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Northeast Fishery Management Task Force

History and Status of the Atlantic Demersal Finfish Fishery Management Plan

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October 1980

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1. *Overview Document of the Northeast Fishery Management Task Force, Phase I.* By Richard C. Hennemuth, Brian J. Rothschild, Lee G. Anderson, and William A. Lund, Jr. October 1980. vi + 12 p., 2 figs.

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16. ABSTRACT

On June 27, 1979 the New England Fishery Management Council formally and unanimously adopted Part I of the Atlantic Demersal Finfish FMP, which includes a definition of the relevant management unit and appropriate management objectives for the species under regulation. Part I: Statement of the Problem for the Atlantic Demersal Finfish Fishery FMP, provides a basis for including within the management unit the following species: cod, haddock, yellowtail flounder, fluke, all other flounders, silver hake (whiting), red and white hakes, pollock, redfish, butterfish and scup. This combined resource complex forms the major source of incomes and benefits to the New England and Mid-Atlantic otter trawl and fixed gear fleets as well as to recreational user-groups. The objectives adopted by the Council for the management of these species are appended to this document. The policy area of adopting an appropriate basis for manageing a multiple species fishery is subject to concerns for the degree of control that a management system should exercise over the fishery. (Author extracted)

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Northeast Fishery Management Task Force

History and Status of the Atlantic Demersal Finfish Fishery Management Plan

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PREFACE

This document is the result of studies originating within the Northeast Fishery Management Task Force. The Task Force, organized in 1979 by the New England and Mid-Atlantic Fishery Management Councils and funded by the NMFS, seeks to promote discussion and dialogue on the major issues of fishery management and to explore the effects of various fishery management alternatives.

Composed of representatives from the fishing industry, Regional Fishery Management Councils, federal and state agencies, academic institutions, and general public, the Task Force will operate in three phases. The first phase will assemble background information for identifying and analyzing management options. The second phase will examine this background information to determine the data requirements, regulatory measures, administrative procedures, and enforcement methods associated with each management option. The third phase will critically review the various options for application to specific fisheries, particularly the Atlantic demersal finfish fishery.

This document is one of eight developed under Phase I operations, all of which are being issued in the *NOAA Technical Memorandum NMFS-F/NEC* series. This document and six others functionally serve as appendixes to the eighth and leading document for Phase I operations—"Overview Document of the Northeast Fishery Management Task Force, Phase I."

Jon A. Gibson, Coordinator
NOAA Technical Memorandum NMFS-F/NEC series

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HISTORY AND STATUS OF THE ATLANTIC DEMERSAL FINFISH FMP

1.0 Overview

The New England Fishery Management Council began work on the preparation of a new comprehensive Atlantic Groundfish FMP in May, 1978. In October the Secretary of Commerce agreed to begin a new fishing year with the understanding that a comprehensive plan would be ready for the following fishing year. A time schedule for plan development was prepared (Figure 1) and a tentative May 1, 1979 completion date was set for the draft FMP.

Between October 1978 and early spring, 1979 the staff made considerable progress (Figure 2) on the plan. But events, including a decision by the Groundfish Oversight Committee to broaden the management unit and the evolution of a NOAA/NMFS Task Force on Multi-Species Management, have necessitated a re-evaluation of the completion date. Along with the decision to broaden the management unit on May 4, 1979, the Groundfish Oversight Committee agreed to change the name of the plan to the Atlantic Demersal Finfish FMP. On June 27, 1979 the New England Council formally and unanimously adopted Part I of the Atlantic Demersal Finfish FMP, which includes a definition of the relevant management unit and appropriate management objectives for the species under regulation. As such, "Part I: Statement of the Problem for the Atlantic Demersal Finfish Fishery FMP" provides a basis for including within the management unit the following species: cod, haddock, yellowtail flounder, fluke, all other flounders, silver hake (whiting), red and white hakes, pollock, redfish, butterfish, and scup. This combined resource complex forms the major source of incomes and benefits to the New England and Mid-Atlantic otter trawl and fixed gear fleets as well as to recreational user-groups. The objectives adopted by the Council for the management of these species are appended to this document (Appendix 1).

