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and policy makers

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5.1 First Action Line – A more dynamic governance of the science and society relationship

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Contents

Summary

Work Package 4 of the GAP2 project is about knowledge, social process and the success of collaborative research. The research reported here, examines the impact of the collaborative research process on the attitudes of fishers, scientists and managers. As our point of departure we understand collaborative research as involving the combination of fisher's experience-based knowledge (EBK) and scientist's research-based knowledge (RBK) and the translation of these results into useful knowledge for management. The knowledge of fishers and the knowledge of scientists have different qualities and are both quite different from the knowledge that is taken up as "scientific advice" by the management system. The research outlined in the report employs Q-methodology (Brown, 1986), a form of factor analysis which allows a detailed examination of subjects' perceptions and attitudes. We compare different groups of people – fishers, scientists and managers in six GAP2 case projects (Table I), and with particular emphasis on their views on stakeholder participation, collaborative research and the relationship between Experience Based Knowledge (EBK) and Research Based Knowledge (RBK) in the area of fisheries management.

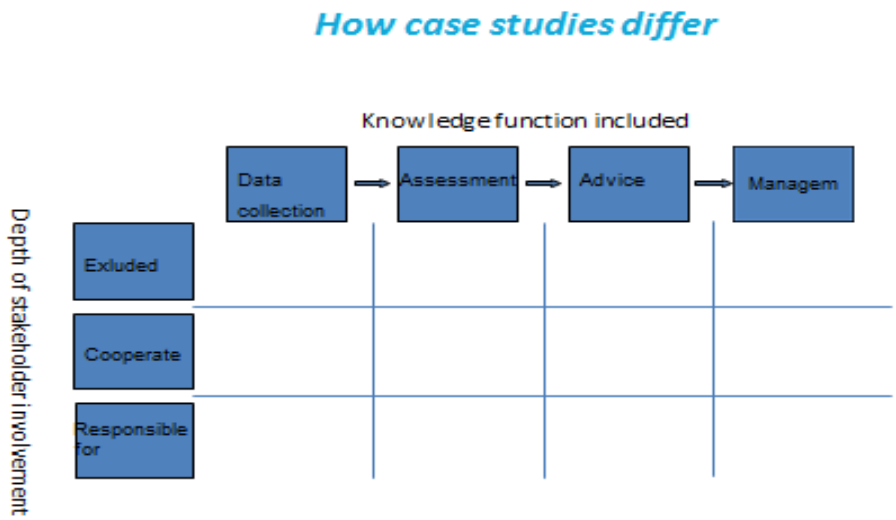
Through a set of qualitative interviews in each of the six case studies, we examine how key representatives of each group view the substantive dimensions of the research to be undertaken within the respective cases. The interviews cover a range of relevant management issues pertinent to the fisheries in question. Based on these initial interviews and through preliminary discourse analysis, a unique set of site-specific statements were produced for 'sorting' by a larger number of respondents, representative of different stakeholder groups in each location.

Case #	Short name	Topic
CS1	Devon brown crab	Sustainability of brown crab stocks with studies on behaviour and migration
CS2	Galicia TURFs	Mapping habitats and fishing grounds in coastal ecosystems of Galicia
CS4	WBSS herring	Management plans for herring in ICES IIIa and adjacent areas: perceptions of stocks and fisheries
CS5	Steigen coastal cod	Developing a fisheries-based resource monitoring system for Norwegian coastal cod
CS8	Chioggia	Spatio-temporal distribution of fishing effort and biological resources in the Northern Adriatic Sea
CS12	Dutch discards	Collaborative discard sampling in the Dutch flatfish fisheries

Analytical framework

A main idea in GAP2 is to organize collaborative projects by which scientists and stakeholders can engage in cooperation on knowledge relevant for management purposes. This is illustrated by the figure below, where the columns represent the main knowledge functions in a management chain (Data collection,

assessment, advice, management decisions). The rows represent the different types of stakeholder engagement, from being excluded (top), via invited to cooperate (middle) to being made responsible for the relevant function. A main idea in GAP2 is to establish cooperative projects in which stakeholder involvement is shifted from the top row to the second row. GAP case studies vary with regard to which knowledge functions they cover. As illustrated by the figure1, the case studies in GAP2 can be seen as a shift from the first to the second row. While the depth of stakeholder involvement in the figure is represented as three steps on a ladder, there is of course room for a lot of variation between the extreme points of complete exclusion and full responsibility. We could perhaps say that the propensity for attitude change is dependent on the gap between GAP2 case studies and conventional practices. The larger the gap, the more likely that participation results in significant attitude changes.



In addition to 'gap size' two other analytical rubrics are considered. The first concerns 'idealistic versus pragmatic notions of Experienced Based Knowledge', and has to do with the cooperative research practice as it unfolds within the GAP2 case studies in contrast to what the prospective participants expected before they were engaged in this work. The assumption is that the attitude change following from participation is likely to be greater if the experience was very different from what people had expected. The second is concerned with the 'management uptake of GAP2 products'. The assumption here is that the extent to which GAP2 case studies are perceived to be successful is likely to affect participants' attitudes towards the project and hence towards cooperative research.

Case studies

CS1 Devon Brown Crab

CS 1 is about "Sustainability of brown crab stocks with studies on behaviour and migration" with an aim "To produce a methodology that will enable the crab fishers to evaluate themselves the sustainability of the stock they exploit." The Devon case is characterized by agreement of the potential positive influence partnering and knowledge production between scientists and fishers may have on local management. There is however disagreement on whether local management decision-making is the most appropriate way to manage the fishery and indeed over the management regimes themselves. According to the case study classification framework (figure I) the knowledge function for fishers' participation in the Devon case, centers largely on data collection but it is intended that once the model is up and running, that fishers will be able to assess the sustainability of the fishery for themselves, thereby shifting the knowledge function towards assessment.

CS2 Galicia TURFs

CS2 is about "Mapping habitats and fishing grounds in coastal ecosystems of Galicia," with an aim "to design and implement a management plan in order to establish a local marine reserve in the area of Aguiño." The Galician case is characterized by agreement in many aspects. There is strong consensus that scientific knowledge is necessary for fisheries management and that ineffective management is a serious issue. From the Galician case study we learn that cooperative research has broad acceptance, not as an alternative, but as an expansion of traditional scientific research. With respect to attitudes towards cooperation, the most dominant perspective favors the type of research initiatives that GAP2 represent and the subjects who load on it come from various groups both in and outside the GAP2 case study. On the basis of this we argue that collaborative research is highly acknowledged in Galicia. Acceptance of the need for participatory research could indicate that collaborative projects have penetrating power in management. The fact that the local *cofradia* is utilizing the GAP2 case study in the making of new management plans support this.

CS4 WBSS Herring

CS4 is about "management plans for herring in ICES IIIa and adjacent areas: perceptions of stocks and fisheries" with an aim "to develop a tool which industry can use to predict the behavior of the Western Baltic Herring stock, under a range of management scenarios. To do this, we want to establish a Long Term Management Plan (LTMP) for the species, through combining traditional knowledge with scientists' understanding." The Western Baltic herring is characterized by many strong opinions that do not cluster

as much as in the other cases. There is however strong consensus that cooperation between scientists and stakeholders is important. Thus, despite technical disagreements on how the herring should be managed, they agree about the process on how this agreement should be established. The analysis does not show variable attitudes between responders in and outside the GAP2 case study. The project is limited in penetration power because of lack of influence at the political level. The limitations in the scope of the project activities that this leads to, make it challenging for the project to continue successfully. From this we learn that a condition for effective collaborative research is that it is anchored on the decision-level in management; in this case in the negotiations between the EU and Norway.

CS5 Steigen Coastal Cod

CS5 is about "Developing a fisheries-based resource monitoring system for Norwegian coastal cod," with an aim to "to develop a fisheries-based monitoring system for Norway's coastal cod." In this case study, specialised knowledge is being co-constructed and feeds into a stable and functional institutional management context. From the results of the q-sorts, there is some evidence to suggest a willingness for fishers' participation to move from purely data collection towards an advisory function but it's uncertain how able the management structures would be to accommodate this. The 'gap size' in Norway is arguably one of the smallest in the region, with many years of scientist fisher collaborations creating a context where there are general norms for fisher participation. Attitudes vary little between stakeholders with the majority opinion resting on the benefits of collaboration. The case study is considered successful in terms of GAP2 project objectives, in a number of key areas; in that across factors 1) the case study assessment methodology and use of hydro acoustic survey techniques are universally supported, and the uptake to management is relatively certain 2) the importance of collaboration between fishers and scientists is strongly supported and that 3) despite clear differences in motivations, opinions converge on the importance of addressing the so called engagement gap.

CS 8 Chioggia

CS8 is about "Spatio-temporal distribution of fishing effort and biological resources in the Northern Adriatic Sea," with an aim to "to map the spatio-temporal distribution of fishing effort and biological resources in the Northern Adriatic Sea: towards the identification of fish habitats and management proposals in the framework of a participatory approach." Whether an actual or a convenient truth the 'crisis narrative' presented in the analysis transcends factors and discourses and appears to be used as a justification for entrenched positions as diverse as (subsides, quotas and conservation approaches such as closed seasons). Crucially though and in the context of the GAP2 case study, this situation may act as an opportunity to motivate engagement around developing local management tools and highlights the importance of working together to illuminate the potential for using collaborative research for effective local resources planning and management.

CS12 Dutch Discards

CS12 is about "Collaborative discard sampling in the Dutch flatfish fisheries", with an aim to "to improve information about discards in the Dutch flatfish fisheries by producing a platform where fishers and scientists are working together to improve information about the catch, with a particular focus on discard sampling." The analysis of the Dutch GAP2 case study has revealed clear disagreements in the ongoing discourse. The most engaging theme in the debate is without question the discard ban, where the three factors have different opinions on the matter. There are different attitudes between the respondents in and outside the GAP2 case study. GAP2 in the Netherlands is a bottom-up process clashing with a top-down process initiated by the EU. From this we learn that a condition for successful collaborative research requires that there is demand for the knowledge product that is being produced. If it is not utilized the motivation for the people involved may cease and challenge further collaborative efforts.

Summary and conclusion

The GAP2 project is based on an understanding of a large gap between stakeholders and governance institutions engaged in managing fisheries resources. In the Q-sort, however, we do not find this gap, at least not as deep and dark as the conventional description might lead us to believe. In general, the GAP2 participants have a somewhat more developed cooperative attitude than non-GAP2 people, but the contrast is not that stark. In *CS1 Devon brown crab* the 'gap size' is moderate, with a history of scientist fisher collaborations creating a context where there are opportunities for fisher participation. While the attitudes do vary, the majority opinion rests on the benefits of collaboration. In *CS2 Galicia TURFs* we learn that cooperative research have broad acceptance as an expansion of traditional scientific research. A condition for this may be the short distance between the research activities and the management level. In *CS4 WBSS herring* there is strong consensus that cooperation between scientists and stakeholders is important. In *CS5 Steigen coastal cod* the 'gap size' is fairly small, with many years of scientist fisher collaborations creating a context where there are general norms for fisher participation. In *CS8 Chioggia* the 'gap size' is quite large, with the GAP2 case study pushing to influence the norms for fisher participation. Attitudes vary quite significantly between stakeholders with those more involved in the GAP project seeing the benefits of collaboration and those outside of it who do not (preferring instead it seems a 'command and control' style approach). In *CS12 Dutch discards* attitudes towards collaborative research are harmonized and generally accepted, but at the moment they are overshadowed by the controversy over the discard ban.

It seems that the gap is not that large after all. One possible explanation may be that the description of the gap has been somewhat exaggerated. Perhaps the broad acceptance of the existence of a gap in itself is an importance step towards its bridging? Another possibility is that the many initiatives and new institutions – including the GAP2 case studies – enabling stakeholder participation over the last 10 years are starting to have an effect. A third possibility is that the GAP2 case studies are not representative of the general situation in European fisheries. In support of this interpretation, we observe that many of the GAP2 case studies build on a long history of science – stakeholder cooperation.

A possibility then is that somehow the project selection process in GAP2 has favored fisheries/areas where the conditions for cooperation have been good.

Are fishers the true ecologists of the ocean? While the Q-sort does not give a straight answer to this question, it does not suggest that this notion has a strong position. We must note, however, that for two of the case studies, *CS1 Devon brown crab* and *CS8 Chioggia*, it is difficult to interpret this question. In Devon there are too few respondents. In Chioggia, opinions diverge along many dimensions, in part because of an underdeveloped governance framework. In the two CFP-related case studies, *CS4 WBSS herring* and *CS12 Dutch discards*, the penetration of science is very strong that there is very little space for idealist notions of EBK.

In the two remaining case studies, *CS2 Galician TURFs* and *CS5 Steigen coastal cod*, there are elements that could be taken in support of an idealist perspective. In *CS2 Galician TURFs*, there is a strong agreement among GAP2 participants that "fishers have complex ecosystem information." In contrast, a group of non-GAP2 respondents strongly disagrees with this statement. Nevertheless, there is no strong support for the idea that "there are things that fishers know and scientist don't". In CS5 *Steigen coastal cod*, some of the fishers take a position that in some ways represents the idealist position to EBK (factor 3). The picture presented in factor 3 is one that exudes confidence in EBK particularly with respect to knowing the status and behavior of coastal cod. Local management and fishers /scientist advisory functions are championed, along with a disagreement over existing regulations restricting the exploitation of coastal cod imposed 'from outside'. The position does not go so far as to want to do away with science, however.

The work with the Q-sort for the case studies quite clearly have demonstrated that the degree to which the case projects are integrated in existing management structures is important for the performance of the projects as well as the attitudes of the participants. In *CS1 Devon brown crab*, the intention is that the project will allow fishers themselves to assess the crab fisheries sustainability, but how this will be maintained after the project and within which institutional management setting it will be received is yet to be fully defined. Whilst the management structure is fairly stable, how it will accommodate the assessment advice provided by the model and to what ends this knowledge will be put are unclear at this stage. From *CS2 Galicia TURFs* we learn that cooperative research have broad acceptance, not as an alternative, but as an expansion of traditional scientific research. A condition for this may be the short distance between the research activities and the management level. In *CS4 WBSS herring*, the project is limited in penetration power because of lack of influence on the political level. The limitations in the scope of the project activities that this leads to, make it challenging for the project to negotiate its way forward. In *CS5 Steigen coastal cod*, cooperation works well; the case study assessment methodology and use of hydro acoustic survey techniques are universally supported, and the uptake to management is relatively certain. In *CS8 Chioggia*, in contrast, the 'crisis narrative' transcends factors and discourses and can be considered as not simply a crisis of resources, but of knowledge and its institutional governance recipients. In *CS12 Dutch discards*, there is strong support for cooperative

research, but the possible impact on management becomes uncertain. Not because the research itself lacks legitimacy, but because the distance between the research activities and the related management measures are too large.

Introduction

WP4 of the GAP2 project is about knowledge, social process and the success of collaborative research. Collaborative research involves the combination of fisher's experience-based knowledge (EBK) and scientist's research-based knowledge (RBK) and the translation of these results into useful knowledge for management. The knowledge of fishers and the knowledge of scientists have different qualities and are both quite different from the knowledge that is taken up as "scientific advice" by the management system. As has been demonstrated (Holm, 2003; Wilson *et al*., 2006) techniques from the sociology of knowledge can be used to develop a better understanding of these processes. What remains unclear and in need for further examination are the ways that the different understandings and interests of managers, scientists and fishers change through their collaboration, what impact this might have on management and the conditions under which collaborative research designs would be a viable mechanism for providing input for management decisions.

The research reported here examines the impact of the collaborative research process on the attitudes of the fishers, scientists and managers involved, using Q-methodology (Brown, 1986). First, we carried out a small set of qualitative interviews in 6 selected GAP2 case studies to examine how the key representatives of each group view the substantive dimensions of the research to be undertaken within the respective cases. The interviews covered a range of relevant management issues pertinent to the fisheries in question. Based on these initial interviews a larger number of respondents were to be asked to participate in a survey. In the section on Q-methodology below we explain the methodology in some detail. Before that, however, we describe the research questions and the analytical framework for this research.

Analytical framework

Collaborative research involves that fishers and scientists cooperate in establishing knowledge and making such knowledge speak to management issues. A Q-sort analysis allows us to examine some of the factors that affect such cooperative efforts, namely the perceptions and attitudes of those involved in them. GAP2 has established 13 case study projects in which scientists and fishers (and sometimes managers) cooperate in research aimed at improving the knowledge base for management. In this case, we compare different groups of people – fishers, scientists and managers – with a main interest in their attitudes towards knowledge and cooperation in the area of fisheries management. In order for the Q-sort method to produce meaningful results in this context, we need to identify questions that the respondents are genuinely interested in and are able to recognize as part of an ongoing discussion or controversy. This means that we cannot simply record respondents' attitudes on the same set of statements across cases, but must construct a specialized set of statements for each of the cases, reflecting particulars of the ongoing discourse in each setting.

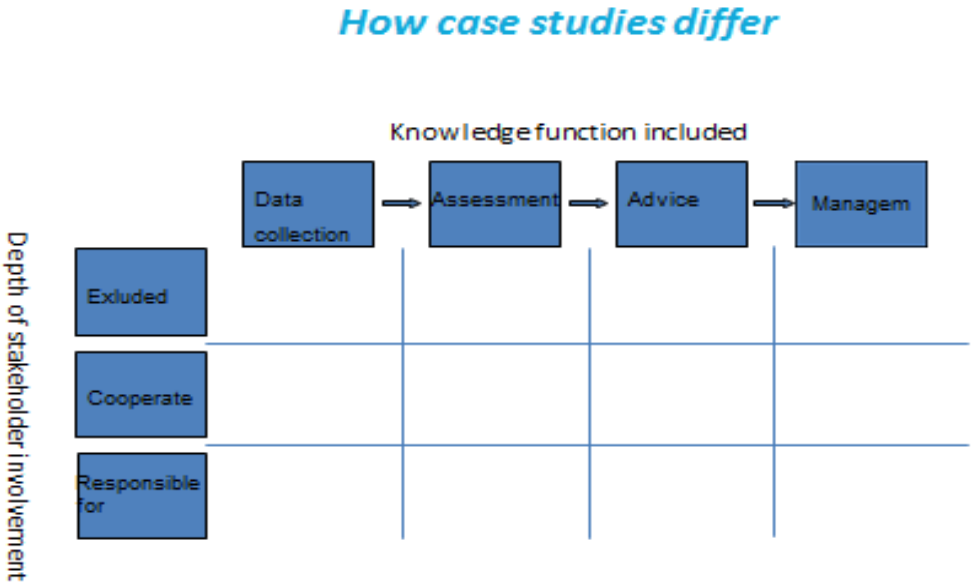


Figure 1: Classification framework for GAP2 case studies. The columns represent the main knowledge functions in a management chain (Data collection, assessment, advice, management decisions). The rows represent the different types of stakeholder engagement, from being excluded (top), via invited to cooperate (middle) to being made responsible for the relevant function. A main idea in GAP2 is to establish cooperative projects in which stakeholder involvement is shifted from the top row to the second row. GAP case studies vary with regard to which knowledge functions they cover.

In order to understand variations and similarities among cases, we need to have some ideas about how the cases vary, and what kind of factors may influence the attitudes of the stakeholders involved. A useful starting point here is to categorize the different case studies according to the type of knowledge functions they involve. This is indicated in Figure 1. In this figure, the columns represent the main knowledge functions in a management chain, that is data collection, assessment, advice, management decisions (Bjørkan, 2011). The rows represent the different depths of stakeholder engagement, from a situation of total excluded (top), via cooperation (middle), to taking full responsibility. In the GAP2 case studies, a main idea is to establish cooperative projects, shifting stakeholder involvement from the top row to the second row. While the depth of stakeholder involvement in the figure is represented as three steps on a ladder, there is of course room for a lot of variation between the extreme points of complete exclusion and full responsibility.

Stakeholder involvement and collaborative research are broad concepts and may cover a number of different things. The figure is a simple diagnostic device that helps to describe the scope and

ambitions of the individual case studies and compare them to each other. In the next section, we shall indicate more precisely how the six case sties included in the Q-sort can be located in the figure. Before that, however, we shall discuss how we expect the particularities of the cases may affect the attitudes of the participants.

A note of caution is warranted at this point. Exactly how experience with cooperative research will change participants' attitudes is far from obvious and this type of research is explorative and open-ended. It seems likely, at the outset, that practical experience with such projects will make participants' attitudes toward cooperation more positive, at least if they were skeptical at the outset and the cooperative effort goes well and deliver as promised. Nevertheless, it is well known that the reward systems and pedagogical technologies employed as part of the organization of such projects are likely to affect participants' attitudes directly, partly decoupled from projects' success (Asplund, 1987).

Having noted that, however, we expect that attitude changes caused by participation in a cooperative research project are dependent on the contrast between the project ethos and the institutionalized practices and accepted norms in the relevant field. In other words: If the GAP2 case study promotes viewpoints on fisher knowledge and cooperation that differs markedly from the accepted norms in the area/fishery, we expect that participation will have a large impact on attitudes. If the GAP2 case study is more in line with the accepted norms in the area/fishery, participation is less likely to give attitude changes. We could perhaps say that the propensity for attitude change is dependent on the gap between GAP2 case studies and conventional practices. The larger the gap, the more likely that participation results in significant attitude changes.

Gap size

We note that there have been considerable changes over the last 10 years or so in the general norms with regard to fisher participation in management functions, including knowledge provision. Whereas it until quite recently has been commonplace to describe the conventional institutional model for fisheries management as top-down and with low regard for stakeholder participation, there now seems to be broad agreement that active stakeholder participation is important and that the legitimacy and effectiveness of fisheries management will suffer without it. In support of this we can note several innovations, like the Regional Advisory Councils (Linke, Dreyer and Sellke, 2011), Long Term Management Plans (Penas, 2007), new forms of stakeholder involvements within ICES (Wilson, 2009); the development of participatory modeling (Hegland and Wilson, 2009), the Fishers' North Sea Stock Survey (Napier, 2011); and the Norwegian Reference Fleet (Bjørkan, 2011). Such a shift may of course be superficial, reflecting the breakthrough of a certain way of talking rather than a more fundamental change in institutional practices. The Q-sort can provide useful information on this count. The Q-sort will reveal to what extent and how attitudes differ between those who participate in collaborative research and those who do not. If there are huge gaps between fishers, scientists and managers in European fisheries, the differences in attitude between participants and non-participants in GAP2 case studies will probably be substantial. However, if the recent changes in norms have taken root in European fisheries

and it is generally accepted that fishers and other stakeholders should be involved in and take management responsibility, the differences in attitudes will not be that great. The adoption of the new norms with regard to stakeholder involvement will probably vary across Europe. In addition, they will probably not be adopted at the same rate by different stakeholder groups. The Q-sort may hence reveal interesting patterns of variation.

Idealist versus pragmatic notion of Experience Based Knowledge (EBK)

The second point to note has to do with the collaborative research practice as it unfolds within the GAP2 case studies, in contrast to what the prospective participants expected before they were engaged in this work. The assumption is simply that the attitude change following from participation is likely to be greater if the experience was very different from what people had expected. This presumes, of course, that the lesson learned somehow was profound, representing a true "learning experience." While this in itself may appear reasonable, it opens another set of questions: Why would stakeholders have strong expectations about collaborative research? Have we any reasons to think that they will be systematically at odds with the research practices within GAP? In general, people have all sorts of expectations to things and activities before they have tried them on. What we are interested in here is not this, but more stable structures of expectations. One candidate here is the idealistic notion of experience based knowledge (EBK) as different from, but in some respects equal to, research based knowledge (RBK) (See Holm 2003 for a review). An early tradition within EBK research tended to portray it as a rich body of systematically tested and shared knowledge, generally ignored by scientists and managers. From this perspective, fishers are the "true ecologists of the oceans." We do not know how influential and widespread such a notion of fisher knowledge actually is. But if prospective GAP2 participants are informed by it, this would create certain expectations about how collaborative projects should be organized. Based on this notion, a collaborative project could be organized like a science seminar, a meeting place between different but equal knowledge brokers. The intended outcome of such projects would be a confirmation that fishers have reliable and relevant knowledge or at least to authorize part of their knowledge as reliable and relevant. The focus of collaborative research would not be to generate new knowledge for management purposes, but to tap and format existing knowledge for management purposes.

In addition to the idealist notion of EBK there is a more pragmatic notion, which contrasts the first on important points. While not necessarily rejecting the idea that fishers and other stakeholders already have a store of knowledge, ready to be harvested for management purposes, the pragmatic notion of EBK is more interested with fishers' capacity to engage in producing new knowledge than in collecting the knowledge they already are in possession of. On this view, the main way to mobilize EBK for management purposes is not to collect ready-made knowledge from fishers, but to include fishers and other stakeholders in making knowledge that addresses actual management needs. Fishers, scientists and other stakeholder have different skills and resources to bring to the table, but it requires a lot of work and collaborative efforts to establish the specialized knowledge products needed. Based on

such a model, EBK can be mobilized through collaborative projects in which tasks and responsibilities are distributed according to the skills and resources of the participants.

At the outset, we can see traces of both idealist and pragmatist notions of EBK in the GAP2 case studies. On the one hand, there are elements of an idealist understanding of RBK in GAP2 case studies, for instance in the collection of oral histories about past fishing practices and catch development (e.g. CS8 Chioggia). On the other hand, since the GAP2 case studies to a large extent are organized as collaborative projects, the pragmatist notion of EBK is clearly visible. Whether and how the contrast between idealist and pragmatist notions of EBK becomes important in the GAP2 case studies, is an open question. An interesting possibility is the extent to which GAP2 case studies attract participants with strong idealist expectations, but that the implementation of cooperative research favors pragmatist notions. If such is the case, the Q-sort may reveal a certain level of participant frustration; that the unfulfilled expectations make participants unhappy with the GAP2 experience. Another possibility is that they learn and adapt, adjusting their expectations to the practical realities of GAP2 work. In this case, we expect the Q-sort to reveal differences in attitudes between GAP2 and non-GAP respondents.

Management uptake of GAP2 knowledge

The extent to which GAP2 case studies are perceived to be successful is likely to affect participants' attitudes towards the case studies and hence towards collaborative research. At one level, the perceived success of case studies is not tightly coupled to what the project actually achieves, as suggested above. Nevertheless, we assume that participants' attitudes will be different in case studies that encounter severe performance problems than in case studies that perform well. Now, a number of different factors will affect this, including the skills and resources of the case study teams, etc. What we are interested here, however, are structural factors that are likely to affect the performance of the case studies in a systematic way. As suggested by the model in Figure 1, GAP2 case studies vary with regard to the knowledge functions they cover. Some focus mainly on data collection (e.g. CS5 Steigen coastal cod) while others include the whole chain from data collection, analysis, advice and management planning (e.g. CS10 Red Shrimp). Such differences in scope will of course not in themselves determine the performance of the case studies. Nevertheless, variation in scope is connected to how the GAP2 cases are integrated in existing management structures.

Some of the case studies are carried out in a setting where they have to relate to well established management structures and requirements (e.g. The CFP or national management institutions in Norway.) In such cases, the success of GAP2 case studies to a large extent hinges on their ability to produce pre-formatted knowledge objects, be it in the form of data, assessments, advice or management plans. In some ways, this may simplify the challenge encountered by the GAP2 case studies since much of the basic infrastructure and technology is already developed and tested. On the other hand, frustration easily builds up among participants if the management system in place does not pick up and act on the knowledge the case studies deliver at the expected rate.

Some of the case studies, in contrast, are carried out in a setting where there are no well-working or stable management structures in place (e.g. in the Mediterranean). In these cases, the challenges are much greater, since the project cannot simply reproduce predefined knowledge objects using known technology, but first need to develop and agree on basic problem definition, framing and formats. In such cases, the projects become much more open and political. The scope by necessity must be broader, since both the knowledge objects and the management system they work within have to be co-constructed.

Overview of the cases

The GAP2 project features 13 cooperative case projects (Table 1). From this pool, six were selected for in-depth examination by WP4. We selected cases in order to get a broad range of different types of cooperative project. Since the selection was made early in the project phase (by month 4), before we had the opportunity to study projects in detail and before most cases had started practical work, the decisions were made on the basis of the general impressions of the cases with regard to research ideas and management context. The 13 cases vary along many dimensions, and can thus be characterized and grouped in different ways. For the overall purpose of GAP2, it was important to include cases that belong within the CFP (CS4 WBSS herring and CS12 Dutch discard) as well as a non-EU management system (CS5 Steigen coastal cod). We also wanted to include cases outside the CFP, both within the frameworks of well-established management structures (CS2 Galicia TURFs) and in settings where such structures are underdeveloped (CS8 Chioggia) or undergoing change (CS1 Devon brown crab).

Case #	Short name	Topic
CS1	Devon brown crab	Sustainability of brown crab stocks with studies on behavior and migration
CS2	Galicia TURFs	Mapping habitats and fishing grounds in coastal ecosystems of Galicia
CS3	Wadden Sea shrimp	Climate change effect on inshore and Wadden sea brown shrimp fishery
CS4	WBSS herring	Management plans for herring in ICES IIIa and adjacent areas: perceptions of stocks and fisheries
CS5	Steigen coastal cod	Developing a fisheries-based resource monitoring system for Norwegian coastal cod
CS6	Vettern co-management	Development of selective fisheries on whitefish in Lake Vettern – joint research involving regional stakeholders linked to "Fisheries Co-management initiatives"
CS7	Tuna FADs	Conservation and management issues of tuna fisheries around FADs
CS8	Chioggia	Spatio-temporal distribution of fishing effort and biological resources in the Northern Adriatic Sea
CS9	Maltese trawl fisheries	Management of the trawl industry in the Maltese 25 nm Fisheries Management Zone (FMZ)

CS10	Red shrimp	Ecological impact and alternative management strategies for the NW Mediterranean red shrimp fishery
CS11	Baltic MSP	Mapping Baltic fisheries in support of marine spatial planning
CS12	Dutch discards	Collaborative discard sampling in the Dutch flatfish fisheries
CS13	North Sea LTMP	Long-term management plans and the ecosystem approach in the North Sea

Table 1: Overview of GAP2 case studies. Cases shaded blue (CS1,CS2, CS4, CS5, CS8 and CS12) have been selected for examination in WP4.

In terms of the classification framework suggested in Figure 1, CS5 Steigen coastal cod and CS12 Dutch discards have a clear emphasis on data collection. The others are more inclusive, involving assessment and advice (CS1, CS2, CS8) and management planning (CS4 and possibly CS8).

Q-methodology – a science of subjectivity

Q-methodology combines quantitative and qualitative methods for the systematic study of subjectivity. It was developed in the 1930's by the British physicist-psychologist William Stephenson who wanted to develop means to investigate beyond the objective level. Unlike traditional approaches for objective discoveries, typically quantitative methods, Q-methodology was developed to investigate areas where objectivity is not a suitable label, such as viewpoints, opinions and beliefs (Brown 1993, Smith 2001). These themes may be covered by the use of qualitative methods, for instance in-depth case-studies. But unlike such traditional approaches, Q-methodology provides means for systematic analyses where different perspectives can be compared according to the groupings of viewpoints rather than of people. Q-methodology in this way is an inversion of conventional factor analysis in the sense that Q correlates persons instead of tests (Stephenson 1935). It reveals *segments* of subjectivity; that is, clusters of significant correlations (Brown 1993). This approach may reveal new groupings of viewpoints across demographic segments and resonates with Stephenson's emphasis "on the importance of having an inquiring attitude and of making discoveries rather than simply testing one's reasoning" (Anderson 2003:40).

Results from Q-methodology can be utilized in several ways. It can, as the initial plan with the GAP2 case studies, be used to study how subjectivities change over time by doing a before and after analysis. Moreover it can be used to categorize viewpoints and perspectives, to understand them in greater detail, but also to see how the segments of subjectivity match or exceed the divisions between stakeholder groups.

In Q-methodology responders sort statements from a discourse they are engaged in according to specific instructions. The validity of discovering segments of subjectivity through this approach rests on two premises. First that subjectivity is communicable (Stephenson 1953; 1968) and second, that subjectivity advances from point of self-reference.

As will be described in "practical steps" below, the researcher has many choices when conducting a Q-study. It may therefore be argued that results are contingent and not replicable. However, as argued by Van Exel and De Graaf (2003), there are only a limited number of distinct viewpoints that exist on any topic. Hence any well-structured Q sample containing the wide range of existing opinions on the topic will reveal these perspectives. The results of a Q methodological study are the distinct subjectivities about a topic that are operant, not the percentage of the sample (or the general population) that adheres to any of them (ibid).

Interested readers will find more information on the methodological background of Q in Stephenson (1953) and Brown (1980; 1986); a guide for Q technique in Brown (1980; 1986; 1993); and a recent discussion and review of applications in Smith (2001).

Practical steps

The practical application of Q-methodology involves five steps which will be elaborated in general below and case specific in the following sections.

Step 1: Assembling the concourse

In order to measure subjectivity on a certain area, the investigator must first assemble the concourse. Brown (1993) has defined concourse as the flow of communicability surrounding any topic, such as ideas, viewpoints and preferences. The concourse is not restricted to words and might also consist of things like images or paintings depending on the topic to be studied. The important thing is that is contains all relevant aspects of all the discourses (Van Exel and De Graaf, 2003). This demands involvement from the investigator at an early stage and it may be a challenge to decide when the representation is satisfactory. However, it is also a point that the level of the discourse dictates the sophistication of the concourse (Brown, 1993). Sources for assembling the concourse can be interviews, media, reports etc., obviously also depending on the case to be investigated. Recommended references on concourse theory are Stephenson (1980).

