

## **PARTICIPATORY MODELLING IN EU FISHERIES MANAGEMENT: Western Horse Mackerel and the Pelagic RAC**

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*Abstract* In 2006 the stakeholders of the Pelagic Regional Advisory Council (Pelagic RAC) contacted scientists with expertise on western horse mackerel and asked them to assist the RAC in developing a long-term management plan. This article reports on that process and contributes to the knowledge of best practices for interactive processes between scientists and stakeholders. Overall, the participants considered the process, which led to the first step of the implementation of the management plan from 2008, as a considerable success. As such, the process could serve as an inspiration for stakeholders, researchers and policy-makers wishing to do similar exercises.

### **Introduction**

The Pelagic Regional Advisory Council (Pelagic RAC) is one of several RACs set up since 2004 to provide advice to the Directorate General for Maritime Affairs and Fisheries (DG MARE), the part of the European Commission that is responsible for the administration of the European Union's (EU) Common Fisheries Policy (CFP). RACs are stakeholder fora consisting of representatives of the fishing industry, conservation groups and other marine fisheries stakeholders. Two thirds of the seats in the RACs are allocated to the fisheries sector and one third to other interests.

In the late summer of 2006 the Pelagic RAC contacted scientists with expertise on horse mackerel and asked them to assist in developing a long-term management plan for western horse mackerel. The stakeholders on the RAC were in doubt about whether the western horse mackerel stock was being harvested optimally and suspected that the development and adoption of a management plan was not a priority for the fisheries managers in DG MARE. Moreover, the Pelagic RAC wished to explore ways to develop management plans by stakeholder consensus, rather than waiting for a plan to arise from the International Council for the Exploration of the Seas (ICES).

What emerged from this initiative was an interesting process from several perspectives. The first is simply as a programmatic way to circumvent the usual cumbersome procedures of the CFP that result from it being the only serious effort on the planet to directly manage fisheries at a continental scale. As such it offers

lessons and cautions for the upcoming 2012 CFP reform.

More than that, it represents an experiment with emerging ways of carrying out science, and may therefore hold lessons valuable beyond the CFP. Fisheries and marine management is a good example of science being performed in a context of high stakes and high uncertainty. Western horse mackerel, the subject matter in this article, is a valuable commodity targeted to a great extent by very large fishing vessels. To exemplify this, the newest such vessel, to be launched in Denmark (though not targeting horse mackerel) is said to represent an investment, including both the vessel itself and the fishing rights needed to keep it in business, in the order of one hundred million dollars.

Identifying a sustainable level of harvesting for western horse mackerel is quite an uncertain business where common assessment procedures, for various reasons, do not apply. 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; ICES 2006). Although western horse mackerel is one of the best studied horse mackerel stocks worldwide, the scientific knowledge base relating to it remains limited. The relationship between size and age shows much overlap between juveniles and adults. Consequently it is difficult to separate mature fish from juveniles based on size alone. Western horse mackerel is, moreover, considered an indeterminate spawner, meaning that the total number of eggs produced by an individual depends on factors that can change during spawning. Spawning also takes place over an extended spawning season. This implies that an otherwise potentially useful assessment methodology, the annual egg production method, is not applicable to horse mackerel. Furthermore, western horse mackerel recruitment is highly spasmodic; the 1982 year class was more than twenty times the average and the 2001 year class is considered much above average (Clarke *et al.* 2007; ICES 2006). The only data systematically available for management purposes are triennial egg abundance surveys, data on catches and on catch-at-age. As a consequence, the spawning stock biomass, recruitment and fishing mortality rate ( $F$ ) cannot be reliably estimated and there are no defined reference points for those values (Clarke *et al.* 2007).

## Research Process

We studied the development process of the management plan for western horse mackerel by means of several research strategies. We 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. For the two meetings we could not attend, we have benefited from information from a stakeholder representative with whom we were collaborating. Besides these observations we have had access to minutes, presentations and papers from all RAC meetings, as well as to significant amounts of e-mail correspondence between the involved horse mackerel scientists. Finally, after the development process ended, we administered an

e-mail survey among key participants in the process. The questionnaire asked how they saw the process in retrospect. We distributed the questionnaire to six scientists and five stakeholder representatives and received six and three answers respectively.

