



ANALYSIS

Strengthening governance of ocean fishery resources

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Abstract

Governance of the world's marine fisheries is ill-adapted to sustainability. Twenty years after the expansion of exclusive economic zones over most of the continental shelves, fisheries worldwide face problems of stock depletion, declining yields and increasing conflict. Other human activities in the ocean compound the effect. What is wrong? This paper is about the internal workings of fishery governance and their links to fishery outcomes. The theme of this paper is that there are fundamental weaknesses in the way fishery governance works that contribute to sustainability problems. Basic requirements for healthy ocean fishery governance are not being met because the scope and structure of governance are weak. Although the particular forms of weakness vary with fisheries and with geopolitical regions, the substance of the weakness is common across all regions. What we ask of fishery governance is that it coordinate institutional rules and individual actions by performing certain functions: incorporate multiple objectives representing different types of conservation and use; bring the time horizons of private individuals into line with those of the public; send signals of resource scarcity and enable effective adaptive responses; promote legitimacy by reflecting accepted norms of equity and by controlling harmful opportunism; contain both the level and distribution of transactions costs. Fishery governance is failing to adequately perform these functions as a result of the attributes of management scope and management structure. At both national and international levels, improvement of governance will rest on the adoption of a stable long-term management scope and the construction of flexible management structures. © 1999 Elsevier Science B.V. All rights reserved.

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1. Introduction

Twenty years after the expansion of coastal nations' exclusive economic zones (EEZ's) to 200 miles, fisheries face common problems of overcap-

italization, stock depletion, declining yields and increasing conflict. Issues such as food security, loss of economic productivity, biodiversity, and ecosystem health are receiving widespread attention. Under standard fishery management practices, the momentum of economic growth consistently leads to levels of fishing capacity that overshoot the ecosystem's natural productive ca-

capacity. Signals of productivity decline are met with sluggish institutional response. A focus on commodity production often hinders the protection of non-commodity ecosystem services, such as reproduction, genetic diversity, and food for predators. Species are managed in isolation, resource stocks are eroded and ecological resilience is reduced. Clearly fishery governance is not promoting sustainability.

This paper is about fishery governance and its linkage to fishery outcomes. *Governance* is the system of implementing contractual relationships between individuals within an institutional environment (Williamson, 1994), the process of making binding decisions for some collective (Shafritz, 1988). *Institutions* are the organizational constraints that structure incentives and shape human interactions (North, 1990). The term *governance* was described over 30 years ago as having 'the dignity of archaism' (Gowers, 1965) and having been replaced by *government* and *control*. The term has recently regained currency, particularly in natural resource management, because governance includes the concepts of transactions costs and behavior that link institutions to individuals, concepts that remain external to the narrower terms of *government* and *control*.

Marine fisheries are publicly owned resources affected by the behavior of diverse groups acting within nested institutional structures. The 'organizational imperative' of fishery governance is to shape behavior so that the transactions of management accommodate limited information, safeguard social objectives, and are conducted at minimum costs (cf. Williamson, 1985). These fundamental requirements for effective governance apply in all ocean fishery contexts and at all management scales—international, national, or local. The argument of this paper is that these requirements are not being met because governance is poorly defined and poorly organized. Although the particular forms of governance vary with fisheries and with geopolitical regions, the substance of poor governance is common across all regions.

I first summarize the state of ocean fishery resources as reflected in biological, economic, management and equity dimensions. I present

fisheries as systems whose governance performance indicates the state of broader ocean governance. Next, fishery governance is deconstructed into two components — organizational scope and organizational structure — to assess the functions of each. The scope of governance is discussed in the context of a long-term planning focus. The structure of governance is discussed in terms of its ability to accommodate the behavioral incentives of fishery users and perform the 'organizational imperative' cited by Williamson. Governance is related to fishery outcomes through a discussion of multiple objectives, the alignment of social time horizons, the provisioning of monitoring and feedbacks, the maintenance of legitimacy and the promotion of efficiency. Finally, I identify changes needed to strengthen ocean governance and assess major challenges to making effective change.

