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Participatory Modelling: Developing a Long-Term Management Plan for Western Horse Mackerel within the Pelagic RAC

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Abstract

In the late summer of 2006 the Pelagic RAC contacted scientists with expertise on western horse mackerel and asked them to assist the RAC in developing a long-term management for that stock. This paper reports on that process from a social science perspective and aims to contribute to the knowledge of best practices for interactive processes between scientists and stakeholders in fisheries management. Overall, the participants considered the process, which led to the implementation of the management plan from 2008, as a considerable success and the process can, although the Pelagic RAC to some extent is a special case, in that way serve as an inspiration for stakeholders, researchers and policy-makers wishing to do similar exercises for other species. Although the process was overall considered a success, it also had problematic elements to it. These elements are likewise useful to keep in mind when designing similar exercises.

Keywords: Pelagic Regional Advisory Council, Common Fisheries Policy, horse mackerel, long-term management plan, participatory modelling.

Introduction

In the late summer of 2006 the Pelagic Regional Advisory Council (Pelagic RAC) contacted scientists with expertise on horse mackerel and asked them to assist the Pelagic RAC in developing a long-term management plan for western horse mackerel. Horse mackerel is one of the species on which the Pelagic RAC advises the Commission of the European Communities (Commission) and the stakeholders on the RAC were concerned that the species was not being harvested optimally. They feared that the development and adoption of a management plan was not a priority for the Commission, so they decided to take the initiative. Moreover, the Pelagic RAC wished to explore ways to develop management plans without going through the Commission to the International Council for the Exploration of the Seas (ICES). This is the standard procedure but the RAC felt it was too cumbersome.

This paper reports on the process from a social science perspective. The SAFMAMS project¹ provided an avenue of cooperation with the Pelagic RAC between a European Union (EU) sponsored project able to support researchers and the RAC initiative on horse mackerel. One of the main problems the RACs face in mobilizing scientific advice is that funding is basically *ad hoc* from one initiative to the next. SAFMAMS, and the social scientific analysis that went with it, was part of the solution here. The paper contains both a detailed description of the development process as well as an analysis of the social processes. The paper aims to contribute to the knowledge of best practices for interactive processes between scientists and stakeholders in fisheries management and more broadly to knowledge about processes of participatory modelling. The natural science aspects of the development of the horse mackerel plan are addressed in an article by Clarke et al. (2007). The present paper draws gratefully on that source.

Research Approach

The research process has contained elements of *action research*, where the researcher assumes a position of participant, as opposed to an observer, in a change process and thereby contributes to the desired change - and at the same time observes and researches the process to gain new knowledge

¹ For details see www.ifm.dk/safmams.

of the social mechanisms of the process (Hegland et al. undated). In the case of the development of the horse mackerel management plan the action aspect was primarily related to the ability of the SAFMAMS research team to help set up and fund a Pelagic RAC meeting on the horse mackerel management plan in February 2007 in Edinburgh. In addition to this the SAFMAMS team was actively involved in discussions on how to handle the question of the lack of response to a questionnaire distributed by the group of horse mackerel scientists to the industry stakeholders in December 2006 (Annex 3) as well as the actual approach to the planned discussions between stakeholders and scientists at the meeting in February 2007.

We studied the development process of the management plan for western horse mackerel by means of several research strategies. During the development process the authors observed five of the seven meetings of the Pelagic RAC where the development of the horse mackerel management plan appeared as an item on the agenda. Intensive discussions on the management plan took place at two of the observed meetings. All meetings were attended by a stakeholder who was also a partner on SAFMAMS and we have benefited from his recounting of the two meetings we could not attend. Besides the observations we have had access to minutes and presentations etc. from all relevant RAC meetings, as well as to significant amounts of e-mail correspondence between the involved horse mackerel scientists.

After the development process ended we administered an e-mail survey among the key participants in the process. The list of questions is reported in Annex 2. The questionnaires asked how they saw the process in retrospect. We sent them out in January 2008 to six scientists and five stakeholder representatives, with one round of reminders, and we received six and three answers respectively. Social science protocols require confidentiality in survey research; therefore completed questionnaires have been numbered from 1 to 6 for scientists and 1 to 3 stakeholders.

Western Horse Mackerel

Atlantic Horse mackerel (*Trachurus trachurus*) is a small, migratory, pelagic species inhabiting wide areas in the North Atlantic, the Mediterranean Sea and the Sea of Marmara. In the North Atlantic horse mackerel is divided into three separate stock units: Southern stock, North Sea stock, and Western stock (Clarke et al. 2007). The management plan developed in the process that we are reporting on deals with the western stock unit.

The longevity of western horse mackerel is approximately 35 years and they reach maturity around the age of 3-4 years. The relationship between size and age shows much overlap between juveniles and adults in terms of size at age. Consequently it is difficult to separate mature fish from juveniles based on size alone. Western horse mackerel is considered to be an indeterminate spawner² that's spawning takes place over an extended spawning season. In short this implies that an otherwise potentially useful assessment methodology, the annual egg production method³, is not applicable to horse mackerel. Furthermore, western horse mackerel recruitment is highly spasmodic; the 1982 year class was more than 20 times the average and the 2001 year class is considered much stronger than the average (Clarke et al. 2007).

² That spawning is indeterminate means that the total number of eggs produced by an individual is not determined in advance of spawning but rather depends on factors that can change during spawning.

³ The annual egg production method entails that egg abundance surveys (see explanation in footnote 4 beneath) are carried out in a specific way that for some species enables scientists to estimate the spawning stock biomass based on the presence of eggs in the water.

Although western horse mackerel is one of the best studied horse mackerel stocks worldwide the scientific knowledge base relating to it remains limited. There is no analytical assessment done so the only data systematically available for management purposes are triennial egg abundance surveys⁴ (latest 2004 and 2007) and data on catches and catch at age. As a consequence of the limited scientific knowledge base, the spawning stock biomass (SSB), recruitment and fishing mortality rate (F) cannot be reliably estimated and there are, consequently, at the moment no defined reference points for those values (Clarke et al. 2007).

