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FISHERY MANAGEMENT, HUMAN DIMENSION

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Introduction

The human dimension is central, not peripheral, to fisheries management. In capture fisheries, the behavior of people can be managed, but not the behavior of fish. Consequently, being able to monitor human behavior and to enforce regulations is an important 'human dimension' of fisheries. Moreover, in all fisheries, management decisions affect individuals and social and cultural groups in different ways. Management decisions have social impacts and come about through political processes. Those processes and impacts are mediated by other aspects of human dimensions that come into play in fisheries management: cultural values and identity (of fishers, managers, scientists, consumers, and society at large); risk perception and behavior; and local, regional, and global demographic, economic, and political forces. We focus on legitimacy, a key aspect of politics. We show that the legitimacy of fisheries management institutions, and hence their success in achieving sustainable fisheries, depends on economic rationality, the use of science in decision-making, the fairness of the processes and decisions that come from it, and how various groups participate in the process.

Fish are an extremely important source of food and income. Worldwide, fish are the largest source of animal protein, even though they rank well behind terrestrial animals in Western countries. In addition, fishing is often an essential source of subsistence and income for people without other means of livelihood. This critical resource is under heavy pressure from increased exploitation and from environmental changes that reduce productivity. The Food and Agriculture Organization of the United Nations (FAO), the leading international agency dealing with fisheries management, believes that 69% of the known fish stocks need management urgently, and that a reduction of 30% is needed in global fishing effort.

Overfishing means removing fish from the water at a higher rate than that which would produce the greatest overall production of fish over time. If any large group of people is allowed to fish without restrictions, the result is likely to be decline in the productivity of the fish stock. The reason is simple: If there are no rules, and one person decides to leave a fish in the water to reproduce or grow bigger, someone else could catch that fish the next day. Neither the first person as an individual, nor the common good, benefits from the first person's restraint. The only one who benefits is the second person who catches the fish. In this situation, no one will voluntarily restrict his or her own fishing. It would be foolish.

Fisheries management is the process that creates and enforces the rules that are needed to prevent overfishing and help overfished stocks rebound. However, it is not about managing fish unless aquaculture is involved. In the case of capture fisheries, the focus of this article, fisheries management is entirely about managing the people who fish. Capture fisheries take many forms. Gigantic factory trawlers catch tonnes of pollock in the Bering Sea and then fillet and freeze the fish on board. This starts the fish on a path through the vast, global chain of processed foods. In the end they may be sold in a supermarket as part of a food product with nothing like 'pollock' appearing on the label. At the other extreme, millions of African and other farmers living near oceans, lakes, swamps, and rivers have small boats that they take out fishing when other tasks permit. These fish feed their families and are

sold to small traders for markets in nearby villages and cities.

The rules involved in fisheries management – whether at the level of local fishing communities or of regional and national governments – are about how fishing is done. To understand the human dimensions of fisheries management the most important thing is that in practice the rules will almost always have an allocative effect; that is, the rules will mean that person A is going to get to catch more fish than person B. This means that fisheries management is, in the final analysis, a political process that involves many competing interests, and it has social consequences, in terms of its effects on different groups and kinds of people and communities.

The political process and social consequences become even more complex when the high level of uncertainty about fish stocks is recognized. It is far more difficult to count or even reliably estimate the size and behavior of creatures that live in lakes, rivers, and oceans than of those living on land. Uncertainty is an important aspect of both scientific and folk, or experience-based, ways of trying to understand fish populations and how they are affected by human activities.

