DISCUSSIONS AND RESEARCH ON OCEAN FISHERY MANAGEMENT:
A SUMMARY OF U.S. WORKSHOP

by

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File Manuscript No. 84

December 1971

NATIONAL MARINE FISHERIES SERVICE
ECONOMIC RESEARCH LABORATORY

ABSTRACT

DISCUSSIONS AND RESEARCH ON OCEAN FISHERY MANAGEMENT: A SUMMARY OF U.S. WORKSHOP

by

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In November of 1970 the U.S. National Marine Fisheries Service, its Division of Economic Research, held a subject workshop which was attended by 60 persons from broad research backgrounds, including representatives from the British Whitefish Authority, the Organization for Economic Co-operation and Development, and Food and Agricultural Organization of the United Nations, and the Canadian Department of Fisheries and Forestry, as well as representatives of U.S. government agencies and universities. Research topics ranged from production economics and bio-economic models to general discussions of management for both conservation and economic purposes, the political framework for management, and the multiple social problems that might be involved. This paper summarizes the key issues in the 16 papers presented at that Workshop and the discussions that resulted. The highlights of these issues are presented to this symposium in the form of suggested critical problems which must urgently be faced by the professionals gathered here.

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A. A. SOKOLOSKI

This paper is to be presented at the OECD Symposium on Fisheries Economics, Paris, France November 29 - December 3, 1971

INTRODUCTION

On November 5 and 6 of 1970 the Division of Economic Research of the National Marine Fisheries Service sponsored a Workshop on Ocean fishery management. Participants were from government agencies and universities within the United States in addition to selected representation from foreign nations and international organizations (appendix A). Sixteen papers were presented for discussion on various aspects of economics and interdisciplinary aspects of fishery management (appendix B). Emphasis was on recent research accomplishments and how these results could be used to facilitate the management of fishery resources.

The papers which were presented, and the ensuing discussion, highlighted issues in fishery management, the research implications of recent research on production functions and bio-economic models, and other multidisciplinary issues related to fishery management. In the synopsis which follows the principal contribution of each paper will be summarized,along with the direction followed for the most discussed issues. A general concensus, based on both the papers and the discussions is presented in the conclusion.

BACKGROUND

Economic issues in fishery management first came to light when economists observed that there appeared to be a "gap" between existing fishery management solutions and the theoretical optimum. This subsequently led to not only an attempt to further measure the extent of this gap but also to research designed to specify the reasons for the gap and suggested measures to reduce its magnitude.

Initial empirical works unearthed several critical components which are currently complicating the issue. These are both empirical and conceptual in nature and multidisciplinary in scope. These may be listed as follows:

1. Existing yield functions need to be expanded and alternative functions need to be specified, both with respect to such factors as diminishing returns (success probabilities for effort on a fixed biomass) and multi-species interrelationships.

2. The appropriate emphasis for economics and biology in bioeconomic models.

3. The correct theoretical and empirical components of effort series needed to construct indices of fishing power as utilized in management programs.

4. The implications of research in the design of "correct" operational management plans: the choice between variations of licensing, quota, auction and/or leasing schemes.

5. A resolution of the choice between long run versus short run "optimal" solutions.

6. An evaluation of the appropriateness of directly applying theoretical models to fisheries for the purpose of deriving implied net gains from the practical application of identical working models.

7. The role of social transfer costs in the evaluation of benefits from new management programs.

8. The desirability of an incentive (pull) approach versus a limited entry (push) form of management program.

9. The place of jurisdictional consideration in program design and operation.

10. The desirability of a multidisciplinary objective simulation approach to the measurement of management ramifications as contrasted to simultaneous equations with maximization and other limiting assumptions.

11. The role of artificial propagation in the design of total management plans.

12. The role of competing uses for the resource base.

Virtually all of these items reflect the fact that as economists begin to penetrate the surface of the management issue they gain a greater appreciation of the vital role to be played by the physical scientist, usually a biologist who has become a population dynamics expert. This involves more than just using the output of the population dynamics expert; it entails understanding the intricacies of this work so that it won't be misused.