It is recognized that it is unlikely that this FMP will initially provide for regulations for all the species noted above. Individual FMPs, in various stages of completion, are being prepared by either the New England Fishery Management Council, the Mid-Atlantic Fishery Management Council, or the National Marine Fisheries Service for eight of the eleven species noted. However, the existence of extensive biological and economic species interdependencies in the New England and Mid-Atlantic demersal finfish fisheries creates the need for the simultaneous determination of the management regulations for these species. It is recognized that the most effective means of achieving such simultaneity is through the preparation of a multiple species management plan. Therefore, it is intended that management measures and regulations will ultimately be developed for those species for which the New England Council has legal authority, and for those species over which the Mid-Atlantic Council has authority, if the Mid-Atlantic Council concurs in the need for appropriate regulations. These management measures and regulations will also be sensitive to the impact on fisheries for species other than those included in the ADF FMP.

2.0 Policy Areas in Support of Management Under the Atlantic Demersal Finfish Fishery (ADF) FMP.

Section 1.5 of the draft FMP relating to Major Policy Areas for Management of the Atlantic Demersal Finfish Fishery is being reviewed by the Council in conjunction with the objectives as a basis for the identification and evaluation of management strategies. This section identifies the major areas where policy decisions must be made by the Council in order to effectively address management of the demersal finfish fisheries in relation to the adopted management objectives. The Oversight Committee has accepted the document and stated that the document is intended to be a guide to the (policy) decisions which the Council has to make as the Demersal Finfish FMP evolves.

The bases for the identification of these policy issues are 1) the management objectives which have been adopted for this fishery, 2) the current status and structure of the specific fishery resources and the fishing industry relative to historical values, and 3) past management experience in this fishery. The policy questions are listed below.

1. The determination of appropriate annual levels of harvest by species in the demersal finfish fishery over some extended planning period.
2. The determination of an appropriate basis for the distribution of benefits arising from harvests among the various sectors of the industry over the fishing year.

3. The determination of appropriate means by which catch or effort allocations may be administered.
4. The determination of the desirability of permitting additional vessels to have access to the species under regulation.
5. The determination of an appropriate basis for managing a multispecies fishery.

It is clear that any efforts to assist or to provide guidance towards the resolution of the management problems associated with this resource must in the final analysis, given the current institutional framework, also address these policy issues. An elaboration of these policy issues is provided in Appendix 2.

3.0 Progress to Date on Major Tasks in the Development of the Atlantic Dermersal Finfish FMP

The following sections contain a review of specific research efforts conducted by the NEFMC staff in cooperation with the technical staff of NMFS/NERO and NMFS/NEFC, or through contractual arrangements in support of the ADF FMP.

3.1 Annotated Bibliography

The compilation and preparation of an annotated bibliography on the biology of three major demersal finfish species (cod, haddock, and yellowtail flounder) has been completed. This research effort paid special attention to Canadian and European sources (ICNAF, ICES, etc.) along with other standard sources of biological and fisheries literature. Though this effort was primarily designed to gather the literature on the three major demersal finfish species mentioned, including their interactions and interdependencies, much literature has been collected on other demersal finfish species.

3.2 Biological Descriptions of the Resource

The descriptive sections of the ADF FMP concerning fish resources and their habits have been completed. This task involved the preparation of a detailed biological description (Appendix I to the FMP) of three major demersal finfish species as well as a brief biological description of several related demersal finfish species focusing on species interdependencies of an ecological and biological nature. The biological descriptions contained in "Part I: Statement of the Problem," are abstracted from this document.