The EU catch of western horse mackerel is primarily taken by British, Dutch, German, Irish and French vessels; Danish vessels catch a limited quantity. Norwegian vessels target to a variable degree western horse mackerel in their own exclusive economic zone (EEZ). Western horse mackerel is currently managed by the setting of a total allowable catch (TAC) for EU waters supported by technical measures (incl. minimum landing size). ICES advised for 2005, 2006 and 2007 a precautionary TAC of no more than 150,000 tonnes for the catches of western horse mackerel in its entire distribution area; the TACs eventually adopted have corresponded to the level of the advice but for a smaller area as the Norwegian fishery has not been covered by the EU TAC. Furthermore, it should be mentioned that other discrepancies exist between the spatial boundaries of the western stock for assessment purposes and management purposes to the south, which complicates matters further (Clarke et al. 2007).

To explain the background for the need to develop a long-term management plan for horse mackerel, Clarke et al. (2007, p. 4) conclude:

”The current management system as it applies in the EU does not serve the horse mackerel situation very well. The lack of an analytical assessment or forecast precludes the implementation of the implicit EU management strategy. The implicit strategy is to set the TAC one year ahead, based on forecasted population size in an intermediate year, from an assessment in a given year. The lack of predictive power in the assessment means that the stock may not be optimally harvested. For example, in periods of elevated stock productivity, due to pulse recruitment, optimal catches cannot be advised for in the current fisheries system.”

It is in the light of the current move in the EU towards management plans for individual stocks that the need for change in this ‘implicit strategy’ must be understood. The impetus of the change for horse mackerel was the wish of the Pelagic RAC to prioritize a management plan for this species, highlighting the role of a RAC leading the way in implementing broader EU policy.

Institutional Setting

In the EU western horse mackerel is managed under the Common Fisheries Policy (CFP). Without going in detail it is reasonable to recall that the CFP as a policy framework is extraordinarily dependent on scientific information in order to function (for details, see Hegland 2006). The core element of the CFP in terms of conservation of resources is a system where TACs are set on an annual basis for individual stocks, usually based on an advice coming from ICES, which is paid by the EU to carry out this task. However, among other issues ICES suffers from limited access to

⁴ An egg abundance survey involves collecting quantitative samples of planktonic eggs in the water. This enables scientists to estimate whether there are more or less eggs than on average and thereby estimate future abundance of fish relative to the past.

manpower, as the scientists connected to ICES are not employed by the institution itself but by national fisheries research institutes with their own priorities and tasks.⁵ This means that ICES cannot always take on *ad hoc* tasks or respond as quickly as desired by the Commission (Wilson and Hegland 2005, CEC 2003). Moreover, the scientific community needs to be better at incorporating the knowledge of stakeholders in its work, something that ICES has not traditionally been geared to do (Commission 2003, Wilson and Hegland 2005). These issues have led to a situation where the almost *de facto* monopoly of ICES on providing scientific advice has increasingly been questioned and the Commission has invested in creating its own capacity for this (Commission 2003). ICES itself has in response undertaken a reform process, which among other things has led to the opening of more meetings for stakeholder observers as well as a reorganisation of its committee structure (for details on the knowledge base of the CFP and the institutional reforms in ICES, see Hegland 2006 and Wilson and Hegland 2005). Once the TACs have been decided in accordance with the procedures of the CFP, the agreed overall fishing opportunities are divided among and allocated to the EU member states in fixed shares in the shape of national quotas. Consequently, the TACs are not only related to *conservation* of resources but as much to *allocation* of resources. The CFP and the TAC-system has repeatedly failed to provide sustainability, neither biological nor economic (see among many others CEC 2001 or Hegland and Raakjær Forthcoming). In light of the poor condition of many stocks in EU waters, the Commission has in several rounds attempted to modify the TAC-framework and the current strategy involves developing single-species, multi-annual management plans as an important element.

A key element in some of the long-term management plans, including the one developed for horse mackerel is a defined harvest control rule (HCR) to improve predictability for the industry and secure biological sustainability. Under the CFP, HCRs are defined as “*rules which consist of a predetermined set of biological parameters to govern catch limits*” (Council 2002, Art. 6(4)). In other words, scientific knowledge on the biological state of the stock is in principle directly determining the size of the TAC.

Developing a long-term management plan for a specific species, such as the one for horse mackerel, usually takes place within the ICES-framework as a response to a request from one of ICES’ clients, of which the EU is the largest. However, in the case of the western horse mackerel it was, as mentioned above, the Pelagic RAC that took the initiative.

The Pelagic RAC is one of the six⁶ stakeholder-driven RACs set up to provide advice to the Commission on aspects relating to the CFP. RACs are stakeholder fora consisting of representatives of the fishing industry, conservation groups and other marine fisheries stakeholders. The RACs are the youngest part of the institutional framework of the CFP. The North Sea RAC, the oldest of the six, began operating in 2004. Two thirds of the seats in the RAC are allocated to the fisheries sector and one third to other interests. RACs were created by the Commission as purely advisory bodies as a tentative step, taken within the most top-down command and control fisheries management regime in the developed world, toward more stakeholder participation in developing fisheries policy. The idea is that the RACs will come to a consensus about management plans among other things and this will allow the Commission to weight the political advantages of following the

⁵ Likewise, the working hours of the horse mackerel scientists, who are by the way also active in the ICES-system, were in relation to the development of the long-term management plan for horse mackerel paid for by the national fisheries research institutes, primarily the Marine Institute, Ireland, and the Centre for Environment, Fisheries and Aquaculture Science (CEFAS), United Kingdom.

⁶ Seven RACs are planned for but the Mediterranean RAC is so far not operational.

RAC's consensus against any differences between the consensus and other preferences the Commission may have. The RACs were from the outset provided by the Commission with a small operating budget, which does not include funds to cover the considerable time that stakeholder representatives spend on RAC work. This has created a real challenge for RAC members; particularly the conservation organizations that must fund their RAC work through grants and donations (see also section on Funding beneath). There are also no RAC funds for scientific advice. If RACs want scientific information they are expected to ask the Commission, and if the Commission agrees the Commission will pass a request for the information on to ICES. In spite of these limitations in both role and funding the RACs, particularly the Pelagic and North Sea RACs, have developed a great deal of institutional momentum during their young lives. Their working groups have produced a surprising number of plans and recommendations; they have organized conferences on their own initiative, received considerable support and encouragement from EU member state governments, and gotten the attention of most actors in Northern European fisheries, including ICES and other scientific bodies. The RACs face a number of problems, but hold at least the seeds of a possible future EU fisheries co-management system.