2. The state of ocean fishery resources: symptoms of a problem

The status of the world's fishery resources signal problems in several dimensions: biological populations, economic health, management performance, and equity effects. This section summarizes the status of each component, and describes fisheries as indicator systems for the health of ocean ecosystems as a whole.

2.1. Biological status

Global landings of marine capture fisheries were at 84 million metric tons in 1995 (FAO, 1997), an approximately five-fold increase since 1950. Production of demersal species have remained stable since the 1970s, but landings of pelagics continue to increase. The most recent FAO (1997) review of world fisheries indicates that of 200 major fish stocks accounting for 77% of world marine landings, 60% are in urgent need of management, classified as either fully exploited (25%) or overexploited (35%). The degree of overfishing varies by geographic area and fish stock, but overall trends indicate overfishing of demersal, highly migratory and straddling stocks.

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The status of stocks in 1997 is in sharp contrast to 1950 when almost no fish stocks were at the fully exploited level, illustrating the very rapid development of fisheries in the post-war period. Discards add to the effect of large increases in landings. An FAO (1994) assessment of world bycatch and discards estimates that 25% of marine catch is discarded before landing (Alverson et al., 1994). Biological productivity in many coastal areas is also suffering from environmental degradation caused by human population growth, intensification of resource use, habitat destruction, and pollution (FAO, 1993).

2.2. Economic status

Worldwide, fisheries are suffering large losses in potential economic productivity, up to as much as \$50 billion per year in excess of costs over revenues (Christy, 1994). Economic losses in the form of foregone earnings, unemployment, higher retail prices and underused capacity result in part from widespread subsidies and over investment during the past 20 years. Subsidies for vessel construction and operation have signalled artificially low costs to harvesters and investors, and as a result the gross tonnage in the world's fishing fleet grew 91% between 1970 and 1992 (FAO, 1996; reported in World Resources Inc., 1996). Subsidies for research and management have signalled artificially low costs of governing and using a public resource. These subsidies have masked signals of scarcity, and have led to overuse.

2.3. Management status

Despite variations in the specifics, the fundamental attributes of fishery management worldwide are similar. Transactions costs of management are rising as a result of declining resource availability, increasing intensity of fishing, increasing complexity of regulations, disrupted management objectives, increases in spillover effects, attacks on the integrity of scientific advice and questions about the legitimacy of management. These problems reflect a common dynamic: technical innovation in the hunting and catching of fish combined with lags in scientific

information, strong markets and increasing numbers of fishermen have inevitably led to overexploitation. Management organizations respond sluggishly to signals of productivity decline, are inconsistent in their responses to pressures from various interests, and have difficulties maintaining regulatory legitimacy. Several recent books describe the status of fishery management as a crisis (cf. McGoodwin, 1990; Crean and Symes, 1996; Hannesson, 1996).

2.4. Equity status

Globally, fish are 16% of the animal protein content of human diets. Regionally, fish are a much more important protein source for poor countries in Africa (21%) and centrally planned Asian economies (22%) than for rich countries in Western Europe (10%) and North America (7%) (FAO, 1993). Geographic variation in fishery dependence for food security and employment create direct equity implications for the status of world fisheries. Current problems with biological productivity, particularly in coastal areas, mean that many small-scale artisanal fisheries are suffering loss of employment and markets. Trends toward the development of export-oriented aquaculture industries in coastal areas have removed coastal residents from access to traditional fishing grounds, revenues from fisheries, and fish in the diet. As scarcity increases, fish prices rise, more is sold on international markets and less is consumed locally, exacerbating the difficulties of the poor (Williams, 1996).

