

Implementing Ecosystem Management in International Fisheries Organizations Through Adaptive Management: The Potential for Future Change

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Abstract. Managing fisheries resources according to an ecosystem approach is an idea that emerged from science and ecology and has now found its way into the international regulation of regional and high seas fisheries. Several fisheries agreements now impose an obligation on states to consider the protection of marine ecosystems. The impact of this relatively new obligation on institutional decision making has yet to be fully determined but implementation of ecosystem based management is impeded by strict requirements for scientific knowledge. At a domestic level, the concept of adaptive management is providing a useful approach to implementing ecosystem resource management. Institutions adopting an adaptive regulatory scheme confront the challenges of complexity and uncertainty in ecosystem analysis through iterative policy and institutional design adjustments. International fisheries institutions could benefit from adopting aspects of adaptive management policies to better implement ecosystem based management.

Keywords: ecosystem management, adaptive management, international fisheries law, regional fisheries institutions

1. INTRODUCTION

Ecosystem management is now a component of several international agreements governing the management of high seas fish stocks. The obligation to consider ecosystems principles ranges from the highly developed ecosystem approach of the 1980 Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR) through to the inclusion of ecosystem principles in the range of issues to be considered by recently created institutions. However, several obstacles prevent ecosystem based management from being fully realized through existing international agreements. First, the basic structure of the international regimes are often incompatible with management of stocks that cross jurisdictional boundaries. Second, international regimes do not integrate scientific and political decision making in a manner that recognizes and deals with scientific uncertainty.

This paper proposes that international fisheries organizations consider adaptive management as a strategy for implementing ecosystem based management. Adaptive management has been developed in the context of national resource management agencies including fisheries management. It offers some solutions to the problems caused by scientific uncertainty and the need to develop greater understanding about ecosystems. Although adaptive management could not be transferred without modification for the international context, the approach may be a positive response to existing difficulties in managing fish stocks in conditions of complexity and uncertainty.

2. DIFFICULTIES IMPLEMENTING ECOSYSTEM BASED MANAGEMENT IN INTERNATIONAL FISHERIES REGIMES

Many agreements now refer to ecosystems principles as among those issues that must be considered by fisheries organizations. In practice, however, attempts at ecosystem based management are hampered by a lack of knowledge about the state of ecosystems, scientific uncertainty and decision processes that fail to maximize the potential for learning from the management process.

2.1 Legal Obligations to Consider Ecosystems Principles

The obligation to consider ecosystem principles is becoming more common in international fisheries agreements. The inclusion of the concept in the 1995 FAO Code of Conduct for Responsible Fisheries (FAO Code of Conduct) and the 1995 Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (the Fish Stocks Convention) has created an impetus for the principle to be included in regional agreements. Two recent conventions – the Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (WESTPAC) and the Convention on the Conservation and Management of Fishery Resources in the South-East Atlantic Ocean (CSEAO) – contain reference to ecosystem principles, although they differ in the manner in which ecosystem considerations are incorporated into the legal framework. This could lead to different legal obligations relating to ecosystem based management on states depending on their membership of the different regimes. However, a common approach to ecosystem principles can be discerned despite the differences in the structure of the agreements.

First, the states negotiating these conventions have acknowledged that fisheries resources are part of complex marine ecosystems which play an important role in regulating the abundance of target species. Therefore, the health of marine ecosystems and the habitat of living resources is important to the sustainable development of fishing activities. Many states have had some experience with implementing ecosystems principles in national environmental policies, and this recognition follows the growth in influence of conservation biology on policy design.

Second, states have a responsibility to protect the biodiversity of fish stocks and related species.

Third, states acknowledge that fishing efforts (and perhaps other human activities, depending on the relevant Convention) can have a permanent impact on marine ecosystems, and there is an obligation to take measures to prevent irreversible damage to the ecosystem.

Fourth, research activities should consider not only the effect of fishing effort on target species, but also on related and dependent species within the ecosystem. This does not appear to be an obligation on each state,¹ but scientific committees and commissions within organizations generally should make an effort to gather or generate research in order to make decisions about related species.

