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nature of the system itself, and by the type of behavior it motivates on the part of many of the individuals in it. As such, the gap is unlikely to be bridged in the near future.

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Bridging the Gap Between Economic Theory and Fisheries Management: Can the MFCMA Produce Economically Rational Management? Discussion

JAMES E. KIRKLEY

Discussing the relationship between economic theory and fisheries management is a difficult task to ask of anyone. It is nearly impossible to do when the discussion is restricted to practical aspects. Given the complexity of such a discussion, Lee G. Anderson has provided an excellent discussion on the problems of managing fisheries with the MFCMA, particularly those relating to economics.

More important, I believe, is that Anderson has clearly identified and stated the problems which have limited the management of fisheries in accordance with economic goals and objectives. This has obviously been a source of consider-

able frustration among economists involved in fisheries management.

Anderson poses one fundamental question about economics and management. The question is "Is it likely that sound and economically rational management will be produced?" in accordance with economic criteria. The criteria are concerned with proper use of fish and other resources over time with appropriate attention given to all related costs including harvest, programmatic, management, implementation, and enforcement costs. The answer offered by Anderson, and which I concur, is "Not very."

Two reasons why sound management will not be produced are given by Anderson. First, the institutional setting and industry structure hinders management. Second, the politically astute and powerful minorities force attention on self-serving interests or away from economic

goals and objectives. These are the same problems identified in the literature on regulating industry (e.g., Buchanan and Tollison, 1984; Crain, 1979; Eckert, 1973; Sen, 1970; Hilton, 1972; McCormick and Tollison, 1981). Other reasons given in the literature for the failure of rational management include issue linkages or making trade-offs explicit among issues, conflicts of interest, and payment of managers and regulators. All of these would appear to be valid causes for the failure to achieve sound economic management of fisheries.

Anderson provides a comprehensive discussion of the institutional setting and structure by which fisheries are managed and regulated under the MFCMA. His paper, in fact, might be more appropriately titled "Collective choice, conflicting criteria, and agency theory in managing fisheries." He notes the existence of multiple objectives, which are often quite diverse; the fact that there are many agents and individuals which affect or are affected by fisheries management; and that, in practice, management is often something upon which all concerned can agree.

One aspect of the institutional setting which is properly accorded rigorous treatment in the paper is the relationship between the Fishery Management Councils and the National Marine Fisheries Service (NMFS). It is proposed that the relationship is one of animosity in which

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the Council members and staff believe that NMFS is attempting to make the work of Councils more difficult and to take control of fisheries management. This argument has been heard many times and there is possibly some element of truth to it. On the other hand, NMFS's staff have often complained that the Councils are attempting to exclude them from the management process or are not adhering to the guidelines which must be followed. There also is likely to be some truth to this. However, as correctly indicated by Anderson, these attitudes are not conducive to good management.

There is, though, another problem between the NMFS and the Councils which needs to be resolved. That is the problem of data sharing. Currently, NMFS collects and distributes most of the data necessary for formulating management plans and policies. However, the distribution of the data is often subject to restrictions. These restrictions may result in inadequate data for formulating and analyzing management plans and regulations. Thus, it is uncertain whether or not the council staff are provided the best data available and that management is based on the best available scientific information. The only immediate solution to this problem is for the councils to request particular analyses from NMFS.

Subsequently proposed in the paper is a political "bioregonomic" approach, the purpose of which is to provide an expanded analysis of the entire management process. This includes understanding legislative behavior regarding policy and budgets, enforcement activities, firm behavior, and the stock dynamics. The approach captures the entire institutional structure and allows for the consideration of other activities such as lobbying fishery agencies or the formation of "special interest" groups.

The major importance of the proposed approach is that it indicates that rational economic management requires an understanding of activities by individuals and agencies other than NMFS, the Councils, and the fishing industry, and that fisheries utilization involves other types of management costs. In effect, the political bioregonomic approach focuses attention on a regulated equilibrium and an optimum utilization which considers

all economic aspects of firm production, lobbying, avoiding regulation, and instituting and monitoring management policy.

Most economists and managers would concur with the need to consider all the possible interactions suggested by Anderson. However, we must consider the issues of whether or not it is possible to consider all the interactions, and what are the ramifications of not doing so. Previous experience would suggest it is neither possible nor feasible to adequately consider all the interactions of so complex a system. We do not, as yet, appear to be able to deal with even the basic economic and biological issues. Nevertheless, Anderson's argument for considering a broader management framework is correct.

