Knowledge in co-management

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ABSTRACT:

Co-management institutions have generally been limited to implementation and have not extended user participation to include the knowledge basis for management decisions. This paper discusses some of the fundamental problems involved if such an extension were to be developed. One set of problems relate to the alienation of the immediate users from the formalised research knowledge which generally is used as the knowledge basis for mainstream modern fisheries management due to the different scales of observation used by formalised research and the immediate resource users and the requirement for predictability which is inherent in many modern management implementations. This set of problems may be reduced through the use of indicators of pressures and state of the resource system which are based on softer predictability requirements and accommodate aspects of local knowledge. Another set of problems relate to the different perceptions of stakeholders where a distinction is made between specific knowledge which is used to guide local management decisions and more generalised information which is used to compare across resource systems as required to monitor compliance with international agreements or for the use of market based instruments such as green labelling. Awareness and transparency regarding these problems is a prerequisite for development of participatory management systems which are extended to include knowledge aspects.

Introduction

The literature on co-management is ambiguous as co-management sometimes is seen as a way to empower resource users but often merely is discussed as a legitimising arrangement which may increase the compliance and thus the efficiency of fisheries management. Many co-management arrangements in both industrialised and developing countries are largely consultative and operate within a limited scope of user involvement in the implementation of management measures which are derived from objectives and a knowledge base which have been established without the involvement of users (Raakjær Nielsen et al 2003). This state of affairs can be interpreted as a deliberate attempt from governments to involve users in a superficial manner in order to increase legitimacy while maintaining control over the purpose and direction of fisheries management.

There are however also more fundamental problems in a more extensive involvement of stakeholders in management. These problems must be identified and understood as a prerequisite for co-management arrangements to move beyond consultations on implementation issues even in cases where there is a genuine acceptance from all involved that user participation should be more profound and include both normative, cognitive and regulatory aspects of the management institution.

This paper focuses on the barriers to the inclusion of cognitive aspects in co-management. It starts from the observation that mainstream modern fisheries management is based on formalised research based knowledge which is alien to the immediate resource users because it has been institutionalised to address problems on a larger scale than the scale that is relevant to the practise of resource users (Degnbol 2003). It follows that if co-management is to include cognitive aspects it will be a prerequisite that some common ground can be found which enables a translation of understandings across these different scales. This has important

implications not only for the institutional setup but for the substance of the knowledge base for management. These implications point to the need to use indicators which can be observed on different scales. Different frameworks of indicators are discussed in this context, one being a comprehensive set of indicators which addresses the various issues of interest to various stakeholders in a piecemeal manner, another being metaindicators which signal overall resource system health within an adaptive management framework. The properties of these frameworks in relation to user participation are discussed below.

Another issue which must be addressed in relation to the knowledge base for co-management arrangements is the different perceptions of stakeholder groups. The immediate resource users – the harvesters - will through their practice have acquired an understanding of some specific and detailed features of the resource system which enables the use of similarly specific and detailed indicators as guides for decisions in a co-management institution. Such use of specific knowledge is here referred to as 'vertical' as it relates to the relation between the state of the specific resource system and management decisions regarding that system without a requirement for compatibility with management in other resource systems. The scope is in that case to use knowledge to guide management and achieve objectives within that specific system and in response to signals from that system. Other stakeholder groups will not have similar specific knowledge about the features of a resource system but will search for general standards across resource systems. International agreements on criteria for sustainable resource use is an example of such a 'horisontal' knowledge base for fisheries management, while consumer choice on the market based on some type of ecolabelling is another example. The main criterion for information is in this context global simplicity and comparability across diverse resource systems rather than the utility of knowledge to guide management decisions and respond to signals in the specific management context. The two types of knowledge may be compatible but there is no *a priori* guarantee that this is the case. Local managers and immediate resource users may find themselves subject to market or international agreement standards which are less useful as guidance for management action than indicators which more specifically signal pressures, state and impacts of the local resource system. Such incompatibilities are a major challenge to management institutions which involve participation of a wide spectrum of stake holder groups.

