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Contents

Executive summary	1
1 Opening of the meeting.....	3
2 Adoption of the agenda.....	3
3 Report of the 2010 Meeting.....	3
3.1 Attendance.....	3
3.2 Terms of Reference	3
3.3 Summary of ToR a).....	4
3.3.1 WGICZM (future name: WGMPCAM).....	4
3.3.2 Workshop on Introducing Coupled Ecological-Economic Modelling and Risk Assessment into Management Tools (WKIMM):.....	4
3.3.3 Request from SGRAMA.....	4
3.3.4 Taking environmental variability into account in fisheries management	5
3.4 Summary of ToR b)	6
3.4.1 Concise summary of recent WGFS achievements	6
3.4.2 Review of WGFS past achievements from a former and inaugural chair, Poul Degnbol	8
3.5 Summary of ToR c).....	8
3.5.1 Summary of social network analysis and some theory behind the method.....	8
Annex 1: List of participants for Working Group on Fishery Systems, (WGFS) 11-14 October 2010.....	12
Annex 2: Agenda.....	13
Annex 4: Structure, Agency and Embeddedness: Sociological Approaches to Fisheries Management Institutions	14
Annex 3: WGFS terms of reference for the next meeting.....	29
Annex 4: Recommendations	30

Executive summary

The Working Group on Fishery Systems met at ICES headquarters in Copenhagen from 11-14 October. This year Dorothy Dankel (Norway) took over for Kjellrun Hiis Hauge (Norway) as Chair. We were an intimate group with seven (effectively six) participants. The meeting was focused on two main tasks: 1) presentations from participants directly related to our ToRs, and 2) drafting and writing a manuscript on the history and future of WGFS for submission to ICES Journal of Marine Science, specifically related to ToR a) and ToR b). The rest of this section is a shortened and un-referenced version of the manuscript.

This year, the Working Group on Fishery Systems celebrates 10 years since it was established by ICES, *inter alia* “to develop a framework and methodology for the analysis of fishery system performance” and “propose ... interdisciplinary research which will advance ICES future capability in fishery systems analysis” . The WGFS created a forum to bring social scientists into ICES to help describe the socio-ecological system around fisheries, and to use this perspective to intensify ICES effectiveness.

The key to governance in the science-policy interface is to put uncertainty at the center of the table. Others have argued, for good reason, that overemphasizing uncertainty in fisheries advice can lead to policy paralysis. However, broader experience in science and policy indicates that underemphasizing uncertainty is even more dangerous. One effective approach for dealing with science in situations of high stakes and high uncertainty is through “post-normal science” developed by Funtowicz and Ravetz (1990). An important pillar of post-normal science is the inclusion of an extended peer community, which comprises different types of experts within a broad policy community. These communities acknowledge, analyse and communicate uncertainties through extended peer review. Hence these communities are the foundation for credible, legitimate and salient science for policy advice. In fact in many cases, a single scientific “answer” will never be available for complex systems such as fisheries. In these cases, more research does not lead to less uncertainty but can instead lead to unforeseen complexities. Concurrently, the potential impacts of decisions based on uncertain science have very large consequences (biological and/or social) and therefore values are in dispute.

We highlight two examples from outside fisheries science to illustrate the importance of putting uncertainty forward early and in a transparent manner. The first is the recent “Climategate” controversy from late 2009, which originated at the Climatic Research Unit at the University of East Anglia (UK) after an e-mail server hack and instigated an independent review panel of the Climatic Research Unit. Overselling certainty creates vulnerability in the scientific basis for policy. Such vulnerabilities can and will be exploited easily to obstruct and delay policy intervention.

An example of a severe scientific credibility crisis between an environmental government agency and the authority providing the scientific advice for policy support is the controversy originated by a whistle-blower at the Netherlands National Institute for Public Health and the Environment (RIVM) in early 1999. The media was the last way out for RIVM Senior statistician Hans De Kwaadsteniet who decried his institution for using poorly validated computer models as the basis of the advice given to the Dutch government. De Kwaadsteniet further claimed that RIVM presented its advice as point values with spurious precision and opaque uncertainties. The new focus is on coping with uncertainties.

These dangers from overselling certainty are relevant for ICES because we are also communicating uncertain results. The majority of ICES assessment scientists have experienced being asked to produce certainty that is not really there.

The WGFS has documented a number of examples of a post-normal approach to fisheries management. An important step in post-normal science is the identification of extended peer communities. For example, in the EFIMAS, SAFMAMS and JAKFISH projects, scientists have built extended peer communities particularly through regional advisory councils (RACs), comprising industry, non-governmental organizations, managers, administrators and other scientists. The first step in including these extended peer communities is to jointly define the research question. This process has been initiated by both scientists and the industry. Pedigrees and uncertainty matrices have been used to facilitate the communication of model complexities, critical assumptions and uncertainties. Questionnaires and focus groups have been used to give feedback with regard to the collective learning and the entire participatory process.

A major benefit of the close collaboration within the extended peer community has been that industry priorities are explicitly included in the investigations. The participants recognize the potential of the modelling approach for demonstrating and rising awareness of the complexity of fisheries management. The participants found the collaborative modelling useful in finding a common frame and definition for complex issues.

A number of scientists are doing participatory modelling now, and they are feeding their knowledge and experiences in the ICES expert groups. Apart from WGFS, the Study Group on Risk Assessment and Management Advice (SGRAMA) and the Study Group on Management Strategies (SGMAS) were two ICES study groups that specifically dealt with the challenges of high uncertainties and risks in fisheries advice and management. These study groups have expired, so WGFS is now the logical the place to continue this line of thought in future.

ICES is now faced with providing scientific advice within a broader marine and maritime governance context. Legitimacy, credibility and saliency are issues of utmost importance when the peer community is extended in a post-normal science-policy context. WGFS has been active in outlining these issues, but now the concern is to put the theory into practice. We therefore suggest a new role for WGFS. First, Working Group Maritime Systems (WGMS) would be an appropriate name change to flag broader objectives of maritime planning. We also think this new title will highlight the need of an extended peer competency and involvement beyond fisheries in our working group. We then propose that WGMS reviews the governance demands in the different ICES expert groups.

On the 10th anniversary of WGFS, we propose a turn towards maritime systems to aid ICES in providing maritime advice, including effective communication of uncertainty within an extended peer community. This is the key to effective advice under uncertainty in the maritime system.

1 Opening of the meeting

The meeting opened at 12:30 on 11 October 2010 by Chair Dorothy Dankel. Introductions were first made after which the Chair presented the Agenda and her vision for the meeting.

2 Adoption of the agenda

The agenda outlined in Annex Two was proposed and adopted.

3 Report of the 2010 Meeting

3.1 Attendance

The reason for the drop in attendance this year was due to the end of funding for interdisciplinary EU projects (like JAKFISH) that have in the past held workshops in conjunction with WGFS. About five other participants gave notice that despite their eagerness in attending the meeting, their schedules would not allow for it. The Chair, however, noted the benefit of an intimate group towards the production of a manuscript for peer review in ICES Journal of Marine Science. The purpose of this paper was to summarize WGFS experiences on its 10 year anniversary, review reasons uncertainty should be placed at the center of the table, and to outline recommendations for the future of the group.

3.2 Terms of Reference

The ToRs for the 2010 WGFS meeting were as follows:

ToR a): Review and generate recommendations about the future structure of risk evaluation and management strategy research within ICES toward greater inclusiveness across the fisheries system and greater usefulness in policy advice. This includes reevaluating the role of WGFS in light of several other ICES groups involved in risk evaluation and management strategy.