Here is where the first problems arise. Once familiar with population dynamics models the economist falls prey to the temptation to alter components which may not be ideally suited to his needs. What results is two versions of population dynamics with one being the result of both explicit and implicit imperfections in the other.

From this point several ramifications may develop, depending on how far each conceptual base may have been developed toward an actual working management program. If this has occurred original differences in population dynamics models will have been magnified. These resultant differences generate a debate, and a portion of this debate, as currently stated, is contained in the following summary. Let us look at these issues in greater detail by turning now to the individual papers, as I have grouped them.

ISSUES IN FISHERY MANAGEMENT

The opening paper by Van Meir (Problems in Implementing New Fishery Management Programs) appropriately cites the Burkenroad observation that fisheries should be managed for people not fish, a trite, but occasionally overlooked admonition. He emphasizes that the critical element now is that time is running out in many fisheries. The solution is to replace common rights with private rights, these rights to be consistent and in balance with allowable yield. The program should not only permit, but also promote economic efficiency both in the short run and in the long run.

To begin limited entry programs we must emphasize three areas: (1) a resolution of jurisdictional conflicts, (2) an educational program which will communicate the potential benefits and dispel the idea that the scheme is to be a government monopoly and, (3) trial programs which will demonstrate how limited entry operates in practice.

Van Meir suggests that in practice we must be willing to accept a second-best solution, i.e., agree with biologists on harvesting MSY and proceed to specifying the most efficient way of doing this. We must develop a system which will insure that fishing rights will be allocated to the most efficient producer at any point in time.

Van Meir concludes by suggesting a system for doing this. It is here that he introduces the first real element of controversy. He suggests a licensing mechanism. Licenses would be alloted so as to include all grandfather rights. They would be reduced by attrition with the total number changing as technology changes. Monopoly powers would be restricted and rents would be redistributed via license fees or taxes.

Undoubtedly this is a reasonable step toward a politically palatable solution. Others would argue that there are other schemes that would be more appropriate for certain fisheries. They would argue that this proposal contains the same faults as U.S. agricultural programs of the past decade, where a central authority is granted the right to determine the number of licenses. To do so it must use existing measures of technological capacity and technological change, when both of these may change substantially under the exogenous influence of a newly introduced licensing scheme. Some alternative suggestions would allow both the rate of technological change and the size and number of property rights to be determined within the market mechanism. The paper presented by Holmsen refers briefly to one alternative. Also the paper by Carlson could serve as a basis for preliminary calculations of the appropriate number of licenses in the tuna and groundfish fisheries.

Pontecorvo (On the Utility of Bio-Economic Models for Fisheries Management) introduces several broad conceptual issues, among these being the need for short run models which can be utilized directly in resource management. If the short run is critical we should examine those models which appear to be more satisfactory for the short run.

Pontecorvo focuses upon the difficulties of choosing biological models and combining these with economic models for both short run and long run analysis--to determine optimum solutions. He cites violent fluctuations in the Pacific red salmon resource as a characteristic which mitigates against the use of even short run models, and also where the costs of improving the information flow may exceed the benefits. Further complications arise due to instability on the economic side (demand and the general state of the economy) and changing political and social considerations. One suggestion here is that a program geared to catch some average level, less than the allowable yield during the highest year, may be the desirable economic solution--one case where we would suggest taking less than MSY.

Pontecorvo's position on social and political issues is that these are fully accounted for (albeit incorrectly) in the economists assumptions of full employment and factor mobility. The economists assumption of human rationality forces the social-political ordering into the same ordering as economics. The more reality deviates from this ordering the more the economic conclusions must be altered by subsequent ad hoc social and political considerations.

This can be extended to multiple use issues as well. Often we treat the fishery as if it were the only user of the resource. Future regulatory organizations will have to incorporate such considerations directly and this will affect the design of these organizations.

Rettig (Multiple Objectives for Marine Resource Management) adds to the mounting chorus warning of the social implications of certain fisheries management plans. He suggests that these may lead us to actually restructure the objectives of these plans. Absence of these considerations may be one reason for our failure to initiate revised management programs. Other reasons for failure may be the present existence of a severe divergence between the objectives of administrators and researchers, incompletely specified models, or the mere absence of sufficient educational programs.