Knowledge in co-management

The concept of co-management has in the last decade entered the mainstream fisheries management debate and user participation is increasingly seen as a necessary element of any fisheries management system. The arguments put forward in support of user participation are basically twofold. One type of arguments centres around implementation efficiency: is has proven impossible to implement management measures through top-down control or the monitoring, surveillance and control measures required are so expensive that the only implementation mode which may have impact and be economically effective must rely on compliance without extensive control. Within this line of thought co-management is seen as a cost-effective way of increasing compliance. Another type of arguments for user participation is based on human rights considerations: top down management is not acceptable in democratic societies and users should for democratic reasons be involved to the largest possible extent in all aspects of management.

The first argument seems in practice to have been the basis for actual implementations as indicated by a study of a range of co-management implementations in Africa and Asia which revealed that the co-management arrangements studied in general only involved users in implementation aspects while the definition of objectives or identification of the knowledge base for management had not been opened for user participation (Raakjær Nielsen et al 2003). This observation is the basis of a critique of this approach to fisheries co-management from a democratic perspective. Raakjær Nielsen et al distinguished between various management implementations on basis of the scope for user participation. A distinction was made between 'Modern management', 'Instrumental co-management' and 'Empowering co-management' where 'Modern management', which has been the prevailing management model in industrialised countries, exercises top down control in terms of both the definition of objectives, identification of knowledge and implementation, 'Instrumental co-management' includes users in implementation aspects and 'Empowering co-management' involves user participation in terms of both objectives, knowledge and implementation. It can from a democratic

perspective be argued that 'Instrumental co-management' merely serves manipulatory purposes from the side of governments as a means to achieve legitimacy and compliance without giving up control over the central issues of defining objectives and identification of what is considered valid knowledge base for decisions.

An extension of the scope of co-management to include knowledge aspects is however not trivial, even if there is an agreement that such an extension is required. There are basic incompatibilities between users' knowledge and that form of research based knowledge which has been developed as the decision base for modern fisheries management. This is basically derived from the different practices which are the basis for users' and research based knowledge respectively and is closely associated with the different scales on which modern fisheries management and fishers operate (Degnbol 2003).

Bridging the knowledge gap is thus not just an issue of better communication but involves a more complex process of developing mutual understanding between what amounts to different discourses. The modest but maybe most realistic aspiration may be to base management decisions on an identification of what can be considered common ground between the different discourses without attempting to mediate what may be fundamentally different views further. 'Common ground' may be reflections of the same basic features of the resource system which may be represented very differently within the different discourses but which nevertheless can be translated across the discourses. An example is fishers' observation of changes in the geographical extent of fishing grounds which in the research domain may translate into changes in the overall abundance of populations with patchy spatial distributions.

It is a basic requirement for this process of identifying common ground that shared understandings about the resource system can not only be identified but also condensed into agreed measures which indicates at least the direction for management action. Decisions and implementation of fisheries management will always be based on considerable uncertainty about states, processes and outcomes combined with evasive reference points. With a participatory approach including the harvesters these uncertainties must be addressed in communications between management agencies and fishers. With a participatory approach which includes more stakeholders such as consumers and environmental citizen organisations multiple interests and objectives must be accommodated and the management institutions must be able to deal with these as well as with uncertainties. These requirements will add immense strains on fisheries management institutions if fisheries management is to be legitimate, effective and efficient.

Approaches to the use of knowledge in fisheries management

The basic approach to the use of knowledge in modern mainstream fisheries management is characterised by some requirement for quantifiable predictability. All variants of TAC based systems are based on the assumption that there is a link between landings and impact and that catch predictions based on certain outcome objectives can be produced. This approach is presently closely linked to management based on single stock considerations. It has more often than not developed into micromanagement systems where new regulations are accumulated as new issues are raised and addressed. It is increasingly realised that the predictability requirement cannot be fulfilled even within the limited scope of single stock management without considering extended impacts such as ecosystem considerations. There are considerable uncertainties involved even in the simplest situations. The major uncertainties related to the biological system are generally the variability in recruitment and distribution of stocks but fleet adaptation is also an important source of uncertainty in the linkage between regulations and outcomes.

The predictability approach is closely associated with a specific form of knowledge production and a specific selection of what is considered valid knowledge. Quantified predictions are produced as mandated research (Salter 1988) in specialised research organisations which may be largely detached from other aspects of the management institution. This leads on the other side to exclusion of other types of knowledge such as the local ecological knowledge of fishermen and the understandings of environmental citizens organisations. Research based knowledge relates to other scales (space and time) and practices than local knowledge and the different sources of knowledge may as a result be in conflict. This has important institutional implications: the knowledge base for management is not shared, there are no mechanisms to mediate different sources of knowledge and management decisions may in the end have less legitimacy. This approach is therefore also associated with top-down management models where stakeholder participation is largely limited to consultations and implementation details.

