

Fishery Socioeconomics: A Survey

Author(s): Anthony T. Charles

Source: *Land Economics*, Vol. 64, No. 3 (Aug., 1988), pp. 276-295

Published by: University of Wisconsin Press

Stable URL: <http://www.jstor.org/stable/3146251>

Accessed: 14-03-2017 07:02 UTC

JSTOR is a not-for-profit service that helps scholars, researchers, and students discover, use, and build upon a wide range of content in a trusted digital archive. We use information technology and tools to increase productivity and facilitate new forms of scholarship. For more information about JSTOR, please contact support@jstor.org.

Your use of the JSTOR archive indicates your acceptance of the Terms & Conditions of Use, available at
<http://about.jstor.org/terms>



University of Wisconsin Press is collaborating with JSTOR to digitize, preserve and extend access to *Land Economics*

Fishery Socioeconomics: A Survey

Anthony T. Charles

Fisheries management is constantly confronted, and sometimes confounded, by the complexities of real-world fishery systems. Two major sources of such complexities are (1) the many conflicting goals and objectives faced by fishery managers, and (2) the wide variety of socioeconomic factors which impact on the validity and effectiveness of regulatory instruments. Amongst the considerations lying within this "fishery socioeconomics" framework are distributional issues, labor market structure, social and opportunity costs, fishing community dynamics, and fishermen-decisionmaking processes. (Andersen 1978; FAO 1985; Fricke 1985; GERMA 1986; Panayotou 1982; Pollnac and Sutinen 1979.) While their importance is widely recognized, little consensus exists regarding the manner in which such topics can best be incorporated into economic analyses and into fishery management decisions.

This paper reviews relevant literature on fishery socioeconomics, addressing the questions: What contribution can multi-objective socioeconomic analysis play in fisheries economics and in practical fisheries management? What insights can be obtained from existing socioeconomic research? What specific questions need to be emphasized in future research? An attempt is made to consolidate the research in this diverse area, which has tended to develop somewhat independently from traditional resource economics theory, and which has some clear connections to the ideas of institutional economics (see, e.g., Wilson 1986).

The paper is organized as follows. Section I explores the wide variety of objectives, such as employment, distributional concerns and rent generation, which often play a practical

role in real-world fisheries, whether or not they are expressed explicitly in fishery policy statements. Section II reviews theoretical and empirical studies of income distribution, while section III presents a broad examination of literature dealing with socioeconomic aspects of fishery management. This involves both critiques of common management methods (such as regulated property rights and limited entry schemes) and examinations of alternative approaches (such as cooperatives, informal contracting and community property rights). This leads into an exploration in sections IV and V of the social and opportunity costs for labor in fisheries, and of related themes involving fishery labor markets, the determinants of labor supply, and the key issue of labor mobility. Section VI presents an overview of the literature concerned with fishermen and fishing-community decision processes and behavioral dynamics. The discussion is broadened in section VII to review data requirements in socioeconomic analysis and to provide perspectives on future priorities for research in fishery socioeconomics. Finally, the paper ends in section VIII with some general conclusions and some thoughts on the difficulties that have been faced in integrating socioeconomic research into economic analyses.

I. OBJECTIVES

The effective management of fisheries (or any economic activity) is based on the

Department of Finance and Management Science, Saint Mary's University, Halifax, Nova Scotia. An earlier version of this paper was presented at the Canadian Economics Association 1987 Annual Meeting. The helpful comments of Parzival Copes, Hélène Tremblay, Anthony Scott, David Robinson, and two anonymous referees are gratefully acknowledged. Research for this paper has been supported financially by the Natural Sciences and Engineering Research Council of Canada, operating grant #A6745, and by a Saint Mary's University Research Grant.

achievement of societal goals and objectives through the use of appropriate policy and regulatory instruments. This implies a natural progression in policy development, as well as in the present discussion; before reviewing socioeconomic aspects of fishery policies and regulations, we first focus on the variety of objectives pursued in fisheries management and development.

For example, Lawson (1984, 157) lists fourteen common goals of fisheries development, including increases to production, employment and fishermen's incomes, industry diversification, skills development, and the encouragement of both exports and domestic consumption. A report of the United Nations Food and Agriculture Organization (FAO 1983, 20) suggested that "objectives could be placed in three groups—maintaining the resources, economic performance, and equity (or social needs)." Three similar categories—conservation, fishery production or productivity, and income distribution—were used by Emmerson (1980) in developing a framework for examining interactions between fishery objectives.

Amongst the lengthy list of potential objectives, certain fishery management goals have become well established both in theory and in practice. For example, while biologists often highlight the conflicting objectives of fish stock conservation and of harvest maximization, the goal of economic efficiency has undoubtedly played a central role in economic studies of fisheries. Indeed, efforts to determine pure "economic optima" have often been justified on the basis that they provide benchmarks against which one can determine "efficiency losses" arising in the pursuit of alternative multi-objective policies.

On the other hand, Hannesson (1981, 173) suggests that, relative to the single-objective ideal of rent maximization, "a 'best' world is simply not obtainable. We should then perhaps not spend too much time on deploring this fact, but seek improvements or second best solutions, given the institutional constraints."

One such constraint is the importance placed on fishery employment as a common means of supporting rural communities and thereby providing a measure of social stability. For example, Cole and Anand (1974, 19)

point out that the fisheries of Thailand provide not only "a source of protein and foreign exchange" but also "a source of employment and subsistence for a significant part of a population of which at least one million are unemployed and ten million underemployed." Indeed, in many social studies of fisheries, employment is portrayed as the principal, if not sole, objective to be pursued, entirely replacing the efficiency criterion which prevails in economic analyses.

Given this situation in which differing objectives are selectively promoted, two questions must be addressed. First, when is a multi-objective analysis required? Second, what is a suitable balance or blend of legitimate objectives?

On the first point, it appears that normative single-objective analyses tend to find favor primarily in "industrial" fisheries, where economic efficiency and export earnings receive high priority. Most work in the theory of fishery economics has tended to concentrate on this situation, where it is assumed that (1) rent maximization is the appropriate management objective, (2) the basic theory of the firm is an appropriate description of the behavior of fishery participants, and (3) the human factor enters principally as "labor costs" to be minimized. On the other hand, multiple-objective socioeconomic analysis has been preferred in developing and "inshore" fisheries, where social concerns (e.g. food, employment) and economic factors blend together.

With respect to the choice of a balance amongst multiple objectives, this is properly a task for policymakers, although systematic approaches exist for the analysis of such trade-offs; these will be discussed below. Ultimately, however, a single harvest level must be selected—Salz (1986, 23) presents the options as follows:

1. Maximum sustainable yield (MSY): maximum quantity of fish which could be theoretically extracted from a given biomass indefinitely (under the unrealistic assumption of constant marine environment).
2. Maximum economic yield (MEY): volume of landings which would produce the highest value added of the sector in the long term.
3. Maximum social yield (MScY): production level which would maximize the social value of factors like income distribution, employment, etc.

While the first two of these are essentially single-objective options, the Maximum Social Yield (or "Optimum Sustainable Yield") reflects fundamental tradeoffs between multiple objectives, leading to inherent conflict. For example, such potential conflicts between community objectives and national goals are discussed by Smith (1981). Programs to encourage investment in the least capitalized components of the fishery "may distribute incomes more equitably among individual fishermen and communities, but to the extent that they decrease the sustainable yield they make the pie to be divided that much smaller, thus conflicting with national goals of resource conservation and management" (p. 21).

As Regier and Grima (1985, 855) point out, the priorities placed on management objectives strongly influence the choice of a "best" regulatory framework. For example, they point out that, in a recent report on fisheries policy for Canada's Pacific coast (Pearse 1982), market mechanisms were advocated for regulating fisheries (e.g. herring) dominated by a *material well-being* objective, but that difficulties were perceived "in expanding the market device very far with respect to salmonids and the small coastal stocks, both of growing interest to recreational and traditional fisheries within the *cultural opportunity* objective."

Whether a fishery is to be explicitly managed on a multi-objective basis, or whether there is an implicit balancing of divergent single-objective user groups, the existence of conflicting goals necessitates the use of suitable methods in order to provide meaningful analyses. While applications of analytical economics to realistic multi-objective fishery problems are not commonplace, the techniques of "goal programming" and of multidimensional welfare economics offer some potential. For example, Hannesson (1981) refers to several goal programming studies carried out in connection with Norwegian fisheries. Related analyses have been undertaken by Bishop, Bromley, and Langdon (1981), Drynan and Sandiford (1985), and Healey (1984), dealing with North American fishery management problems. Mueller and Wang (1981, 10) advocate the formalism of multidimensional welfare economics, with welfare depending

on such criteria as "economic efficiency, contribution to net economic output, income distribution, balance of payment equilibrium, reduction in structural unemployment, freedom from arbitrary government action, etc."