Regarding the incorrectly specified models Rettig makes the intriguing observation that market imperfections on the buyers side would alter the optimum solution. Ignoring this fact would actually result in a further misallocation of resources. He suggests a further evaluation of inter-market linkages before making irreversible management steps.

Additional issues which must be faced are the multispecies management problems and the absence of a reasonable discount rate in the sustainable yield curve. This relates to some degree to his final conclusion that we must include so many diverse factors that in the end our "theory" may be useless. Nevertheless, like many others as well as participants at this workshop, he can see no other alternative but to follow this course unless we intend to ignore realism and the needs of fishery administrators.

In the last of four general papers on the issues in fishery management, Crutchfield (Institutional Elements of Fishery Management for Selected Pacific Northwest Fisheries) reviews the inputs to fishery modeling work now developing for four Pacific northwest fisheries: anchovy, salmon, king crab, and halibut.

These models have three basic components; economics, biology and law. In the economics portion the cost and earnings and profit and loss statements for representative vessels are developed, related to certain catch rates, technological factors and market conditions (product price, interest rate, alternative employment). By this manner the complete operation of vessels in the selected fisheries can be specified and from this it is possible to construct an exit-entry function which would relate to changes in these economic variables, independently, or as affected by biological and/or legal variables.

The biological elements of this model include gross stock parameters and a yield-effort function which generates catch rates, these serving as direct input into both the economic model and into population dynamics components of the biological model. In the case of the salmon fishery separate, though similar, models are developed for five different stocks at ten locations, a 50 cell matrix. Any pertinent species interactions are also included.

The legal portion of this model specifies the existing regulatory structure which may determine the component of both the biological and economic models, determining what is fished for, when, how, and to what extent. As in other portions of the model, alternative legal structures will be posited to allow for alternative patterns of resource utilization.

The ultimate purpose of this model is to take a complete interdisciplinary approach to fisheries management. Alternative management programs will be specified. Among these an optimum plan will be identified, with the sequence of steps which would most effectively lead toward this plan. In its most extensive form this model will consider multiple species management cases such as anchovy-mackerel-tuna in California and salmon-tuna-crab-halibut of the Pacific northwest. As emphasized by Crutchfield, in its present form the model emphasizes the multidisciplinary nature of the management problem and will readily incorporate many of the suggestions made at this workshop.

PRODUCTION FUNCTIONS AND BIO-ECONOMIC MODELS: RESEARCH IMPLICATIONS

Against the broad background of these four introductory papers we can proceed to some of the more specific research which will constitute the principal inputs into the broader management process. The first of these papers relates the results of an extensive effort by Carlson (Cross Section Production Functions for North Atlantic Groundfish and Tropical Tuna Seine Fisheries) to specify production functions for the North Atlantic groundfish and tropical tuna fisheries. In each case the research is designed to identify the most significant determinants of vessel productivity, with some of the investigation devoted to the question of a proper measure of productivity.

Using existing data series on the area and time patterns of fishing activity, landings statistics on species, quantity and value, and other sources of data on vessel characteristics, specific effort combinations are related to productivity. The "best" measure of productivity was found to be value in groundfish and a weighted combination of species landed in tuna.

This research output has many possible uses, among these being the suggestion of the optimum input package to maximize output and the development of a fishing power index which could be used to measure effort, a critical input into those types of management plans that require the administrator to develop seasonal or sharing arrangements based on the fishing capabilities of the fleet. This is the case for the Inter-American Tropical Tuna Commission. Here a techñique of measuring fishing power has evolved which is somewhat different from the Carlson approach. Future investigations will determine the advisability of each approach. Indeed, if differences and difficulties cannot be resolved, this may have some effect on the choice between management plans which require this type of calculation and types which do not.