The predictability requirement and the inherent incompatibility of different knowledge discourses leads to serious limitations for this approach in terms of the large costs involved in producing the research base for management and the lack of legitimacy when resource users cannot recognise their understanding of the resource system as a part of the knowledge base for management decisions.

The intermediate solution to the knowledge problem is to maintain a softer predictability requirement by basing management on a comprehensive set of indicators of pressures, states and impacts without necessarily attempting to quantify outcomes of management actions. This approach is based on assumptions about the processes linking pressures on the system and the resulting impacts and state and about the mechanisms through which specific responses or regulatory measures can modify the pressures and thus the states. This approach was the basis for OECD's pressure-state-response system for environmental management (OECD 1993) and is in single stock fisheries management inherent in the limit and 'pa' reference point system used as a basis for fisheries management in the North Atlantic.

On the institutional level this approach represent extensions of the predictive mode: there is still a requirement for some understanding and tracking of specific processes linking pressure and outcome, the knowledge base is still comprehensive and complex and it is produced in specialised research organisations.

This approach does not necessarily pretend to address separate issues in a connected way. Indicators reflect specific features of the ecosystem separately. If the indicators in this approach are not developed as a part of a consistent framework it may thus prove possible to base management on a different knowledge base for specific issues, that is other types of knowledge beyond research based knowledge are not necessarily excluded. A management system based on this approach is therefore open to a development into patchwork management where new regulations with associated indicators are developed ad hoc and added on according to the interests and influences of various stakeholder groups. There is thus a considerable potential for inconsistencies when various issues are addresses in what appears to be an ad hoc manner, on basis of a growing set of indicators which are not interconnected.

The solution to this problem may be to discard the basic requirement for comprehensive causal understanding and focus on the overall pressures on the resource system and guide management by metaindicators which reflect the overall impacts of such pressures. This may be possible because there are considerable correlations between many types of impacts of fisheries on fish stocks and aquatic ecosystems. High levels of exerted fishing effort on the system will simultaneously have high probability of reducing target species below acceptable levels, of reducing populations of non-target species through by-catches, of high impact on bottom fauna or sensitive habitats, of high competition with other top-predators such as seabirds, sharks and seamammals etc.

Given the correlation between many types of impact and the complexities and costs involved in understanding, monitoring and regulating fisheries specifically in relation to many impacts separately an option could be to renounce the detailed control and thus the requirement for detailed understanding and predictability altogether and regulate the overall pressure on the ecosystem.

Two main implementation mechanisms have been suggested on this basis:

1) Reduction of exerted effort to sustainable levels. In the longer term effort would most effectively be reduced through capacity reduction. Effective reduction of effort will address many environmental concerns simultaneously (NRC 1999, FAO 2001).

2) Seasonal or permanent closures of areas for fishing. Marine protected areas have been proposed as an important or even the major contribution to fisheries management by many authors (for an overview see of this approach see Salm *et al* 2000, Roberts and Dawkins 2000). In the present context the relevant argument is that marine protected areas will serve as refugees for a large cross section of marine life which will ultimately limit the possible impact from fisheries. Marine protected areas have also been proposed to serve other purposes such as protection of sensitive habitats or protection of feeding or breeding grounds.

If fisheries management would mainly be based on such generalised measures there would be a need to monitor impact through a set of metaindicators which synthesises the overall state of the ecosystem without pretending to track specific interactions. Such metaindicators were for instance discussed by the ICES Advisory Group on Ecosystems (ICES 2002) and could include abundance indices of sensitive species, proportion of mature individuals in sensitive populations or ecosystem metrics such as size compositions or average trophic level of catch. The identification of these specific metaindicators and a general understanding of their significance are

based on extensive research in various ecosystems. Such research may be conducted in the specific system in which case there will be some understanding of the specific processes linking pressures and indicator. In other cases the choice and interpretation of metaindicators may in lack of better options be based on analogies from similar ecosystems. However, a better understanding of the ecosystem will in all cases improve the possibilities for relevant choices and interpretations of indicators.

