



Editor's Choice

What hat are you wearing? On the multiple roles of fishery scientists in the ICES community

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Trends towards a more participatory agenda in policy-relevant science imply that the roles and work tasks of scientists become more multifaceted. In Europe, the increased use of multiannual plans creates a need for fishery scientists to contribute with their expertise in a wide variety of situations. We identify and characterize four roles for scientists as *developers*, *reviewers*, *judges*, and *messengers* in arenas where management plans are produced and evaluated. Using examples of producing and evaluating management plans for pelagic fish stocks in Europe, we present different scientific roles and how they may intertwine. The examples illustrate that fishery scientists increasingly interact with advisory councils and industry stakeholders when performing roles as developers and messengers. The roles as reviewers and judges are typically affiliated with evaluation processes carried out under the auspices of the marine science and advisory organization International Council for the Exploration of the Sea (ICES). While it may be difficult to separate the roles in practice, we argue that it must be emphasized to be aware of their different requirements to ensure that scientific credibility is not compromised. By asking the question “What hat are you wearing?”, we encourage individual fishery scientists, their employers, and ICES as a network organization of expertise to reflect on roles, affiliations, mandates, and possible consequences of wearing different “hats”.

Keywords: common fisheries policy, credibility, fishery management, fishery science, institutions, legitimacy, science – policy interface, stakeholder participation, transparency.

Introduction

The role of science in society is changing and, therefore, so is the role of scientific institutions (Gibbons *et al.*, 1994; Latour, 1998; Latour, 1999; Nowotny *et al.*, 2001; van der Sluijs *et al.*, 2008; Gluckman, 2014). Individual scientists are affected by this change. Formal and informal conventions have developed through a history to shape expectations about how a scientist should act. According to Robert Merton's classical “ethos of science” (Merton, 1996), good science is guided by the principles of universalism, communism, disinterestedness, and organized scepticism. These norms correspond to a view that science is at its best when it is not disturbed—

or “corrupted”—by external influences, and reflects the ideal of science as an “independent republic” (Polanyi, 1962). If it ever was, however, science is no longer pursued in isolated academic “ivory towers”. More open and diverse forms of knowledge production have emerged, captured by the concepts “mandated science” (Jasanoff, 1990), “Mode 2 science” (Gibbons *et al.*, 1994; Gibbons, 2000), and “Post-Normal Science” (Funtowicz and Ravetz, 1993). In contrast to viewing science as a value-free, curiosity-driven, and an independent pursuit of knowledge, these concepts refer to types of scientific knowledge production that result from a closer interaction with public and private interests in society. Such

interests have an increasingly important role in defining what is to be researched and how research is carried out. The development can be noted through, for example, the consolidated role of research funding agencies (Rip, 1994), privately funded and prioritized research (Rabeharisoa and Callon, 2002), and the active merging of different types of knowledge from a wider pool of experts, including citizens and stakeholders, as denoted by the term “participatory research” (Cornwall and Jewkes, 1995). These trends lead to the formation of new operational spaces where societal and scientific problems are framed and defined, and solutions negotiated (Metze, 2010).

In this Food for Thought article, we draw attention to implications of these societal trends towards more diverse forms of knowledge production in the context of fishery scientists and the International Council for the Exploration of the Sea (ICES). ICES is an international organization that develops science and advice to support the sustainable use of the oceans (www.ices.dk). ICES provides scientific advice to its 20 member countries and to client commissions and plays a key role in the science–policy landscape in Europe [see Stange et al. (2012) for a description of the ICES organizational structure and function].

We use the development of management plans for pelagic fish stocks in Europe to illustrate how individual scientists and ICES get involved in various roles as such plans proceed from idea towards implementation. We identify and describe four roles: the *developer*, the *reviewer*, the *judge*, and the *messenger*. Our interest in this topic emerged within the ICES Working Group on Marine Systems (WGMARS) when this group was tasked with analysing management strategy evaluations and management procedures. WGMARS’ investigations shed light on the diversity of practices in such contexts regarding stakeholder participation, quality assurance, and documentation of procedures. In this article, we focus on the multiple roles taken on by individual scientists in work related to developing and evaluating management plans and draw attention to possible tensions and conflict of interest that might occur. The word “hat” is used here as a metaphor for many different possible combinations of roles, tasks, affiliations, and mandates a scientist might have (Figure 1). The hat metaphor is commonly heard when fishery scientists in Europe request, state, or communicate a clarification of the role an individual takes on when engaging in a debate or a collaboration, raising the question “What hat are you wearing?” or making statements such as “I am wearing the hat of . . .”, followed by the scientist’s institutional affiliation, sometimes combined with further specification of a mandate or a task.

Our aim with this article is twofold. First, we argue that it must be emphasized that institutions, such as ICES, which deliver scientific advice for policy, are aware of, and reflect on, how their operations are affected by societal changes that influence how science is produced and used in support of planning or policy-making. It must be emphasized that it is not the trend towards more participatory knowledge production *per se* that causes potential tensions or conflict of interest for scientists in various roles. It is, for example, always good practice for scientists to be transparent about their funding sources and never good practice to ask scientists to review their own work. These issues need to be addressed in all scientific processes and are not unique to participatory research efforts or to the making of management plans. Our second aim is to highlight and acknowledge the efforts of fishery scientists in the ICES community who have explored new territory by responding to calls for participatory knowledge production. Their experiences are valuable and can inspire others who are challenged to take on similar tasks.