Through various contracts, or through staff research in preparation for individual FMPs, extensive biological descriptions have also been prepared for pollock, red and white hakes, silver hake, and ocean perch. The Mid-Atlantic Council is preparing biological descriptions for butterfish and other flou ders.

3.3 Harvesting, Utilization, and Marketing Studies

The description of the commercial harvesting and utilization of the New England and Mid-Atlantic demersal finfish resource is in progress. This task consists of several phases, some of which have been completed. Studies of the harvesting sector are based on sections of a series of groundfish tables which focus on the eleven demersal finfish species from 1970 to 1978. These groundfish tables report landings, revenues, and effort data by gear types, GRT classes, ports of landing, fishing areas, catch dependency and other variables. The seasonality and by-catch studies (described in sections 3.3.1. and 3.3.2.) concentrated on otter trawl and gill net catches, since review of the groundfish tables indicated that these gear types accounted for an overwhelming majority of the landings of dermersal finfish from 1970 to 1978.

3.3.1. Seasonality

A study identifying the seasonality patterns in the New England Otter Trawl fishery for demersal finfish has been completed. To develop measures of seasonality, the monthly distribution of landings of the eleven demersal finfish species in 13 landing areas (ports) from Eastern Maine to Point Judith were examined for the period 1970-76 and for 1978. Time periods were chosen to provide a basis for comparing seasonality patterns during a pre-FCMA period with those emerging in 1978.

Traditional management tools such as spawning closures, catch quotas, mesh size regulations, and other effort restrictions serve to limit access to the resource. In assessing the economic impacts of any such regulations on individual fleet sectors the seasonality in harvesting patterns becomes an important consideration.

To allow for a broad classification of fisheries by degree of seasonality the study selected the following criteria:

Proportion of annual landings harvested during the four months which produced the highest landings	**Classification**
50 percent or less	No Seasonality
between 50 and 75 percent	Seasonality
greater than 75 percent	Pronounced Seasonality

Application of these criteria, coupled with the information in Table 1, yields the results in the classification of fisheries by degree of seasonality as shown in Figure 3.

The preliminary computer processing has also been completed to reveal seasonality patterns of the demersal finfish gillnet fisheries.

3.3.2. By-catch

A study of joint species harvesting relationships (by-catch) is in progress. The by-catch analysis will allow determination of the degree to which individual species fisheries are direct fisheries. Traditionally, the term 'by-catch' has applied to the harvesting of a species when the species accounts for less than 50% of the trip catch. It is possible to indicate the degree of by-catch (or multiple

species return) orientation of the fisheries for individual species, by the species representation in the total landings from trips on which the species accounted for 50% or less of the trip catch (by-catch trips).

The preliminary results of the analysis indicate that for the majority of the demersal finfish fisheries (the exceptions are redfish, whiting, and butterfish in the otter trawl fisheries and pollock in the gillnet fisheries), the by-catch proportion of total landings ranges between 40 and 80 percent (Figure 4). This study provides evidence of the high degree of interaction within the demersal finfish fisheries.

3.3.3. Processing Industry Structure

A statistical profile of the groundfish processing industry in New England and the Mid-Atlantic has been developed and is in the final revision stage. These statistics were computed from the NMFS processed fishery products data file, and the study covers all of the demersal finfish being considered for the FMP. Data reported are: total demersal finfish output by regions and product form; quantity and value from demersal finfish by species and product form; prices for demersal finfish by species and product form; market concentration ratios for all demersal finfish by product groups; and the number of plants processing demersal finfish by product group.

3.3.4. Marketing and Consumption

The market structure and marketing channels must be investigated to allow for the estimation of market responses in terms of quantity and price for demersal finfish species at various market levels. The staff has completed a search for existing market studies of demersal finfish. As a result of the search, the staff has concluded that additional market studies are needed as input into the ADF FMP. It is noted that this effort will be complementary to the economic modelling effort described later in this paper.