Fifth, fisheries organizations should consider the status of related species in the ecosystem when determining fisheries management measures. Whether addressed directly in principles for decision making as in CCAMLR or CSEAO, or addressed through the precautionary approach as in WESTPAC, it is clear that parties to these agreements consider that at least some consideration of the ecosystem should take place in deciding on management measures.

Despite these emerging principles, most international fisheries organizations are struggling to implement ecosystem based management in a meaningful way, despite renewed attempts to deal with issues such as by-catch. Even CCAMLR, long the model for ecosystem management, struggled for many years to implement an ecosystem approach. (Regwell, 1999) The requirement for extensive scientific information about an ecosystem is unavoidable given the complexity of natural systems, and this requirement can be an impediment to implementation of ecosystem based management.

2.2 The Problems Caused by Scientific Uncertainty

Scientific uncertainty is a constant issue for the management of fisheries resources, regardless of whether a traditional approach or an ecosystem approach is taken. Although managers of fish stocks would prefer to have concrete information about the state of the ecosystem, fisheries science necessarily involves assumptions and interpretations that can affect the accuracy of the advice. (Peterson, 1993; Walters, 1997). The declining status of many fish stocks around the world is an indication that it is not possible for scientists to accurately predict the effect of management and

¹ For example, see article 13(1)(a) of the CSEAO where states are obliged to exchange data only about fisheries resources, not living marine resources in general.

conservation measures in all cases. However, the dynamism and complexity of ecosystems mean that scientific uncertainty can never be completely eliminated. (Lee and Lawrence, 1986; Holling, 1995; Botkin, 1990; Tarlock, 1994).

In the international sphere, arguments over the correct interpretation of scientific data have led to several disputes with potential political and legal consequences. For example, the Southern Bluefin Tuna case between Australia, New Zealand and Japan arose from a dispute regarding the biological status of the stock. (Foster, 2001) Disputes may also arise where there is suspicion about the apolitical character of scientific advice provided to fisheries bodies. (Lutgen, 1999; Clark and Hemmings, 2001).

The question remains: how can international fisheries organizations implement ecosystem management given the complexities of incorporating information about ecosystems into decision making? Simply acknowledging the existence of uncertainty may not resolve the issue. Holling (1995) has argued that in the face of uncertainty resulting from the complexity of ecosystems, resource managers have the tendency to request more data or to resort to unsupported beliefs. Therefore institutional arrangement must allow uncertainty to be acknowledged and addressed before management can be optimized.

3. ADAPTIVE ECOSYSTEM MANAGEMENT

One response to the challenges facing the implementation of ecosystem management is adaptive management. This strategy has been utilized in several national resource management programs, including in the fisheries management area. Adaptive management policies assume that scientific uncertainty is inherent in any attempt to manage resources and therefore the management process is constructed in order to maximize opportunities to learn about ecosystems.

3.1 Defining Adaptive Management

As scientific understanding of the dynamic nature of ecosystems developed, adaptive management has been created to manage the complexity of ecosystems. The National Academy of Sciences definition of adaptive management is as follows (Tarlock, 1994):

“Adaptive planning and management involve a decision making process based on trial, monitoring, and feedback. Rather than developing a fixed goal and an inflexible plan to achieve the goal, adaptive management recognizes the imperfect knowledge of interdependencies existing within and among natural and social systems, which requires plans to be modified as technical knowledge improves”

A more informal description is given by Lynam et al. (2002): “adaptive management is generally accepted as a continuously iterative, learning-by-doing process, in which objectives, activities, monitoring protocols, and evaluative procedures are established and then refined as new information is gleaned from the experimental manipulation of structures or processes.”

The fundamental assumption underlying adaptive management is that ecosystems are complex and dynamic, so that managers can never be confident of the impact that particular actions will have on the ecosystem. (See Gunderson, 1999; Botkin, 1990; Holling, 1995) This does not mean that it is impossible to manage the resource, only that the scientists and managers should take an adaptive approach – continual monitoring is vital, as is prompt action in response to new information. Decision makers understand that each decision is something of an experiment – the decision is undertaken on certain assumptions, but those assumptions are subject to falsification based on careful monitoring of the resource. Decision makers are prepared to change the management approach and assumptions if earlier decisions have unexpected and undesirable consequences.