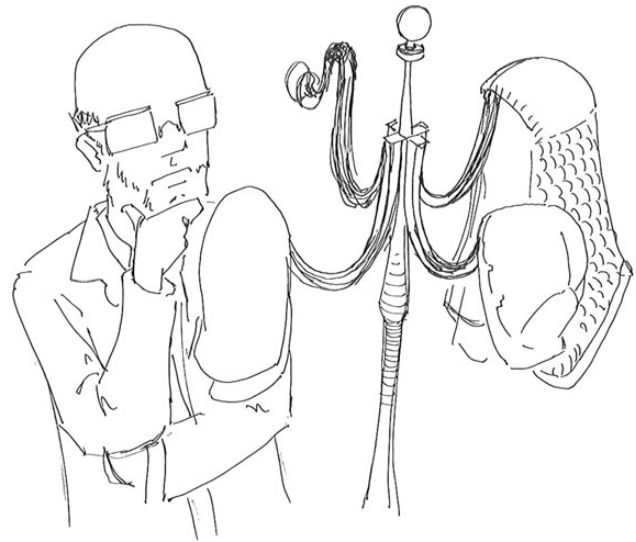


Figure 1. The individual on the left is pondering the plurality of roles that can confront scientists who are working on policy-relevant science. On the right is a hat stand. Each hat represents a metaphor for the roles themselves. In our definition, roles are dictated by the combination of mandates, affiliations, and work tasks that come together to create different hats. In this illustration, we see depictions of a *developer's* construction hat, a *judge's* wig, and a *messenger's* cap as representations of three of the roles we describe in this article. Illustration by J. Mariano Collantes Alegre.

Data to inform this Food for Thought article were obtained through interviews, document review, and observations in Pelagic Advisory Council meetings during 2014. Interviews ($n = 10$) were conducted between November 2013 and December 2014 with scientists who had hands-on experience with the production of fishery management plans for pelagic stocks in European waters. Interviewees were asked to tell their story how the plans evolved and to reflect on their own roles. ICES expert group reports [ICES Expert Group reports are available at <http://www.ices.dk> (accessed 6 October 2015).] and minutes from meetings of the Pelagic Advisory Council [minutes from meetings of the Pelagic Advisory Council are available at <http://www.pelagicac.org/> (accessed 6 October 2015).] provided further information on timelines and key issues.

We proceed as follows. In the section on “Roles in making management plans, roles of scientists within the context of developing and evaluating fishery management plans in Europe are described”. The section on “Case descriptions” introduces two case studies of scientists involved in the development of such plans and highlights dilemmas and tensions that might occur. In the “Discussion” section, we discuss how roles develop and implications of the multiple and shifting roles for scientific knowledge production. We conclude in the “Food for further thought” section with some questions and recommendations to stimulate further reflection and discussion within the ICES community.

Roles in making management plans

Multiannual plans were introduced in the 2002 reform of the European Common Fisheries Policy (CFP) to move towards longer time perspectives on management. The desired characteristics of such plans were outlined:

... multi-annual plans should establish targets for sustainable exploitation of the stocks concerned, contain harvesting rules laying down the manner in which annual catch and/or fishing effort limits are to be calculated and provide for other specific management measures, taking account also of the effect on other species. (Council, 2002, p. L358/59)

Overviews compiled by the ICES Workshop on Guidelines for Management Strategy Evaluations (ICES, 2013) highlight that a diversity of actors and practices are involved in the production and evaluation of elements that form parts of such plans. Developing quota-setting mechanisms—specifically; harvest control rules—became the key component of the plans developed to the extent that harvest control rules and management plans are sometimes used as synonyms. In its 2013 reformed version (EU, 2013), the CFP again promotes the use of multiannual plans as a management tool to meet overall policy objectives:

Multiannual plans shall be adopted as a priority, based on scientific, technical and economic advice, and shall contain conservation measures to restore and maintain fish stocks above levels capable of producing maximum sustainable yield. (Article 9-1)

Furthermore, regarding the content of such plans,

A multiannual plan shall include: a) the scope, in terms of stocks, fishery and the area to which the multiannual plan shall be applied; b) objectives ... c) quantifiable targets ... d) clear time-frames to reach the quantifiable targets; e) conservation reference points ... f) objectives for conservation and technical measures; g) safeguards to ensure that quantifiable targets are met, as well as remedial action, where needed ... (Article 10-1)

These developments will have implications on how future requests for science and advice related to management plans are formulated as well as on the associated work tasks to be carried out by scientists. Based on scientists' experiences with plans produced before the reform, we here identify and describe four roles that they take on when producing and evaluating management plans: the *developer*, the *reviewer*, the *judge*, and the *messenger*.