In the GAP2 case studies the concourses were defined through words and were assembled mainly through interviews, but also through reports, previous projects and media. See each case for more information.

Step 2: Deciding the Q-sample

After the concourse is assembled, the next task is to select representative statements that capture the main essence of the concourse. As the bridge from the concourse to the examination this step is crucial for the level of validity. Nevertheless there are no strict rules for how to select statements, and the researcher is left with many decisions of what to include or leave out. The Q-methodology literature suggests that 40-50 statements often are appropriate to cover the discourse (Van Exel and De Graaf, 2003), but that more or less is also possible (Van Eeten, 1998). In addition to deciding on the number of statements, the concourse will be loaded with values and causalities that must be sorted out so that the statements in the sample are not double-barreled or demands a context to give reason. Statements may

be merged or edited as long as the meaning does not change. A good process is to first develop an initial sample and then do a pilot study where the investigator can see how they communicate and if the respondents recognize the discourses. In this way the Q-sample may go through several refinements.

As Brown (1980) pertinently put it, the design of the Q-sample is more an art than a science, and different researchers may choose different statements. It has been argued however, that different Q-sets from the same concourse is not a problem (Brown, 1993); It is only a logical construct by the investigator and meaning to them is added by the subjects that sort them at a later stage. Comparative studies show that different samples converge on the same conclusions.

In the GAP2 case studies the process of deciding the Q-sample was slightly different from case to case. Interviews from the concourse assembly were transcribed and sorted by theme. Then the most representative statements were chosen. In some cases this process led the researchers back to the first step to do more interviews or find other sources to make sure the statements resonated with the ongoing discourses. A draft of statements was sent to the rest of the WP4 project team for technical refinements; such as removal of double-barreled statements. Then the initial Q-sample was sent to the local case leader for feedback and after final editing, the statements were translated into the native language. The strategy for Q-sorting was to do a web-based survey and based on practicalities in this matter (see step 4), it was decided to use about 24 statements for each case.

Step 3: Selecting the P-set

In addition to selecting statements, appropriate respondents must be chosen. Just as the Q-sample should cover the concourse, the number of people should cover the viewpoints in a way that allows for statistical significance in the analysis. According to Brown (1980) all that is required are enough subjects to establish the existence of a factor for comparative purposes. Normally a concourse would have from 2-4 factors, and each factor needs to be defined by 4-5 sorts (Smith, 2001).

In the GAP2 project we aimed for about 30 respondents in each case. Table 2 gives an overview of number of Q-sorts distributed and number of responses for each of the six case studies.

Case #	Short name	Number Q-sorts	Number responses
CS1	Devon brown crab	44	10
CS2	Galicia TURFs	32	28
CS4	WBSS herring	24	19
CS5	Steigen coastal cod	27	20

CS8	Chioggia	44	25
CS12	Dutch discards	36	22

Table 2: Overview of Q-sorts distributed and responses from GAP2 case studies.

Step 4: Q-sorting

When the statements have reached their final draft and the P-set is selected it is time to have the responders rank the statements. The sorting should be according to a condition of instructions, typically personal opinions ranging from most agree to most disagree. The sorting process is twofold. First the responders sort the statements in two piles; agree and disagree. Second, the statements are ranked at a scale from -5/5, -4/4 or -3/3, depending on the total number of statements. Most often the distribution is set, so that the resultant distribution assumes a quasi-normal shape with the most agreeable or disagreeable statements placed in the two extreme polar slots with the neutral statements placed in the central region. This pyramid shape may be steep or flatter according to the choice of the researcher (Van Exel and de Graaf, 2003). In cases with low involvement the distribution shape should be steeper in order to leave more room for ambiguity. In cases with high involvement, the pyramid should be flatter in order to provide more room for strong opinions. After the responder has ranked all the statements each individual sort is treated as a one unit in the following analysis.

The practicalities of having the responders to rank the statements can be done in different ways, normally either through a face to face interview or through the web. The web based version is more cost-efficient and more convenient when distances are large. On the other hand the face to face version is easier for the respondent to understand as the interviewer can guide him or her along the way. Face to face sorting also allows for it to be followed by an interview where they can elaborate on their points. This information may helpful for the interpretation of factors later on. Either way, studies show no apparent difference in reliability or validity between web-based or face to face Q-sorting (Reber, Kaufman and Cropp, 2000).

In the GAP2 project we initially decided to use a web-based survey due to long distances. We used the free software “Web-Q” developed by Peter Schmolck that allowed for altering according to our preferences. We used 23-26 statements and in all cases we used a fixed distribution from -3 to 3. The shape of the pyramid, however, varied from case to case, some steeper than others. To ease the task for the responders we wrote an instruction with a link on the Web-Q. See Appendix 1. This strategy worked a little different in the different cases, and in some cases we chose to supply the web-results with face to face sorts to cover as much of the P-set as possible. We will be more specific in each case description below.

Step 5: Analysis and interpretation

The last step in Q-methodology is to analyze the sorts by factor analysis. Factor analysis reveals patterns of responses and show statistically similarity/dissimilarity among units. Different from traditional factor

analysis, however, the focus in Q factor analysis is how the statements correlate: "Q-methodology does not seek to generalize across populations, but the factors that surface represent the way people associated with each factor think" (Anderson, 2003: 43). Factor analysis has three technical steps; a) calculation of correlation matrix, b) rotation and c) factor scores. To analyze the sorts we used the PQ method; a statistical program developed by Peter Schmolck tailored to the requirements of Q studies.

Correlation matrix. The correlation matrix is the level of (dis)agreement between the individual sorts, that is, the (dis)similarity in points of view (Van Exel and De Graaf, 2003). PQ method gives two alternative options for extracting unrotated factors; centroid analysis (QCENT) or principal component analysis (QPCA). With QCENT the researcher can choose how many factors to extract (seven has been suggested as a 'magical number', see Brown 1980). QCENT is not so much used outside the Q-sort community. QPCA always extracts eight factors and computes and outputs all eigenvalues. The absolute and relative sizes of the eigenvalues are of some importance when deciding on how many factors to keep for rotating. In the GAP2 project we used QPCA for calculating the correlation matrix.

Rotation. The objective of rotating the factors is to arrive at the final set of factors; factors that are significant, either statistically or practically. Rotation does not affect the consistency in sentiment throughout individual Q-sorts or the relationships between Q-sorts; it only shifts the perspective from which they are observed (Van Exel and De Graaf, 2003).

Before rotating the researcher must decide how many factors to rotate. There are alternative ways for determining this. Through PCA in the preceding step, the eigenvalues for eight factors are known. One strategy, the Kaiser criterion, is to rotate all factors with eigenvalues >1 (Kaiser, 1960). This will normally include more factors than are beneficial. Another strategy is the Cattell scree test: If the eigenvalues are plotted into a diagram, with eigenvalues along the y-axis and factors on the x-axis, the curve between the values at some point will make a sudden turn to the right. All factors before this turn are then rotated (Cattell, 1966). Both criteria have been studied in detail (Browne, 1968; Hakstian, Rogers, and Cattell, 1982; Tucker, Koopman and Linn, 1969). The first method (Kaiser criterion) sometimes retains too many factors, while the second technique (scree test) sometimes retains too few. In practice, an additional important aspect is the extent to which a solution is interpretable. Therefore, one usually examines several solutions with more or fewer factors, and chooses the one that makes the best sense. We will relate what we did in the GAP2 case studies along with each case description.

There are two different ways of rotating the factors; objective or judgmental. Objective rotation is done according to statistical principles. PQ method has Varimax installed for this. Varimax rotates the factors in a way that maximizes the sum of the variances of the squared loadings (squared correlations between variables and factors). Judgmental rotation is done according to theoretical or empirical perceptions, for instance what the researcher believe are the "distinctive statements" in explaining the discourse analysis. In the GAP2 project we used Varimax for statistical rotation. After the researcher is satisfied with the rotated factors, the subjects that are associated with particular factors are flagged. This is necessary for the analysis that PQ method runs on the data. The flagged subjects are those who load

on a specific factor; that is at a statistically satisfying level. PQ method gives the option of automatic (p>0,01 is a defining variable) or manual flagging. In the GAP2 project we used automatic flagging.

Scores. When factors are rotated and flagged, PQ method runs an analysis that results in factor scores, difference scores and consensus scores. A statement's factor score (Z-score) is the normalized average statement score of respondents that define that factor (Van Exel and De Graaf, 2003). Through the calculation of every statement's Z-score PQ method defines the idealistic Q-sort for every factor. This is how a person with 100 % loading on that factor would sort the statements. The extreme points of this sort are the characteristic statements of that factor. Z-score also allows an evaluation of each sort to see how they load on each factor. The difference score is the magnitude of difference between a statement's score on any two factors that is required for it to be statistically significant. When the difference score is exceeding this level it is a distinctive statement, defining that factor. A statement that is not distinguishing between any of the identified factors is called a consensus statement.

CS1 Devon Brown Crab

From the GAP2 website the aim is stated as follows:

> *To produce a methodology that will enable the crab fishers to evaluate themselves the sustainability of the stock they exploit.* (*http://gap2.eu/case-studies/case-study-1/*)

Professor Paul Hart the GAP2 case study leader clarified the aim as trying to assess recruitment into the area and compare with catch and determine if it balances. If so, the assumption is, is it sustainable given the stability of environmental conditions in the Channel, e.g. flows, food, temperature etc.?

The GAP2 case study builds on two decades of relations between Paul Hart and his students and crab fishers in Devon. Like many of the case studies the GAP2 project seeks to add something different to and build on existing work. Professor Hart states that:

> *The GAP2 project has helped to cement on-going collaboration among scientists and crab fishers, the joint research efforts have helped share knowledge in both directions.*

The GAP2 case study in Devon was initiated to enable scientists and fishers to work together to collect spatio-temporal catch and discard data. This together with crab migration data from CEFAS tagging studies, historical catch data from fisher's diaries and the collection of fisher's experience based knowledge will create the foundation of an 'Individual Based Model'. This was carried out over a one year period with fishers on eight boats contributing their monthly catch and discard data, experience based knowledge through finding and catching crabs and also in conversation on the boats and at monthly meetings.

> *Field activities finished once we had collected sufficient data to start the "modeling" stage of our work. Emma Pearson is now analysing data in order to map crab distribution and migration. From this, we will be able to develop a model to integrate crab movements and catches (Paul Hart).*

Figure 2: From left to right: recording catches, Brown crab and fishers hauling pots.

In addition to data collection on board, 'knowledge interviews' are being conducted in order to understand what fishers know about the ecology, behavior and status of the brown crab stocks. This will be considered also in the light of a detailed tagging and recapture study which demonstrated a pattern of crab migration which is still somewhat counterintuitive and contested by some fishers.

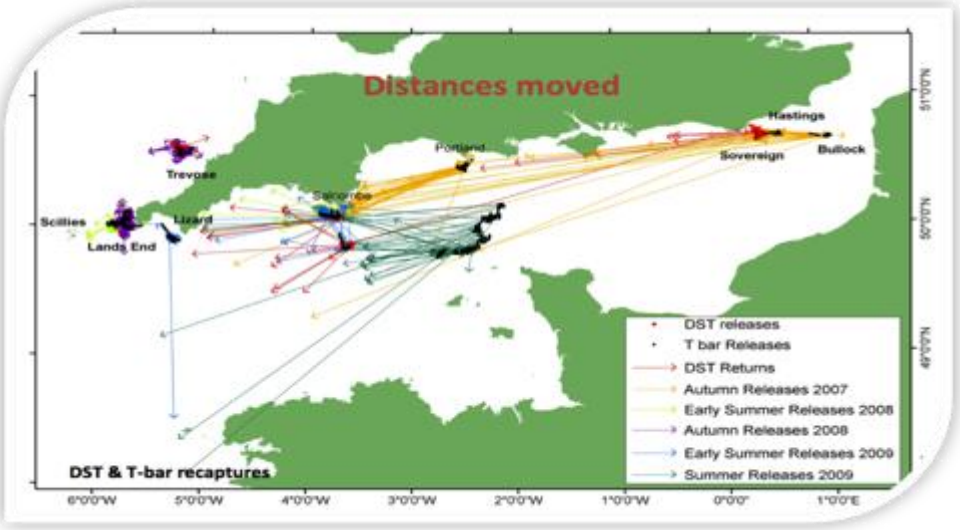


Figure 3: Crab tagging study. Source CEFAS (2011).

Information generated from the field-work and the interviews are being shared with fishers and the intention is also to do so once a prototype of the model has been developed so scientists and fishers can attempt to reconcile the data needs of the model with the activities of the fishers.

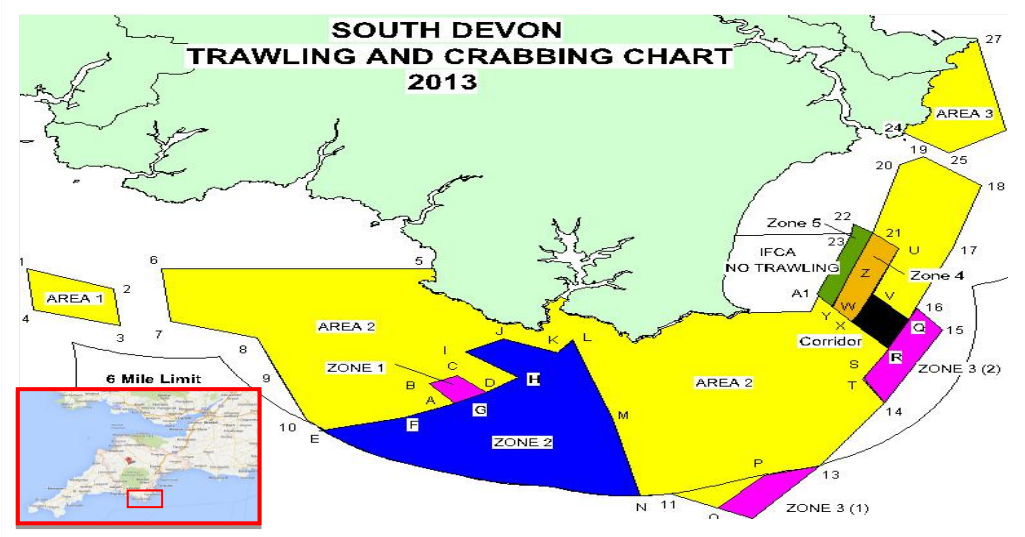


Figure 4 Devon case study area showing the IPA, SW Coast of England. Source: SDCSA 2013

The partners:

- Leicester University: Science partner
- CEFAS: Science partner
- The South Devon and Channel Shell Fishers' Association: Stakeholder partner

Assembling the concourse

The fieldwork was conducted on behalf of WP4 by Mark Dubois in 2012 and 2013. A series of in depth semi-structured interviews were carried out with managers, scientists, fishers, NGOs and other industry stakeholders. The interviews were recorded and later transcribed and coded using the Nvivo software programme. Alongside the interviews, the concourse was informed through a review of secondary data; including journal articles, GAP2 reports and media communications.

The Inshore Potting Agreement (IPA)

The IPA started out in life as a gentleman's agreement drafted in the mid-1970s when conflicts between static gear and mobile gears arose as a result of technological improvements to the mobile gear and their ability to access fishing grounds formerly closed to them. The IPA consist of areas which are permanently closed to mobile gear and other areas which are seasonally open to the use of mobile gear. One of the principle aims of the agreement was to reduce conflicts through ensuring that static gear fishers were able to continue to fish in traditional areas without losing gear to the towed sector, (Blythe *et al.,* 2002). Over the years several amendments have been made to the agreement without significantly shifting the overall ethos. Dr. Blythe states that:

> *The IPA is regarded as a successful fishery management regime by fishers and managers because it has effectively allowed fishers from both sectors to operate profitably on traditional fishing grounds, and because it has continued to function for several decades.* (Blythe 2002)

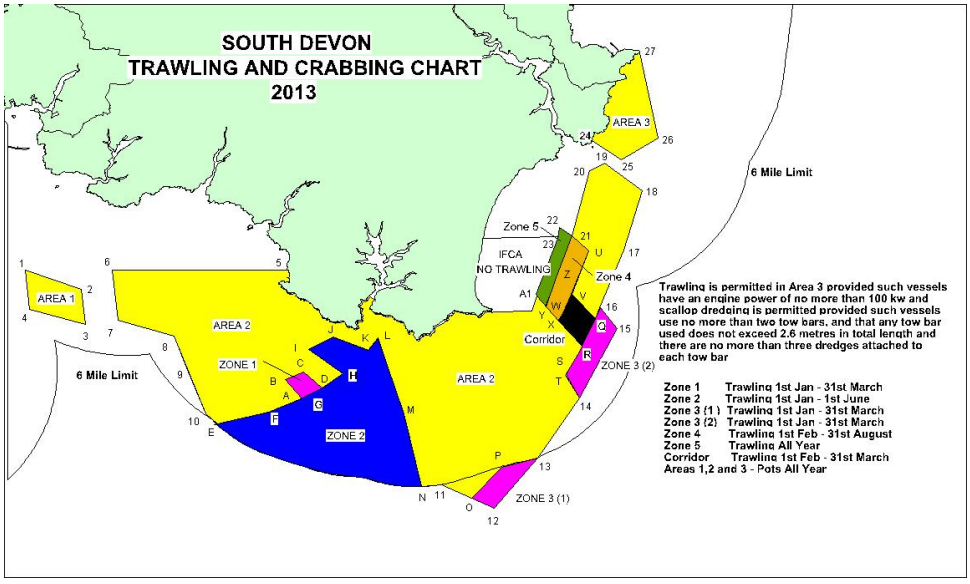


Figure 5: South Devon (IPA) trawling and crabbing chart

Stock status and ecology

Fishers have been fishing the same grounds for generations and within the IPA at least, fishers consider their exploitation of *Cancer pagurus* (edible brown crab), to be sustainable:

> *My experience over the last fifteen years of fishing the same ground is that the catch rates have remained stable. But, year on year it varies so you have to take a long-term average* (Devon Crab fisher).

> *Latest assessments indicate that stocks are being fished roughly at MSY* (Paul Hart referring to the CEFAS 2011 stock assessment for *Cancer pagurus*, Western English Channel).

> *We're catching crabs now in the big boat the same as we was catching, what, 30, 40 years ago and loads of what we call 'small crabs*', *you shooting off the Start there, and you'll get 60, 70, 80 in a pot. All little tiny proper crabs, proper brown crabs. And I mean, chuck'em all over, and it must be good breeding somewhere because there's always plenty there all the time (Devon Crab fisher*).

There are currently few restrictions on fishing brown crab in the English Channel beyond minimum landing sizes (originally introduced in Britain in the 1870s), and the landing of soft shelled or buried crabs. Some argue, however, that in today's context of increasing fishing pressure, minimum landing sizes is insufficient as a regulatory measure.

> *I think people are beginning to realise that if the development of the fishery, the increase of effort in to the fisheries continues to increase, it's actually going to come a point in time when it's not going to be sustainable. I think it's right and proper that something should be done to curtail the effort in to the fishery. Not just in our part of the world, but nationally* (Devon Crab fisher).

> *In almost all lobster and edible crab stocks the present fishing rates are well above the optimum point on their yield curves. The stocks are therefore substantially depleted (*Colin Bannister – former scientific adviser on shell fisheries at CEFAS*)*

This last quote does necessarily imply that the stocks are not sustainable *per se,* but rather should be understood as a warning that if effort continues or exceeds its current rate there may be difficult problems to face in the future. Dr. Bannister goes on to state that:

> *Scientists cannot say just how much extra effort can be accommodated safely, since we cannot yet identify the most likely collapse point', and 'there is a very strong case for precautionary action to cap the current effort on potting* (Colin Bannister).

Given the uncertainties, and in the light of the importance culturally and economically of the fishery, a precautionary approach in the face of increasing pressure may be sound advice. How this effort 'capping'

(and indeed whether it should be done at all), is however, a contentious issue. Even hypothetically, there is no agreement as to how it should be done.

> *We have debated the best way to cap effort or curtail effort and some would be happy to do it by pot limitations, some would like to see quotas introduced; it's very difficult to come down on a single sort of measure which would suit everybody* (Devon Crab fisher).

Whether through pot restrictions or quotas, there would be much to address should either approach be selected. Most fishers who fish inside the IPA, state that the limited size of the IPA area itself is all the restriction that is required.

> *Because it's a non-quota species now, there is no top limit to what you can catch, there is no restriction on the amount of gear you can use. Although in a practical sense, because the area that we fish in is a defined area, there is only so much gear you can get in that area, so that in a sense takes care of itself* (Devon crab fisher).

This is not, however, true of those fishing outside of the IPA and a fairly clear distinction exists between smaller boats fishing inside the IPA and 'Vivier' crabbers fishing offshore. Indeed they can be considered as different fisheries, but they do overlap in terms of the availability of crab in the market place and potentially to some degree over the status of the stocks.

That the stock status of brown crab is poorly understood, however, is something of a given, and of itself a justification for the Devon case study. There is considerable uncertainty, at least empirically over the status, distribution and composition of English Channel crab stocks. This gains credence in the light of the following statements:

> *Where you have a patchy distribution of animals, in odd bits and pieces of suitable habitats in different places at different times of the year it becomes more difficult to make up a stock pattern* (Colin Bannister).

And perhaps crucially, in terms of assessing what 'sustainability implies with respect to the IPA:

> *That's why we don't know that if you fish very hard in one part of the crab distribution, does it affect the rest of the distribution, does the whole stock change accordingly or does it only change that of the little local area fished?* (Colin Bannister).

Management Issues

As discussed above the IPA was set up in order to reduce conflicts between mobile and static gear fisheries. It can be considered to have been really rather successful in this regard. As a by-product of the arrangement, considerable areas within the IPA have not been trawled in almost 40 years. The implications of this from a conservation perspective, particularly the benefits for the benthos, some fish

species and scallops, have been well documented scientifically (Blyth-Skyrme *et al.,* 2004, 2006, 2007; Hart *et al.,* 2003).

> *We firmly believe that a lot of fin fish species use the IPA as a refuge, 'cos we're not catching them, we just take the crab and the lobster. So the ground is being protected by virtue of the fact that we've insisted that some areas should be permanently made over to static-gear fisheries* (Devon crab fisher).

> *We've got the best conservation area you can have with this potting area. It's the best thing you can have. They can't improve on that, I think. Because all the fish, all the scallops, everything else, all breeds here. If it ain't broken don't fix it, that's the old saying* (Devon crab fisher).

> *The IPA was not established for stock maintenance or conservation reasons, yet benefits appear to have developed for some commercially fished species as a result of its function'*(Blyth Skyrme, 2006).

> *The closed area has acted as a MCZ having conservation benefits for the benthic fauna, some fish species and the reproductive capacity of scallops. An important conclusion from this is that crab fishing, using static gear, does not have a significant impact on the benthic habitat* (Professor Paul Hart in a communication with Natural England).

The belief in the conservation benefits of the IPA is widely held, however it is not the only perspective:

> *There is the potential that high levels of exploitation could lead to ecosystem effects that would be of conservation concern, or that the sheer level of fishing activity causes deterioration of reef communities through for example abrasion. Current evidence on the condition of the reef habitat within the SAC does not indicate any deterioration that would suggest a change of management of static gear fisheries is necessary. However, if further evidence becomes available, there may be a requirement to put further management measures in place* (Dr. Roger Covey, Natural England in correspondence with Professor Hart).

This discussion is pertinent given that the IPA has been gazetted by new European and National conservation initiatives. The European Special Areas of Conservation (SAC) initiative under the EU Habitats Directive and the British Marine Conservation Zones (MCZ) initiative, are both essentially variants of Marine Protected Areas (MPA) and are primarily interested in 'features', in this case, 'reef features' in and adjacent to the IPA.

There is concern that future conservation restrictions will affect the current operation of the crab fishery in the IPA:

> *In designing a system of MCZs in this area, it would seem sensible and intelligent to recognise the current Inshore Potting Agreement area as an existing conservation area and to acknowledge*

that this is compatible with the continuing execution of the crab fishery, which has been shown to have only a minor effect on the benthic ecosystem, Professor Paul Hart in a communication with Natural England).

The proposed SAC and MCZ will roughly bisect the existing IPA (the SAC to the West & the MCZ to the East), effectively creating a three-tiered, spatially based system of local, national and European area management. Whether there will be areas of conflict between the different systems remains to be seen, as despite the area itself being gazetted as a SAC and MCZ, the management rules and regulations have not yet been decided.

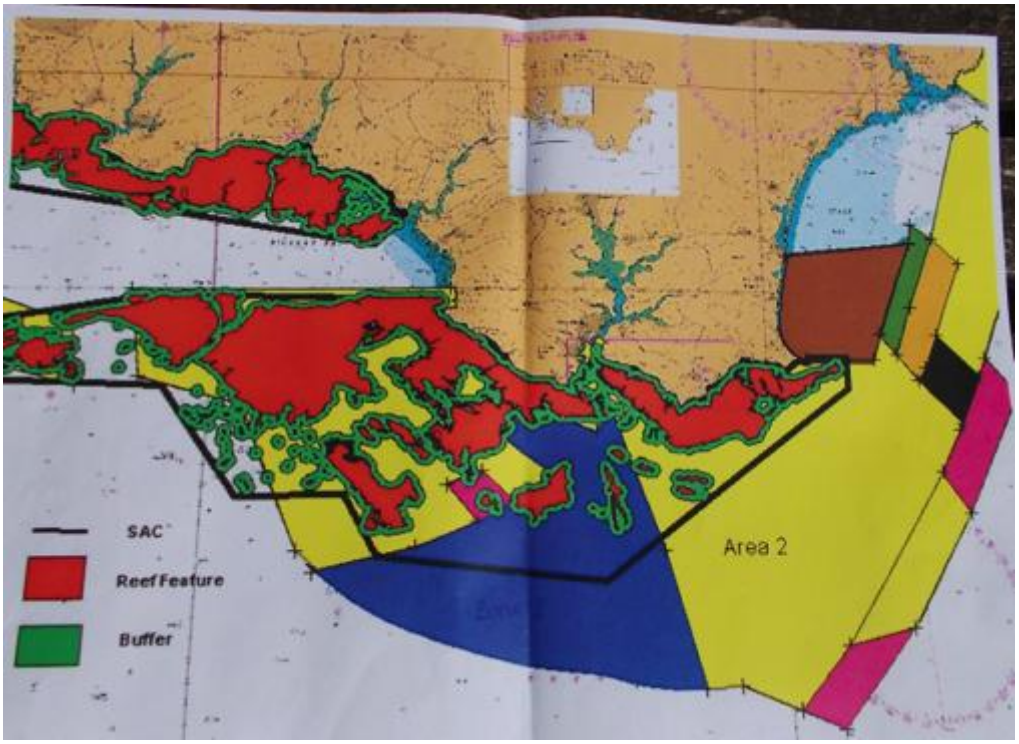


Figure 6: IPA showing reef features in red and the SAC area inside the thick black border.

Deciding the Q-sample

There are a number of connected issues involved in the Devon case study and as a result, the key topic could be formulated in a number of different ways. After review of the case study material and seeing the project in practice, the issues around sustainability and management, particularly those concerned with conservation; whether the IPA already acts as an MCZ and how this relates to new initiatives such as the SAC and MCZ, emerge as the key local elements in the discourse. Whilst the question of producing a methodology for self-assessment of fishing sustainability remains central to the case study, it is perhaps

equally important to ensure sustainability issues do not become secondary to protecting reef features. The q-sort statements have been constructed in order to connect and reflect these issues:

1. The status of the stock of brown crab in area western English Channel is good with spawning stocks around the level required to produce Maximum Sustainable Yield.
2. Except for cock crabs in the western Channel, brown crab stocks are 'growth overfished' (i.e. fish are harvested at an average size that is smaller than the size that would produce the maximum yield per recruit).
3. Mature female crabs move from east to west through the English Channel.
4. The brown crab in the English Channel is comprised of two stocks (East and West English Channel).
5. Fishing pressure on brown crab in the Channel has grown significantly in the last 10 years.
6. Scientific data on the crab fishery is not accurate.
7. The Inshore Potting Agreement (IPA) acts as a conservation area.
8. Additional conservation measures to the IPA (such as those proposed by the SAC (Special Area of Conservation) and MCZ (Marine Conservation Zones) are needed to protect reef features.
9. Reef communities in the IPA are not harmed by potting activities.
10. There is no conflict of interest between the different layers of management as designated by the IPA, SAC and MCZ.
11. The public consultation for the SAC provided a good platform for fishers to negotiate for their interests.
12. Pot restrictions are better than quotas in the management of brown crab.
13. The amount of pots that can be fished in the IPA is sufficiently limited by the size of the area.
14. The rules in the IPA are not well enforced.
15. More data is needed to provide an adequate assessment of the sustainability of the brown crab stocks in the west English Channel.
16. VMS should be introduced on trawling vessels
17. Managers must have fishers on side to be able to implement rules successfully.
18. Scientists collaborate with fishers in order to encourage fishers to comply with the rules.
19. Fishers benefit from making alliances with scientists.
20. Successful management needs partnerships between fishers and scientists.
21. Decisions made locally between managers and fishers is the most appropriate way to manage the brown crab fishery.
22. Policy makers will listen to fishers more as a result of the GAP project.
23. Fishers are able to influence policy decisions.

Each person was allocated a code for processing the data. The code consisted of 8 characters. The first three characters were 'dev' to recognize the case (Devon). The fourth character showed which stakeholder group the person belonged to (1=fishers, 2=scientist, 3=management, 4=fisheries representative, etc.). The fifth character was either a 'y' (yes) or 'n' (no) to indicate whether the person is a GAP2 participant. The remaining three characters were numbers to distinguish people in equal categories. To illustrate, a respondent with the code dev1y001 would be respondent nr 01 in the Devon case; a fisher working in the GAP2 case study.

Q-sorting

The q-sort was developed and tested with mixed results. The nature of the q-sort, particularly the forced distribution was not well received by those that tested the on line version. One fisher and three scientists pre-tested the survey and some of the statements as well as the online instructions were adjusted based on their feedback.

Of the 44 persons that were introduced to the survey by email and asked to participate, only 5 replied, 5 additional sorts were conducted face to face. A number of fishers attempted the web-based survey but gave up due to difficulties either connected to the forced distribution or to other issues.

Only one fisher, Alan Steer, submitted on line. The distribution of the 10 respondents is as follows:

- 2 fishers not participating in the GAP2 project
- 2 fishers participating in the GAP2 project
- 3 scientists working in the GAP2 project
- 2 scientists not working with the GAP2 project
- I manager Non GAP2

Analysis

The data from the 10 sorts were entered into PQ method. As a result of the low numbers of respondents (and given the spread of sorts loading on each factor) we are unable to provide much meaningful analysis with respect to the different stakeholder groups, and consequently have focused on comparing groupings of viewpoints rather than of stakeholder groups. As described in the section "Q-methodology" we used PCA to calculate the correlation matrix and rotated the factors with higher eigenvalues than 1. In the Devon case this was four. We used Varimax for statistical rotation and automatic flagging for marking the defining sorts (sorts that load significantly on specific factors, p>0,01). Three sorts loaded significantly on factor 1, three sorts loaded significantly on factor 2 and three sorts loaded on factor 3. Sixty-eight per cent of the explainable variance is represented by the three factors.

Factor 1: More conservation please

Factor 1 is represented by three significant loadings. The sorts are made up from two non GAP2 scientists, and one non GAP2 fisher. The ideal sort[1] for this factor is displayed in Table 3 and elaborated below.

Factor 1 stresses the importance of installing VMS on all fishing vessels. Certainly the vast majority of the inshore crabbers and most scientists and managers are in favour of the VMS, and it is

[1] The ideal sort is how a person with a 100% loading on this factor would sort the Qs.

strongly touted as a virtually fool proof mechanism for ensuring compliance with fishing area restrictions.

Factor 1 also strongly agrees with statement #11 in that the public consultation process (led by finding sanctuary) for the MCZs and SACs was good. And in relation to this topic there is agreement with the introduction of the new conservation measures under SAC and MCZ (statement #8) and there is considered to be no potential conflict of interest (statement #10). In addition factor 1 strongly agrees that fishers benefit from making alliances with scientists (statement #19) and that working in partnership between fishers and scientists is beneficial (statement #20). It is in strong disagreement, however, that this partnership should form a decision-making unit at local level for management purposes (statement #21) and is also in strong disagreement with the idea that the IPA has conservation benefits (statement #7). Finally it strongly disagrees with statements #13 and #14 that the rules in the IPA are not well enforced and that the size of the IPA and its existing usage is not enough to restrict effort.

In summary, factor 1 is something of top down conservationist perspective with a rather traditional concept of how management should be carried out perhaps reflecting the respondents' non-GAP2 status.

Most agree	16. VMS should be introduced on trawling vessels
Strongly agree	11. The public consultation for the SAC provided a good platform for fishers to negotiate for their interests. 19. Fishers benefit from making alliances with scientists 20. Successful management needs partnerships between fishers and scientist
Agree	8. Additional conservation measures to the IPA (such as those proposed by the SAC (Special Area of Conservation) and MCZ (Marine conservation zones) are needed to protect reef features 4. The brown crab in the English Channel is comprised of two stocks (east and west English Channel) 23. Fishers are able to influence policy decisions 10. There is no conflict of interest between the different layers of management as designated by the IPA, SAC and MCZ 6. Scientific data on the crab fishery is not accurate
Undecided	18. Scientists collaborate with fishers in order to encourage fishers to comply with the rules 5. Fishing pressure on brown crab in the channel has grown significantly in the last 10 years 2. Except for cock crabs in the western Channel, brown crab stocks are 'growth overfished' 22. Policy makers will listen to fishers more as a result of the GAP2 project 15. More data is needed to provide an adequate assessment of the sustainability of the brown crab stocks in the west English Channel
Disagree	12. Pot restrictions are better than quotas in the management of brown crab 17. Managers must have fishers on side to be able to implement rules successfully 1. The status of the stock of brown crab in area western English Channel is good with spawning stocks around the level required to produce Maximum Sustainable Yield.