ToR b): Evaluate the past contribution of WGFS activities on ICES as a way to inform future directions.

ToR c): Review ongoing work in social network analysis on the science - policy boundary.

To meet these ToRs, the Chair proposed that the working group write a short communication to the ICES Journal of Marine Science for peer-review publication. The Chair proposed this idea, on the 10th anniversary of the group, as a way to effectively address and communicate ToRs a) and b). Considering that WGFS has traditionally been comprised of many interdisciplinary scientists (funded by EU projects to attend WGFS) outside traditional ICES boundaries, the work of WGFS has not always been visible to the broad range of ICES scientists. The Chair felt that a publication reviewing the recent work of WGFS and affiliated projects in ICES JMS would be the most effective way to make WGFS visible and to suggest a new route for the group. All participants agreed to this plan.

Therefore, the Chair asked the participants to keep the short communication paper in the back of their minds while presentations on the three ToRs were presented the first two days. On the eve of the second meeting day, a paper structure and theme was agreed to for the paper and writing tasks were distributed. It was also agreed that the

three former chairs not present at this year's meeting would be invited to review the manuscript.

The following subsections outline the WGFS presentations and discussion on the three ToRs.

3.3 Summary of ToR a)

WGFS has identified a handful of working groups within ICES that are dealing with risk evaluation and management: SGRAMA, SGMAS, WGICZM, and WKIMM.

3.3.1 WGICZM (future name: WGMPCAM)

Christine Röckmann gave an overview of the work of the WGICZM (future name: WGMPCAM), summarizing the 2010 report and pointing to the intended future focus of WGMPCAM. WGFS sees potential for collaboration, synergies and cross-pollination with WGICZM (future name: WGMPCAM). In WGICZM's 2010 report, the role of uncertainty and risk based decision-making is mentioned explicitly under ToR d): *Progress the development of an integrated decision-making framework for ICZM.* The 2010 report mentions examples from Canada and Germany where risk assessment structures exist or are in development, taking account of ecological, socio-economic, socio-cultural and governance issues. *"In Canada, the development of risk-based approaches to support decision-making continues to be a priority for integrated coastal zone management. The development of a conceptual framework for risk-based integrated management is considered as a means to more effectively use existing information and ensure the efficient deployment of resources as well as renewing the focus priority on setting. Strengthening the initial phases of this process is key to building a credible and pragmatic management process that has the potential to be successful at achieving realistic goals within a well defined scope and scale of issues."* The issue of risk-based management was also discussed at the ICES ASC 2010 in Nantes within Session B. Marine spatial planning (MSP) is a field where stakes as well as uncertainties in the sectors involved are high. Today, the ICES community is faced with a new Integrated Maritime Policy (IMP) in the European Union (EC, 2007). MSP is seen as a tool for improved decision-making that provides a framework including the extended peer community for arbitrating between competing human activities and managing their impacts on the marine environment.

3.3.2 Workshop on Introducing Coupled Ecological-Economic Modelling and Risk Assessment into Management Tools (WKIMM):

Economists and ecologists reviewed regional examples of state-of-the-art in ecological-economic modelling in fisheries science and identified ways for further development and integration in relation to scientific fish stock and fisheries advice. WGFS sees the importance of cross-pollination with WKIMM as a concrete way to improve the extended peer community within ICES working groups. One of the co-conveners of WKIMM is an active past member of WGFS, so cross-pollination should be readily feasible.

3.3.3 Request from SGRAMA

In addition to ToR a), SGRAMA (now expired) asked WGFS to shed light on the following two topics:

- i) Experience gained outside ICES points to stakeholder and manager participation as being essential in a risk assessment process. The "how to" part of such participation should be based on recommendations from Working Group on Fishery Systems (WGFS).

- ii) The planning of, and conducting of a proper evaluation of the case study is needed. In particular, criteria for the success (or failure) of the risk assessment need to be defined upfront.

During the 2010 WGFS meeting, Jeroen van der Sluijs from Utrecht University in the Netherlands engaged WGFS in a day-long discussion on various facets of uncertainty in the science-policy interface, mainly drawing on examples within climate science and environmental science. The Netherlands National Institute for Public Health and the Environment (RIVM) has, with the help of outside consultants (extended peer review), actively wrote reviews and handbooks of best practices for scientists that are applicable to fisheries scientists (see references below).

The International Risk Governance Council in Geneva www.igrc.org is also an important source of general information on risk governance. They have produced a general policy brief, with an annex using fisheries management as a case study (IRGC 2009). They have also published a much more comprehensive White Paper on Risk Governance (2005) authored by Ortwin Renn. Renn is perhaps the best known author in Europe on risk governance and is the Scientific and Managing Director of DIALOGIK <http://www.dialogik-expert.de/en/> an organization that has done a considerable amount of work in fisheries among other subjects. He is also the author of a very substantial handbook on participatory risk governance (Renn, 2008).

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3.3.4 Taking environmental variability into account in fisheries management

Christine Röckmann presented Brunel *et al.*'s study on 'Performance of harvest control rules in a variable environment' (Brunel *et al.*, 2009). One main conclusion of this study is that if changing environmental conditions are negatively influencing the state of a given fish stock, then taking environmental variability into account could

benefit the management of this stock. In the instances modelled in this paper, environmental harvest control rules performed better than the conventional ones. The benefits are strongest when the correlation between the environmental variable and the stock dynamics is larger. WGFS considers this approach of incorporating environmental variability into management rules an important field for future research. WGFS sees HCRs as an important boundary object, which benefits from the involvement of an extended peer community.

Reference

Brunel, T., Piet, G. J., Van Hal, R. and Röckmann, C. 2010. Performance of harvest control rules in a variable environment. *ICES Journal of Marine Science: Journal du Conseil*, 67: 1051-1062.

3.4 Summary of ToR b)

3.4.1 Concise summary of recent WGFS achievements

In 2010 the Working Group on Fishery Systems is celebrating 10 years since it was established by ICES, *inter alia* “to develop a framework and methodology for the analysis of fishery system performance” and “propose ... interdisciplinary research which will advance ICES future capability in fishery systems analysis” (ICES, 2000). The WGFS created a forum to bring social scientists into ICES to help describe the socio-ecological system around fisheries, and to use this perspective to intensify ICES effectiveness.

During the first five years the focus was on case studies of cod management. This culminated in a series of WGFS papers presented at the 2006 ICES Symposium on Fisheries Management involving four major contributions:

The idea of describing the science policy interface in the CFP as yearly “TAC Machine”. This image contributed greatly to subsequent analyses of how to improve the link between fisheries science, stakeholders and policy (Schwach *et al.*, 2007; Degnbol and McCay, 2007; Holm and Nielsen, 2004);

Documentation of surprising depth of dissatisfaction within ICES of the way the fisheries science policy interface was operating, particularly in respect to the handling and communication of uncertainty (Hauge *et al.*, 2007; Wilson and Delaney, 2005; Schwach *et al.*, 2007);

A series of retrospective analyses of assessments revealing systemic biases (Reeves and Pastoors, 2007; Schwach *et al.*, 2007);

Documentation of stakeholder perspectives on science, revealing the challenges to scientific legitimacy that are particularly important under the CFP, especially in relation to other places such as Norway (Delaney *et al.*, 2007).