A second question posited by Anderson is "How can the institutional and industry structures be altered such that the regulated equilibrium coincides with the expanded notion of optimal utilization?" Alternatively, "What types of regulation are optimal when the costs related to activities other than fishing are considered?"

A concise answer to this very difficult question is not provided in the paper. There is not, in fact, likely to be an easy answer. As I interpret Anderson, the process of formulating, implementing, monitoring, and enforcing management and regulations is too complex to offer an answer to the problem.

Anderson does, however, imply some possible solutions:

- 1) Other interests should be represented on the councils (e.g., consumer advocates and planners).
- 2) Encourage broader response to proposed management plans and regulations.
- 3) Promote greater cooperation between the states and Councils.
- 4) Induce the U.S. Coast Guard to act in a coordinated way with NMFS.
- 5) Specify objectives that have operational significance.
- 6) Identify a set of alternative plans which specify optimum yield and how the harvest will be limited to that level.
- 7) Impose a single-source accountability for success of a plan and grant it

sufficient latitude and resources to do the job.

There are, though, some possible problems with the implied solutions. First, prior attempts to broaden interests and responses have not been successful; there was often a lack of knowledge or understanding about fisheries and management. Second, some states have legal barriers which prevent cooperation. Third, the Coast Guard has experienced budget reductions, and thus, curtailed its fishery-related activities. They are not likely to increase their level of cooperation without increases in their operating budget. Fourth, if operational objectives are well specified such that trade-offs are permitted, other interests will likely dominate the economic criteria and objectives. Last, a single-source accountability does not necessarily guarantee good management. Currently, the Secretary of Commerce has final approval and is responsible for the fishery management plan. Yet, there is not one FMP with well specified economic goals and objectives.

Overall, I find little to criticize or find fault with in the paper by Anderson. Politics and "back-room bargaining" are an integral part of the management process; they do result in exploitation patterns which are not economically optimum. The fact that there is a trade-off between efficiency and equity in formulating management policies is well recognized; the equity aspects should be considered as well as the efficiency aspects (Layard and Walters, 1978). In general, I am in complete agreement with Anderson that given the economic criteria and institutional structure, it is not very likely that sound economically rational management will be produced under MFCMA.

In diffidence to Anderson, however, I do not believe that the fault lies entirely with the MFCMA. My argument is similar to the statement against gun control that "guns don't kill people, people kill people." In managing fisheries, it is man that specifies goals, objectives, and regulations. The paper upon which the Act is printed provides only a set of guidelines. The fact that Councils and NMFS have elected not to promote efficiency or minimize all costs is their decision. The Na-

tional Standards clearly indicate, where practical, that these conditions shall be considered.

Instead, and with some fear, I offer that the reasons for the failure to achieve rational economical management are our predecessors and we economists of today. Alternatively, I propose that some of the failure is due to 1) our wide acceptance of economic theory and applied methods, 2) our limited and often inadequate economic analysis, and 3) the lack of importance placed on economics by NMFS and the councils.

I do not propose to know all there is to know about economic theory and applied methods. However, I do know that almost every paper or text on determining the optimum rate of exploitation commences with a control theoretic model (e.g., Clark, 1976, 1985; Waugh, 1984). Most often, the objective is to maximize total net discounted revenues of the industry subject to a growth-removal equilibrium condition:

$$\text{Max} \int_0^{\infty} e(-rt) \cdot [P \cdot h(t) - C(X) \cdot h(t)] dt, \quad (1)$$

subject to $[F(X) - h(t)]$

where P is output price, h is output, C is cost per unit of h , X is stock size, $F(X)$ is a growth function, r is the social discount rate, and t is time.

Although there have been substantial variations of equation (1) which include multiple objectives, uncertainty, price response to quantity changes, and different growth functions, I think we must ask the question "How can management authorities seriously consider economic objectives if equation (1) cannot be solved if expanded to include Anderson's political bioregonomics framework. A simple expansion of equation (1) is all we have to offer?" It is also quite likely that equation (1) in which demand includes substitute species, cost is not separable between stocks and production, and the production technology varies over firms would likely present a difficult problem to solve.