	3. Mature female crabs move from east to west through the English Channel 9. Reef communities in the IPA are not harmed by potting activities.
Strongly disagree	13. The amount of pots that can be fished in the IPA is sufficiently limited by the size of the area. 14. The rules in the IPA are not well enforced. 7. The Inshore Potting Agreement (IPA) acts as a conservation area
Most disagree	21. Decisions made locally between managers and fishers is the most appropriate way to manage the brown crab fishery

Table 3: The ideal sort for factor 1 in the Devon case study.

Factor 2: IPA as conservation and local management

Factor 2 is represented by three significant loadings. The sorts are made up from one GAP2 fisher, one GAP2 scientist and one non GAP2 manager. These loadings represent a fairly heterogeneous set but given only three sorts loading on this factor this should be seen as indicative at best. The ideal sort for this factor is displayed in Table 4 and elaborated below.

Like factor 1, factor 2 also stresses the importance of installing VMS on all fishing vessels (statement #16). Unlike factor 1, however, factor 2 strongly agrees that that the IPA acts as a conservation area and that local management decisions between managers and fishers is appropriate for brown crab management (statement #21). There is strong agreement with the benefits to fishers of making alliances with scientists and strong disagreement that the public consultation for the SAC was a good process (statement #11) and considers there to be a potential conflict of interest between the MCZ, SAC and IPA.

Factor 2 is in strong disagreement that the rules in the IPA are not well enforced (statement #14) and that policy makers will listen more as a result of the GAP2 case study (statement #22). Statement 22 seems somewhat at odds with factor 2's agreement with statement #23 'fishers are able to influence policy decisions. Perhaps it is a problem with the wording of the statements in that one speaks of influencing and the other listening?

Factor 2's nature can be considered as positive towards the IPA and its role in conservation and also in local management. It seems that factor 2 is more locally oriented and also positive about science fisher collaborations, again perhaps a reflection of the GAP respondents loading on this factor.

Most agree	16. VMS should be introduced on trawling vessels
Strongly agree	7. The Inshore Potting Agreement (IPA) acts as a conservation area 21. Decisions made locally between managers and fishers is the most appropriate way to manage the brown crab fishery 19. Fishers benefit from making alliances with scientists
Agree	23. Fishers are able to influence policy decisions 20. Successful management needs partnerships between fishers and scientists 5. Fishing pressure on brown crab in the Channel has grown significantly in the last

	10 years 1. The status of the stock of brown crab in area western English Channel is good with spawning stocks around the level required to produce Maximum Sustainable Yield. 3. Mature female crabs move from east to west through the English Channel
Undecided	8. Additional conservation measures to the IPA (such as those proposed by the SAC(Special Area of Conservation) and MCZ (Marine conservation zones) are needed to protect reef features 17. Managers must have fishers on side to be able to implement rules successfully 15. More data is needed to provide an adequate assessment of the sustainability of the brown crab stocks in the west English Channel 4. The brown crab in the English channel is comprised of two stocks (east and west English Channel) 13. The amount of pots that can be fished in the IPA is sufficiently limited by the size of the area.
Disagree	12. Pot restrictions are better than quotas in the management of brown crab 9. Reef communities in the IPA are not harmed by potting activities. 2. Except for cock crabs in the western channel, brown crab stocks are 'growth overfished' 6. Scientific data on the crab fishery is not accurate 10. There is no conflict of interest between the different layers of management as designated by the IPA, SAC and MCZ
Strongly disagree	22. Policy makers will listen to fishers more as a result of the GAP2 project 14. The rules in the IPA are not well enforced. 18. Scientists collaborate with fishers in order to encourage fishers to comply with the rules
Most disagree	11. The public consultation for the SAC provided a good platform for fishers to negotiate for their interests.

Table 4: The ideal sort for factor 2 in the Devon case study.

Factor 3 Credibility of scientific data

Factor 3 is also represented by three significant loadings. The sorts are made up from two fishers (both non GAP2) and one GAP2 scientist. The ideal sort for this factor is displayed in Table 5 and elaborated below.

Factor 3 is most concerned with the status and credibility of crab stock assessment data. In line with the project purpose, factor 3 is in strong agreement with statement #6 that 'scientific data on the crab fishery is not accurate, and that successful management needs partnerships (statement #20). It also strongly agrees that there has been an increase in fishing pressure (statement #5).

There is strong disagreement that scientists collaborate with fishers in order to encourage fishers to comply with the rules (statement #18), that the brown crab is comprised of two stocks and that the rules in the IPA are not well enforced. Finally it most strongly agrees with the statement that mature female crabs move from east to west through the English Channel. Despite all the tagging work it seems there is still disagreement on this quite fundamental issue.

Factor 3 is about the credibility of scientific data, it considers the data incomplete and inaccurate. Once again there is agreement on the importance of partnerships and as the case study is

about collaborative knowledge production for stock assessment it should address some of the issues alluded to in this ideal sort.

Most agree	15. More data is needed to provide an adequate assessment of the sustainability of the brown crab stocks in the west English Channel
Strongly agree	6. Scientific data on the crab fishery is not accurate 5. Fishing pressure on brown crab in the channel has grown significantly in the last 10 years 20. Successful management needs partnerships between fishers and scientists
Agree	22. Policy makers will listen to fishers more as a result of the GAP project 17. Managers must have fishers on side to be able to implement rules successfully 2. Except for cock crabs in the western channel, brown crab stocks are 'growth overfished' 16. VMS should be introduced on trawling vessels 7. The Inshore Potting Agreement (IPA) acts as a conservation area
Undecided	23. Fishers are able to influence policy decisions 12. Pot restrictions are better than quotas in the management of brown crab 19. Fishers benefit from making alliances with scientists 21. Decisions made locally between managers and fishers is the most appropriate way to manage the brown crab fishery 9. Reef communities in the IPA are not harmed by potting activities.
Disagree	13. The amount of pots that can be fished in the IPA is sufficiently limited by the size of the area. 8. Additional conservation measures to the IPA (such as those proposed by the SAC (Special Area of Conservation) and MCZ (Marine conservation zones) are needed to protect reef features 10. There is no conflict of interest between the different layers of management as designated by the IPA, SAC and MCZ 1. The status of the stock of brown crab in area western English Channel is good with spawning stocks around the level required to produce Maximum Sustainable Yield. 11. The public consultation for the SAC provided a good platform for fishers to negotiate for their interests.
Strongly disagree	4. The brown crab in the English Channel is comprised of two stocks (east and west English channel) 18. Scientists collaborate with fishers in order to encourage fishers to comply with the rules 14.The rules in the IPA are not well enforced.
Most disagree	3. Mature female crabs move from east to west through the English Channel

Table 5: The ideal sort for factor 3 in the Devon case study.

Summary and conclusion

Unfortunately given that only 10 respondents completed the q-sort, we do not know how well the data reflect the attitudes of the participants in the case study. Instead we focus on a description of the factors themselves, where we have three quite distinct positions with some clear areas of consensus and disagreement.

Factor 1 is the only factor to consider that there is a need for more conservation measures, and indeed that the IPA does not provide this function. It agrees with the process of establishing the SACs unlike both factors 2 and 3. It is also different to factors 2 and 3 in that it disagrees that local management decision-making is the most appropriate way to manage the fishery. It does however agree with both the other factors on the importance of working together.

Factors 2 and 3 are closer together in so far as both consider the IPA as a functional conservation area and that additional conservation measures are not required. There is also agreement about increasing fishing pressure and the potential positive influence partnering between scientists and fishers may have on local management factor 2, and knowledge production factor 3.

The factors/outcomes of the q-sort tie in well with the main themes of the discourse analysis derived from interview, despite having only 10 respondents. The fact that all agree that partnering between science and fishers is beneficial bodes well for the work of the case study (*viz* local management and knowledge production), but it is also clear that an area of contention exists around who should control the IPA and for what purpose, exemplified in the disagreements over management regimes for conservation.

According to the case study classification framework (figure 1) the knowledge function for fishers' participation in the Devon case, centers largely on data collection but it is intended that once the model is up and running, that fishers will be able to assess the sustainability of the fishery for themselves, thereby shifting the knowledge function towards assessment. Specialized knowledge is being co-constructed and the format of the knowledge object itself (the model) is currently being developed. The intention is that the model will allow fishers to self-assess the crab fisheries sustainability but how this will be maintained after the project and within which institutional management setting it will be received is yet to be fully defined. Whilst the management structure is fairly stable, how it will accommodate the assessment advice provided by the model and to what ends this knowledge will be put are unclear at this stage.

The 'gap size' in Devon is moderate, with a number of years of scientist fisher collaborations creating a context where there are opportunities for fisher participation. Attitudes do vary yet the majority opinion rests on the benefits of collaboration.

CS2 Galicia TURFs

The main aim of the GAP2 case study in Galicia was to design and implement a management plan in order to establish a local marine reserve in the area of Aguiño. A marine reserve here is a kind of MPA, but one controlled by the fishers through a cofradía and used to secure access to marine resources. The marine reserve would be the final output of the work that was conducted in GAP1: "mapping habitats and fishing grounds in coastal ecosystems". However, a new provincial government with different priorities together with the financial crisis in Europe resulted in declining political support for another MPA. The scope of the GAP2 case study in Galicia was therefore broadened to expand the Territorial Use Rights in Fisheries (TURF) model in general. Most sedentary marine resources are regulated through specific management plans based on TURFs. However, the rest of the fisheries in the area are regulated by traditional centralized top-down norms and regulations. The driving force for the GAP2 case study is that the success of the co-management models for specific resources opens the door for the application of similar models to the rest of fisheries in the area (http://gap2.eu/case-studies/case-study-2/).

The project has three phases, where fishers and scientists share information and discuss how to use it in workshops throughout the project. First, fishers' experience based knowledge (EBK) is collected through interviews with maps of individual fishers to create maps of species and habitats. These maps are validated by discussion groups, and log-books and GPS data loggers are used for monitoring in the same areas. Second, the collected EBK, appropriately validated, is used to complement scientific data. Finally, the collected and validated information is used as input in management plans. Where the initial ambition was that these management plans would be within the framework as a local marine reserve, the ambition now is to empower fishers to protect their interests in general. By translating their experience-based knowledge into scientific documented facts, the fishers are equipped to negotiate with management in any situation, whether it eventually leads to a marine reserve or in situations where access to fishing areas may be threatened by other competitive activities. We will let this quote from Juan Freire, the former case study leader from the University of Coruña, set the stage for this case:

> *Fishers' knowledge can be used to expand scientific knowledge. It is a treasure for us. (…). Fishers have complex ecosystem information.*

The partners

- University of Coruña: Science partner
- The Federación Galega de Confrarías de Pescadores (FGCP) and their local partners, the Cofradías of Aguiño, Cambados and Ribeira: Stakeholder partners

Assembling the concourse

The WP4 team, Maiken Bjørkan and Petter Holm, carried out fieldwork from the 24th to the 27th of October 2011. The GAP2 crew in Galicia arranged nine interviews with partners and key stakeholders, including fishers, managers and scientists. The fieldwork, together with the GAP documentation of the case study, is the main source of information.

According to the scientist Juan Freire who was the leader of this case study at the time, the management in the area is “a history of conflicts that is not easy to break”. According to Freire, there is a lack data and hence sound regulations for the coastal area. Given the complex setting with a growing number of interests, Freire underlines that “the fishers need to start thinking about their rights: *“We are helping them [fishers] to think about their problems, make a strategy and a management plan: Territorial User Rights for Fishers (TURFs) and Marine Protected Areas (MPAs)”*. In the Galician context, several communities have turned to marine reserves as a tool to avoid overfishing and to ensure their rights to use the area. Two such reserves in the Galician coast have already been established by Galician authorities since 2003 as Marine Reserves for Fishing Interest:, in Lira and Ria de Cedeira. The proposed Marine Reserve in Aguiño is modeled after the reserves in Lira and Cedeira. In all three cases the initiatives have come from the local Cofradías and can be characterized as “bottom-up” in a governance perspective.

Figure 7: Map of Galicia. Marine Reserves for Fishing Interests are located in the three communities Aguiño, Lira and Cedeira

In addition to the Marine Reserves for Fishing Interests, another and more conservation-oriented type of MPA is also represented in Galicia. The National Park "Islas Atlánticas" was established in a top-down process. It is one of Spain's 15 National Parks, and was established for conservationist and tourism purposes. It was declared a National Park in 2002 and consists of a group of four Islands off the South West coast of Galicia, including both sea and land areas. The establishment of the National Park has been controversial from the start, and the process has been surrounded by conflicts. Numerous interests are identified in the area, and key stakeholders are tourism and fishers (http://www.iatlanticas.es/). Within the National Park there are many areas that are considered important for fishers in Galicia, and some of these are now being closed for fishing. In general, Galician fishers are against the National Park regulations and that these have little legitimacy: *"No take zones will end the shellfish fisheries"* (Voz de Galicia). According to park staff, fishers' opposition has grown since the National Park has started to establish zones where they are excluded: "*The controversy started when we wanted to establish No Take Zones"* (Spokesperson, Islas Atlánticas). Fishers are negative both because the park restricts their access to fishing areas and because of the lack of a participatory process when defining for instance "no take zones" in the park.

While there is an increasing pressure due to these issues, a proper framework for Integrated Coastal Zone Management (ICZM) is missing. More people are gathering in the coastal areas looking for a living, and with them an increasing diversity of interests. This population pressure also fuels the need for more infrastructures (i.e. sewers, garbage and electricity). In Galicia, fishers are competing for space with aquaculture, tourism, conservation interests and windmills. In addition, there are ongoing location-debates for sewers and other spills due to an increased human pressure in the zone.

The ambition of establishing a marine reserve fits well with these challenges. In Galicia, regional government regulations promote a co-management system and the local Cofradía has been delegated some management responsibilities from the fisheries authorities. There are 63 Cofradías located in the coast of Galicia, According to an informant at the Galician central organization, *"their role as an organization is to be 'middlemen' (intermediaries) for the people, to manage and to develop strategies".* The informant also explained the history of the Cofradías, where the organization developed with three functions in the local community: manage the resources, organize the fishers and a social responsibility for the families as well as the fishers themselves. Since 1992, the exploitation is granted to Cofradías after presentation of an annual plan of harvesting and management. The increased management authority given to the Cofradías was a reaction to the over-exploitation of the resources, in particular shellfish. Since 1995 the biomass has increased, even if some areas still are over-exploited. Some problems that Cofradías are facing are an increase in organizational and human resource level, illegal fishing, excessive fishing effort, and price collusion at auctions. The establishment of a marine reserve would mitigate these issues. On their webpage, the Aguiño Cofradía presents the idea of the MPA as follows:

Throughout its history the Cofradía has demonstrated its management skills and a concern about sustainable exploitation of the resources. Following this line, the Fishers' Association is promoting the creation of a marine reserve as a measure to optimize the harvest control in the area, and thus promote the proper biological development of the area.
(http://www.cofradiadeaguino.com/es/node/3627)

Deciding the Q-sample

As described in the introduction, a marine reserve will not be established at this time because of different political priorities. The concourse in Galicia is characterized by this; the concerns are the same, yet the possible management measures change. How does this affect the cooperation between fishers, scientists and managers? In order to expand and strengthen the territorial user rights in the fisheries, an important strategy is the facilitation of cooperation between scientists and fishers. Mobilization and authorization of fisher's knowledge, mainly in the form of documentation (mapping) of fishing practices, is used to strengthen TURFs. However, the fishers involved in the project were envisioned to contribute to the establishment of a marine reserve, not just another management plan. It is possible that the change of scope may have affected the level of trust in the project.

As this suggests, there are a number of different issues involved here, and the key topic for the Q-sort could be formulated in different ways. In the project, the notion of TURFs is put up as a key feature. While this topic is interesting in itself and could be developed in different directions, it was, and maybe still is, in this particular setting strongly associated with the establishment of MPAs. Because of the variety of MPAs in Galicia, in the span from the National Park to the locally controlled "Marine reserves for fishing interests", this is a highly current and interesting topic. This is of course connected to ICZM: the increasing competition for space and resources in the coastal zone and the relatively underdeveloped legal and institutional framework. Another important aspect is the role and function of the Cofradías. While this is a Spanish construction, it is an important example of co-management. It is often used as an example in governance literature, where issues like participation, saliency and transparency are central. Importantly, this is also connected to the role of knowledge and division of responsibility with regard to knowledge provision, which is the key focus of the GAP2 project.

Based on the above, we understand the Galician GAP2 case study's focus on TURFs as a response to the increasing number of interests and heightened competition for space in the coastal zone. The initial driving force; the possibility of establishing a Marine reserve for the protection of fishing interests, and the existence of the controversial National Park in the area makes MPAs in its different shapes into a key issue in the local discourse. While other issues are also apparent, like the role of TURFs for management purposes, participation and co-management, coastal zone management and the role of Cofradías, these are more often than not connected to and made part of the discourse on MPAs. On the basis of this it made sense to construct the q-sort loosely around the topic of MPAs. However, since the scope of the project slightly changed while we were conducting the study, fishers' knowledge and the cooperative research in itself have been given more attention.

We transcribed all the interviews. In order to make it manageable for deciding the Q-sample we listed all the statements collected from the interviews and other sources. After that we sorted the statements by themes and selected the statements that best represented the concourse. After internal review by the project team and a pilot run with three of the scientists from Galicia we ended up with a Q-set of 24 statements:

1. Scientific knowledge is necessary for management
2. There are things that fishers know and scientists don't
3. Fishers have complex ecosystem information
4. Fishers' knowledge is not necessary for management
5. Fishers don't want to share their knowledge with scientists
6. If fishers are included in the decision-making process they have more respect for the regulations
7. Fishers have real influence in management issues
8. Fishers don't want to be involved in the management process
9. The managers do appreciate the fishers' point of view
10. The fishers don't trust the managers of Islas Atlánticas National Park
11. The fishers' interest are not threatened by Islas Atlánticas National Park
12. Cooperation between fishers and scientists is important
13. Cooperation with scientists gives fishers a voice in management issues
14. Cooperation with scientists will not help fishers protect their own interest
15. Fishers don't trust scientists
16. Cooperation with scientists improves fishers' trust in science
17. Marine reserves do not lead to better management
18. Marine reserves lead to more cooperation
19. Fishers want Marine reserves in order to improve surveillance
20. Marine reserves allow local fishers to exclude other fishers
21. Marine reserves will not improve the fishers' capacity to look after the resources
22. Poaching has not increased after the financial crisis
23. Ineffective management is a big problem in the fisheries
24. Cooperation between fishers and scientists is difficult

The statements and the instructions were translated into Spanish and entered into Web-Q for the survey. We used a quasi-normal distribution with 1 statement for the +3/-3 slots, 3 statements for +2/-2 slots, 5 statements for +1/-1 slots and 6 statements for undecided.

Selecting the P-set

The concourse in Galicia has many stakeholders. When selecting the P-set we focused on having all of these groups covered and optimally both responders from in and outside the GAP2 case study. We sent a list with categories to the case lead in Galicia and with their assistance we had the list filled out with names. The list consisted of 32 people with the following distribution:

- 6 fishers participating in the GAP2 case study
- 4 fishers not participating in the GAP2 case study
- 3 scientists working in the GAP2 case study
- 5 scientists not working with the GAP2 case study
- 6 people from the management level
- 4 technical assistants
- 2 staff from the Cofradía of Aguiño
- 2 staff from FGCP

Each person was allocated a code for processing the data. The code consisted of 8 characters. The first three characters were 'gal' to recognize the case (Galicia). The fourth character showed which stakeholder group the person belonged to (1=fishers, 2=scientist, 3=management, 4= technical assistant and 6=staff). The fifth character was either a 'y' (yes) or 'n' (no) to indicate whether the person is a GAP2 participant and the remaining three characters was numbers to distinguish people in equal categories. To illustrate, a respondent with the code gal2y013 would be respondent nr 13 in the Galician case; a scientist working in the GAP2 case study. In order to secure confidentiality for the respondents we will refer to the participants in the survey without the last three digests, thus only indicating stakeholder group and involvement in the GAP2 case study.

Q-sorting

All of the 32 persons in the P-set were introduced to the survey and asked to participate. It was anticipated that it may be hard for some of the respondents to do the survey online, either because of low/no internet connection or because of lack of equipment. The researchers from the Galician case therefore brought their computers and requested people's participation "in the field". In this way many of the web-based Q-sorts from Galicia had the additional benefit of face to face interviews where the respondents could ask questions, receive guiding and give their reflections. On the other hand, the presence of the scientists in the room may have interfered with condition of instruction; the personal opinion. It is a possible limitation of the Galician case study that fishers may have adjusted their viewpoints according to what they may have believed were the favored answers. However, there are no practical indications of this. The scientists explained the idea of sorting and assured the respondents that it was important that they sorted according to the condition of instruction. The data material also shows variance in the fisher's responses. We received 28 Q-sorts represented by:

- 6 fishers participating in the GAP2 project
- 3 fishers not participating in the GAP2 project
- 3 scientists working in the GAP2 project
- 5 scientists not working with the GAP2 project
- 3 people from the management level
- 4 technical assistants
- 2 staff from the Cofradía of Aguiño
- 2 staff from FGCP

Analysis

The data from the 28 sorts were entered into PQ method. As described in the section "Q-methodology" we used PCA to calculate the correlation matrix and rotated the factors with higher eigenvalues than 1. In the Galician case this was six factors. We used Varimax for statistical rotation and automatically flagging for marking the defining sorts (sorts that load significantly on specific factors, p>0,01). Nine sorts loaded significantly on factor 1, five sorts loaded significantly on factor 2 and three sorts loaded on factor 3. These three factors account for 64 % of the variance and were kept for the further analysis. Factors 4-6 had only one flagged sort each, and should be interpreted as three "outliers" in the segments of viewpoints.

The three factors do not represent opposite views, and the Galician case is characterized by agreement in many aspects. For instance there is strong consensus with the statement that scientific knowledge is necessary for management and that ineffective management is a big problem in the fisheries. However, the three factors emphasize different issues in different ways and thereby also favor different alternatives on how to make fisheries management more effective. This is evident in disagreement in how fishers' knowledge and the impact of cooperative research is perceived: Whereas factor 1 highlights fishers' knowledge as something valuable, factor 2 argues that scientific knowledge is sufficient for management purposes. Factor 3 takes on a more pragmatic perspective and focus on how inclusion of fishers in research is important for legitimacy. Below we will first describe each factor, comment on the outliers and lastly summarize the findings from the Galician case.

Factor 1: Fisher's knowledge is a treasure

Factor 1 is the most dominating perspective in the Galician case. The nine respondents who load on this factor is a composite of three fishers, two who were involved in the GAP2 case study; five scientists of which two were involved in the GAP2 case study; and one staff from the Cofradia in Aguiño. In this way factor 1 is a perspective that exceeds the boundaries of stakeholder groups and engagement in collaborative research. The ideal sort for this factor is displayed in Table 6. Based on this we will describe the perspective on the case issues in Galicia represented by factor 1.

Factor 1 stresses the competence and engagement of fishers. They agree the most that fishers have complex ecosystem information and disagree most that fishers don't want to be involved in the management process. This shows how the discourse is dominated by the GAP2 case study perspective: fishers' knowledge is a treasure, the knowledge base that fishers have developed through years of experience is valuable – not only for the fishers themselves, but for science and management as well.

The perspective should not be understood as rebellion against the established knowledge production system. This is evident in that factor 1 also agrees strongly that scientific knowledge is necessary for management and strengthened by the fact that they disagree (-1) that there are things that fishers know that scientists don't. It is more correct to say that this perspective equate traditional knowledge with traditional scientific knowledge in terms of importance.

Most agree	3 Fishers have complex ecosystem information
Strongly agree	1 Cooperation between fishers and scientists is important 12 Scientific knowledge is necessary for management 23 Ineffective management is a big problem in the fisheries
Agree	6 If fishers are included in the decision-making process they have more respect for the regulations 13 Cooperation with scientists gives fishers a voice in management issues 18 Marine reserves lead to more cooperation 16 Cooperation with scientists improves fishers' trust in science 9 The managers do appreciate the fisher's point of view
Undecided	19 Fishers want Marine reserves in order to improve surveillance 10 The fishers don't trust the managers of Islas Atlánticas National Park 11 The fisher's interest are not threatened by Islas Atlánticas National Park 24 Cooperation between fishers and scientists is difficult 15 Fishers don't trust scientists 20 Marine reserves allow local fishers to exclude other fishers
Disagree	7 Fishers have real influence in management issues 22 Poaching has not increased after the financial crisis 14 Cooperation with scientists will not help fishers protect their own interest 21 Marine reserves will not improve the fishers' capacity to look after the resources 2 There are things that fishers know and scientists don't
Strongly disagree	17 Marine reserves do not lead to better management 5 Fishers don't want to share their knowledge with scientists 4 Fishers' knowledge is not necessary for management
Most disagree	8 Fishers don't want to be involved in the management process

Table 6: The ideal sort for factor 1 in the Galician case

Their point is that cooperation between fishers and scientists is important (strongly agree) and that fishers' knowledge is also necessary for management (strongly disagrees with the statement saying it is not). The perspective represented by factor 1 seems to favor the idea of symbioses in knowledge production for fisheries management and believe that this is possible in that they disagree with statement #5; fishers don't want to share their knowledge with scientists.

The people behind this factor also agree that ineffective management is a big problem in the fisheries and a marine reserve may lead to better management. In this way factor 1 is fully in line with the scope of the GAP2 case study in Galicia: By translating fishers' ecological knowledge into scientific means, the competences they have are authorized and validated at a level where it is also can have impact at the management level.

Factor 2: Scientific knowledge is sufficient

Factor 2 is the second most dominating perspective in the discourse. Five respondents load significantly on this factor and their denominator is that they are *not* in the GAP2 case study and none of them are fishers. The subjects are one scientist, two managers and two technical assistants. The ideal sort for this factor is displayed in Table 7. Based on the ideal sort we will describe this perspective on the case issues in Galicia.

Factor 2 represents a traditional, conservative perspective on research. Not surprisingly they most agree that scientific knowledge is necessary for management. This is not controversial in this case study; all factors agree on this. The conservative approach is underlined in this perspective by the disagreement with the statement there are things that fishers know and scientists don't. These two extreme points indicate a belief that scientific knowledge is sufficient for management.

It makes sense that all the subjects who load on this factor are outside of the GAP2 case study, as the perspective undermines the importance of the ambitions with the project. This indicates that the GAP2 case study may have some legitimate problems in Galicia; if the effort is not appreciated by people outside the project, it is likely that the impact will be lower. This concern is supported with factor 2's strong disagreement that fishers have complex ecosystem information: Not only does this perspective disclaim that fishers' knowledge is exclusive; it undermines that fishers have the relevant knowledge at all.

Most agree	1 Scientific knowledge is necessary for management
Strongly agree	23 Ineffective management is a big problem in the fisheries 6 If fishers are included in the decision-making process they have more respect for the regulations 12 Cooperation between fishers and scientists is important
Agree	7 Fishers have real influence in management issues 24 Cooperation between fishers and scientists is difficult 13 Cooperation with scientists gives fishers a voice in management issues 5 Fishers don't want to share their knowledge with scientists 16 Cooperation with scientists improves fishers' trust in science
Undecided	20 Marine reserves allow local fishers to exclude other fishers 18 Marine reserves lead to more cooperation 11 The fishers' interest are not threatened by Islas Atlánticas National Park 15 Fishers don't trust scientists 19 Fishers want Marine reserves in order to improve surveillance 9 The managers do appreciate the fishers' point of view
Disagree	8 Fishers don't want to be involved in the management process 10 The fishers don't trust the managers of Islas Atlánticas National Park 21 Marine reserves will not improve the fishers' capacity to look after the resources 14 Cooperation with scientists will not help fishers protect their own interest 17 Marine reserves do not lead to better management
Strongly disagree	4 Fishers' knowledge is not necessary for management 22 Poaching has not increased after the financial crisis 3 Fishers have complex ecosystem information
Most disagree	2 There are things that fishers know and scientists don't

Table 7: The ideal sort for factor 2 in the Galician case

Despite the traditional perspective, factor 2 agrees that ineffective management is a big problem in the fisheries, and also that poaching has increased after the financial crisis. This shows how factor 2 does not say that the conventional knowledge production system is perfect. The perspective further strongly agrees that cooperation between fishers and scientist is important and that if fishers are included in the decision-making process they have more respect for the regulations. Supported by their strong

disagreement that fishers' knowledge is not necessary for management, this seems like this perspective acknowledges participatory research, if not as necessary, then at least as useful for legitimate management measures.

Factor 3: Collaboration leads to commitment

Factor 3 is the least represented perspective in the discourse. Three sorts load significantly on this factor; they are all involved in the GAP2 case study; one fisher and two staff from FGCP. The ideal sort for this factor is displayed in Table 8. Based on the ideal sort in the table we will describe this perspective on the case issues in Galicia.

This factor can be characterized as a pragmatic perspective. They most agree that if fishers are included in the decision-making process they have more respect for the regulations and disagree most that fishers' knowledge is not necessary for management. In this way factor 3 stresses the importance of legitimacy that was also acknowledged in factor 2, but without downgrading the knowledge of fishers in principal. Statements about the quality of fishers' knowledge are mostly set to the middle of the sort and therefore not an engaging theme for this factor (in relative terms). It is interesting to notice how this perspective also stress that fishers don't have any distrust in the managers of the national park, and also that they disagree that fishers want marine reserve in order to improve surveillance. This gives an impression that this perspective accepts fishers as novel contributors to the management process – not as "wild-men" that may be tamed through collaborative events.

Most agree	6 If fishers are included in the decision-making process they have more respect for the regulations
Strongly agree	1 Scientific knowledge is necessary for management 23 Ineffective management is a big problem in the fisheries 10 The fishers don't trust the managers of Islas Atlánticas National Park 12 Cooperation between fishers and scientists is important
Agree	24 Cooperation between fishers and scientists is difficult 16 Cooperation with scientists improves fishers' trust in science 13 Cooperation with scientists gives fishers a voice in management issues 22 Poaching has not increased after the financial crisis
Undecided	17 Marine reserves do not lead to better management 15 Fishers don't trust scientists 2 There are things that fishers know and scientists don't 3 Fishers have complex ecosystem information 20 Marine reserves allow local fishers to exclude other fishers 5 Fishers don't want to share their knowledge with scientists
Disagree	14 Cooperation with scientists will not help fishers protect their own interest 21 Marine reserves will not improve the fishers' capacity to look after the resources 11 The fishers' interest are not threatened by Islas Atlánticas National Park 18 Marine reserves lead to more cooperation 8 Fishers don't want to be involved in the management process
Strongly disagree	7 Fishers have real influence in management issues 9 The managers do appreciate the fishers' point of view 19 Fishers want marine reserve in order to improve surveillance
Most disagree	4 Fishers' knowledge is not necessary for management

Table 8: The ideal sort for factor 3 in the Galician case

Like the other two factors they strongly agree that scientific knowledge is necessary for management. Hence they seem to support the traditional knowledge production just like factor 1, but stress the involvement of fishers' knowledge for the sake of effective management. This is supported by strong agreement with the statement that says that ineffective management is a big problem in the fisheries. Further they disagree strongly that fishers have real influence in management issues and that the managers do appreciate the fishers' point of view. In this way it may seem as factor 3 are mostly engaged with how the management system works: From their sorting they seem to believe that it will be more efficient if fishers are included – not just for the sake of including; but that this type of knowledge is respected and considered in management issues.

The outliers

As described above, there were six factors with eigenvalues>1. After statistical rotation only the three described above were kept for further analysis. The three factors that were not kept had only one loading each and therefore not qualified as a perspective on the discourse. Brown (2001) notes however, that such outliers should be evaluated qualitatively to see if they are a "relevant" outlier, for instance if they have a very central position in the discourse. In the Galician case all three outliers are fishers: two involved in the GAP2 case study and one not. Since they were all fishers we will include their extreme points in their ideal score and discuss how this affects the discourse.

Factor 4, not participating in collaborative research, most agree that "fishers want marine reserves in order to improve surveillance" and most disagree that "marine reserves allow local fishers to exclude other fishers". This is in line with the case description and the initial aim of the GAP2 case study in Galicia. The reason his opinions did not correlate with the others may be that he stresses these points more than then quality or procedure of knowledge production for management.

Factor 5 is a participating fisher in the GAP2 case study. This factor most agrees that "fishers don't want to share their knowledge with scientists" and most disagrees that "fishers have real influence in management issues". These extreme points are a bit surprising given that this is a participator in the project. Following factor 4 one explanation may be that this fisher got involved in the project in order to achieve a marine reserve in Aguiño and now feels dejected. This is of course only speculation and needs to be followed up by further research to be valid. However, if the GAP2 case study has participators who feel their effort have little impact and don't even want to share their knowledge this is a warning sign for the output of the project in total.