Horse mackerel is one of the in total four species on which the Pelagic RAC advises the Commission. The Pelagic RAC stands out from most of the other RACs because it is *not* a regionally defined stakeholder forum but rather defined by dealing with fisheries for four pelagic species in *all* EU waters; in contrast, most other RACs provide advice on management issues relating to all fisheries in the specific region that they cover, e.g. the North Sea. Despite the relatively broad geographic coverage of the Pelagic RAC, it remains relatively homogeneous in relation to the composition of stakeholders from the catch sector, which was the most active group in relation to the development of the long-term management plan for horse mackerel. Most catch sector representatives in the Pelagic RAC sit there on behalf of large-scale fishing enterprises employing large, highly capital-intensive, modern vessels.⁷ Although the enterprises are competitors on the market, the relative homogeneity among them means that they often see eye-to-eye on issues relating to management. Moreover, the fisheries covered by the Pelagic RAC have been blessed with relatively healthy stocks in later years compared to many of the fisheries covered by other RACs.⁸ These elements all contribute to making the Pelagic RAC less prone to internal conflict than would be the case in other RACs. Partly as a result hereof, the Pelagic RAC has already acquired a reputation of being one of the most productive and efficient RACs.

Steps of the Management Plan Development Process

In 2006 the stakeholders of the Pelagic RAC with an interest in horse mackerel came to the conclusion that the development and adoption of a management plan for this species would not take place for a long time yet unless they themselves instigated the process.⁹ The key stakeholders were of the opinion that the species was being harvested in a suboptimal way and that the development of a long-term management plan could lead both more sustainable fisheries and higher average catches. The development of management plans is a time- and effort-consuming process; and although according to the regulations management plans should be developed for an ever-increasing range of species under the CFP within the Commission and ICES they are being developed based on urgency.

⁷ This is particularly the case for stakeholders from the Northern European countries, which are the most important in relation to western horse mackerel.

⁸ However, in relation to herring several years of low recruitment for some of the core stocks for EU vessels has from 2008 led to dramatically lower TACs.

⁹ A detailed, chronologic overview of the development process can be found in Annex 1.

In late summer of 2006 the Pelagic RAC contacted scientists with expertise on horse mackerel and invited them to assist it in developing a long-term management plan. In response six scientists set up an informal *ad hoc* working group with the aim of developing and presenting various strategies for a future management plan.

At the Pelagic RAC Working Group meeting in Brussels in November 2006, when the idea of developing a long-term management plan for horse mackerel was presented for the first time, the Commission representative confirmed that a management plan for western horse mackerel was not a high priority in the Commission. Moreover, the Commission representative informed the Pelagic RAC that the Commission leaned towards a 15 percent reduction of the TAC for 2007 *vis-à-vis* 2006 in the light of the weak scientific knowledge base and the lack of a management plan for the species. However, the Commission welcomed the suggested efforts by the industry and indicated that if the efforts were genuine the Commission would consider maintaining the 150,000 tonne TAC (Observer's notes November 2006; PRAC 2006). This was in fact the outcome for 2007.

At the meeting a representative of the *ad hoc* group of scientists introduced the basic biological features and status of the stock, the challenges in terms of the limited scientific knowledge base, and the current management regime. Preliminary results of simulations on a range of different HCR scenarios were outlined. It was recalled that the aim of the process was to have a plan ready for presentation to (and validation by) ICES' Working Group on the Assessment of Mackerel, Horse Mackerel, Sardine and Anchovy (WHMHS) in September 2007 so that it could enter into force from 2008.

Finally, the Pelagic RAC was presented with a number of questions (see Annex 3), which the scientists felt that it would be helpful that the industry answered before more in-depth calculations were carried out. These questions related to issues of stability *vs.* flexibility of TAC, the acceptable range of the TAC, the preferences of the market in relation to sizes etc. (Clarke 2006). These questions were also distributed to the stakeholders by e-mail by the Pelagic RAC secretariat with a deadline of 12 January 2007 for responses. After the plan for combining a meeting of the Pelagic RAC with a meeting under the EU-funded SAFMAMS project had been presented and agreed upon, it was decided to have the next meeting in February 2007 in Edinburgh where the aim was to present results of simulations that to some extent took the input from industry into account. The response from the industry to the questionnaire, however, was limited and came in too late to really steer the preparatory work of the scientists in advance of that meeting (Clarke 2007; Scientist e-mail, 8 January 2007).

At the meeting in February two detailed presentations of the results of simulations on five different HCR scenarios were held. The meeting allowed substantial time for discussion and questions to the presenting scientists and provided the first substantial discussions between the scientists and the industry stakeholders, who raised a number of questions. The issues taken up, some of which we will look closer at in the following sections of this paper, related to:

- the fact that the assessment areas do not correspond to the management areas;
- the usefulness of the triennial egg survey;
- the question of including occasional pulse recruitment in the models,
- the question of how to handle the Norwegian fishery in the models; and
- the limited scientific knowledge base etc.

Before a decision could be made on the management plan, particularly what relationship or indicator on which to base the HCR, more work and discussions were needed. The scientists still had specific questions that they needed the industry to answer. Considering the limited response from the industry to the questionnaire that had been sent out, it was decided that the best way to go forward was to set up a focus group meeting between the key stakeholders from the industry, the horse mackerel scientists, and the Pelagic RAC as organiser and convener. This meeting was scheduled for April 2007 in Dublin. At the meeting in Edinburgh in February the Commission representative once again expressed support for the process and, notably, the fact that it was taking place outside the ICES-system:

“We want to say that the Commission believes that ICES is somewhat set in their ways and we very much support this initiative. This does not need to go through the traditional route.” (Observer’s notes February 2007)

This next meeting took, as mentioned, place in April in Dublin, the latest possible time in a time schedule that would allow the plan to be implemented in 2008. This meeting also began with two presentations of results of simulations on the five HCR scenarios (Kelly and Campbell 2007; Roel 2007). In one of the presentations industry priorities had explicitly been implemented in the scenarios (Kelly and Campbell 2007). The results, underlying assumptions and weaknesses of the simulations were discussed and the group proceeded to discuss the elements besides the HCR that could form part of a management plan.

