending on the rate of precision chosen in the sampling design – between 5 and 10%. For instance, for an estimation of 20% of the proportion of vessels operating in a grid square (e.g., density indicator, see further on) and a precision of 5% in the sampling design (a 95% confident interval for the whole population might be 15% to 25%).
- Then, a year of exhaustive data collection is again done, and so on.

For exhaustive surveys, the interviewer takes an opportunistic strategy, whereas for surveys based on a sampling strategy, they have to conduct interviews for a specific list of randomly selected vessels (except for the first sampling plan, where the population to be surveyed has been divided into three sub-populations, each having to be surveyed in one of the three years) and can fall back on an additional list if necessary.

Where the first and third above-mentioned risks are concerned, although the survey data was initially entered manually into spreadsheets, entry is now performed via an online application specially designed for the purpose (in addition to an off-line version with less functions, which is only used if the application is not available online). It enables automated data collection via a map-based data entry interface (Figure 2), thus limiting the risk of error during this operation. Available and in use since 2014, the application has two logic components:
- a server divided into:
    - a map-based server application (geoServer);
    - a database server (PostgreSQL);
    - a back-end application offering REST API for storing data (Java technology and the Spring software suite).
- a client: a front-end HTML/JavaScript application based on Ext JS, GeoExt and OpenLayers components.

Figure 2 Here

During the survey, using the relevant cartographic background(s) and by displaying the grid developed for this experiment, the interviewer selects one or more grid squares for a given month and enters the gear and target species using drop-down menus. For the same month and grid square (or group of grid squares), the entry operation is repeated as many times as required for entering all gear/species combinations. The procedure is the same for each of the other months. Functionalities have been developed to indicate when any incompatible gear/species combinations are selected. At the end of the survey, the application enables one or more maps selected by the interviewer to be generated – to show the responder the results immediately – along with a “.csv” file containing all the survey data. The data remains editable, along with the procedures defined for compiling results, for as long as the surveying period is still underway for a given year.

Now that this application provides all the functions for collecting data, managing surveys and archiving, work is about to start. It will cover developing a new version which will integrate the data processing functionalities currently handled by external GIS software. A series of seven indicators has been developed to harmonise and standardise the data processing handled by fishers' representatives (Table 2). They have already been made available to fishers' representatives in the form of Structured Query Language (SQL) queries. These queries will soon be available in the application so that processing can be performed directly without any specific GIS knowledge being required. The plan is also to develop other indicators, firstly to study potential intra-and inter-annual variabilities (differences between indicators calculated each year, variability in concentration of activities, etc.), and secondly to summarise and compile the variabilities (multi-year indicators: means, totals, etc.).

Table 2 Here

All the scientific and technical aspects of the protocol for collecting and processing data are described in technical documents in the form of information sheets (how to conduct a survey, conditions for and limits of using indicators, sampling plan, etc.) for fishers' representatives in charge of implementing the protocol.

4. Results

Firstly, the results had a positive outcome in terms of the experiment generating new knowledge. Launched in 2010 by scientists and fishers' representatives from the Pays de la Loire, this experiment has grown following the successive widening of its geographical scope: Brittany in 2012, Hauts-de-France in 2013, Normandy in 2014, Provence-Alpes-Côte d'Azur in 2015, Charente-Maritime in 2016. This means that the fishing practices of vessels represented by these six Fishery Committees can now potentially be mapped, i.e., about 3,250 vessels or three-quarters of French metropolitan fleets or more than 90% of the landed value at fish auctions. At the start of 2017, a little over 4,800 surveys had been conducted and since then, around 6,000 surveys have been conducted in total (Table 3). It is difficult to estimate the exact number for at least four reasons: (i) the surveys conducted in 2017 (on activity during 2016) have not yet been compiled; (ii) given that the different Fishery Committees did not all become part of the experiment at the same time, the surveys for all the Committees are not yet synchronised in terms of years for exhaustive data collection and years for collection based on successive sampling plans; (iii) exhaustive surveys are never actually exhaustive (the survey response rate has reached 65% in total), and neither are the surveys based on sampling designs (88% response rate); (iv) a falling trend in the number of fleets requires baselines to be revised each year. The data produced and the maps they create (e.g., Figures 3 and 4) break new ground in terms of the type and scale of the experiment (both geographically and temporally).