In interpreting the results of any multi-objective analysis, the fundamental decision remains that of determining the desired weighting of the objectives. For example, as Hannesson (1985) notes, Norwegian fishery management has been based on three key objectives: "(1) preservation of the pattern of settlements; (2) provision of employment; (3) conservation of fish stocks" (p. 118). While similar lists of objectives exist in most jurisdictions, these are not in themselves sufficient to define an optimal policy. Appropriate weightings are required before the results of a fishery management regime can be judged (unless it can be shown that current management is suboptimal with respect to *all* objectives). Multi-objective methods, then, provide a useful framework for examining quantitatively the effects of proposed management options and the resulting tradeoffs between conflicting goals.

II. INCOME DISTRIBUTION

In selecting acceptable regulatory alternatives, fishery policymakers are well aware that distributional implications must be taken into account. This practical interest in income distribution is matched by its theoretical relevance to the determination of social optima. As Mueller and Wang (1981, 10) note, "economic efficiency [alone] does not necessarily dictate the socially desirable course of action in the face of the income distribution issue." Thus, for both practical and theoretical reasons, Bromley and Bishop (1977) suggest that the effects of management measures on fishery income distribution need to be highlighted explicitly in fisheries economics studies. "Only in this way will it be possible to approach, as nearly as we can at this stage in the development of economics, the conclusion of welfare economics that social welfare is based on both efficiency and equity" (p. 299). This is an area where further research, perhaps based on the methods of multidimensional

welfare economics and goal programming, referred to above, will be of value.

Pending such theoretical and/or analytical advances, the de facto importance of these factors has led to several recent empirical studies of fisheries income distribution. These analyses range from micro-oriented community studies to macro-level policy analyses. For example, on the one hand, Smith (1977a) conducts a case study of a specific New England fishing port, analyzing distributional aspects of income, capital and labor. On the other hand, Davis and Thiessen (1986) and Thiessen and Davis (1986) deal with broad issues concerning the public policy implications of income distribution amongst Atlantic Canadian fishermen.

In Panayotou (1985), several authors undertake analyses of socioeconomic conditions in small-scale Asian fisheries, examining various measures of income distribution. For example, Fredericks, Nair, and Yahaya (1985), and Huq and Huq (1985) derive Gini coefficients and Lorenz curves to compare distribution of incomes between differing parts of Bangladesh and Malaysia respectively. Fredericks et al. find that the level of income inequality tends to be inversely correlated with the average monthly income per household, a result contrary to the conclusion of Lim (1971). Huq and Huq find that distribution of income may behave quite differently from that of assets:

Income was relatively more equally distributed than assets in all three areas studied. Moreover, the distribution of income was slightly more egalitarian in low-income Ajmiriganj than in the other two higher-income sites. The reverse was true for assets where Ajmiriganj had the most unequal distribution. (p.91)

Huq and Huq then broaden their analysis to compare the fishery sector with other parts of the Bangladesh economy, thereby connecting together the income distribution issue with that of property rights:

Distribution of income and assets for our study areas is apparently more egalitarian than for rural Bangladesh as a whole. This is probably because the major part of income in our study areas is derived from a source, the *hoar* water bodies [marshy

freshwater impoundments], that is almost equally accessible to all the fishermen and income inequality is likely to be less than in other sectors where access is rather restricted. (p. 91–92)

Ullah (1985) classifies fishermen on the River Jamuna of Bangladesh according to the relative use of outside hired labor versus family labor. He then applies econometric methods to derive Cobb-Douglas production functions for each class of fishermen, concluding that productivity declines with an increasing proportion of hired labor. However, rank analysis of variance (Kruskal-Wallis) tests showed no effect of labor ratio on profit rates. Ullah also examines the complex interaction of property rights, religious and caste differences, and labor mobility in this fishery.

While providing useful information about particular case studies, the empirical data and the conclusions outlined above need to be synthesized, and verified with further studies, to a point where general conclusions can be made regarding the interaction of income distribution with other factors involved in fishery management decision making. Quantification and generalization of such interactions will then enable the incorporation of distributional factors into multi-objective analyses, as suggested by Bromley and Bishop (1977), and Mueller and Wang (1981), as well as into the modeling of behavioral responses by fishing communities and fishermen groups.

Such potential certainly does exist—the studies point clearly to interactions between income distribution, productivity, and property rights. For example, if Huq and Huq's observation—that the institution of limited entry or property rights regulation leads to a less equal income distribution—should prove quite general, this may impact seriously on the relative desirability of such management options.

III. FISHERIES MANAGEMENT AND PROPERTY RIGHTS

The debate over fishery objectives, discussed above, interacts directly with the choice of appropriate management approaches and regulatory instruments. Certain fishery policies may be entirely incompatible

with declared objectives, while with others it may not be possible to "get there from here" in terms of achieving fishery goals. In this section, we review the literature concerning this interaction of fishery objectives and fishery management.

Perhaps the most widely discussed concept in natural resource studies is that of "common property" (see, e.g., Ciriacy-Wantrup and Bishop 1975; Christy 1982). Indeed, the fundamental topic of property rights, referred to briefly above, has a lengthy and expanding presence in resource economics (Furubotn and Pejovich 1974; Scott and Johnson 1985). Hardin's (1968) "Tragedy of the Commons" paradigm is central to the conventional wisdom in fisheries economics. Left to their own devices, so the argument goes, fishermen will destroy any social benefits that a fishery could produce. This conclusion, based on the assumption that fishermen are individualistic and myopic profit-maximizers, has led to the widespread advocacy of measures to reduce the number of fishermen and "rationalize" the fishery. In particular, limited entry regulations have received considerable attention (e.g., Rettig and Ginter 1978).

In recent years, a second line of property rights research has emerged from social scientists examining the detailed process of common property resource exploitation (Andersen 1979; Berkes 1985; McCay and Acheson 1987). These studies, involving analysis of interactions between fishing communities and regulatory regimes, question the universal validity of the "tragedy of the commons" paradigm. While acknowledging the existence of self-interest on the part of fishermen, this approach emphasizes the group dynamics in fishing communities which result in systems of informal property rights, "territorial use rights," "informal contracting" and the development of cooperatives and other fishermen organizations. It is argued that encouragement of such arrangements may be more cost effective, easier to enforce, and superior from a socioeconomic perspective. The various critiques and alternatives to standard fisheries regulation will be reviewed briefly below. Since the basic economic theory of fisheries regulation is well covered in Scott (1979) and a variety of other sources, the discussion is

restricted to extensions of the theory which incorporate important behavioral and social factors.

Regulated Property Rights

While limited entry is the most common tool used in regulating fishermen, individual vessel quotas (also referred to as "enterprise allocations" or "quantitative rights") are perhaps the most popular in recent theoretical discussions of fisheries economics. Socio-economic critiques of each of these regulatory instruments are reviewed here.

The need for and desirability of government regulation is usually accepted as a basic premise in fisheries management. Townsend (1985), however, questions the use of limited-entry management, defending open-access fisheries against the conventional wisdom that such fisheries represent little more than a waste of resources. Focusing on New England fisheries, he analyzes the non-pecuniary benefits accruing from fishing, and in particular from the existence of open access to fishery resources. Townsend suggests that the "right to fish" is an important external benefit accruing from an open-access fishery regime, providing enhanced community stability. In particular, he argues that an open-access fishery serves as a base-line occupation in the community, serving to raise overall wage levels by providing local workers with some wage bargaining leverage in the form of a readily available fallback job in the fishery (representing a floor on the opportunity cost of labor). For further discussion of the fishery's role within a local labor market, see Panayotou (1982).

This argument is presented as well by Sinclair (1983), who examines the effects of introducing limited-entry licensing to the shrimp and cod fisheries of northwest Newfoundland. He suggests that "the economic objectives of licensing were partially achieved, but the social consequences . . . suggest limited-entry licensing is a flawed management strategy in isolated, fishery-dependent regions" (p. 307). Indeed he argues that:

Even advocates of limited entry and enterprise allocation sometimes concede that the social conse-

quences may be excessive and the economic gains illusory. Crutchfield (1979, 751), for example, after arguing that unemployment is seldom a serious problem as a result of limited entry, noted: "An important exception would be isolated fishing communities where other employment opportunities are severely limited. It is quite possible that spreading employment in the fishery would still be the least cost method of achieving some desired minimum economic and social standards." For most of rural Newfoundland, this appears to be a valid argument. (p. 312)

This perspective, based on objectives different from that of rent maximization, highlights the point that from a theoretical multi-objective standpoint, there may be losses as well as gains from limited-entry programs (cf. Rettig and Ginter 1978). Some type of social cost-benefit analysis is therefore needed to achieve a balanced policy decision.