The paper by Segura (Optimal Fishing Effort in the Peruvian Anchoveta Fishery) relates part of his broad investigation into the world supply and demand for fish meal. His efforts for this paper have concentrated on a measure of fishing power in the Peruvian anchoveta fleet for the purpose of determining the optimum harvest level. His focus is upon the role of technological change as this relates to time series cacluations of effort indices.

In his paper, Segura points out the differing results which will be forthcoming if you use the most recent year's measure of yield-effort, the index of vessel productivity, to calculate changing pressures on the resource, the response of the resource to that pressure, and use these relationships to determine an optimum catch quota for the coming year. He compares these results to calculations now used where these interrelationships are all derived based upon some earlier base year. The results are substantially different, resulting in a suggested catch of 162 million ton trips derived via the existing method.

The work done by Segura relates closely to that of Carlson in that a method of crosssectional analysis of recent years data is being developed which obviates the need to use standard vessels from some base period, supplemented by ad hoc measures of technological change. These considerations are in addition to the question of diminishing returns as introduced by the Carlson-Waugh-Bell function.

The research reported by Rich (Natural Resources and External Economics; Regulation of the Pacific Halibut Fishery) is an extension of a generalized model to be applied to the Pacific halibut fishery. The purpose is to evaluate possible losses which may have resulted in the fishery from the use of MSY as a regulation goal.

Consistent with the Carlson-Waugh-Bell exposition, the function developed incorporates short run diminishing returns. When combined with a fish growth function it is possible to measure the long run externalities associated with this alternative specification of the yield-effort function.

This approach is the antithesis of that suggested by Pontecorvo in that it is explicitly structured upon the classic assumptions of full employment and complete labor mobility, both in the short run and the long run. Political and social questions are definitely excluded and would have to be appended on an ad hoc basis to determine if there was any cause for modifying the constrained results. The work done by Rich would serve as but one component in the simulator described by Crutchfield, albeit possibly the dominant component.

Bell, Carlson and Waugh (Production from the Sea) focus on the issue of diminishing returns in fisheries, relaxing a strong assumption of fixed proportionality utilized by most writers in the existing literature.

The motivation for this exercise is the appreciation that we are rapidly approaching total utilization of the world's fish resources. As this point is approached, demand pressures and considerations of maximum efficiency dictate the need to make maximum use of these resources consistent with any overriding conservation objectives. The work done by these authors, though preliminary, suggests that some degree of diminishing returns can be identified for the fisheries studied: Chesapeake Bay menhaden, Atlantic and Gulf blue crab, Atlantic long line tuna, Bering Sea king crab and Cape Flattery sablefish.

As with the other five papers in this section, this paper modifies existing biological functions. The modified logistic introduced here is the author's candidate for a "better" function, based primarily on the inclusion of diminishing returns in the logistic specifications. As with the other contributions this paper suggests an area meriting further discussion in the near future, with our best use of marine food resources being the stake.

Thompson (Some Limitations to the Development of a Bio-Economic Theory of the Fishery) continues the parade of alternative functions with his concern being the absence of a proper dynamic component within the prevalent fisheries models. To correct this error he proposes the marriage of the Schaefer model and the Thompson-George (TG) production-investment model. He also suggests some alterations in the Schaefer model.

The TG model replicates the sequence of investment-production decisions which are involved in the operation of the individual fishing firm (vessel). Pertinent stocks and flows are specified with elaborate preconditions for entry, though there are no provisions for entry within the decision period, an interesting trait in light of the Johnson fixed asset theory as referred to by Stevens and Mattox subsequently. By adjoining this model to the Schaefer biological fluctuation we have a bio-economic model which is uniquely micro in character; the dynamics of change in the fishery stock (and hence fishing success) will be reflected in the investment decision of the sole owner as the limiting case, and vice versa.

This method avoids the critical use of static methods prevalent in economic literature. Inherently, the adjustment mechanism in the individual owner also facilitates the modification of the Schaefer function to incorporate decreasing returns to effort, as discussed by Bell, Carlson and Waugh and by Rich and increasing returns to scale. Relaxation of the sole owner condition further amplifies the critical nature of these alterations and within the confines of standard economic assumptions reaffirms the desirability of limiting entry and suggests an additional method of measuring the critical management variables.