Table 3 Here

Secondly, another positive outcome of the results is that they suggest that this type of a experiment could introduce politics into MSP. A rundown based on a survey by questionnaires filled-in by the different regional Fishery Committees (winter 2017) indicated that the data had already been used in more than 60 instances when fishers and other actors worked together, especially on issues concerning offshore wind farm projects, new concessions for extracting marine aggregates, and MPAs. In real terms, by ensuring that the stakes for fisheries were better taken into consideration by mobilising knowledge produced by fishers, certain layouts for placing wind turbines within farms and corridors for carrying electricity between the farms and the mainland were modified; socio-economic diagnostics were improved for MPAs; and the interests of fleets were put forward during discussions in the aftermath of the Brexit vote. In relation to the above, the discussions underway between government agencies and fishers' representatives on launching an analysis of the risk that fishing poses to Natura 2000 sites are an interesting case in point. Thanks to the data at their disposal, fishers were able to participate in technical discussions. In other words, they were able to take part at an earlier stage and gain access to what until then had been a "black box" conditioning the later-stage decision-making process. In fact, given the method chosen to describe this fishing risk on a national level, fishers' representatives heeded the advice of scientists and decided not to comply with a general request for use of the data they had acquired.

Instead, they opted to lay down conditions for a case by case analysis (depending on the size of sites, the shape and scope of habitats, etc.). As a result, we can see that this experiment provides a variety of advantages: for fishers – of course – who have data and maps to promote their interests; for other actors, who can take fishers' interests into account; and for MSP.

Figures 3 and 4 Here

5. Discussion

Looking at the first result, despite the positive outcome, it should be noted that not all French fleets participated in this initiative. This is the case in the following regions: Nouvelle-Aquitaine (in part), Occitanie and Corsica. Although this is difficult to explain inasmuch as no steps have been taken to encourage the relevant Fishery Committees to join in this initiative (and consequently, they have not been able to express any form of refusal), the most probable reasons are that these three committees have not felt the need or not wished to take part. The first of these reasons is easy to understand, particularly as one of the committees will soon be participating in the experiment due to the arrival of the very first wind farm projects in the geographical area where their fleets operate. In contrast, the second possible reason is a more sensitive one, potentially suggesting political tensions between committees. It is worth highlighting that this experiment is not limited to regional committees because for many years now, the National Fisheries Committee and five POs have been associated with it and participate in collaborative work to varying degrees.

As for the second result, which is a logical outcome of the study's original idea, the issue of access to produced knowledge can be both an advantage and a constraint. The interest of this kind of approach is namely that the fishers and their representatives keep a hold on the raw data (in other words, the data belongs to them). It not only helps them to be invited to the discussion table, but also enables them to take part in debates, with arguments backed by data. The advantage is that fishers are placed in an *empowered* position as opposed to a powerful one: they are able to partake in bilateral or multilateral discussions with other maritime actors. However, it is also a constraint because inevitably the data produced is not openly available to the public and cannot automatically be accessed by third parties, even though information based on the data is shared in an MSP context. At the same time, official data used in most MSP processes is not available anymore (e.g., VMS data); an issue we came up against in the context of this experiment (see below). More generally, this accessibility issue fundamentally questions the role of public authorities in the production of data against the backdrop of the withdrawal of funding for a certain number of missions. This can actually lead to an ambiguous situation where on the one hand, public authorities off-load onto actors, who have to compensate for this lack of funding, and on the other hand, they reproach these same actors for organising themselves in response. The "neutrality" card is often played when it comes to the production of data. With regards to this, the status of the data acquired through an experiment such as the one described in this paper raises questions similar to the ones on using data generated by citizen sciences (as opposed to "sovereign data", which is naturally considered as "neutral" by the sovereign authority) and the possibility of bypassing opposition via a hybrid alternative (Goodchild, 2009). This experiment has not always been held in high esteem, especially by certain government agencies or subcontractors (who may have felt that they were being robbed either of some of their prerogatives or some of their contracts). But its aim has always been to develop a complementary system, specifically dedicated to MSP, and not to replace existing systems that have their own place and legitimacy. It would seem, however, that the attitudes of government agencies are somewhat changing.. This is due in part to the fact that in developing marine plans, they are not only faced with a lack of standard data to describe fishing activities, but they also need to take all interests into account, including those of the fishing sector.