The use of allocated vessel quotas in fishery management is discussed by Pinkerton (1981). While agreeing with Pearse (1980) that such quotas may have significant theoretical benefits, she argues that to achieve their full long-run potential in achieving resource conservation and efficiency, these quotas must be community based and nontransferable. Pinkerton cites the experience of Japan, where fishing cooperatives hold complex overlapping rights in the same area. The sale of fishing rights by some of the cooperatives, often to companies interested in industrial development rather than fishing, resulted in a reduction in the overall number of fishermen, but for remaining fishing cooperatives "the impact on morale and customs . . . was disastrous: they were unable to exert the community pressure upon their peers which had formerly curbed over-fishing and illegal practices" (p. 5). She advocates instead the support and development of existing cultural and social mechanisms for "informal management of the resource," referring to positive examples in British Columbia Indian communities, amongst Nova Scotian fishermen, and in the Norwegian purse-seine herring fishery.

While the above critiques tend to favor local community fishery management over regulated property rights, a very different perspective is presented by Keen (1983) who, although also criticizing limited-entry regula-

tion, argues that economic rationalization can be achieved with lower social costs through a "sole owner" public fishery agency charged with the responsibility for optimal harvesting and marketing. He notes that such an approach typically has been rejected out of hand (primarily on ideological grounds) but argues that theoretical economic superiority makes the concept worthy of further research effort.

Cooperatives, Co-management, and Fishermen's Organizations

The encouragement and development of fishery cooperatives is a frequently recommended policy action, particularly for developing countries (e.g., Lawson 1984; McGoodwin 1983, and references therein). Such cooperatives are seen as vehicles for encouraging self-regulation and/or cooperative management (co-management) in which fishermen and government regulators jointly develop fishery management plans (Pinkerton 1988).

The current and potential role of cooperatives in the developed world has been examined by Jentoft (1985) and McCay (1980). The first of these papers discusses three benefits which can be provided by cooperatives: (1) self-regulation and coordination, (2) a method for dealing with distributional issues and (3) the encouragement of fishery innovation. Jentoft argues that cooperatives are well-suited to the fishing industry since fishery problems "are collective in nature not only because they affect many actors simultaneously, but also because they influence patterns of social interaction themselves" (p. 331).

As a case study, McCay describes the operation of a New York Bight fishing cooperative, operating since the early 1950s, which specializes in the harvest of whiting. Members of the cooperative are provided with (1) docking and marketing facilities, (2) coordination of harvesting effort, and (3) a mechanism for limiting entry in the fishery. The latter benefit, although only partially achieved, is provided informally through a closed membership policy and the monopolization of docking space. This, together with control over fishing effort (with overall "dock limits" for the entire fleet and "boat limits" for each vessel), serves to

maintain fish prices and fishermen's incomes through a process of supply management.

The interaction between fishermen's organizations (including cooperatives) and the formal regulatory process is a particularly complex area. In the absence of full property rights, how should government agencies determine who gets the fish? How are such decisions influenced by those involved in the industry? (See, for example, the papers in Grover [1982].)

On this topic, Johnson and Libecap (1982) discuss a variety of fisheries in which informal contracting systems operate: the shrimp fishery of Galveston and San Antonio bays in Texas, the lobster fishery in parts of Maine, and (formerly) the inshore cod fishery of Newfoundland. These authors also examine the role of fishermen unions in restricting the open access nature of fisheries, particularly through price-setting efforts and product quality control. While arguing that informal contracting and unions "have provided [only] limited gains because informal arrangements lack enforcement, and because of government opposition to union attempts to restrict fishing effort" (p. 1007), Johnson and Libecap emphasize that "there is, though, one crucial advantage offered by sole ownership and trade associations over government regulation: they will internalize the costs of regulation. Accordingly, they should not arbitrarily be denied consideration in the selection of management policies" (p. 1020). For an account of an attempt at "fishermen-government co-management" in Canada's Bay of Fundy herring fishery, see Kearney (1984).

Karpoff (1987) picks up on the work of Johnson and Libecap, developing a model of fishery regulation that incorporates realistic "self-interest" objectives of fishermen. He notes: "Since regulations are in fact the result of a complex process involving many actors with divergent beliefs and self-interests, the controls proposed in economists' models are only rarely observed among real-world fishery regulations" (p. 182). Karpoff, viewing fishery regulations as the natural products of the political process, addresses the question: "Why have many traditional fishery regulatory techniques [such as restrictions on fishery access and the use of capital equipment] sur-

vived the onslaught of theory and data that demonstrate their suboptimality?" (p. 180). The answer, Karpoff proposes, is that such controls cause a redistribution of wealth that is favored by the majority of fishermen in the regulatory body's jurisdiction, and hence "regulations that appear to be perverse are the results of rational maximizers exploiting the political process for redistributive gains" (p. 181).

Informal Property Rights

Lawson (1984) surveys a variety of property rights arrangements in developing countries, pointing out that: "The most effective method of control exists where it is possible geographically and physically to delineate a territory in a way in which all fishing which takes place within it can be monitored and controlled, and which can, if possible, be supervised by the fishing community itself or by its elected leaders" (pp. 80–81). However, little effort has been made to encourage this management option and in some cases, such as the fisheries of Oceania (Johannes 1978), these traditional management and conservation approaches have declined as fisheries have "developed." Nevertheless, Cycon (1986) notes that "traditional sea tenure systems have operated, and continue to operate, around the world" (p. 5). Lawson (1984) provides several current examples of these informal community management and territorial use rights systems, including: lagoon fisheries in the Ivory Coast, beach seine net fisheries along the West African coast, collection of shellfish and seaweed on a coastal village basis in South Korea and Japan, and tight controls over "strangers" and "fishermen from outside" by Sri Lankan fishing communities. She concludes that for developing countries: "Substantial government propaganda and extension work would be needed to support management of small-scale fisheries through institutions formed by fishermen, but this method does offer an alternative to the control of this otherwise intractable sector." (p. 82).

In a frequently referenced paper, Acheson (1975) discusses the role of traditional fishing rights in the lobstering communities of Maine, where "to go lobster fishing at all, one needs

to be accepted by the men fishing out of one harbor; and once one has gained admission to a 'harbor gang', one is ordinarily allowed to go fishing only in the traditional territory of that harbor" (p. 187). Acheson notes that this informal system is maintained through "political" inter-harbor competition, since the territorial system "contains no 'legal' or jural elements" (p. 187). (Note however that Wilson [1977] questions the effectiveness of informal property rights in this fishery.)

Davis (1984) presents a similar situation in his discussion of implicit property rights within the small-boat fishery of Port Lameron Harbour, Nova Scotia. In such communities, "claims of ownership and control of property are centred in the community, and individual use-rights are derived from membership in the community" (p. 146). Davis suggests that this community-based approach is "basically foreign to the system of owner/non-owner property relations" (p. 146) inherent in a market economy, and hence the existence of these informal property rights is not fully utilized in the development of government policy.

This argument relates closely to several reviewed above, with an emphasis being placed on the role of fishing communities in regulating the fishery areas in which they have a "community self-interest." While this approach is by no means universally supported (see, e.g., Hannesson 1985), the key research question raised is to determine why community/fishermen self-regulation works in some jurisdictions and not in others, and whether incentives can be formulated to improve the potential of this potentially cost-effective management tool.

This question has been addressed in an interesting paper by Berkes (1986), who examines five case studies of Turkish fisheries. He concludes that "local-level management provides a relevant and feasible set of institutional arrangements for managing some coastal fisheries," particularly "small-scale fisheries in which the community of users is relatively homogeneous and the group size relatively small" (p. 229). In contrast, "for offshore fish resources and larger-scale, more mobile fishing fleets, community-level management is less likely to work. In such cases, the often discussed measures for the assignment of ex-

clusive and transferable fishing rights may indeed be more appropriate" (p. 229). Interestingly, this classification of fisheries with respect to appropriate management approaches meshes closely with that discussed in regard to differing management *objectives* in section I.

A Regulatory Model

As a final point in this section, it is worthwhile to note the innovative modeling approach of Anderson (1984), in which the fishery regulatory framework is treated as "endogenous to the system." To complement the biological and economic sectors of the fishery, he introduces a "regulation sector, which consists of those agencies and institutions which . . . devise, implement, and enforce specific regulations" (p. 78).

Anderson (1987) expands on this "bio-regunomic" model, examining the "optimal" strategy for a fishery regulator, and noting that "if a fishery agency hopes to regulate with any degree of accuracy it has to know what effects different policies will actually have on industry behavior" (p. 126). This point reflects the theme of much of the literature reviewed above, and will be returned to, particularly in section VI.

The analysis presented by Anderson assumes that only one objective is relevant in the fishery: "The motivating forces behind fishermen's behavior do not change under regulation. Each will still try to maximize profits" (p. 125). Nevertheless, such a framework, with interactions between fishermen and regulators made explicit, has excellent potential to incorporate a wide variety of multi-objective socioeconomic elements and behavioral dynamics.