Equation (1) also suggests another possible failure on our part and relates to

Anderson's criteria for an intertemporal harvest plan in which the correct amount is harvested each year. First, is there any reason to believe that any of the economic functions will be constant over all time periods; dynamic processes characterize fisheries. Second, equation (1) leads to either a steady state solution or a "bang-bang" control; we must ask whether these solutions are practical, reasonable, and feasible. Intuitively, I doubt it. Third, if the problem was specified as a finite time horizon problem, how would we establish the appropriate time interval? A quick review of five texts (Chow, 1975; Clark, 1976, 1985; Kamien and Schwartz, 1981; Mangel, 1985) fails to provide any guidance about the relationship between specification, solution, and the selection of a time interval in a dynamic problem.

In practice, I know of no fishery in which the management rules were established based on a control model. The problem, in fact, is not caused by the control theoretic approach. The problem is, however, related to the control model. The model serves as a reference for the economic theory and principles used to analyze the economics of fisheries, and it provides the basis for establishing economic goals and objectives of management. The consistent publication of control models in the literature only serves to reinforce its use by economists.

A further examination of equation (1) and relating it to economic theory and research needs illustrates the second possible reason why I believe economists are part of the problem. Most often, the specifications of the economic and growth functions in equation (1) or in other economic models used in fisheries are overly simplified. In many instances, the economic specifications bear no resemblance to economic theory.

For example, what type of inverse demand function has nominal price as a linear function of only the quantity demand. As economists, we know that the ex-vessel demand is a derived demand and should satisfy certain properties. Yet, the management plans and economic analyses of fisheries abound with these ad-hoc price response specifications. Alternatively, how many fisheries are single-product fisheries. Almost all of the eco-

nomics and biological specifications of the technology used in fisheries assume the technology is nonjoint-in-inputs or sufficient conditions exist for input and output aggregation. I suspect, as does Clark (1985), that a single-product fishery is quite rare. In the event of multiple products, the economic analysis and determination of optimum yields is likely to be very difficult.

In many of the empirical economic studies of fisheries, ad-hoc economic specifications are used. On occasion, from 5 to 20 equations may be specified and estimated as part of a system, but not one of the equations will be consistent with economic theory. How, then, are such results to be interpreted and applied to fisheries management. More important, what is the valuation of economics by managers when presented with such results.

In a "round-about" way, I am suggesting a need for more basic economic research in fisheries. That is, if economics is to serve as a basis for optimal management, we, as economists, must provide good economic analysis of the basic issues. A partial review of the economic programs and research within NMFS further illustrates this need and highlights the lack of importance placed on economics. NMFS is selected because it is the "national" fisheries agency, and thus, should indicate the importance placed and conveyed to others on the economics of fisheries.

The economics program of NMFS consists of economists located in Washington, D.C., and at several centers, regional offices, and laboratories. There does not appear to be a well defined goal and set of research objectives for the program. However, a substantial amount of analysis and research is conducted by these economists. This includes analysis of ex-vessel prices, productivity, imports, and the technology. Unfortunately, this research is most often reactive or necessitated by a problem which must be analyzed over a very short time-period. These conditions likely prevent the implementation of a basic research program and limit economic analysis.

It is more alarming that, given the level of resources allocated to economics, inadequate but still quite large, there

are no routine economic reports and analysis. I consider the "Fisheries of the United States" publication and similar reports to be data summaries and not economic reports. For example, there is no regular publication on productivity, the status and implications of imports, costs and utilization of the factors of production, short-run price projections, or the economic implications of management plans and regulations. There, in fact, is no routine publication that summarizes the number of fishermen, vessels, landings, and revenue by fishery, region, or state. This type of information is routinely produced by other government agencies concerned with the development, management, and regulation of other industries.

This gives the impression that NMFS is not very concerned with economics. If this is the case, the gap between economic theory and fisheries management is not likely to be narrowed.

To narrow the gap, NMFS must assume a leadership role, at least, in the identification of issues in need of basic research, NMFS, along with the states, universities, Councils, industry, and concerned individuals, must provide substantial resource support. This includes funding, data access, and identification of the issues in need of attention. In turn, our job as economists is to conduct competent research on the basic issues. I believe we will discover that once we provide competent research on the basic issues, economics will become a significant driving force in the management of fisheries under MFCMA.

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