Important scientific work has been carried out through this experiment over the last few years in terms of building and improving the tools and methods used: survey protocol, software application, sampling strategies, indicators and mapping, etc. This said, there is still much to be done to improve this experiment.

Firstly, from a quantitative point of view, a certain number of organisational choices were made concerning surveys as the experiment developed, and these were sometimes hampered by material circumstances (e.g., a certain type of survey was not conducted by one of the committees for one year due to a shortfall in resources, or simply because they refused to do so). Work is still needed to be able to jointly use data acquired on different bases (e.g., exhaustive surveys or using several sampling plans) or to evaluate the usability of data sets in relation to years and regions which produced weaker scores. Similarly, the issue of missing data is also relevant for data acquired according to the more recent sampling plans based on stratified sampling with proportional allocation. If we step back a little, the work to be done leads us to another central element of this experiment: the fact that the intermediary assumption on the empowerment of fishers and their representatives (by mastering a technical mapping instrument that enables them to benefit fully from the knowledge it produces) has only been partially proven. In fact, from a purely simplistic and perilously naïve point of view, the empowerment process will only end when collaborating with scientists is no longer worthwhile for fishers; in other words, when all their scientific questions have been answered. However, the numerous discussions and even disagreements witnessed over the last few years between scientists and fishers' representatives reveal that representatives sometimes refuse to follow the recommendations of scientists due to a lack of thorough understanding (e.g., the refusal mentioned above concerning a survey based on a sampling plan). The above clearly shows the commitment of fishers' representatives (and fishers themselves, on another level) to gradually come to grips with how data is produced and represented. This said, we must not presume that this experiment is based on a one-way relationship where scientists have the authority and knowledge every which way. The relationship is actually two-way because fishers not only take possession of scientific know-how, but also contribute to it – they are co-developing it.

As for the quality of collected data (which refers back to the previously-raised issue of neutrality), there is still important work to be done here too. For apparently confidential reasons, it has not been possible until recently to begin work on comparing data acquired through this experiment with data from official sources, which has unfortunately remained inaccessible (e.g., VMS). In addition, we cannot naturally assume that official data have no limitations, especially as they were only collected from a small portion of the fleets. We can see that more research is also required here, even though this issue is more complex than it first seemed when viewed from another angle. It is complex because first of all, as the data is used to defend the interest of fishers in discussions on the sharing of maritime space, fishers would make their case worse if the data was of bad quality. As a result, it is for many a question of knowledge transmission/acquisition as well as of the legitimacy of the body conducting the surveys (and of those responding to them, from a fisher's perspective). It is probably also worth envisaging quality over the long term by considering the whole experiment as a process, rather than just regarding the data as a finished product. Two main lessons can be learnt from this experiment: (i) the fact that surveys are conducted by fishers' representatives is a prerequisite in terms of feasibility, but also quality (e.g., few errors or approximations spotted in individual reports during collective validation); (ii) the duration of the experiment obviously favours quality data because it gradually limits or mitigates any biased reporting (e.g., the longer the experiment goes on for, the less important the context in which the survey is conducted becomes). The issue is also complex because, secondly, given the ultimate hypothesis of this experiment (i.e., that the empowerment of fishers will enable them to become "real actors" with a minimum power due to their possession of their own data the issue of the quality of geographical information needs to be viewed not only in terms of "internal" quality, but also of "external" quality (see Devillers and Jeansoulin, 2006), and probably by additionally integrating the capacity of producing it. In this regard, the experiment relates to works on citizen sciences, which encourage notions of data quality, legitimacy of sources and levels of uncertainty to be reviewed (Mericksay and Roche, 2011).