2.5. Fisheries as ocean indicators

Marine capture fisheries are not, of course, the only use of the world's oceans. Oceans provide important services for aquaculture, transportation, minerals, defense and energy production. Oceans also provide life-support services critical to the planet's survival. The subject of fisheries governance does not capture all these critical services. But as systems, fisheries are important indicators of the status of other ocean resources because they share common space and characteristics. Fisheries are complex systems with both

biophysical and human components. They contain a large number of interacting fish and animal populations, characterized by variations in age structures, life histories, responses to oceanographic change, and market values. They also contain human systems. Fisheries are harvested by diverse groups that differ in motivation, skill, scales and types of operation. Their products are traded in increasingly globalized markets. Fisheries are affected by other ocean activities such as energy production and waste disposal, and are managed within layered institutional structures. For example, local management of inshore fisheries must accommodate and are also affected by the rules and properties of regional, national and international fisheries.

Fishery governance reflects in a general way the issues embedded in all other uses of the ocean because fishery governance is concerned with managing the use and performance of a complex, dynamic, publicly owned resource. The mechanisms and functions of fishery governance generalize to other resources. The governance problems of fisheries are signaling basic flaws in the regulation and management of use of the ocean at sub-national, national and international levels.

The performance of management within national economic zones is especially important to the performance of fisheries management worldwide because the majority of fishery production comes from the continental shelves. In addition, nations bring their histories and expectations about governance to international agreements which are basis for managing migratory and transboundary stocks, the control of fishing practices, and the protection of habitat quality and basic ocean system functions.

A cluster of international agreements signed in 1995 address various aspects of ocean fishery problems at the international level. These are the Rome Consensus on World Fisheries adopted by the FAO ministerial meeting in March 1995, the code of conduct on responsible fisheries, adopted by the Rome Conference of FAO in October 1995, and the Kyoto Declaration adopted at the conference on the sustainable contribution of fisheries to food security (FAO, 1997). The Rome consensus includes agreement on the need to elim-

inate overfishing, reduce fishing capacity, reduce bycatch and discards and strengthen governance. The code of conduct contains guidelines on fishery management and operations, aquaculture, coastal zone management, trade and research. The Kyoto declaration, concerned with food security, includes agreements on the need to reduce fishing capacity, strengthen the scientific basis for multispecies and ecosystem management, reduce incidental catch and strengthen institutional coordination. In several cases these international agreements are leading to national efforts to define and implement the various actions (FAO, 1997). In turn, national acceptance of concepts embedded in international agreements is leading to experiments at the sub-national level with various structures and processes, for example, community-based resource management and co-management.

3. Deconstructing fishery governance

Fishery governance is often characterized as a common pool management problem, solvable by well-specified property rights regimes. *Property rights regimes* are a subset of institutions; bundles of entitlements that define owners' rights and duties, and the rules under which those rights and duties are exercised (Bromley, 1989). Governance is also characterized as a behavioral problem, reflecting the lure of greed, the power of false expectations, and the failure of political will. But the definition of governance makes it clear that neither explanation is sufficient by itself. It is the interaction between the institutional environment, property rights and individual behaviors that contribute to the outcome.

What we ask of fishery governance is that it coordinate institutional rules and individual actions by performing the following functions. It must incorporate multiple objectives representing both conservation and use. It must bring the short-term time horizons of private individuals into line with the intergenerational time horizons of society. It must send signals of resource scarcity, and enable effective adaptive responses in the face of uncertainty. It must promote legiti-

macy by reflecting accepted norms of equity and by controlling harmful opportunism. And it must finally, and importantly, contain both the level and distribution of transactions costs, (Hanna, 1996). These functions are expressions of Williamson's organizational imperative to minimize costs, accommodate limited information, and safeguard against harmful opportunism.

Because property rights are recognized to be important to governance, arguments are sometimes made that a particular type of property rights regime, e.g. private property or common property, is superior in performing these functions. The empirical evidence suggests, however, that any number of types of property rights regimes can perform well, depending on the cultural, economic and biophysical context (Ostrom, 1990; Hanna et al., 1995). The promotion of effective governance does not depend on a particular property rights regime but rather on an institutional environment that promotes these basic functions within the context of well-specified property rights which range from collective to private.