A control of overall pressure monitored through metaindicators can only be implemented within an adaptive management framework. There is not necessarily an *a priori* understanding of the specific processes which link fishing activities and indicators and the long term impact of a specific activity level can therefore not be predicted. The development of the knowledge base must basically take place through adaptive learning.

One of the major challenges for such an approach would be to reach decisions on relevant metaindicators and not least reference points for these indicators since it is the reference points which will indicate the direction of management action. It will in this case be evident that such decisions cannot be made on a natural science basis alone and could only be produced by a negotiation process between stakeholders which would require conflicts to be reconciled and the necessary compromises to be made. Contrary to the patchwork approach conflicting interests must therefore negotiate and agree on both regulations and indicators as regulations and indicators do not relate to specific issues or problems but to large groups of issues simultaneously.

The institutional implications of these various approaches are summarised in the table below. It is in relation to co-management important to notice that the implications of the various approaches for participation are very different with the approaches based on quantifiable predictability being basically exclusive to other types of knowledge and the various indicator based approaches opening up for other types of knowledge and thus for grater participation in relation to the cognitive aspects of management.

Object of management	Single stock/ optimisation	Single stock/ Precautionary approach	Specific considerations (stock, birds, corals)	Addressing multiple considerations simultaneously without predictability requirement
Regulatory framework	Instrumental / micromanagement	Instrumental / micromanagement	Instrumental/patchwork management	Adaptive – general measures to reduce overall pressure
Knowledge base	Deterministic predictability.	Probabilistic predictability	Soft predictability, structured indicators	Adaptive learning, metaindicators
Normative base	Utility / optimisation of long term economic and social utility	Utility – risk avoidance or precautionary approach	Multiple objectives addressed separately – production and conservation related. Conflicts not resolved	Multiple objectives must be reconciliated
Participation	Top-down or negotiation framed by research based knowledge – largely consultative	Top-down or negotiation framed by research based knowledge – largely consultative	Multiple stake holders, negotiation based on research based knowledge on state, processes and outcomes but other types of knowledge may be used.	Multiple stakeholders, negotiated reconciliation of interests / compromises

Indicators for comparability or to guide local management?

The development of the concept of indicators in relation to fisheries sustainability has taken place within two different agendas.

One agenda is concerned about establishing indicators that can be used to govern policies in the international domain, in relation to sustainable development and in relation to market regulations. This development is promoted by international organisations and NGO's and centres around the Indicators of Sustainable Development initiative of the UN Commission on Sustainable Development (CSD) (CSD 2001), which is a body assigned to follow up on the UNCED Agenda 21. The Organisation for Economic Co-operation and Development (OECD) has likewise developed an indicator framework for environmental performance reviews (OECD 1993). This agenda has been developed in relation to environmental sustainability in general but is also reflected in fisheries. An account of this development in relation to fisheries has been presented by Bell and Morse (1999); Garcia and Staples (2000), Dahl (2000) and Pitcher and Preikshot (2001).

The requirements in this context of international ("horizontal") indicators are that indicators should be observable on a comparable, standardised basis across a multitude of ecological and social systems, be based on internationally accepted research and relate to the objectives set out in the relevant agreements and codes. Acceptance among international decision makers or immediate market acceptability is important while local acceptance by users may have less priority.

In a development context these requirements are presently mainly present in relation to industrialised fisheries. However, the internationalisation of trade with fisheries products and the associated requirements for accountability and tractability will put increasing pressure on some coastal semi-industrial and even artisanal fisheries. This problem is highlighted by the resistance of some developing countries regarding proposals for green labelling, which is rooted in the fear that requirements may include formal stock assessments rooted in mainstream science with all that goes with it in terms of costs.

The second agenda relates to the need to develop a basis of knowledge which can guide practical fisheries management in the local context. Practical management decisions should be guided by knowledge about the present state of the specific fisheries and resource system and this knowledge should be sufficient to indicate directions of required regulatory measures and to evaluate the outcome of such measures. This knowledge does not necessarily need to be comparable across fisheries systems, the main issue is that it reflects the local system and can be communicated among those involved in the fisheries and in management – the emphasis is on the 'vertical' use of knowledge within the fisheries systems rather than horizontal comparability across systems. The need for using indicators in this context is rooted in the scientific community and based on a realisation that mandated fisheries research may have reached limits in terms of the complexity it is able to address on a predictive basis and that a new approach therefore is required if the wider ecosystem effects of fisheries are to be addressed. A response to this "complexity wall" has been explorations into the identification of proxies for the standard reference points of stock assessments and into indicators that are assumed to capture the effects of fisheries pressures on the ecosystem. This investigation of indicators has been especially pertinent in relation to the wider ecosystem effects of fisheries, which is a much more recent research area than classical fisheries biology, and where an approach involving the development of fully-fledged functional models as an extension of classical approaches seems impossible from the outset (Hall 1999, Kaiser and de Groot 1999, Gislason et al. 2000).

