Options and Limitations in Fisheries Management

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Options and Limitations in Fisheries Management

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I want to use the Forum as an opportunity to discuss some of the options and limitations that we face in fisheries management, both commercial and recreational, and in particular, those aspects which relate to biologic considerations. I also hope to simplify the complex systems that we call "fisheries" and the complex process we call "management."

Recreational and commercial fisheries are extremely complex systems; everyone who has studied these systems will agree on this premise. Fisheries are invariably composed of many game and/or commercial fish populations. Moreover, we cannot forget the other parts of a fishery: aquatic plants and animals; man, the fisherman; man, the entrepreneur. The interaction between fish, their environment, and humans is highly intertwined and often extremely obscure. Fisherman diversity is also large. Some recreational or commercial fishermen exclusively pursue a single species, whereas many exhibit little species preference. Management strategies for trophy fisheries are very different from those applied to multiple species "family" fisheries. Strategies for marlin management differ markedly from those for clam management!

On the commercial side of fisheries management, the complexity is particularly great, with an added international dimension. Fleets may pursue a multitude of species; they also relate in a very real way to political and economic problems within their respective nations. Recent developments in the 200-mile coastal fishing zone reflect the importance of fishing to many nations.

Fisheries Management

Fisheries management is the "practice of analyzing, making, and implementing decisions to maintain or alter the structure, dynamics, and interaction of habitat, aquatic biota, and man to achieve human goals and objectives through aquatic resource" (Powers and others 1975). When we consider the number and diversity of the components that form fisheries (i.e., fish, phyto- and zooplankton, bottom animals, rooted plants, chemical and physical water parameters, various types of fishermen, and the related commercial and recreation activities), the true complexity of these renewable aquatic resources becomes apparent. A slight change in one part of a fishery may result in substantial changes in other, seemingly unrelated parts (Lackey 1975).

Freshwater fisheries scientists, at least in the United States, have nearly always been more concerned with aquatic habitat and the whole array of aquatic animal populations than their marine counterparts. The reason is quite understandable; the marine fisheries manager can rarely exert much influence on habitat or nonexploited biota. Freshwater habitats and ecosystems, in contrast, may often be manipulated as part of a management strategy. Both groups of fisheries scientists have been quite concerned with target fish populations but equally disinterested in the third fisheries component, humans, as a decision option. It is easier to manipulate habitat and biota than society! Regulations and information/education activities are efforts at influencing human activities as related to aquatic resources (Clark and Lackey 1975).

If we make the assumption in fisheries management that all benefits derivable from aquatic renewable natural resources are accruable to man, then we can develop a philosophic basis for management theory (Lackey 1978a). This initial assumption is not as difficult to accept as it may appear. One immediate reaction might be that even though most people never see a "wilderness" area, for example, it still has value to them. This is certainly true, but even though one human may never see this wilderness, it still has value or benefit to other humans, and thus the benefits are accruable to all humans. It is important to keep in mind that *consumptive* use of resources (i.e., harvesting fish) is only one of the benefits derivable from fisheries. Other, nontangible benefits may be equal or of greater importance in terms of total societal benefits (Hampton and Lackey 1976).

As a basic theory of fisheries management, let me propose the equation

$$Q_{max} = f(X_1, X_2, \ldots, X_m \mid Y_1, Y_2, \ldots, Y_n)$$

where

Q = some measure of societal benefit
X = a management decision variable (the vertical line reads "given that")
Y = a management constraint variable

The theory reads "the greatest (max) societal benefit (Q) from a fishery can be realized by manipulating a series of decision variables (X's), given a set of constraints (Y's)." Controlled or partially controlled decision variables (X's) are those regarded as management techniques (stocking,

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habitat improvement, etc.). Noncontrolled decision variables (Y's) are random or dependent on other factors (whether, highway development, recreation attitudes, oil spills, etc.). Variables, however, may overlap both categories. Within constraint variables the manager tries to select a series of decision variables and to maximize Q. Everything we do in management, whether it be biologic, economic, or social, fits into this theory.

This theory of fisheries management is the philosophic basis upon which we are trying to maximize yield or some other measure of "output" from a fishery. The current controversy between "maximum sustainable yield" and "optimum sustainable yield" is largely an issue of selecting with constraint and decision variables we recognize and how we measure Q. In fact, measuring Q is "where it is at" in fisheries management (Lackey 1978b).