WGFS then turned to the question of what could be done about the problems diagnosed in the cod case studies. The strategy was to begin working directly with scientists and stakeholders to gather insights on what kinds of changes in the fishery system would result in more effective input of various kinds of knowledge into policy. There were three import foci of this research. The first was the mobilization of fishers’ knowledge into improving fisheries science and advice, particularly through looking at the best practices in collaborative research between fishers and scientists. The second was an analysis of ICES interactions with both stakeholders and policy-makers. The third focus involved reaching out to other areas where scientific advice plays a critical policy role to explore what has been learned there about effective ad-

vice giving. The results included a) the observation of a considerable number of practical experiences of stakeholder/scientists interactions that resulted in reports highlighting best practices (Hegland and Wilson, 2009, Johnson and van Densen, 2007, Wilson and Pascoe, 2006); b) an in-depth analysis of the science policy interface in ICES including recommendations for improving it (ICES, 2007b) (Wilson, 2009); and c) a series of presentations and a workshop in which five experts from outside fisheries (one each from power generation, natural disaster management, risk assessment, climate change, and the communication of risk in the mass media) joined 23 fisheries experts from various disciplines. The workshop resulted in rich interactions and the central message was clear: many interests should be represented when science and policy meet and uncertainty should be placed at the center of the discussion (ICES, 2008).

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3.4.2 Review of WGFS past achievements from a former and inaugural chair, Poul Degnbol

The main contributions of WGFS to ICES are very pervasive but not linked to WGFS by direct references. WGFS has had an important impact on the culture in ICES and on the ability for reflection on the role of science – and thus also for the quality of discussions. The contributions and discussions at the recent theme session P at the ICES ASC in Nantes could in my opinion not have been possible if we had not had this infusion of reflection coming from the social sciences into the ICES environment. Governance and communication issues are now attracting a lot of interest in the ICES community – also among the hard core natural scientists – and we have now several fora where ICES natural scientists can discuss this with people with a professional background for this. For the social scientists we think WGFS has been a grand opportunity to dig into the science-policy linkage interface using fisheries as a case.

One important example of this, firmly based in WGFS, was the Policy Knowledge in Fisheries Management (PKFM) project which was the first project in the EU framework programmes where considerable effort was dedicated to reflection of the role of science in European fisheries policy, in a collaborative effort between natural scientists, sociologists and economists – and even a historian.

The impact on the current procedures is probably most clearly reflected in the breakthrough for transparency in the production of advice. Ten years ago this was run as a black box model and there was strong faith in the ICES system that this was how it should be. I heard at the time often the simplistic diagnosis from colleagues that the only problem in fisheries management was that scientific advice was not followed. In 2003 ICES opened ACFM for observation for the first time on an experimental basis, with great fear and concern from many. It was people active in WGFS which supported and promoted this. Since then transparency is now the norm and is seen as a great step forward by everybody – proof by demonstration.

Where WGFS ought to have had a larger impact is in relation to management plans – in retrospect it would have been a big improvement if WGFS had been linked closer to the Study Group on Management Strategies (SGMAS). SGMAS was populated largely by hard-core modellers, but was also one of the first quantitative groups to be open to stakeholders and did include a stakeholder in meetings.

3.5 Summary of ToR c)

Doug Wilson gave a presentation on some preliminary results of the social network analysis done within the JAKFISH project. His case study was on the Northern Prawn Fishery in Australia.

3.5.1 Summary of social network analysis and some theory behind the method

Social network analysis (SNA) is a sociological technique based on the analysis of data on relationships between people, such as the frequency and quality of their interpersonal context. It has been widely applied in the areas of formal organizations, social movements and in general policy-making contexts (Knoke, 1993). The use of social network analysis to examine fisheries management has been around for some time (Maiolo and Johnson, 1989; Gibbs 2008; Grafton 2005)) but using it specifically to examine science-boundary networks is just beginning to be applied in marine man-

agement (Bodin, 2006; Bodin *et al.*, 2006; Crona, 2006; Hartley, 2010; Hartley and Glass, 2010; Wilson, 2009).

The theory behind the network approach to society, laid out in detail in the appended paper, is rooted in one of the central debates in sociology. This is the question of whether society is best conceptualized as the product of the interaction of atomized individuals (agency) or as supra-individual social facts that are irreducible to individual actions (structure). Agency approaches use an epistemology based on methodological individualism. They currently enjoy greater prominence in the social science as a whole, where the rational choice approach to agency is dominant. Their strength is the ability to develop quantitative models of social processes, their weakness is that they reduce individuals to instances of a simple theory of behaviour, e.g. utility maximization, and the empirical relevance of these theories of behaviour are limited to particular institutional contexts. Structural approaches are less adequate than agency approaches in both the clarity of their basic concepts and the elegance of their models. Agency approaches, however, because of their reliance on the simple theories of behaviour, have never succeeded in defining and modelling many consequential social phenomena such as culture, norms, organization and especially power.

Sociologists have made some progress in finding ways to bridge this gap, relying most recently on the idea of networks. Social network theory (e.g. Burt, 1982; Granovetter, 1992) conceptualizes individuals as embedded within systems of concrete, patterned interactions with other individuals. These patterned interactions provide a concept of social structure that is well defined and allows theories involving supra-individual variables to be measured and tested. In addition to its ability to make use of formal models, network theory is also able to incorporate important qualitative dynamics such as discourses and identities (Emirbayer and Goodwin, 1994).

The network approach is very useful for studying the science-policy interface. It was a central concept in Wilson's (2009) study of ICES and its clients. This and other studies have suggested the importance of "polycentric" institutions for science policy deliberations. Ostrom (2001) defines polycentric systems as "an organization of small-, medium-, and large-scale democratic units that exercise considerable independence" For Ostrom the strength of a polycentric governance mechanism is its ability to experiment with diverse approaches and provide for a range of responses to external shocks. In theory, at least, there is a clear analogy to science-based policy-making in conditions of uncertainty. Indeed, for Cash and Clark (2001) the polycentric networks that they see characterizing effective use of science in policy do this because of quite similar reasons. They are able provide methodological coherence across scale levels while still allowing local specialization, the redundancy of the system provides for multiple pathways to encourage innovation and flexibility. A polycentric network also facilitates stakeholder capacity building and involvement (Cash and Clark 2001). It is an institutional design that gives form to the continuously operating process of debate and dialogue Funtowicz and Ravetz (1990) see as the next higher level in their description of the scientific practice needed for addressing uncertainty. Furthermore, formal social network analysis can test if this form of interaction really leads to less divergent views and more cooperative attitudes.

The formal network analysis literature has examined many concepts important to the science-policy interface. Trust has been found to result from the frequency of interactions - the more interactions with positive outcomes between two people the greater

the trust and from third parties (Granovetter, 1985). If third parties are shared, trust increases; if third parties are not shared, trust decreases (Burt and Knez, 1995). Other studies have found that the same effect attaches to the multiplexity of relationships, i.e. the degree to which a relationship has several facets (Coleman 1988, Hart, 1988).

More direct analyses of fisheries have found, for example, that in diffuse management networks, such as Atlantic herring, it is important for scientists and managers to cultivate relationships with people who bridge these groups (Hartley and Glass, 2010). The context of interaction is important as well. The formality of the communications influences the degree to which perceptions are shared (Habermas, 1987). If the only interaction participants have is at formal meetings, this may have a negative influence on trust. The design of the policy process has a direct bearing on the quality of interactions (Jentoft and McCay 1995). These factors may turn out to be more important than either the characteristics of the individual such as their scientific credentials. Finally, being a diffuse, polycentric network has benefitted ICES by making it easier for scientists to resist pressure to take the focus away from problematic uncertainties and other attempts to present science in inappropriate ways (Wilson 2009).