IV. SOCIAL COST AND OPPORTUNITY COST OF LABOR

It is often suggested that differences between private, financially motivated actions and those deemed to be socially optimal can be explained through an examination of the private and social costs inherent in an industry. The comments of Sinclair (1983) and Crutchfield (1979), referred to above, allude to this

point—social factors may weigh heavily in the choice of a fishery policy only in the face of low opportunity costs of labor, as in isolated fishing communities where few alternative employment possibilities are available. Indeed, in such cases the costs of unemployment may be very high if government transfer payments are necessary in the absence of fishery employment. Of course, cost differentials may work in the opposite direction: the social cost of fuel may exceed the private cost if fishermen's purchases of petroleum products are subsidized.

Measuring the opportunity cost of labor can be a complex task. For example, a recent study by Martin (1986) addresses differences between private and social costs in Quebec fisheries. Martin utilizes two common approaches to the measurement of the social opportunity cost of labor: (1) a "labor economics" methodology, focusing on differences between the financial cost of labor and the true resource cost to the economy, and (2) a benefit-cost approach dealing with the determination of shadow prices and measurement of the extent to which private costs must be modified to account for distortions in the economy.

Two key issues in fishery policy analysis involve (1) the extent to which the opportunity cost of fishing for small-scale fishermen can be raised by providing non-fishing employment alternatives, and (2) the extent to which differences between private and social labor costs affect optimal governmental management practices.

With respect to policy approaches for dealing with low opportunity costs of labor in many fisheries, Panayotou (1980, 146), referring to the Thailand fishery, suggests that "the solutions to the problems of small-scale fishermen are to be found outside the fishing sector." While he acknowledges that "to maintain the status quo of unregulated open access is to propagate the 'tragedy of the commons' in terms of both human and natural resources," nevertheless Panayotou notes that "in the presence of widespread unemployment outside the fishery sector, not only is a reduction in the number of small-scale fishermen unwarranted, but even restrictions of entry for potential fishermen cannot be justified."

Smith (1981), like Panayotou, accepts that

reducing the number of fishermen in over-extended fisheries would likely increase net economic benefits, but he points out that "it is necessary to do more than develop fishery management programmes if incomes in fishing communities are to increase. Management programmes fail to deal adequately with fishermen who are displaced" (p. 22). This treatment of the fishery as a component of the macro-economy is in keeping with multi-objective socioeconomic analysis, balancing the two major goals of rent generation and employment. However, the problem of determining appropriate weightings for the objectives remain a "political" issue.

An analytical treatment of interactions between private and social costs on the one hand, and optimal fishery management on the other, has been carried out by Panayotou (1982), who discusses the modifications required to incorporate a variety of socioeconomic factors into the basic static bio-economic analysis. Problems of income distribution, lack of mobility and of alternative employment, and conflicts between industrial and small-scale fisheries are considered, particularly with respect to their effect on fishery management approaches.

Panayotou's approach, as depicted in Figure 1, involves a division of fishing costs into two components, private labor costs (wages) and other capital and operating costs. Assuming the existence of high levels of unemployment in the economy, so that the opportunity cost of labor is essentially zero, the "social yield" is comprised of resource rents *plus* wages. Five possible equilibria, corresponding to differing fishery objectives, can be plotted at increasing levels of fishing effort:

1. Maximum Economic Yield "MEY" (private optimum)
2. Maximum Social Yield "MScY" (social optimum)
3. Maximum Sustainable Yield "MSY" (harvest yield optimum)
4. Zero Resource Rent "OAE" (open access equilibrium)
5. Zero Social Yield "ZSY" (employment optimum).

Panayotou points out that the MEY social yield (including both "surplus profits" and

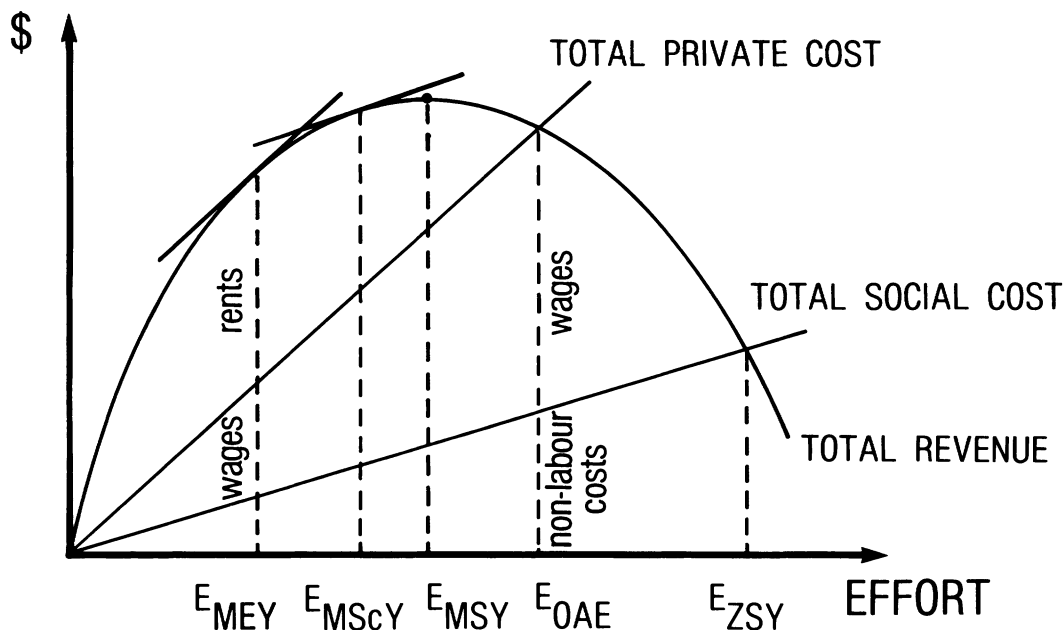


FIGURE 1

The division of fishery revenues into (1) non-labor fixed and variable costs, (2) private labor costs, and (3) fishery rents. From a societal perspective, if the opportunity cost of labor is zero, net social benefits comprise the sum of fishery rents and payments to labor. The social optimum (MScY), which may be determined through a balancing of multiple fishery objectives, is unlikely to coincide with either the Maximum Economic Yield or the Maximum Sustainable Yield (adapted from Panayotou 1982).

wages) may or may not exceed the social yield at OAE (comprised entirely of wages). The difference between management at MEY and at MScY is even greater if physical capital invested in the fishery is taken as “sunk,” further decreasing the social cost curve.

Munro (1976) develops a dynamic optimization analysis of the opportunity cost question, deriving economically optimal fishery management plans given a gradual transition from a low-opportunity-cost world to one in which alternative employment opportunities are more available. Munro emphasized that ideally fish stock management must anticipate such changes—for example, if an employment diversification and training program will produce higher opportunity costs in the future, this may imply more moderate exploitation of the fish stock at present than would otherwise be the case.

Thus social costs and opportunity costs of

fishery labor impact on optimal management targets, interacting with fishery objectives to determine, for example, the desired fishing effort or harvest levels (as in Figure 1). However, there is more to practical fishery management than choosing a management goal—the adjustment path is largely determined by the decision-making procedures and dynamic behavioral responses of fishermen and fishing communities. These factors will be examined in the following two sections.

V. FISHERY LABOR MARKETS

Literature dealing with labor supply and demand in fisheries ranges from descriptive treatments of the complex socioeconomic and community interactions involved in determining participation in the fishery, to analyses based on economic theory (using fishermen utility functions, marginal product of labor,

and similar concepts). A major theme is that of adjustment processes, and in particular the question of migration into and out of the fishery. As Panayotou (1982) has noted, fishery labor processes, particularly in developing areas, are intimately related to the overall socioeconomic environment.

One of the best-studied fisheries with respect to labor adjustment processes is that of Newfoundland, on Canada's Atlantic coast. For example, Copes (1973, 1983) traces fishery and non-fishery labor force trends in this area, emphasizing the problem of differentiating between full-time and part-time fishermen in the analysis. He recounts the socioeconomic difficulties experienced by fishermen in Newfoundland outports, highlighting the potential for increasing per capita incomes by reducing the number of inshore fishermen, and discussing government efforts to accomplish this by inducing migration and resettlement away from small outports toward fishery "growth centres."

Antler and Faris (1979) address the effects of this resettlement program, with respect to the operation of the labor market and to the mix of fish products produced. They analyze the economic structures in a particular fishing community subjected to a combination of resettlement and the institution of a monopsonistic marketing agency which controlled purchases of the community's primary product. These changes resulted in (1) a dramatic transformation from self-employed fishing to wage laboring; (2) a shift in the type of fish produced; (3) a change in the organization of processing activity from family-based "fishermen-recruited production units" to privately owned fish plants; and (4) the end of participation by many women in the fishery, and indeed in the economy, due to a reduction in employment opportunities. Antler and Faris conclude that the former community economy remains viable, and preferable from a social perspective, but irreversible institutional changes make it impossible to reestablish the past structure.