3.4 Recreational Fisheries Study

A report describing the recreational fisheries for cod, haddock, pollock and silver hake off the northeast coast of the United States has been completed. The report presents catch, effort, limited economic data, and other descriptive data on four recreational user groups: party boat fisheries; charter boat fisheries; private boat fisheries; and shore-based fisheries. This report recognizes the limitations of the current recreational data base. Figure 5 is a summary of the most recent available estimates of the recreational catches of demersal finfish.

3.5 Recreational Section of FMP

The descriptive section of the FMP concerning the recreational demersal finfish industry, including the most recent available catch and effort estimates, has been completed. There are about 500 party fishing boats and 1,100 charter boats operating in coastal waters from Virginia through Maine. An unknown, but substantial, number of these vessels fish for demersal finfish at some time during the year. Of these, 1,600 commercial sportfishing vessels, 507 were licensed to fish for cod and haddock in March 1979. Approximately 92% of the 507 vessels are located from New York through Maine. The 1978 catch of licensed commercial sportfishing boats from Virginia through Maine, as reported through the logbook system, was approximately 1101 metric tons of cod and 279 metric tons of haddock. Vessels north and east of Montauk, New York are likely to be heavily dependent on cod, pollock, and haddock during some portion of their operating seasons. The substantial winter party boat fishery of the New York Bight is largely supported by silver hake. About 90% of commercial sportfishing for demersal finfish is conducted within 20 miles of shore. The division of catch between the territorial seas of the coastal states and the FCZ is not known.

Preliminary reports from the new National Survey, currently in progress, are being reviewed and the relevant information will be integrated as it becomes available.

4.0 Multispecies Modelling Efforts

The groundfish management objectives adopted in July, 1978 and the revised objectives for an Atlantic Demersal Finfish FMP (June, 1979) both imply the need for a multispecies model which provides the capability to determine an 'optimum' time path of harvest levels in the multi-species New England demersal finfish fishery over a multiple year planning period. Various forms of species interdependence in this generalized fishery result from biological/resource and market/industry characteristics:

1. Biological links e.g. predator-prey relations and stock recruitment relationships between species;
2. Joint production relationships (by-catch) in the harvesting sector.
3. Substitutability among species in the fishermen's selection of harvesting strategies, and expected catch mix (i.e. market price and costs of catching, species i relative to species j may affect fishermen's allocation of effort.);
4. Substitutions among species in the market place (i.e. the price of species i is dependent on the price/landings of species j).

In early May 1978 the staff began to organize efforts to develop formal models of the groundfish fisheries to improve the capability of evaluating the economic and biological consequences of alternative management strategies. It was recognized that these models should be predictive over a multiple year planning period and be capable of dealing with the uncertainty associated with biological and economic parameters. Figure 6 is an overview of the major components and general relations in a New England groundfish industry model. Two general research efforts support the formulation of a bioeconomic mathematical programming model and they are proceeding simultaneously.

The status of these efforts is summarized below.

4.1 Biological Modelling

Progress on the development of biological models to describe the population dynamics of several key groundfish species over a 5 year time period has been substantial. The models are designed to interface with similar efforts on the economic side. They are not intended to give precise predictions of stock dynamics, but to illustrate the consequences of management options over a multiple year planning period.

The models emphasize the role of individual biological factors in stock changes, rather than net results, which allows for a better understanding of events that occur in a population, but why they occur. Through the use of these models, management should be capable of addressing options such as stock rebuilding or maintaining recruitment. Through the inclusion of a stochastic factor reflecting the variability in post stock behavior, it becomes possible to assess the chances of achieving a stock size goal at the end of the planning period.

Two biological models have been developed, which provide a basis for: 1) evaluating the impacts of harvesting strategies on future stock dynamics; and 2) evaluating biological constraints for use in the economic modeling. Although these models have to date been applied to only one of the major groundfish species, progress on other species is underway. It is anticipated that modeling efforts will initially focus only on the key species requiring regulation, but they may be expanded to other species, where feasible, as the number of species under regulation increases.