Human Dimensions and Management Rules

Fisheries management has a long history. It includes controls on the techniques used in fishing, on fishing effort (the intensity of fishing), on the timing and location of fishing activity, and on the size and amount of fish (or shellfish) that can be taken. 'Traditional' or 'folk' management refers to practices, beliefs, and rules that arise from the experience, knowledge, and sociocultural systems of groups engaged in fishing. They may be formally recognized and enforced by local governments, or they may be informally recognized and reliant on social pressure for enforcement. One traditional mechanism involves changes in technique or fishing pressure in the face of the declining productivity of overexploited areas. Sometimes cultural practices that relate to other activities also protect fisheries. There have been many religious taboos, for example, against fishing in particular areas or for particular species. Some societies have developed forms of fishing etiquette that can reduce or spread fishing effort. A common traditional management mechanism is restriction of rights to fish in particular marine areas. This can be as simple as denying access to outsiders or can be a complex system of valid claims to particular areas. Another is to require the taking of turns at access to a valued fishing spot. Many of these traditional management techniques are still in effect today. Many others were intentionally destroyed by colonial authorities or have broken down under pressure from commercial fish markets. Others are being created all the time, particularly to deal with conflicts over fishing grounds.

Traditional management usually deals with when, where, and how to fish rather than with controls on how much fish is taken. To some extent that is true for 'modern' management too. Modern management means regulation by a government authority that relies heavily on scientific analyses and formal police and judicial powers. Managers often find controls on techniques or closed seasons or areas attractive because they have fewer implications for allocation: it is easier to tell all the fishers that they must not use a specific gear or fishing ground than it is to try to determine and divide up a quota of fish. Restrictions on techniques, seasons, and areas do not, however, have a good track record for protecting a fish stock's ability to reproduce itself given high demand for fish and other factors influencing how many people fish and how hard. Nor do they completely avoid social and political or allocative questions: A classic way of protecting one group's interest against that of another group is to seek restriction of the techniques, fishing times, or fishing grounds of the other group.

Modern fisheries managers often try to regulate the effects of fishing on fish stocks more directly, by imposing limits on the size or other biological features of fish and on the amount of fish caught. Controls on the amount of fish are based on 'quotas,' which are a mechanism for distributing a 'total allowable catch' (TAC). The TAC is, in turn, ideally based on a scientific stock assessment model using data from fishery catches supplemented by fishery-independent survey and other data. Quota-based management has problems too. The information required for reliable stock assessments and predictions of the consequences of different quota levels is often scarce, heavily biased, or nonexistent, which makes it difficult to come up with consensus about TACs. Quota-based management is not feasible for many anadromous fishes, such as salmon, and it can be difficult to justify for many subtropical and tropical fishes. Where many different species are caught at one time, managing with separate quotas for each species can be extremely difficult. This situation can lead to high rates of discarding and 'high-grading,' in which fishers who are only allowed to land a certain amount of fish throw less-valuable fish overboard. (High-grading can be a problem in relatively 'clean'

fisheries targeted at a single species, too, if there are market-based incentives to discard less-valuable sex classes or sizes.) But quota systems have brought back depleted fisheries. Fishers are often able to respond to management measures by changing techniques and finding ways to catch as much fish as before. Quotas can be an effective way to keep them from doing this.

Discussions of human dimensions in the past have focused on the harvesters and fishing communities involved in commercial and subsistence fishing. The kinds of people and social values involved are broader and various, and conflicts have escalated. For example, many people are marine conservationists, whose focus is protecting fish, birds, and marine mammals. Institutional measures they seek, for example, in reducing by-catch and creating large 'marine protected areas,' may cause economic and social distress for commercial fishing communities. A growing number of people around the world are recreationists, who compete with commercial and subsistence fishers for fish and fishing space and who, in some areas, are well enough organized to force the end of commercial fishing. Aquaculturists, boaters, shipping companies, the military, researchers, industries, and sewerage authorities are among the many others with distinct and often competing uses of and ways of valuing marine ecosystems.

The references cited for further reading develop these and related areas. We will narrow our focus to issues of surveillance, enforcement, and legitimacy.

Cooperation with Fisheries Management

Regardless of the strengths and weaknesses of different management measures, the key is to ensure cooperation with them. The cooperation of people with any rule, or a set of related rules that social scientists refer to as an 'institution,' involves three dimensions: enforcement, surveillance, and legitimacy. Enforcement consists of the probability that one will be caught violating an institution, and the severity of the sanctions that follow from being caught. Surveillance is clearly necessary for enforcement. Just as importantly, people need to know about the behavior of other people in order to decide their own behavior. Seeing others, and being seen by others, as conforming to an institution is an independent and essential part of maintaining that institution. Legitimacy is the social and cultural acceptance of an institution. It involves the degree to which people assume that behavior will follow the institution and the degree to which the institution shapes people's understanding of situations. When an institution is legitimate, people will refer to it to justify or explain behavior.