Fishery governance as currently constructed is incompletely designed for variable multicomponent fishery systems. Instead of accounting for the multiplicity of ecosystem goods and services, it narrowly focuses on single species commodity production. It typically fails to produce information in innovative or cost-effective ways, and is often inadequate to the task of managing opportunistic behaviors. Instead of defining human interactions, governance is frequently defined by human interactions. Transactions costs are often extremely high. This outcome is as a result of the attributes of scope and structure.

3.1. *The scope of governance*

A fishery has economic, social, cultural, political, biological and ecological components. The scope of fishery governance may encompass one, some or all of these categories, and, except for the rare situations where marine ecosystems are relatively untouched, will be forced to deal either directly or indirectly with the tradeoffs between them (Hanna, 1998).

The scope of governance is often defined in terms of the reach of regulatory control, for example, geographic areas or gear types. Using this definition we can see that the scope of management has expanded since the mid-1970s enclosures of EEZ's in a predictable sequence. As fisheries exploitation pressure increased, and as better biological information became available, controls expanded from relatively simple localized input controls to more complex combinations of input-output controls over multiple gear types and larger areas. Spillover effects between gear groups and between fisheries led management to expand across previously independent authorities, for example, interregional and international agreements.

But if the scope of governance is defined at a more basic level, we see a different picture. As a planning focus, the scope of governance is the long-term vision for the fishery, expressed in a set of operational objectives for the different fishery components. Ideally, this scope should be stable over time, but in practice the scope of governance has been confused. Are fisheries managed primarily for biological ends — for conservation? Are they managed for economic productivity? For social and cultural goals? For ecosystem sustainability? For all components? Unlike the expanding scope of regulation, management objectives have not expanded in a systematic way, but instead have emphasized different fishery components at different times. Overall, the scope of governance is characterized by a lack of clear vision or specification of long-term objectives. Decision makers typically select short-term objectives from a 'cafeteria' list in response to immediate pressures, leading to an unstable emphasis. A fishery may at different points in time be managed for economic development, small-scale employment, cultural survival, export revenues or protected species. In the short-term, the shifting management focus provides managers with political flexibility, but in the long-term it means that there is no solid framework for coordinating with various governmental levels or for responding to sources of change.

The vacillating scope of governance has other negative effects on fisheries. Emphasizing some components of a fishery to the detriment of others

can have distorting effects on the system as a whole. Management policies affect the 'field of action' of resource users (Vestergaard, 1996). A shifting list of management objectives can therefore destabilize expectations and behavior of user groups. Time horizons shorten, interference competition increases, and transactions costs increase. Perhaps worst, shifts and changes in the scope of governance response to changes in sector components prevent the formation of a long-term vision of the mix of objectives and the management of change for that end. This leaves management in a vulnerable, reactive mode, creating 'policy surprises' for participants, without a stable core. Management follows change, rather than anticipates or directs change (Hanna, 1998).

3.2. *The structure of governance*

Public authority for fishery resource management can assume a variety of forms. There is no best governance structure; all involve tradeoffs between stability and flexibility, authority and representation, social and individual. The basic function of a governance structure is to provide stability and consistency for decision making while retaining flexibility and adapting to changing conditions (Nohria and Gulati, 1994). In theory the ideal institution is adaptively efficient (North, 1990), accommodating an ability to respond to change. This attribute is important not only for institutional evolution, but also for the accommodation of ecological variability and the construction of institutional resilience (Hanna, 1998).