6. Conclusion

The case of fisheries is an interesting one because it invites us to take a more critical look at MSP as it is implemented today, i.e., as a process that is both implicitly dominated by "technical" aspects and heavily conditioned by strategies developed "outside" of the MSP context, namely in sector-based policies and planning. These predominant influences are encouraged by the supposedly paradoxical convergence of two opposing concepts of sustainability, one favouring economic growth (namely by developing marine renewable energies) and the other, marine conservation. The place given to the "spatial" aspect is one of the points in common, which is a particularly critical facet for fisheries, and consequently for MSP, because its capacity for integration has levelled out. It is of utmost importance that all kinds of viewpoints and interests be expressed in MSP, and it seems equally crucial to be able to do this explicitly, i.e., without technical issues being used as a screen for expressing dominant interests. This is why it seems vital to (re)position technical issues within the scope of democratic debate, rather than cutting loose from the "technical" aspect or considering it as a tool for steering democratic debate. In this respect, the outcomes of this experiment, which is still in progress, are already positive, offering one option among others for further exploration that is both highly promising and which raises new questions. These efforts will help in the rebalancing of the "technical" and the "political" dimensions of MSP, and maybe towards a more strategic than spatial process, mainly more participatory and democratic.

Acknowledgements

This work was supported by the European Union (European Maritime and Fisheries Fund, *L'Europe s'engage en France avec le fonds européen pour les affaires maritimes et la pêche*) [Cop-Valpena]; the Fondation de France [grant number 1320, Kifanlo]; and the SMIDAP, Région Pays de la Loire [Valpena]. We would like to warmly thank all Fisheries Committees that participated to the experiment since 2010, and Rodolphe Devillers for his constructive comments on the very first draft version of the paper. We are also very grateful to the editors, invited editors, and three anonymous reviews that contributed to improve the first version of the text with insightful comments.

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Figure 1: Fishers' empowerment through map-making: an experiment

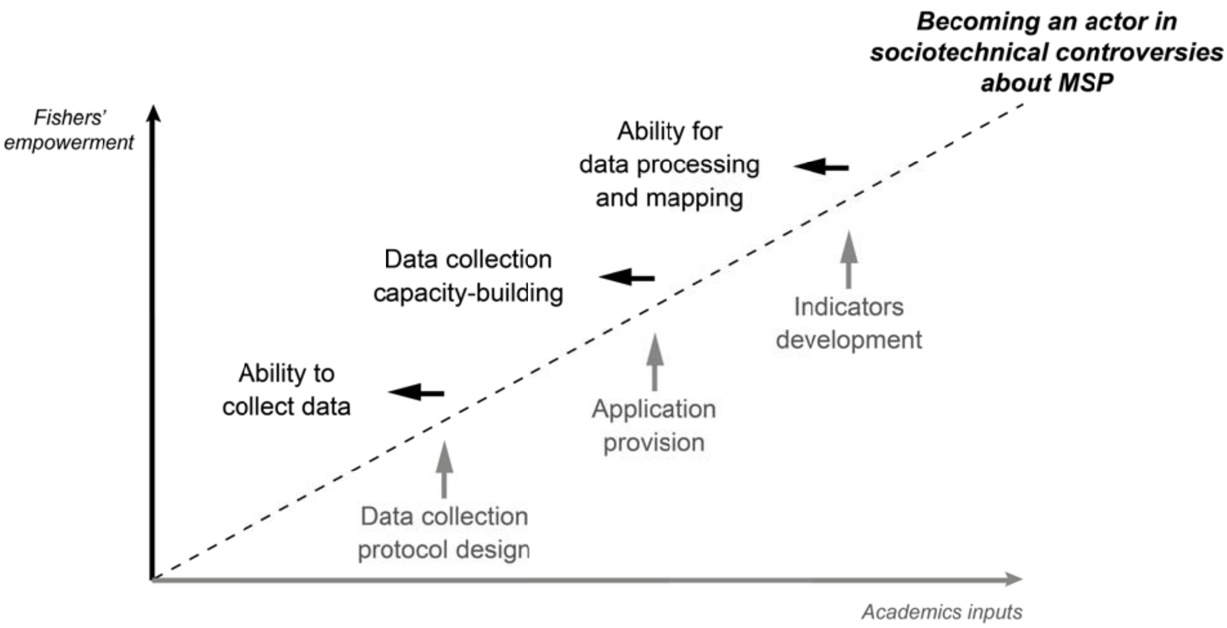

Table 1: Example of the data collected

Vessel_ID	Month	Year	Grid_ID	Gear	Species
xxxxxx	4	2010	2722E7K8	OTB	SOL
xxxxxx	4	2010	2722E7K9	OTB	SOL
xxxxxx	4	2010	2722E7L5	OTB	SOL
xxxxxx	4	2010	2722E7L6	OTB	SOL
xxxxxx	4	2010	2722E7L6	OTM	SOL