The main emphasis in this case of local/regional ("vertical") indicators is acceptance by stakeholders within all levels of the local/regional management system. Dependent on the relative power and worldview of stakeholders in the management system, indicators must be congruent with both local ecological knowledge and research-based knowledge. As international comparability is not the issue, indicators can be selected to satisfy local requirements in terms of knowledge and resources available for observation.

There is no reason to expect that indicators developed within the "horizontal" and the"vertical" contexts will coincide. As an example, the Maximum Sustainable Yield (MSY) concept, which has now largely been abandoned by fisheries biologists as a relevant and measurable reference point to guide local management decisions, is the only fisheries related indicator on the Commison of Sustainable Development's list of indicator candidates (CSD 2001), and was mentioned as a target in the Johannesburg Implementation Plan (UN 2002). Indicators selected on the basis of their international comparability and acceptance among international decision makers or on the market should in principle be an extension of, and build on, internationally agreed results of the research agenda. However, they may be associated with low acceptance among local resource users – and *vice versa*, indicators based on a congruence between local and research-based knowledge may be specific to the local situation and may therefore carry little weight out of the local context – on export markets or in international comparisons of fisheries management performance.

Such incompatibilities between different indicator systems represent a dilemma to fisheries management and especially to national governments: governments must both ensure local legitimacy and practical utility of the knowledge base for management, and be able to meet (future) requirements for documentation in relation to international agreements. This dilemma cannot be resolved but may be diminished if the process of identifying and selecting indicators is prepared to consider the different institutional requirements for indicators from the outset, and as an integral part of the selection criteria.

Conclusions

There are fundamental problems which must be addressed if the involvement of stakeholders in fisheries management is to be extended to include cognitive aspects.

One set of problems relate to the difference between the perspective of the formalised research based knowledge which forms the basis for mainstream modern fisheries management and the perspective of the immediate resource users. This difference is systemic as it *inter alia* reflects the different scales of observation required for the practices of governments and the immediate resource users. The requirements for quantitative predicatibility which is an inherent feature of many modern management implementations also contribute to alienating users from the knowledge base used for management decisions. A common ground which may translate better across scales and accommodate the interests of a more diverse spectrum of stakeholders is represented by indicators which convey signals relating to pressures, state and impacts on ecosystems. Such indicators may either be used as a comprehensive set of indicators, each reflecting separate issues in a piecemeal manner to address multiple concerns separately or as metaindicators which reflect overall pressures and the state of the resource system and are used to guide management within an adaptive management framework. Both approaches may be a basis for extended stakeholder participation but the piecemeal approach may in the longer term develop inconsistencies and may fail to address issues which have not attracted the attention of strong stakeholder groups.

Another set of problems relate to the different perceptions of stakeholder groups. A distinction can be made between the use of knowledge to guide local management on basis of specific signals from the resource system ('vertical' indicators) and the use of indicators to compare across resource systems ('horisontal' indicators) as required to monitor the performance of management relative to international agreements or as information top guide consumer behaviour on the market. Vertical indicators may accommodate local and specific knowledge and may thus perform well in relation to both the provision of relevant signals from the resource system and acceptance from local resource users but may perform less well in terms of being understood by stakeholders which are more remote from the resource system. Horisontal indicators will have the opposite characteristics and there is thus no guarantee that the two types of indicators are compatible in a specific context.

These incompatibilities between formalised research knowledge and the local knowledge of the immediate resource users and between the perceptions of different stakeholder groups are a major challenge to management institutions which are set up to involve participation of a wide spectrum of stake holder groups. The incompatibilities are systemic and cannot be removed as such. However, awareness and transparency about their existence and nature is a first prerequisite if participatory management institutions are to be developed to include the knowledge basis for management.

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