The adaptive management approach has been described as the opposite of a “trial and error” approach to resource management. On the one hand, more traditional forms of regulatory structures can be seen as “adaptive” in an ordinary sense – when information shows that a conservation measure is failing, decision makers generally adopt a new course of action. However, adaptive management is a particular strategy that emphasizes the importance of learning as a focus of regulatory effort, and therefore should be more than a reactive response to an unforeseen crisis. Rather than implementing a conservation measure and hoping (expecting) it to be successful, decision makers test several possible theories and

expect surprises. In this way, proponents argue that true adaptive management is “active” rather than “passive”. (Walters and Holling, 1990).

Johnson (1999) distinguishes between “monitor and modify” and “adaptive management” approaches. The monitor and modify approach characterizes most existing international fisheries management. A policy decision will be made using the best current data available, and then the policy is implemented. Often a monitoring plan is also implemented, and data from the program is used to evaluate and periodically modify the policy relative to a specific goal such as total allowable catch. The modifications are intended to “hone” the policy and keep the system in the optimal state.

In contrast, adaptive management approaches use collaborative decision making based on models of the ecosystem to improve understanding of the ecosystem at stake. Gaps in information and uncertainties are identified. Alternative management options are identified, and models are used to predict the effects of the actions. Management plans are designed to meet management goals (e.g. achieving MSY) and also provide new information to address scientific uncertainties. As the plan is implemented, monitoring programs provide new data which is analyzed and management plans are revised as understanding of the system improves.

Halbert (1993) identifies two essential characteristics of an adaptive management policy. First, a link between science and management must be created through which evaluation of the effect of policy decisions can occur. Therefore, it will be important for clear objectives to be established. Second, adaptive management emphasizes experimentation as a feature of management plans in order to maximize information and avoid incrementalism.

3.2 Establishing the Boundaries of Adaptive Management

The experimentalism behind adaptive management may appear to some observers to portend a high risk approach to fisheries management. In international fisheries organizations there may be resistance to any implication that fish stocks would be endangered by experiments with harvesting methods or other management measures. However this is not the inevitable result of using adaptive management.

In short, there must be normative limits on the experimentalism of adaptive management policies, limits that should be identified by the institution in advance of adopting the strategy. Adaptive management’s strength is in the development of information through the testing of hypotheses, and efforts must be made to support the utility of the experiments. However, inevitably the values of the political and social context will impose parameters on the extent of the experimentation. Because resource management policies are developed within political institutions, any international institution that implements adaptive management will tend to focus on designing an experimental management process that has scientific as well as political support. This may require placing limits on the extent of the experimentation with stocks as well as creating political support to ensure the experimentations are conducted as well as possible.

One example of a possible boundary on experimentalism is the precautionary approach. This approach is becoming firmly established as a guiding principle of fisheries management, and it would be possible to adopt adaptive management under a precautionary framework. Under adaptive management, a range of conservation measures would be considered and evaluated. Those with the highest risk to the sustainability of the fish stock could be given lower priority than options that produce useful information in a less intrusive manner. In the ultimate analysis, it may be that a particular stock is at such high risk that it is politically unacceptable to experiment with management measures and a highly conservative approach should be adopted – this is a legitimate option for an institution, but it should not be the default position.

4. IMPLICATIONS FOR INTERNATIONAL ORGANIZATIONS ADOPTING ADAPTIVE MANAGEMENT

4.1 The Advantages of Adopting Adaptive Management in International Fisheries Institutions

To some extent, international fisheries regimes incorporate features that may appear adaptive. All fisheries institutions require regular interaction by the states parties through the regular negotiation of TACs at the very least. Most institutions have a scientific committee that advises the decision makers on the sustainability of regulatory decisions. Recently, some organizations have taken steps to more fully explain the role of uncertainty in the scientific advice provided to managers. (Lutgen, 1999). Many revise their rules regularly – although much of the rule revision effort goes into compliance and enforcement procedures. To this extent fisheries agreements appear, on the surface, to be more adaptive than the majority of environmental regimes.