The final author in this section addresses the problem of multiple species fisheries--or combination vessels. In this regard three issues are of prime importance to Adam (Practical Problems of Constructing Bio-Economic Models for Fishery Management). The first of these relates to the existence of yield curves for fisheries. Adam views most of these curves as average curves, pointing out that for many fisheries this average curve will be bounded by upper and lower curves which are usually the result of substantial fluctuations in either effort and/or recruitment. The average curve is essentially a product of a stable fishery whereas the boundary curves are the result of a rapidly growing fishery. In his opinion we do not move along the average curve as a fishery rapidly develops. We move from one curve to another, somewhat erratically as the fishery develops. He looks to the economist, via a function akin to Carlson, where effort is value dependent, to indicate what effort will be in subsequent years, as the fisherman's response to his monetary success is one of the few reliable variables which can be presented to a biologist in such a dynamic situation.

His second point extends this argument to multiple species. If a vessel has the capability to adjust his harvesting pattern based upon conditions in the fishery or the market, this would preclude estimation based solely on biological factors. It suggests that many of these calculations must be made instantaneously, at that time each year when a fishery is being initiated. It suggests also that this must be done for several fisheries simultaneously if those fisheries are interrelated. For the Northeast Atlantic this is increasingly the case.

Adam's final related point concerns the measurement of fishing effort. Simply stated, he concludes that there is no single measure which can unequivocally serve the needs of all the disciplines. These different measures should be closely examined, however, so that we may maximize their comparability and/or ascertain which measure would be most appropriate for each circumstance.

ISSUES RELATED TO FISHERY MANAGEMENT: RESEARCH RESULTS

In the final section concerning other issues related to fishery management, the first page by Holmsen (Management of the Peruvian Anchoveta Resource) summarizes the results of his study of the Peruvian anchoveta fishery. His is very much an applied study, for he is interested in indicating the critical components of what they have done in the past, the faults that may exist, and an evaluation of alternative management programs.

By his measure the current excess capacity in the fleet should be reduced by 14-38% depending upon the biological or social constraints imposed (length of closed season). Alternative plans which might correct this situation are reviewed, including:

(1) restrictions on fleet size

(2) government purchase of scrap fleet, the cost to be covered by an assessment on the remainder of the fleet. New entry would be restricted simultaneously.

(3) require private scrapping to permit new private construction - a scrapping ratio

(4) tie fleet size to licensed capacity of factories

(5) a quota system with variable, long-lived shares allocated via an auction system.

As there is excess capacity at the processing level also this becomes part of the consideration. Possible controls here would be (1) reducing licensing capacity leading to forced insolvency, (2) government purchase of plants, or (3) transferable factory quotas.

Holmsen recommends a combination program including both levels. Emphasized would be a high scrap/rebuild ratio and lifting the debt moratorium on plants.

In the paper by Thompson, Callen and Wolken (An Extension of a Stockastic Investment Model for a Survival Conscious Firm) the TG model, as previously referred to, is expanded to account for income taxes and depreciation. Emphasizing the desire for survival as a key decision element the authors apply this model to sample firms in the

Gulf shrimp fishery, using alternative sets of price and landings data. The critical nature of each decision variable is noted for each set of inputs.

Anderson, Connolly, Halter and Longhurst (Simulation Experiments to Evaluate Alternative Hunting Strategies for a Deer Population) present another version of a simulation approach to evaluation of management alternatives, relating experience in the management of deer population subject to different hunting strategies defined by alternative sets of regulations.

Some interesting general methodological points are made in this paper. Among these is the stress on the iterative-feedback elements of the simulator. By stressing this mechanism in fisheries we could obtain a continuing evaluation of the quality of the input in addition to the quantitative dimensions of alternative programs. Thus, a type of continuing sensitivity analysis can be performed on such items as estimates of MSY, alternative measures of fishing power, the existence of diminishing returns, social transfer costs, and alternative discount rates.

As does Adam, the authors consider biological issues to be the essence of first generation models. Second generation models would include economics and other considerations. This differs somewhat from Pontecorvo, who would have biology and economics as first and second generation models, respectively, and other considerations as part of third generation models.