The outcome of the meeting was an agreement on doing detailed simulations on no more than three different HCR scenarios; this should then be presented in a comparable format at the Pelagic RAC Working Group meeting in May where it was hoped that a firm decision could be made (Clarke et al. 2007). As it turned out, a single presentation comparing the simulated performance of only two different HCR scenarios was held at the May meeting. The two HCR strategies that the Pelagic RAC eventually were presented with simulations of were 1) a hybrid between a constant yield and proportional catch strategy (referred to as the slope strategy); and 2) a modified constant yield strategy. Simply put, under the slope strategy the coming 3 years’ TAC is calculated by adjusting a share of the previous year’s TAC based on information from the triennial egg abundance surveys, which monitor the trend of the stock. If the data from the egg surveys for the last 9 years (3 surveys) shows a downwards trend the adjustable share of the TAC will be reduced while the opposite will be the case if the data shows an upwards trend. This approach can be implemented without a full assessment of the stock. Under the modified constant yield strategy the TAC is modified based on the overall development of the SSB, and as such this strategy demands that an assessment is done, as the TAC is a proportion of the SSB (Kelly, Campbell and Roel 2007; Clarke et al. 2007; Roel and De Oliveira 2007). The Pelagic RAC did, however, not feel ready to decide upon the specific approach and the details of a management plan, and it was decided to postpone the decision to the Pelagic RAC Working Groups meeting in June to allow the stakeholders to consider the options presented (Observer’s notes April 2007).

The decision and the final discussions on what elements to include in the long-term management plan for horse mackerel were consequently taken at the Pelagic RAC Working Group meeting in June 2007. There the indicators and relationships that the HCR would be based upon was decided as well as the remaining issues that the scientists needed input on before being able to do the final analyses and evaluations. When all the conditions had been introduced in the models, the

simulations on the two different HCR scenarios delivered relatively similar results. A final decision was made to go with the slope strategy, which is based on using the triennial egg abundance surveys and as such does not require a reliable stock assessment (Clarke et al. 2007; PRAC 2007d). Notably, although long-term average yields were very similar in the two simulations, the slope strategy is the one that delivers the highest yield in the short term (Kelly, Campbell and Roel 2007). The final draft of the plan (PRAC 2007c) was, subsequently, developed for, presented at, and formally adopted by the Pelagic RAC Executive Committee at its meeting in July 2007; where it was also agreed that the plan should be passed on to the Commission with a request to have it submitted to ICES for evaluation (PRAC 2007e).

In the fall of 2007, after having been through its internal committee structure, ICES evaluated the plan and found it to be in accordance with the precautionary principle for a period of 3 years and it was on that background able to advise a TAC for 2008, 2009 and 2010 of 180,000 tonnes covering all areas where western horse mackerel is caught; although on the longer term ICES pointed to a number of issues that needed attention before the plan could be implemented for yet another three years (PRAC 2007b; ICES 2007). The member states' ministers in the Council of the European Union (Council) increased based on the advice from the Pelagic RAC (PRAC 2007g) the EU TAC for western horse mackerel to 180,000 tonnes¹⁰ (Council 2008). In contrast to envisioned in the management plan this TAC does not cover the Norwegian catches.

In the following sections, we will discuss some issues and lessons of the horse mackerel process. We believe that this experience offers useful inspiration for future approaches to participatory modelling. We will look at 1) issues relating to the differences in perspectives between scientists and stakeholders, 2) issues relating to ICES, 3) issues relating to funding, and 4) issues relating to planning. The paper is rounded off with a brief discussion of the level of applicability of the lessons learned in this process.

Scientist / Stakeholder Interaction

Fisheries scientists and industry stakeholders approach the issue of modelling from different perspectives. Where the scientists make a living from being able to make accurate scientific models, industry stakeholders make their living based on the output of the models not on their accuracy. In practice scientists have to be prepared to listen and take the input of the industry into account when designing the model. The traditional argument in favour of keeping scientific modelling separated from the influence of industry stakeholders is, of course, the concern that stakeholders' own short term interests will lead to undue influence on outcomes. If industry stakeholders are continuously arguing based on a notion of achieving highest short-term yields while scientists are arguing based on merits of the science and the accuracy of the model without taking the input from the industry serious, then the cooperation will not be fruitful.

In line with this concern, Scientist 1 responded to our questionnaire that he¹¹ prior to the process "*was concerned that RAC members may push for unsustainable and non-precautionary approaches.*" The scientist, however, reported that he did not feel that this had turned out to be the case. Rather, although the stakeholders had different objectives than the scientists, this scientist had

¹⁰ In practice the advice and adopted TAC of 180.000 tonnes was due to the area discrepancies divided with 170.000 tonnes to the traditional western horse mackerel TAC area and 10.000 tonnes to southern areas covered by the TAC for southern horse mackerel (PRAC 2007g; Council 2008).

¹¹ There was only one female among the scientists and stakeholders. In order to keep her anonymous, we will generally use 'he' when referring to a scientist or a stakeholder.

the feeling that the group had been working towards a common goal and that the objectives of the industry stakeholders could easily be aligned with the issue of sustainability. Along the same lines, Scientist 4 commented that the “*willingness [of the industry stakeholders] to deal openly with trade-offs*” had surprised him.

Our observations confirm that the industry did not push for outright unsustainable or non-precautionary elements being added to the models. As an example, the industry stakeholders did not insist on having pulse recruitment included in the models. As described above, horse mackerel is a spasmodic recruiter that occasionally produces an enormous year class, if these pulses were included in the models the outcome would be higher short-term yield for the industry. Historical data suggests that pulses occur approximately once in every 20 years. The stakeholders were in fact presented both with HCR scenarios that did and did not include assumed pulse recruitments (Kelly and Campbell 2007; Roel 2007) - and ways of including the pulses were debated internally among the scientists (Scientists’ e-mails, January 2007). It was on the other hand clear that the most precautionary strategy would be not counting on these infrequent events – before they actually occurred. Instead of insisting on including the pulses, the industry stakeholders supported including a clause stating that if pulse recruitment was detected then the normal HCR of the management plan would be suspended (PRAC 2007c).