Moreover, the research process has contained elements of 'action research', where the researcher assumes a position of participant, as opposed to only an observer, in a change process – and at the same time observes and researches the process to gain new knowledge of the social mechanisms of the process (Hegland *et al.* undated). The EU sponsored SAFMAMS research project<sup>1</sup> provided an avenue of cooperation between us and the Pelagic RAC. This was related 1) to the ability of SAFMAMS to help set up a Pelagic RAC meeting on the horse mackerel management plan in February 2007; and 2) the involvement of SAFMAMS researchers in discussions on the limited response to a questionnaire presented by the group of horse mackerel scientists to the stakeholders.

### Science and Participatory Modelling

Scientists involved in supporting policy often find themselves required to deal with uncertainty in contexts where the stakes are high as is the case with western horse mackerel. In this situation scientists are moved beyond their training and, sometimes, even their understanding of what it means to do 'science'. They refer to science carried out under these conditions as 'post-normal' science.

Funtowicz and Ravetz (1990) develop two important ideas about how scientists can aid, and be aided, in dealing with these situations of high stakes and high uncertainty. The first is the concept of the 'extended peer community' as a way to guard the quality of science. To deal with new problems in a high uncertainty and high stakes area an open dialogue or 'extended peer review' is needed. The idea of the extended peer community is close to, but not synonymous with, stakeholder involvement in science. Stakeholder involvement in science, as it is broadly understood, includes issues beyond the questions of quality control, such as how science comes to reflect social values, priorities, and ethics. The idea of the 'extended peer review' focuses on the more limited issue of stakeholder involvement and scientific quality control. The extended peer community is made up of the various groups who have perspectives on policy and their own knowledge to contribute. Ravetz (1999) argues that effective science-based policies in arenas of high stakes and high uncertainty require an open dialogue with all those affected. The extended peer community is primarily about quality control, but this quality control extends beyond simply ensuring the scientific credibility of results, it also extends to the relevance of the result for the policy process and the legitimacy of the results as something which is perceived as emerging from a fair and unbiased process.

The other important concept is the contrast between 'knowing-how' and 'knowing-that'. Traditional science has seen itself basically as the second, but post-normal science requires a new emphasis on the first. Within the high stakes, high uncertainty context it is scientific skills in respect to providing 'rubrics, guidelines

and elicitation procedures, for the expression of uncertainty, for the assessment of quality, and also for the training in both skills' (Funtowicz and Ravetz 1990:68) that come to the fore. Scientists are not trained to be consultants but it is the skills of the consultant that are required here. These are the skills to work with policy makers and other stakeholders in a process linking the uncertainty and quality of the information with the needs of the policy. They point out that where experts in consulting professions normally have very long practical, apprentice-type training (for example doctors) after their formal educations, scientists generally do one major research project under supervision and are then certified as able to operate as independent scientists. They argue that the ideas of skill and craftsmanship can be the basis of a way to reformulate the 'science boundary', that is the line drawn by various social processes between what is and is not science and who is and is not practicing science, in areas of high stakes and high uncertainty (Funtowicz and Ravetz 1990).

Scientists are often able to model the environmental risks of activities such as fishing and provide probabilistic estimates of uncertainty, whereas the acceptable level of risk and the setting of management objectives – while they have important scientific elements – are not strictly scientific issues. One important expression of 'knowing-how' within an extended peer community, therefore, is 'participatory modelling'. Sometimes also referred to as 'co-modelling' (Levrel *et al.* 2009), participatory modelling is an interactive process in which stakeholders and scientists work together choosing and modelling various scenarios linking policies and outcomes. Various modelling approaches, including multi-agent system modelling, Bayesian modelling (Boulanger and Bréchet 2005), bio-economic fisheries models (EFIMAS 2008) and, as in the present case, simple stock assessment models, have been used as the basis of participatory modelling. Experience in several science-based policy arenas has shown that participatory modelling can allow decision makers and other interested parties to help scientists to choose the most useful simplifications of reality. Because the focus of the discussions is on crafting carefully coordinated strategies rather than horse-trading options into a lowest common denominator strategy, less time is spent battling over fundamental values (Andrews 2002). An important aspect of participatory modelling is that it forces stakeholders to clarify their objectives and explicitly address the trade-offs implied by various strategies (Wilson and Pascoe 2006).