Factor 6 is also a participating fisher. He most agrees that "fishers have complex ecosystem information" and most disagrees that "fishers' knowledge is not necessary for management". This is supportive of factor 1, the most dominating perspective on the case matters. However, factor 6 does not put equally emphasis on the importance of scientific knowledge. Hence, this factor stresses the quality of fishers' ecological knowledge as superior to scientific knowledge.

We have not put too much weight on the outliers in the overall analysis. However, when three out of ten fishers have quite different perspectives, it is interesting information for collaborative research. It indicates clearly how fishers cannot be understood as a single group, but that they have a variety of perspectives and subjectivities.

Summary and conclusion

The Galician case is characterized by agreement in many aspects. As has been shown previously there is strong consensus that scientific knowledge is necessary for management and that ineffective management is a big problem in the fisheries. But as the description of the three factors also has shown, there are different opinions on fishers' knowledge and participatory research. Especially do factor 2 deviate from the others on this matter. The significant difference between factor 1 and 2 is the statement "fishers have complex ecosystem information". Where factor 1 clearly acknowledges the knowledge that fishers have, factor 2 does not. The significant difference between factor 2 and 3 is slightly different: "fishers have real influence in management issues". The conventional perspective in factor 2 to some degree agrees that they do, whereas factor 3 sees the lack of this as the reason for ineffective fisheries management. Factor 1 and 3 do not have any statistically significant difference. They share viewpoints on most of the matters, but where factor 1 highlight fishers' knowledge as something genuine, factor 3 highlights it as a pragmatic need: it needs to be acknowledged more in order to improve the effectiveness of fisheries management.

There are other consensus statements than the two already mentioned. However, they are all placed in the middle of the sorts. They may therefore be interpreted as the denominator in the discourse; the difference in the viewpoints is concentrated on the need for fishers' knowledge for management. The question is what this means for the research questions for this study.

The results from the Q-sort analysis show some variance in attitudes between participators in and outside the GAP2 case study. The most conventional perspective represented by factor 2 only consist of people not involved in the project whereas factor 3, the more pragmatic one is represented only by people involved in the project. As stated in the introduction it is hard to discuss valid causal explanations from the results because of the challenge of self-selection. Maybe the subjects who load on factor 2 would have other preferences if they were actually participating, but maybe the subjects who load on factor 3 participate because they already had a favorable attitude towards collaborative research. Why else would they get involved? However, with respect to attitudes towards cooperation, the most dominant perspective in this factor, represented by factor 1, is the most interesting. It is the perspective that to the highest degree favors the type of research initiatives that GAP2 represent *and* the subjects who load on it come from various groups both in and outside the GAP2 case study. On the basis of this we argue that collaborative research is highly acknowledged in Galicia.

Acceptance of the need for participatory research could indicate that collaborative projects have penetrating power in management. The fact that the local Cofradía is utilizing the GAP2 case study in

the making of new management plans support this. The FGCP is also a partner in the project. On the other side, the plans for establishing a marine reserve in Aguiño have been shelved. However, since this, at least partly, is caused by other factors such as different political priorities and the financial crisis, we don't see this as an argument of the limits of participatory research. The making of management plans is nevertheless not a controversial issue in the Galician context. Whether the collaborative efforts would be sufficient in a rougher setting is therefore in question.

From the Galician case study we learn that cooperative research has broad acceptance, not as an alternative, but as an expansion of traditional scientific research. A condition for this may be the short distance between the research activities and the management level.

CS4: WBSS Herring

According to the GAP2 webpage, the aim of this case study is to:

> *Develop a tool which industry can use to predict the behavior of the Western Baltic Herring stock, under a range of management scenarios. To do this, we want to establish a Long Term Management Plan (LTMP) for the species, through combining traditional knowledge with scientists' understanding.* (*http://gap2.eu/case-studies/case-study-4/*)

The setting of the case study is the management of the western Baltic Spring Spawning (WBSS) herring stock, which has been problematic for several reasons. One reason for this is the lack of understanding of the stock structure and migration pattern, compounded by imprecise catch statistics and misreporting. In addition, the management problems are related to a complex pattern of fisheries, where different fleets exploit the stock in different ways along its migration route. In the Baltic and Belt area, there is a directed fishery for herring, while the fleets in the Skagerrak/North Sea take WBSS in fisheries that primarily targets North Sea autumn spawning herring (NSAS). The situation is complicated since the WBSS is managed jointly – but somewhat uncoordinated – under two different management regimes. In the Baltic, WBSS is managed by the EU as part of the governance regime for the Baltic fisheries. Here, stakeholders are engaged in management issues through the Baltic Sea RAC (BSRAC). In the North Sea, the WBSS is tangled up in the management of NSAS, which is managed jointly by EU and Norway. Here, stakeholders (on the EU side) are engaged in management issues through the Pelagic RAC (PELRAC). The split between the two areas is 50/50 – but subject to annual negotiations (Ulrich *et. al*., 2010: 3).

The result of these complexities is that the management of the stock has been difficult, with no agreed management plan in place:

> Despite its relatively small size and economic values, western Baltic spring spawning herring (WBSS) is managed in a highly complex governance scheme, with demanding scientific challenges and an elaborate political process of resource allocation among fishing fleets. (Ulrich *et. al.,* 2010: 1)

The aim of the GAP2 case study is to improve this through a bottom-up approach, in which scientists and stakeholders work together on the major unresolved issues and come up with an proposal for a long term management plan (LTMP). Such a proposal could then be presented to the management authorities and hopefully be accepted in the relevant authorities. Nevertheless, the unresolved issue of WBSS' division between management regimes seems to be creating difficulties in carrying out this plan.

The partners

- National Institute of Aquatic Resources (DTU Aqua) at Technical University of Denmark: Science partner
- Pelagic Regional Advisory Council (PelRAC): Stakeholder partner
- North Sea Regional Advisory Council (NSRAC: Stakeholder partner

- Baltic Regional Advisory Council (BSRAC): Stakeholder partner

Assembling the concourse

Fieldwork was conducted at the DTU headquarters during the first stakeholder meeting for GAP2, in November 2011. Here, we participated in the meeting and also did two interviews. After reviewing the data material, however, we realized that more work was needed. While it was no problem getting people to talk about WBSS herring, the fisheries exploiting the stock, the management problems and its possible solutions, these interviews did not allow for a precise understanding of the issues. To some extent, of course, our difficulties may reflect on the skills and training of the WP4 team. Nevertheless, it must be added that in the herring case stakeholder representatives have a long history of involvement with complex management issues in a way that sets it apart from the other GAP2 cases. In order to understand what the WBSS project was about, we had to dig into the technical terminology developed within ICES, and also try to figure out the relationship between this and the management regimes into which it is (partly) integrated. In addition we conducted two Skype interviews in March 2013. In the following we will account for the events leading up to the relevant discourses around herring management.

Western Baltic Spring Spawning herring

The herring known as western Baltic Spring Spawners (WBSS) is a mixture of different herring populations that mostly spawn during spring, with the main spawning ground near Rügen Island (ICES 2010: 9). Most of the 2+ ringers (adult herring) migrate during spring through the Sound and Belt Sea to the western parts of Skagerrak and the eastern North Sea to feed. Towards the end of summer, the herring aggregates in Skagerrak and Kattegat before they return to the wintering area in the southern Kattegat and the western Baltic. The migration patterns are variable on a number of dimensions and not fully understood (ibid: 10).

For assessment purposes, ICES divides between four different fleets catching WBSS. Fleet F is the fleet that operates within the Baltic (area 22-24), which is mostly a directed fishery by German, Danish, Swedish and Polish vessels, but also includes some bycatch in the sprat fishery. Fleets C and D comprise vessels operating in division IIA (Skagerrak). Fleet C is a directed fishery for herring by trawlers and purse seiners and includes vessels Denmark, Sweden and Norway. Fleet D consists of (mostly Danish) trawlers and small purse seiners that fish sprat along the Swedish coast, landing herring as bycatch. Fleet A catches some WBSS as part of a directed fishery for NSAS in area IVa East. (ICES 2012a: Annex 04).

The landings of WBSS herring have declined steadily from the early 1990s, when it was around 200 000 tons, until today when the landings are around 30 000 t. In the same period, the SSB has declined from around 300 000 t to around 110 000 tons, with recent signs that the trend has been reversed (ICES Advice May 2012: 6.4.15). There is no agreed management plan in place for the stock, and no PA reference points have been defined. Nevertheless, in line with ICES' MSY approach, an F_{MSY} has been estimated to 0.28, an MSY $B_{trigger}$ of 110 000 t. B_{lim} is 90 000 t, while B_{pa} is 110 000 t. ICES 2013: 6.4.8).

As already mentioned, the purpose of the GAP2 case study on WBSS is involving stakeholders, scientists and managers in a bottom-up process of developing a long term management plan for the stock. While stakeholder involvement, including cooperative research, makes a lot of sense in an LTMP setting, the events leading up to the this particular case are significant. A key concept here is "participatory modeling", referring to a particular strategy and framework for involving stakeholders directly in the stock assessment process within an ICES framework. During 2009, the WBSS was targeted for such a modeling process within the framework of JAKFISH, an EU FP7 project (Ulrich *et al.*, 2012). In 2010, a similar process design was used in an ICES workshop on procedures to establish the appropriate level of the mixed herring TAC (ICES 2010): "The outcome of the meeting was a realization that there had been a lack of communication and fundamental differences in the perception of the problem" (ICES 2012b: 3). On the basis of these experiences, the GAP case on WBSS was established with a clear commitment to complete the process that had started within these projects.

Since the WKWATSUP is cited as a direct precursor and inspiration for the GAP2 (ICES Inside Out: 3), we briefly review the process and proceedings here. The WKWATSUP, which was dominated by ICES scientists but also included stakeholder representatives and managers, was convened by ICES in order to address a joint EU/Norway request on "long term management of herring in the western Baltic and the Skagerrak and Kattegat." The request stated that while the existing LTMP for NSAS and the one proposed for WBSS could be used to fix the overall TACs for the respective stocks, they *"do not indicate the appropriate level of the mixed stock TAC in the Skagerrak and Kattegat"* (ICES Advice 2010, book 6: 22). On this basis, ICES was asked for advice on a series of specific issues related to the mixed stock TAC.

The conclusion was that "WKWATSUP did not find any of the above options optimal to manage the mixed stock in Division IIIa" (ibid: 36). Instead, the group recommended a different TAC-setting rule, which was formulated like this ICES response to the joint request:

i) First set the TAC for the WBSS herring according to the MSY (transition) framework for WBSS herring alone;

ii) A seasonal closure of parts of the Eastern North Sea is suggested (…), but until this is implemented it is recommended that the fraction taken in this area should be subtracted from the total TAC for WBSS before sharing the TAC between Division IIIa and Subdivision 22-24;

iii) Subsequently use the best estimates of the proportions of the NSAS and the WBSS herring in the catch by fleet to calculate the combined catch options in compliance with the targeted catch for WBSS herring. (ICES Advice 2010: Book 6: 23)

While the request had been specified as a series of TAC-fixing alternatives within area IIIa, i.e. the domain of the Norway-EU negotiations, the alternative recommended by ICES seems to require a joint consideration of the TAC for all fleets. There seems to be a deadlock here, in which the scientifically acceptable solutions have little or no overlap with the politically acceptable ones. The alternative recommended by science implies changes in the management framework or that Norway accepts a

deferential role where EC management decisions for 22-24 are taken as a fait accompli. From the management perspective, however, the minimum requirement of a TAC-setting rule option is that it is compatible with the existing management framework, i.e. that that it retains an acceptable division of management authority between Norway and the EU. TAC-setting options that do not fulfill this requirement are not acceptable, even though they perform better on other criteria, for instance in terms of stock rebuilding or allowing for sensible modeling and clear advice. Since the management side has the final word, the result is that the ICES advice is not accepted.

GAP2 process on WBSS

In an interview with ICES Inside Out (ICES 2012b: 3), Lotte Worsøe Clausen, the Case study leader, presents the GAP2 case study with an emphasis on the establishing a productive working relationship between the stakeholders:

> *We have the luxury of having a case study devoted to a common issue and therefore we have had the time to build the trust between the European Commission, the Baltic Sea RAC and Pelagic RAC, the fishers, the fishing associations and the scientists. We all want to discuss and solve this. We are not meeting to state our minds and then go back home again. I think that's the plus and the success story – that through a process based on transparency and trust, we have actually bridged the gaps between us and can now, with a common effort, look at how to solve this problem.*

In order to get an impression of exactly how the GAP2 case has engaged stakeholders in this work, we describe the main events in the process so far.

Kick-off meeting November 2011

The first of these meetings, held in Copenhagen November 2011, aimed at establishing "common ground for such a LTMP between all stakeholders." (ICES 2012a: 10). In particular, the seminar tried to "reach a common perception of MSY and the creation of an agreed "Table of Contents" for a LTMP for WBSS" (GAP 2011: 2). Since the commitment to an operational MSY-criterion formed part of the "table of content", we focus on the latter. In the meeting report, the reasoning behind the agenda is explained like this:

> *It is easy to get lost in the vast amount of parameters with each their adhered trade-off that exist in the creation of a LTMP for WBSS; issues like spatial split of TAC, fleet shares, mixing with other herring stocks, multi-species considerations, stability (IAV), management tools, etc. However, as the first step, it is necessary to define and agree upon the over-arching Management Objectives for the stock. Once these are settled, the participatory modeling of management plan evaluations can start and with illustrative numerical examples, all stakeholders can engage in an enlightened debate aiming for an agreed LTMP*. (ibid: 9)

Noting the complexities of the task, the strategy for the meeting was to reach agreement on main objectives, which then could be dealt with through participatory modeling. In the meeting report, the strategy is explained like this:

> *The over-arching objectives of a LTMP were that the plan should be Specific, Measureable, Achievable, Realistic and Time-limited (SMART); it needs to be simple to grasp by all stakeholders and the most important objective to aim for is a high and stable yield based on a sensible F.* (ibid: 10)

The commitment is to make a management plan that is specific and binding on the parties. In particular, this is suggested by the reference to "a sensible F" and "Target F= F_{MSY} robust to ecosystem changes." Here, the agreement in the first part of the seminar on how the MSY criterion can be implemented. This is also in line with the current MSY framework in ICES and EU.

Also, the meeting report contains several references to the mixed fisheries issue and how to deal with area based management. For instance, reference is made to the "Required political decisions," which is the allocation of TACs between areas IIIA and SD 22-24, and among the fleets. Here, the agreement was that "The separation between the TAC areas (IIIa and SD 22-24) should be upheld; however, the division of the catch opportunities between these two areas should be discussed, but finally carved in stone somewhere." (ibid: 10).

Summing up, then, we note that this meeting engaged stakeholders in a process that could, eventually, lead to a participatory modeling event. But while the process was clearly participatory, there was no modeling going on. It would seem that the conditions allowing for meaningful participatory modeling was not in place, probably due to the political uncertainties created by the unsettled relations between the two management regimes. In addition, the problem of getting representation from all stakeholder groups was a problem.

Meeting between BSRAC and GAP2 November 2011

Since the BSRAC representatives had not been able to come to the kick-off meeting, and this made progress on the questions of allocation difficult, a post-seminar meeting between the cases study leader (Lotte Worsøe Clausen) and the BSRAC chairman and secretariat was held November 24, 2011. It was here agreed to plan a follow-up meeting with the objective of "reaching agreement on the sharing of catch options and the IAV parameter of the LTMP." A point was made that the Pelagic RAC, BSRAC and representatives from Norway should be invited. Lotte Worsøe Clausen was also invited to present the GAP2 herring case study at the BSRAC ExCom meeting in January 2012.

Meeting on Herring Case Study April 2012

According to the agreement with the BSRAC chairman/secretariat in November, a new GAP2 meeting was held in April 2012 (GAP2, 2012). While this meeting did not include representatives from Norway, BSRAC was present together with PELRAC people. After a brief introduction to the complexities of WBSS

science and management, the meeting went on to discuss the different perceptions of key management plan issues; the main policy options to be explored as a basis for the LTMP. The discussion in the meeting can be effectively summarized with reference to the table below. The main point of these discussions was to identify the best and most realistic framework conditions that would allow for the development and agreement of a LTMP. The three options considered were (1). To harmonize the timing of the advice for NSAS and WBSS; (2). Manage the WBSS on a stock basis instead the area approach; (3). A mixed fisheries approach.

The point of the first option, harmonizing the timing of advice, is to improve the possibilities for coordinating the management between the two management areas (IIIa and SD22-24). This would solve a major problem of today, in that as the advice and management for the Baltic stocks, including WBSS in SD 22-24, is decided before the Norway-EU negotiations. This means that some of the decisions relevant for the EU-Norway negotiations are locked in internal EU agreements, making Norway unhappy. While this was thought to be "doable without too much trouble" and could work as a "transition" as other options are adopted, it turned out to be a dead end. According to Clausen, this was shot down because the Baltic ICES delegates wanted to keep the timing with the advice for the other Baltic stocks.

The third option – that of a mixed fisheries approach – implies that instead of a stock by stock and area by area approach one would do an integrated assessment of the whole WBSS-NSAS complex, including local stocks. It appears that this option involves considerable complexities and lies somewhere in the future, as it although the most solid in scientific terms "needs a lot of work before it can be operational." In the end, then, this option was not deemed to be practical as a foundation for stakeholder involvement, since it involved a large number of scientific challenges.

This left option 2, which "seemed to be the option which could be operational within the nearest future and as such could set the stage for what the Herring Case Study in GAP2 would use for the elaboration of a LTMP for the WBSS stock complex." What does this option entail? On a direct question, Clausen explains it like this (interview):

> *This is an old idea from managers. That is, instead of scientists making predictions divided by area, we would only make predictions with regard to how much can be fished in total…. It doesn't really matter whether the fishers catch their quota in Skagerrak or Kattegat or 22-24, or rather, one would have to find out about that. The point is that the science part does not have to suggest how to divide it up. This makes sense. Science actually goes one step too far when we divide it up 50/50. The problem is that we have to have an idea about how the fleets are distributed, since the different fisheries do not harvest the stock in the same way. If we remove this barrier (area quota), however, the consumer fishers – but also Norway – say that the risk is that it opens up Skagerrak and Kattegat for fishers from the south. What will it mean for the fishers already there, if TAC shares are not divided between the different countries? We haven't run the simulations yet, what it would mean if all TAC were taken in Skagerrak or 22-24, because we didn't have the data for it. But this is part of the plan.*

The purpose is to develop a problem frame that is politically acceptable and will allow stakeholders and scientists to carry out a participatory modeling exercise with an LTMP in mind. In comparison with the earlier attempt under JAKFISH, which proved to be a non-starter because it didn't take account of the sharing problem between areas 22-24 and IIIA and hence between Norway and EU, the idea here is to identify a modeling scenario that is politically realistic, technically feasible as well as interesting. This is done, as we understand it, by trying to negotiate a division between the scientific issues and the politically sensitive ones. That is, without preempting the allocation issues among Member States, or between the EU and Norway, the strategy is to identify management options that can be explored and agreed by stakeholders in a participatory modeling event. Such agreement would then form the basis for a political agreement with regard to the division of catch opportunities between areas and fleets. This interpretation seems to be consistent with the following formulation in the meeting report: "The group discussed the options to test in an MSE[2] like set-up assuming that the WBSS TAC was to be shared between the MS giving no areal restrictions to the utilization of the TACs" (GAP2, 2012). The four options discussed in this regard were:

a. 100% TAC utilized in Div IIIa
b. 100% TAC utilized in SD 22-24
c. Stock TAC utilized following historical proportions
d. 50/50 stock TAC utilization between Div. IIIa and SD 22-24

The different options imply different harvesting patterns, since different age segments are caught (by different fleets) in different areas, and also will have different consequences for the mix with NSAS in catches. The modeling exercise hence will give different scenarios for the WBSS for the same level TAC. On the basis of these scenarios, different allocation options can be considered.

Summing up then, this meeting continued the work in trying to stabilize a framework that would allow a participatory modeling exercise to be undertaken. Of the three options explored, two turned out to be dead ends. The one that initially had seemed to be realistic but not very interesting – aligning the timing of the advisory process across management regimes – stranded on resistance within ICES. The ideal and ambitions alternative, going for a full mixed-fisheries approach, would bring the task the full way back into the scientific arena, and would therefore be less interesting from the perspective of engaging stakeholders. The one-stock TAC option was hence the only feasible way to go. But this option remained vulnerable to the divided management regime.

[2] MSE is the acronym for Management Strategy Evaluation, and is the evaluation framework used in ICES for evaluating management plans that includes HCRs. The participatory modeling exercise for WBSS in JAKFISH is considered an example of MSE

Further plans

In the April 2012 meeting, a plan for the further work of GAP2 was sketched like this:

> *In terms of timing, some preliminary tests could be performed over the summer to give an idea of the consequences of removing the 50-50 split and using stock based TACs instead of area based TACs. This information would then be available for all parties interested in the EU-Norway debate on LTMP for herring. Then, prior to the planned GAP2 meeting in November 2012, the full stochastic based MSEs of the options outlined above could be performed, so that these scenarios can be presented and discussed at that meeting. It was noted at the meeting that the outcome from the Herring Case Study meeting would end up being able to convey vital information to the process of benchmarking the WBSS assessment which will be starting in the ICES system this fall (GAP2, 2012).*

We note both the ambitions for GAP2 as a key arena in establishing a LTMP for the WBSS and the way the case study is linked in with other process, in ICES as well as the Norway-EU negotiation process. Nevertheless, the progress in the case study turned out to be different, perhaps because of the difficulties in arranging a meeting of the relevant stakeholders. The current plans for the further work are closely tied to the EU-Norway process. In the agreement on Herring, negotiated in Clonakilty in January 2013, section 11.1 states:

> *The Delegations noted that catches of herring in ICES Division IIIa consists of herring from several stocks and that the absence of a method of establishing a TAC for herring in this area is not satisfactory. The Delegations therefore agreed to establish a Working Group on management measures for herring in ICES Division IIIa (Skagerrak). This Working Group, the Terms of Reference for which are set out in Annex V, shall develop and recommend alternative methods to set a TAC for herring in this area that is consistent with maximum sustainable yield.*

Again we note the narrow terms of reference, "to develop and recommend alternative methods to set a TAC for the herring" in IIIa. This seems to be a repetition of the joint request from 2010, except that the terms of reference now do not operate with specific suggestions on what the TAC-setting rules could be. Nevertheless, it could be expected that if the WG comes up with specific alternatives, ICES will be asked to evaluate them.

Deciding the Q-sample

In an interview with Lotte Worsøe Clausen, she presented the case as building on three pillars. These are, first, the biological pillar, pertaining to stock structure and data quality. The second is the modeling part, the technical stock assessment or management strategy evaluation process. The third and most challenging is related to management of the stock, in particular the problems related to the unresolved issues relating to the WBSS stock's split between different management regimes.

In the following, we comment on these issues, starting with the "pillar" on biology and stock structure. We then go on to comment the next two. We prefer to comment on these two together, as it seems that the close ties between the technical and political aspects are of key importance.

Biology and stock structure

In biological terms, the WBSS is quite complex. In part, it is not one single stock, but a mix of several different components. In part, the WBSS complex mixes with NSAS to a varying degree, making things even more difficult. This creates all sorts of challenges when it comes to stock assessment and such, and there is a wide variety of work to overcome this, including different methods for mapping the stock structures (vertebral counts; otolith microstructure; molecular genetic approaches), improved sampling regimes etc. Most of this is undertaken as conventional research activities within the national marine research facilities. Nevertheless, one issue here has been picked up as a GAP2 thing, namely the reconstruction of faulty landing statistics on the basis of information from fishers. The background here is a long history of misreporting, making the historical catch data uncertain. The reason seems to be a practice by which vessels would fish opportunistically on its way from the Belt and Kattegat towards Skagerrak and the North Sea. This meant that there would be a mix of WBSS and NSAS herring in catches, depending on the exact route and the fishing opportunities underway. This was not accurately reflected in the catch reports, however, which would arbitrarily assign the catch as either WBSS or NSAS. Such misreporting seems to have been widespread, creating substantial uncertainties for the assessment.

The GAP2 case has been engaged in resolving this issue: *"A big part of the project has been to get the personal notes from fishers about where the herring has been caught – what herring stocks they have been exploiting."* (interview LWC). In part as a result of this, catch records have been repaired*: "HAWG has calculated that a substantial part of the catch reported as taken in Division IIIa in fleet C actually has been taken I Area IV. These catches have been allocated to the North Sea stock and accounted for under the A-fleet. Misreported catches have been moved to the appropriate stock for the assessment*" (ICES 2012a: 199). From 2009, moreover, a Danish regulation prohibited catches in the North Sea and Skagerrak during the same fishing trip (ibid: 658). This seems to have solved the misreporting problem: "From 2009 and onwards, information from both the industry and VMS estimates suggests that this pattern of misreporting of catches into Division IIIa" [is no longer apparent]. (Ibid: 199)

Participatory modeling and unresolved management issues

While the attempt to reconstruct the faulty data records on WBSS catch and landings is emphasized by Lotte Worsøe Clausen, it seems that the main focus in the GAP2 case has been on participatory modeling. Nevertheless, the progress on this issue seems to have stalled somewhat. While the case study has continued preparing the ground for a participatory modeling event, it has never really managed to get off the ground. In a way, this seems to be confirmed by Clausen when she in an interview says:

> *With regard to the modeling aspect, to set up a Management Strategy Evaluation model, this is in a way ready. We have just finished a Benchmark on the WBSS stock, that is, we have made a new assessment model and such. This model will be updated, but the technical we have the pillar under control, and this has turned out to be the easiest part. … For the case study, the MSE model is ready on the shelf.* (LWC interview)

While the model is ready "on the shelf", the GAP2 case has not been in a position to undertake a participatory modeling or MSE type process because of the political problems, in particular related to the Norwegian unwillingness to go with the options that make sense in a modeling framework. Instead, the GAP2 process so far have settled for preliminaries, engaging in topics that are less politically sensitive (MSY and its operationalization) and trying to identify management options that could, given appropriate authorization from the management side, be candidates for participatory modeling. It appears that the GAP2 case gradually has come to accept that it is pointless to go on without securing close alignment with what is politically feasible. Hence, in the latest revision of the working plan, the GAP2 process is closely linked up with the activities in the Working group set down by the joint Norway – EU agreement.

Defining themes for the Q-sort

As is apparent from the preceding review, the GAP2 case on WBSS herring is very interesting. It's framing as a case of participatory modeling foregrounds the issue of stakeholder participation in advisory processes, turning it into a perfect cases study from a GAP2 perspective. In particular, the case's setting, as stakeholder involvement directly connected to the development of a LTMP, establishes – at least as a potential – a demand side for the knowledge products generated, which is a problematic and underexplored dimension of cooperative research efforts in general.

In addition, however, the previous review suggests that the WBSS herring case is reasonably complex and not easy understand. In part, this follows from the tension that remains between the case study network, which includes scientists and stakeholders based in EU, and the management authorities, the EU-Norway negotiation team. It seems that the development of an LTMP has stalled on a continuing difference in viewpoints and priorities between these two communities. As noted in the introduction of the case, the complexity of the case follows from its pre-framing as part of ICES assessment and modeling framework. From the perspective of the present Work Task, which is to design and perform a Q-sort on the case, the problem here is that the highly technical context, and the specialist language skills required to be a competent participant in it, makes it challenging to get the Q-sort statements right.

Based on an understanding of key elements in the GAP2 case from a variety of sources we developed the Q-sort themes. The main themes are, to use the of the first GAP2 meeting, the "table of content" for the LTMP. That is, we tried to identify the most important topics that have come up in the attempt to develop such a LTMP. Because of the (growing) realization for the participants is that there will be no plan unless it is in line with the requirements from the EU-Norway negotiation team, it goes without saying that the interesting topics are framed and related to that in some way or another.

Note, however, that some of the topics are included in the case will not figure highly on such a list. For instance, the case has been preoccupied with the misreporting problem, and collected information from fishers in order to reconstruct catch and landing records. While this is important in order to get the assessment right, there is little reason to believe that there are strong or divided opinions about this. Most likely, statements about that will not provoke string agree or disagree in a Q-sort. Another such example is the MSY criteria. While the EU has adopted MSY as a management objective, to be realized within 2015, and a transition framework has already been put in place, statements about this may not give much in a Q-sort. But these are speculations. While we try to focus the Q-sort on the most critical aspects for the development of an LTMP, we will include some relevant but probably low-score statements in order to test such assumptions.

After internal review by the project team and a pilot run with the case coordinator in Denmark, we ended up with a Q-set of 24 statements:

1. In the herring fishery, fishing mortality on juveniles is a very small proportion of the natural mortality rate
2. By-catch of juveniles in the small-mesh fishery is significant
3. In the herring fishery, MSY criteria was introduced without proper stakeholder involvement
4. MSY criteria are not well suited for the management of the herring stocks
5. In pelagic fisheries, MSY criteria are not very different from precautionary reference points
6. In the fisheries for western Baltic Spring Spawning herring (WBSS), misreporting used to be widespread until 2009
7. Misreporting did not stop after 2009
8. Cooperation between scientists and fishers has been important to restore faulty landing records
9. Cooperation between stakeholders and scientists is not important for the development of effective Long Term Management Plan
10. The timing of advice for western Baltic (WBSS) and North Sea herring (NSAS) should be harmonized
11. In the case of western Baltic Spring Spawning herring, lack of support from managers has made cooperation between stakeholders and scientists less effective
12. Cooperation between stakeholders and scientists is important even without active support from the management level
13. A mixed fisheries approach, where western Baltic and North Sea herring are assessed jointly, is preferable to a single stock approach
14. The split area TACs for western Baltic Spring Spawning herring are working well
15. Instead of the split area TACs, the western Baltic Spring Spawning herring should be managed by a single TAC
16. A single TAC approach for western Baltic Spring Spawning herring will upset relative stability
17. A single TAC approach for western Baltic Spring Spawning herring will upset the balance between Norway and EU
18. The 50:50 split between IIIa and SD 22-24 is appropriate
19. A single TAC combined with seasonal closure in the North Sea is the most promising framework for a Long Term Management Plan for WBSS

20. The agreement that 50% of the herring TAC in IIIa can be fished in the North Sea is not advisable from a scientific perspective
21. The agreement that 50% of the herring TAC in IIIa can be fished in the North Sea has reduced fishing mortality for western Baltic Spring Spawning herring
22. Adopting a sound TAC setting rule for herring in IIIa is the key for solving the management problems for western Baltic Spring Spawning herring
23. It is difficult to make a TAC setting rule for herring in IIIa that will be advisable from a scientific viewpoint
24. A Long Term management Plan for western Baltic Spring Spawning herring is only realistic if it is managed together with North Sea herring under a joint EU-Norway agreement

Selecting the P-set

The concourse in the Danish case has several stakeholders. Fisher representatives and scientists as well as managers are involved in the project, also from different countries. In this case the division between stakeholder groups is nevertheless more blurred than in the other cases; their denominator is stronger as they all work with modeling and the technicalities in making a LTMP. Where the other cases work according to a "value chain"; transforming fishers' ecological knowledge into scientific means for management purposes, the herring case is better characterized as a junction, or workshop, where they all sit down and work jointly. This also affects the possibilities of having responders from both in and outside the GAP2 case study. When selecting the P-set we found it difficult to find stakeholders outside the project that also had sufficient knowledge about the issues to be able to rank the statements.

Based on the lists of participants from GAP2 meetings and other herring management events we constructed the responder list. The list consisted of 31 names. After discussing it with the case coordinator in Denmark, the list was reduced to 24 names, mostly because the people had not worked with the GAP2 issues for a long time. The remaining names are a composite of:

- 4 stakeholders representing fishers
- 3 stakeholders representing RACs
- 1 stakeholder from NGOs
- 11 scientists
- 5 from the management level

Note that none of the subjects in the P-set are representing the Norwegian side. We asked the Norwegian head negotiator to participate but she declined.

Each person was allocated a number for submitting the data. Before the analysis of the case this number was expanded to a code of 8 characters. The first three characters were 'den' to recognize the case (Denmark). The fourth character showed which stakeholder group the person belonged to (1= representing fishers, 2=representing RACs, 3=NGO, 4= scientists and 5=managers). The fifth character was either a 'y' (yes) or 'n' (no) to indicate whether the person is a GAP2 participant. The remaining three characters were numbers to distinguish people in equal categories. To illustrate, a respondent with

the code den4y013 would be respondent nr 13 in the Danish case; a scientist working in the GAP2 case study. In order to secure confidentiality for the respondents we will refer to the participants in the survey without the last three digests, thus only indicating stakeholder group and involvement in the GAP2 case study.

Q-sorting

Two of the responders were asked to do the Q-sort in a face to face interview at the GAP2 annual meeting in June 2013. These exercises confirmed that the statements captured the essence of the case, but also that some of them were hard to agree or disagree with because they were contingent. This confirmed the research team's suspicion that it might be hard to have people respond because of the technical level of the case and therefore also the statements.