Although the general picture is that the industry did not seek to push the limits of the precautionary approach (see also section on the Role of ICES beneath), our questionnaire revealed that at least Scientist 2 had more mixed feelings *vis-à-vis* the way that the industry stakeholders approached the process:

“My impression is that Industry worked out which harvest control rule had the potential of providing higher yields in the short term and therefore favoured a particular strategy on that basis. So, the worse elements are linked to the very different perspectives / interests stakeholders and scientists may have. This is to be expected but communication and mutual trust may not be easy as a result.”

The same scientist also indicated that he does not “*think stakeholders are particularly concerned about the science and that is a concern.*” This interpretation of the process is supported by the industry stakeholders’ observed reluctance to take decisions based on principles and the quality of the models alone. Thus, a major concern of the industry stakeholders was to have calculations on how the different HCRs performed in relation to size of TAC. That the industry stakeholders wanted to see what they were buying in to is not particularly surprising; nevertheless, at several instances scientists actually asked if the stakeholders could not just take a decision in principle and then afterwards see the result of the calculations. It is of course a very different approach to choose a specific HCR based on the TAC it can deliver compared to the scientific approach of choosing a specific HCR based on its scientific merits - and then afterwards calculate the size of the TAC it delivers.

Consequently, there seems to be evidence that industry stakeholders working towards a management plan discount future catch opportunities compared to immediate catch opportunities, just as basic economic theory would suggest any business person would. That the catches of the future are discounted means that the value of having one fish today is considered larger than the value of having a similar fish in some years’ time. The whole idea of creating a long-term management plan is to some extent to solve the problem of discounting and bind the actors to a

particular strategy. Discounting can simply be a product of the time dimension, but it is obvious that the discounting rate increases with the amount of uncertainty connected to the future. In the light of all the uncertainties of fish stock modelling and fisheries management in general makes it is unsurprising that the industry stakeholders discount the future (for a theoretical discussion of discounting and self-binding, see Elster 2000). However, when the process includes an independent scientific evaluation - in this case by ICES - after the management plan has been developed, the experience from the horse mackerel process is that little suggests that the industry stakeholders will risk trying to push the limits of the precautionary approach - the objectives of the industry stakeholders could consequently be aligned with sustainability.

Another important issue relating to the interaction between scientists and stakeholders is communication. Based on the responses to our questionnaire, particularly the group of scientists expressed that they were positively surprised about how quickly the stakeholders grasped the concepts of the science and became able to ask relevant questions and “*judge the scientific merits of various schemes*” (Scientist 1). On the other side, the stakeholders were also positively surprised about the scientists’ ability to explain their concepts, so that they could be understood by laymen. Consequently, the material suggests - maybe somewhat surprisingly - that the process was not characterized by significant problems related to the communication of science. The scientists were able to communicate what they were doing, and the stakeholder representatives were able to pick up the messages.

In contrast to the success in relation to communicating and discussing the science, it turned out to be more challenging to find effective tools for feeding the information from the industry stakeholders into the work of the scientists. From the perspective of the scientists it was of concern to get clear information and objectives that could be used in model development from the stakeholders. For that purpose the group of scientists presented at the meeting in November 2006 a number of questions that they wanted the industry stakeholders to provide answers for. These questions were subsequently mailed to the stakeholders (see list of questions in Annex 3). This strategy did not turn out to be fruitful and the low level of response to this questionnaire surprised the scientists. The problem that the industry had was that the questions were much too “*concrete*” (Industry stakeholder, personal communication). Another reason to the failure might also be that a questionnaire is a scientific tool, which is far from the way that stakeholders are use to communicating.

At the meeting in February 2007 it was agreed that the right way to get the needed information from the industry would be through face-to-face interactions. However, the meeting in February also proved that this could not work in a setting with all stakeholders present. In this respect the problem related not so much to the presence of representatives of conservation organisations etc., which in fact does not turn up that often to Pelagic RAC working group meetings (for details on the reasons for this, see section on Funding beneath). Rather, the problem was the presence of a large number of industry stakeholders with overlapping, marginal or no interest in the discussion on horse mackerel, which made it difficult to have a targeted and efficient discussion. The experiences relating to the meeting in February and the partly failed questionnaire led directly to the decision to set up a focus group consisting of the scientists and the key stakeholders only. This turned according to the participants out to be a good strategy and in our questionnaires several respondents suggest that this is a strategy that could be employed more in future processes of this sort (see also section on Planning beneath).

Although the input to the questionnaire remained limited it did provide guidance to the scientists because the industry stakeholders among other issues notably agreed on the fact that a relatively stable TAC would be good and actually better than a higher average if the higher average meant large fluctuations. Moreover, the answers from the industry also highlighted management issues that they thought were important to look at - though without giving clear guidance on their priorities (Scientists' e-mails, January 2007; Clarke 2007).

Evaluating on the input from stakeholders after the process Scientist 1 put it like this in his response to our questionnaire:

“I was very pleased with the input from all stakeholders on the horse mackerel plan. However receiving no feed back from the stakeholders to the questionnaire was frustrating, but the reasons for this were made clear at the subsequent meeting, thus it was evident that questionnaires are not a useful tool in this situation.”

Although both stakeholders and scientist had been concerned about communication prior to the process, on the whole both the group of stakeholders and scientists indicated in the responses to our questionnaire that they had been satisfied with the communication with the other group and that this had been one of the most positive elements of the experience.

Role of ICES

As mentioned above, the development of long-term management plans in Europe would usually take place within the framework of ICES. Although ICES as an organisation¹² did not take active part in the actual development process, the organisation had nonetheless in various ways an impact on the course of it.