The present article documents the process of participatory modelling as it emerged around the management of western horse mackerel. We begin by shortly describing the institutional context in which the participatory modelling took place. We turn next to the flow of the participatory modelling process itself. Then we discuss a series of practical and procedural issues that emerged, before offering a conclusion.

## **Institutional Setting**

In the EU western horse mackerel is managed under the CFP, which is as a policy framework extraordinarily dependent on scientific information in order to func-

tion (for details see Hegland 2006). The core element of the CFP is a system where total allowable catches (TACs) – being quantitative limits (expressed in tonnes) on landings – for individual stock units are decided on and allocated to the member states on an annual basis, usually based on advice coming from ICES. ICES, however, cannot always take on *ad hoc* tasks or respond as quickly as desired by DG MARE. 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. These issues have led to a situation where the almost *de facto* monopoly of ICES on providing scientific advice has increasingly been questioned and DG MARE has invested in creating its own capacity for this. In the case of the horse mackerel management plan ICES functioned as a final reviewer of the plan as opposed to being instrumental in the development of it.

The CFP and the TAC system has continuously failed to provide either biological or economic sustainability. In light of the poor condition of many stocks in EU waters, DG MARE 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 (see for instance Hegland and Raakjær 2008). A key element in several 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 state of the stock is in principle directly determining the size of the TAC. This, of course, makes the principles underlying the HCR of utmost importance to all stakeholders.

RACS were created by DG MARE as purely advisory bodies as a tentative step, taken within the most top-down command and control fisheries management regime in the developed world in connection with the 2002 CFP reform, towards more stakeholder participation in developing fisheries policy. The idea is that the stakeholders on the RACS will come to a consensus about fisheries management and policy issues and this will allow DG MARE to weight the political advantages of following the RAC’s consensus against any differences between the consensus and other preferences of DG MARE. The RACS are from the outset provided by DG MARE with a small operating budget, which does not include funds to cover the considerable time that stakeholder representatives spend on RAC work. There are also no RAC funds for scientific advice. If RACS want scientific information they are expected to ask DG MARE, and if DG MARE agrees a request for the information will be passed 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. Arguably the RACS face a number of problems, but they hold at least the seeds of a possible future EU fisheries co-management system (Symes 2007).

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 specific pelagic species (for example horse mackerel) in *all* EU waters. In contrast, all but one other RAC, the long distance RAC, provide advice on management

issues relating to a specific region. Despite the broad geographic coverage of the Pelagic RAC, it remains relatively homogeneous in relation to the composition of stakeholders from the catch sector, which was in reality the only active stakeholder group in relation to 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. This is particularly the case for stakeholders from the Northern European countries, which are the most important in relation to western horse mackerel. 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, many of 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.

### The Management Plan Development Process

In 2006 the Pelagic RAC catch sector stakeholders with an interest in western horse mackerel came to the conclusion that the development of a management plan for this stock would not take place for a long time unless they themselves instigated the process. The key stakeholders were of the opinion that the stock was being harvested in a suboptimal way and that the development of a long-term management plan could lead both to more sustainable fisheries and higher average catches. As a consequence, the Pelagic RAC contacted scientists with expertise on horse mackerel and invited them to assist. 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 (WG) meeting in Brussels in November 2006, when the idea of developing a long-term management plan for horse mackerel was presented publicly for the first time, the DG MARE representative confirmed that a management plan for western horse mackerel was not a high priority in DG MARE. Moreover, the representative informed the Pelagic RAC that DG MARE leaned towards proposing a cut in TACS for horse mackerel 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. DG MARE welcomed the suggested efforts by the industry and indicated that if the efforts were genuine DG MARE would reconsider its stand on the TAC question (PRAC 2006). At the same 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 decided to aim 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, which the scientists felt that it would be helpful that the industry answered. These questions related to issues of stability versus flexibility

of TAC, the acceptable range of the TAC, the preferences of the market in relation to sizes et cetera (Clarke 2006). The response from the industry to the questionnaire, however, was limited and came in too late to really aid the preparatory work of the scientists in advance of the following meeting (Clarke 2007).