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Annex 1: List of participants for Working Group on Fishery Systems, (WGFS) 11-14 October 2010

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Annex 2: Agenda

	MONDAY, 11 OCTOBER 2010	TUESDAY, 12 OCTOBER 2010	WEDNESDAY, 13 OCTOBER 2010	THURSDAY, 14 OCTOBER 2010
09.15-12.00	Arrival Eat lunch before meeting! ☺	Jeroen on the “outsider’s view” and models of governance (see attached references) Discussion of science-policy boundary and governance in fisheries	Distribution of report writing activities (paper/report)	Writing Update on writing and discussion when needed
12.00-13.30	Meeting Opening by Dorothy Dorothy on ToR b) (outline of possible ICES JMS policy brief article) Discussion on possible policy brief* collaboration in connection/addition to the report	(No Doug in afternoon) LUNCH	LUNCH	LUNCH
13.30-15.00	Robert on ToR a) Gurpreet on science communication	Jeroen continued Christine on ToR a) (WGICZM)	Writing	Final wrap-up, walk-thru of report Discussion on future work, next year’s WGFS
15.00-17.00	Doug on ToR c)	Christine on Brunel <i>et al.</i> Performance of HCRs in a variable environment Summary of ToRs discussion	Writing	Travel home

Annex 4: Structure, Agency and Embeddedness: Sociological Approaches to Fisheries Management Institutions

By Douglas C. Wilson and Svein Jentoft

Structure, Agency and Embeddedness:

Sociological Approaches to Fisheries Management Institutions

By Douglas Clyde Kongshøj Wilson and Svein Jentoft

Pp 63–72 in Symes, D. (Ed) Alternative Management Systems Oxford: Blackwell Science (1998)

Abstract

We relate fisheries management institutions to sociological theory in terms of one of its central debates - agency and structure. This is the question of whether society is best conceptualized as the product of the interaction of atomized individuals (agency) or as supra-individual social facts that are irreducible to individual actions (structure).

Structural approaches are less adequate than agency approaches in both the clarity of their basic concepts and the elegance of their models. Agency approaches, however, have never succeeded in defining and modelling many consequential social phenomena such as culture, norms, organization and power. Sociologists have begun to use the concept of embeddedness to bridge this gap. Approaches to fisheries management have emphasized either agency or structure and produced two quite different accounts. Studies emphasizing agency define the management problem as how best to design institutions to avert the tragedy of the commons. Studies emphasizing structure focus on how management decisions more often reflect social power than rational institutional arrangements. We seek to combine the two through an embeddedness-based strategy. We define embeddedness as primarily a cultural phenomenon: the breadth of shared understandings drawn upon in communicative interactions. We suggest that management can be analysed by tracing five forms of meaningful communications that differ in their degree of embeddedness: rational communication, prestige, influence, money and authority. We illustrate this approach using examples drawn from Atlantic coast fisheries management.

Introduction

Sociology has not been a central player in the evolution of our understanding of common pool resource management over the past twenty years. This lack of centrality has something of an ironic twist. The focal concept that has emerged in this evolution has been the social institution, specifically those institutions that are created to avert the tragedy of the commons. The irony is that sociologists have traditionally put a lot of work into understanding social institutions and have developed useful analytical tools to understand how they come about, how they work and how they change. The sociological perspective on institutions also challenges the reductionism of the rational choice-based concept of institutions dominant in resource economics and political science. While the rational choice approach has made a major contribution to understanding resource management (Bromley, 1991; Ostrom, 1990), it has also served to limit our imaginations about the potential forms that management institutions can take (Jentoft and McCay, 1995; Jentoft *et al.*, 1998).

The present chapter relates fisheries management institutions to sociological theory in terms of one of its central debates - agency and structure. This is the question of whether society is best conceptualized as the product of the interaction of atomized individuals (agency) or as supra-individual social facts that are irreducible to individual actions (structure). Agency approaches use an epistemology based on methodological individualism. They currently enjoy greater prominence in the social science as a whole, where the rational choice approach to agency is dominant. Rational choice theory conceptualizes individuals as actors in pursuit of maximizing sets of utilities and makes use of game theory and other models of competition. Structural approaches focus on social facts such as shared norms, relations between social groups, and questions of power and dominance. Such approaches have historically been important in sociology. Marx, Durkheim, and Parsons all believed that human conduct is shaped by social forces beyond their personal control. Indeed they argued that very constitution of individuals as social actors is a social phenomenon. Humans live not only to fulfil their own ambitions, but also to respect and obey the demands and expectations that society put upon them. Individual ideologies, attitudes and perspectives express social relations. Individual interests stem from their positions in a social system. More recent formulations have emphasized how social structures are reciprocally reproduced by structurally determined individual agency (Giddens, 1984). Thus, economic actors and their social relations are not only perceived as being controlled by social structures. They are also believed to be carriers of these structures.

Structural approaches are less adequate than agency approaches in both the clarity of their basic concepts and the elegance of their models. Agency approaches, however, have never succeeded in defining and modelling many consequential social phenomena such as culture, norms, organization and power. Sociologists have made some progress in finding ways to bridge this gap. For instance, social network theory (e.g. Burt 1982; Granovetter, 1992) conceptualizes individuals as embedded within systems of concrete, patterned interactions with other individuals. These patterned interactions provide a concept of social structure that is well defined and allows theories involving supra-individual variables to be measured and tested.

Our concern is the way that this dichotomy between agency and structure has been reflected in approaches to fisheries management institutions and how this embeddedness concept might aid us in bringing them together for a richer understanding of how these institutions are created and maintained. We think that the embeddedness perspective as developed by Polanyi (1957) and Granovetter (1992) provides a bridge between structural and agency accounts of fisheries management. It maintains the basic dialectic perspective that man is both the producer and the product of society, and that social institution despite their "natural" appearance, are nevertheless the construct of social action and choice (cf. Berger and Luckman, 1966).

In what follows, we begin with a brief outline of how approaches to fisheries management have emphasized either agency or structure and produced two quite different accounts. We argue that each of these accounts contain insights that are crucial to understanding management. Studies emphasizing agency define the management problem as how best to design institutions to avert the tragedy of the commons. A central insight of this approach is the benefits that stakeholder participation brings to effective management. Studies emphasizing structure, on the other hand, have focused on the political nature of fisheries management and how management decisions more often reflect structures of social power than they do freely arrived at agreements among stakeholders.

We then seek to develop an embeddedness-based analysis strategy for fisheries management institutions. We argue that understanding these institutions sociologically begins with the micro-level interactions that give institutions concrete form. First, we introduce and illustrate a model of management institutions resulting from a bargaining process between stakeholder groups. Then, we draw heavily on Habermas' (1984, 1987) work on communicative processes to specify an interpretation of the embeddedness perspective. We define embeddedness as primarily a cultural phenomenon: the breadth of shared understandings drawn upon in communicative interactions. We suggest that this bargaining process can be analysed by tracing the use of five forms of meaningful communications that differ by the degree to which they are embedded in shared understandings. We call these forms of communication "governance mechanisms" (Wilson and McCay, 1998) and identify five: rational communication, which draws extensively on shared meanings to reach a mutual understanding; prestige and influence which govern social networks; money, which governs markets; and authority, which governs bureaucracies. These different mechanisms have different strengths and weaknesses. We conclude with some remarks about how governance mechanisms can be useful in analysing fisheries management institutions.