On the most basic level, the dissatisfaction with the standard way of developing management plans under the CFP, in which ICES plays a central role, was - together with the recognition of the comparatively low priority of the horse mackerel plan within the Commission - the main argument for developing the management plan within the Pelagic RAC. As mentioned earlier, also the Commission itself supported developing the plan in the Pelagic RAC with reference to ICES being “*somewhat set in its way*” (Observer's notes February 2007). In response to the question of what the best elements of the Pelagic RAC development process were, Scientist 5 specifically compares that process to the traditional process, which he argues to be overly bureaucratic and slow - and failing to put the stakeholders at the centre:

“The best element of the process was the interactive dynamic of work between scientists and stakeholders, skipping over the, many times, slow and/or bureaucratic procedure of the complete path for the process (stakeholders, national administrations, European Commission and ICES, for going for queries and coming back with answers, which usually make the processes of definition of management plans too lengthy). With the selected procedures the pros and contras of alternative management plans were quite quickly revised and sorted out by stakeholders, which are the ultimate end-users of the management plans.”

¹² Most - if not all - of the scientists involved in the Pelagic RAC horse mackerel management plan development process are active within ICES, as well.

However, as we will discuss in the following section on Planning, especially the speediness of the Pelagic RAC development process did not come entirely without costs.

Besides the fact that dissatisfaction with ICES was part of the argumentation for starting the process altogether, the presence of the organisation as the final reviewer of the plan may very well have affected the way the participants acted and related to each other as well. The group of stakeholders and the scientists were aware that the management plan would have to go through an evaluation within ICES advisory system in the end. Consequently, pushing the limits of the precautionary approach or in other ways challenge ICES' standard norms would jeopardize the approval and implementation of the management plan from 2008, which was of high priority to the industry stakeholders. Moreover, having the plan turned down in ICES would discredit the process, the Pelagic RAC, and the scientists involved with the political costs that this would entail.

Consequently, we are of the opinion that the presence of ICES as a final reviewer of the plan functioned as a disciplinary measure particularly *vis-à-vis* the industry stakeholders. This interpretation would also contribute to explaining the experienced relative success in the communication between stakeholders and scientists, which came to the surprise of most participants. Although the scientists and the stakeholders were engaging on something that could be understood as an equal footing in the development process, the fact that the plan would eventually have to go through an almost pure scientific review process within ICES may - more or less unconsciously - have inspired the industry stakeholders to conform more to scientific thinking and norms than they would otherwise have.

Although ICES did not take active part in the development process, its institutionalised role as provider of advice to the Commission on issues relating to fish and fisheries means that the organisation - even in an independent process as the one relating to horse mackerel - retains a significant position *qua* its role as the final reviewer and highest authority. This position of ICES has in turn an impact on the actions of the participants taking part in the independent process.

Funding

Obtaining sufficient funding to carry out the work was a major issue in relation to the horse mackerel process. The development of the horse mackerel management plan involved significant additional costs compared to those associated with the daily running of the Pelagic RAC. The extra costs related primarily to the involvement of scientists in the process as well as to additional meetings with associated costs for for instance travel and interpretation services.

The original legal provisions of the RACs did not provide for complete or permanent EU funding for their operation. Rather, it was originally decided that each RAC would on a yearly basis for its first 5 years of operation be able to receive a continuously decreasing amount from the EU (decreasing from initially 90 percent of their budget and no more than 200,000 € in year one to 50 percent and no more than 110,000 € in year five). On top the EU would provide up to 50,000 € to cover translation costs (Council 2004). It was envisioned that the RACs would over time be able to cover more of their operational costs from other sources, incl. member state contributions and membership fees. This funding arrangement remained the situation until June 2007, where the Council agreed to award the RACs with a general status of *bodies pursuing an aim of general European interest*. Based on experiences with the operational RACs, the Council granted in connection with this change of status from 2007 each RAC with a permanent, yearly budget of up to 250,000 € (constituting no more than 90 percent of the operating budget incl. translation)

(Commission 2006). Although this relieves the RACs of the uncertainty of not knowing where future funds should come from, the amount is adjusted to make the RACs able to “*to effectively pursue their advisory role within the Common Fisheries Policy*” (Commission 2006, p. 10). Consequently, if a RAC wishes to assume a wider, more proactive role extending beyond a purely advisory, for instance by assuming a greater role in developing management plans, funding will likely remain a challenge also under the new funding scheme.

In relation to the horse mackerel process the funding issue proved particularly relevant in relation to 1) the participation of NGOs, 2) the salary and travel costs of scientists and other costs related to the additional meetings.

As briefly mentioned above, no conservation organisations took part in the development process related to the long-term management plan for horse mackerel. This was regretted by the industry stakeholders, who were of the opinion that the participation of organisations devoted to conservation would help give deserved credibility to the process and its output. Moreover, they mentioned that it was a general problem to get such participation in meetings of the Pelagic RAC. An representative of a conservation organisation (personal e-mail communication) explained to us that there are at least 3 reasons as to why the conservation organisations to some extent choose to focus on “*iconic species such as cod*”: limited time, limited knowledge and the basic fee (generally more than 1000 €) for participating in a RAC, which motivates them to concentrate their efforts in as few RACs as possible.

All of the above reasons seem on a fundamental level to have roots in the fact that the conservation organisations does not have sufficient funding available (to pay fees or travel costs, or to hire expertise) to effectively carry out the task of participating actively and productively in all the relevant meetings of the different RACs. This raises the question whether the funding situation for conservation organisations, which are increasingly recognised as legitimate stakeholder representatives under the CFP, is adequate in a situation where the RACs develop into more proactive bodies, as the horse mackerel development process might be understood as an indication of. If the conservation organisations due to lack of funding are unable to increase their level of activity in a situation where the RACs increase their level of activity, it seems necessary to review the conditions under which the conservation organisations participate.

The conservation organisations are in a qualitatively different position than the industry. Where each industry representative in a RAC defends the interests of a relatively well-defined, *specific* group of fishermen or processors - often with an interest in a limited number of RACs; each conservation organisation defends the interests of a broader and less well-defined *diffuse* group of citizens - most often with an interest in issues cutting across many or all of the RACs. Without going in detail, it seems evident that the conservation organisations are in a situation where they risk ‘spreading themselves thin’ in terms of both money and expertise if they have to step up their level of activity, for instance by participating in more meetings. The conservation representative that we corresponded with actually indicated that the conservation organisations are already spread thin as it is. Although the industry representatives also have to consider their funds, it seems likely that they - as representatives of commercial interests - are in a better position to step up activities and meeting frequency - and at least they have easier access to expertise among those they represent (for a detailed discussion of diffuse and specific interest associations in EU policy-making, see Beyers 2004).