The principal task for the *developer* is to make a plan that meets the client's needs and that also adheres to the general objectives of fishery management (e.g. the CFP). The role of the developer is thus akin to that of an engineer who provides technology development services to clients while ensuring that legal requirements or product standards are met. The call to engage in development work can reach the scientist via ICES, triggered by a client request to ICES from, for example, the European Commission or an ICES member country. The request can also come to the scientist directly from stakeholder groups such as the Advisory Councils or individual fishing industry organizations. An interviewee who assisted the Pelagic Advisory Council with developing a management plan for Western horse mackerel (*Trachurus trachurus*) in 2007 (Clarke *et al.*, 2007; Hegland and Wilson, 2009) explained his role in this context:

They (the industry) said: 'This is what we want. Would you help us write it?' So, what they asked us to do was to provide some translation of their needs into the normal language of fisheries science. ... While we (the scientists) didn't have any specific objectives with regards to the yield of the

(western horse mackerel) plan, we would have represented the minimum criteria that needed to be adhered to with regards to the sustainability of any fishery which would be prosecuted on the stock. So, we had a kind of an ancillary role in setting the objectives. (Interview, Scientist A)

Scientists' reflections illustrate that the work tasks associated with the developer's role are not limited to developing a quota-setting mechanism. In this case, multiple iterations between scientists and stakeholders were needed to formulate objectives that guided the more technical aspects of the development work.

The second role is the *reviewer*. As a reviewer, the scientist is asked to critically examine and comment on work done by others. The well-known procedure for quality assurance within science, that is peer review, can be seen as a general model for this role (Bornmann, 2011). Various peer-review practices apply within the ICES advisory system, depending on whether the request concerns recurring or non-recurring advice. ICES also provides review services for research conducted outside ICES. This involves selecting qualified experts without a vested interest to provide reviews (ICES, 2015, p. 3). Given that management plans are developed in a variety of ways, there is not one standardized review procedure that applies to such plans within the ICES system.

The third role is the *judge*. The judge is typically called upon in response to a specific request from a client (i.e. a fishery management authority such as the European Commission). The judge is asked—in our examples under the institutional capacity of ICES—to assess whether a management plan is consistent with the management objectives defined by the client. The outcome is exemplified in this generic formulation of ICES advice as a response to such a request: "ICES has evaluated the plan and concludes that it is in accordance with the precautionary approach and the ICES maximum sustainable yield (MSY) framework". [See Lassen *et al.* (2014) for a historical overview of how the precautionary approach and the MSY framework have been integrated into the ICES advisory context.]

The fourth role is the *messenger*. As a messenger, the scientist needs to disseminate, clarify, or give a detailed account of scientific advice. For example, the scientist can be tasked with explaining to the European Commission or to an Advisory Council why a management plan is deemed precautionary or not by ICES. An interviewee reflected on how the work task of the messenger in interaction with stakeholders has evolved favourably over the last 15 years:

Presenting fisheries advice in the late 1990s to the fishing industry was not a pleasant experience. It is completely different today. [You do not dread it. ...]. We have come a long ways. (Interview, Scientist B)

A Memorandum of Understanding (MoU) between ICES and the European Commission specifies that recurrent advice from ICES will be presented to the Advisory Councils by ICES staff or scientists. [AGREEMENT In the form of a MoU between the European Union and the International Council for the Exploration of the Sea (p. 11). http://www.ices.dk/exploreus/Documents/Cooperation%20agreements/EU/2015_EU_ICES_MOU_web.pdf (accessed 6 October 2015).] In this context, the idealized role for the messenger is similar to that of diplomat who is instructed to deliver an official message to representatives of a foreign government. It is neither up to the messenger to change details of the decision nor to communicate agreement or disagreement with it. The role of the messenger is simply

to communicate decisions made elsewhere, to explain underlying reasons, and to respond to questions (in so far this does not undermine the intent of the message being communicated). In reality, however, the messenger sometimes gets entangled in political processes that override the simple mandate of disseminating the outcome of scientific work. An interviewee recalled how an invitation to present a management plan proposal developed by an ICES Working Group to an international meeting ended up not going through:

The [non-EU country] chairman refused to accept the presentation on the management plan, because [the Chair] wanted to make a public statement that they were not having the (European) Commission telling them what to do. This was the first time I had actually hit such a public political problem. It was a bit of a shock. (Interview, Scientist B)

This scientist's experience may serve as a reminder that production and dissemination of science for advice at the science–policy interface may become entangled in political agendas.

Case descriptions

In this section, two case studies are presented to highlight the diversity of roles of fishery scientists at work producing and evaluating management plans and to illustrate roles taken on by ICES. The Northeast Atlantic (NEA) mackerel (*Scomber scombrus*) case exemplifies a situation where

ICES receives a request from a client to provide advice on long-term management strategies for a stock that is shared between the EU and coastal states. The North Sea horse mackerel case illustrates the involvement of fishery scientists and ICES in a setting where industry stakeholders take an initiative to make fishery management plans.