Approaches to Fisheries Management Emphasizing Agency

The intellectual heart of the agency approach to fisheries management institutions is the tragedy of the commons. In its general form, this is one of the best known problems in social science. The problem of the free rider (Olson, 1968) or the social dilemma (Marwell and Ames, 1979) arises whenever the possibility exists for an actor to shift some of the costs of his or her activity on to a group. In situations of resource exploitation, the problem involves the harvesting of a resource beyond replacement levels, because actors receive all of the benefit of their exploitation while sharing the costs of overexploitation with all other users. This leads to overharvesting. Privatization of the resource is often argued to be the best way to deal with the commons problem because it forces actors to bear all the costs of their exploitation (Dregne, 1983; Gordon, 1954; Scott, 1955).

Where private property is too difficult or costly to implement, other institutions to guard against the tragedy must be created. The question becomes how to bring people together to formulate these institutions. This means some sort of community or state-based management process. Economists have generally approached this question by asking how best to mimic individual property rights. This would call for a contribution from the state to facilitate such an institutional reform, but, by allowing market forces to work, the government could be relieved from its costly and troublesome burden as manager.

Sociologists, political scientists, anthropologists, and geographers, on the other hand, have focused on community-based approaches to avoiding overexploitation. There have been many studies of "common property" regimes (McCay and Acheson, 1987) where ownership of a resource and the management of access and effort are vested with some group larger than the individual. Others have looked at instances of "co-management" where a group of users works with the government in various ways to avoid overexploitation (Jentoft, 1989; Pinkerton, 1989). Ostrom (1990) used a rational choice approach to identify the characteristics that common property institutions must have to effectively coordinate the actions of competing stakeholders.

Other scholars (van der Schans, 1996; Wilson, 1996) have built on this work by introducing a communicative concept of rationality along side of the choice concept of

rationality used by Ostrom (1990) and others. These studies have focused on the qualities of involvement and participation by stakeholders in the management process. When participation by stakeholders is open and well designed it is argued to aid management in several ways. One is to facilitate access to needed information by those making management decisions (Pinkerton, 1989) which includes aiding surveillance of fishing activities to enable enforcement. Beyond the exchange of information, participation makes possible more open communications focused on the creation and renegotiation of the management institutions themselves. Such communications increase the flexibility of the institutions to respond to ecological changes (Dryzek, 1987; McCay and Jentoft, 1996). Overall, participation increases the "ecological rationality" (Dryzek, 1987) of management by making it more robust, responsive and flexible. Another key function of involvement and participation is to increase the legitimacy of the management measures. Legitimacy is enhanced through increased transparency in decision making process (Jentoft, 1989), greater accountability for management officials (Magrath, 1989), and increased respect for indigenous perspectives on management (Pomeroy, 1993). This increased legitimacy attaches to individual management measures as well as the overall management process (Magrath, 1989). The expectation here is that the more legitimate a resource management is perceived to be among users, the more inclined they are to abide by the rules. As Hall (1972:31) proclaims: "Compliance and involvement are interrelated phenomena." Involvement is expected to enhance the proficiency of fisheries management. Thus, effective management remains dependent on the cooperation of those who cannot be physically excluded from the resource. This cooperation includes accepting the management institutions as legitimate, being willing to provide information, and being willing to negotiate in good faith as changes arise. It is true that such cooperation is rarely achieved, which helps explain why fisheries management is rarely effective.

In sum, looking at fisheries management in terms of agency leads to two key conclusions. First, without some sort of management institution a resource will be overexploited by agents who are acting out of short-term, individual rationality, resulting in a collectively irrational, long-term outcome. Second, to be effective these management institutions must meet one of three conditions: they must involve enforceable individual property rights which make it impossible for actors to avoid the costs of their overexploitation; they must involve state regulations that can be legitimately enacted, surveilled and enforced; or they must involve the active cooperation of resource stakeholders. The ecological factors that exist in most fisheries and the political and legal realities that exist in most democracies make the first condition very difficult to meet. They also often make the second condition dependent on the third because legitimacy, surveillance and enforcement are all much easier with stakeholder cooperation. Furthermore, the third condition often depends on the second as cooperation among users at the local level is a necessary, but insufficient, tool for addressing the subtraction that occurs on larger scales. This interdependency between the second and third conditions means that cooperation among actors is required along two dimensions: horizontally among users and user groups; and vertically, between user-groups on the one hand, and government agencies and research institutions on the other.

Approaches to Fisheries Management Emphasizing Structure

Viewing fisheries management from the perspective of the social structure does not lead to the neat theoretical conclusions that the agency perspective does, but it often provides a more satisfying description of empirical situations. Fisheries management actions are political tools that have the effect of allocating profits and determining

relations of power. This allocation is often the most important factor in determining what actions will be taken. Competition over profit can be argued to be a more important concept for understanding the actual management process than maintaining sustainability in the face of the tragedy of the commons (Marchak, 1987). From this structural perspective, the tragedy of the commons model is used to legitimate a relationship between stakeholders and the state rooted in a need to define property rights that arises once profit becomes the reason for catching fish (Marchak, 1987). The state acts as the guarantor of both its own power and that of interests that have “captured” the state agencies (Libecap, 1989). From this perspective, the delegating of management authority to user-organizations, i.e. co-management, may well lead to the further empowering of special interests, and thus entrenching social inequities that already persist within the fishing industry (Davis and Bailey, 1996). Whatever the solution is, co-management can hardly be part of it, unless those basic predetermined inequities are rectified.

Studies have found structural lines that affect fisheries management defined by ethnicity, gender, colonial domination, fishing sector and class. For ethnic groups, issues involving native North Americans are probably the best known cases, but these issues arise around the world. Bailey (1986) outlines how the Indonesian government protected the interests of small-scale against large-scale fishers because the large-scale fishers were mainly ethnic Chinese. Jentoft and Carlsen (1996) describe conflicts over management between Norwegian and Saami fishers. Medard and Wilson (1996) argue that fisheries management decisions on Lake Victoria are having direct, negative impacts on riparian women. Chirwa (1989) outlines how colonial authorities abolished traditional fishing methods, calling them 'dangerous and destructive' with little justification. Colonial authorities often caused the collapse of management regimes by undercutting traditional authorities and, in fact, imposing open access on fisheries where effective management institutions had been in place (Bromley 1990, Johannes 1978).

Issues of class and fishing sector are often closely linked. Barrett (1991) describes how a territorial use rights system worked well in Bermuda until the tourist boom broke down the normative system that supported it. Then an alliance between the tourist industry and conservation groups managed to put the blame on the artisanal fishers and the most common artisanal fishing methods were banned. A similar alliance, with similar arguments, pushed through a ban on commercial gillnets in Florida (Smith and Jepson 1993). Ferguson and Derman (1993) tell the story of a lake in Malawi where the drop in one species, which was preferred by the upper classes, became defined as a “fisheries crisis” although no problem existed with other species in the lake. This led to the introduction of intrusive state management, albeit with “participatory” rhetoric.

Social structures do not merely define battle lines over allocation decisions. As Palmer and Sinclair (1996) demonstrate through interviews with Canadian fishers, these variables also strongly influence the perception and definition of the management problem. The issue that these scholars raise, and that we seek to raise here in another fashion, is what it means to have “participation” in fisheries management when the very question in dispute is whose definition of both ecological and social reality is going to prevail?