Enforcement

Enforcement is a continuous challenge in fisheries management. Fishing can be a very difficult activity to monitor, and the fines imposed for breaking regulations are often much less valuable than illegally caught fish. Sometimes, especially in Third World countries, the main reason a management measure is chosen is to facilitate enforcement. A good example is found in Zambia, which has extensive, commercial freshwater fisheries. In Zambia a single closed season is imposed on all fishing in all parts of the country regardless of species. This blanket ban makes enforcement feasible. The main reason is that the police on the highways can confiscate any fish they find during the closed season. This curtails the commercial fish trade, which, in turn, reduces the fishing pressure.

International fisheries pose major challenges to enforcement. The main enforcement focus of the United Nations is flag state responsibility. The problem is 'reflagging'. Often when one country changes its fisheries regulations to become more stringent, boats from that country will move to another country with less stringent regulations. This practice has been used to avoid many kinds of maritime regulations and taxes for years. It has made international fisheries agreements ineffective because vessels in states that acceded to international fisheries agreements evade restrictions by reflagging in nonmember states. The World Congress on Fisheries Management and Development in 1984 adopted the principle of flag state responsibility for the behavior of all its vessels.

Sanctions for illegal fishing vary greatly among nations, creating difficulties for regional and international fisheries management. Efforts to harmonize fisheries enforcement are being made in various world regions. These include agreement by nations to impose sanctions on their own fishers when they violate other nation's rules. The threat of blacklisting of repeated violators across large areas of ocean has worked well in the Western Pacific, for example, where regional enforcement provisions authorize the hot pursuit of fishing vessels into foreign jurisdictions.

Surveillance

At the local level, people engaged in fishing can often see at least some part of what the others in the area are doing, which may support local-level management. However, in many of the world's commercial fisheries this is difficult because fishing may take

place far from land and can involve vessels from many different ports and nations. Gathering information, or surveillance, depends on national governments and international agreements. One of the most important provisions of the Reflagging Agreement is that it requires flag states to maintain records of their vessels operating in international waters and to report such information to FAO. These records are very extensive and important. They include information about the technical and economic characteristics of the vessels that are gathered during the licensing procedure. At FAO, this information is linked with the vessel's fishing history. This database, which is still in the early stages of development, is a critical tool for understanding both what regulations are necessary and how they can be enforced.

One of the most important characteristics of a fisheries management measure is whether compliance can be monitored from land or whether it involves only behavior at sea. The first kind is, of course, much easier to monitor. Some measures, such as the banning of certain gears, can be fairly easily monitored in port. In most Western countries, the amount and size of fish that a vessel sells can often be monitored through a system of licensed fish dealers.

Most at-sea monitoring still depends on physical inspections from surface craft that are time consuming, expensive, and difficult to do effectively. Another option is to place observers, who can be government officers or private contractors, on fishing vessels. Areal surveillance is also used in fisheries management. The newest trend is toward satellite-based vessel monitoring systems (VMS) that are both more comprehensive and less expensive. Current plans call for these systems to be linked to the FAO database on fishing vessels.

All of these types of surveillance are feasible only on vessels that are large enough that the costs of observation are only a small portion of the value of the fish the vessel lands. For most fishing vessels in the world that is not the case, nor will it be in the foreseeable future. Small-scale, inshore fisheries will continue to rely on the cooperation of fishers both to comply with management measures and to aid in monitoring those who do not.

Legitimacy

Four characteristics of fisheries management are particularly important in determining how acceptable fisheries management will be and thus the probability of compliance with it. These are its economic rationality, its basis in science, its fairness to the various user groups, and who participates in making management decisions.