The 22 remaining persons in the P-set was introduced to the survey and asked to participate via email. Some responded immediately, some after reminders. We also offered assistance in cases where responders found it hard to follow the set distribution. One responder declined to participate because of too little knowledge, two did not have time to participate, one did not understand the sorting process and gave up, and one responder was not available (vacation). We received a total amount of 19 Q-sorts. These are a composite of:

- 3 stakeholders representing fishers, all participating in the GAP2 case study
- 3 stakeholders representing RACs, all participating in the GAP2 case study
- 6 scientists working with the GAP2 case study
- 3 scientists not participating in the GAP2 case study
- 4 from the management level

Analysis

The data from the 19 sorts were entered into PQ method. As described in the section "Q-methodology" we used PCA to calculate the correlation matrix and rotated the factors with higher eigenvalues than 1. In the Danish case this was six factors. We used Varimax for statistical rotation and automatically flagging for marking the defining sorts (sorts that load significantly on specific factors). Three sorts loaded significantly on factor 1, only two sorts loaded significantly on factor 2, three factors loaded on factor 3 and four sorts loaded on factor 4. Factor 5 had only one significant loading and factor 6 had two. This spread and low loadings show that there aren't really any dominating perspectives in the Danish case. There are many strong opinions, but they do not cluster together. In other words it is a case with many individual convictions. Factor 1, 3 and 4 (that had three or more factor loadings) were kept for the further analysis (from now on referred to as factor 1-3). This represents 43 % of the explanation variance. The differences between the three factors can best be described as different focuses: They are more engaged with one specific theme then the others (referring to the themes listed in Appendix 9). Factor 1 is mostly engaged with the' practical approaches for TAC setting in IIIa', factor 2 is mostly

engaged in the debate about 'reducing incidental catch of small herring', while factor 3 is mostly engaged in the theme 'participatory modeling and collaborative research'. Below we will first describe each factor and lastly summarize the findings from the Danish case by comparing the factors in terms of consensus and differences.

Factor 1: The management wall

The three people who load on this factor are one representative for the RACs, one scientist not participating in the GAP2 case study and one from the management level, also not participating in the project. The ideal sort for this factor is displayed in Table 9 and will be elaborated in the following.

Factor 1's extreme ranking (+3 and -3) are both statement from the theme 'practical approaches for TAC setting in IIIa'. As the case description shows, there are different recommendations on this matter and they to various degrees correspond with the EU/Norway requests. The perspective represented by factor 1 most agrees that a long term management plan for WBSS herring only is realistic only if managed together with North Sea herring under a joint EU-Norway agreement. This also corresponds with the statement they disagree the most with; that the split area TACs are working well. In this way this perspective highlights what may be referred to as the "management wall". As the several previous collaborative projects have shown, it is not so much the gap between fishers' knowledge and scientific knowledge that needs to be connected as it is the gap from their results and the management level. This does not mean that the factor means the period for collaborative research on the matters is over, quite the opposite. It is important for the development for a LTMP and the factor even agrees that this collaboration is important even without the active support from the management level. For instance the perspective agrees that it is difficult to make a TAC setting rule for herring in IIIa that is advisable from a scientific viewpoint and suggests that a mixed fisheries approach is preferable. Hence the point is that the collaborative work - that works out solutions like this - is good and should continue, but that the efforts must reach through the management level in order to have the desired effects.

Most agree	24 A Long Term management Plan for western Baltic Spring Spawning herring is only realistic if it is managed together with North Sea herring under a joint EU-Norway agreement
Strongly agree	23 It is difficult to make a TAC setting rule for herring in IIIa that will be advisable from a scientific viewpoint 13 A mixed fisheries approach, where western Baltic and North Sea herring are assessed jointly, is preferable to a single stock approach 12 Cooperation between stakeholders and scientists is important even without active support from the management level
Agree	1 In the herring fishery, fishing mortality on juveniles is a very small proportion of the natural mortality rate 16 A single TAC approach for western Baltic Spring Spawning herring will upset relative stability 18 The 50:50 split between IIIa and SD 22-24 is appropriate 22 Adopting a sound TAC setting rule for herring in IIIa is the key for solving the management

	problems for western Baltic Spring Spawning herring 6 In the fisheries for Western Baltic Spring Spawning herring (WBSS), misreporting used to be widespread until 2009
Undecided	8 Cooperation between scientists and fishers has been important to restore faulty landing records 19 A single TAC combined with seasonal closure in the North Sea is the most promising framework for a Long Term Management Plan for WBSS 7 Misreporting did not stop after 2009 4 MSY criteria are not well suited for the management of the herring stocks 21 The agreement that 50% of the herring TAC in IIIa can be fished in the North Sea has reduced fishing mortality for Western Baltic Spring Spawning herring 10 In the case of western Baltic Spring Spawning herring, lack of support from managers has made cooperation between stakeholders and scientists less effective
Disagree	11 In the case of western Baltic Spring Spawning herring, lack of support from managers has made cooperation between stakeholders and scientists less effective 2 By-catch of juveniles in the small-mesh fishery is significant 15 Instead of the split area TACs, the western Baltic Spring Spawning herring should be managed by a single TAC 20 The agreement that 50% of the herring TAC in IIIa can be fished in the North Sea is not advisable from a scientific perspective 17 A single TAC approach for western Baltic Spring Spawning herring will upset the balance between Norway and EU
Strongly disagree	3 In the herring fishery, MSY criteria was introduced without proper stakeholder involvement 5 In pelagic fisheries, MSY criteria are not very different from precautionary reference points 9 Cooperation between stakeholders and scientists is not important for the development of effective Long Term Management Plan
Most disagree	14 The split area TACs for Western Baltic Spring Spawning herring are working well

Table 9: The ideal sort for factor 1 in the western Baltic herring case

Factor 2: The management disturbance of collaborative research

The three sorts who load on factor 2 are represented by one representative from the fishers, one representative from the RACs and one from the management level. They are all participators of the GAP2 case study. The ideal sort for this factor is displayed in Table 10 and will be elaborated in the following.

Most agree	1 In the herring fishery, fishing mortality on juveniles is a very small proportion of the natural mortality rate
Strongly agree	11 In the case of western Baltic Spring Spawning herring, lack of support from managers has made cooperation between stakeholders and scientists less effective 16 A single TAC approach for western Baltic Spring Spawning herring will upset relative stability 18 The 50:50 split between IIIa and SD 22-24 is appropriate
Agree	17 A single TAC approach for western Baltic Spring Spawning herring will upset the balance between Norway and EU 3 In the herring fishery, MSY criteria was introduced without proper stakeholder involvement 12 Cooperation between stakeholders and scientists is important even without active support from the management level

	22 Adopting a sound TAC setting rule for herring in IIIa is the key for solving the management problems for western Baltic Spring Spawning herring 21 The agreement that 50% of the herring TAC in IIIa can be fished in the North Sea has reduced fishing mortality for western Baltic Spring Spawning herring
Undecided	10 In the case of western Baltic Spring Spawning herring, lack of support from managers has made cooperation between stakeholders and scientists less effective 8 Cooperation between scientists and fishers has been important to restore faulty landing records 6 In the fisheries for western Baltic Spring Spawning herring (WBSS), misreporting used to be widespread until 2009 5 In pelagic fisheries, MSY criteria are not very different from precautionary reference points 4 MSY criteria are not well suited for the management of the herring stocks 13 A mixed fisheries approach, where western Baltic and North Sea herring are assessed jointly, is preferable to a single stock approach
Disagree	14 The split area TACs for western Baltic Spring Spawning herring are working well 20 The agreement that 50% of the herring TAC in IIIa can be fished in the North Sea is not advisable from a scientific perspective 23 It is difficult to make a TAC setting rule for herring in IIIa that will be advisable from a scientific viewpoint 7 Misreporting did not stop after 2009 15 Instead of the split area TACs, the western Baltic Spring Spawning herring should be managed by a single TAC
Strongly disagree	19 A single TAC combined with seasonal closure in the North Sea is the most promising framework for a Long Term Management Plan for WBSS 24 A Long Term management Plan for western Baltic Spring Spawning herring is only realistic if it is managed together with North Sea herring under a joint EU-Norway agreement 9 Cooperation between stakeholders and scientists is not important for the development of effective Long Term Management Plan
Most disagree	2 By-catch of juveniles in the small-mesh fishery is significant

Table 10: The ideal sort for factor 2 in the western Baltic herring case

This perspective is most occupied with the theme “incidental catch of small herring”. The most important message from them is that fishing mortality on juveniles is a very small proportion of the natural mortality rate and that by-catch of these in the small-mesh fishery not is significant. This touches upon the disagreements between Norway and EU and of course the discard ban that will be implemented after the CFP reform.

The factor also agrees that lack of support from managers in the case of WBSS herring has made the cooperation between stakeholders and scientists less effective. At first it may seem as the factor in this way agrees with factor 1; the management wall. However, factor 2 does not agree that a LTMP is only effective if it is managed together with North Sea herring under a joint EU-Norway agreement. They agree that the 50:50 split is appropriate and that it’s not difficult to make a TAC setting rule for herring in IIIa that will be advisable from a scientific viewpoint. Hence it may seem as factor 2 means the lack of support from managers has disturbed the collaborative research by hindering some of the radical ambitions (such as a mixed fisheries approach), not necessarily that there is a management wall that

needs to be broke through. In this way factor 2 seems more pragmatic about the management challenges.

Factor 3: Collaborative research despite the management challenges

Factor 3 is represented by four significant loadings. Behind these sorts are two fisheries representatives and two scientists. They all participate in the GAP2 case study. The ideal sort for this factor is displayed in Table 11 and will be elaborated in the following.

Factor 3 is most engaged with participatory modeling and collaborative research. They highlight the importance of this when they most agree that cooperation between scientists and fishers has been important to restore faulty landing records. This is not a contested statement (undecided in factor 1 and factor 2). That factor 3 nevertheless most agrees with this statement may have several explanations. The feedback from the two face to face interviews was that many of the statements are hard to (dis)agree with because they are contingent. Similarly factor 3 may have found this statement most easy to agree the most with since the success on this matter is so obvious. Another explanation may be that this factor is mostly occupied with the success of the GAP2 case study. This is supported by their disagreement (different from factor 2) that the lack of support from managers has made cooperation less effective. They strongly agree that cooperation between stakeholders and scientists is important even without active support from the management level, for instance for the development of an effective LTMP. They agree that adopting a sound TAC setting rule is the key for solving the management problems for WBSS herring and like factor 2 they disagree that this is hard to accomplish from a scientific perspective.

Most agree	8 Cooperation between scientists and fishers has been important to restore faulty landing records
Strongly agree	22 Adopting a sound TAC setting rule for herring in IIIa is the key for solving the management problems for western Baltic Spring Spawning herring 24 A Long Term management Plan for western Baltic Spring Spawning herring is only realistic if it is managed together with North Sea herring under a joint EU-Norway agreement 12 Cooperation between stakeholders and scientists is important even without active support from the management level
Agree	6 In the fisheries for western Baltic Spring Spawning herring (WBSS), misreporting used to be widespread until 2009 21 The agreement that 50% of the herring TAC in IIIa can be fished in the North Sea has reduced fishing mortality for western Baltic Spring Spawning herring 14 The split area TACs for western Baltic Spring Spawning herring are working well 1 In the herring fishery, fishing mortality on juveniles is a very small proportion of the natural mortality rate 7 Misreporting did not stop after 2009
Undecided	15 Instead of the split area TACs, the western Baltic Spring Spawning herring should be managed by a single TAC 5 In pelagic fisheries, MSY criteria are not very different from precautionary reference points

	18 The 50:50 split between IIIa and SD 22-24 is appropriate 10 In the case of western Baltic Spring Spawning herring, lack of support from managers has made cooperation between stakeholders and scientists less effective 16 A single TAC approach for Western Baltic Spring Spawning herring will upset relative stability 3 In the herring fishery, MSY criteria was introduced without proper stakeholder involvement
Disagree	19 A single TAC combined with seasonal closure in the North Sea is the most promising framework for a Long Term Management Plan for WBSS 2 By-catch of juveniles in the small-mesh fishery is significant 20 The agreement that 50% of the herring TAC in IIIa can be fished in the North Sea is not advisable from a scientific perspective 17 A single TAC approach for western Baltic Spring Spawning herring will upset the balance between Norway and EU 13 A mixed fisheries approach, where Western Baltic and North Sea herring are assessed jointly, is preferable to a single stock approach
Strongly disagree	11 In the case of western Baltic Spring Spawning herring, lack of support from managers has made cooperation between stakeholders and scientists less effective 23 It is difficult to make a TAC setting rule for herring in IIIa that will be advisable from a scientific viewpoint 9 Cooperation between stakeholders and scientists is not important for the development of effective Long Term Management Plan
Most disagree	4 MSY criteria are not well suited for the management of the herring stocks

Table 11: The ideal sort for factor 3 in the western Baltic herring case

Summary and conclusion

The GAP2 case study on western Baltic herring is characterized by many strong opinions that do not cluster as much as in the other cases. This is not strange since knowledge of the project matters requires expertise and remains an unresolved issue. What is interesting is that the one thing it is strong consensus about is that cooperation between scientists and stakeholders is important. Thus, despite technical disagreements on how the herring should be managed, they agree about the process on how this agreement should be established.

The disagreements in the case may be explained by highlighting different aspects of the case. As described in the case text the outcomes of the project has experienced challenges on the political level because the management of WBSS herring is caught up in the negotiations between Norway and the EU. The respondents relate to this in different ways. Whereas factor 1 focuses on the shortcomings of the project because of what we have named the management wall, factor 2 focuses on how this has disturbed the case events, but that action is still possible. Factor 3 focuses more on what has been accomplished in the project and credit the collaborative efforts for this.

The analysis does not show variable attitudes between responders in and outside the GAP2 case study. This may be explained by the shortcomings in the P-set: it is hard to find non-participators with the required knowledge level *and* representatives from the Norwegian side. We nevertheless conclude that the Western Baltic herring case is a successful case in terms of unifying stakeholders.

However, just like in the Dutch case, the project is limited in penetration power because of lack of influence on the political level. The limitations in the scope of the project activities that this leads to, make it challenging for the project to continue successfully. From this we learn that a condition for effective collaborative research is that it is anchored on the decision-level in management; in this case in the negotiations between the EU and Norway.

CS5 Steigen Coastal Cod

The overall aim of the Steigen case study is*:*

> *to develop a fisheries-based monitoring system for Norway's coastal cod. (http://gap2.eu/case-studies/case-study-5/)*

GAP2 scientist Maiken Bjørkan provides some context:

> *While the North East Arctic Cod is successfully managed within sustainable frames by the International Council for the Exploration of the Sea (ICES) and the Norwegian Institute of Marine Science (IMR), the same cannot be said for the coastal cod. GAP II in Steigen is aiming at developing a method that makes it possible to manage the coastal cod stocks sustainably, with a focus on size and status (Bjørkan et al., 2011).*

Managing coastal cod is a contentious issue with strong differences of opinion; on status, structure appropriate management regime and current fishing restrictions, to name but a few. This is stated up front on the GAP2 case study website as follows:

> *The management of coastal cod is often controversial, causing heated discussions between scientists and fishers.*

And in this case study, scientists and local fishers are cooperating to find out more about the coastal zone and how to overcome the challenges posed by the species management.

Figure 8: showing the Steigen case study area in red.

Partners

- Norwegian College of Fisheries Science (NCFS): Science partner

- Institute for Marine Research (IMR): Science partner
- Norwegian Fishers' Association: Stakeholder partner

Methods

Starting off with a series of dialogues between the partners, with the aim of establishing a platform for collecting and sharing information that can be operated by fishers as an integral part of the fishing operation, discussions were held to ascertain exactly how this was going to be done. Initially a form of Catch Per Unit Effort (CPUE) was proposed, however, after further deliberations, for reasons of data standardization and quality (to ensure best fit with regular IMR data collection protocol) it was decided to use acoustic equipment, together with biological sampling (otolith analysis, and length and weight measurement), refer to figures 9 and 10 below.

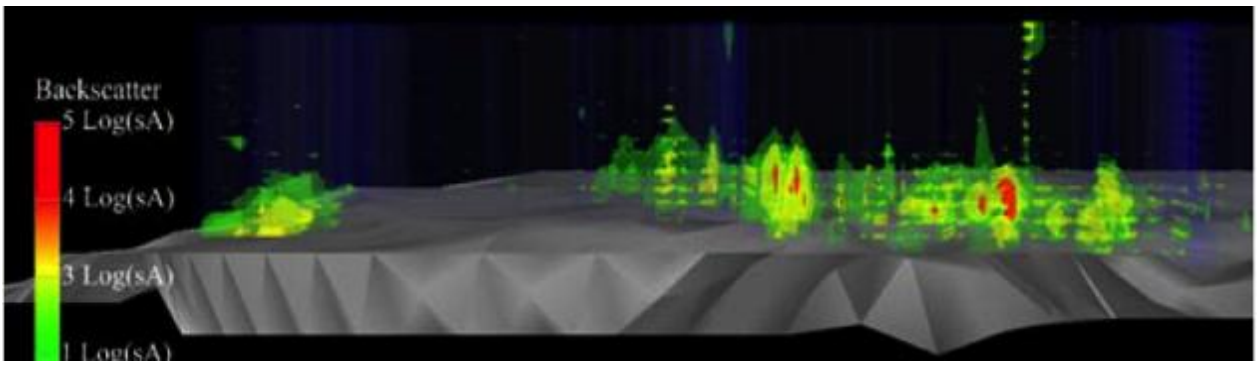
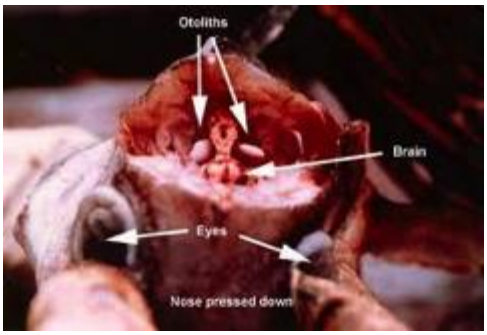


Figure 9: Screen shot of acoustic imagery transmitted as a video for analysis

The acoustic equipment (SIMRAD, ES70 System) was purchased, thus ensuring it was the same as that on board of one of the research vessels of the reference fleet again in order to standardize data and tools but this came at a considerable cost. The implication of this was that initially, only one was purchased and fitted on a vessel, reducing significantly the numbers of fishers able to participate. In addition, biological sampling equipment was installed onboard and training provided to the vessel owner, who now operates the equipment and collects samples (according to scientific principles) for scientific analysis and quality assurance at IMR, (Bjørkan *et al.,* 2011*)*.

A payment is made to the vessel owner for collecting the data in line with current reference fleet practice in Norway. In this way, fishers can collect data that can flow into the knowledge base for stock assessment, since it is standardised, quality assured and traceable. This institutional connection to the knowledge base for stock assessment (through the IMR) is important in ensuring the uptake of the knowledge generated through collaborative research, albeit in a format shaped exclusively by scientists for scientific assessment and analysis.



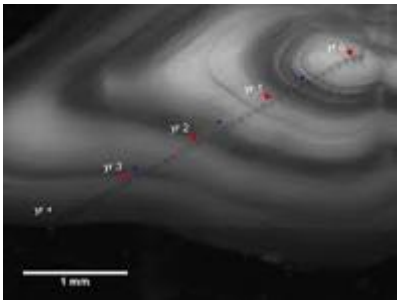


Figure 10: from left to right – a) measuring length onboard, b) cross section showing otolith, c) otolith analysis

Plans are also emerging to establish a **"**Centre for Experienced Based-Knowledge**" –** owned and run locally by fishers. Fishers are able to take pride in a community project such as this and can enjoy engaging with researchers in this context (http://gap2.eu/case-studies/case-study-5/).

Assembling the concourse

Cod status and structure

There is some considerable and often heated debate in the discourse as to whether coastal cod is a single stock, a stock complex, stationary in the Steigen area, able to be fairly accurately differentiated from NE Arctic cod by phenotypic (visual) characteristics, and crucially, over stock status and management strategy.

> *That coastal cod actually contain several distinct sub-populations along the coast and in the fjords, and that there may be a mixing of fish among coastal and Arctic cod, indicate that the debate over one population of coastal and one population of Arctic cod may be oversimplifying the situation. Therefore, finding differences between coastal and Arctic cod may be difficult and will depend on valid verification of the two populations (Colstad et al., 2006).*

Further to this, coastal cod stock assessment is widely considered to be inaccurate and poorly understood. There are a number of elements here, one is the ability to differentiate between NE arctic and coastal cod, and whether coastal cod is a single stock or a stock complex. If a stock complex, whether it is assessed and managed as a single stock complex or smaller local sub-groups. The way stock assessment is carried out is also a contentious area.

However restrictions on coastal cod remain in place prohibiting the targeting of coastal cod. There is no coastal cod quota *per se* only a minimum amount to account for unavoidable by catch as coastal cod interacts with NE Arctic cod particularly in winter months. According to ICES, Norwegian coastal cod is doing poorly, *ICES Arctic Fisheries Working Group (AFWG) 2013.* IMR scientist Knut Sunnanå tells us that there are:

> *only slight increases in abundance of coastal cod are being observed through the assessment data over the last five years (GAP2 scientist).*

This assessment, and also the data collection methodology from which this view is derived, is also contested:

> *The coastal cod biomass is increasing quite a lot. It was very low, because of poor regulations and catching too much coastal cod with the skrei (NE Arctic cod) as during the winter season the skrei and coastal cod live together. Now it is ok…..*
>
> *….And you see the scientists have surveys, yes. They come once a year, once or twice but fishers are there every day and they follow the fish and they follow the food situation in the sea, and I think it is a much better way to catch knowledge* (Steigen fisher).

Adding to the complexity:

> *Northeast Arctic cod in particular is currently at a level not seen since the 1950s (ICES Arctic Fisheries Working Group, 2013).*

A local fisher describes it like this:

> *At the moment (NE Arctic cod) catch, it is a fairytale, people that are 70 years old, they can't remember seeing as much fish ever. So this year, the problem was you had to be careful where you put your gill nets because they filled up and you couldn't take care if you put too many in, (Steigen fisher).*

So, if you cannot easily tell the difference visually between coastal cod and NE arctic cod (over which there is some disagreement) and if assessment methodologies are called into question, there will naturally be perceptional and or empirical differences over stock status and abundance particularly for coastal cod. This provides a real opportunity for the GAP2 case study to bring stakeholders closer together both in terms of the credibility of the knowledge base for stock assessment and also in terms of assessment and management approaches and restrictions.

Working together, integrating knowledge and reversing the burden of proof

The GAP2 case study is concerned with addressing the so called 'engagement gap' between science and society through collaborative research (knowledge production and integration) for better fisheries management. From the GAP2 website introducing the Steigen case study we learn:

The management of coastal cod is often controversial, causing heated discussions between scientists and fishers. But in this project, scientists and local fishers are cooperating to find out more about the coastal zone and how to overcome the challenges posed by the species' management,…

And that …

efforts to collect data in the Steigen region are particularly valuable because Steigen will be one of the areas used for defining the "reference fleet" – a small group of Norwegian fishing vessels that are contracted to provide IMR with detailed information about their fishing activity and catches on a regular basis (http://gap2.eu/case-studies/case-study-5/).

This is therefore a very relevant initiative and its important to point out that there has been a long tradition in Norway of fishers and fisheries scientists working together. From the IMR publication on the reference fleet we learn:

The Institute of Marine Research has always had a close and good cooperation with fishers and the fishing industry. These contact and information flows have traditionally occurred by having institute personnel collect scientific samples on board fishing vessels or at ports, and on board commercial fishing vessels chartered for conducting scientific research surveys. The Reference Fleet aims to improve data collection and information flows both from and to the fishers (IMR 2010).

This is echoed by GAP2 scientists Maiken Bjørkan in the following:

The thing is that now there isn't any gap really because cod stocks are so healthy and the relationship between fishers and scientists in Norway is actually really good in many, many ways and you already have projects like the Reference Fleet, which is helping with the gap. There is a trust relationship (GAP scientist).

So how does this collaboration look in practice and what are some of the outcomes and implications in terms of levels of engagement and participation in analysis and advice? Bjørkan *et. al (2011)* tell us that:

- *GAP II in Steigen shows that it is possible to make a platform for fishers and scientists cooperation,*
- *Fishers are integrated in developing the methodology and their experience based knowledge is included by focusing on their local knowledge about spawning areas.*
- *Still, one should note that data analysis and quality checks is performed by science alone. This is because of the strict demands with regards to quality and format within the ICES,* **(**Bjørkan *et al.,* 2011).

Is there then a role for fishers in data analysis and therefore being in a position to provide advice? At present and historically fisheries are considered as a commons resource with the state providing the expertise and resources to assess and manage the fisheries. Indeed it is common practice to pay fishers to collect data, which is intended in part to ensure credibility of the information collected. Yet what are the implications of this for participation in decision-making and providing advice? If responsibility remains with the state to demonstrate stock health, will this limit the interest and capacity of fishers to move from data collectors to management advisers – a common goal of many collaborative research initiatives?

A related question concerns the type of knowledge contribution provided by fishers. In this case we have learned that a mix of hydro acoustic and biological monitoring is carried out on board one vessel and fishers experience based knowledge is primarily on where to fish. In addition fishers took part in formulating research questions and hypothesis as well as in methods selection. Whilst it was noted that analysis could be undertaken by any suitably trained person, it is in reality conducted by IMR scientists. This is partly due to quality control issues as discussed by Bjørkan *et al (2011)* above, but may also be linked to the idea that fishers prefer fishing to stock assessment and are disinterested in providing advice and taking on a role in reversing the burden of proof. As we shall see through the following review and analysis of the Q sorts this last point about taking on an advisory role is an idea that is not unpalatable to all.

Local, regional and long–term management

The two main themes described above relate to the final part of this review which is concerned with the roles and responsibilities of the state, research institutions and fishers in management, and what form and scale is most appropriate. Of course this strongly links to an understanding of the composition and status of the stocks of coastal cod as well as the opportunity, willingness and interests of individuals to use the knowledge base for management.

As there is some disagreement over whether coastal cod in Steigen is a population sub group (part of a stock complex) that is either a local resident or migratory, or, a single stock with a broader range, alternative management regimes and scales are favoured. These basically fall into two camps; those that favour a regionally managed approach versus those that favour local management. The interests for wanting to engage in management may also be influenced by how stock composition and status is viewed and vice versa.

A strong driving force for some is the belief that there is a lot of coastal cod and therefore fishers should be given quotas accordingly. If coastal cod in Steigen can be shown to be in good shape and coupled with the belief of a Steigen resident sub group, or the whole stock can be shown to be doing well, it is understandable that there are calls for local management and a lifting of current restrictions.

For the main part, calls are based on a willingness to share management as opposed to taking it over.

> *We must have scientists, but we must control each other, and what one of us doesn't see the other does, so we match* (Steigen fisher).

And there is also an element of wanting to improve the way scientific advice and management are conducted.

> *Now and before the authorities have got advice from the scientists and the authorities feel that this is the only advice to get to set the quotas. But that's a fault, that's a false way to do it, we must have fishers experience in the picture and I think we will have it in this GAP2 project* (Steigen fisher).

It is not simply inclusion that is desired, but also prior agreements on advice before it is provided to the authorities:

> *Yes, if the fishers and scientists have agreed before the authorities get the advice, there will be less conflicts* (Steigen fisher).

For many though, this approach is a step too far, preferring a more traditional approach 'objective science as the cornerstone' of fisheries advice and policy. After all the set up and structure of what is referred to as the 'TAC machine' was created by scientists for scientific advisory functions and doesn't easily lend itself to including fishers knowledge.

> *Well, it's just that when you're caught in this TAC-machine stuff, then the possibility for fisher to contribute is so small.*

But,

> *When you shift that around and say that we need to think about a management plan in that area.... It's not only from year to year and about certain specific things but about how can we do this? It's much more open. It's an arena where you sort of start on scratch in a different way (GAP2 scientist).*

This brings into focus an important perspective on how cooperation can be more meaningful by not simply considering the question of how we engage, but to emphasise the framework for that engagement.

Deciding the Q-sample

The key focus of the Steigen case is the collaborative process to develop a fisheries based monitoring system for coastal cod. A major component of this is to determine the status and structure of the stocks and how this advice might be used in management, and by whom.

All interviews conducted with fishers, scientists, fishing association representatives and managers were audio recorded and transcribed. Using the NVIVO software transcripts were coded and statements compiled. From a concourse of around 200 coded statements, a set of 23 statements were compiled falling across issues concerning differentiation between coastal cod and NE Arctic cod, stock status and assessment performance, management regimes and reasons for collaboration. We organised the Q statements around these issues as follows:

1. Fishers can differentiate between coastal cod and NE Arctic cod by its visual characteristics
2. Fishers cannot accurately differentiate between coastal cod and NE Arctic cod
3. Coastal cod is a stock complex
4. Coastal cod in the Steigen area is one stock
5. Stock status justifies a continuation of the current restrictions on coastal cod
6. There is more coastal cod than the scientific assessment indicates
7. In the last five years coastal cod has shown only a very slight increase in abundance
8. Coastal cod in the Steigen area are stationary
9. Fishing local coastal cod stocks should be restricted
10. There should be local agreements on coastal cod management measures
11. Fishers should play an advisory role in quota setting
12. local management is the most appropriate management regime for coastal cod
13. Providing scientific advice based on stock assessment of coastal cod is straightforward
14. Scientific stock assessment of coastal cod is accurate
15. Stock abundance of coastal cod is poorly understood
16. Local hydro acoustic surveys will not significantly improve coastal cod stock assessments
17. Working with fishers' experience based knowledge together with scientific research based knowledge will improve coastal cod stock assessment
18. Fishers' experience based knowledge is incompatible with scientific stock assessment of coastal cod
19. The purpose of collaborating with fishers is mainly so that they can provide data for scientific purposes
20. Fishers and scientists should agree together before advice is provided to the authorities
21. Fishers feel included in marine science
22. Scientists and fishers are partners in fisheries management
23. There is a high degree of trust between scientists and fishers

The statements and the instructions were translated into Norwegian and entered into Web-Q for the survey. We used a quasi-normal distribution: The extreme points +3/-3 was allocated two slots each, +2/-2 had three slots, +1/-1 had 4 slots and the 0-category had 5 slots.

Selecting the P-set

The main stakeholders in the Steigen case study included fishers, scientists, fishing association representatives and mangers. When selecting the P-set we focused on having all of these groups covered and optimally both responders from in and outside the GAP2 case study. The list consisted of 27 people with the following distribution:

- 5 fishers participating in the GAP2 case study
- 5 fishers not participating in the GAP2 case study
- 3 fisheries representatives
- 6 scientists working in the GAP2 case study
- 3 scientists not working with the GAP2 case study
- 1 representatives from NGO's
- 4 people from the management level

Each person was allocated a code for processing the data. The code consisted of eight characters. The three first was 'ste' to recognize the case (Steigen). The fourth character showed which stakeholder group the person belonged to (1=fishers, , 2=scientist, 3=management, 4=fisheries representative, and 5= NGO). The fifth character was either a 'y' (yes) or 'n' (no) to indicate whether the person is a GAP2 participant. The remaining three characters were numbers to distinguish people in equal categories. To illustrate, a respondent with the code ste1y001 would be respondent nr 01 in the Steigen case; a fisher working in the GAP2 case study.

Q-sorting

Of the 27 persons in the P set 10 had the Q sort administered face to face and remaining 17 persons were sent an email outlining the survey and with a link to allow for participation. In total 20 participants completed the survey with the following distribution:

- 5 fishers participating in the GAP2 case study[3]
- 5 fishers not participating in the GAP2 case study[4]
- 1 fisheries representatives
- 6 scientists participating in the GAP2 case study
- 1 scientists not participating in the GAP2 case study
- 2 managers not participating in the GAP2 case study

[3] Six of these are from the mentioned village

[4] One of these has participated in other collaborative research projects

Analysis

The data from the 20 sorts were entered into PQ method. As described in the section "Q-methodology" we used PCA to calculate the correlation matrix and rotated the factors with higher eigenvalues than 1. In the Steigen case study this was six factors. We used Varimax for statistical rotation and automatically flagging for marking the defining sorts (sorts that load significantly on specific factors, p>0,01). Eight sorts loaded significantly on factor 1, seven sorts loaded significantly on factor 2 and four sorts loaded on factor 3. The remaining factors had <three defining sorts each and after subjective review in relation to the key discourse were not considered.

Factor 1: 'A cautionary tale'

Factor 1 is represented by eight significant loadings. These sorts are derived from three fisheries representatives (one GAP2, two non GAP2), three scientists (two GAP2, one non GAP2) and two non GAP2 managers. The ideal sort for this factor is displayed in Table 12 and elaborated below.

Factor 1 stresses that 'stock abundance of coastal cod is poorly understood' and reflects the main aim of the Steigen case study which is 'to develop a fisheries based monitoring system' to assess and improve the management of coastal cod. There is strong agreement with statement #2, that ' fishers cannot accurately differentiate between coastal cod and NE Arctic cod', and with statement #9, that 'fishing local coastal cod stocks should [continue to be] restricted. This suggests that just because you think its coastal cod, it doesn't mean it is. Thus a 'precautionary perspective' in line with current regulations and reflecting that coastal cod stocks are poorly understood, would be prudent.

This is in line with factor 1's disagreement with statements #13 and #14 which point out that scientific stock assessments are inaccurate and difficult to interpret for management. Interestingly from a GAP2 perspective, a potential solution to the problem of stock abundance being poorly understood, is to highlight the compatibility of, (statement #18), and the opportunity to, 'work with fishers experience based knowledge in combination with scientific knowledge, which it is understood will improve coastal cod stock assessment (statement #17). This underlines the GAP2 approach's efforts at integrating scientific and experience based knowledge for use empirically, and for management.