NEA mackerel

The fishery for mackerel in the NEA is a highly valuable for a number of European countries. It is a shared stock between EU and non-EU coastal states, and management decisions about the size and distribution of quotas need to be negotiated between the competent authorities. The sharing arrangement is disputed and has triggered long-lasting conflicts. A request from the European Commission to ICES in 2007 regarding this stock illustrates a situation where several roles were called for:

ICES is requested to identify multi-annual plans of the following form, and assuming that egg surveys of mackerel continue on a tri-annual basis: [detailed description of the criteria]. ICES is asked to identify combinations of values for [parameters] that would assure management of the mackerel stock that would conform to the precautionary approach i.e. a low risk of stock depletion, stable catches and sustained high yield. [...]. ICES are also invited to suggest other approaches to the multi-annual management of mackerel on its own initiative. (ICES, 2008a, p.1)

An ICES *ad hoc* expert group was established to deal with this request (ICES, 2008b). Several of the scientists engaged to carry out the work had recently been involved in the ICES Study Group on Management Strategies (SGMAS) 2006–2008, and were eager to put the outcomes to use. The SGMAS had highlighted the importance of interaction between scientists, stakeholders, and managers at an early stage in a development

process “to get some understanding of needs and preferences, and communicate possibilities, limitations and tradeoffs” (ICES, 2007, p. 31). However, there were no established routines within ICES on how to organize a participatory process in such a setting, and this added another learning-by-doing aspect to the challenge at hand. At the outset of the NEA mackerel plan development work, stakeholders and managers were invited to discuss priorities and options with the scientists. The *developers* then proceeded to explore a number of strategies, using simulations. They acknowledged the need to keep the roles of developing and evaluating management strategies separate and emphasized in their report how far they as developers had been able to take the process:

This document describes the technical basis and the results from the simulations in order that they may be evaluated by ACOM (the ICES Advisory Committee), and provide an answer to the EU request. (ICES, 2008a, p. 2)

They also highlighted that development work needs to be guided by objectives:

It should be recognized that these simulations, while they may form the basis for a putative management plan, do not in themselves constitute such plan. If a management plan is to be developed, it will require a clarification of objectives, and a full consideration of review period, performance monitoring, and actions to be taken in exceptional circumstances. This will require further interaction with stakeholders. (ICES, 2008a, p. 2)

In reply to the request, ACOM acted as a judge and informed the European Commission that “any of the types of harvest control rules (developed) would be consistent with the precautionary approach if the appropriate parameters were incorporated within the harvest control rule” (ICES, 2008a, p.1). Following the 2008 development work, a management plan was negotiated and agreed between the EU, Norway, and the Faroe Islands. However, this plan was never formally applied because of disputes between the three coastal states and Iceland and Greenland around access to the NEA mackerel stock. In 2014, the three coastal states issued another request to ICES to evaluate potential elements of a new management plan for this stock. A workshop was organized by the ICES Secretariat to deal with this request (ICES, 2014a). Scientists assigned roles as co-chairs used their network to identify potential participants who could provide relevant information. An interviewee commented:

We deliberately chose also people who had been involved with the evaluation of the current management plan to be in the group. We don't need to reinvent the wheel, because they did a lot of work on this already. (There were) really good people doing it the last time. (Interview, Scientist C)

This pragmatic approach to getting people with the desired competence to contribute to the workshop is not sensitive to any possible vested interests among the participants. Two scientists attended the workshop with explicit roles as reviewers. Their mandate is spelled out in the annex to the report produced: “The process of the review of this type in ICES, is that: i) the reviewers attend the workshop, ii) reviewers comments are taken on board during the process; and iii) the report reflects the work of the experts and the implementation of the reviewers' recommendations” (ICES 2014a, p. 118). This review procedure makes the roles of developers and reviewers

somewhat blurred as the contributions made by the reviewers are not known to anyone who was not present. Stakeholders with industry affiliations from EU countries also attended the workshop. Some of them had attended previous meetings with similar agenda items as scientists with ICES or national research institute affiliations, exemplifying the need for all participants to clarify their “hats” and to declare any possible conflict of interest.

North Sea horse mackerel

In 2013, an industry stakeholder organization in the fishery for horse mackerel in the North Sea asked a national research institute to develop a multiannual management plan to ensure sustainable exploitation of this stock. The industry’s interest in a management plan was triggered by the fact that ICES was implementing a new approach to advice for “data limited” stocks (ICES, 2012). With only landings data available to inform advice, ICES considered North Sea horse mackerel a Category 5 (data limited) stock, a status which would imply a 20% reduction in advice on total allowable catch as part of the ICES Data Limited Stock approach. In addition to having a management plan developed, the industry organization was, therefore, also eager to enhance availability of data and fill knowledge gaps in ways that would allow the stock to move up the ICES stock category “ladder” (Coers and Miller, 2014).

The industry–science collaboration acquired funding, and a small project group was assembled. The group was chaired by a representative of the fishery industry organization acting as the client, while two national scientists led the scientific work as *developers*. One of them was, at the time, chair of the ICES Working Group on Widely Distributed Stocks (WGWISE), a role which had made this scientist familiar with the history and intricacies of the stock in the context of ICES science and advice. The other scientist had an extensive network among the industry stakeholders. During the development stage, both scientists described in our interviews that they felt they had “national scientist hats” on. However, the engagement with WGWISE gave one of them a sense of having dual affiliations, representing both their national institute and ICES.