A third Newfoundland study, by McCay (1979), discusses the functioning of labor markets in the small fishing region of Fogo Island, off the northeast coast of Newfoundland. She concentrates on changes in labor ar-

rangements caused not by "rationalization" but by fleet development. The technological change brought about through the introduction of a new longliner fishery was found to affect the level of earnings, returns to capital, labor mobility, and the share system by which revenues are split between owner and crew. These factors led to shifts in the labor supply curve and changes in the level of fishery participation, to the extent that at times difficulties were experienced in recruiting crews, in spite of high unemployment levels.

The complexities of Newfoundland fishery labor markets have been incorporated within an analytical framework by Ferris and Plourde (1980, 1982). These authors develop a set of models to analyze labor supply in the Newfoundland inshore fishery, together with the work-leisure tradeoffs made by inshore fishermen. They produce an "opportunity set" depicting the tradeoff possibilities between work and leisure (having previously determined the optimal combination of fishing and non-fishing work for any given level of leisure), and use this together with a set of assumed indifference curves to model the process of optimization by an individual fisherman.

Ferris and Plourde then expand the analysis to consider the inshore fishery as a whole, using regression methods to test hypotheses about the effect on occupational choice (and hence the number of inshore fishermen) of (1) per capita inshore fishing income, (2) per capita inshore unemployment insurance, (3) per capita offshore fishery income, and (4) expected provincial non-fishing income (given as the per capita income in Newfoundland times one minus the unemployment rate). Two key results suggested that (1) unemployment insurance plays a major role in maintaining the number of inshore fishermen, and (2) "the inshore fisherman is more responsive to market incentives than might have been expected" (Ferris and Plourde 1982, 108), based on a strong negative correlation between the number of active inshore fishermen and the expected income that could be obtained outside the fishery.

Panayotou and Panayotou (1986) develop a related model of (1) labor supply, based on household consumption-leisure tradeoffs, and (2) labor allocation, based on choices of fish-

ing versus non-fishing and local versus non-local employment. Econometric analyses are carried out using data from the fisheries of Thailand. The results provide a significant predictor of the changes in household labor supply devoted to fishing, as measured by socioeconomic and demographic independent variables (with $\bar{R}^2 = 0.71$). The primary conclusion of this analysis is: "Fishermen are responsive to economic incentives and do move between occupations and locations to take advantage of earning differentials. Yet, this mobility is far from perfect. Labour is quite mobile between occupations but less so between locations" (p. 52–53). This observation leads the authors to suggest that regional development efforts may be best channelled into promotion of non-fishing employment alternatives in those areas where geographical mobility is most limited.

The interaction of labor mobility and fisheries management in the context of two major New England fisheries has been addressed by Terkla, Doeringer, and Moss (1985). These authors suggest that in a developed nation context, discussion of labor mobility has focused on "the difficulties of transferring labor out of fishing in small isolated ports where there are few alternative sources of employment and where labor outmigration is low because of strong attachment to community and family," but that in fact, "understanding labor adjustment processes is likely to be crucial for implementing efficient and equitable management policy throughout the fishing industry, not just in isolated areas" (p. 1).

Terkla et al. address labor "stickiness" and the related issue of opportunity costs in a qualitative manner, differentiating fishermen by their geographical location, their extent of involvement in the fishery and the employment system under which they operate. They point out, however, the need for further research to incorporate these ideas into fishery models and management discussions. (See, for example, the analysis in Charles [1987], where optimization and behavioral models are developed to deal explicitly with labor dynamics and the social value placed on stable fishing communities.)

Doeringer, Moss, and Terkla (1986) present an important socioeconomic analysis of

the New England offshore fishery, complementary to their discussions in Terkla et al. (1985). Together with a full description of this fishery in general, the authors focus on two specific fishing ports, Gloucester and New Bedford, examining differences in the labor market, in employment, and in investment due to differing social arrangements. In particular, they note that in Gloucester, where family ties in a "kinship system" predominate, fishing income and unemployment tend to be spread more evenly amongst fishery workers than in the "capitalist system" of New Bedford. It is argued that such labor market complexities need to be taken into account in fishery management, especially with regard to effort controls, since "effort" includes a multidimensional labor component with complicated behavioral responses.

While the studies reviewed above provide valuable insights into fishery labor markets, there remains considerable scope in this area to develop models incorporating more fully the complex behavioral response of fishermen, and their interaction with the broader socioeconomic environment. In the following section we turn to two key determinants of these behavioral responses—fishermen objectives and decision-making processes of fishing communities.

VI. FISHERMEN AND FISHING COMMUNITIES

A major rationale for fishery socioeconomic analysis is the realization that development of economic policies and regulations in fisheries requires an understanding of objectives and behavior followed by fishing communities and individual fishermen. Basic data on these topics has been obtained through two related approaches. On the one hand, a great many case studies of individual communities have been carried out, many in a sociological or anthropological vein—such as those in Andersen (1979) and Smith (1977b)—and some following a socioeconomic methodology, including the papers in Panayotou (1985) and the extensive study of New England fishing communities in Doeringer et al. (1986), discussed above.

These detailed analyses of specific com-

munities are complemented by broader statistical descriptions of the socioeconomic fishery system, obtained through surveys of fishermen and shore-based fishery workers. For example, a series of studies concerned with fisheries on the Atlantic coast of North America have been carried out by Poggie and Pollnac (1978), Pollnac and Poggie (1979), and Apostle, Kasdan, and Hanson (1985). These authors are interested in the effects of changing conditions on coastal communities: "it is essential to understand how inhabitants perceive their presentday existence. . . . Do people continue to live in these small villages by choice, or from lack of alternatives? Is work satisfaction a prime reason for wishing to remain within the community, or is the work secondary to other factors related to place?" (Apostle et al. 1985, 256).

Apostle et al. compare their survey of fishermen in southwest Nova Scotia with those carried out in New England by Pollnac and Poggie, using multiple regression and factor analysis to examine: (1) work satisfaction indices, (2) the relative significance of work satisfaction predictors, and (3) the relative importance of job satisfaction versus community attachment in fishermen's decisions to remain in their community. The authors identify three general classifications of fishing communities, characterized by: (1) a high level of job satisfaction and strong community attachment (as in southwest Nova Scotia); (2) a high level of job satisfaction but weak community ties (e.g., Point Judith, Rhode Island); and (3) a weak commitment to the fishery as an occupation, but a strong community attachment and/or interest in maintenance of kin and status positions (e.g., New Bedford, Massachusetts).

Interestingly, this classification of Nova Scotian and New England fishermen can be clearly related to that of Panayotou and Panayotou (1986) for the fisheries of Thailand. In the latter paper, reviewed in section V, fishermen and fishing communities could be categorized according to their degree of geographical mobility and of occupational mobility (likely determined in part by community ties and job satisfaction respectively). In particular, Panayotou and Panayotou found that many fishermen interviewed in Thailand fit within category (3) above.

With respect to shore-based fishery operations, a series of articles in Chaumel (1984) report on surveys of the relationship between employee work environment and corresponding productivity levels in fish plants. For example, Baldursson (1984) undertakes a statistical analysis of interactions between health, work stress and the effects of "productivity increasing salary systems" on processing workers in Danish fish plants. Such analyses highlight the status of fish plant work relative to other employment, providing insights into the "reservation wage" and implicit opportunity costs of labor for fishermen (for whom fish plant jobs represent alternative, albeit undesirable, employment).

In addressing objectives, decision-making structure and behavioral aspects of fishing communities (and indeed most rural communities), it is relevant to examine the different goals and the different roles of men and women. For example, Chapman (1987) discusses women's fishing in Oceania, reviewing a variety of case studies from that region. She concludes that this activity, while looked down upon by the men in these communities, in fact provides a major and especially regular source of food protein. She also quotes evidence that women are often more knowledgeable than men on fisheries and ecological matters in this region, while noting that "consultation of women as fishing experts would be a complete reversal in policy for most modern fisheries development officers in Oceania" (p. 283).

While Chapman emphasizes their role in fish harvesting, women are particularly involved in on-shore fish plant work. For example, Lamson (1986) discusses the role of women in Atlantic Canada processing plants, while Gunnlaugsdottir (1984) studies differences in work conditions and payment systems between men and women working in Icelandic processing plants.