Most agree	15. Stock abundance of coastal cod is poorly understood 2. Fishers cannot accurately differentiate between coastal cod and NE Arctic cod
Strongly agree	9. Fishing local coastal cod stocks should be restricted 17. Working with fishers experience based knowledge together with scientific research based knowledge will improve coastal cod stock assessment 11. Fishers should play an advisory role in quota setting
Agree	3. Coastal cod is a stock complex 10. There should be local agreements on coastal cod management measures

	12. local management is the most appropriate management regime for coastal cod 5. Stock status justifies a continuation of the current restrictions on coastal cod
Undecided	19. The purpose of collaborating with fishers is mainly so that they can provide data for scientific purposes 21. Fishers feel included in marine science 7. In the last five years coastal cod has shown only a very slight increase in abundance 8. Coastal cod in the Steigen area are stationary 4. Coastal cod in the Steigen area is one stock
Disagree	6. There is more coastal cod than the scientific assessment indicates 23. There is a high degree of trust between scientists and fishers 16. Local hydro acoustic surveys will not significantly improve coastal cod stock assessments 22. Scientists and fishers are partners in fisheries management
Strongly disagree	20. Fishers and scientists should agree together before advice is provided to the authorities 1. Fishers can differentiate between coastal cod and NE Arctic cod by its visual characteristics 18. Fishers experience based knowledge is incompatible with scientific stock assessment of coastal cod
Most disagree	13. Providing scientific advice based on stock assessment of coastal cod is straightforward 14. Scientific stock assessment of coastal cod is accurate

Table 12: Ideal sort for factor 1 in the Steigen coastal cod case study.

Factor 2: 'Working together'

Factor 2 is represented by seven significant loadings. Behind these sorts are three fisheries representatives (two GAP2, one non GAP2), three GAP2 scientists and one non GAP2 fishing association representative. The ideal sort for this factor is displayed in Table 13 and elaborated below.

Factor 2 is concerned with working with experience based and research based knowledge (satement # 17) to broaden the knowledge base for stock assessment and management. This is very much in line with the GAP2 approach to working collaboratively and perhaps this is to be expected given that five out of seven sorts which load on factor two are from GAP2 partners. Factor 2 moderately (i.e., >0.33 and < 0.66) correlates with factor 1 and reflects more of an emphasis on working together to solve the problem than factor one given that factor one had less respondents from GAP partners than factor 2.

All three statements in the strongly agree category which give shape to factor 2, are concerned with the ecology, behaviour and status of coastal cod. These are statement #3 ("Coastal cod is a stock complex"), statement #8 (Coastal cod in the Steigen area are stationary") and statement #7 ("In the last five years coastal cod has shown only a very slight increase in abundance.")

Again perhaps understandably given the make-up of respondents, most disagreement focuses on the incompatibility of research based and experience based knowledge for stock assessment (statement

18) and crucially that 'Local hydro acoustic surveys will not significantly improve coastal cod stock assessments' (statement #9), a key part of the *modus operandi* of the GAP2 case study in Steigen.

There is a clear recognition of the difficulties and inaccuracies in existing coastal cod stock assessment efforts and data. Finally, there is strong disagreement with the idea that local management is the most appropriate strategy for managing coastal cod. This we consider a key statement in understanding perspectives associated with factor 2 demonstrating that whilst it is crucial to work together using both experiential and research based knowledge systems, this should not be seen as an argument for local management *per se*, rather it speaks of a perspective concerned with an integrated and holistic approach at a scale considered most appropriate for management.

Most agree	17. Working with fishers experience based knowledge together with scientific research based knowledge will improve coastal cod stock assessment 3. Coastal cod is a stock complex
Strongly agree	1. Fishers can differentiate between coastal cod and NE Arctic cod by its visual characteristics 8. Coastal cod in the Steigen area are stationary 7. In the last five years coastal cod has shown only a very slight increase in abundance.
Agree	11. Fishers should play an advisory role in quota setting 20. Fishers and scientists should agree together before advice is provided to the authorities 15. Stock abundance of coastal cod is poorly understood 19. The purpose of collaborating with fishers is mainly so that they can provide data for scientific purposes
Neither agree nor disagree	22. Scientists and fishers are partners in fisheries management 5. Stock status justifies a continuation of the current restrictions on coastal cod 10. There should be local agreements on coastal cod management measures 9. Fishing local coastal cod stocks should be restricted 6. There is more coastal cod than the scientific assessment indicates
Disagree	4. Coastal cod in the Steigen area is one stock 21. Fishers feel included in marine science 23. There is a high degree of trust between scientists and fishers 2. Fishers cannot accurately differentiate between coastal cod and NE Arctic cod
Strongly disagree	12. Local management is the most appropriate management regime for coastal cod 13. Providing scientific advice based on stock assessment of coastal cod is straightforward 14. Scientific stock assessment of coastal cod is accurate
Most disagree	18. Fishers experience based knowledge is incompatible with scientific stock

	assessment of coastal cod 16. Local hydro acoustic surveys will not significantly improve coastal cod stock assessments

Table 13: Ideal sort for factor 2 in the Steigen coastal cod case study.

Factor 3: 'Just leave it to us'

Factor 3 is represented by four significant loadings. Behind these sorts are four fisheries representatives (two GAP2, & two non GAP2). This is the only factor which is exclusively described by loadings from fishers. The ideal sort for this factor is displayed in Table 14 and elaborated below.

Factor 3 is concerned with 'local management as the most appropriate management regime for coastal cod' (statement # 12). In part (only) this can be justified by the perspective that 'coastal cod in the Steigen area are stationary' (statement # 8) and thus suitable for local management. This is a clear departure from factors 1 & 2 in that it advocates for local management, considers 'scientists and fishers to be partners' (statement # 22) and goes further to suggest that 'fishers and scientists should agree together before advice is provided to the authorities' (statement # 20). This very much promotes the role of fishers as 'equal partners' in management and is in strong disagreement with the perspective that states that current coastal cod restrictions are justified (statement # 5).

It is interesting that there is strong agreement with the statement 'The purpose of collaborating with fishers is mainly so that they can provide data for scientific purposes' (statement # 19) which belies an unequal partnership. However this can also be interpreted as an unwillingness to be held accountable by 'the burden of proof' argument to sustainable exploitation through the passing on of responsibilities as well as rights, of access to and control over fisheries resources as discussed above.

It is also important to note that there are issues with stakeholder relations seen through the strong disagreement with the statement that 'there is a high degree of trust between scientists and fishers' (statement # 23) as well as a perspective of 'just leave it to us' seen through strong disagreement that existing restrictions should be upheld (statement # 5) and that 'fishers cannot accurately differentiate between coastal cod and NE Arctic cod' (statement # 2).

Whilst this factor represents a clear departure it is also important to note that this does not extend to thinking that the case study is less important, evidenced in that it most strongly disagrees with the statement that 'local hydro acoustic surveys will not significantly improve coastal cod stock assessments' (statement # 16). This presents an interesting opportunity to bring stakeholders together around a resource 'problem' where motivations for engagement are different.

Most agree	12. local management is the most appropriate management regime for coastal cod 8. Coastal cod in the Steigen area are stationary
Strongly agree	20. Fishers and scientists should agree together before advice is provided to the authorities 22. Scientists and fishers are partners in fisheries management 19. The purpose of collaborating with fishers is mainly so that they can provide data for scientific purposes
Agree	9. Fishing local coastal cod stocks should be restricted 6. There is more coastal cod than the scientific assessment indicates 3. Coastal cod is a stock complex 15. Stock abundance of coastal cod is poorly understood
Undecided	10. There should be local agreements on coastal cod management measures 4. Coastal cod in the Steigen area is one stock 17. Working with fishers experience based knowledge together with scientific research based knowledge will improve coastal cod stock assessment 21. Fishers feel included in marine science 18. Fishers experience based knowledge is incompatible with scientific stock assessment of coastal cod
Disagree	1. Fishers can differentiate between coastal cod and NE Arctic cod by its visual characteristics 13. Providing scientific advice based on stock assessment of coastal cod is straightforward 11. Fishers should play an advisory role in quota setting 7. In the last five years coastal cod has shown only a very slight increase in abundance
Strongly disagree	5. Stock status justifies a continuation of the current restrictions on coastal cod 14. Scientific stock assessment of coastal cod is accurate 23. There is a high degree of trust between scientists and fishers
Most disagree	16. Local hydro acoustic surveys will not significantly improve coastal cod stock assessments 2. Fishers cannot accurately differentiate between coastal cod and NE Arctic cod

Table 14: Ideal sort for factor 3 in the Steigen coastal cod case study.

Summary and conclusion

The perspective of *'a cautionary tale'* supports a precautionary approach to coastal cod management. It starts from the premise that coastal cod is poorly understood and that therefore the most appropriate strategy is to continue with existing restrictions and management regime. It does however open the door to the potential of including fishers' knowledge with scientific knowledge for the purposes of stock assessment and the role of fishers in providing advice. This is perhaps the dominant regime in European fisheries management reflecting perhaps the lack of association with the GAP2 project by management respondents. Not simply a conventional approach, the interest in fishers knowledge and apparent

willingness to consider the role of fishers in providing advice is less usual and perhaps demonstrates the 'smaller gap between fishers and scientist in Norway', stated by Petter Holm and referred to in the section above.

The perspective provided by *'working together'* is focused very closely on collaboration between scientists and fishers and closely follows the GAP2 philosophy of taking as a starting point an interest and willingness to collaborate together to solve problems and provide sustainable solutions. It is similar to perspectives around 'a cautionary tale' in as far as it recognises the same problem, i.e. 'Insufficient status of coastal cod stocks to warrant changes in existing management restrictions. And inaccurate data. It differs in that it doesn't see local management as a potential solution.

And finally '*just leave it to us'*, highlights a clear difference and area of contestation in the case study by supporting perspectives of local management and disagreement on the status of the stocks and therefore the current restrictions on their exploitation.

According to the case study classification framework (figure 1) the knowledge function for fishers' participation in the Steigen case, centers on data collection. Specialised knowledge is being co-constructed and feeds into a stable and functional institutional management context. From the results of the q-sorts, there is some evidence to suggest a willingness for fishers' participation to move towards an advisory function but it's uncertain how able the management structures would be to accommodate this. The 'gap size' in Norway is arguably one of the smallest in the region, with many years of scientist fisher collaborations creating a context where there are general norms for fisher participation. Attitudes vary little between stakeholders with the majority opinion resting on the benefits of collaboration. Of the three factors in the Steigen case, factor 3 might be closest to presenting a position that in some ways represents the idealist position to Experience Based Knowledge (EBK). The picture presented is one that exudes confidence in EBK particularly with respect to knowing the status and behaviour of coastal cod. Local management and fishers /scientist advisory functions are championed, along with a disagreement over existing regulations restricting the exploitation of coastal cod imposed 'from outside'. The position does not go so far as to want to do away with science as demonstrated by its strong disagreement with the statement 'that 'local hydro acoustic surveys will not significantly improve coastal cod stock assessments' (statement # 16).

The case study is considered successful in terms of GAP2 project objectives, in a number of key areas; in that across factors 1) the case study assessment methodology and use of hydro acoustic survey techniques are universally supported, and the uptake to management is relatively certain 2) the importance of collaboration between fishers and scientists is strongly supported and that 3) despite clear differences in motivations, opinions converge on the importance of addressing the so called engagement gap.

CS8: Chioggia

The initial aim of the GAP2 case study in Chioggia was to map the spatial and temporal distribution of fishing effort and resources in the Northern Adriatic Sea. Through seeking to understand fishers experience based knowledge and linking this with data recording on board fishing vessels and surveys, the knowledge generated is expected to contribute to developing management proposals. From the GAP2 website the aim is stated as follows:

> *Spatio-temporal distribution of fishing effort and biological resources in the Northern Adriatic Sea: towards the identification of fish habitats and management proposals in the framework of a participatory approach. (http://gap2.eu/case-studies/case-study-8/)*

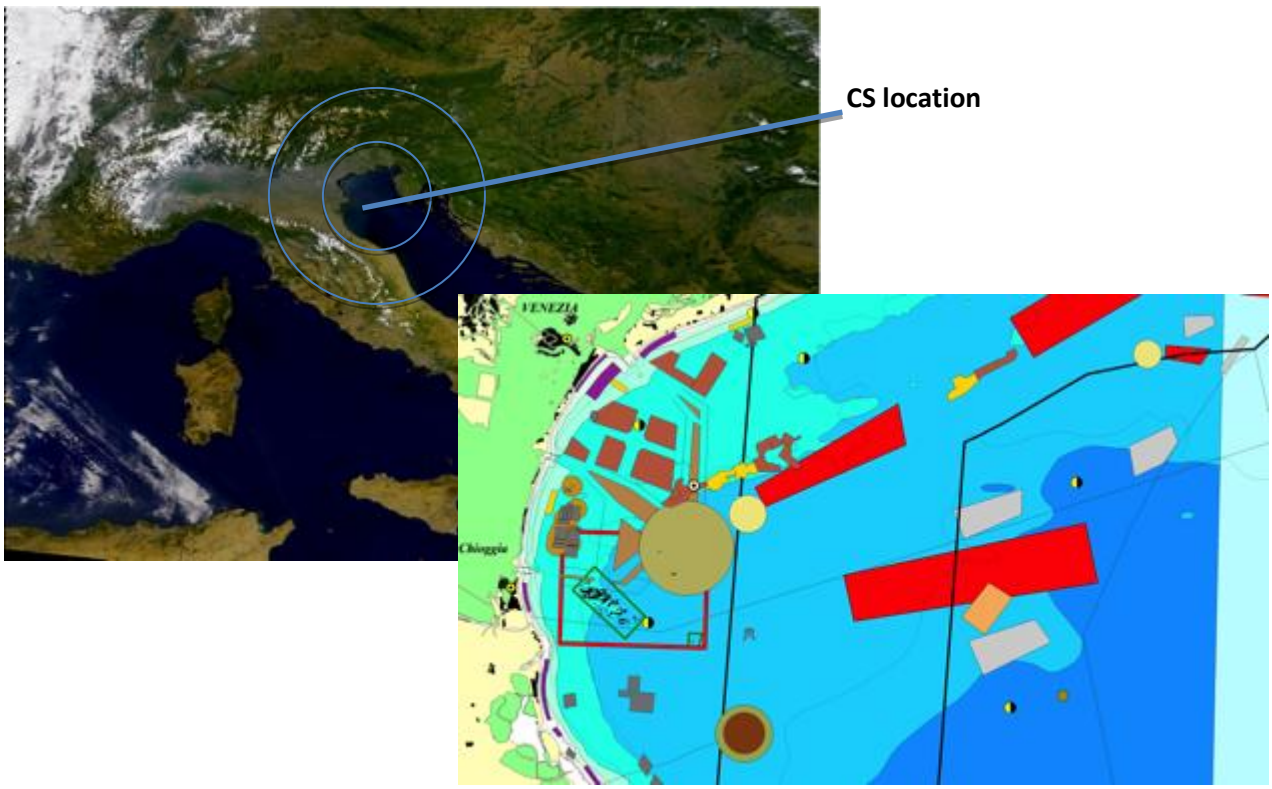


Figure 11: The case study area: Venetian lagoon & Chioggia city NE Adriatic, Italy.

'Towards the identification of management proposals in a participatory framework' is phrased perhaps as a reflection of not wanting to promise too much, however what was witnessed as part of the WP4 missions to Chioggia was very much about commencing a process of management planning, albeit in parallel to mapping effort, resources and knowledge. Given the much quoted 'critical state of many of the most important commercial fisheries in the region' (discussed in the section below 'a system in crisis?') it is understandable that there is a need to find solutions to the problems and an opportunity to work with a more engaged set of stakeholders.

Again from the website, the case study team states, 'through combining fishery-dependent and independent data sources, we want to:

- identify and map fishing grounds
- define fishing effort, catches and discard composition in these areas
- define target and non-target species' spatial and temporal distributions
- identify spawning and nursery grounds (and therefore essential fish habitats) of the most exploited species, e.g. common sole, cuttlefish, scallops.
- assess how commercial species' distributions vary in relation to environmental variables'. (http://gap2.eu/case-studies/case-study-8/)

It is hoped that this will help to provide the empirical justification for 'management proposals' and, should an agreement be reached on specific regional management, to justify regional specificity for the Northern Adriatic within an overall EU management frame.

The Partners in the GAP2 Chioggia case study:

- ISPRA Italian National Institute for Environmental Protection and Research, Chioggia (Venice) - Consorzio UNIMAR (Rome): Science partners
- Legapesca – Federcoopesca – AGCI Pesca – Local Coop: Stakeholder partners
- RAC Med – Veneto Region – Ministry of Fishery: Management partners

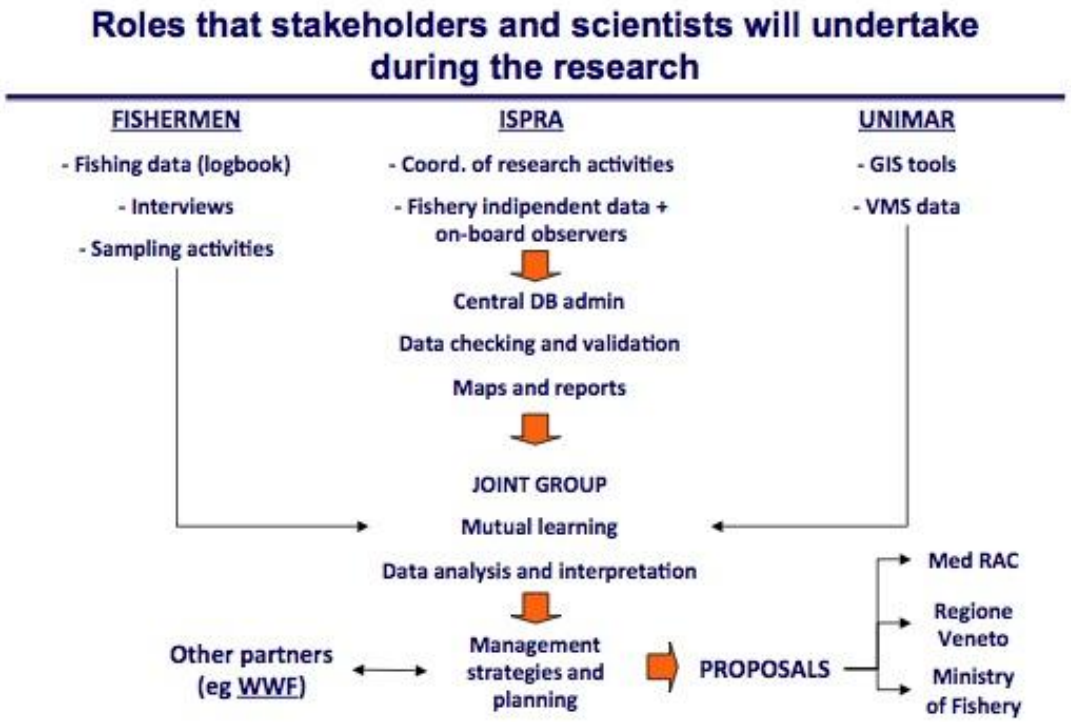


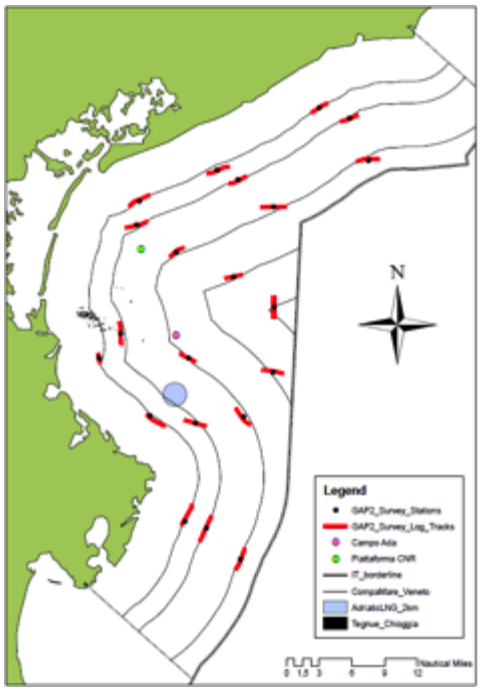
Figure 12 Flow diagram outlining partner roles and responsibilities Source: GAP2 Inception meeting – Case Study presentation June 2011.

Assembling the concourse

The fieldwork was conducted on behalf of WP4 in 2011 and 2013 by Mark Dubois, and in 2013, by Laura Sabatini. A series of in depth semi-structured interviews were carried out with managers, scientists, fishers and other industry stakeholders. Where interviews were conducted in Venetian, Giovanni Bulian a local anthropologist and Chioggia resident provided translation. The interviews were recorded and later transcribed and coded using Nvivo software programme. Alongside the interviews, the concourse was informed through a review of secondary data; including a historical profile, existing management regulations, GAP2 reports and ISPRA GAP2 SWOT analysis review. From this, more than 300 statements were considered before drafting an initial set of statements intended to reflect the key issues in the discourse for the Chioggia case study. Given the complexity and breadth of issues this first set of statements included more than 45 statements. After consultation with the WP4 team and review of the case study focus, this was reduced 26 statements, see below.

Method and Approach

The methods applied by the Chioggia GAP2 CS fall broadly into the following areas; biological, technical and discursive. Biological, using fishery dependent and independent trawl surveys, are those from commercial fishing activities and scientific survey, refer to Figure 13 below.



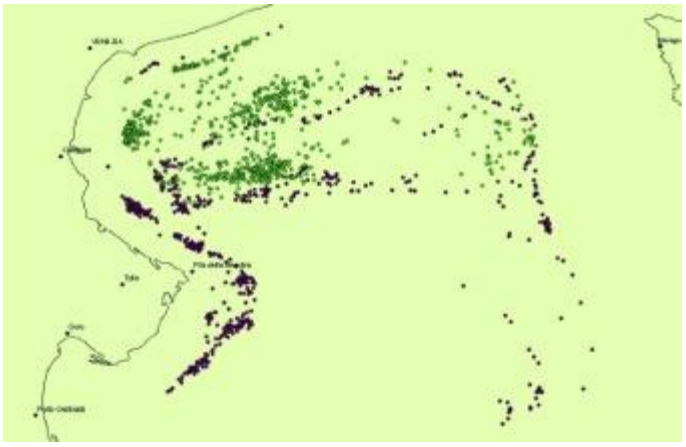


Fig. 12 Fishing area of GAP2 (data log: July-Oct 2012) Source: Sabatini, L ISPRA.

Figure 13 Fishery independent trawl survey Veneto Region administrative area. Source Sabatini, L ISPRA.

Technical methods include electronic logbooks (real-time position data (GPS) and catch data collected by fishermen) on board 2 beam and 5 bottom trawlers and VMS data loggers. Discursive and participatory methods include oral histories for a historical perspective through personal accounts, semi-structured interviews and participatory mapping. Information is shared and fed back through regular meetings between fishers and scientists in order to verify and integrate knowledge products and build consensus.

The fleet

The Chioggia fleet consists of:

- 50 - 55 otter-trawlers
- 35 - 40 rapido (iron toothed dredge) trawlers
- 12 - 14 mid-water pelagic trawlers, and
- around 100 hydraulic dredges and 5-6 gill net/trammel nets FV

Crisis what crisis?

The Chioggia case is extremely complex with multiple conflicts and concerns. It is a mixed fishery operating in a weak governance context with considerable social, economic and environmental problems. There is little confidence or trust within and between stakeholder groups and a widespread belief that the Northern Adriatic and associated fishing communities are a 'system in crisis'.

Presented below are a number of quotes from different stakeholders on perceptions of 'the crisis':

I started working in this field in 1976/77. (There was) still an expansion of the fisheries and good catches. So as you know, the catch per unit effort has decreased a lot and even the total landings (GAP2 affiliated scientist).

Since the 90s up to the last 20 years, there was a continuous decrease not only in the revenues but also changes in the exploited resources... some species earlier, some species later and some disappeared or collapsed. In the last (few) years, this crisis became more evident due to the collapse of many resources (GAP2 scientist).

I catch maybe 80% less fish than 7/8 years before (Fisher, Chioggia)

Some species like sharks or rays are gone earlier than other species.... we had, for example, some banks of scallops that were fished up to the middle of 90s, I guess, and one fishers vessel was able to catch one night about 1 tonnes of scallops and now they can fish, if they are lucky 50 kilos, something like that and that applies also to other species (GAP2 scientist).

My main concern is that I made a big mistake having two sons, their life is lost because I, instead of suggesting they do something else, I convinced them to join the boat to work with me, but now, there is no fish for them (A Chioggian fisher's tale).

These voices tell of a crisis in the fisheries of the Northern Adriatic and their social and economic implications. It is evident from speaking to stakeholders that there are a number of reasons for the perception of crisis which include: overfishing, illegal, unregulated and unreported fishing, poor management and weak governance structures, environmental concerns such as pollution and dumping of toxic waste, biochemical changes such as nutrient loading, and political manoeuvring and illegalities.

So from the fishers' perspective the crisis is... I don't earn enough money from my activities or I'm not earning, I'm losing money in order to keep working but I have to use the money that I make in the past, so it's a negative economic balance and from their perspective, this negative economic balance is due to lack of good catches... so many species are gone or there is a very strong reduction, so this is overfishing and this is just the long term effect of the fishing that has been done in the past (GAP2 case study leader).

The first phase of overfishing was masked by nutrients, a lot of nutrients from the Po River region, phosphates, nitrates that were keeping the production very high. In the 80s, even in the 70s, I remember a lot of eutrophication, so the colour of the water was always red or green and then the anoxia, hypoxia….So today, we discovered that phosphorous is limiting, one of the limiting factors for the production – in addition to fishing effort, of course (GAP2 scientist).

The Eco-mafia is the Mafia but with industry connections, they (get paid to) put in the sea very dangerous materials (Non GAP2 stakeholder).

The problem is that so far, the reason is that the stock assessment has been applied very little in the Mediterranean. For many reasons but one of the reasons was that it might have shown... and from my point of view... really I don't know if this was a deliberate decision... it might have shown earlier that all the stocks were over-exploited (GAP2 scientists).

This last point also relates to the credibility and availability of stock assessment data and more generally a lack of trust in official data, and in the officials themselves:

I know only this, in Italy reality is the way you look at the things. To believe in official statistics is difficult because there are a lot of things that are true but are not included in the statistics because sometimes when you want to give a picture, (you) probably don't want to give the real picture. (Just) the best picture to avoid problems' (GAP2 scientist).

This perspective of officials and the way they operate particularly on this issue of presenting a certain rosy picture is common in the discourse. Some believe it is done so as not to upset the status quo; important people get to keep their jobs and the funding streams flowing from EU, Rome and the regions.

In this situation, the upper level of the administration.... say there is something that doesn't work well, no one will say it's my fault...so you always try to say that all is going good, to avoid responsibility. I'm not happy with that. I think that the administration at every level... it seems from ten years/twenty years of comfortable existence that they must be responsible for what's happening but only on the paper because when it comes to... 'now you've done something wrong and now you've got to pay', they all have their exit... So no, I don't think that the statistics, even if they are from institute of statistics... I don't think the data is real... (GAP2 scientist).

Despite the many problems with the resources and their management, the case study team is looking for solutions. As an example, a number of EU directives are locally unpopular, e.g., certain gear restrictions. Fishers often speak of the specificity of the Adriatic and the need for local regulations. The EU provides a mechanism for this (through its policy on regionalisation), which is viewed by the case study team as an opportunity.

the requirement from the EU regulation is not a requirement but an opportunity. It is stating...OK...if you want to have some rules that are different from what Europe likes to work with now, you must submit a management plan. So it's an opportunity – if you want to change the rules, so make a management plan (GAP2 case study leader).

Indeed despite the wording set out in the overall case study aim …' the knowledge generated is expected to contribute to developing management proposals', it is clear that the implementation is more targeted, 'now we are starting to work with developing a management plan……fishers are pushing for a

plan, they don't always agree on the content but they do agree that one is needed' (GAP2 case study leader).

The case study team make it clear that the authority for developing a management plan lies with Veneto region and therefore politically, it is important that Veneto Region lead the process, with on the ground actions being facilitated through the GAP2 case study partners ISPRA in collaboration with fishers and (in consultation with the powerful fishing associations).

This has of course its own political issues,

> *a difficulty is that the directors of the fishing associations see GAP as the enemy because they are paid by the authorities in effect to keep the status quo, in terms of the practice of providing funding through the associations (subsidies etc,) to ensure that all the problems are solved, this is how it has been done for decades, & anything that challenges that is seen as a threat* (local stakeholder).

Even this is seen as an opportunity (for our 'glass is half full' case study team),

> *this gives us an opportunity to work lower down the chain, with the fishers themselves and in collaboration with the associations* (GAP2 scientist)

and indeed, it is said that now, more than any time previously,

> *fishers are more willing to work with scientists* (Fisher, Chioggia).

This in effect lends its support to the approach of the case study team, and more broadly that of the GAP2, which is, bottom up participatory research and action.

Two key remaining issues in the discourse with respect to the management planning process that will be discussed here are; 'the fishing ban' and 'effort restrictions'. Taken together, they are arguably the two most important current management regulations in place. Unsurprisingly perhaps, they are also contentious.

The temporary fishing ban

The temporary fishing ban is an annual closed season for between 4-6 weeks in the summer (commonly July-August) for trawl gear fisheries. During the fishing ban period there are national subsidies provided to fishers through the fishing associations. The ban is called a "biological ban" implying that it would be timed with the spawning season for as many commercially exploited species as possible, but in practice it relies especially on one species, the red mullet. Many, but not all, agree that the fishing ban is a useful management measure, at least in principle. There is however considerable disagreement over the timing and duration of the ban. Some believe the ban is too short and that both resource and economic benefits would be derived from extending the ban. Despite the suggested increase in economic returns, fishers stated that there would need to be additional subsidies to compensate for the extension in

fishing ban period. A number of fishers told us that the ban is in the wrong period for the fisheries they exploit commercially, and some, disagreed with the ban as a management measure at all.

Effort restrictions

Currently, during the 10 weeks after the end of the temporary ban, fishers are restricted to fish 3 days per week (between Monday to Thursday), where fishers in the case of bad weather can decide when to fish over this 4 days period. Moreover in this period large FFVV should fish at least 6 NM from the seashore while small trawlers should fish at least 4 NM from the seashore. This is a broadly unpopular measure with small boat owners and crew, who do not have capabilities to fish beyond 12 NM from the seashore. The rigidity of this system necessitates that fishers must go out and work around the clock instead fishing 14 hours as they are used to. This means that they are forced to work also in bad weather conditions risking accidents, and if they stay ashore they lose income (especially when some species migrate from the seashore to the open sea). Larger boats however are able to handle weather extremes much more easily and, as they have sufficient crew, they are able to fish around the clock. This too is a disincentive for smaller boats with limited crew. Many feel the system favours the large operators at the expense of those under 10 tonnes. Calls for fishing hours to be taken freely at any time during the week (e.g. with a maximum time of about 72 hours per week, a limit often quoted by fishermen) is popular with small trawlers, who could have higher flexibility, for instance fishing 4 days a week, while larger trawlers prefer the current system, where effort is set according to days at sea limits, rather than hours. A quota system may indeed be fairer for the majority and have resource benefits if well implemented. The fear is that the price of fish at the market could not compensate the reduction in landings. Moreover stock status is poorly understood and management regulations are unlikely to be effectively implemented. Thus a quota system is generally not seen as a viable solution by either large or small trawlers. Moreover, the implementation of a quota system in multi-target fisheries, as in the case of the Northern Adriatic demersal trawl fishery, is considered very problematic, since there would make little sense, when a quota is reached for one species, to discard it in order to keep fishing other species. As with the temporary fishing ban there are those who believe in the system and believe that hours at sea should be reduced (by enforcing a limit of hours per week), citing ‘the crisis’ as a justification for stricter effort controls.

It is hoped that the knowledge produced collaboratively, as an outcome of the GAP2, and supported through on-going participatory discursive process, will provide a platform and operational mechanism for management planning that ameliorates some of the above issues.

Deciding the Q-sample

As discussed above there are multiple issues involved in the Chioggia case study and as a result, the key topic could be formulated in a number of different ways. After review of the case study material and seeing the project in practice, the issues around ‘a system in crisis’ and the potential of collaborative planning processes to engage with this issue emerge as the key local elements in the discourse. This is supported through the approach of the case study to promoting collaborative knowledge production and

discursive planning processes. Regionalisation of management planning processes is a hot topic within the EU Common Fisheries Policy Reform and has potential in terms of the frame of engagement for the inclusion of fishers experience based knowledge and effective stakeholder engagement. The q-sort statements are constructed in order to broadly reflect this:

1. The fishing ban period is too short
2. A longer fishing ban period will improve the value for the catch
3. The fishing ban is not an effective management measure
4. Fishing hours at sea should be reduced to 72hrs per week
5. Fishing hours should be able to be used anytime in the week
6. There should be a quota system enforced for commercial species
7. In general across species, landings have been stable over the last 10-15 years.
8. Many stocks are severely depleted
9. Species composition has remained relatively stable over the last 20 years
10. There is strong political pressure to demonstrate that everything is ok with the stocks
11. The situation of the stocks now is far worse than before.
12. Fishers are more likely to work together with scientists than before
13. Fishers are very individualistic
14. Scientists don't listen to fishers
15. It is NOT important to include fishers in making the rules, they just need to follow the rules
16. Cooperation between researchers and fishers is NOT important for effective management
17. There is too little reliable scientific data for the Northern Adriatic
18. The ministry has some scientists they prefer to work with because the scientists tell them what they want to hear
19. Stock assessments have been widely carried out
20. Not all scientific data on stock condition are made available
21. Quota setting is an appropriate management strategy
22. Everyone agrees a management plan is needed.
23. Most fishers do NOT want a management plan
24. Management plans will never work, it's impossible
25. Bad management is the main reason for the poor status of the stocks
26. Stricter controls and bigger penalties will improve stock sustainability

Selecting the P-set

Many stakeholder groups are involved in Chioggia and efforts have been made to include all of the main ones, optimally with both respondents affiliated to the GAP2 case study and those outside of it. In consultation with the case study lead in Chioggia a list of 44 people was put together, with the following distribution:

- 5 fishers participating in the GAP2 case study
- 5 fishers not participating in the GAP2 case study
- 6 scientists working in the GAP2 case study

- 7 scientists not working with the GAP2 case study
- 8 people from the management/policy level participating (consultative) in the GAP2 case study
- 4 people from the management/policy level not participating in the GAP2 case study
- 5 Fishing association representatives participating in the GAP2 case study
- 3 Fishing association representatives not participating in the GAP2 case study
- 1 Industry stakeholder (marketing) not participating in the GAP2 case study

Each person was allocated a code for processing the data. The code consisted of eight characters. The first three characters were 'chi' to recognize the case (Chioggia). The fourth character showed which stakeholder group the person belonged to (1=fishers, 2=scientist, 3=management, 4=fisheries representative, etc.,). The fifth character was either a 'y' (yes) or 'n' (no) to indicate whether the person is a GAP2 participant. The remaining three characters were numbers to distinguish people in equal categories. To illustrate, a respondent with the code chi1y001 would be respondent nr 01 in the Chioggia case; a fisher working in the GAP2 case study.