In April 2013, a kick-off meeting was arranged to discuss availability and interpretation of data. Industry stakeholders, including skippers and fleet managers, were invited, as were scientific experts from other European countries. The national institute scientists then proceeded with exploratory development work. Progress reports were presented to the Pelagic Advisory Council in October 2013 and again in February 2014 with the scientists as *developers* with national institute affiliations. The exploratory work had been challenging and many question marks remained. The industry was eager to make progress towards a finished plan, and the idea was put forward to have ICES evaluate the proposal produced by the industry–science collaboration. The owner of the initiative was the industry organization.

However, neither the industry organization nor the Pelagic Advisory Council is entitled to send requests to ICES directly; all requests must go via the European Commission or via an ICES member country. Therefore, the request to evaluate the proposed plan for North Sea horse mackerel was submitted to ICES by the member country’s ministry. In response to the evaluation request, the ICES Secretariat organized a workshop to review and evaluate the proposed plan (ICES, 2014b). Two independent *reviewers* were recruited, and the two *developers* were assigned roles as co-chairs. The workshop was held at the developers’ home institute. Issues regarding broader participation in the *ad hoc* workshop had not been discussed between the ICES Secretariat and the chairs

before the meeting. One of the *developers* reflected on roles and work tasks for ICES and for the assigned chairs in this context:

I did not feel responsible for organizing the participatory process. I assumed throughout the preparations of this meeting that they (the ICES Secretariat) had extended the invitations to the stakeholders. [...]. Then I found out maybe four or five days before the meeting that this hadn’t happened. So I basically stepped out of my role as an invited expert to ICES, or as invited Chair, by inviting the industry organization, saying: ‘Hey, this meeting is going on. I’m sure that it is intended to be an open meeting. You can participate! Are you coming?’ (Interview, Scientist, D)

In the workshop, the two invited scientists served as both *reviewers* and *judges*. However, because the results from the exploratory analyses showed that the proposed management plan would not meet precautionary criteria, the meeting turned into a discussion among peers on alternative, more appropriate management approaches, using the technical background document as a basis. Based on the *reviewers’* feedback, the *developers* completed the technical document, including a number of recommendations for management of the stock in the short term. The outcome of the workshop was then discussed in an ICES Advice Drafting Group meeting in which the task was to formulate a reply to the request from the ICES member country. One of the *developers* was called in as an expert in this group of *judges*. Asked to reflect on the multiple roles and work tasks, the scientist commented:

I don’t think we wanted to be the people doing the work and the people reviewing it, but we did in a way end up being that. I was a participant in the Advice Drafting Group. I didn’t actively push particular perspectives, because the data was speaking for itself and I was obviously in agreement with (the Advice Drafting Group Chair) and other people about what we should be saying. (Interview, Scientist E)

An update with focus on the industry–science project work was presented to the Pelagic Advisory Council in July 2014, again with the scientist as a *developer* wearing a “national institute hat”. The review and evaluation process going on within ICES was not mentioned during the presentation. Instead, the focus of the message was on the bad news: no precautionary harvest control rule could be suggested. An interviewee commented on being a *developer* in this situation:

You can change how you look at a management plan or a rule, but you are still maintaining the same scientific guideline of what is precautionary. You are just trying to find—within that precautionary space—what is the most acceptable thing for the stakeholders and play around with that. Unfortunately, that precautionary space was very small. I really would have been a lot happier if the stock had been doing well. I think it would have been a really nice exercise, but it didn’t quite work out that way. (Interview, Scientist, E)

The scientist’s reflection highlights that there is not always an acceptable science-based solution to be found to the problem at hand; the exploratory modelling work could not produce any precautionary harvest control rules that were acceptable to the reviewers and judges. The *developer* could thus not deliver the outcome that the industry had hoped for when they initiated the industry–science collaboration. At this point, the industry–science project had come to an end; however, the process of assessing the

status of the North Sea horse mackerel stock and advising on catches continued within the ICES advisory system. When ICES (2015) catch advice for this stock was to be presented to the Pelagic Advisory Council in October 2014, one of the *developers* was offered to take on yet another role—that of the *messenger*. The scientist declined:

I didn't want to! (laughter) It seemed like I was just wearing too many hats there. I had already presented to them a couple of times—told them what we were doing and what we had looked at. And then I didn't want to come back and say: 'This is the advice'. I felt it would have more gravitas with the group if somebody from ICES was there—an official ICES person—to present the results. (Interview, Scientist, E)

The scientist had already worked on the North Sea horse mackerel issue as a *developer*. The scientist engaged in the issue again together with the *reviewers* in the review workshop, and together with the *judges* in the Advice Drafting Group. When offered the role of the *messenger*, this scientist encountered all four roles we have previously described. ICES advice on catches for North Sea horse mackerel for 2015 ended up being presented to the Pelagic Advisory Council by one of the ICES ACOM vice chairs, who in this situation was a *messenger* with an ICES affiliation.