At the next meeting in February 2007 in Edinburgh two detailed presentations of the results of simulations on five different HCR scenarios were held. The meeting allowed the first substantive discussions between scientists and industry stakeholders. However, considering the limited response from the industry to the questionnaire that had been distributed and the need for more in-depth discussions particularly on the question of the HCR, it was decided that the best way to go forward was to set up a meeting between the key stakeholders from the industry, the horse mackerel scientists, and the Pelagic RAC as organiser and convener. At the February meeting the DG MARE representative 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).

The following meeting with only key stakeholders present took place in April 2007 in Dublin and 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). However, differences in the two presentations made it difficult to compare the performance of the HCRs. The outcome of the discussion at 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 following Pelagic RAC WG meeting (Clarke *et al.* 2007). To facilitate a targeted discussion, the key stakeholders considered it – in the light of the experiences from the February meeting – important to reduce the number of different HCR scenarios before presenting them to the entire group of stakeholders for decision.

As it turned out, one single presentation comparing the simulated performance of two fundamentally different HCR scenarios was held at the Pelagic RAC WG meeting in May 2007: 1) a hybrid between a constant yield and proportional catch strategy (referred to as the 'slope strategy'); and 2) a 'modified constant yield strategy'. Under the 'slope strategy' the coming three 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 nine years (three 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 spawning stock biomass; notably this strategy demands an assessment (Kelly *et al.* 2007; Clarke *et al.* 2007; Roel and De Oliveira 2007).

As the members of the Pelagic RAC needed to discuss the implications with their home constituencies, the final discussions and a decision on what elements

and HCR to include in the long-term management plan were taken at the Pelagic RAC WG meeting in June 2007. Here it was decided to go with the slope strategy (PRAC 2007d), which did not demand a full assessment to be carried out. Although long-term average yields were quite similar in the two simulations, the slope strategy did not impose any limit on TAC variation (Kelly *et al.* 2007; Scientist Two). The final draft of the plan (PRAC 2007c) was formally adopted by the Pelagic RAC Executive Committee in July 2007, after which it was passed on to DG MARE 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 procedures, ICES found it to be in accordance with the precautionary principle – initially for a period of three years (PRAC 2007b; ICES 2007).

## Emergent Practical and Procedural Issues

### *Scientist/Stakeholder Interactions*

Fisheries scientists and industry stakeholders approach modelling from different perspectives. Scientists want accurate scientific models; industry stakeholders are concerned with practical output rather than accuracy. 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 input from the industry seriously, then the cooperation will not be fruitful.

In line with this concern, Scientist One responded to our questionnaire that prior to the process he<sup>2</sup> had been '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 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 Four 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 argue particularly hard in favour of having pulse recruitment included in the models even though this would have provided a potential for higher short-term yields as it would have been possible to 'count' on the future occurrence of a pulse recruitment event when setting the TAC. The scientists did at an early stage discuss how to incorporate pulse recruitment in the simulation work but left the idea along the way with reference to the infrequency of the events (Scientists' e-mails, January 2007; Kelly *et al.* 2007). 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 revisited – the precautionary way to incor-

porate pulses (PRAC 2007c).

Although the general picture is that the industry did not seek to push the limits of the precautionary approach, our questionnaire revealed that at least Scientist Two 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.

Here clear differences arise between the two groups about the basic meaning of using science to support policy goals. The same scientist also indicated that he does not 'think stakeholders are particularly concerned about the science and that is a concern'. Industry stakeholders were reluctant to take decisions based on the 'quality' of the models alone. They wanted to know the policy implications up front, that is to see the implications of various HCRs for the size of the TAC. The scientists, however, would have preferred that the stakeholders could make a decision about an HCR '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. But what needs to be understood here is that these 'scientific merits' are to a large extent about the application of the precautionary approach, which is itself a political decision often packaged as a scientific one. Given the general commitment of fisheries scientists to the precautionary approach and that the process includes an independent scientific evaluation – in this case by ICES – after the management plan has been developed, the experience from this case suggests that the industry stakeholders will not risk trying to push the limits of the precautionary approach.