The substantial body of case study and survey information dealing with fishermen and fishing communities has yet to be fully incorporated into economic analyses of fisheries. There is, however, considerable agreement amongst fisheries economists that the socioeconomic rationale for fishermen decision-making needs to be better understood. For example, Opaluch and Bockstael (1984) argue

for "a change in research focus from the behavior of fish to the behavior of fishermen [since] . . . the fishermen's decision as to effort level is perhaps the most important type of behavior to be understood" (p.107). This point of view is echoed by Wilen (1979), who develops a model of the interaction between fishermen behavior and fishery regulation. Karpoff (1985) has shown statistically that non-pecuniary factors are important in understanding fishermen's decision-making behavior, particularly the continued activity of low-revenue fishermen.

A recent quantitative analysis of fishermen and fishing community strategies has been undertaken by Gaskill, May, and Clark (1986), involving the development of hypotheses to explain the economic behavior in small Newfoundland outports. This research points to the prevalence of work-sharing strategies in such communities, based on maximization of *community* income (including transfer payments such as unemployment insurance). The authors note that the use of quantitative models, such as that used in their paper, "can lead to a better understanding of such interactions and the resultant alterations of economic behaviour" (p. 24) and can be useful in the process of formulating economic policies in fisheries.

VII. SOCIOECONOMIC INFORMATION AND RESEARCH

Along with the recognition that socioeconomic factors are relevant in understanding real-world fisheries, and therefore in implementing appropriate policies, has come the realization that the collection of data and the conduct of fishery research need to incorporate these concerns. Fishery management agencies traditionally have concentrated on the acquisition and use of biological data from survey trips and sampling experiments, fishery data in the form of catch and effort statistics, and perhaps (if the budget allows it) economic data such as that collected in cost and earnings surveys. In general, the collection of socioeconomic information has not been a priority amongst management agencies.

Not surprisingly, social scientists have been at the forefront in pointing out the need to expand the horizons of fishery studies to in-

corporate social and socioeconomic considerations. For example, Andersen (1978), in a report to the Canadian government, reviews social aspects of the Atlantic fisheries and argues that in the face of rapidly changing conditions, "the human and nonhuman sides of the equation require *systematic monitoring*. . . . Much of our knowledge of the human factors—fishermen adjustment, their communities, industry, and government—in the fisheries management and development process is fragmentary and, because of extended jurisdiction, obsolescent" (p.1043).

Fricke (1985) echoes this point, showing that in the United States, forestry management has been considerably more successful than fishery management in incorporating sociological and social impact analyses. His paper, which provides a useful set of references concerning social analysis of U.S. fisheries, analyzes the post-1977 fishery plans developed under the U.S. Magnuson Act. Fricke notes that few of these incorporate all six categories of social and socioeconomic information outlined in the Act's guidelines: (1) ethnic character, family structure, community organization; (2) age and education profiles of fishermen; (3) employment opportunities and unemployment rates; (4) recreational fishing; (5) economic dependence on fishing or related activities; (6) distribution of income in fishing communities.

Josupeit (1981), drawing on United Nations statistics, has compiled the limited data available on a nation-by-nation basis for such socioeconomic factors as food production, employment, and the indirect economic effects of the fishing industry. While this is a useful collection of information, it also makes clear how little data of this type is systematically available to fishery policymakers.

Of course, as important as the collection of socioeconomic data is the use of this information in fishery research and in management decision making. Three key perspectives on research needs in fishery socioeconomics are those of FAO (1985), Smith (1979) and Wilson (1982). The first two of these focus on "traditional" small-scale fisheries, while the latter refers primarily to developed-nation fisheries. Each will be discussed briefly below.

Perhaps the major compendium of material dealing with the *process* of acquiring socio-

economic information in small-scale fisheries has been produced for the U.N. Food and Agriculture Organization (FAO 1985). This paper examines the role of socioeconomic information in managing fully exploited fisheries (where concerns of employment, efficiency, food supply and demand, and distribution of income and wealth are considered paramount) and in developing new fisheries (where improving the standard of living, increasing fish production, and expansion of markets for fish are most crucial). Detailed suggestions are made concerning the priorities for information acquisition and the tools for collecting the data.

Smith (1979) addresses the *focus* of fishery research, arguing that "particularly in the area of socioeconomic, much of the previous research on traditional fisheries in the tropics has been essentially descriptive" but "an analytical framework and methodology is required if the results of research are to be useful to decision makers" (p. 35). He suggests that priority should be placed on research dealing with stock assessment, development of appropriate management tools, reduction of waste in the distribution system, and development of alternative income sources for artisanal fishermen. However, Smith notes that "a necessary precondition" of this work is the development of "an understanding, on the one hand, of the resource/fishermen/distribution continuum and, on the other hand, of the linkages among fisheries, fishing communities, and other rural sectors, and institutions, including government" (p. 35–36).

From the perspective of institutional economics, Wilson (1982) echoes this emphasis on studies of the full fishery system. In a critique of standard fishery management approaches, he argues that such management needs to recognize the presence of (1) constraints on regulatory options due to a high level of variability and lack of information, (2) high social (transactions) costs involved in rule making and enforcement, and (3) a close relationship between adaptive economic behavior and economic efficiency. These factors, which Wilson suggests are "more or less alien to the traditional treatment of fisheries economics and management" (p. 417), concern a range of socioeconomic complexities which

provide abundant scope for future research activity.

Several of the research areas addressed by these authors have also arisen in the literature examined earlier in this paper. For example, there appears to be a clear need for further work on such topics as the implementation of multi-objective methods in fishery management, the generalization of results concerning income distribution, and the development of behavioral models for fishermen and fishing communities. Such research efforts are perhaps most likely to succeed if approached from an interdisciplinary perspective, and while this has not been a common practice in the past, there may be an increasing trend in this direction as the potential benefits become apparent.

VIII. CONCLUSIONS

Fishery systems are inherently complex, with interactions amongst social, economic, biological, environmental, and regulatory components—involving fishermen and fishing communities, fishery capital, fish stocks, and both the economic and ecological environments. The term "fishery socioeconomic" has been used here to incorporate those aspects of the fishery system in which human and social elements influence fishery objectives and economic activity. These topics have been grouped within broad categories: multi-objective fishery management, the income distribution issue, fishery management/property rights interactions, social costs and opportunity costs of labor, fishery labor markets, and the decision-making processes of fishermen and fishing communities.

A rich literature exists on these themes, but this work tends to be found in a wide variety of sources, ranging from professional journals in a number of disciplines to national and international agency reports. This paper has attempted to bring together a representative selection of the "fishery socioeconomic" literature. An emphasis has been placed on addressing the relevance of this literature both to economic analyses of fisheries and to practical fisheries management. It has been argued, in particular, that the effectiveness of proposed regulations will depend on the behavioral re-

sponse of fishermen and fishing communities, which in turn may be influenced by such socioeconomic factors as income distribution, labor mobility, and the interaction of fishermen objectives with the property rights structure in the fishery.

With social and socioeconomic considerations recognized as having an important role to play in understanding the way fishery systems work, and thereby improving fishery management practices, why then has it been so difficult to integrate these elements into economic analyses of fisheries? There appear to be at least two key reasons.

First, there is the question of "language" and style of research—unlike the usual methods of economic analysis, social and socioeconomic fisheries research methodology has been largely on a case study basis. For example, Marchak (1984, 3) notes that "fishing has long attracted social scientists with a romantic streak in them. A considerable library of descriptive accounts of fishermen, fishing villages, the tasks and the trials of fishing attest to that." This has led to a perception that social scientists often play the role of defending "their" fishermen, fishing community or other "special interests" against outside forces. However, Marchak argues that characterizations of these practitioners as "rural romantics" (Copes, 1973, 231) are no longer valid as the social analysis of fisheries matures. In any case, the economic insights that can be gleaned from social and socioeconomic case studies may make the effort to overcome the "language barrier" worthwhile.

Perhaps even more fundamental is the fact that in a multi-objective world, differences exist in the weights placed on fishery objectives by various groups. The extent to which socioeconomic factors should be incorporated into actual fishery management decisions depends very much on which fishery objectives are considered legitimate. If, for example, income distribution is accepted as a valid concern in policy formulation, then it needs to be included in the economic models used to analyze policy proposals. The choice of valid fishery objectives is therefore fundamental. Unfortunately, most of the fisheries literature, whether written from a "social" or an "economic" angle, fails to make clear what objec-

tives (economic efficiency, employment, etc.) are being pursued, and to justify why these were chosen.

Together with the need to deal explicitly with fishery objectives, it is important to determine priorities for further socioeconomic data collection and research activity. Smith's (1979) framework for research in "traditional" fisheries and the institutional approach of Wilson (1982), referred to previously, are useful in this regard. Perhaps the major research effort needs to lie in setting out the theoretical groundwork for an integrated "bio-socio-economic" fishery analysis. In particular, relevant social, economic, and socioeconomic components must be brought together in a form suitable for developing and analyzing practical fishery management plans. The complexities of fishermen behavior, multiple objectives, and a multidimensional fishery system ensure that this task will challenge fisheries research into the future.