In contrast to the theoretical ideal, the structure of fishery governance is typically rigid in form, often residual to an earlier time of expansion and development. Because of the need to establish a formal process and define the 'rules of the game', structure emphasizes stability in representation, the distribution of authority, the channels through which information flows, and the distinction between advisory roles and decision roles. Information flows are often unidirectional or truncated. Incomplete representation of interests is common. Deliberation is strategic, careful and slow. Procedural rules employed as safeguards against cap-

ture by special interests can work against the rapid adaptation to changing ecological conditions, as do equity-based practices of protecting historical patterns of participation. Practical constraints on the speed of data processing and analysis also limit the rate of response. In addition, economic pressures to stabilize landings also work against flexibility (Hanna, 1995, 1998).

The tradeoff between stability and flexibility is an old dilemma in fishery governance. There are certain benefits to a stable time horizon, just as there are benefits to an opportunistic response to changing conditions. In fisheries, the overwhelming characteristic of the environment is variability, and to adapt to that environment the structure of fishery governance must be shaped by it (Hanna and Freeman, 1989). It must also accommodate the behavioral incentives of fishery users, three of which are particularly important: to minimize or shift transactions costs, to reduce uncertainty, and to compete.

3.3. *Transactions costs*

A basic principle of motivation, whether at the individual or social level, is the minimization of transactions costs. Transactions costs are the costs of arranging, monitoring, or enforcing agreements; the costs associated with all the exchanges that take place within an economy (Eggertsson, 1990; North, 1990). The management structure importantly influences the magnitude of transactions costs because it determines how users are coordinated, how information is generated, how decisions are made, and how monitoring and enforcement take place. The environment also influences the nature of transactions costs (Williamson, 1985, 1994). As biological resources become more scarce, the management structure must account for more tradeoffs between direct and indirect uses, between present and future uses, and between user groups. Under these conditions, the rules that govern resource distribution and use become correspondingly more complex and costly. A management structure that is low-cost at one time in a fishery may become high cost at another time, if it does not adapt.

Management structure also influences the distribution of transactions costs (Eggersson, 1990). Top-down authoritative management structures are associated with low levels of costs for fishery description and regulation design (*ex ante* to implementation), and high levels of costs for implementation, monitoring and enforcement (*ex post*). A decentralized cooperative management process involving more interest groups in decision making tends to have higher *ex ante* costs created by coordination and information needs, and lower *ex post* costs, created by higher levels of compliance (cf. Hanna, 1994; Raakjær Nielsen and Vedsman, 1995). Each distribution of transactions costs will exert stresses on different points of the management structure. In consequence, management must be able to adapt to pressures to reduce the magnitude of transactions costs and maintain equity in cost distribution (Hanna 1998).

3.4. Uncertainty

Uncertainty pervades fishery management and provides a powerful behavioral incentive. *Fact uncertainty* results from a lack of knowledge about how ecological, economic and social systems function, their key driving variables, their binding constraints and their interactions. For example, the current biological status of the world's fisheries reflects large uncertainties about the dynamics of populations and ecosystems. *Tenure uncertainty* results from unspecified property rights or changes in management scope that undermine assurance about access to the resource. Current issues of food security and overcapitalization are direct outcomes of tenure uncertainty.

The problem created by fact and tenure uncertainty is that when people don't have full information or when they are unsure about the long-term management objectives, it is in their interest to intensify rates of use or avoid investing in the future (Runge, 1984). This is one reason why implementing long-term rebuilding schedules for depleted stocks is so difficult. The same dynamic applies to resource managers as well, further enhanced by the political uncertainty that often characterizes their work environment. It is only when resource users and managers share a

long-term vision for the resources, are confident that claims to resources will be protected and that free riding will be minimized that they will have the incentive to behave in ways that maintain ecosystem health and protect economic productivity. When tenure is long-term and the management scope stable, incentives for use become more compatible with the costs of investing in information to reduce fact uncertainty.

Management structure influences uncertainty through the procedures it uses to exchange information and make decisions. For example, a continuity of interaction promotes credible commitment between participants that allows exchange and reciprocity related to both benefits and threats and allows decision making to move forward (Williamson, 1985). The ability to craft mutual interdependencies and expectations creates assurance and minimizes conflict (Schelling, 1960; Runge, 1984). Because many fishery management decisions are outcomes of temporary processes organized around a particular problem (Williamson, 1985), they rely on an established background of cooperation. In practice, cooperation between different interests is missing in many fishery management systems which are based instead on polarized interest-based conflicts (Hanna, 1998).