Goals and Objectives

The value for Q clearly needs further elaboration. Q is not simply a measure of pounds of fish or numbers of fish harvested but may involve many additional components. In the parlance of management by objectives (MBO), a management objective is a statement of the desired result of a decision or set of decision. The X's (decision variables) previously discussed could be viewed as "operational" objectives. Such statements as "to produce 200 pounds of fish per acre per year" are management objectives; "to produce 2,000 angler visitor days per year" is another objective, at least in MBO nonmenclature. An objective is not usually equated with a goal; a goal is defined as an end toward which a strategy is directed. It is an ideal state, which is usually expressed in general or abstract terms. The few goals we commonly use in fisheries management usually deal with "best" or "wise" use of resource. "Conservation," "protection," and "enhancement" of resources are commonly used terms associated with goals. Although a goal does have value and is extremely useful for a number of reasons, it does not supplant the role of objectives in management.

However defined, objectives have very important properties that affect their use in renewable natural resource management. Some of these properties are: (1) Objectives should be clearly stated if at all possible. (2) Objectives should be specific, or at least be as specific as possible, and not filled with broad, sweeping generalizations. (3) Objectives should be quantifiable by some means, if not empirically, then at least subjectively. Objectives always have a performance measure so that management progress can be evaluated (Powers and Lackey 1976).

Virtually all managers have recognized the inherent difficulties of operating without functional objectives, and this is certainly true in fisheries management. Many managers have tried to substitute more measurable objectives, but with less than exemplary success. Historically, the most common objective has been to maximize pounds or numbers of fish on a sustained basis (Larkin 1977). This is usually referred to as MSY (maximum sustained yield) or, possibly, equilibrium sustained yield. In the last 10 or 15 years, this approach has come under increasing criticism primarily from those who do not agree with the basic concept that protein or biomass output from a fishery is the prime societal benefit from that resource. There are many variants of the MSY approach; these usually revolve around maximizing yield of certain species or maximizing catches of certain sizes of a species (Anderson 1976). Desirable properties of MSY are that it is conceptually simple and that it is an objective-oriented approach to management. However, MSY has some inherent disadvantages, the main one being that many recreational fisheries managers, and some commercial fisheries managers as well, regard catch as only one of several measures of output from a fishery. Catch is important, but *fishing* is also important. Numerous surveys have shown that many recreational anglers enjoy the fishing experience even though "fishing" is less than what may be considered ideal. Other important aspects of the angling experience are the outdoor experience, environmental quality, and the sporting challenge. Additional considerations are the species caught, size of the fish, the setting in which the fish are found, and the method by which they are sought (Hampton and Lackey 1976).

In commercial fisheries management, it is important to recognize the economic output, whether it is accruable to the fisherman or to society, is more important than the pounds of fish the individual fisherman catches (Radovich 1975). Then, of course, this might lead to the broader array of problems relating to the value of salt- and freshwater resources as protein sources versus a net economic consideration. Benefits of a pychic nature are probably a major factor in commercial fishing as a vocation.

There is no question in recreational fisheries management that the public receives benefits of a psychological nature which may in total be larger than the more tangible benefits received from harvest. The social output of sport fishing is the value that accrues to participants from an enriching use of their leisure time. Fishing may be an escape to solitude, a social enterprise, a challenging physical experience, or simply relaxation.

Although all this cogitation is important, it often does not help the poor fisheries manager faced with the problem of trying to quantify an objective. Given that we can show that MSY is of less than perfect application in recreational

fisheries and is equally so in commercial fisheries, what are we to recommend to the practicing fisheries manager?

Perhaps another approach to management is maximizing esthetics or environmental quality. Whereas this sounds laudible and desirable, it is extremely difficult to apply in practice. Often referred to as optimum sustained yield (OSY), when combined with some of the characteristics of MSY the definition of OSY means so many different things to so many different people that it has ceased to be of much utility except as a process or approach to management (Bennett and others 1978, Roedel 1975).

Another problem is the lack of a functional pricing system by which to value the various recreational factors (and commercial factors) that cannot be easily determined by market survey. Esthetics can probably never be accurately measured. However, by perceiving the variables associated with the angling experience and the angler's perception of them, a reasonable understanding of esthetics possibly can be obtained.