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 'judge the scientific merits of various schemes' (Scientist One). 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 process was not characterised by significant problems related to the communication of science. This challenges the common idea (Pálsson 1995; Roepstorff 2000, Smith 1995) that scientists and fishers have problems communicating because of cultural differences, an idea that has also been qualified by earlier research by one of the present authors (Wilson 2003). However, the pelagic fishery is a large and important industry and these particular fishermen – or fishermen's representatives – are highly sophisticated managers, which suggests that there may be less of

a cultural gap here than would be found in smaller scale fisheries.

It turned out to be more challenging to find effective tools for feeding 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. The scientists drafted early in the process a questionnaire for the Pelagic RAC stakeholders but the responses to that came in late and only after several reminders. Moreover, although the answers were in some respects useful they were in other respects lacking and, notably, one major industry player did not answer at all (Clarke *et al.* 2007). The hesitance of the industry might be related to two issues: 1) the nature of the questionnaire as a communication tool and 2) the nature of the questions posed. The questionnaire as a communication tool demands written answers. Based on the experiences from the meeting in April with only key stakeholder representatives present, it seems that they were more comfortable discussing freely within their mandate compared to having to consult their members to be able to provide a fixed answer to a question. Moreover the face-to-face discussion gives the involved parties the possibility to add 'off the record' explanations to answers. Most importantly, simply, may be that the industry actors are culturally accustomed to meetings, not to questionnaires. In relation to the nature of the questions one industry stakeholder (Personal communication) argued that they had been too 'concrete' without developing further what that meant. A reasonable interpretation could be that the industry stakeholders were uneasy about answering – for example about the acceptable size of TAC – without really having a clear idea of how their answers would be used in the process.

In response to the partly failed questionnaire, it was at the meeting in February 2007 agreed that the 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 where many attendees had only marginal interest in horse mackerel. The experiences relating to the meeting in February and the partly failed questionnaire led thereby to the decision to set up a group consisting of the scientists and the key stakeholders. This turned out to be a good strategy and several respondents suggest that this strategy could be employed in future processes. However, it should also be noted that some insights did come out of the responses to the questionnaire, for example the emphasis on stability of TAC, which seems to indicate that a questionnaire may be useful, as well, but not as the only communication tool.

#### *Role of ICES*

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 DG MARE – the main argument for developing the management plan within the Pelagic RAC. In our questionnaire Scientist Five compares the RAC process to the traditional process, which he argues to be overly bureaucratic 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.

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, which may also add to the explanation of the 'communication success' described above. Consequently, pushing the limits of the precautionary approach or in other ways challenge ICES' standard norms would jeopardise the approval and implementation of the management plan. Moreover, having the plan turned down in ICES would discredit the Pelagic RAC and the scientists involved. Consequently, the presence of ICES as a final reviewer of the plan probably functioned as a disciplinary measure particularly *vis-à-vis* the industry stakeholders. Although the scientists and the stakeholders were formally on an equal footing in the development process, the plan would eventually have to go through a strictly scientific review process, which may have inspired the industry stakeholders to conform more to scientific norms than they would otherwise have.

### *Funding*

The RACS have recently been accepted as 'bodies pursuing an aim of general European interest', which has entitled them to a permanent budget (Commission 2006). Although this relieves the RACS of the uncertainty of not knowing where future funds should come from, which was a concern under the earlier arrangement where the initial 'basic' EU funding was decreasing year by year, the amount under the new scheme is adjusted to make the RACS able 'to effectively pursue their advisory role within the Common Fisheries Policy' (Commission 2006:10). Consequently, if a RAC wishes to assume a wider, more proactive role extending beyond the purely advisory, for instance by assuming a greater role in developing management plans, funding will likely remain a challenge.

It is noteworthy that no conservation organisations took part in the development process related to the long-term management plan for horse mackerel. A representative of a conservation organisation explained to us that there are at least three reasons why conservation organisations choose to focus on 'iconic species such as cod': limited time, limited knowledge and the basic fee (generally more than 1,000 Euro) for participating in a RAC, which altogether motivates them to concentrate their efforts in as few RACS as possible. Consequently, it seems that the conservation organisations do not have sufficient funding to participate productively in the relevant activities. This raises the question whether the funding arrangement for conservation organisations is adequate if the RACS develop into

more proactive bodies. 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 RACS (for a detailed discussion of diffuse and specific interest associations in EU policy-making, see Beyers (2004)).