In relation to the participation of the group of horse mackerel scientists, two funding challenges emerged: salary costs and costs of travel and accommodation. The first issue proved least problematic as the national fisheries institutes, where the fisheries scientists are employed, proved willing to bear the salary costs since participating in this process was of relevance to their work. Another explanation for this being relatively unproblematic is probably that covering their salaries was not an additional cost for the institutes as their salaries were already budgeted with. Notably, however, the scientists were not relieved of their day-to-day work to allow them to concentrate fully on the development of the long-term management plan something that had significant impact on the process, see section on Planning beneath.

Covering their travel costs was more challenging for the scientists as this constituted an additional cost that the national fisheries institutes were less inclined to cover. As a consequence, the meeting in Edinburgh in February 2007 was arranged so that these costs could be covered by the SAFMAMS project. The Scottish Executive provided meeting rooms, food and refreshments and the Pelagic RAC covered the costs of translation etc.¹³ At the following meeting in Dublin one of the lead scientists was able to get a grant from his institute to cover most of the costs for travel and accommodation for the other scientists; translation services proved unnecessary at this meeting.

Consequently, funding constituted a major challenge in the horse mackerel process; and lack of funding may very well have prevented conservation organisations from taking part in the process altogether.

Planning

In the questionnaire we sent out to the key scientists and stakeholders we asked them to tell us what they felt were the worst elements of the process as well as what they would do differently if they should do the process over again. Many of the comments we received to these questions fall under what we try to capture under the broad heading of *planning*.

Several of the scientists (1, 5 and 6) stated in their questionnaires that they felt that the development process had been a bit rushed because of the desire of the industry stakeholders to have the plan ready by July 2007 at the latest to fit it into the calendars of ICES and the Commission and thereby allow implementation of it from 2008. The resulting relatively short time between the five meetings held from February to July 2007 meant that there was little time for the scientists to work on the simulations between them. However, this was not the only problem related to the speediness of the process. Scientist 5 added that the tight schedule between the last couple of meetings in reality meant that stakeholders who were unable to take part in a meeting and/or needed documents to be translated were effectively sidelined in relation to the final discussions on the management plan. The same scientist also mentioned that it was a problem that the final draft of the management plan was never discussed at working group level due to the calendar issue and therefore presented directly by the main industry stakeholders to the Pelagic RAC Executive Committee in which not all stakeholders have a seat.

¹³ An additional RAC meeting is not free. There are significant costs related to the participation of stakeholders and scientists but also translation and other additional costs are significant in light of the limited budget of the Pelagic RAC. The average cost of translation for one additional meeting (one day, two languages) of the Pelagic RAC is 4500 € (Pelagic RAC secretariat, personal e-mail communication). On top of this come costs of travel and accommodation for the support staff from the Pelagic RAC secretariat.

The feeling of being short on time on behalf of the scientists is probably also related to the fact that the scientists had to a large extent to fit the simulation work in with all their other work, which they were not relieved of during the period. Several respondents (Scientists 1 and 6, Stakeholder 1) indicated that they believed a main problem during the process was that the scientists did not really have any devoted time for the horse mackerel management plan. A recommendation was therefore that in future processes it should be made clear that in the national fisheries institutes' commitment to pay the salary of the scientists there was also a commitment to relieve them of some other work. A similar experience of not being relieved of other work when working on tasks outside day-to-day business of the national fisheries institutes was reported by Wilson and Hegland (2005) who among other issues looked at fisheries scientists' perceptions of their own working conditions when working in the ICES advisory system. This seems to indicate that there is a specific problem in the way that national institutes structure their work in this respect - and in general a problem because the pool of expertise is limited compared to the tasks at hand. Dedicating time to the development work could enable the scientists to work more intensively, which would most likely mean that progress from one meeting to the next would become more visible. This would at least be to the satisfaction of Stakeholder 3, who expressed the feeling that it was the same things that were being discussed over and over and that the number of meetings should have been cut down.

Of other recommendations relating to planning, it is relevant to mention that Scientists 2 and 3 indicated that smaller, more interactive groups performed better than larger in term of getting an exchange between scientists and stakeholders. Generally, it should therefore be considered to break out in smaller groups when doing the development work with many stakeholders present. Moreover, Scientists 1 and 3 also indicated that the process would have benefitted from having its steps laid out in more detail from the start compared to the *ad hoc* approach, which characterised the horse mackerel process. On the other hand, as Scientist 3 mentioned, "*it was unclear what the steps were the first time around.*"

Applicability of Lessons Learned

The process that led to the adoption of the long-term management plan for western horse mackerel may serve as an inspiration for stakeholders, researchers and policy-makers in several respects. On the most basic level the successfulness of the process proves that it is possible to develop a long-term management plan and have it implemented without following the CFP standard procedure of having it developed within ICES - and that industry stakeholders can alongside scientists contribute positively and actively to the development of a biologically sustainable management plan. Besides these significant lessons, the process offers lessons in relations to a number of different more specific issues, which may be useful to keep in mind when wishing to design processes of a similar character in the future. These issue-specific lessons, which have been discussed in detail in the preceding sections, are, however, to some degree related to the specific conditions surrounding the Pelagic RAC. Consequently, it is necessary briefly to discuss what limitations in terms of general applicability it entails that the Pelagic RAC can in some respects be considered a special case.