In sum, empirical fisheries management decisions are very often described most accurately by structural accounts. Management decisions are driven more by struggles between groups with variable social power than rational management models sug-

gest. These descriptions have an uneasy relationship to agency-driven theories of cooperative responses to the tragedy of the commons. The tragedy of the commons and the over-exploitation that accompanies it, however, is as much an empirical reality as politically driven management solutions. The structural approach concludes that fisheries management is too narrowly defined. For fisheries management to be sustainable, a broader reform is needed than just new institutional fixes, such as ITQ's or co-management, or any other remedy that is currently part of the fisheries management tool-box. It would also include structural policies such as fleet-composition, issues pertaining to economic scale, and community organization and development.

Building a Bridge: the Embeddedness Perspective

Many of the social scientists who have taken a primarily agency-driven approach to management and participation have not been oblivious to structural problems (e.g., Bromley 1991; Ostrom 1990; Pinkerton 1994) and recent work has begun on how these perspectives can be linked. One promising approach has adopted Polanyi's (1957) concept of embeddedness. A prominent advocate of this perspective is Granovetter (1992). Following Denis Wrong's (1961) well-known argument, Granovetter points out that the agency/structure dichotomy is the result of competing "undersocialized" and "oversocialized" accounts of human behaviour. In the former actors are seen as utterly independent agents pursuing nothing but their individual interests while, in the latter, behaviours are choiceless expressions of structure-determined socialization, as in Parsons, or false consciousness, as in Marx. Granovetter (1992) argues that we can overcome this dichotomy by conceptualizing social structure as the concrete, patterned interactions of people in networks of social relations.

"A fruitful analysis of human action requires us to avoid the atomization of implicit in the theoretical extremes of under and oversocialized conceptions. Actors do not behave or decide as atoms outside a social context, nor do they adhere slavishly to a script written for them by the particular intersection of social categories that they happen to occupy. Their attempts at purposive actions are instead embedded in concrete, ongoing systems of social relations." Granovetter (1992:58)

Granovetter's concept of networks responds to what Emirbayer and Goodwin (1994) call the "anti-categorical imperative", i.e. the need to conceptualize structural influences on individuals without reducing these individuals to mere representatives of categories. The anti-categorical imperative insists that understanding social structure benefits neither from placing individuals within structural categories, e.g. class, nor ignoring individual choices. Granovetter and other network researchers have achieved this goal by using a rational choice concept of agency within a network perspective. Emirbayer and Goodwin (1994) argue that remaining wedded to rational choice is not necessary to maintain the anti-categorical imperative. They suggest that there is nothing intrinsic to network analysis that precludes attention to the cultural discourses, identities and narratives which, in fact, help define and maintain networks.

Emirbayer and Goodwin (1994) point to the importance of the cultural idioms that actors draw upon in communications. Analyzing these idioms provides a description of the social structure that is independent of and complementary to networks while maintaining the anti-categorical imperative. Agency and structure-based theories both treat the meaning content of communications as an epiphenomenon - merely an

expression of either structurally determined ideologies and attitudes, or rhetorical strategies to attain utilities. They both miss the fact that it is through communications that mutual understandings of situations, including understandings of social structure, are created and recreated by people within them (Habermas, 1984). An embeddedness approach that followed Emirbayer and Goodwin's (1994) advice recognizes that, while communications include both ideological and rhetorical components, they also draw upon and reproduce the shared reality in which individuals pursue their utilities and the social structure is maintained.

The bureaucratic approach to fisheries management, by and large, disregards the extent to which fisheries practices are embedded in human communities. Fisheries management typically has an individualistic bias. The receiver of licences and quotas are always individuals, mostly boat-owners, sometimes corporations, but hardly ever local communities. Management systems, with their basic assumptions founded on methodological individualism and rational choice rarely has a focus on the social relations of fishers, their networks, communities and associations. There are, however, some interesting exceptions, some of them famous, such as the Japanese management system for inshore fisheries where producer cooperatives play a prominent part, and the Alaska "community development quotas". But not even these examples should be regarded as ideal cases, as they often fail to live up to some of their expectations concerning social equity and justice (cf. Barret and Okudfiara, 1995). In their analysis of a Canadian co-management program, Davis and Bailey (1996) argue that what is often missing in such programs is how small-boat fishers are rooted in the community. The programs ignored variation within a community and the result was that co-management had entrenched elite power.

By looking at how the fishers are embedded in the community the relationship between power and participation is revealed. McCay and Jentoft (1996) echo both Emirbayer and Goodwin (1994) and Habermas (1987) when they argue that embeddedness implies both that economic behaviours, such as fishing, should be analysed from the perspective of their social dimensions and that cultural systems differ in how embedded economic behaviour is. They also refer to the Giddens' concept of dis-embedding, when they point out the tendency in current management approaches to "lift out" of the community the management the responsibilities and practices that are part of their traditional patterns of collective action. Jentoft *et.al.* (1998) see co-management as a means of counteracting that tendency, as an institution for reembedding of management functions in the community, be it geographical, functional or epistemic.

We believe that the embeddedness concept has clear promise as a way to bring together our agency and structure-based understandings of management. We need to identify alternatives to current management practices, if not for other reasons that most have failed dismally. We think that it is essential then to search out and discuss the basic perspectives on which management practices start from and rest. Rather than throwing out the net to see what comes up, we need to be more selective and targeted in our approach to fisheries management. But for that, we need a theory that will enable us to systematically address what we can expect from concrete management initiatives and institutions.

The problem is that embeddedness is a slippery concept. There is a real danger of it being defined so loosely as to simply be another general word for "society," void of analytic content. Granovetter (1992) tried to avoid this by tying the concept to observable patterned interactions among people. Following Emirbayer and Goodwin's

(1994) critique, however, a rational choice-based concept of networks that focuses only on observable patterns and not on communicative content cannot adequately capture structural influences. The remaining part of this paper attempts to expand the usefulness of the concept of embeddedness for analysing fisheries management institutions. Drawing on Habermas (1984, 1987), we apply a concept of embeddedness that is based on the communicative content of interactions, but which specifies a set of identifiable communicative mechanisms that are differentiated by the degree to which they are embedded in shared meanings. Before we can apply this model to fisheries management, however, we need to outline a communications-based understanding of fisheries management institutions.

A Bargaining Model of Fisheries Management Institutions

Fisheries management is about creating social institutions which are meant to guard the sustainability of the resource. Closed seasons, mesh size regulations, marketing cooperatives, and management councils are all examples of such institutions. Following Scott (1995), we define institutions as patterned social interactions with behavioural, cognitive and normative dimensions. This definition expands the prevailing concept of management institutions that emphasizes only the rule aspect and it gives management systems a predominantly legalistic content. Our approach to institutions emphasizes their reliance on shared meanings that define behaviours and cognitions as fitting or not fitting particular normative patterns. The emphasis is not on the rule content of fisheries management. It is on the shared meanings which create the procedures and knowledge bases through which these rules are determined. It is this subtle shift that most clearly reveals the benefits to be derived from co-management approaches. Only this broader definition of institutions can perceive and appreciate the contribution and relevance of the knowledge that user-groups provide into the decision-making process.

Building from this definition, we adopt an analytic strategy that begins with the day-to-day, person-to-person interactions which give concrete expression to social institutions. The shared meanings that form institutions are created and interpreted through communicative actions. The authorities, organizations and regulations that make up a fisheries management system are attempts to create specific patterns in the interactions of human bodies, and their technological extensions, with an aquatic ecosystem.