Full representation of interests in the management structure, a precondition for effective cooperation, is missing in many cases. Incorporation of interests into either an advisory or decision making capacity is often *ad hoc*, and information channels are often one-way or truncated. The problems associated with a lack of cooperation have led to experiments with alternative management structures in various settings (Jentoft and McCay, 1995; Sen and Raakjær Nielsen, 1996).

Current conflicts surrounding property rights and the control of information used in management have their origin in the need to reduce uncertainty. While on the one hand, the tenure security introduced by well-defined property rights reduces uncertainty, great uncertainty exists about the distributional consequences of new forms of property rights such as individual transferable quotas (ITQ's) (Pålsson and Helgason, 1996). Demands for access to and control of the

information used in decision making in fishery management come from a desire to reduce fact uncertainty about both the nature of the fishing system and the transformation of information into decisions (Hanna, 1998).

3.5. Competition

Management structures should anticipate two forms of competitive behavior common to resource settings: *scramble competition* and *interference competition* (Hirshleifer, 1978). In scramble competition each user behaves autonomously to capture resources in a race against other users. The absence of property rights to fisheries promotes this type of competition and has led to current problems of overcapacity and overexploitation. In contrast, interference competition is based on strategies that interfere with users' abilities to compete; for example manipulating a management process to create rules that work to one's advantage and others' disadvantage. Interference competition may proceed aggressively or at levels low enough to qualify as coordination. The expansion of national jurisdictions and the development of layered national and international arrangements have limited the scope for scramble competition but have given rise to more interference competition, as groups attempt to garner political support for favorable management outcomes. Some fishery users are poorly equipped for new management approaches, and use interference competition to derail management processes (Hanna, 1997). At times the deliberative decision processes imposed by management structure have allowed management to be paralyzed by strategies of interference competition. The resulting overcapitalization, overexploitation and excessive management costs are causing huge losses in potential economic productivity (Christy, 1994).

The way that the management structure adapts to transactions costs, uncertainty and competition will heavily influence its long-term effectiveness and its ability to respond quickly to change. Just as there are good reasons for management's scope to be stable at its core and resist change, there are equally compelling reasons for management structure to be adaptable to change. In practice, both

management scope and management structure in the post-war period have been the opposite of their desirable characteristics: management scope has been variable instead of stable; management structure has been sluggish instead of adaptable. The pathology of fishery management institutions stems from this gap between desirable and actual characteristics for management scope and management structure (Hanna, 1998).

4. Governance outcomes

How are the outcomes of ocean fishery governance related to its scope and structure? The stability of governance scope and the flexibility of governance structure determine the degree to which the basic governance is effective in the incorporation of multiple objectives, the alignment of private and social time horizons, the provisioning of monitoring and feedbacks, the maintenance of legitimacy, and the achievement of management efficiency.

4.1. Multiple objectives

We know that people have multiple objectives for marine ecosystems and these objectives involve tradeoffs. We also know that ecosystem sustainability requires that objectives for noncommodity goods and services must also be included in governance scope. Standard fishery management approaches determine the mix of objectives only indirectly, as the sum of individual species objectives. Each species used in commodity production has implicit property rights attached, based on historical patterns of use. For example, Pacific salmon 'belong' to commercial trawlers, gillnetters and sport fishermen but not to trawlers. Moving to ecosystem management requires an explicit consideration of multiple objectives not only for the production of commodity species but also for the protection of species that provide ecosystem services. It also requires a mechanism to overcome difficulties presented by entrenched single-species interests, and a central organizing principle (Juda and Burroughs, 1990). Ecosystems are such an organizing principle.