Q-sorting

All of the 44 persons were introduced to the survey and asked to participate. Of the 25 that undertook the q-sort, 11 were conducted face to face and the remaining 14 were submitted online, with the following distribution:

- 5 fishers participating in the GAP2 case study
- 5 fishers not participating in the GAP2 case study
- 7 scientists working in the GAP2 case study
- 4 scientists not working with the GAP2 case study
- 3 Fishing association representatives participating in the GAP2 case study
- 1 Industry stakeholder (aquaculture) not participating in the GAP2 case study

Analysis

The data from the 25 sorts were entered into PQ method. As described in the section "Q-methodology" we used PCA to calculate the correlation matrix and rotated the factors with higher eigenvalues than 1. In the Chioggia case this was seven factors. We used Varimax for statistical rotation and automatic flagging for marking the defining sorts (sorts that load significantly on specific factors, p>0,01). Nine sorts loaded significantly on factor 1, eight sorts loaded significantly on factor 2 and five sorts loaded on factor 3. The remaining factors had <3 defining sorts each and after subjective review in relation to the key discourse were not considered.

Factor 1 'Crisis' management and local management planning.

Factor 1 is represented by nine significant loadings. The sorts are made up from four GAP2 fishers, and three fisher's association representative (who are in this case fisher and involved with the GAP2 case study) and two GAP2 scientists. This is a multi-stakeholder set of GAP2 affiliates. The ideal sort for this factor is displayed in Table 15 and elaborated below.

Factor 1 is concerned with limiting fishing hours to 72 hours per week. As discussed above this is a key issue for many fishers with differences of opinion between big boat and small boat owners, fishers and conservationists and those who consider quotas a more effective management measure. As with factor 2, factor 1 highlights an important management issue as fulcrum about which management and the factor itself are framed.

It is clear that as well as effort restrictions, the fishing ban is also considered highly important (statement #3), whereas quotas are not wanted (statement #21). But in this case the fact that 'many stocks are severely depleted' (statement #8) is put down to management problems, 'bad management is cited as the main reason for the poor status of the stocks' (statement #25). Whilst 'bad management' is something of a catch-all term, the emphasis here is what can be done about it and there is strong agreement that the solution should be in the form of a management plan, 'everyone agrees a management plan is needed' (statement #22). Whether 'everyone agrees' is something of an issue as discussed above, but there is more likelihood of fishers working together with scientists on management planning than before the GAP2 (statement #12), the caveat being 'fishers are very individualistic (statement # 13). As with factor 1, cooperation is cited as being very important (statement #16) and reflects the ethos of the GAP2 case study very well, collaborative management planning for sustainable fishery and social outcomes.

Most agree	4. Fishing hours at sea should be reduced to 72hrs per week
Strongly agree	22. Everyone agrees a management plan is needed. 25. Bad management is the main reason for the poor status of the stocks 8. Many stocks are severely depleted
Agree	13. Fishers are very individualistic 12. Fishers are more likely to work together with scientists than before 10. There is strong political pressure to demonstrate that everything is ok with the stocks 11. The situation of the stocks now is far worse than before. 5. Fishing hours should be able to be used anytime in the week 19. Stock assessments have been widely carried out
Undecided	18. The ministry has some scientists they prefer to work with because the scientists tell them what they want to hear 17. There is too little reliable scientific data for the Northern Adriatic 1. The fishing ban period is too short 15. It is NOT important to include fishers in making the rules, they just need to follow the rules 20. Not all scientific data on stock condition are made available 2. A longer fishing ban period will improve the value for the catch
Disagree	6. There should be a quota system enforced for commercial species 7. In general across species, landings have been stable over the last 10-15 years 24. Management plans will never work, it's impossible 6. Stricter controls and bigger penalties will improve stock sustainability 9. Species composition has remained relatively stable over the last 20 years

	14. Scientists don't listen to fishers
Strongly disagree	21. Quota setting is an appropriate management strategy 23. Most fishers do NOT want a management plan 16. Cooperation between researchers and fishers is NOT important for effective management
Most disagree	3. The fishing ban is not an effective management measure

Table 15: Ideal sort for factor 1 in the Chioggia case study.

Factor 2 The fishing ban: stock recovery and sustainability

Factor 2 is represented by eight significant loadings. The sorts are made up from two non GAP2 fishers, three GAP2 scientists and three non GAP2 scientists. These loadings represent a fairly heterogeneous set. The ideal sort for this factor is displayed in Table 16 and elaborated below.

Factor 2 is concerned with the fishing ban, a contentious issue in the discourse, more in terms of when it should occur and for how long than whether it should, though some disagreement exists as to the importance of having a ban at all. There is strong agreement with (statement #8) *'Many stocks are severely depleted'* and (statement #11) *'The situation of the stocks now is far worse than before'*, providing a justification for the existence/continuation of the ban based on a 'crisis narrative' over stock status. There is also strong agreement with the proposal for 'A longer fishing ban period will improve the value for the catch' (statement #2) on the grounds of it being economically beneficial as well as having conservation benefits.

Factor 2 might be viewed as being reasonably in line with traditional conservation style approaches with exclusion as its primary strategy for stock recovery and sustainability (linking up with other restrictions discussed above such as effort control). This may reflect that six of the eight loadings come from scientists, many of whom are working in environmental protection. Importantly however, in terms of the GAP2 case study, the 'how' part of the approach can be seen clearly through disagreements with statements #16, #24 and #15. These statements, in negative form, relate to the importance of cooperation between stakeholders, particularly scientists and fishers, in management decision- making and the belief in the potential of a collaborative management planning process.

Most agree	1. The fishing ban period is too short
Strongly agree	8. Many stocks are severely depleted 11. The situation of the stocks now is far worse than before. 2. A longer fishing ban period will improve the value for the catch
Agree	10. There is strong political pressure to demonstrate that everything is ok with the stocks 18. The ministry has some scientists they prefer to work with because the scientists tell them what they want to hear 20. Not all scientific data on stock condition are made available 25. Bad management is the main reason for the poor status of the stocks 22. Everyone agrees a management plan is needed. 6. There should be a quota system enforced for commercial species
Undecided	12. Fishers are more likely to work together with scientists than before 21. Quota setting is an appropriate management strategy

	14. Scientists don't listen to fishers 13. Fishers are very individualistic 19. Stock assessments have been widely carried out 5. Fishing hours should be able to be used anytime in the week
Disagree	26. Stricter controls and bigger penalties will improve stock sustainability 23. Most fishers do NOT want a management plan 4. Fishing hours at sea should be reduced to 72hrs per week 17. There is too little reliable scientific data for the Northern Adriatic 3. The fishing ban is not an effective management measure 9. Species composition has remained relatively stable over the last 20 years
Strongly disagree	7. In general across species, landings have been stable over the last 10-15 years. 16. Cooperation between researchers and fishers is NOT important for effective management 24. Management plans will never work, it's impossible
Most disagree	15. It is NOT important to include fishers in making the rules, they just need to follow the rules

Table 16: Ideal sort for factor 2 in the Chioggia case study.

Factor 3 Quotas not collaborative management

Factor 3 is represented by five significant loadings. The sorts are made up from three fishers (one GAP2 and two non GAP2), one non GAP2 scientist and one non GAP2 aquaculture farmer. This loading represents a non GAP2 perspective including as it does just one GAP2 affiliated fisher. The ideal sort for this factor is displayed in Table 17 and elaborated below.

Factor 3is concerned with that 'fishing hours should be able to be used anytime in the week which relates primarily to the weather and secondarily relates to fishing as a way of life. As explained above, the rigidity of the system forces the fishers to go out and work around the clock and also in bad weather conditions. This is particularly true for the smaller boats and poses a serious risk. Some fishers also prefer to manage their time in such a way as they only go fishing when they want to so they don't need to keep unsociable hours.

The factor is also strongly related to the idea that 'there should be a quota system enforced' (statement #6) as a management measure which is in contrast to other factors. This may be due to their status outside of GAP2 and or their respective work areas. Like all other factors there is agreement with statement #10 which states: 'there is strong political pressure to demonstrate everything is ok'. This is interesting as it is clearly at odds with the universally agreed stock status problems. It highlights a specific area of tension between fishing association representatives and managers and the fishers.

Again what sets this factor apart is that it disagrees that everyone wants a management plan (statement #22), that bad management (statement #25) is the main reason for the problems and that management planning is the answer to them. Less strongly correlated but also of interest is the idea that fishers and scientists are not more likely to work together. This may reflect the fact that q-sorts are derived from those outside the GAP2 case study. Finally the factor most strongly disagrees with the

statement that 'the fishing ban period is too short' (statement #1) thus once again diverging strongly from factors 1 & 2.

Most agree	5. Fishing hours should be able to be used anytime in the week
Strongly agree	6. There should be a quota system enforced for commercial species 11. The situation of the stocks now is far worse than before. 21. Quota setting is an appropriate management strategy
Agree	10. There is strong political pressure to demonstrate that everything is ok with the stocks 8. Many stocks are severely depleted 23. Most fishers do NOT want a management plan 4. Fishing hours at sea should be reduced to 72hrs per week 3. The fishing ban is not an effective management measure 24. Management plans will never work, it's impossible
Undecided	7. In general across species, landings have been stable over the last 10-15 years. 16. Cooperation between researchers and fishers is NOT important for effective management 19. Stock assessments have been widely carried out 20. Not all scientific data on stock condition are made available 26. Stricter controls and bigger penalties will improve stock sustainability 18. The ministry has some scientists they prefer to work with because the scientists tell them what they want to hear
Disagree	15. It is NOT important to include fishers in making the rules, they just need to follow the rules 12. Fishers are more likely to work together with scientists than before 2. A longer fishing ban period will improve the value for the catch 25. Bad management is the main reason for the poor status of the stocks 9. Species composition has remained relatively stable over the last 20 years 17. There is too little reliable scientific data for the Northern Adriatic
Strongly disagree	13. Fishers are very individualistic 14. Scientists don't listen to fishers 22. Everyone agrees a management plan is needed.
Most disagree	1. The fishing ban period is too short

Table 17: Ideal sort for factor 3 in the Chioggia case study.

Summary and conclusion

Whether an actual or a convenient truth the 'crisis narrative' transcends factors and discourses and is often times used as a justification for entrenched positions as diverse as (subsides, quotas and conservation approaches such as closed seasons). Crucially though and in the context of the GAP2 case study, this situation may act as an opportunity to motivate engagement around developing local management tools.

Factors 1 and 2 are moderately correlated to each other and taken together present the basis of a strategy for addressing the view of a 'system in crisis'. It aligns itself to collaborative (in the sense of supporting an integrated experience and research knowledge base for sustainable fisheries

management), and precautionary (such as those operating through evidence of benefits of management measures) approaches. Factors 1 and 2 emphasise the importance of working together and illuminate the potential for using collaborative research for effective local resource planning and management.

Factors 1 and 2 are only very weakly correlated with factor 3, and demonstrates the difference in perceptions, within and outside the project. The 'outside' perspective which factor 3 describes, presents a picture where management planning and conservation oriented management regulations are much less important. It will be interesting to return to this towards the end of the project to assess what change if any has come about as a result of the GAP2.

According to the case study classification framework (figure 1) the knowledge function for fishers' participation in the Chioggia case, hopes to include all knowledge functions from data collection through to management planning. Specialized knowledge is being co-constructed. However, collaborators have to define the problems and agree on a framework for action including formats for the knowledge object in question. The management structure within which the case study is operating is somewhat unstable and dysfunctional and thus the case study is in a sense having to co-construct both the knowledge object and the management structure to receive it.

The 'gap size' in Chioggia is quite large, with the GAP2 case study, a leading innovator pushing to influence the norms for fisher participation. Attitudes vary quite significantly between stakeholders with those more involved in the GAP2 case study seeing the benefits of collaboration and those outside of it who do not (preferring instead it seems a 'command and control' style approach).

CS12 Dutch Discards

The main aim of GAP2 within the Dutch case is to improve information about discards in the Dutch flatfish fisheries by producing a platform where fishers and scientists are working together to improve information about the catch, with a particular focus on discard sampling. According to the GAP2 webpage:

> *Collaboration between scientists and fishers within self-sampling projects will improve fisheries catch data, include more fishers' knowledge and improve communication and understanding between the two sectors. This in turn will help fisheries managers fine-tune their policy.* (*http://gap2.eu/case-studies/case-study-12/*)

The GAP2 case study is one in a number of collaborative projects in the Netherlands, and is described as bringing an extra dimension to the existing collaboration. According to the science partners, IMARES, GAP2 is a tool to develop an understanding with regards to how the self-sampling programs are influencing the relationship between scientists and fishers.

Partners

- Institute for Marine Resources and Ecosystem Studies (IMARES), Wageningen UR: Science partner
- The Dutch Fish Product Board (FPB): Stakeholder partner
- North Sea Regional Advisory Council (NSRAC): stakeholder partner

Assembling the concourse

Fieldwork was realized by one of the WP4 team members, Maiken Bjørkan, from the 29th of August to the 1st of September 2012. During fieldwork, four scientists (IMARES), one representative from the FPB and one from the NSRAC as well as three fishers where interviewed in multiple harbors. While the interviews and fieldwork, together with the GAP documentation of the case is our main source of information, we have used secondary sources to gain an understanding of the context and the discourse in which this case is embedded.

In the Netherlands, the GAP2 science partners are focused on establishing a well-working self-sampling regime with protocols and sound methods that can produce data that can be used in the discard policy. While IMARES is concerned with getting more data about discards from fishers and improving communication, this is a sensitive issue. GAP2 in the Netherlands is a part of an umbrella of numerous other cooperative projects on discard sampling. This entails both EU- and national projects. In total, around 350 trawlers participate in these projects, which cover different gear types (beam trawl, pulse trawl, shrimp trawl, etc) and target species (plaice, sole, pelagic, demersal). The landings are distributed in eight different harbors.

The Dutch beam trawl fishery is mainly located in the southern part of the North Sea. In 2009, the active fleet consisted of 104 large cutters (engine capacity between 300 and 2,000hp) and 204 smaller cutters (< 300 hp engine capacity), compared with 2002 when there were 157 large and 235 smaller cutters (DFPB 2010).

Most of the beam trawlers target sole and plaice. While high rates of by-catch and discards are featured as major problems within the European fisheries policy in general – and has received particular attention through the CFP reform process – the Dutch beam trawl fishery stand out as a notorious case.

The basis for the persistence of the discard problem in Dutch beam trawl fishery is the combination of a gear technology with low selectivity in a mixed fishery. In the fisheries targeting flatfish (mainly plaice and sole), the beam trawl will also bring up large quantities of other species of fish and benthic species starfish and crabs. In addition to undersized exemplars of sole and place, the catch also will include commercially important species like dab, whiting, and Nephrops (Helmond *et. al*., 2012: 9-10).

The discard rates in the Dutch beam trawl fishery are high. Note also that the issue of discards is highly controversial, and is surrounded by a great deal of mistrust and suspicion. This controversy also includes the various efforts to sample and quantify the discard rates. In a report from 2001 on the economic aspects of discarding, Cappell (2011) estimated that the economic revenues at landing of marketable species discarded in the Dutch beam trawl fishery were about 60 million euros per year, 70% of the landed catch (sited in Catchpole *et. al.,* 2008: 775).

As this suggests, discards is a major issue in Dutch fisheries, as it is within EU. An important reason for this, besides the combination of mixed-fisheries and non-selective gear, is the discard policy within the CFP. In contrast to Norway and Iceland, where discarding is banned, vessels operating under EU jurisdiction are not allowed to keep onboard fish that are undersized or for which the vessels do not have a quota. In the current CFP reform, however, the discard problem has been one of the major issues from the start (CEC, 2009), getting attention and momentum after a high-profile public campaign (http://www.fishfight.net). A discard ban, to take effect from 2014 (pelagic species), 2015 (cod, hake and sole) and with full effect from 2016, is now an important part of the reform package (http://ec.europa.eu/fisheries/reform/docs/discards_en.pdf).

Discard is also the issue featured by the Dutch case study within GAP2. More precisely, the GAP2 case study focuses on how self- sampling can be used to get more information on discarding. This is how it is illustrated by the GAP2 team:

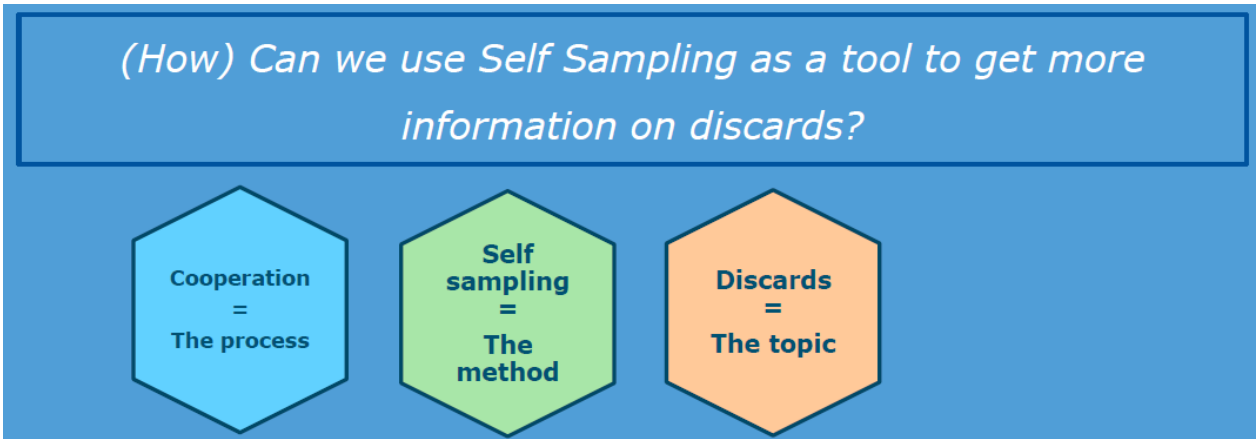


Figure 14: Self-sampling as a tool in the GAP2 case study (http://gap2.eu/gap2wordpress/wp-content/uploads/2011/09/Kraan-Steenbergen_The-optimal-process-of-SS-120509.pdf)

While discards is the key topic, and self-sampling the main method, the key to the Dutch case, as we understand it, is the left-hand side of the figure, the process of cooperation itself. That is, the case does not involve the establishment of new self-sampling projects. These projects are already underway, and the idea of the GAP2 case study is to improve the cooperation with regard to self-sampling on three of these projects. According to the GAP2 web page:

> *Our case study takes a closer look at three of these self-sampling programmes. The first is the self-sampling fleet providing data for the data collection regulation of the EU (approximately 21 fishing vessels); the self-sampling for monitoring the effects of the pulse-fishery (appr.20 fishing vessels) and the self-sampling in the TR gears (appr. 52 fishing vessels). The three programmes have a different set-up with different goals as well as with different methods of self-sampling.*

In general, there is growing use of self-sampling programs as part of data collection for assessment purposes, since they can generate more samples from more trips at a lower cost than for instance observer based data collection or port sampling programs (Bjørkan, 2011, Catchpole and Gray, 2010). In the Netherlands, the Fishing Product Board (FPB) begun its own plaice sampling program in 2004 because it was not satisfied with the accuracy of the estimates of discards produced by IMARES. From 2009, self-sampling programs has been developed in cooperation between IMARES and the FPB.

While discard sampling is an important objective across the self-sampling projects, they vary in focus and organization. Some programs are focused on collecting data on discards under normal operational conditions; others are focusing on the effects of gear adjustments (mesh size; sorting panels) or innovations (pulse trawl). Some programs are organized by the fisheries authorities, usually through IMARES, others are organized by the fishers' organizations (the Fisheries Product Board), or, as in the GAP2 case, as cooperative programs. Some programs motivate fishers by paying money for sampling; others use extra quotas as reward. As noted above, one of the three self-sample programs in GAP2

involves pulse-trawling. The pulse-trawl, which operates by sending electrical pulses through the sea bottom, scaring up the fish, is less hard on the habitat and allows more selective fishing than a conventional beam trawl. Other gears involved in the demersal self-sampling programmes are flyshoot (Scottish seine) and twinrig.

The self-sampling programs are described as a cooperative process between fishers and scientists. However, during fieldwork, some issues were raised with regards to the process. For instance, there is no institutionalized platform for fishers and scientists to interact in person. The samples are collected at the vessel, and picked up by an IMARES employee at the landing site. Also, there seems to be less than ideal communication between the partners. Several fishers mentioned that they missed information about whether the data is used, how it is used, and the overall results of the program. This concern was also voiced by scientists working close to fishers. Note, however, that the GAP2 case study was at a relatively early stage during fieldwork, and as this issue came up repeatedly in interviews, the IMARES partner took this very seriously and started a series of information letters to fishers. Still, the information flow seems to go primarily one way: from fishers to scientists (see also Bjørkan, 2011). One IMARES scientists stated that the self-sampling programs "*lack openness and transparency – the fishers should get the result back*". Another scientist said that *"[…] does not want the fishers to get access to the reports since he is afraid of their reactions – the results are bad*". A fisher pointed to the same lack of transparency when he stated "*Scientists don't show me the result. I had an observer from IMARES, and I never heard back from him*".

As this suggests, there is not complete trust between the partners. Fishers can be skeptical with regards to how scientists use the data:

> *I trust scientists (…). But they don't know what happens at sea. Scientists look at fish and surveys. When they do surveys they always go to the same spot but the fish is not always there*.

On their side, scientists can be skeptical to the quality of the data collected by fishers. As one IMARES scientists stated: "*Some scientists are very skeptical to self-sampling projects."*

Deciding the Q-sample

The discard problem in the Dutch flatfish fishery is the key topic in the Dutch GAP2 case. While the primary focus of the GAP2 case itself is the cooperative process within the self-sampling programs, the discursive focus is the discard challenge. This is probably going to be even more pronounced as the discard ban proposal in the CFP reform comes up for a final decision. As this suggests, we found it reasonable to organize the Q sort statements around the issue of discarding.

We transcribed all the interviews. In order to make it manageable for deciding the Q-sample we listed all the statements collected from the interviews and other sources. For instance we used

secondary sources to cover this issue, in particular the EU commission's impact assessment of discard policy from 2008 (CEC, 2008). After that we sorted the statements by themes and selected the statements that best represented the concourse.

The natural starting point was statements with regard to the nature and severity of the discard challenge and the different causes and cures (selective gear; dynamic area restrictions, etc.) for discarding. Case coordinator Marloes Kraan advised against statements with regard to the size of the discard problem (e.g. "The discard rate in Dutch flatfish fisheries is 80 %") since there is no accepted common standard for discards rates. Since a discard ban has been adopted, at least in principle, the wisdom end effectiveness of such a measure was considered as important topics. These issues were not well covered in the fieldwork, but were taken up in the Skype interview with Marloes Kraan. In addition, we decided to cover the issue of cooperation between fishers and scientists, as it is undertaken within the framework of the self-sampling programs. Since the issue of a discard ban is highly controversial and may influence the trust and cooperation between scientists and fishers, it is important to cover the issues of discards and the discard ban as well as the issues of cooperation and trust.

After internal review by the WP4 project team and a pilot run with one scientist and three fishers from the Netherlands we ended up with a Q-set of 24 statements:

1. Discarding is a huge problem in the Dutch flatfish fishery
2. It is better to land than to discard unwanted catch
3. Cooperation between fishers and scientists is important
4. The discard ban will lead to much higher costs in the fishing fleets
5. With healthy stocks discarding is not a problem
6. Discarding is not a real problem but something the environmentalists invented
7. The fishers are not interested in reducing discards
8. Discarding is unavoidable in mixed fisheries
9. It is better to reduce discards by involving fishers than to impose the discard ban
10. The self-sampling projects (DCF, discardbemonstering) have been successful
11. The cod recovery plan has made it difficult to reduce discards
12. Discarding can be reduced by more selective fishing gear
13. Discarding can cannot be reduced by real-time closures
14. Making the fleet smaller is the best way to reduce discarding
15. The discard ban is necessary
16. Scientists are more loyal to the policy-makers than to fishers
17. It is impossible to enforce a discard ban
18. The discard ban will turn fishers into law breakers
19. The discard ban is important to improve the reputation of the Dutch flatfish fishery
20. The cooperation between fishers and scientists does not depend on trust
21. The discard ban will lead to a more sustainable fishery
22. The self-sampling projects have improved trust between fisheries managers and the industry
23. The discard ban is a threat to the established cooperation between fishers and scientists
24. Data collected by fishers cannot be trusted

The statements and the instructions were translated into Dutch and entered into Web-Q for the survey. We used a quasi-normal distribution: The extreme points +3/-3 was allocated two slots each, +2/-2 had three slots, +1/-1 had four slots and the 0-category had five slots. This makes the pyramid shape of the distribution flatter then in some of the other cases. The reason is that we realized that the questions of discards and the discard ban in particular mobilize strong opinions in this case. By allocating more slots in the extreme points we allow the responders to express this.

Selecting the P-set

The concourse in the Netherlands has several stakeholders. When selecting the P-set we focused on having all of these groups covered and optimally both responders from in and outside the GAP2 case study. We sent a list with categories to the case coordinator and with her assistance we had the list filled out with names. Following her advice we also decided to include more fishers than other participants. The fishers were selected randomly. The list consisted of 36 people with the following distribution:

- 10 fishers participating in the GAP2 case study
- 10 fishers not participating in the GAP2 case study
- 4 fisheries representatives
- 2 scientists working in the GAP2 case study
- 4 scientists not working with the GAP2 case study
- 4 representatives from NGO's
- 2 people from the government level

Each person was allocated a code for processing the data. The code consisted of 8 characters. The first three characters were 'dut' to recognize the case (Dutch). The fourth character showed which stakeholder group the person belonged to (1=fishers, 2=fisheries representative, 3=scientist, 4= NGO and 5=management). The fifth character was either a 'y' (yes) or 'n' (no) to indicate whether the person is a GAP2 participant. Please note that group 2 in the Dutch P-set; the fisheries representatives, represent both GAP2 participatory fishers as well as fishers not collaborating in research projects. The remaining three characters were numbers to distinguish people in equal categories. To illustrate, a respondent with the code dut1y013 would be respondent nr 13 in the Dutch case; a fisher working in the GAP2 case study. In order to secure confidentiality for the respondents we will refer to the participants in the survey without the last three digests, thus only indicating stakeholder group and involvement in the GAP2 case study.

Q-sorting

All of the 36 persons in the P-set was introduced to the survey and asked to participate via email in May 2013. From this we received only eight responses. In order to have enough data for the analysis we, together with case coordinator Marloes Kraan, decided to do face to face sorting with some of the remaining responders, mainly fishers. This was scheduled for early September 2013 alongside a major

meeting. The planned meeting was one of three 'haventours' (harbour tours), which were planned to discuss the upcoming discard ban of the reformed CFP with the fleet and the research[5] that would be necessary. The ministry would be present, as well as the Dutch research institute IMARES and the Belgian ILVO, and the fisher organisations. The meetings would be hosted by the National Blueport platform[6]. Two days before the scheduled meeting, Kraan was informed that the meeting was cancelled as the fisher organisations had received a letter from the Minister for Agriculture that had strongly disappointed them. Out of the 1th meeting and the letter they still felt without an understanding of why the ban was to be implemented, how, what it will mean for the fleet and how they can best prepare[7]. Kraan therefore instead visited two different villages to Q-interview fishers. In light of the turbulent timing, these sorts are likely affected by the events where fishers feel they are not heard by the ministry.

Figure 15: Waiting for the boat, cutters coming back to port (Lands End). (Source: Kraan)

Optimally, the interviews should follow the same random selection as the one we used when we made the original list. This was not possible due to lack of resources. It might also happen that many fishers would have refused to respond due to their reactions on the ban and its implementation. Kraan was

[5] The ministry announced in 2013 to make a budget available of 3 million euro for research & innovation for the Dutch fleet, in order to prepare for the expected changes resulting from the policy change of the discard ban.

[6] This has been set up in 2012 to stimulate cooperation and innovation in the fish value chain at the regional level (sub-national). There are 5 regional blueports, and one national coordinating platform. (http://www.blueportal.nl/actueel/nieuws)

[7] See the blog on the site of Visned: http://www.visned.nl/nl/nieuws/item/id/5918/discussie-aanlandplicht

suggested to do the interviews in a specific village where she "probably still (would) find people willing to talk". The fishers in this village are in general very cooperative and forward looking. This may also have influenced the sorting of statements concentrated on cooperation. Further it should be noted that in this village they all fish with large beam trawlers with pulse gear (electric fishing) with sole as their target species thus fishing with the 80mm mesh. That also means that they will be strongly affected by the discard ban as discards are high in the 80mm fishery. Although with the pulse discards are lower than with the beam trawl, it still is one of the most critical fleets of the Dutch demersal fishing sector. Despite of these possible biases in the actual P-set, we find the timing of the Q-sort interesting: Engagement in the discourse triggers the strongest opinions.

For the face to face sorting Kraan used a map (see appendix 8) and a deck of cards. First she read the statements out loud one by one and gave the card to the responder. He/she sorted it in two piles; agree/disagree. After this rough sorting, the responder was asked to place the cards on the map, starting with the 'agree' pile. When the pile was empty, the responder was asked to move to the 'disagree' pile. When the sorting was finished, Kraan took a photograph of the map and sent it by email to the project team who transferred the information to PQ method.

Figure 16: Resondent Q-sorting (source: Kraan)

We received a total amount of 22 Q-sorts with the following distribution:

- 9 fishers participating in GAP2[8]
- 3 fishers not participating in GAP2[9]

[8] six of these are from the mentioned village

[9] Please note that one of these has participated in other collaborative research projects

- 2 fisheries representatives
- 2 scientists participating in GAP2
- 2 scientists not participating in GAP2
- 2 from NGOs
- 2 from the ministry

Kraan also did field notes which will be quoted to add depth to the analysis.

Analysis

The data from the 22 sorts were entered into PQ method. As described in the section "Q-methodology" we used PCA to calculate the correlation matrix and rotated the factors with higher eigenvalues than 1. In the Dutch case this was five factors. Using scree plot, however, the research team noticed that most of the variance were explained by the three first factors, see figure 17 below. We therefore decided to keep three factors for the further analysis. This explains 72 % of the variance. We used Varimax for statistical rotation and automatically flagging for marking the defining sorts (sorts that load significantly on specific factors). 12 sorts loaded significantly on factor 1 and four sorts loaded on factor 2 and 3 respectively. One GAP2 fisher and one GAP2 scientist did not load significantly on any factors.

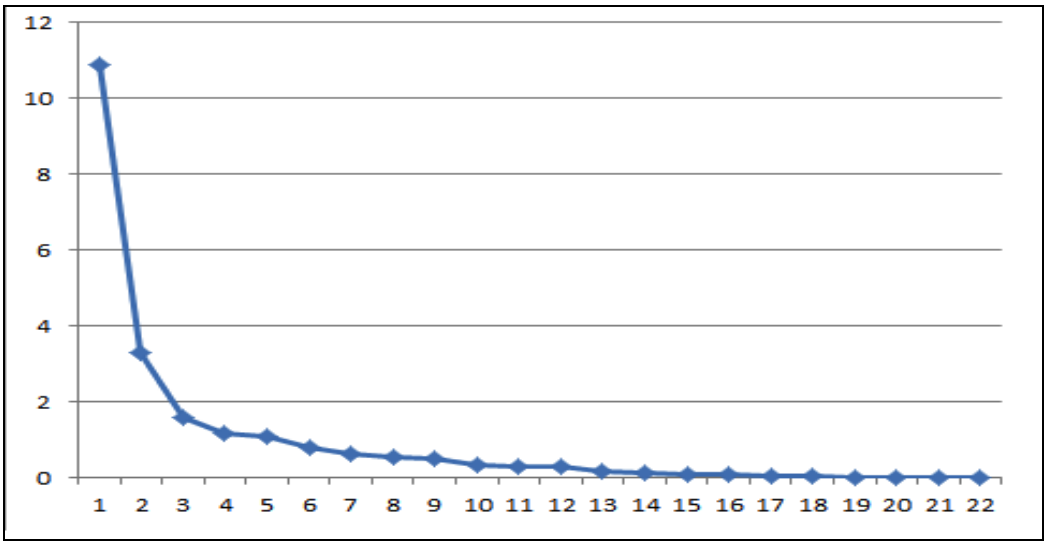


Figure 17: Scree plot in the Dutch case

All the perspectives in the Dutch case are centered on discard issues as anticipated. Factor 1 disagrees that discards is a real problem whereas factor 2 and 3 agree that it is, only they have different approaches on how to mitigate it. Below we will first describe each factor and lastly summarize the findings from the Dutch case by comparing the factors in terms of consensus and differences.