Economic rationality Almost any management measure introduces economic irrationality because it restricts the ability of a fisher to use his assets in the most efficient way to produce new wealth. This irrationality can produce senseless consequences, such as derby fisheries. The halibut fishery in the North Pacific waters of the United States, for example, had a fishing fleet of 2900 vessels in 1981, which grew to about 4400 vessels in 1991. The fishing season, meanwhile, was reduced from 120 days to 48 hours. Four thousand boats all trying to catch halibut in two days is an enormous waste of fishing assets that results only in a very low price for the fish. In the eyes of many fishers, the worst example of a perverse incentive structure is regulatory discarding. When fishers catch fish that they cannot legally sell, they must throw them back. With many fishing methods, however, the fish are already dead or dying when they are sorted and the regulation simply causes dead fish to be thrown back in the water.

In the eyes of many people the solution to these examples of management-driven economic irrationality is the Individual Transferable Quota (ITQ) system. This technique creates exclusive and tradable rights in fishing, usually as a percentage of the total allowable catch of a certain stock. A similar technique can be based on exclusive and transferable rights to use certain fishing gears, such as lobster traps. In both cases, markets are relied upon to adjust investments to the actual status of the resource and to correct for distortions caused by other management techniques. For example, in the North Pacific halibut case mentioned above, ITQs have made it easier for some to continue in this fishery and for others to leave, but with something to sell when they leave. They have expanded the season, which in turn adds fresh halibut, rather than just frozen halibut, to the market. In Florida, individual trap certificates have helped reduce the number of traps used in the spiny lobster fishery. However, there is major resistance to this form of fisheries management because of the displacement of labor and other factors when market forces result in major downsizing. Consequently, in recent years attention has also been given to the potentials for community-based property rights, where rights and responsibilities are clearly defined. See the section on Participation below for further discussion.

Science The second critical area for the legitimacy of management is its basis in science. Indeed, it was

this role that gave birth to fisheries science. In the late nineteenth century, politicians looking for ways to resolve disputes between fishers brought biologists together and asked them to study fisheries. This was the genesis of today's national fisheries research organizations, such as the American Fisheries Society formed in 1870, as well as the first international society for fisheries science, the International Council for the Exploration of the Sea (ICES) formed in 1902.

Fisheries scientists are confident in their basic approach to management: the principle of regulating fishing mortality to ensure future recruitment and growth of populations. Despite high levels of uncertainty and inadequacy of data, most cases of serious decline in fish stocks have not been the result of inadequate scientific advice as much as of the failure of others to follow the advice. Fisheries science is a form of what sociologists of science call 'mandated science'. It is a science that is trying to respond to political and legal as well as scientific questions. When government managers draw on science, they are looking for clear distinctions about what is at issue, precise decision rules, and efficiencies in presentation and procedure, all difficult to achieve given the practice and requirements of science. Moreover, science applied to policy often produces conflicting results, makes moral and political dilemmas more explicit, and is often accused of corruption. Competing user groups will use both science and gaps in science to define the issues in terms of their own social objectives.

One crucial factor that makes using fisheries science as the basis of policy particularly problematic is that fishers also know a deal about the fisheries resource, but from a different perspective from that of the scientists. This perspective is often referred to as 'traditional ecological knowledge,' or just 'local knowledge.' Many people concerned with management feel that local knowledge should be utilized by management. This is a very difficult goal. Fishers tend to view the resource in much smaller temporal and spatial scales than it is conceived of by managers. They often see fisheries as systems in which small perturbations may have substantial future consequences and are likely to emphasize the importance of habitat over population dynamics. These viewpoints can be incongruous with management, because managers are responsible for large areas and often need to simplify ecological complexity to a point where decisions can be identified and made. However, in many circumstances the knowledge of fishers is virtually the only source of information about a particular fish population or spawning area. It can yield insights and information that help scientists develop improved methods of data collection and analysis. In addition, the willingness of fishers to articulate and share their knowledge can be an extremely important expression of their desire to collaborate with scientists in the development of tools for marine conservation.

Fairness As mentioned above, fisheries management is an inherently political process because any given management decision affects different people and groups in different ways. Every management measure not only seeks to protect fish from overexploitation but also allocates them among potential users. The legitimacy of a system may depend on how fair people see that allocation to be.