Improving fishery governance will require that tradeoffs between species be considered within a context of ecosystem portfolios, with the objective to maximize the sum of commodity and service values over the long term. The contrast between individual and social motivations will influence the final mix of objectives. For example, individual motivations of profit or risk reduction will lead interest groups to continue to seek rents through production of 'their' species, while the social motivation of sustainability will truncate substitution possibilities by safe minimum standards set for each species within ecosystem portfolios. To the extent that the scope of governance is stable, these behavioral tendencies will have a core idea to be measured against. To the extent that governance structure is flexible, learning and adaptation is possible.

4.2. Alignment of social and private time horizons

Fishery resources are natural capital, containing value in both the size of the stock and the flow of services. Fishery management's greatest success has been the design of incentives to capture the flow of goods and services from fish populations; its correspondingly most difficult problem has been the design of incentives to sustain the stock of assets. A governance system must constrain human exploitation at levels that will ensure the continuance of the stock and flow of ecosystem benefits into the indefinite future. The time horizon over which ecosystems are managed is critical to their rates of use. Future expected benefits from any resource have less value to users and managers than do known current benefits, and so the future is discounted relative to the present. The shorter the time horizon over which planning is carried out, the greater the discounting of future benefits, and the higher the rates of current use. For purposes of sustainability and intergenerational equity, it is in the social interest to extend the management time horizon as far out into the future as possible, using very low rates of discount.

Stabilizing the scope of governance would provide a long-term perspective that expands individual time horizons. Impacts of short-term deci-

sions could then be evaluated according to their impacts on long-term objectives. A structure of governance that incorporates well-specified property rights allows contracting between users within the framework of a stable governance scope.

4.3. Monitoring and feedbacks

Adaptable governance structures are built on the ability to monitor environmental changes and provide the appropriate response. Unfortunately, the requirements for adaptability are in many ways the opposite of stability requirements for reducing uncertainty. The attribute of adaptability is important not only for institutional evolution, but also for the accommodation of ecological variability. To structure behavioral incentives to be compatible with monitoring and feedbacks, managers and users would have to be given incentives and rewards for information provision, innovation and investment in ecosystem-friendly fishing and management practices. The current structure of fishery governance is based on disincentives and punishment for poor behavior on the part of users. Managers are exempt from such accountability. Incentives could be realigned to provide rewards to both users and managers for behavior that promotes sustainable use, for example, by making the continuation of both rights of access and rights of management contingent on positive contributions and innovation.

A limitation of the property rights regimes under which fishery resources are currently managed is that they do not specify claims to the full range of goods and services provided by an ecosystem. The lack of full specification means that it is unclear who can claim rights of use, or how those rights may be used. Property rights and rules in fisheries apply to the harvest of fish for sale or sport, but ignore other services provided by those stocks of fish. The rights of non-human predators to prey, the rights of populations to genetic diversity, or the right of the ecosystem to a given level of biodiversity are generally left unspecified. The rules under which those rules might be protected are also, except in cases of endangered species legislation, unclear. Without a mechanism for

feedback and response, monitoring may be hindered.

4.4. Legitimacy

Fishery management requires the compliance of resource users as well as those excluded from use. Compliance, in turn, hinges on the extent to which the system of regulations is perceived to be legitimate, derived in a fair process and implemented with an acceptable distribution of outcomes. To be legitimate, a management organization, the procedures by which it functions, the content of its regulations, the method of enforcement and the distribution of its outcomes must all be perceived to be fair (Jentoft, 1989). The expectations of resource users are often formed during periods of high resource productivity. Changes in governance scope have distributional consequences that may erode the legitimacy of the management process. The problem of perceived inequity may be especially acute when a new management scope supplants existing patterns of use. If people doubt the legitimacy of the process because they cannot accept the management outcome, they have incentives to undermine its implementation and enforcement. This behavior can slow adaptation to change. Probably the most important aspect of legitimacy is procedural (Jentoft, 1993). Procedures must be seen to be fair if they are to manage conflict and control rent seeking.