Discussion

The two cases presented in the section on “Case descriptions” give glimpses into how the work of scientists is influenced as fishing industry stakeholders and the Advisory Councils increasingly engage in knowledge production processes aimed at underpinning fisheries management decisions in Europe. The cases also show how management plan evaluation requests to ICES trigger a need for clear procedures and clarification of mandates associated with various roles.

When acting in roles as *developers* in the cases described here, scientists encountered settings where they needed to communicate efficiently with non-scientific audiences when discussing objectives, priorities, and trade-offs. When development work is financed by the fishing industry, the industry's stakes increase, and it is understandable if they express disappointment if their goals cannot be met. One can speculate that it is more personally satisfying for a scientist to deliver outputs that meet the goals set and that can be put to use in the process towards implementation of sustainable management measures. Scientists, however, are expected to be “disinterested” from a Mertonian view of the role of science and not let their work be influenced by any pressure to arrive at a particular conclusion. In the interest of scientific credibility, it thus becomes crucial that the process is transparent and allows review of the steps that achieved the results.

The role of the *reviewer* is also present in the cases described in this article, although somewhat blurred. When the role of ICES is to evaluate a management plan, the evaluation processes sometimes involve development, review, and judging elements. ICES review procedures have evolved during the period studied here, and some different practices are being explored. The fact that the *developers* in the North Sea horse mackerel case were assigned roles as chairs of the workshop where the development work was evaluated raises questions as to the extent this review process can be considered “independent”, and whether the review is “internal” or “external”. A review group may at times find itself in a situation where different interpretations are asserted and contested by different individuals. The maintenance of external credibility of the scientific work thus

warrants a more formalized procedure set-up to establish the independence of the review process. In Europe, a practical limitation to establishing an independent review process relates to the fact that the pool of fishery scientists with competence to carry out the work task called for in the settings described above is small. Only a limited number of scientists have in-depth knowledge of particular biological operating models, data sources, methods, and stocks. The interconnectedness of fishery scientists contributes to a lack of competent “independent” alternatives (Finlayson, 1994). This dilemma highlights the need for strategic planning in ICES Member Countries. It also highlights the need for scientists to reflect on their role, interests, and stakes when participating in settings where their own work is up for evaluation, and when acting as a *reviewer* in a group of peers.

The work task for the *judge* in the context of evaluating management plans depends on the evaluation criteria. In the examples described above, the focus was on judging whether a management plan—or more specifically, a harvest control rule—could be considered precautionary or not. The process of producing management plans for stocks and fisheries in Europe is not standardized. To date, plans have focused on single stocks, and harvest control rules have been central components. Future management plans in Europe are likely to have other key components, reflecting the objectives of the recently reformed CFP, the legal requirements of co-decision procedures, and the resulting priorities of managers in the European Commission (EC, 2014). With changing management priorities, operationalization by ICES of the criteria to be evaluated scientifically will need to adapt as well. The role of the *judge* will still be needed, but the work to be carried out is likely to become more diverse.

The role of the *messenger* has evolved in terms of the work task involved. There are probably several factors that contribute to the positive development regarding interactions between scientists and stakeholders. ICES has attempted to become a more open organization. For example, observers are now welcome to workshops within the ICES advisory process. [How to join the advisory process as stakeholder observer: <http://www.ices.dk/community/advisory-process/Pages/How-to-join-the-advisory-process.aspx> (accessed 6 October 2015).] “Opening the box” training courses organized by ICES have made stock assessment and fisheries advice more accessible for non-scientific audiences, including fishing industry stakeholders, NGOs, managers, and policy-makers. Meetings between ICES and the Advisory Councils [so-called MIRAC (before RAC's name change) and MIACO meetings] have been arranged annually since 2006 as a high-level forum for interaction and exchange. Several of the industry representatives who hold seats on the Advisory Councils have been involved in projects and collaborations with fishery scientists and have become familiar with the intricacies of the science that underpins ICES advice. As a result of increased interactions between industry representatives, fishery scientists, and the ICES advisory process, the presentation of official ICES advice no longer comes out of a “black box”. The reasons why the advice looks like it does are often already known to the stakeholder representatives whose constituencies will be most affected by the advice in question. Discussions in settings where the scientist is in a *messenger* role can, therefore, focus on clarifications, as well as be opportunities for expressing frustrations, or sometimes agreement, with the advice provided.

Food for further thought

The trend towards a more participatory agenda in European fisheries management and towards a more prevalent use of multiannual

plans implies that the roles and work tasks of fishery scientists in Europe will become more multifaceted. Our examples from the production of management plans for pelagic fish stocks illustrate that the various roles intertwine at several points. To stimulate further reflection, we ask what is the role of scientists in arenas where the general objectives outlined in the CFP need to be translated into specific, operational management tools? In what ways does the setting change if the development work is financed by the industry? Whose responsibility is it to organize and facilitate a participatory process when ICES receives a request to develop or evaluate a management plan? How can transparency and scientific credibility be ensured when scientists get involved in processes where their own work is evaluated? The scientists who contributed with their experiences in this study have been actively involved in participatory processes with industry stakeholders, some on multiple occasions. These engagements had led them to reflect on their own various roles and affiliations. They expressed sensitivity to the presence of different mandates as well as to the requirements and expectations associated with them.