In relation to the 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. 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 costs of the scientists were covered in an *ad hoc* fashion by such sources as the SAFMAMS project, the Scottish Executive, the Pelagic RAC itself and the various institutions where the scientists worked.

### *Planning*

Several of the scientists felt that the process had been rushed because of the desire of the industry stakeholders to have the plan ready by July 2007 to allow implementation by 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 Five 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 but was presented directly by the main industry stakeholders to the Pelagic RAC Executive Committee in which not all stakeholders have a seat.

The scientists' feeling of being short on time is probably also related to the fact that the scientists had to fit the simulation work in with their other work. Notably, although the national fisheries institutes paid the salary, the scientists were not convincingly relieved of their day-to-day work to allow them to concentrate on the development of the long-term management plan. Several respondents indicated that they believed a main problem was that the scientists did not have sufficient time allotted for the horse mackerel work. A recommendation was therefore that in future processes the national fisheries institutes' commitment to pay the salary of the scientists should also include a commitment to relieve them of other work (see also Hegland and Wilson 2009).

### *Science/Management Discrepancies*

For EU TAC management purposes one sea area (ICES area VIIIIC north of Spain in the Bay of Biscay) that is covered by the western horse mackerel stock assessment is traditionally combined with another sea area (ICES area IXA covering the waters off the west coast of Spain and Portugal) covered by the assessment for southern horse mackerel. The TAC and quotas set for horse mackerel in the combined southern areas include thus both southern and western horse mackerel.

This issue caused considerable debate since the Spanish, Portuguese and to a lesser extent French fishermen, who target horse mackerel in the southern waters, were concerned that the proposed management plan could set a problematic precedent for them in terms of size of quotas and where to catch quotas (Clarke 2007; PRAC 2007a; PRAC 2007f). The communication between the scientists, the fishermen fishing in the northern EU waters and the fishermen fishing in the southern EU waters was somewhat complicated by the need for translation of the English presentations and discussions into French and Spanish. Moreover, as mentioned earlier, the tight schedule towards the end of the development process meant that there was insufficient time to have key documents translated into the relevant languages to allow all stakeholders to participate in the discussions on an equal footing. Nevertheless, the issue was settled with assurance from the WG chairman stating 'that there was no intention to interfere with the relative stability<sup>3</sup> for horse mackerel and that he envisaged the present horse mackerel areas being maintained' (PRAC 2007e).

Another issue concerned how to handle the at times substantial, unregulated Norwegian fishery for western horse mackerel north of EU waters (ICES areas IVA and II covering the northern North Sea and the Norwegian Sea). This fishery developed in response to western horse mackerel spreading northwards after the large year class of 1982 (Roel and De Oliveira 2007) and to be able to implement the management plan, which according to its general provisions is designed to cover the *entire* distribution area (PRAC 2007c), some sort of political understanding would need to be established between the EU and Norway. Historically the TAC for horse mackerel covers only the EU zone. Nevertheless, during the development process various ways of approaching the issue in the management plan were aired. The horse mackerel scientists were in relation to this concerned about the risk of being dragged into discussions on non-scientific management decisions and seemed in this situation determined to protect the 'science boundary', which was potentially being put under pressure by stakeholders wanting science to provide answers of a political nature. This was discussed by the scientists over e-mail in January 2007 where one scientist wrote the following:

The TAC management and division to quotas both spatially and nationally is really an issue for the industry and managers to solve. We have a stock definition (from HOMSIR [Horse Mackerel Stock Identification Research, an EU fifth Framework research project], the findings of which are unlikely to change) and the data for the abundance (egg survey) and outtake from this area; we can therefore simulate management tactics for this as a single area. There is no spatial dimension either in the assessment or in the

simulation (at least the one [name of scientist] and [name of scientist] are working on), so we can't provide the workshop with any information on how a stock TAC might be managed spatially. If this is the case for [name of scientist] also then we should make this crystal clear to the industry before the question arises.

Consequently, the management plan developed in the Pelagic RAC covers the *entire* area where the western horse mackerel stock is distributed and provides a method on how to set a sustainable TAC for that area – and notably *not only* for the part of the EU waters where the western horse mackerel TAC traditionally applies. This means, as it is stated in the management plan, that a general provision for the plan is that '[a] unified management regime across all areas where the stock is distributed' (PRAC 2007c) is in place. Whereas the EU is in a position to solve the issues related to the southern areas on its own, the same is not the case in relation to the Norwegian catches.