4.2 Economic Research

Two general areas of economic research are being pursued: demand for and supply of demersal finfish. The importance of this research is evident, in that demand and supply determine the market equilibrium prices and quantities, and thereby the gross and net revenues within all sectors. This information is essential to the estimation of a profit maximization strategy for an industry which represents the expected response to supply and demand.

4.2.1. Demand Research

Due to the nature of substitutability and complementarity among demersal finfish species, demand for one species at the retail level and the derived demand for that species at subsequent market levels depends not only upon the price of that species, but also the price of related species, among other factors. The existence of this interrelationship provides the rationale for lthe development of multispecies models in demand research. Studies of this kind are limited in existence, and have thus been undertaken by the staff. Demand models for several of the demersal finfish ex-vessel markets have been completed. However, demand research for the other market levels must still be initiated. It is expected that these studies can be completed within one man-month after they are begun.

4.2.2. Supply Research

Supply behavior, in terms of species interrelationships depends on the nature of the production processes in both fish processing and harvesting sectors. For the processing sector, it may be observed that a plant with fixed facilities produces a number of products from various demersal finfish species. This fact is a basis for considering multispecies supply behavior at intermediate levels. For the harvesting sector, it is found that trip landings are composed of mixed species in the New England demersal finfish fisheries. The nature of species substitutability and complementarity in the processing sector and of by-catch in the harvesting sector must be investigated. Finally, the supply models reflecting these factors will be estimated and used as inputs to the bioeconomic mathematical programming model.

Our preliminary studies show that the joint catch and supply behavior for various demersal finfish species is affected by the relative abundance of fish stocks and by other economic variables. These findings suggest that interactions among species and between biological and economic factors exist in these fisheries. Moreover, these interactions are key factors in the determination of profit maximization in the demersal fishing industry within the bioeconomic mathematical programming model. Further investigation is called for to assure the validity of the relationships among species as well as the relationships between biological and economic factors. Moreover, further study of market supply factors is required so that they can be explicitly considered in a multispecies/multi-year fishery management scheme.

APPENDIX I
MANAGEMENT OBJECTIVES FOR THE ATLANTIC DEMERSAL FINFISH FMP

1. Recognizing that management of demersal finfish impacts on benefits and costs in the utilization of other species, the overall objective of the plan shall be to manage the demersal finfish fishery in a manner which will generate over the period of the plan the greatest possible joint economic and social net benefits from the harvesting and utilization of the overall fishery resource.

   The overall objective implies the following:

   (a) The management unit for this plan shall consist of cod, haddock, and yellowtail flounder as well as other species in the commercial and recreational fisheries for demersal finfish that the Council, in deliberation with other Councils involved, considers necessary or desirable to bring under regulation of this plan. In designing and implementing the plan the Council shall consider the impact of the plan on species not regulated by the plan.

(b) Over the plan period expected total removals will be established on a yearly basis consistent with the overall objective as constrained by a minimum spawning stock level for each species which the Council determines will ensure an acceptable probability of continued recruitment.

(c) Management's ultimate aim is to generate the greatest possible social and economic values to the users of the resource. In determining the optimum annual levels of exploitation of individual fish stocks (optimum in the sense that they best satisfy the overall objective), the Council would implicitly determine the biomass size of the stocks at given points in time.

(d) Benefits to users include incomes to harvesters and processors as well as the values to consumers. Furthermore, it is recognized that benefits include the values associated with the size of the fish stocks at the end of the planning period. Costs to users involve harvesting and processing costs, as well as management and enforcement costs (see 2d, 2e). Social costs and benefits are implied in the considerations listed under 2a, b, and e.

(e) A multiple year planning period is required so as to make a determination within the framework of the plan of how alternative harvesting levels in the immediate future affect the options available for later years.