Figure 2: Application used to collect data

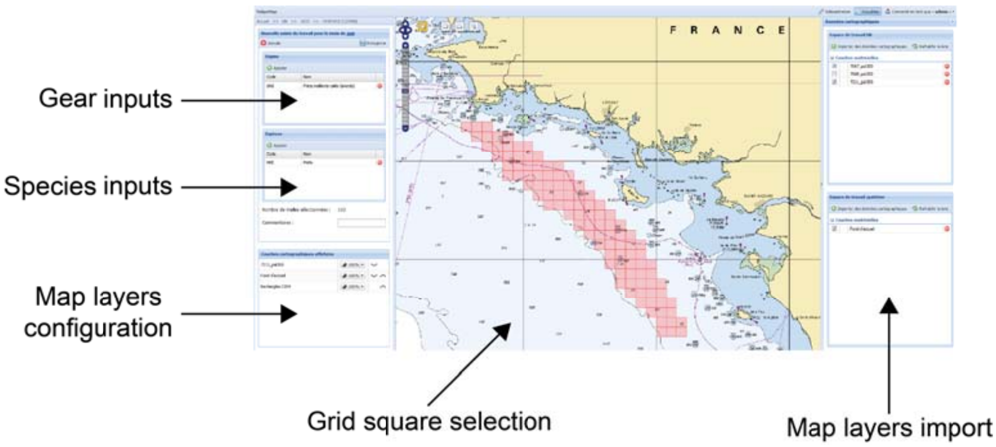

Table 2: Indicators used for processing

Indicator	Brief description
Density	Number of different vessels in a given grid square (number of vessels)
Frequency	Number of months during which vessels work in a given grid square (number of months)
Intensity	Total number of months a fleet works within a given grid square (number of vessel*months)
Spatial dependency	For one fleet, the share of a grid square (or zone under study) compared to all the grid squares where vessels work (percentage)
Temporal dependency	For one fleet, the share of a grid square (or zone under study) compared to all of the months vessels worked (percentage)
Intensity dependency	For one fleet, the share of a grid square (or zone under study) compared to all of the vessel*months (percentage)
Economic dependency	For one fleet, by combining with sales data (other sources), the share of the turnover generated within a grid square (or zone under study) compared to overall turnover (percentage)

Table 3: Results of the conducted surveys

		2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Pays de la Loire	*Surveys*	359	280	*90*	*97*	*96*	*102*	*90*
	Score	77,7%	64,8%	*69,8%*	*75,2%*	*74,4%*	*97%*	79,6%
Bretagne	*Surveys*		391	611	1,035		*343*	*245*
	Score		30,9%	77,7%	78,5%		*97,2%*	*71,0%*
Hauts-de-France	*Surveys*			139	137	*61*	*61*	86
	Score			83,2%	85,6%	*98,4%*	*100%*	65,6%
Normandie	*Surveys*				307	476	*213*	*108*
	Score				52,8%	82,8%	*89,1%*	*57,4%*
Provence-Alpes-Côte d'Azur	*Surveys*							433
	Score							73,0%
Charente-Maritime	*Surveys*							210
	Score							88,2%
	TOTAL	359	671	840	1,576	633	722	1,172

4,801	**5,973**

NB: The years correspond to activity data (the surveys were conducted at n+1). The grey squares represent years during which no survey was conducted: either because the committee had not yet joined this initiative, or due to lack of resources (in only one case). The indicated targets correspond to vessels to be surveyed and consequently, do not correspond to the total number of vessels in fleets for the years when a sampling plan was followed. The surveys conducted appear in italics: either conducted according to a sampling plan, or as a "mixed" version (i.e., following a fusion between two committees, one conducting an exhaustive survey and the other using a sampling plan: Normandy in 2015). In any case, the sampling strategy changed over time (there have been three different sampling plans) before becoming more established in 2016.