The responsibility to ensure that different scientific roles are acted out in an adequate and transparent manner resides at a top level as well as at an individual level. While institutions frame, guide and supervise individual actions, individuals are responsible for that their own actions are in accordance with established norms. Accordingly we suggest two main types of approaches to address the issue of tensions and overlaps between different roles: (i) increased formalization of procedures of roles and mandates and (ii) enhanced reflective capacity and role communication. The following approaches are generic in their applicability outside the scientific advisory institution of ICES and even outside the field of fisheries science.

Increased formalization

With a basis in Mertonian norms of science, this approach seeks to organize for an independent and credible scientific process, sheltered from vested interests and political bias. Concretely, the approach sets out to eliminate the potential for role overlaps and conflicts of interest through institutional and organizational change. For example, this could imply that a scientist who has acted as a *developer* in relation to a management plan cannot be accepted as a *reviewer* or a *judge* in relation to the same plan. Pushed to its limits, this approach might imply that a researcher can only hold one role relative to a given development or advisory process. Furthermore, the possibility for the industry, or other non-governmental parties, to fund research in support of a management plan should be welcomed as an element in a participatory agenda, but must be associated with a transparent and independent review process. As we indicated previously, however, there are practical concerns that constrain the extent to which the strategy of formalization can be pursued as a means to maintain transparency in the advisory process. Importantly, there are resource constraints as the pool of fishery scientists with the required skills in a given area is limited, which creates pressure for individuals to take on multiple roles. This fact underscores the necessity of the transparent dialogue with clients of science and advice and the adoption of methods of responsible research and innovation in the following point.

Enhanced reflective capacity and role communication

This approach has a different normative basis which recognizes that advisory science, in the context of post-normal science in particular (Dankel *et al.*, 2012), is embedded in value judgments. Strictly

speaking, this implies that science cannot be fully “disinterested” and “independent”. This perspective implies that transparency and scientific legitimacy in the context of policy-relevant science cannot alone be met through formalization, as described above. In Europe and elsewhere, a shift from centralized fisheries management to more inclusive forms of governance has led to new types of engagement with science. [Participatory research, fishery-dependent research, and industry-contracted research (The cross-cutting Responsible Research and Innovation (RRI) platform of the EU Framework Program for Research and Innovation “Horizon 2020”; Owen *et al.*, 2012; von Schomberg, 2013) are part and parcel of the effort to align science and society to help earn trust and aid the utmost credibility, legitimacy, and transparency of science and advice.] Taken together, there are many roles to be filled by a limited number of qualified experts. Maintaining the legitimacy and credibility of fisheries science in the context of a multiplicity of roles will benefit from continued and perhaps even enhanced awareness and communication about roles. We, therefore, suggest a reflexive review of ICES procedures in all areas of working group and committee membership. Concrete codes of conduct that guide individual scientists to identify situations when their credibility is compromised are also recommended.

ICES is a unique institution of continued high relevance for marine science and centralized advice across European countries. Our involvement within ICES in the Working Group on Marine Systems (WGMARS) has helped us identify the institutional and individual tensions of dynamic and overlapping roles, and we fulfil our mandate to explore these themes with the food for thought we provide here. It is our hope that the ICES community will engage in further discussions on how institutional practices can provide the optimal field for its network of scientists. By continuing to ask the question “What hat are you wearing?”, we also encourage others outside of ICES to reflect on their roles, affiliations, mandates, and associated consequences of wearing different “hats” when participating at the science–policy interface.

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References

- Bornmann, L. 2011. Scientific peer review. *Annual Review of Information Science and Technology*, 45: 199–245.
- Clarke, M., van Balsfoort, G., Coers, A., Campbell, A., Dickey-Collas, M., Egan, A., Ghiglia, M., *et al.* 2007. A New Scientific Initiative with the Pelagic RAC to Develop a Management Plan for Western Horse Mackerel. ICES Document CM 2007/O: 20.