A final element of general interest is the use of random number generator to create an array of "forage factors". This would be a method of considering the many combinations of environmental factors that affect recruitment in fish stocks. In particular, as Pontecorvo suggests, there may be trade-offs between levels of accuracy and the costs of these levels. This analysis could be performed within a complete simulated fishery system with the aid of this generator.

The paper by Stevens and Mattox (Augmentation of Salmon Stocks Through Artificial Propagation: Methods and Implications) is actually a report on two separate, but related studies, one on the economics of salmon hatching operations and the other on the supply response of fishing vessels (boats) to changes in catch/effort ratios and market conditions. The hatcheries issue is one which has achieved little attention in the economics literature and is timely considering the growth in salmon hatcheries and the increasing research and development work being conducted for other species.

That these hatcheries programs are critical to the overall management plans is a patently obvious, but seldom mentioned fact. With hatchery fish ranging from 30-80% of all fish caught from hatchery streams and 20% of all Pacific salmon, no management program could be successful without explicit consideration of the hatcheries. In this examination of 15 Oregon hatcheries production functions were estimated which indicated fixed input proportionality, constant returns to size and substitution between the fixed proportional input and water temperature.

In the study of entry and exit an irreversible function was found to exist. Entry followed good years, but exit did not follow bad years to the same degree. Thus successful "hatchery years" would lead to entry and expanded fleet size which could not be justified by lesser, even average years. This is a further enforcement of the argument for limited entry as the effectiveness of hatcheries programs in raising fishermen's incomes will be mitigated unless the countervailing tendency to overcapitalize is restricted. Part of this restrictive element may include a deliberate effort to increase opportunity costs, as discussed previously.

Keen (The Case of the Japenese Tuna Fishery) is the only author here reflecting on a historical system used to limit entry, the Japanese experience. When reviewing this work it is necessary to recall that the principal objective of the Japanese program has always been "to maintain the viability of the individual enterprise." As this objective is somewhat akin to "maintaining the family farm" it differs from the objective held by most economists to be desirable. If the Japenese program can be judged successful in meeting its own objective, it may still not be suitable to our purposes. Nevertheless, we can proceed to evaluate the components of the program to determine its failure and successes and to gain an appreciation of the critical decisions which need to be made in a management program as it evolves over time.

The Japanese system began in 1946 when all craft greater than 10 tons had to be licensed. It evolved to include area restrictions and to be divided into tonnage groupings, with different restrictions for distant water fisheries as these developed. Its principal overall characteristic was its pliability. When pressures for additional development of certain fisheries mounted adjustments were made to allow for some of this investment. In some instances, when certain fishing operations were no longer viable, attractions to divert excess effort to other fisheries were established. The principal thrust of these regulations was to modify the tendency to over invest and dilute capital values. In some instances the growing value of fishing licenses attest to the success of this program.

Critical is the effect of these programs on the development of technology. It can be shown that in some cases technology took some strange courses because of the regulations, somewhat akin to our own Alaskan limit seiners. This and other elements of an existing scheme could prove a fruitful area of examination in the future now that substantial progress has been made in theoretical studies.

The final paper by Huq (A Study of the Socio-Economic Impact of Changes in the Harvesting Labor Force in the Maine Lobster Fishery) is so timely as to appear to be at the unanimous request of the other authors and participants in the workshop. This is because the subject is labor mobility and social transfer costs, with the study reported on being confined to three representative communities in the Maine pot-lobster fishery.

In this study the goal is to evaluate such measures of labor mobility as age, level of education, income levels, technical skills, other employment, time in present occupation, investments in the fishery, attitudes toward fishing as an occupation and attitudes toward certain management plans. In addition, data was collected on critical elements of the harvesting process so that alternative forms of limited entry would be evaluated. Results indicate that immobility is substantial, but that this may not be a problem as the limitation may successfully be applied to capital inputs with little reduction in the labor input for much of the sample examined in the three communities. For the remainder some form of an adjustment assistance program may be necessary, particularly since a portion of the labor force in the fishery is currently supplementing public assistance or social security incomes with its lobstering activity. These members of the labor force truly have limited opportunities. Restricting their participation would place a greater burden on other family members, who may also be in the lobster fishery.