In practice ICES advised in late 2007 – on the background of the full implementation of the management plan – that a TAC of 180,000 tonnes for 2008, 2009 and 2010 would be sustainable (PRAC 2007b; ICES 2007). Subsequently, however, the general provisions of the plan have not been lived up to, as no unified management regime has been agreed on. Nevertheless, the EU adopted a TAC of 180,000 tonnes covering EU waters only<sup>4</sup> which ignores the possible Norwegian catches outside EU waters. The level of the western horse mackerel TAC has been decided according to the HCR but for a smaller area than that envisioned by the management plan. One of the horse mackerel scientists, in a personal e-mail to us, evaluated the situation like this:

What has happened politically is that the RAC have decided to take the results of the simulation (in terms of catch) and apply them to the EU *only*. When we warned them that if they did this, either Norway would have to have a zero catch or the conditions of the risk perception in the HCR would be violated, they said they would deal with this at a political level and that the scientists did not need to consider themselves further with the problem.

However, the same scientist also emphasises that the Pelagic RAC and DG MARE as a result of the development of the management plan are starting the work on aligning the assessment and management areas for horse mackerel; something that ICES has advised being done for the last several years.

## Conclusion

Although the Pelagic RAC to some degree stands out among RACs, mainly due to the relative homogeneity between and large institutional capacity of the industry stakeholders as well as the relatively healthy stocks that the RAC deals with, we believe that the horse mackerel process nonetheless offers a number of useful

lessons for stakeholders, scientists and policy-makers as well as insights to the knowledge behind participatory modelling.

On the most basic level the positive end result suggests that it is possible to develop a long-term management plan without following the CFP standard procedure of having it developed within ICES – and that industry stakeholders are alongside scientists able to contribute positively and actively to the development of a biologically sustainable management plan. Besides these very general insights, however, the process offers lessons in relation to a number of practical and procedural issues, which may be useful to keep in mind when wishing to design processes of a similar character in the future. These issues have been detailed in the preceding sections. Beneath we outline some more general crosscutting lessons.

While recognising that the Pelagic RAC may represent an extreme case in respect of variable institutional capacity between the industry stakeholders and other interest groups, it still seems that this imbalance represents a challenge on a more general level in processes of participatory modelling – at least if the exercise shall extend to all legitimate stakeholders. As evidenced by the horse mackerel case, conservation groups, primarily representing diffuse interests, find it difficult to stretch their resources and expertise to the entire range of issues and arenas that potentially is of relevance to their objectives. As a result these groups opted out of the horse mackerel process to focus their attention on issues with higher public impact factor; the process of interaction between stakeholders and scientists became in this case effectively a process of interaction between industry stakeholders and scientists. Although this does not *per se* disqualify a process, it still casts a shadow over it and must stand as a source of concern in relation to the potential of participatory modelling as the new way of formulating policy in science dependent policy areas. The legitimacy of the output of participatory modelling in the policy process will be lower if some stakeholder groups are prevented from participating. Arguably, although industry stakeholders have a more direct stake in issues relating to the resources they base their business on, most conservation groups seek – at least ideally – to serve less direct but still legitimate interests of a much wider constituency. It seems likely that the issue of the variable institutional capacities of the different stakeholders is something that may need to be approached by the legislators, in this case the EU and the member states, possibly by making funding available to stakeholder groups participating in similar targeted policy support actions with scientists.

A related question is an ongoing discussion in European fisheries management about the placement of the burden of proof on fishing activities (Lassen *et al.* 2008). If the industry stakeholders were required to show that they are meeting standards of sustainability as a condition of their license to fish then the stakeholders with revenue from fishing would be funding part of the scientific process and its public review. In the current situation the public is setting the limits on fishing, demonstrating that these limits meet standards of sustainability, as well as funding the monitoring of the fishing activities. If the burden of proof were reversed the public would be responsible only for setting the standards of sustainability.