A common principle used to decide what is and is not fair in fisheries management is 'historical participation'. People who have been fishing a stock more heavily or for a longer time are said to have a greater 'right' to fish that stock in the future. Except in the case of the treaty rights of indigenous peoples, historical participation often derives more from a sense among fishers about what is fair than it does from any actual legal claim. In 1998, for example, the Iceland Supreme Court rejected aspects of an individual transferable quota system, which was based on historical participation, as unconstitutional because relying on historical participation discriminated illegally, given Icelanders' constitutional right to work.

Fisheries management begins with the idea that we are being unfair to those in the future if we fail to conserve fish. Because of this issue of intergenerational fairness, many people involved in fisheries have come to believe in the 'precautionary' approach, which says that when knowledge is uncertain we must err on the conservative side. We should be risk-averse. This approach, however, has its own fairness issue because the costs of caution are borne by people fishing today while the benefits will often go to others. Indeed, those who lose out are often the more economically vulnerable people who cannot afford to wait until the fish stock recovers.

Participation The participation of fishermen and fishing communities in resource management has been widely accepted as a desirable policy goal. 'Participation' is used to describe many different activities, but its basic meaning is that people who are concerned with, make a living on, or are otherwise dependent on a fish resource are involved in enhancing the resource and/or preventing its misuse. Participation takes many forms, from top-down processes where the government tells the fishers what to do and the fishers participate by

complying, to systems where fishers organize and run their own management schemes. A wide range of advisory systems can be found in between, including co-management, or the active cooperation of resource users and government agencies in management. Various forms of cooperation between governments and the fishing industry have become commonplace in the West since the 1970s. Regarding Third World countries, FAO published a local management manual in 1985 and other donor agencies such as the World Bank are encouraging user group participation in fisheries programs that they support.

Researchers have documented local and co-management schemes for over 20 years. They have found that participation by fishermen and other people from fishing communities aids management in several ways. One is to facilitate access to information that fishermen have about the fishery, how it is fished, and what they will do in response to specific management measures. Participation also increases transparency in decision making, creates greater accountability for officials, and increases the use of and respect for community perspectives. The resulting management systems have greater legitimacy, a more open flow of information, and are more flexible in their response to changes in the fishery. Rights-based management at the community rather than individual level is thus an attractive alternative to either open access at one extreme, or individual transferable quotas on the other.

Local and co-management schemes around the world share certain problems. One is difficulty maintaining local autonomy, especially when the fish stocks involved go beyond local boundaries. This usually means some extra-local government involvement to handle conflicts among local communities and protect fish stocks. Such involvement may threaten local systems of fisheries governance in a variety of ways. For instance, external government agencies can be treated as resources that increase factionalism within the community, weakening its capacity for local management. This almost always must be recognized and addressed. Another challenge is reconciling scientists' and local knowledge about the resource system in a way that is acceptable to all stakeholders and therefore elicits cooperation, while still maintaining the values of objective science. A third problem is having fair representation of different interests in management decision making. Effective co-management requires a democratic decision-making system. At all but the smallest scales it is very difficult to have all interests represented in ways seen as fair without sacrificing other conditions required for effective co-management, such as open communication.

Conclusion

Fisheries management is often seen as a solution to 'tragedies of the commons,' where the lack of exclusive property rights means that the fish stocks are likely to be overfished and capital and labor are used wastefully. Government must intervene. Intervention is unlikely to be successful, however, if the knowledge used is poor, if the economic and social impacts create major political problems for government, and if people are unwilling to comply with the rules. Our discussion of legitimacy highlights the importance of these issues and underscores the value of transparent and participatory decision-making processes to fisheries management.

See also

Coral Reef and Other Tropical Fisheries. Crustacean Fisheries. Demersal Species Fisheries. Marine Fishery Resources, Global State of. Molluskan Fisheries. Open Ocean Fisheries for Deep Water Species. Open Ocean Fisheries for Large Pelagic Species. Salmon Fisheries: Atlantic. Salmon Fisheries: Pacific. Seabirds and Fisheries Interaction. Small Pelagic Species Fisheries. Southern Ocean Fisheries.

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