The Pelagic RAC stands out from most other RACs due too its homogeneity. As described earlier, this provides for a setting where the involved industry stakeholders - although being fierce competitors in the market - often see eye-to-eye on issues relating to management. Some of the management issues discussed in the Pelagic RAC may also to some extent be considered less complicated because many pelagic fisheries are close to single-species fisheries as opposed to the case in several other RACs where complex mixed-fisheries issues are often relevant. Moreover, the stocks, which the Pelagic RAC deals with, are also on average in a better condition than many

stocks dealt with by other RACs. As described, this last fact - among other things - has led to a situation where conservation organisations tend to prioritise participating in other RACs over the Pelagic RAC something that also contributes to the homogeneity. Lastly, the industry stakeholders in the RAC sit there for the majority part on behalf on industry actors with a significant institutional capacity both in terms of financial resources and expertise to lift the burden of contributing to the development of something as relatively complex as a long-term management plan. In comparison we would argue that the industry stakeholders in other RACs have a more unequal institutional capacity to lift such a burden, which would make the issue of the ability of all stakeholders to be able to take part in the process on an equal footing more important there.

Given the special characteristics of the Pelagic RAC that we have described above, we believe that the process of participatory modelling within the setting of other RACs (or completely different bodies) may well prove more difficult than experienced in the horse mackerel case. On the other hand, other processes may be facilitated by better scientific knowledge on the species in question. Nevertheless, even though the framework conditions for the development process differs from RAC to RAC and from species to species, it is our opinion that knowledge on what worked well in the Pelagic RAC constitutes a useful starting point when looking for inspiration for comparable processes in different settings where stakeholders and scientists engage in participatory modelling. Particularly the problems that the Pelagic RAC encountered may be useful to bear in mind, since issues creating problems in a relatively favourable setting may very well create even larger problems in other, less favourable settings.

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Annex 1

Overview of the process and research undertaken

Date	Event	Action	Research undertaken by authors*
Process of developing the management plan			
Sept 2006	Kickoff of process	Invitation by PRAC to scientists. Consortium of scientists formed.	SAFMAMS team becomes notified of and engaged in the process.
Nov 2006	PRAC Working Group meeting	Presentation of 3 possible HCR scenarios. Presentation of questions to industry. The Commission expresses its support. Presentation of SAFMAMS.	Meeting observed, PRAC minutes and presentations studied.
Dec 2006	Preparation for February PRAC Working Group meeting	E-mail questionnaire on priorities sent to industry stakeholder representatives (questions presented at PRAC Working Group meeting, Nov 2006).	E-mail correspondence studied.
Jan 2007	Preparation for February PRAC Working Group meeting	Limited response on questionnaires. Exploration of different approaches by horse mackerel scientists.	E-mail correspondence studied, SAFMAMS team involved in discussion of approach to February meeting.
Feb 2007	PRAC meeting on management plan for horse mackerel / PRAC Working Group meeting	Update on industry priorities. Presentations of simulations on two different principles for HCR. / Decision to set up focus group with scientists and stakeholders in April to get more input from industry.	Meeting observed, PRAC minutes and presentations studied.
April 2007	PRAC Horse Mackerel Focus Group meeting	Focused discussions between scientists and key industry stakeholder representatives.	Meeting observed, subsequent e-mail correspondence studied and presentations studied
May 2007	PRAC Working Group meeting	Combined presentation of 2 possible HCRs. Stakeholder representatives asked to consider the two options. Focus group members (incl. an NGO representative) to continue discussions.	Meeting observed, PRAC minutes and presentations studied.
June 2007	PRAC Working Group meeting	Combined presentation of 2 possible HCRs. Decision by working group on management plan to fully develop and support.	PRAC minutes and presentations studied.
July 2007	PRAC Executive Committee meeting	Draft management plan presented. Formal decision to ask the Commission to have the plan evaluated and possibly implemented by ICES. Management plan subsequently sent to Commission.	PRAC minutes studied.
Process of getting the management plan implemented			
Aug 2007	Commission confirmation	Commission acknowledges management plan and forwards to ICES for evaluation	Mail correspondence studied.
Oct 2007	PRAC Working Group meeting	ICES confirms having evaluated the management plan and found it consistent with the precautionary approach for the coming 3 years. ICES recommends a TAC of 180,000 tonnes	PRAC minutes and ICES advice studied.

		for 2008, 2009 and 2010 covering <i>all</i> areas where western horse mackerel is caught (meaning not only EU waters). In the longer term several technical issues need to be addressed.	
Nov 2007	PRAC Executive Committee meeting	PRAC recommends that the Commission implements management plan and suggests an EU TAC of 180,000 tonnes (170.000 tonnes to the traditional western horse mackerel TAC area and 10.000 tonnes to the combined southern areas). A focus group should work on aligning assessment areas and management areas.	PRAC minutes studied.
Dec 2007	Council adopts TACs for 2008	Following the advice of the Pelagic RAC the Council adopts EU TAC of 180,000 tonnes for 2008 (170.000 tonnes to the traditional western horse mackerel TAC area and 10.000 tonnes to the combined southern areas).	Adopted TACs studied.
* After the process had ended an e-mail survey was carried out among key participants in the process.			

Annex 2

Questionnaire to stakeholders, January / February 2008

1. Did the group of scientists surprise you in any way by the how they acted and operated? If yes, how so?
2. What were the best elements of the process and why?
3. What were the worst elements of the process and why?
4. Were you satisfied with the way that the scientists presented and communicated their material? Why? / Why not?
5. What were (if any) your major concerns in relation to working with a group of scientists on developing a management plan?
6. How would you do the process differently if you were to repeat it?

Questionnaire to scientists, January / February 2008

1. Did the group of stakeholders surprise you in any way by the how they acted and operated? If yes, how so?
2. What were the best elements of the process and why?
3. What were the worst elements of the process and why?
4. Where you satisfied with the level and usefulness of input provided by the stakeholders? Why? / Why not?
5. What were (if any) your major concerns in relation to working with a group of stakeholders on developing a management plan?
6. How would you do the process differently if you were to repeat it?

Annex 3

Questionnaire to stakeholders on priorities, December 2006 / January 2007

1. For western horse mackerel, what average catch would you be happy with?
2. What is, in your view, the minimum and maximum annual TAC for industry viability?
3. What would be the maximum catch above which there may be marketing difficulties?
4. Is there, in your view, a ceiling on processing capacity?
5. Would you prefer a lower but stable TAC or a more variable but higher one, on average?
6. Is there, in your view, a market preference for smaller or bigger fish? How variable is this between area and fleet?