(f) Due to the biological and economic interactions between species, it is unlikely that the economic and social values derived from individual fish stocks can be maximized simultaneously. The particular considerations of annual species/area TACs to be chosen depends on the relative prices and costs as well as on the by-catch and discard considerations. In view thereof, it appears desirable to apply to the greatest possible extent a multiple species approach to management.

2. Sub-objectives/considerations were:

(a) **Prevention of abrupt changes in the relative shares of domestic user-groups in the resources.** The management measures implemented in the groundfish fishery in 1978 reflect the Council's desire to avoid economically or socially disruptive changes in the traditional relative shares of various vessel-gear groups in the fisheries for regulated species. Concerns were expressed by regional/geographic user-groups for maintaining their "fair" shares of the harvests of individual species. The concept of "fair" shares shall be reassessed periodically.

(b) **Freedom of decision-making and choice for individual participants in the fishery should be maintained to the greatest possible extent.** Concerns were voiced regarding excessive encroachment by government interference and management regulations on the individual freedom of fishermen to choose and plan harvesting operations.

(c) **Inducement of diversification in the groundfish fishery towards increased utilization of species other than cod, haddock and yellowtail.** There appeared to be universal agreement that management of the groundfish fishery should attempt to induce effort away from the over-fished species. It is necessary to evaluate the impacts of alternative strategies with respect to this criterion.

(d) **Minimization of management regulations, subject to attainment of the overall objective.**

(e) **Minimization of enforcement costs, subject to attainment of the overall objective.**

(f) **Provision of accurate and consistent economic, social and biological data required to monitor effectively and assess the performance of the fishery relative to the overall objective.** A major consideration for implementation and monitoring of any management plan would be the provision of reliable data concerning the state and performance of biological, economic and social resources engaged. Furthermore, it is important that consistency of biological and economic data is maintained over time so as to enable good assessments of performance of resources.

APPENDIX II

MAJOR POLICY AREAS FOR MANAGEMENT OF THE ATLANTIC DEMERSAL FINFISH FISHERY

(Abstracted from Part 1, Section 1.5, Draft ADF FMP)

1.5.1 Introduction

In the process of developing a management plan for the demersal finfish species off the northeast coast of the United States, various strategies, comprised of combinations of management measures, must be evaluated relative to the goals and objectives adopted to guide management decision-making. Although quantitative impacts relative to various biological, economic, and social criteria may serve as a useful basis to assist the Council(s) in discriminating among available management strategies, all of the Council's decisions are rooted in fundamental determinations of policy.

It is the purpose of this section to identify the major areas where policy decisions must be made at the Council level in order to effectively address management of the Atlantic Demersal Finfish fishery. The bases for the determination of these policy issues are 1) the management objectives which have been adopted for this fishery, 2) the current status and structure of the specific fishery resources and the fishing industry relative to historical values, and 3) past management experience for this fishery. Accordingly, it is apparent that at least five generalized policy issue areas need to be considered in

the management decision-making process. These policy areas are listed below.

1. The determination of appropriate annual levels of harvest by species in the demersal finfish fishery over some extended planning period.
2. The determination of an appropriate basis for the distribution of benefits (arising from harvests) among the various sectors of the industry over the fishing year.
3. The determination of an appropriate means by which catch or effort allocations are to be administered.
4. The determination as to the desirability of prohibiting additional vessels from having access to the species under regulation.
5. The determination of an appropriate basis for managing a multi-species fishery.

An elaboration of each of these policy issue areas is provided in the following sections. In discussing the relevant dimensions of each policy issue area, various general approaches to addressing them will be noted for clarification purposes only.