It is at this micro level of institutional interpretation and creation that the questions of legitimacy, politics and economics come together and take on whatever force they have in patterning these concrete interactions between people and the ecosystem. Institutions are continually recreated (or broken down) by actions and the ways these actions are interpreted as following or not following the institution, in the same way that the ethnomethodologists demonstrated is true of norms in general. These researchers showed that norms are not structural phenomena that define appropriate behavior in a situation a priori; rather they are created through processes of deciding on, accounting for, and rationalizing behaviour in discourse (Heritage 1984). It is this process that relates shared meanings to concrete ecological outcomes. Fisheries management institutions are created and recreated through a bargaining process that consists not just of explicit bargaining over the codification of specific rules, but implicit bargaining over how compliance with the institution will be interpreted and enforced. Furthermore, institutions that are not codified, e.g. values, identities, etc., have a crucial role in determining how a resource is treated. These uncoded institutions are also created and recreated through interpretation and enforcement.

Here is a simple example. One author was a recent a passenger on a charter fishing trip. The primary target was striped bass and the two-fish-per-person bag limit was caught an hour and a half into the six-hour trip. While the aggregate limit had been caught, not every passenger had caught two fish. The captain ordered the mate to throw over dead two of the smallest of the eight, legal-sized fish in the cooler. Then, when the person who had not yet caught two legal-sized fish had done so, the captain told the passengers that this was as much as he was willing to push the regulations and suggested they shift to catching summer flounder.

The example illustrates several things. Enforcement was only possible in relation to the total number of fish landed, so it was the legitimacy of the regulation alone which gave it what force it had to affect behaviour regarding discards. This force, however, was entangled with other imperatives, such as making sure every passenger got their bag limit. The management institution codified as "the vessel may only land two legal-sized fish per person" was expressed with the addendum that "the vessel may continue to catch legal-sized fish until every individual has two, even if this means killing more fish than the limit." This interpretation expressed the management institution in that concrete moment. If there had been no alternative fishery, or if one of the passengers had expressed dissatisfaction with the size of his two striped bass, then another interpretation may have expressed the institution.

From the communications-based perspective we are developing we define embeddedness as follows: the breadth of shared understandings drawn upon in communicative interactions. A more embedded interaction means that those participating in the interaction draw on a broader range of background assumptions about meanings. These shared background assumptions point to understandings of social groups, personalities, and, especially, culture (Habermas, 1987).

Bargaining over the definition of institutions draws continually upon cultural accounts of both society and the resource. In line with the "new-institutionalism" developing in organizational theory (Powell and DiMaggiol, 1991), we believe that any analysis of the efficacy of fisheries management institutions must seek out these background, "taken-as-given" understandings. In other words, we must begin with how users interpret management institutions against these background understandings to be able explore the entire range of possibilities and potentials for institutional reform. We must perceive management institutions as embedded in a cultural context. This should not be interpreted too narrowly, as is the danger when the word "culture" is associated with picturesque fishing villages. Global markets have, albeit rudimentary, cultures as well, and fisheries science takes place within a culture that includes rigorously (and sometimes rigidly) defined notions of what constitutes valid descriptions of the resource.

Bargaining over the definitions of institutions takes place between groups of stakeholders. This means that some of the most important cultural accounts are those that define the identity of these groups. Identities, patterned interactions, and shared economic and political interests give form to these groups. These groups have differential abilities to reach a mutual understanding within the group to coordinate actions, as well as differential access to resources - both of which are important in the bargaining over institutions.

We choose the word "bargaining" to describe this process because it captures the image of an activity involving competitive give and take in which the relative advantages possessed by actors are of primary concern. The choice of this word has several problems as well (Wilson and McCay 1997). The most important is that "bargaining"

is usually thought of as something that happens between individuals. Creating institutions, however, is a contest over meanings and meanings are intended to be shared. The struggle over the definition of institutions is a struggle between groups that should not be reduced to individuals. Bargaining participants are all carriers of socially constructed meanings and reality perceptions. To understand how people argue when they bargain, one must understand where they come from personally, socially and culturally. Another objection is that many of the groups that participate in this bargaining over institutions will not have enough power to get "to the table" in any sort of formal sense. In this case bargaining must be thought of as the tacit process where a group's only power may come from access to the "back regions" beyond the surveillance required if institutions will affect behaviour (Giddens, 1984, Scott 1990). Finally, bargaining implies a process which is completed when an agreement is reached, an agreement which will then be in force as long as its explicit duration. The bargaining that is involved in creating and maintaining institutions is dynamic and ongoing. This bargaining process is particularly dynamic in fisheries management because of volatility of aquatic ecosystems leads to constant changes in the physical parameters which the institutions mirror and because of the difficulty of observing compliance.

An Embeddedness-Based Analysis Strategy

We have been working to develop the concept of "governance mechanism" as a possible approach to analysing the bargaining over fisheries management institutions at the micro level and relating these struggles to larger social structures (Wilson and McCay 1998). The basic idea is a modified version of Habermas' (1984, 1987) Theory of Communicative Action. Governance mechanisms are different ways of coordinating social action that operate by determining what needs to be discussed to bring interactions to closure. They are expressed within communicative interactions at the micro level. All institutions operate through a mixture of governance mechanisms (Wilson and McCay 1998).

Communications that draw fully upon shared meanings to reach a non-coercive consensus are one kind of governance mechanism. Following Habermas (1984), we call this mechanism "rational communication" and suggest that it is the most flexible and ecologically robust (Dryzek, 1987) way to make decisions about fisheries management. The studies of participation mentioned above tell us that when all participants are able to openly draw upon the entire range of their shared understandings of words, associations, values, and social orders the communications process yields the most contextually nuanced outcomes and the greatest possible legitimacy (Dryzek, 1987; Jentoft 1989). It is important to differentiate between institutions and governance mechanisms. Science is the best example of an institution that makes primary use of rational communication. The institution of science, however, also uses other governance mechanisms to coordinate its activities. But the heavy use that science makes of rational communication demonstrates the strengths this mechanism has in creating mutual understandings that reflect reality as closely as possible. Scientists are free to raise any argument to challenge conclusions and these arguments must be met with other arguments. Rational communication, on the other hand, is a cumbersome mechanism for coordinating activities over large-scales and is unpredictable in its outcomes.

In addition to rational communication, other governance mechanisms operate, but they are less embedded in shared background understandings. Rather than using an achieved mutual understanding, they utilize people's interlocking strategic objectives

to coordinate action (Habermas, 1987; Wilson 1998). Prestige and influence are two such mechanisms (Habermas, 1987) and social networks are the institutions that rely heavily on them. Prestige points to individuals having greater power to determine outcomes based on characteristics that increase their attractiveness, while influence points to greater power that derives from control of exchange values. These mechanisms are still substantially embedded in the background assumptions about meaning because they still rely on discussions to coordinate action, but they are less embedded than rational communications because there is no need for an open discussion to arrive at a non-coercive consensus.

Two other governance mechanisms are money and authority. These mechanisms are much less embedded in shared meanings than the other three. Markets are the institutions that make extensive use of money, while bureaucracies make extensive use of authority. These mechanisms are not entirely free of shared meanings (indeed they are themselves shared meanings), but they require little or no discussion drawing on other shared meanings to coordinate action. Money coordinated interactions always come to a point where actors must decide to “take it or leave it” according to the reality of the market situation. Authority eliminates the need for discussions about who will make final decisions. These two governance mechanisms confront each participant as a distinct system over which she has little or no control. Disembedded mechanisms tend to narrow options and often block opportunities for richer communications. The advantage of the more disembedded mechanisms, however, is that they can coordinate actions over larger scales, and they are more predictable (Wilson and McCay, 1998).