Figure 3: First example of a map created using data from the experiment

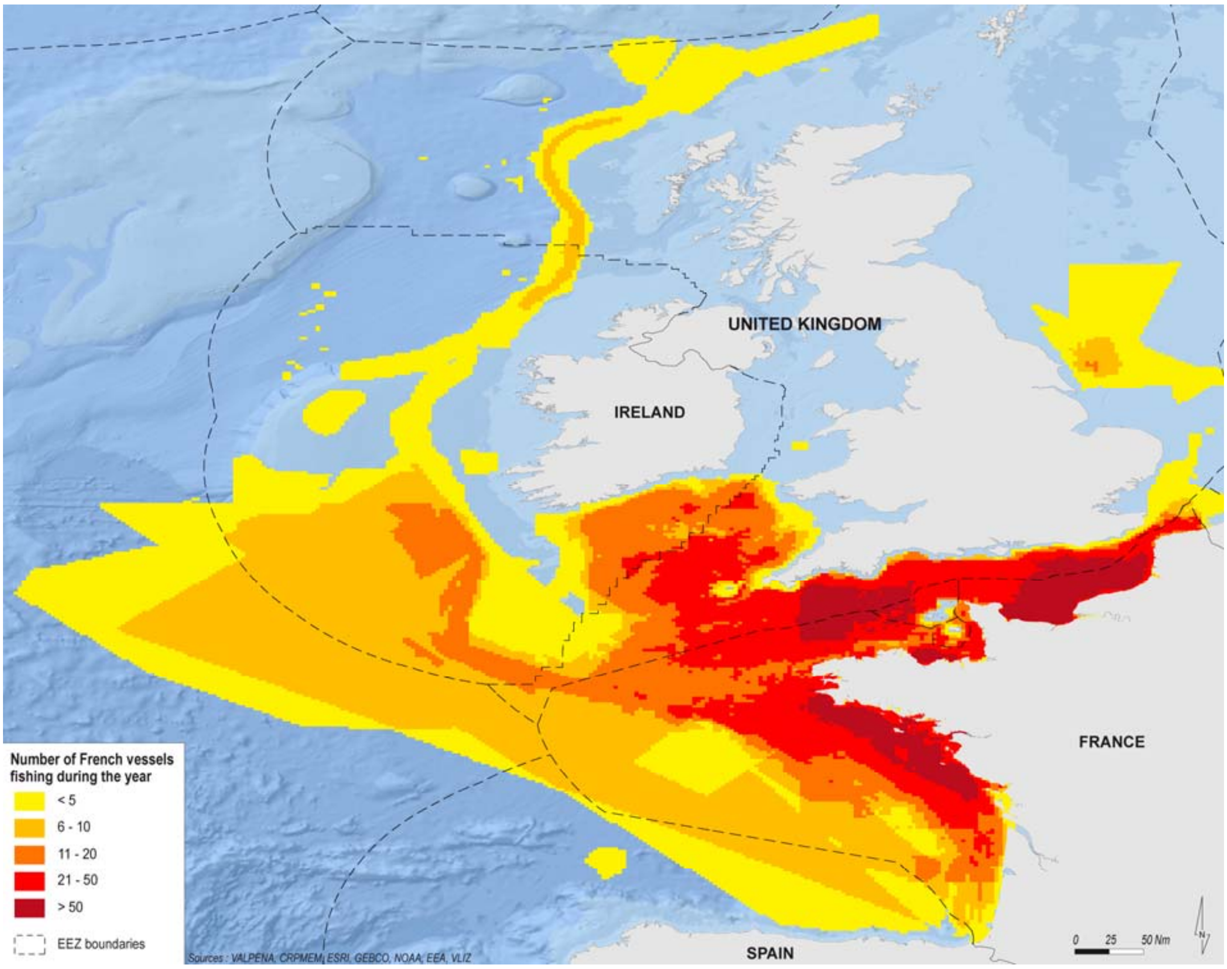

Figure 4: Second example of a map created using data from the experiment