- Coers, A., and Miller, D. 2014. Evaluation of a Multi-annual Plan Including an Index Based HCR for North Sea Horse Mackerel. Report Number C097/14. IMARES Wageningen UR.
- Cornwall, A., and Jewkes, R. 1995. What is participatory research? *Social Science and Medicine*, 41: 1667–1676.
- Council of the European Union (Council). 2002. Council Regulation (EC) No 2371/2002 of 20 December 2002 on the Conservation and Sustainable Exploitation of Fisheries Resources Under the Common Fisheries Policy. *Official Journal of the European Communities* L 358, p. 59–80, 31.12.2002. http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2002.358.01.0059.01.ENG.
- Dankel, D. J., Aps, R., Padda, G., Röckmann, C., van der Sluijs, J. P., Wilson, D. C., and Degnbol, P. 2012. Advice under uncertainty in the marine system. *ICES Journal of Marine Science*, 69: 3–7.
- EU. 2013. Regulation (EU) No 1380/2013 of the European Parliament and of the Council of 11 December 2013 on the Common Fisheries Policy, amending Council Regulations (EC) No 1954/2003 and (EC) No 1224/2009 and repealing Council Regulations (EC) No 2371/2002 and (EC) No 639/2004 and Council Decision 2004/585/EC. *Official Journal of the European Union*, L 354/22, 28.12.2013.
- European Commission (EC). 2014. Communication from the Commission to the European Parliament and the Council—Concerning a Consultation on Fishing Opportunities for 2015 under the Common Fisheries Policy. COM(2014) 388 final.
- Finlayson, A. C. 1994. Fishing for Truth: A Sociological Analysis of Northern Cod Stock Assessments from 1977 to 1990. Institute of Social and Economic Research, Memorial University of Newfoundland, St John's, Newfoundland. 176 pp.
- Funtowicz, S. O., and Ravetz, J. R. 1993. Science for the post-normal age. *Futures*, 25: 739–755.
- Gibbons, M. 2000. Mode 2 society and the emergence of context-sensitive science. *Science and Public Policy*, 27: 159–163.
- Gibbons, M., Limoges, C., and Nowotny, H. 1994. *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*. Sage, London. 192 pp.
- Gluckman, P. 2014. The art of science advice to government. *Nature*, 507: 163–165.
- Hegland, T. J., and Wilson, D. C. 2009. Participatory modelling in EU fisheries management: Western horse mackerel and the Pelagic RAC. *Maritime Studies*, 8: 75–96.
- ICES. 2007. Report of the Study Group on Management Strategies (SGMAS). ICES Document CM 2007/ACFM: 04. 59 pp.
- ICES. 2008a. Section 9.3.2.1. European Commission (EC) request on evaluation of management plan for NEA mackerel. *In* Report of the ICES Advisory Committee, 2008. ICES Advice, 2008. Book 9. 345 pp.
- ICES. 2008b. Report of the Working Group on NEA Mackerel Long-Term Management Scientific Evaluations (NEAMACKLTM). ICES Document CM 2008/ACOM: 54. 229 pp.
- ICES. 2012. Section 1.2. General context of ICES advice. *In* Report of the ICES Advisory Committee, 2012. ICES Advice, 2012. Book 1. 156 pp.
- ICES. 2013. Report of the Workshop on Guidelines for Management Strategy Evaluations (WKG MSE). ICES Document CM 2013/ACOM: 39. 122 pp.
- ICES. 2014a. Report of the EU Workshop on the NEA Mackerel Long-term Management Plan (WKMACLTMP). ICES Document CM 2014/ACOM: 63. 120 pp.
- ICES. 2014b. Workshop on North Sea horse mackerel management plan (WKHOMMP), 17–18 June 2014, IJmuiden, The Netherlands. ICES Document CM 2014/ACOM: 55. 23 pp.
- ICES. 2015. ICES Advice Basis. ICES Advice 2015, Book 1. 13 pp.
- Jasanoff, S. 1990. *The Fifth Branch: Science Advisers as Policymakers*. Harvard University Press, Cambridge, MA. 320 pp.
- Lassen, H., Kelly, C., and Sissenwine, M. 2014. ICES advisory framework 1977–2012: From F_{max} to precautionary approach and beyond. *ICES Journal of Marine Science*, 71: 166–172.
- Latour, B. 1998. From the world of science to the world of research? *Science*, 280: 208–209.
- Latour, B. 1999. *Pandora's Hope: Essays on the Reality of Science Studies*. Harvard University Press, Cambridge, MA. 336 pp.
- Merton, R. K. 1996. *On Social Structure and Science*. University of Chicago Press, Chicago. 394 pp.
- Metze, T. 2010. *Innovation Ltd.: Boundary Work in Deliberative Governance in Land Use Planning*. Eburon Academic Publishers, Delft. 264 pp.
- Nowotny, H., Scott, P., and Gibbons, M. 2001. *Re-Thinking Science: Knowledge and the Public in an Age of Uncertainty*. Polity Press, Cambridge. 288 pp.
- Owen, R., Macnaghten, P., and Stilgoe, J. 2012. Responsible research and innovation: From science in society to science for society, with society. *Science and Public Policy*, 39: 751–760.
- Polanyi, M. 1962. The republic of science: Its political and economic theory. *Minerva*, 1: 54–73.
- Rabeharisoa, V., and Callon, M. 2002. The involvement of patients' associations in research. *International Social Science Journal*, 54: 57–63.
- Rip, A. 1994. The republic of science in the 1990s. *Higher Education*, 28: 3–23.
- Stange, K., Olsson, P., and Österblom, H. 2012. Managing organizational change in an international scientific network: A study of ICES reform processes. *Marine Policy*, 36: 681–688.
- van der Sluijs, J. P., Petersen, A. C., Janssen, P. H. M., Risbey, J. S., and Ravetz, J. R. 2008. Exploring the quality of evidence for complex and contested policy decisions. *Environmental Research Letters*, 3: 9.
- von Schomberg, R. 2013. A vision of responsible innovation. *In* *Responsible Innovation*, pp. 51–74. Ed. by R. Owen, M. Heintz, and J. Bessant. John Wiley, London.

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