References

- Acheson, J. M. 1975. "The Lobster Fiefs: Economic and Ecological Effects of Territoriality in the Maine Lobster Industry." *Human Ecology* 3:183–207.
- . 1981. "Anthropology of Fishing." *Annual Review of Anthropology* 10:275–316.
- Andersen, R. 1978. "The Need for Human Sciences Research in Atlantic Coast Fisheries." *Journal of the Fisheries Research Board of Canada* 35:1031–49.
- , ed. 1979. *North Atlantic Maritime Cultures: Anthropological Essays on Changing Adaptations*. The Hague: Mouton.
- Anderson, L. G. 1984. "Uncertainty in the Fisheries Management Process." *Marine Resource Economics* 1:77–87.
- . 1987. "A Management Agency Perspective of the Economics of Fisheries Regulation." *Marine Resource Economics* 4:123–31.
- Antler, E., and J. Faris. 1979. "Adaptation to Changes in Technology and Government Policy: A Newfoundland Example (Cat Harbour)." In *North Atlantic Maritime Cultures*, ed. R. Andersen. The Hague: Mouton.
- Apostle, R., L. Kasdan, and A. Hanson. 1985. "Work Satisfaction and Community Attachment among Fishermen in Southwest Nova Scotia." *Canadian Journal of Fisheries and Aquatic Sciences* 42:256–67.

- Baldursson, E. B. 1984. "Work Stress in the Fishing Transformation Plants." In *Labor Developments in the Fishing Industry*, ed. J. L. Chaumel. Canadian Special Publication of Fisheries and Aquatic Sciences 72.
- Berkes, F. 1985. "The Common Property Resource Problem and the Creation of Limited Property Rights." *Human Ecology* 13:187-208.
- . 1986. "Local-level Management and the Commons Problem: A Comparative Study of Turkish Coastal Fisheries." *Marine Policy* 10:215-29.
- Bishop, R. C., D. W. Bromley, and S. Langdon. 1981. "Implementing Multiobjective Management of Commercial Fisheries: A Strategy for Policy-relevant Research." In *Economic Analysis for Fisheries Management Plans*, ed. L. G. Anderson. Ann Arbor, MI: Ann Arbor Science.
- Bromley, D. W., and R. C. Bishop. 1977. "From Economic Theory to Fisheries Policy: Conceptual Problem and Management Prescription." In *Economic Impacts of Extended Jurisdiction*, ed. L. G. Anderson. Ann Arbor, MI: Ann Arbor Science.
- Chapman, M. D. 1987. "Women's Fishing in Oceania." *Human Ecology* 15: 267-88.
- Charles, A. T. 1988. "Socioeconomic Fishery Models: Labour Dynamics and Multiple Objectives." Working Paper No. 87-5, Department of Finance and Management Science, Saint Mary's University, Halifax.
- Chaumel, J. L., ed. 1984. *Labor Developments in the Fishing Industry*, Canadian Special Publication of Fisheries and Aquatic Sciences 72.
- Christy, F. T. 1982. *Territorial Use Rights in Marine Fisheries: Definitions and Conditions*, FAO Fisheries Technical Paper No. 227, Rome.
- Ciriacy-Wantrup, S. V., and R. C. Bishop. 1975. "'Common Property' as a Concept in Natural Resources Policy." *Natural Resources Journal* 15:713-27.
- Cole, R. C., and N. Anand. 1974. "Report on Some Aspects of Fisheries Development in Thailand." London: Tropical Products Institute.
- Copes, P. 1973. "Community Resettlement and Rationalization of the Fishing Industry in Newfoundland." In *The Political Economy of Newfoundland, 1929-1972*, ed. P. Neary. Toronto: Copp-Clark.
- . 1983. "Fisheries Management on Canada's Atlantic Coast: Economic Factors and Socio-political Constraints." *Canadian Journal of Regional Science* 6:1-32.
- Crutchfield, J. A. 1979. "Economic and Social Implications of the Main Policy Alternatives for Controlling Fishing Effort." *Journal of the Fisheries Research Board of Canada* 36:742-52.
- Cycon, D. E. 1986. "Managing Fisheries in Developing Nations: A Plea for Appropriate Development." *Natural Resources Journal* 26:1-14.
- Davis, A. 1984. "Property Rights and Access Management in the Small Boat Fishery: A Case Study from Southwest Nova Scotia." In *Atlantic Fisheries and Coastal Communities: Fisheries Decision-Making Case Studies*, eds. C. Lamson and A. J. Hanson. Halifax, Nova Scotia: Dalhousie Ocean Studies Program.
- Davis, A., and V. Thiessen. 1986. "Making Sense of the Dollars: Income Distribution among Atlantic Canadian Fishermen and Public Policy." *Marine Policy* 10:201-14.
- Doeringer, P. B., P. I. Moss, and D. G. Terkla. 1986. *The New England Fishing Economy: Jobs, Income, and Kinship*. Amherst: University of Massachusetts Press.
- Drynan, R. G., and F. Sandiford. 1985. "Incorporating Economic Objectives in Goal Programs for Fishery Management." *Marine Resource Economics* 2:175-95.
- Emmerson, D. K. 1980. "Rethinking Artisanal Fisheries Development: Western Concepts, Asian Experiences." World Bank Staff Working Paper No. 423.
- FAO. 1983. *Report of the Expert Consultation on the Regulation of Fishing Effort (Fishing Mortality)*. FAO Fisheries Report No. 289, Rome.
- . 1985. *Report of the Expert Consultation on the Acquisition of Socio-economic Information in Fisheries*. FAO Fisheries Report No. 344, Rome.
- Ferris S., and C. Plourde. 1980. "Fisheries Management and Employment in the Newfoundland Economy." Discussion Paper No. 173, Economic Council of Canada, Ottawa.
- . 1982. "Labour Mobility, Seasonal Unemployment Insurance, and the Newfoundland Inshore Fishery." *Canadian Journal of Economics* 15:426-41.
- Fredericks, L. J., S. Nair, and J. Yahaya. 1985. "Small-scale Fisheries in Peninsular Malaysia: Socioeconomic Profile and Income Distribution." In *Small-Scale Fisheries in Asia: Socioeconomic Analysis and Policy*, ed. T. Panayotou. Ottawa: International Development Research Centre.
- Fricke, P. 1985. "Use of Sociological Data in the Allocation of Common Property Resources." *Marine Policy* 9:39-52.
- Furubotn, E. G., and S. Pejovich. 1974. *The Economics of Property Rights*. Cambridge, MA: Ballinger Press.
- Gaskill, H. S., S. May, and C. A. Clark. 1986. "Economic Strategies in Outport Fishing Communities in Newfoundland." Unpublished man-