However, this appearance of flexibility does not create institutions that in fact operate adaptively. At an operational level, few organizations perform extensive modeling when making predictions about the effects of fisheries measures. (Stokke, 2001) Although limited attempts at modeling occur, usually they are in the context of the data that is available rather than as a result of a systemic attempt to obtain data. (Dr. Beth Babcock, personal communication). Ecosystem models are generally not attempted due to their complexity, although simple ecosystems concepts may be used in attempting to create predictions for a single species. In most organizations, scientific committees do not have the time, resources or mandate to create research plans to address inadequacies in information.

“Learning by doing” is often inhibited by institutional rules that lead to unchanging TACs or the sidelining of scientific advice. These rules sometimes reflect the need to obtain consensus within the organization, and may be the inevitable result of operating within the international legal environment. However, this does not prevent the re-evaluation of institutional structures to seek an adaptive institutional structure that allows fisheries organizations to focus on the development of research and the optimization of learning possibilities. Juda and Hennessey (2001) argue that adaptive management is the most promising governance structure for large marine ecosystems that entail considerable uncertainty.

First, emphasizing change in managing complex natural resource systems means decision makers come to the decision making process with new assumptions. Using adaptive management in fisheries organizations means that institutions may be able to take into account the poor information available in respect of migratory and straddling stocks, make progress based on this knowledge, but focus on making new information available through the operation of the management plan itself.

Second, an adaptive management approach also implies that decisions must be made even in situations where insufficient information is available. (Holling, 1995; Profeta, 1996). Therefore, in a situation where states are deadlocked over scientific advice and it appears that conservation measures may be required, an adaptive management approach would favor taking action to gain further information about the situation, rather than simply ignoring it. When combined with the precautionary approach, the solution would be to favor measures that are designed to maximize the information about the potential crisis in a manner that minimizes any possibility of overfishing the stock in the long term.

There are some indications in the various fisheries instruments that a flexible, adaptive approach is contemplated by some states. The 1995 FAO Code of Conduct for Responsible Fisheries contains guidelines for, among other things, data gathering, management measures and fisheries research. In addition to the usual exhortations to conduct scientific studies, the Code indicates a need to consider alternative management options designed to rationalize fishing.² The Code also prescribes that the “efficacy of conservation and management measures and their possible interactions should be kept under continuous review. Such measures should, as appropriate, be revised or abolished in the light of new information.”³ A lengthy section on fisheries research includes such instructions as initiating research in the absence of scientific information; monitoring the impacts of ecosystem changes

² Article 7.4.3.

³ Article 7.6.8.

resulting from fishing pressure, pollution or habitat alteration; and emphasizing the need for ongoing monitoring and analysis in several circumstances.⁴ These guidelines are consistent with an adaptive management approach to resource management although the Code's provisions do not explicitly contemplate adaptive management. However, the Code could provide a springboard for the adoption of adaptive management in international fisheries institutions.

4.2 Incorporating Adaptive Management into International Fisheries Institutions

It is important to note that it is impossible to simply transfer an adaptive management process from a national context into an international organization. However, elements of successful adaptive management strategies can be adapted for use in international fisheries law. Wiener (2001) points out that international environmental law did not develop piecemeal from general international law principles but reflects a substantive application of insights from national law to global environmental problems. International fisheries law can also benefit from studying national experiences.

Adaptive management can influence a number of levels of institutional operation. According to Lee and Lawrence (1986), adaptive management is both a strategy and a concept. It can guide the development of scientific advice, but it is also a commitment to "learning by doing". Adaptive management can be used to reconceptualize the role of international fisheries institutions at a broad level as well as assist in revising the decision making process and the provision of scientific advice.

Although in theory existing international institutions could implement adaptive management in sectors of their operations if there is political will to do so, a developing body of literature is focusing on the role of institutions in the success of adaptive policies. Adaptive management can be less than optimal if institutions are not well equipped and the decision makers do not sufficiently understand the approach. Adaptive management must be more than an activity undertaken by scientists or the process may not lead to significantly improved results. The institutional decision making process needs to be structured so that flexibility is built in. Monitoring is essential. But an institution also requires the ability to receive the results of the monitoring, interpret them and incorporate the results into decision making.