CONCLUSIONS

Throughout the presentation and discussion of these papers a theme which was continually present was the deep conviction that serious policy guidance mistakes could be made if attention were not paid to the various social costs which might arise if the correct management strategy were not adopted. Furthermore, we must acknowledge that some social costs exist for all forms of management, and these costs may be substantial enough to lead to an entirely different course of action if properly included in any benefit/cost evaluation of the strategy under consideration.

Critical here is whether the adjustment period is lengthy compared to the benefit period under evaluation. Certainly short run benefits will be considerably decreased in those circumstances where unemployed labor and/or capital will result.

The issue may be further complicated when the possibilities of imperfect product markets exists, as well as the existence of multiple, interrelated fisheries. In either case the supposed existence of rents which may be "saved" or "captured" may in actuality not exist because of sufficient mobility to cause dissipation in related fisheries or because they are in reality being captured by monopsonistic processors.

In the face of difficulties even more sophisticated analytical techniques have been developed. Often these come via the increased use of more complicated multiple regression, bio-economic models or multidisciplinary simulation techniques, possible due to the advent of computerization. Much progress remains to be made however, with uncertainty still present as to the value of existing measures of fishing power for the relatively simple single fishery case, *ceteris paribus*.

Nevertheless, progress is being made on all fronts, with broadening bio-economic models, attempts to differentiate between the short run

APPENDIX A

List of Participants

Paul Adam, Organization for Economic Cooperation and Development
Harold B. Allen, National Marine Fisheries Service
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Frederick W. Bell, National Marine Fisheries Service
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Ernest W. Carlson, National Marine Fisheries Service
Donald P. Cleary, National Marine Fisheries Service
Francis T. Christy, Jr., Resources for the Future
James A. Crutchfield, University of Washington
John P. Doll, University of Missouri
Richard F. Fullenbaum, National Marine Fisheries Service
John M. Gates, University of Rhode Island
Thomas Geer, International Bank for Reconstruction and Development
William G. Gordon, National Marine Fisheries Services
Loren Grant, Canadian Department of Fisheries and Forestry
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Frederick L. Olson, National Marine Fisheries Service
Erwin Penn, National Marine Fisheries Service
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Frederick Prochaska, University of Florida
R. Bruce Rettig, Oregon State University
Jack Rich, Oregon State University
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Richard Roberts, Fisheries Service of Canada
Michael A. Robinson, Food & Agriculture Organization of the United Nations
Edilberto L. Segura, Columbia University

versus the long run benefits and costs, the continued growth of simulation models, the introduction of multiple fishery investigations, and the introduction of some first evaluations of the true social costs that result from alternative plans to limit the application of labor and capital.

With these modifications, and with some recent attempts to initiate some form of limited entry in selected instances here and abroad, the real value of our policy guidance will soon be readily calculable. I expect that this symposium will continue to reveal the trend toward a more broadly based evaluation and trial of management alternatives.

APPENDIX B

PAPERS PRESENTED AT U.S. NATIONAL MARINE FISHERIES SERVICE WORKSHOP ON DISCUSSIONS AND RESEARCH ON OCEAN FISHERY MANAGEMENT, NOV. 5,6, 1970

Frederick J. Smith, Oregon State University
Adam A. Sokoloski, National Marine Fisheries Service
Miller Spangler, National Planning Association
Joe B. Stevens, Oregon State University
David A. Storey, University of Massachusetts
John K. Sullivan, National Marine Fisheries Service
William M. Terry, National Marine Fisheries Service
B. G. Thompson, National Marine Fisheries Service
Russell G. Thompson, National Water Commission
Lawrence W. Van Meir, National Canners Association
John Vondruska, National Marine Fisheries Service
Hoyt A. Wheeland, National Marine Fisheries Service
Donald R. Whitaker, National Marine Fisheries Service
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