We suggest that, when further developed, these five governance mechanisms, differentiated as they are by the degree to which they are embedded in shared meanings, may offer an illuminating way to use the concept of embeddedness in the analysis, including comparative analyses, of fisheries management institutions.

The following example shows the importance of the mixture of governance mechanisms. A recent series of advisory panel meetings were held in a joint US and state management program. The underlying issue was one of distribution, and some advisors represented fishers from states that wanted more of the quota currently enjoyed by another set of states represented by other advisors. At the first meeting, the government representatives demanded that the advisors stop debating each other and focus on the pre-defined issues at hand. This meeting had no meaningful outcome for resolving the problem. At a second meeting, the use of formal rules and specific motions curtailed open discussions and kept the fishers focused on what divided them. However, when they finally had a chance, due to the intervention of several influential individuals, to move beyond formal procedures and talk more openly they made progress at identifying areas of compromise over the problems of allocating quota. This was because they were able to widen the discussion to include other species and alternative rules and because they were able to listen to other fishers’ interpretation of the “historical participation” on which the quota was based. This was not possible when they were only allowed to discuss motions based on particular, already defined provisions of the proposed amendment. Reflecting the unpredictability of this openness from the managers’ perspective, they also worked to strengthen their own solidarity as fishers vis-à-vis the management process. In this example, when the use of authority to coordinate the interactions was overemphasized, the advantages that come from the more embedded mechanisms were lost.

There are crucial differences between the effects that different governance mechanisms have on bargaining over institutions. Money and authority tend to make it more formal and constrained, limiting communicative give and take in interpreting the institutions. Their systemic character locks people into specific strategic goals that they must achieve, and makes it more difficult to reach a mutual understanding. Strategies are often enhanced by withholding information rather than sharing it. Networks are not as constrained as hierarchies and markets, and allow less formal interactions in future bargaining (Thompson, *et al.*, 1991). Hence, they are both less predictable and more flexible. Networks do not confront participants as an immutable system and allow greater latitude in building up a mutual understanding.

Conclusion

The chief problem with both agency and structural approaches is that they treat the content of communications as unimportant. One effect of this is that they abstract away the whole dimension of validity. Validity is a characteristic of the communicative content of interactions. These perspectives reduce the content of communications to mere superstructure, either one more strategic action among others or a choiceless expression of a person's location in the social structure. One of the main difficulties in analysing any sort of regulatory situation is the relationship between the validity of the regulation in the eyes of stakeholders and the facticity of strategic interactions (Habermas, 1994). The embeddedness perspective reveals how both of these dimensions are present in micro-level interactions as participants are faced with the dual tasks of pursuing their interests and building up a mutual understanding of the situation (Habermas, 1984). The embeddedness approach responds not only to the disparity in the accounts of empirical situations that these two approaches yield, it does so in a way that no longer ignores the questions of validity (particularly, but not exclusively, scientific validity), which anyone familiar with real world management debates knows are vital.

In offering this broad outline of an embeddedness approach, an element that has received little attention is how social power affects the bargaining over institutions. A bottom-up analysis of embeddedness that begins with communicative actions and physical behaviours, however, does not ignore questions of social power. It begins where power is made manifest in the inclusion or exclusion of voices in the bargaining over institutions and their meanings. The analysis then traces the governance mechanisms to macro structures and asks how the particular mixture of mechanisms that is shaping this bargaining came into being.

This approach is limited in its ability to produce generalizable knowledge because of the highly contextual nature of shared meanings. However, it is able to produce applicable knowledge for concrete, empirical situations and suggest hypotheses for more generalizable studies. It also describes information that is, at least intuitively, available to participants in the local context. It provides a critique of the interactions in which the positions of all the participants are related to their shared understandings and strategic actions. It brings self-consciousness to the responsibility that all these participants share in defining institutions. Dealing with such an analysis may, at times, force participants to take a decentered relationship to the bargaining process, and provide other participants with language that can be used to demand such a decentered relationship. This will, hopefully, increase the probability of compromise and flexibility.

Tying this approach to the governance mechanisms focuses attention on the central problem of institutional flexibility and its trade-off with predictability. From a practi-

cal perspective, it gives us a new way to talk about what we are after with co-management programs. Co-management is about capturing flexibility by shifting from our over-reliance on bureaucratic rules and markets as mechanisms for governing management institutions to greater reliance on rational communication and networks of stakeholders. Networks do not present themselves to participants as unalterable systems. They govern institutions in ways that are adaptable to shifting circumstances. This should not be overdrawn, the predictability that markets and bureaucratic rules offer must also be present, but co-management is precisely about creating a space within these systems where legitimacy and flexibility can also be used as resources for effective management.

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Annex 3: WGFS terms of reference for the next meeting

The **Working Group on Fishery Systems** (WGFS), chaired by Dorothy Dankel*, Norway, will be renamed the **Working Group on Maritime Systems** (WGMS) and will meet in Bergen, Norway from 31 October – 4 November, 2011 to:

- a) Review the 2011 reports from all Expert Groups that report to ACOM to get a global picture of ICES advice contributions from a perspective of marine governance;
- b) Based on this review, evaluate current practices in ICES in light of best practices of the science-policy interface. We will point out areas where improvements can be made.

WGFS will report by 1 December, 2011 (via SSGSUE) to the attention of the SCICOM.

Supporting Information

Priority	The main focus of WGFS is the fishery system and the role of scientific advice within that system. The system-based approach relates directly to priorities such as developing an ecosystem-based approach to management and the effective implementation of the precautionary approach. Consequently, these activities have a very high priority. The work of the Group is also essential if ICES is to advance the development of realistic projections of fisheries development that account for the reaction of other parts of the overall fisheries system.
Scientific justification and relation to action plan	The main focus of WGFS is the fishery system and the role of scientific advice within that system. The system-based approach relates directly to priorities such as developing an ecosystem-based approach to management and the effective implementation of the precautionary approach. Consequently, these activities have a very high priority. The work of the Group is also essential if ICES is to advance the development of realistic projections of fisheries development that account for the reaction of other parts of the overall fisheries system.
Resource requirements	Secretariat support for meeting.
Participants	These include scientists working with fisheries management, both from an economic, social and biological perspective. Participation is from ICES countries and scientists both from disciplines and scientific circles not traditionally represented at ICES.
Secretariat facilities	No additional software/hardware is anticipated beyond that which is currently available.
Financial	No financial implications.
Linkages to advisory committees	The goal for this Working Group is to better understand fishery and greater maritime management systems which is a central element of the work of ACOM.
Linkages to other committees or groups	Close links to SGMAS and SGRAMA who address the technical aspects of management strategies, also WGICZM (future name: WGMPCAM).
Linkages to other organizations	WGFS will continue to seek to widen participation for this group, including contact with relevant academic and inter-governmental organizations.

Annex 4: Recommendations

WGFS will be renamed to Working Group on Maritime Systems (WGMS). Our reasoning on this name change is based on the following points:

RECOMMENDATION	FOR FOLLOW UP BY:
1. Broader inclusion of marine sectors beyond fisheries, for example within the Integrated Maritime Policy and the Marine Strategy Framework Directive	SSGSUE/SCICOM
2. The new naming from "Fishery" to "Maritime" is more appropriate to the ecosystem approach and for extending our peer community outside solely fisheries	SSGSUE/SCICOM