4.2.1 Develop institutional capacity for ecosystem based management

Fisheries institutions that do not currently operate under a mandate to consider the ecosystem effects of fishing will have to reconsider the principles on which they are based. There are several ways in which existing fisheries institutions do not possess the capacity to incorporate an ecosystem approach.

The first, and probably most difficult, problem is the case of institutions with jurisdictions that overlap geographically. This usually occurs where various institutions have been created on an ad hoc basis to manage one or a few species of commercially important fish. Successive institutions may have been created for other species of fish in the same area. Clearly in these cases it is very difficult for fisheries institutions to adopt an ecosystem approach. First, the bifurcated decision making responsibility means that the effects of management measures on species covered by the other institutions may not be fully accounted for. Second, research efforts may not be coordinated sufficiently, so that opportunities to maximize information gathering on the ecosystem are lost. Third, there may be inadequate information sharing between the organizations.

In these cases an ideal approach would be for existing over-lapping organizations to consider whether reform is necessary to integrate the fisheries management decisions for related species within an ecosystem. (See Kimball, 2001). This may require restructuring organizations to avoid single species management models. (Regwell, 1999; Botsford, 1997). There is also a challenge for states, when considering new fisheries problems, to consider whether the problem can be addressed within an existing institutions rather than creating a new institution with responsibility for a single species within an area already covered by a broader, ecosystem-oriented institution. The concept of large marine ecosystems as a basis for governance is a welcome development that may lead to better institutional design. (Griffis and Kimball, 1996; Juda and Hennessey, 2001).

⁴ See article 12.

The second related issue is that of institutions with a broad geographic scope that do not have a strong ecosystem focus. Generally these include institutions that pre-date the 1995 Fish Stocks Agreement and the FAO Code of Conduct. These organizations should address the extent to which they consider ecosystems in their management decisions.

4.2.2 Re-evaluate the role and structure of scientific advice

It is inevitable that adopting an adaptive management approach would require a re-evaluation of the role of scientific advice in fisheries organizations. Institutional reform is required to address the requirement for reliable and cooperative scientific advice in which states can have confidence. Fisheries organizations have now had sufficient experience that a thorough review should be conducted of the institutional and political barriers to obtaining apolitical and high quality science.

First, states must have confidence in the integrity of scientific advice and processes incorporated in institutions. There will not be one solution for all organizations. In some cases, allowing for independent peer review may be sufficient to break the occasional impasse in institutions where the scientific committee is generally producing reliable advice. However more significant reforms may be necessary if the scientific advice provided to an organization is seen as too politicized. This could include relying on an independent research institution such as ICES or PICES for the provision of advice, or isolating the appointments process from the political process.

It is also inevitable that an adaptive management approach will require a greater investment in obtaining information about fishing activities and the state of stocks. Many successful fisheries management programs involve a high coverage of observers and collaboration between scientists and industry. Clearly the greater costs of an adaptive management program will have to be borne by the states involved in the organizations, which may create some broad opposition. However, the need for greater investment in scientific research to address issues of uncertainty is widely recognized. (Botsford, 1997; Stokke, 2001; Kimball, 2001).

The investment in research and monitoring must also be coordinated to ensure it is being directed at the areas that the organization as a whole requires to improve its decision making. This has two consequences. First, a greater degree of collaboration is required between the Commission of an organization (the political body with final decision making power) and the scientific advisers. Scientific and management roles must have the ability to communicate in order to set priorities for research and experiments.

Second, where the scientific committee does not have control over the types of research that is conducted by individual parties, some method of proposing and coordinating national research plans should be considered. At present there is a tendency for states to conduct research to bolster political claims to greater fishing rights, and not because there is a genuine need for the information within the organization. This means not only that information gaps are closed only on an ad hoc basis, but the results of the research may be regarded with suspicion among other members of the Commission. An adaptive management approach would require a more coordinated approach to research activities, which may help reduce the conflicts based on perceptions of national interest in the results of research.