Another possible management objective is maximizing some measure of angler use. Quality is an extremely vague and variable parameter to measure, but certain factors that contribute to the quality of the fishing experience can be delineated and measured (Driver and Knopf 1976). The number of potential variables is extremely great and specific areas may only have a few aspects that determine quality. If these aspects could be identified, the job would be much simpler. Providing the maximum diversity of angling opportunity is a practical approach to providing quality angling (Martin 1976).

Although all this discussion about management objectives certainly does not solve any problems, it points out some of the very real issues that we face in the profession. What are we attempting to measure? This information is needed to define sound management goals and objectives. Historically, we have assumed that production in terms of biomass and numbers of fish is a desirable measure of output and, therefore, we have devoted most of our efforts toward establishing, enhancing, and maintaining fish populations and their habitat. This approach is now suspect (McFadden 1969). Presently, there is increased emphasis on developing measures of output other than biomass, numbers of fish, or profit. The next issue we face is really one of *setting* objectives. The issue of *who* sets objectives is perhaps the most critical and controversial issue facing renewable natural resource managers today.

Setting Objectives

Setting objectives is no simple task. Aside from the problems of defining what an objective is, practically speaking, the identification, selection, articulation, and ranking of objectives are not easily achieved, and the problems concerning the quantification and measurement of esthetic and environmental factors are nearly impossible to solve (Lackey 1975). Because of the complexity of natural resources systems, establishment of management objectives may tend to be ignored by some managers. Although it is easy to scoff at this intentional oversight, the oversight does not occur without reason. Some of the reasons are possibly that the decision makers may be, in reality, unwilling to formulate objectives for fear that some of the *real* objectives may be disapproved under public scrutiny and fear that some may not be approved by all interested parties. Managers may be unable to formulate objectives because of a number of difficulties; incomplete problem awareness; incomplete knowledge of the intricacies of the problem; and inability because of time, money, and/or manpower constraints to devote sufficient thinking to the effort. Furthermore objective-setting methodology is not sufficiently defined and succinct to be of use to most fisheries managers. Although virtually everyone stresses the importance of objectives and the sound setting of procedures to some objectives, there are few sound techniques available and these are extremely complex to use in practice (Clark and Lackey 1976).

Beyond the goals of an agency, managers must decide initially on who should set objectives—agency personnel or the general public, or a combination of the two. Historically, fisheries managers have used consultation of professionals in institutional roles and positions to set objectives. Whereas this may be termed an "elitist" planning process, it does have a number of advantages in that it allows those who are "best qualified" and most knowledgeable to make decisions. However, most professionals now advocate use of systematic public input in decision making, the theory being that a more informed and concerned general public is currently seeking a greater role in allocation of economic and physical resources. One of the most urgent social needs in fisheries management is determining public needs and preferences. Much of the poor past and future planning is and will be attributable to the inability of planners and managers to consider the needs and desires of certain segments of the public (Lackey 1978a).

An informed and concerned public is essential for natural resource decision making in the current social climate. Theoretically, a planning process or a management process involving the public is more nearly democratic and as such probably has a higher probability of success because it provides representation from those affected. Management personnel cannot rely solely on public opinion in formulating decisions. Public opinion is valuable input because light

may be shed on the public response to potential management actions. The interactions between the managers and the public may bring greater appreciation for both sides' viewpoints and problems. Greater understanding should ultimately improve natural resource management.

Although this sounds fine in theory, in practice it may lead to a rather traumatic way of doing business for professionals. One of the greatest problems to avoid in soliciting public input is to minimize the likelihood that pressure groups will dominate public influence. Relatively small, well-organized, and well-orchestrated pressure groups can pressure agencies and professionals to altering strategies which *they* feel are in the best interest in the greater public. We are all familiar with public interest of the greater public. We are all familiar with public meetings where a relatively small group can voice opinions in such a way as to disproportionally influence the outcome.

Conclusion

As a final thought, I want to conclude with the cliche that a "problem recognized is half solved." Certainly, I cannot be accused of laying out a solution to solving the major fisheries management problems, but it is hoped that the problems managers face are now clearer. The complexity of fisheries as *systems* to be managed is clear to even the most casual observer. The second point, a broad "theory of fisheries management," should provide a framework to categorize all of the disjointed activities that we associate with management of our fisheries resources.

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