Factor 1: Discards is not a real problem

Factor 1 is the most dominating perspective in the Dutch case. The 12 respondents who load on this factor is a composite of: nine fishers involved in the GAP2 case study; the two fisheries representatives and one scientist from the GAP2 case study. In this way factor 1 may be interpreted as the fishers' perspective. The ideal sort for this factor is displayed in Table 18. Based on this we will describe the perspective on the case issues in the Netherlands represented by factor 1.

Most agree	8 Discarding is unavoidable in mixed fisheries 6 Discarding is not a real problem but something the environmentalists invented
Strongly agree	3 Cooperation between fishers and scientists is important 5 With healthy stocks discarding is not a problem 4 The discard ban will lead to much higher costs in the fishing fleets
Agree	9 It is better to reduce discards by involving fishers than to impose the discard ban 18 The discard ban will turn fishers into law breakers 10 The self-sampling projects (DCF, discardbemonstering) have been successful 23 The discard ban is a threat to the established cooperation between fishers and scientists
Undecided	11 The cod recovery plan has made it difficult to reduce discards 13 Discarding can cannot be reduced by real-time closures 16 Scientists are more loyal to the policy-makers than to fishers 17 It is impossible to enforce a discard ban 20 The cooperation between fishers and scientists does not depend on trust 22 The self-sampling projects have improved trust between fisheries managers and the industry
Disagree	24 Data collected by fishers cannot be trusted 14 Making the fleet smaller is the best way to reduce discarding 12 Discarding can be reduced by more selective fishing gear 19 The discard ban is important to improve the reputation of the Dutch flatfish fishery
Strongly disagree	7 The fishers are not interested in reducing discards 1 Discarding is a huge problem in the Dutch flatfish fishery 21 The discard ban will lead to a more sustainable fishery
Most disagree	2 It is better to land than to discard unwanted catch 15 The discard ban is necessary

Table 18: Ideal sort for factor 1 in the Dutch case

Factor 1 is to a large degree summed up in the two statements that they most agree with: Discarding is unavoidable in mixed fisheries. It is not a real problem, but something the environmentalists invented. They therefore disagree that a discard ban is necessary. The argument in this perspective is supported by Kraan's fieldnotes:

> *I could notice that the fishers had been talking a lot about it [the discard ban], some used arguments such as 'they [the ministry] can't mention one reason for the ban; they can't explain what is good about it'. Some stressed it was rather time for rewards as they [the Dutch fleet] had improved so much over the last decades: The fleet had shrunken, commercial species are all*

doing well in the North Sea (except for cod), discards are reduced a lot, a lot of nature areas, MSC etc. And now, this? Why? Do they want us disappear altogether?

The lack of support and understanding for the discard ban may be explained by how this perspective perceives sustainability - which of course is a shared interest: Healthy stocks are a sign of sustainable fisheries, thus as long as the stocks are in good shape, discards is not a problem. Quite the opposite; by releasing unwanted catch, some of it lives and the rest feeds the ecosystem. Whereas landing it means that nothing of the by-catch survives. One respondent says:

I was in Spain for my holidays, and if you then observe what is landed there – we always have commented strongly about it, like: 'look at what they bring to the shore'. And now we have to do the same? I am really worried about what that will do with the flatfish stocks. I don't think they can carry that.

Dutch fishers feel that the particularity in mixed fisheries is not understood in the EU management where the discard ban stems from. As one respondent said:

I think many of us have reckoned that the suggested measure was too absurd to become reality. We never thought it would really happen.

As stated in the case description, the aim of the GAP2 case study in the Netherlands is to cooperate in the data-collection that, from the fishers' side, may demonstrate these arguments, and also highlight how discards already are reduced. The recent events in the case context may imply that the motivation for participating in sampling projects ceases. Kraan says in her field notes:

Another observation I made, or expectation I have – based on the conversations we had, is that the fishers will be less 'positive' about research cooperation propositions due to the recent developments. Proposition 22 [The self-sampling projects have improved trust between fisheries managers and the industry] will be scored more negatively then in another week. The fact the 'trust' and government were mentioned in one sentence, worked like a red rag to a bull.

In factor 1 statement 22 is sorted in the 0-category and hence does not show itself as a relative important statement. How it would be sorted in a different week is of course impossible to indicate. However, the ideal sorting of factor 1 does not demonstrate a disbelief in collaborative research. For instance they strongly agree that cooperation between fishers and scientists is important, and agrees that self-sampling projects have been successful. Even though they also have placed statement #23 [The discard ban is a threat to the established cooperation between fishers and scientists] in the agree (+1) category, this may rather be interpreted as the disappointment expressed in the quote above; that they have already done so much, rather than as a disclaimer of participatory research. Anyhow, what is clear is that the discard ban is the most engaging theme for this factor at this moment and dominates the ranking of the statements.

Factor 2: Discard is a real problem – the ban is a necessary solution

Factor 2 and factor 3 is equally represented in the discourse with four loadings each. The sorts who load significantly on factor 2 are a composite of one scientist (not participating in self-sampling projects), one NGO and the two representatives from the ministry. The ideal sort for this factor is displayed in Table 19.

The dominating argument in this perspective is that discards is a real problem. Not just in general, it is also a huge problem in the Dutch flatfish fishery. They disagree very strongly (-3) that this can be ignored as long as the stocks are healthy, and strongly agree that the ban is necessary and will lead to a more sustainable fishery. In many aspects it may seem as this perspective is the opponent of factor 1, also supported by the fact that no fishers load significantly on this factor. In fact, many of those who load on factor 1 and 2 have a negative loading on the other. However, none of these polar loadings are significant. Thus factor 1 and 2 are different but not total opposite.

Most agree	3 Cooperation between fishers and scientists is important 1 Discarding is a huge problem in the Dutch flatfish fishery
Strongly agree	12 Discarding can be reduced by more selective fishing gear 15 The discard ban is necessary 21 The discard ban will lead to a more sustainable fishery
Agree	19 The discard ban is important to improve the reputation of the Dutch flatfish fishery 2 It is better to land than to discard unwanted catch 4 The discard ban will lead to much higher costs in the fishing fleets 17 It is impossible to enforce a discard ban
Undecided	10 The self-sampling projects (DCF, discardbemonstering) have been successful 22 The self-sampling projects have improved trust between fisheries managers and the industry 24 Data collected by fishers cannot be trusted 14 Making the fleet smaller is the best way to reduce discarding 23 The discard ban is a threat to the established cooperation between fishers and scientists 8 Discarding is unavoidable in mixed fisheries
Disagree	18 The discard ban will turn fishers into law breakers 20 The cooperation between fishers and scientists does not depend on trust 16 Scientists are more loyal to the policy-makers than to fishers 11 The cod recovery plan has made it difficult to reduce discards
Strongly disagree	13 Discarding can cannot be reduced by real-time closures 7 The fishers are not interested in reducing discards 9 It is better to reduce discards by involving fishers than to impose the discard ban
Most disagree	5 With healthy stocks discarding is not a problem 6 Discarding is not a real problem but something the environmentalists invented

Table 19: Ideal sort for factor 2 in the Dutch case

For instance factor 2 also very strongly agrees that cooperation between fishers and scientists is important and they do not believe that fishers are not interested in reducing discards. Collaborative

research is nevertheless not sufficient when it comes to discards; it is not a new understanding of by-catch in mixed fisheries that is needed, but actual management measures. More selective gear and real-time closures are actions that factor 2 agree may work.

Both the representatives from the ministry load on this factor 2 and their sorting was conducted by face to face sorting by Kraan. During the ranking of the statements the representatives expressed understanding for the fishers' point of view by ambivalence on some of the statements. One of them also explicitly said (s)he on some themes felt split. This is underlined with the comment on statement #21 [The discard ban will lead to a more sustainable fishery]:

> *It must be! Otherwise we do it for nothing.*

On the same statement the other representative commented:

> *Well we don't know yet, do we? But that is what is meant to be. But if it will be implemented wrongly, it might not work out that way.*

When asked what would be a bad implementation the respondent replied:

> *Well if there is a too strong focus on making it doable, fit with existing situations, instead of taking tough decisions.*

These comments from the field notes support how factor 2 agrees that cooperation is good but that a new regime; the ban, is needed in order to secure sustainable Dutch fisheries.

Factor 3: Discarding is a huge problem but there are better solutions than the ban

Like factor 2, factor 3 is represented by four Q-sorts from the Dutch sample. Those who load on this factor are a composite of two fishers whereof one involved in self-sampling projects and the other not, one scientist (not from GAP2) and one NGO. In this way factor 3 exceeds the borders between established stakeholder groups, different from the other two factors. The ideal sort for this factor is displayed in Table 20.

Most agree	1 Discarding is a huge problem in the Dutch flatfish fishery 4 The discard ban will lead to much higher costs in the fishing fleets
Strongly agree	9 It is better to reduce discards by involving fishers than to impose the discard ban 5 With healthy stocks discarding is not a problem 18 The discard ban will turn fishers into law breakers
Agree	3 Cooperation between fishers and scientists is important 10 The self-sampling projects (DCF, discardbemonstering) have been successful 11 The cod recovery plan has made it difficult to reduce discards 22 The self-sampling projects have improved trust between fisheries managers and the industry
Undecided	8 Discarding is unavoidable in mixed fisheries 17 It is impossible to enforce a discard ban 13 Discarding can cannot be reduced by real-time closures

	7 The fishers are not interested in reducing discards 14 Making the fleet smaller is the best way to reduce discarding 6 Discarding is not a real problem but something the environmentalists invented
Disagree	20 The cooperation between fishers and scientists does not depend on trust 16 Scientists are more loyal to the policy-makers than to fishers 19 The discard ban is important to improve the reputation of the Dutch flatfish fishery 23 The discard ban is a threat to the established cooperation between fishers and scientists
Strongly disagree	15 The discard ban is necessary 21 The discard ban will lead to a more sustainable fishery 12 Discarding can be reduced by more selective fishing gear
Most disagree	24 Data collected by fishers cannot be trusted 2 It is better to land than to discard unwanted catch

Table 20: Ideal sort for factor 3 in the Dutch case

Like factor 2, factor 3 agrees that discarding is a huge problem in the Dutch flatfish fishery. However, factor 3 to a larger degree agrees that collaborative research, such as self-sampling projects, may be effective in mitigating this. This is evident in that factor 3 strongly agrees that it is better to reduce the discards by involving fishers and at the same time strongly disagrees that the discard ban is necessary. From the ideal sort in table 19 it seems that factor 3 shares factor 1's perception of sustainability in mixed fisheries; with healthy stocks discards is not a problem. And further; a ban will not make it more sustainable. In fact, the only significant difference between factor 1 and 3 is that factor 3 acknowledges discards as a problem.

We find it puzzling that not more GAP2 participators load on this factor as it to a large degree represents the ambitions of the project. This may of course be explained by the context surrounding the face to face Q-sorts where many fishers were upset with the Ministry and the discard ban. As one of the respondents characterized it:

> *We are rather black or white; fishers think in black or white, there is not a lot of 'weighing' there.*

If we assume that the recent events influenced the people loading on factor 1 to sort more extremely than they would have at some other point, it will of course be relevant to do a follow-up study of the Dutch case to see how this evolves. As accounted for under factor 1, the majority of the GAP2 participators did not express a disbelief in collaborative research. However, as one of the responders commented on the success of self-sampling projects:

> *We'll fall in our own sword. I mean the fishers who are doing it deserve a lot of respect! But the discard sampling will be used against us, instead of giving us any advantages. By participating the negative sides will surface, but in general the program itself… It depends on what is done with it, before we know if it is a success. Depends on what the government comes up with.*

This quote shows a wait-and-see attitude towards the collaborative research going on in the GAP2 case study in the Netherlands. This is not aimed towards the collaboration itself but towards the possible impact on the management level.

Summary and conclusion

The analysis of the Dutch GAP2 case study has revealed clear disagreements in the ongoing discourse. The most engaging theme in the debate is without question the discard ban, where the three factors have different opinions on the matter. Because the statements concerning discards and the ban are so engaging the "other" statements are placed in the central region and appear as consensus statements. It is hard to know whether the ranking would be different at a different time and how that would affect what stands out as most important to the responders.

Just like in the Galician case there are different attitudes between the respondents in and outside the GAP2 case study. The most dominating perspective, factor 1, consists only of GAP2-participators whereas factor 2 consists of only subjects from outside the project. Based on that it may be tempting to argue that attitudes are different if you are a participator in collaborative research or not. However, these perspectives do not touch upon the matter of cooperative research as much as upon the discard ban. It is fairer to say that the division between fishers and the management level is clear. Factor 3, which to a larger extent favors the ambitions with collaborative research, *is* represented by people from both in and outside GAP2 *and* a mixture of stakeholder groups. Three out of the four who load on factor 3 responded before the recent events described in the analysis. This may indicate that factor 3 would have more loadings under "normal" circumstances. That remains a speculation of course, but we nevertheless conclude that attitudes towards collaborative research in the Netherlands is harmonized and generally accepted, but that they are overshadowed by attitudes towards the management measures at the CFP level.

The possible impact on management then, becomes uncertain. Not because the research itself lacks legitimacy, but because the distance between the research activities and the related management measures are too large. GAP2 in the Netherlands is a bottom-up process clashing with a top-down process initiated by the EU. From this we learn that a condition for successful collaborative research requires that there is demand for the knowledge product that is being produced. If it is not utilized the motivation for the people involved may cease and challenge further collaborative efforts.

Summary and conclusion

The GAP2 project is based on an understanding of a large gap between stakeholders and governance institutions engaged in managing fisheries resources:

> *Centralized fisheries management has until now been focused on the state of fisheries resources and based on formal biological science. With its top-down approach, it is unresponsive to local conditions and lacks support from both the communities reliant on fish resources for a living, and other stakeholders interested in the long term wellbeing of the ecosystem. Fisheries stakeholders in particular view the governance system as top-down controlled, characterized by a history of negative incentives*. (GAP2 2010: 7)

In order to bridge this gap, GAP2 has taken a bottom-up approach, inviting "stakeholders (to) participate in activities that develop approaches and methods to enable integration of their knowledge and experience in a meaningful way" (ibid: 9). In practice this happens through the organization of collaborative research projects, 13 of which have been set up across Europe.

The purpose of WP4 is to examine what happens as these case projects are developed and start to produce results. Do the case projects manage to bridge the gap, if so how? Are the case projects actually able to make a difference? To the extent they do, what kind of results do they achieve and what are the conditions for their success or absence of such?

As a part of WP4, we have undertaken a Q-sort analysis featuring six of the 13 GAP2 case projects. The purpose of this analysis is to examine the attitudes of the participants in the case projects, with particular emphasis on their views on stakeholder participation, collaborative research and the relationship between Experience Based Knowledge (EBK) and Research Based Knowledge (RBK). Given the overall focus of GAP2, and the commitment to bridge the gap between stakeholders, science and policy makers, we are particularly interested in attitudes relating to this. In the section entitled "Analytical framework" above (p 13-17) we developed a set of arguments and expectations regarding what the Q-sort might be able to yield. Before we discuss the findings, we recap the main analytical points.

First, we noted that there have been considerable changes over the last 10 years or so in the general norms with regard to fisher participation and integration in management. Whereas it until quite recently has been commonplace to describe the conventional institutional model for fisheries management as top-down and with a low regard for stakeholder participation, as described by the GAP2 DOW as cited above. There now seems to be broad agreement that active stakeholder participation is important and that the legitimacy and effectiveness of fisheries management will suffer without it. While it is difficult to assess whether this shift is superficial or reflects more fundamental changes in institutional practices, we suggested that the Q-sort can provide useful information on this count. If there (still) is a huge gap between fishers, scientists and managers, we would expect that the difference

in attitude between participants and non-participants will be substantial. However, if the recent changes in norms have taken root, and it is generally accepted that fishers and other stakeholders should be involved in and take management responsibility, the difference in attitudes will not be that great.

Second, we noted that there are different interpretations of EBK and how it relates to RBK. If the GAP2 case studies are committed to a specific take on EBK, and this is in contrast with prospective participants' notion of EBK, this could affect the performance of the projects. Specifically, we proposed that there may be a potential contrast between idealistic and pragmatist notions of (EBK). For instance, GAP2 case studies may attract participants with strong idealist expectations, whereas implementation of cooperative research favors pragmatist notions. One possibility then is that the Q-sort will reveal a high level of participant frustration: that the unfulfilled expectations make participants unhappy with the GAP2 experience. Another possibility is that they learn and adapt, adjusting their expectations to the practical realities of GAP work. In this case, we expect the Q-sort to reveal differences in attitudes between GAP2 and non-GAP respondents.

Third, we noted that the attitudes of participants are likely to be affected by the perceived or actual success of case projects. Hence, we assumed that participants' attitudes probably will be different in projects that encounter severe performance problems than in projects that perform well. On this count, we observed that the GAP2 case studies vary to the extent they are integrated in existing management structures. Some of the case studies are carried out in a setting where they are well adapted to established management structures. In such cases, the success of GAP2 case studies to a large extent hinge on their ability to produce pre-formatted knowledge objects, be it in the form of data, assessments, advice or management plans. This, we proposed, will simplify the challenge encountered by the GAP2 case studies since much of the basic infrastructure and technology are already developed and tested. Nevertheless, frustration easily builds up among participants if the management system in place does not pick up and act on the knowledge the projects deliver at the expected rate. Some of the case studies, in contrast, are carried out in a setting where there are no well-working or stable management structures in place. In these cases, the challenges are much greater, since the project cannot simply reproduce predefined knowledge objects using known technology, but first need to develop and agree on basic problem definition, framing and formats. In such cases, the projects become much more open, political and more challenging. The scope by necessity must be broader, since both the knowledge objects and the management system they work within have to be co-constructed.

Decreasing gap size

As we have seen, the GAP2 project was based on a perception of a large gap between stakeholders and management. In the Q-sort, however, we do not find this gap, at least not as deep and dark as the conventional description might lead us to believe. In general, the GAP2 participants have a somewhat more developed cooperative attitude than non-GAP2 people, but the contrast is not that great.

In *CS1 Devon brown crab* the 'gap size' is moderate, with a history of scientist fisher collaborations creating a context where there are opportunities for fisher participation. While the attitudes do vary, the majority opinion rests on the benefits of collaboration. In *CS2 Galicia TURFs* we learn that cooperative research have broad acceptance as an expansion of traditional scientific research. A condition for this may be the short distance between the research activities and the management level. In *CS4 WBSS herring* there is strong consensus that cooperation between scientists and stakeholders is important. Thus, despite technical disagreements on how the herring should be managed, there is broad agreement about the process on how such agreement should be established. The analysis does not show strong differences in attitudes between respondents in and outside the GAP2 project. We nevertheless conclude that the Western Baltic herring case has been quite a successful case in terms of unifying stakeholders on the value of cooperation. In *CS5 Steigen coastal cod* the 'gap size' is fairly small, with many years of scientist fisher collaborations creating a context where there are general norms for fisher participation. Attitudes vary little between stakeholders with a strong majority opinion resting on the benefits of collaboration. In *CS8 Chioggia* the 'gap size' is quite large, with the GAP2 case study pushing to influence the norms for fisher participation. Attitudes vary quite significantly between stakeholders with those more involved in the GAP project seeing the benefits of collaboration and those outside of it who do not (preferring instead it seems a 'command and control' style approach). In *CS12 Dutch discards* attitudes towards collaborative research are harmonized and generally accepted, but at the moment they are overshadowed by the controversy over the discard ban.

Summing up, then, it seems that the gap is not that large after all. One possible explanation may be that the description of the gap has been somewhat exaggerated. Perhaps the broad acceptance of the existence of a gap in itself is an importance step towards its bridging? Another possibility is that the many initiatives and new institutions – including the GAP2 case studies – enabling stakeholder participation over the last 10 years are starting to have an effect. A more pessimistic interpretation would be that the GAP2 case studies are not representative of the general situation in European fisheries. Strengthening this interpretation, we observed that many of the GAP2 case studies build on a long history of science – stakeholder cooperation. A possibility then is that somehow the project selection process in GAP2 has favored fisheries/areas where the conditions for cooperation have been good.

A pragmatist turn?

Are fishers the true ecologists of the ocean? While the Q-sort does not give a straight answer to this question, it does not suggest that this notion has a strong position. We must note, however, that for two of the case studies, *CS1 Devon brown crab* and *CS8 Chioggia*, it is difficult to interpret this question. In Devon there are too few respondents. In Chioggia, opinions diverge along many dimensions, in part because of an underdeveloped governance framework. In the two CFP-related case studies, *CS4 WBSS herring* and *CS12 Dutch discards*, the management discourse is dominated by science to a degree that allows very little space for idealist notions of EBK.

In the two remaining case studies, *CS2 Galician TURFs* and *CS5 Steigen coastal cod*, there are elements that could be taken in support of an idealist perspective. In *CS2 Galician TURFs*, there is a strong agreement among GAP2 participants that "fishers have complex ecosystem information." In contrast, a group of non-GAP2 respondents strongly disagrees with this statement. Nevertheless, there is no strong support for the idea that "there are things that fishers know and scientist don't". In CS5 *Steigen coastal cod*, some of the fishers take a position that in some ways represents the idealist position to EBK (factor 3). The picture presented in factor 3 is one that exudes confidence in EBK particularly with respect to knowing the status and behavior of coastal cod. Local management and fishers /scientist advisory functions are championed, along with a disagreement over existing regulations restricting the exploitation of coastal cod imposed 'from outside'. The position does not go so far as to want to do away with science, however.

The management wall

The work with the Q-sort for the case studies quite clearly have demonstrated that the degree to which the case projects are integrated in existing management structures is important for the performance of the projects as well as the attitudes of the participants.

In *CS1 Devon brown crab*, the intention is that the project will allow fishers themselves to assess the crab fisheries sustainability, but how this will be maintained after the project and within which institutional management setting it will be received is yet to be fully defined. Whilst the management structure is fairly stable, how it will accommodate the assessment advice provided by the model and to what ends this knowledge will be put are unclear at this stage. From *CS2 Galicia TURFs* we learn that cooperative research have broad acceptance, not as an alternative, but as an expansion of traditional scientific research. A condition for this may be the short distance between the research activities and the management level. In *CS4 WBSS herring*, the project is limited in penetration power because of lack of influence on the political level. The limitations in the scope of the project activities that this lead to, make it challenging for the project to negotiate its way forward. From this we learn that a condition for effective collaborative research is that it must be securely anchored at the management level. In *CS5 Steigen coastal cod*, cooperation works well; the case study assessment methodology and use of hydro acoustic survey techniques are universally supported, and the uptake to management is relatively certain. The importance of collaboration between fishers and scientists is strongly supported and, despite clear differences in motivations, opinions converge on the importance of addressing the engagement gap. In *CS8 Chioggia*, in contrast, the 'crisis narrative' transcends factors and discourses and is often used as a justification for entrenched positions as diverse as subsidies, quotas and conservation approaches such as closed seasons. Crucially though and in the context of the GAP2 project, this situation may act as an opportunity to motivate engagement around developing local management tools. In *CS12 Dutch discards*, there is strong support for cooperative research, but the possible impact on management becomes uncertain. Not because the research itself lacks legitimacy, but because the distance between the research activities and the related management measures are too large. The GAP2 case study in the Netherlands is a bottom-up process clashing with a top-down process initiated by the

EU. From this we learn that a condition for successful collaborative research is that there is demand for the knowledge product in question. If it is not utilized the motivation for the people involved may cease and challenge further collaborative efforts.

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Appendix 1: Instructions for Q-sorting[10]

What is Q-sorting?

Q-sorting is sorting a pile of statements on a scale from *most agree* to *most disagree* according to your personal opinion.

There are no right or wrong statements. This is not a test, but a method to measure how people rank statements that are relevant to an issue they are interested in.

The researchers responsible for the Q-sorting will examine the differences in attitudes and opinions among various stakeholder groups, and how such differences affect cooperation.

All the statements stem from the ongoing GAP2 case study.

How do you do it?

When Web-Q is started you will see a range of statements displayed in random order. Your task is to sort these statements from +3 (most agree) to -3 (most disagree).

Please note that there is a set distribution for how many statements that can belong to each category. When the sorting is finished, the sorted statements will form a "sideway pyramid" with most statements in the middle like this[11]:

Category	Number of statements
+3 (most agree)	1 statement
+ 2	3 statements
+1	5 statements
0	7 statements
-1	5 statements
-2	3 statements
-3 (most disagree)	1 statement

[10] The instructions were translated into the language utilized in the different cases

[11] Please note that the allocated number of statements in each pile to some degree varied among the selected cases. See each case description for further information

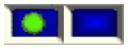
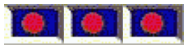
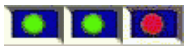
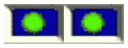
When you start the Web-Q, all statements are assigned to the '0' category ('undecided'). Your task will be to sort the appropriate number of statements into each of the categories according to your attitudes.

Statements are sorted by clicking on a radio button.

At any point during a Q-sort, you can click on the **Update** button to view the results.

Symbols

Symbols are used to indicate the condition of the number of statements in each category. For example:

	Category provides place ('slots') for 1 item. However, no item is sorted into this category yet.
	There is 1 item sorted into this category, 1 other slot is still empty.
	Category should be filled with 3 items, but there are at least 3 too many.
	Still 1 item too much in a category that provides 3 slots.
	Exact match, both slots filled with 1 item.

Notice that the statements are in order from *most agree* to *most disagree* and see how the symbols have changed.

Keep sorting and re-sorting until you get *all* green, which indicates that the distribution is according to the “sideway pyramid” as shown above.

At this point, check whether the ranking accurately represented your view. Do the necessary revisions. When *your view* is represented in the statement ordering, you click on the **Send** button.

Hint on sorting strategies

There are quite a few statements to sort. Some will be easy to rank. But it is likely that you will need to distinguish between statements that are difficult to compare.

In order to make sorting easier, one strategy is to start by dividing them into three piles. Use the three central buttons (+1, 0, and -1) to create three piles (agree, undecided, disagree). Next, click on the **Update** button to sort these statements. Turn now to the upper (+) pile and select the one statement you agree most with by clicking the +3 button. Continue by finding the two statements with which you agree with (+2), and then the five statements with which you are in somewhat agreement with (+1).

Then turn to the lower (-) pile and repeat the procedure, starting with locating the statement with which you disagree most with (-3).

Don't forget to click on the **Update** button to sort statements into place.

Sending your Data

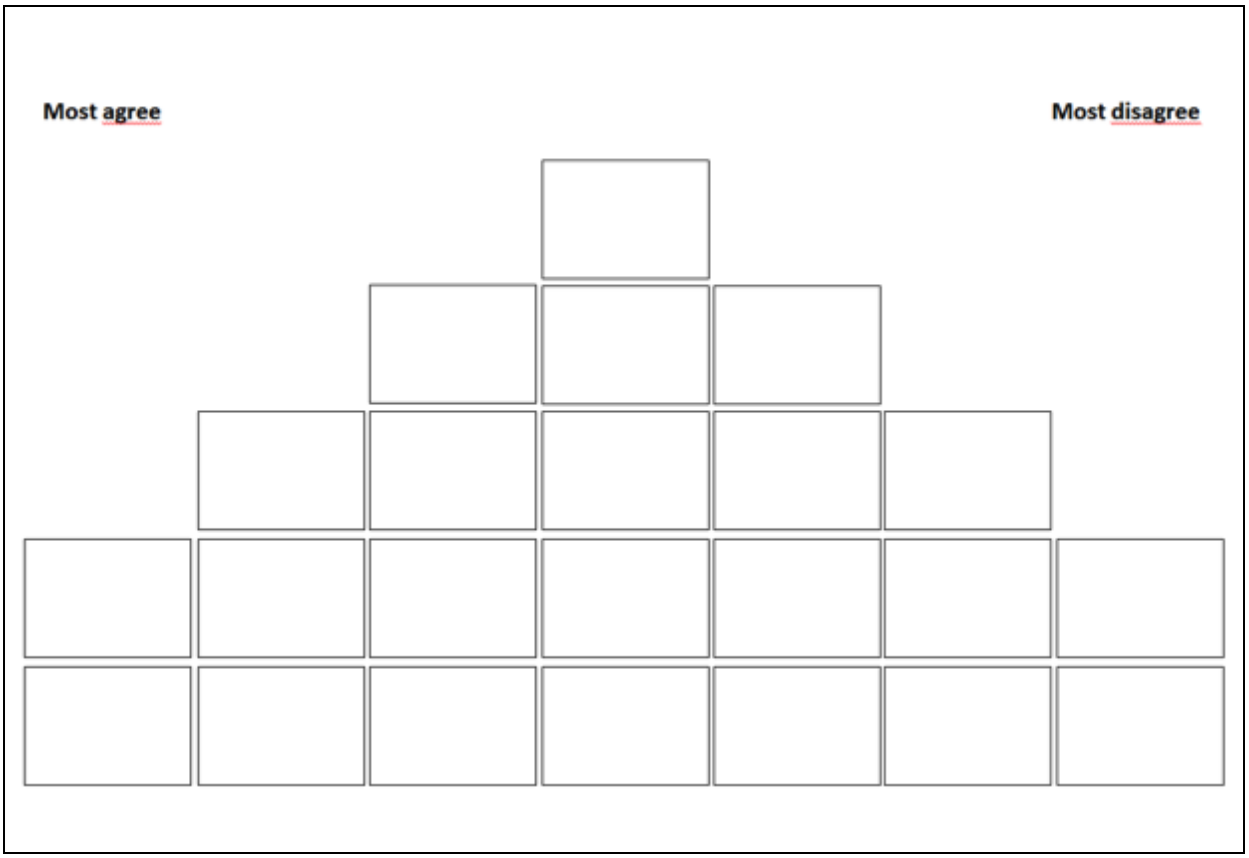
When you click on the **Send** button, the number of statements in each pile is checked, and if there are categories with too many or too few statements, you are asked to continue with sorting.

When your Q-sort is OK, you will next be asked for a code word which will be used for processing your data. Please use the code that was given to you together with this instruction.

Before sending the email with the data away, please don't forget to add your comments to questions that you may find within the email body.

Please note that q-sorting is not anonymous. Nevertheless, the data will be treated with strict confidentiality, and the result of the analysis will be made public in ways so that opinions cannot be traced back to individuals.

Appendix 2: Q-sort map[12]



[12] The map for Q-sorting was printed in size A3 with the quasi-normal distribution decided for each case.

Appendix 3: Revision of research design

As described in the DOW (GAP2, 2010), the plan for task 4.2 is to conduct two (identical) Q-sorts, one in the beginning of the GAP project and one when the project is well established. The original schedule was to report from the first Q-sort within month 18 and the second within month 40. The purpose of this design was to examine how participant's attitudes change through collaborative research.

As we started work on task 4.2, however, it soon became clear that we would have to revise this plan. The first problem encountered was that it took more time than planned for to undertake the discourse analysis on which the Q-sort is based. In part this was because we had underestimated the amount of work it took to understand the cases thoroughly. In part it was due to unforeseen changes in the WP4 team, which meant that the work did not have ready access to Q-sort expertise. As a direct result, the deadline for D4.2.1 was postponed to month 30.

It also turned out that in some of the cases, it was difficult to get sufficient response on the Q-sort, and that at least part of the problem was related to the internet version of the Q-sort. As a result, we in some cases, for some of the respondents, resorted to direct face-to-face interviews. In one case CS1 Devon brown crab, this was difficult to arrange, and the response rate was lower than we had hoped. With the added work of arranging face-to-face interviews, the completion of the Q-sort proved somewhat more time-consuming that the original design, but meant that we got an acceptable number of responses for five of the cases.

In addition, we realized once we started the initial round of interviews, that most of the GAP2 cases were continuing collaborative projects, in which scientists and fishers had been working together for several years in different organizational forms. In this way, repeating the same Q-sort at two different times may not be as valuable as we had originally thought. Instead of a "before and after" analysis, what we get is an examination of attitudes at two different times, with no obviously important events in between.

This may suggest that it should be considered whether the second Q-sort is likely to bring new insights. In other words, it is possible that the research question that motivated it (how attitudes change through collaborative research) can be better addressed by other means. We have no clear answers to this yet. Instead, we will use the results of the first Q-sort to inform this question. Since the Q-sorts have been administered to respondents both within and outside GAP, the results allow us to investigate how viewpoints vary according to respondents' experience with collaborative research. This approach does not fully substitute for a "before and after" design, and does not give us the opportunity to examine the direct causal link between participation and attitudes. While we do get information on differences in attitudes between those who participate and those who don't, such difference may in part be explained by self-selection processes. Nevertheless, the results of such an analysis can indicate whether a second Q-sort will be worth the effort.

As described in the DOW, the plan for task 4.2 included a consensus analysis as well as a Q-sort. Since preparing and undertaking the Q-sorts took more effort than we had planned for, we have not undertaken a consensus analysis in this round. A contributing factor here was that the team member with expertise in consensus analysis has not been able to participate in the work to the extent we had planned. It will still be possible to undertake the consensus analysis at a later stage.

Date of latest version of Annex I (Description of Work):
21/10/2013

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