4.2.3 Increase the flexibility of institutional structures

Arguably adaptive management is not restricted to making decisions about the regulatory responses to fisheries issues. It can also apply to evaluating and making decisions about compliance, monitoring, enforcement. Therefore, the benefits of a flexible, adaptive institution can have spill over effects on legal issues other than resolution of uncertainty in ecosystem management.

The area of enforcement and compliance has received considerable attention in previous years. Recent agreements have fostered some institutional support by establishing a committee designed to focus on compliance issues.⁵ However, in general the rules and procedures of the organization are enshrined in legal rules that are not amenable to easy alteration if necessary.

⁵ See, e.g. CSEAO, article 9 and WESTPAC, article 13, both establishing committees to address compliance issues, although the latter is also to address technical matters.

Further research into the ways in which fisheries institutions can incorporate more flexibility into their rules and structure would be valuable. The ozone depletion regime offers one model of institutional flexibility that can assist states in developing measures in response to improved understanding of the problem. Fishing organizations could be structured to allow reevaluation of the rules and constitution of the organization if it appears that particular measures are not meeting the organization's goals. Regular reviews mandated by the constitutive agreement can assist in turning states' attention to this issue.

5. SOME CHALLENGES FOR THE USE OF ADAPTIVE MANAGEMENT IN INTERNATIONAL INSTITUTIONS

It will not be a simple task to translate adaptive management into international fisheries institutions. Both the nature of the international legal and political environment and the difficulties of integrating science and management mean that significant attention should be paid to the circumstances and design of the new processes.

Undoubtedly there will need to be significant changes to the traditional adaptive management processes if they are to be adapted for use in international decision making. For example, most adaptive management programs in domestic arrangements emphasize stakeholder involvement in defining and implementing policies in order to enhance the legitimacy and long term sustainability of the policies. (Schelhas et al., 2001) Not only the state but industry, communities and environmentalists are involved in defining issues for further analysis and identifying the boundaries of fisheries policy. Halbert (1993) points out that adaptive management has the advantage of focusing stakeholders with varying interests on the issues to be evaluated and resolved. In the international context states are the traditional participants and only legal objects. It is possible to conceptualize adaptive management as offering an opportunity for states with vastly differing perspectives on fisheries management to attempt to resolve these differences (at least to the extent of disagreements about science and management issues) in a problem solving format. This could lead to a reduction in formal disputes between states in the event of disagreements.

There is room for consideration about how international institutions could better incorporate the views of other stakeholders in the international management of fisheries in order to obtain better compliance. Despite the increasing direct involvement of other actors including NGOs, (Wiser, 2001) the state of international fisheries law is such that there is only a limited role for these stakeholders to be involved in the decision making process in international institutions as they are currently formulated.

Another concern will be the extent of political will to conduct experimentation with international fisheries stocks. Barriers to effective implementation of adaptive management have arisen in domestic institutions where policy managers and politicians have been unwilling to admit that expectations have not been met, and to implement experiments even where they have been previously agreed upon by those involved in the fishery. (Lee, 1999, Halbert 1993). Political support for the long term study and management of stocks under adaptive management is essential.

The perennial issue of compliance will play an important role in whether adaptive management will have an opportunity to succeed. For example, in addition to obtaining agreement to undertake an adaptive management program, the institutions will have to ensure that the experimentation with management is complied with, in order to be sure that the results of the experimentation are accurate and in fact provide the informational benefits that they are designed for. This makes the presence of decision making devices such as opt-out clauses even more significant than under present fisheries management.

6. CONCLUSIONS

Although adopting adaptive management would not be a complete panacea for the difficulties facing international fisheries regimes, there are many benefits that adaptive management could provide. Not least, adaptive management provides a manageable process for implementing ecosystem management, which until now has been somewhat stalled in international regimes. In addition, adaptive management

processes directly address issues of scientific uncertainty, which present significant problems for fisheries institutions.

Adaptive management policies for international fisheries institutions will necessarily differ from similar approaches in national resource management institutions. However, it is possible to identify several ways in which the existing international institutions require modifications to allow ecosystem management and adaptive decision making processes. Such modifications should attempt to predict and circumvent the potential problems that could undermine adaptive processes.

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