4.5. Efficiency

The efficiency of governance depends on the cost-effectiveness with which objectives are met. As we have seen, the cost-effectiveness of management relies on the containment of transactions costs, which are influenced by both management scope and management structure. Frequent changes in management scope create uncertainty that shortens time horizons, directs resources toward interference competition in the definition of management objectives, creates additional information needs and increases negotiation costs. An inflexible management structure retards the processing of environmental signals, slows adaptive

response to external change, and tends to lead to the sequential and costly layering of regulations.

5. Conclusions: strengthening ocean fishery governance

I have argued in this paper that fishery management scope and fishery management structure in the post-EEZ period, particularly at national levels, have been the opposite of their desirable characteristics: management scope has been variable instead of stable; management structure has been sluggish instead of adaptable. The weakness of fishery governance is expressed in terms of biological overuse, loss of economic productivity, costly management, and inequitable processes and outcomes. It stems from the gap between desirable and actual characteristics for management scope and management structure. Its failure has led to stronger efforts at the international level to attain agreement on concepts of sustainable management, and at the national and sub-national levels to experiment with alternative management structures and processes in the implementation of those concepts.

5.1. Requirements

Stabilizing management scope must first be carried out at a scale appropriate to management decision making, because the scope of management reflects public values and expectations regarding the contribution of fishery resources over time. There are many possible choices, and each choice represents tradeoffs that must appropriate to each biophysical, economic and cultural setting. Stabilizing scope requires, in addition to the definition of multiple objectives, a resolve to maintain that scope in the face of pressures to use fishery resources as 'sink' resources into which excess labor or excess capital are directed. It also requires resisting the temptation to use fishery resources as 'pawns' resources in international bargaining over larger scale issues. Well-defined and stable management scopes at national levels will introduce a clarity to international fishery governance negotiations that is currently absent.

Building flexible management structures must also be carried out first at regional or national levels. The design requirements for management flexibility are fairly well-known at the general level, but in their specifics they must reflect the context in which they are applied. We know that management structures tend to be more adaptive and resilient when they are based on clearly defined rules of participation and decision making, well-specified property rights, associate responsibilities with rights, create incentive compatibility between behavior and outcomes, anticipate competitive behaviors of all actors, encourage full dissemination of information, link monitoring to feedback and contain transactions costs. These requirements articulate the 'Lisbon principles of sustainable governance' set forth in this Special Issue's lead article (Costanza et al., 1999), and at the same time may constrain the simultaneous application of all principles through the existence of tradeoffs.

5.2. Challenges

There are a number of practical challenges to meeting these requirements for strengthening ocean fishery governance. Internally, whether at sub-national, national or international levels, fishery governance is challenged by the current state of fishery resources worldwide. Scarcity of fishery resources creates a truncation of opportunity sets for fishery users which means that shifting to other fisheries, the old response to decline, is no longer an option. Excess capacity remains within a declining fishery exerting pressures to focus on short-term needs. Scarcity increases information needs as each stock is managed for maximum possible short-term yield. In addition, the requirements for participating in fishery governance are changing. Especially at sub-national levels, there is an increasing and controversial emphasis on the devolution of fishery management authority away from the center. In some cases, fishery users are being given more responsibility for management without the corresponding transfer of skills related to information gathering and presentation, critical assessment, or negotiation. As a result, transactions costs of management are increasing.

There are also external challenges to strengthening fishery governance. As fishery production declines and national economies expand, fisheries are now a smaller percentage of the economic base than in the past. Decreasing economic importance means a decreasing political base, with decreasing public support for funding the governance infrastructure. In addition, changing public values in developed countries are increasingly supporting nonconsumptive uses, uses which the current fishery governance system is ill-prepared to support. And finally, expanding international markets for seafood are creating greater distance between points of production and consumption, making control points more diffuse and increasing personal anonymity.

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