- uscript, Newfoundland Oceans Research and Development Corporation, St. John's, Newfoundland.
- GERMA (Groupe d'étude des ressources maritimes), ed. 1986. *Proceedings of the International Conference on Fisheries, August 10–15 1986*, Université du Québec, Rimouski.
- Grover, J. H., ed. 1982. *Allocation of Fishery Resources: Proceedings of the Technical Consultation on Allocation of Fishery Resources*, Vichy, France. FAO, Rome.
- Gunnlaugsdottir, S. S. 1984. "Restraint in Workers' Situation as Determined by Organization of the Labor Process in the Fishing Industry in Iceland." In *Labor Developments in the Fishing Industry*, ed. J. L. Chaumel. Canadian Special Publication of Fisheries and Aquatic Sciences 72.
- Hannesson, R. 1981. "Fisheries Management Problems and Research on Fisheries Economics in Norway and Iceland." In *Economic Analysis for Fisheries Management Plans*, ed. L. G. Anderson. Ann Arbor, MI: Ann Arbor Science.
- . 1985. "Inefficiency through Government Regulations: The Case of Norway's Fishery Policy." *Marine Resource Economics* 2:115–41.
- Hardin, G. 1968. "The Tragedy of the Commons." *Science* 162: 1243–47.
- Healey, M. C. 1984. "Multiattribute Analysis and the Concept of Optimum Yield." *Canadian Journal of Fisheries and Aquatic Sciences* 41:1393–1406.
- Huq, M., and A. Huq. 1985. "Fishermen in Natural Depressions of Bangladesh: Socioeconomic Conditions and Standards of Living." In *Small-Scale Fisheries in Asia: Socioeconomic Analysis and Policy*, ed. T. Panayotou. Ottawa: International Development Research Centre.
- Jentoft, S. 1985. "Models of Fishery Development: The Cooperative Approach." *Marine Policy* 9:322–31.
- Johannes, R. E. 1978. "Traditional Marine Conservation Methods in Oceania and Their Demise." *Annual Review of Ecology and Systematics* 9:349–64.
- Johnson, R. N., and G. D. Libecap. 1982. "Contracting Problems and Regulation: The Case of the Fishery." *American Economic Review* 72:1005–22.
- Josuweit, H. 1981. "The Economic and Social Effects of the Fishing Industry: A Comparative Study." FAO Fisheries Circular 314 (Rev.1).
- Karpoff, J. M. 1985. "Non-pecuniary Benefits in Commercial Fishing: Empirical Findings from the Alaska Salmon Fisheries." *Economic Inquiry* 23:159–73.
- . 1987. "Suboptimal Controls in Common Resource Management: The Case of the Fishery." *Journal of Political Economy* 95:179–94.
- Kearney, J. 1984. "The Transformation of the Bay of Fundy Herring Fisheries, 1976–1978: An Experiment in Fishermen-government Co-management." In *Atlantic Fisheries and Coastal Communities: Fisheries Decision-Making Case Studies*, eds. C. Lamson and A. J. Hanson. Halifax, Nova Scotia: Dalhousie Ocean Studies Program.
- Keen, E. A. 1983. "Common Property in Fisheries: Is Sole Ownership an Option?" *Marine Policy* 7:197–211.
- Lamson, C. 1986. "On the Line: Women and Fish Plant Jobs in Atlantic Canada." *Industrial Relations* 41.
- Lawson, R. 1984. *Economics of Fisheries Development*. London: Frances Pinter Publishers.
- Lim, L. L. 1971. "Some Aspects of Income Differentials in West Malaysia." M. Economics thesis, Universiti Malaya, Kuala Lumpur, Malaysia.
- Marchak, P. 1984. "Introduction." *Journal of Canadian Studies* 19:3–4.
- Martin, A. 1986. "La Gestion des Ressources Halieutiques: Prise en Compte du Coût Social Associé à la Main d'Oeuvre Impliquée dans l'Effort de Pêche au Québec." In *Proceedings of the International Conference on Fisheries, August 10–15 1986*, ed. Groupe d'étude des ressources maritimes. Rimouski: Université du Québec.
- McCay, B. J. 1979. "Fish is Scarce: Fisheries Modernization on Fogo Island, Newfoundland." In *North Atlantic Maritime Cultures*, ed. R. Andersen. The Hague: Mouton.
- . 1980. "A Fishermen's Cooperative, Limited: Indigenous Resource Management in a Complex Society." *Anthropological Quarterly* 53:29–38.
- McCay, B. J., and J. Acheson. 1987. *The Question of the Commons: Anthropological Contributions to Natural Resource Management*. Tucson: University of Arizona Press.
- McGoodwin, J. R. 1983. "Some Examples of Self-regulatory Mechanisms in Unmanaged Fisheries." In *Expert Consultation on the Regulation of Fishing Effort (Fishing Mortality)*, FAO Fisheries Report No. 289, Supplement 2, Rome: FAO.
- Mueller, J. J., and D. H. Wang. 1981. "Economic Analysis in Fishery Management Plans." In *Economic Analysis for Fisheries Management Plans*, ed. L. G. Anderson. Ann Arbor, MI: Ann Arbor Science.
- Munro, G. R. 1976. "Applications to Policy Problems: An Example." In *Mathematical Bioeco-*

- nomics: The Optimal Management of Renewable Resources*, C. W. Clark, 77–86. New York: Wiley-Interscience.
- Opaluch, J. J., and N. E. Bockstael. 1984. "Behavioral Modelling and Fisheries Management." *Marine Resource Economics* 1:105–15.
- Panayotou, T. 1980. "Economic Conditions and Prospects of Small-scale Fishermen in Thailand." *Marine Policy* 4:142–46.
- . 1982. "Management Concepts for Small-scale Fisheries: Economic and Social Aspects." FAO Fisheries Technical Paper No. 228.
- , ed. 1985. *Small-Scale Fisheries in Asia: Socioeconomic Analysis and Policy*. Ottawa: International Development Research Centre.
- Panayotou, T., and D. Panayotou. 1986. "Occupational and Geographical Mobility In and Out of Thai Fisheries." FAO Fisheries Technical Paper 271.
- Pearse, P. H. 1980. "Property Rights and Regulation of Commercial Fisheries." *Journal of Business Administration* 11:185–209.
- . 1982. *Turning the Tide: A New Policy for Canada's Pacific Fisheries*. Final Report of the Commission on Pacific Fishery Policy, Ottawa: Canadian Government Publishing Centre.
- Pinkerton, E. W. 1981. "Managing the West Coast Fishery: Regulating the Commons or the Community?" Presentation to the Commission on Pacific Fisheries Policy, Vancouver.
- , ed. 1988. *Improving Fisheries Management through Co-management*. Vancouver: University of British Columbia Press.
- Poggie, J., and R. Pollnac. 1978. "Social Desirability of Work and Management among Fishermen in Two New England Ports." Anthropology Working Paper No.5, International Center for Marine Resource Development, Kingston, Rhode Island.
- Pollnac, R., and J. Poggie. 1979. "The Structure of Job Satisfaction among New England Fishermen." Anthropology Working Paper No.31, International Center for Marine Resource Development, Kingston, Rhode Island.
- Pollnac, R. B., and J. Sutinen. 1979. "Economic, Social, and Cultural Aspects of Stock Assessment for Tropical Small-scale Fisheries." In *Stock Assessment for Tropical Small-Scale Fisheries*, eds. S. B. Saila and P. M. Roedel. Kingston, RI: International Center for Marine Resource Development.
- Regier, H. A., and A. P. Grima. 1985. "Fishery Resource Allocation: An Exploratory Essay." *Canadian Journal of Fisheries and Aquatic Sciences* 42:845–59.
- Rettig, R. B., and J. C. Ginter, eds. 1978. *Limited Entry as a Fishery Management Tool*. Seattle: University of Washington Press.
- Salz, P. 1986. "Policy Instruments for Development of Fisheries." Publication No. 5.74, The Hague: Agricultural Economics Research Institute.
- Scott, A. 1979. "Development of Economic Theory on Fisheries Regulation." *Journal of the Fisheries Research Board of Canada* 36:725–41.
- Scott, A., and J. Johnson. 1985. "Property Rights: Developing the Characteristics of Interests in Natural Resources." In *Progress in Natural Resource Economics*, ed. A. Scott. Oxford: Clarendon Press.
- Sinclair, P. R. 1983. "Fishermen Divided: The Impact of Limited Entry Licensing in Northwest Newfoundland." *Human Organization* 42:307–13.
- Smith, I. R. 1979. "A Research Framework for Traditional Fisheries." International Center for Living Aquatic Resources Management, Studies and Reviews No. 2.
- . 1981. "Improving Fishing Incomes When Resources are Overfished." *Marine Policy* 5:17–22.
- Smith, L. J. 1977a. "Fishing Boat Income, Capital and Labor: A Distributional Study of a New England Port." In *Economic Impacts of Extended Jurisdiction*, ed. L. G. Anderson. Ann Arbor, MI: Ann Arbor Science.
- Smith, M. E., ed. 1977b. *Those Who Live from the Sea: A Study in Maritime Anthropology*. St. Paul: West Publishing Co.
- Terkla, D. G., P. B. Doeringer, and P. I. Moss. 1985. "Common Property Resource Management with Sticky Labor: The Effects of Job Attachment on Fisheries Management." Discussion Paper No. 108, Department of Economics, Boston University.
- Thiessen, V., and A. Davis. 1986. "A Further Note to Making Sense of the Dollars: Income Distribution among Atlantic Canadian Fishermen and Public Policy." *Marine Policy* 10:310–14.
- Townsend, R. E. 1985. "The Right to Fish as an External Benefit of Open Access." *Canadian Journal of Fisheries and Aquatic Sciences* 42:2050–53.
- Ullah, M. 1985. "Fishing Rights, Production Relations, and Profitability: A Case Study of Jamuna fishermen in Bangladesh." In *Small-Scale Fisheries in Asia: Socioeconomic Analysis and Policy*, ed. T. Panayotou. Ottawa: International Development Research Centre.
- Wilen, J. E. 1979. "Fishermen Behavior and the Design of Efficient Fisheries Regulation Programs." *Journal of the Fishery Research Board of Canada* 36:855–58.
- Wilson, J. A. 1977. "A Test of the Tragedy of the Commons." In *Managing the Commons*, eds.

- G. Hardin and J. Baden. San Francisco: W. H. Freeman & Company.
- . 1982. "The Economical Management of Multispecies Fisheries." *Land Economics* 58 (Nov.): 414–33.
- Wilson, J. R. 1986. "Reassessing the Contributions of Economics to the Management of Fish-

eries: What We Can Learn from the 'Institutional' Economists." In *Proceedings of the International Conference on Fisheries, August 10–15 1986*, ed. GERMA (Groupe d'étude des ressources maritimes). Rimouski: Université du Québec.