The participation of scientists represented another side of the resource and funding problem. The scientists in this process found themselves having partly to

base their participation on creative *ad hoc* funding sources, which hardly constitutes a useful permanent model, and they had problems fitting the involved work with other tasks. Consequently, as long as the RACS (or other science dependent actors) are unable to fund the scientific expertise needed to develop a proactive role and strengthen the upstream processes in policy formulation under the CFP – then their contributions risk lacking in quality. Anyway, in relation to fisheries scientists a possible solution to this problem has to take into account the general shortage of qualified manpower within this field. The way forward must therefore also involve a rethinking of the policy design of the CFP, which has created a demand for scientific support that exceeds the available capacity.

An additional issue relating to the participation of scientists in modelling exercises and policy making with stakeholders was the events following the development process. As described, the Pelagic RAC recommended a TAC of 180,000 tonnes and the EU later adopted the same TAC on the background of the chosen HCR. However, this happened *without* taking into consideration that the HCR was only sustainable in so far that certain basic conditions had been met (particularly a solution to the issue of Norwegian catches), which was *not* the case by 2008.<sup>5</sup> There is, of course, nothing new in the fact that scientific advice is not followed in a precise manner when it comes to policy because it is only one of several things policy makers must consider (Wilson 2009). However, when scientists have been involved in close cooperation with industry stakeholders on creating a joint product, it does not seem unreasonable to require that stakeholders do their utmost to respect the result arrived at when manoeuvring in the political system. If loyalty to the integrity of the joint product cannot be expected, then there is a risk that scientists try to re-isolate their science from stakeholder influence to avoid being taken hostage to unsustainable application of joint products. Although probably aware that this will not lead to more useful science, the scientists can more easily renounce responsibility for unsustainable policy decisions and protect the science boundary in that way.

One could speculate if the Pelagic RAC had been more cautious in its recommendations, if the plan had *not* been reviewed by ICES but rather had been a direct output of the participatory modelling process. The fact that ICES functioned as a final reviewer may have served to ‘mentally allow’ the industry stakeholders in the Pelagic RAC to resort to ‘business as usual’ when the advice came out, as it was no longer ‘their’ advice. This also highlights the role that conservation organisations can play in the process. That the advice of the Pelagic RAC was in fact not in line with the management plan was not evident without in-depth knowledge of the process, which no conservation organisations had; hence they could not assume the role as whistle-blower.

Keeping the concerns expressed above in mind, carefully designed processes of participatory modelling can assist us in understanding and clarifying the science boundary in situations of high stakes and high uncertainty. Such processes cannot separate science from politics, because in environmental policy such separation is an illusion. What they can do is to provide a mechanism for making the distinction a bit clearer between discussions of fact and discussions of values and interests. Doing so increases the transparency of negotiations and builds

more rational communications that can lead to stronger mutual understandings of the situations being addressed. This can aid in reaching greater sustainability and fairer compromises.

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## Notes

- 1 For details see [www.ifm.dk/safmams](http://www.ifm.dk/safmams).
- 2 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.
- 3 Simply put, the principle of 'relative stability' ensures under normal circumstances each EU member state a fixed share of the -- to any time -- agreed TAC for an individual stock unit. Originally these shares were agreed with reference to: 1) historic catches, 2) special provisions for fisheries dependent, coastal communities, and 3) compensation for losses in catches in third countries' waters after the adoption of 200 miles exclusive economic zones in the mid-70s.
- 4 The EU TAC decision entailed a TAC of 170,000 tonnes for the traditional western horse mackerel area but does not mention specifically that the remaining 10,000 tonnes *vis-à-vis* the advice were included in the TAC set for the southern areas (Council 2008). However, that this was in fact the case seems to be indicated by a statement by Commissioner Joe Borg indicating that the Council decided to follow the advice of the Pelagic RAC in relation to the TAC for the traditional areas (Directorate-General for Maritime Affairs and Fisheries 2007). The advice for a 180,000 tonnes TAC from the Pelagic RAC was divided in two: 170,000 tonnes to the traditional western horse mackerel TAC area and 10,000 tonnes to the combined southern areas (PRAC 2007g) -- possible Norwegian catches were ignored.
- 5 In fact, DG MARE advised a lower TAC than the RAC, possibly in recognition of the fact that the management plan as a whole could not be implemented in 2008 (Commission 2007).

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