1.5.2.Appropriate Levels of Harvest Over an Extended Planning Period

The need to address the issue of determining the most appropriate or "optimal" levels of allowable harvest from the demersal finfish fishery for a planning period longer than one year is dictated by both the overall objective adopted for management (Section 1.4), and the renewable nature of the resource. The overall objective calls for management of this fishery in a manner which will generate over the period of the plan the greatest possible joint economic and social net benefits from the harvesting and utilization of the overall fishery resource. With full recognition of the dynamics of the various species components of the resource, it is clear that the biological, social, and economic consequences of determining overall allowable levels of expected catch for the current year extend into the future. As a result, it is the sequence of expected catch levels over the plan period which must be considered and evaluated with reference to the achievement of management goals.

The selection of a management strategy for the Atlantic demersal finfish fishery therefore includes the identification of the optimum (defined with reference to achieving the overall objective) distribution of expected harvests from the overall resource over the period of the plan. Various criteria such as returns to capital and labor, employment and spawning stock abundance are useful as relative measures in evaluating the extent to which various strategies will serve to achieve the overall objective. In support of this evaluation process, an analytical framework for assessing biological and economic impacts (all of which have social implications) is under development. This analytical framework will to the greatest extent possible capture the full range of costs and benefits, including those costs associated with the implementation and control of the management system.

Clearly other, less quantifiable considerations will impact on the selection of an "optimal" strategy. These considerations may typically be associated with perceptions of management and enforcement problems and will need to be reconciled with the more conventional quantifiable criteria indicated above for evaluating net benefits. The relevant dimension of this policy issue, then, is the extent to which various immediate concerns for perceived problems arising from implementation of the management system are to be traded off against net benefits evaluated using quantifiable criteria. Moreover, the issue raises concerns of how in the absence of quantifiable criteria as a basis for management strategy selection, progress toward the achievement of management objectives will be justified in light of the various requirements of the National Standards and demands from representatives of the industry and spokesmen for the resource.

1.5.3 Appropriate Basis for the Distribution of Benefits

Recent management experience has demonstrated that in a situation where there is a need to restrict harvesting of one or more species to a level which imposes a constraint on the harvesting sector, various distributional consequences will inevitably result. Much of the management action in the groundfish fishery over the past two years has reflected attempts to address concerns for the inequitable distribution of catch among harvesting sectors while attempting to minimize the degree of management intervention.

In Section 1.4. the Council has expressed its concern for the prevention of abrupt changes in the relative shares of various fleet sectors as a consideration of the objectives which it adopted for management of the demersal finfish fishery. Under a management system where some limitations are established for the expected harvest of one or more species, the Council must evaluate the effectiveness of alternative strategies in achieving an equitable distribution of benefits among fleet sectors

The relevant dimensions of this policy issue are contained in the following specific considerations:

1. What is the basis for user-group or fleet sector identification? To what extent can or should factors such as geographic locations, seasonal access, economic profile, and technological development be considered in determining equitability?
2. How many discrete user-groups can feasibly be recognized for allocation under the management system?
3. What specific criteria should be used for determining each user-group's equitable allocation (current or past catch performance, size of group, etc.)?

4. To what extent should evolutionary trends be encouraged or traditional patterns of fishing be maintained?

It is clear that the policy issue of limiting the entry or access of additional vessels to the fishery under regulation (See Section 5.5.) has implications for the equitable distribution of benefits. In the absence of controls on access to the fishery, the number of participants may increase overall as well as within a particular user-group or fleet sector. If relative allocations to user-groups remain unchanged over time, the relative expected shares of individuals within groups which have experienced entry will necessarily be reduced.

1.5.4. Appropriate Means for Administering Catch or Effort Allocations

Over the past two years a major concern for implementing the management system for Atlantic Groundfish has been the means by which species catch quotas would be administered. The concern has been influenced by the pressure for exceeding the catch limitation, the desire to restrict actual catches to the established level, and the desire to encourage the harvesting of less restricted or unrestricted species by avoiding, where possible, a fishery closure.

Whether future management systems employ catch or effort restrictions to limit the expected removals of a given species to some desired level, various decisions of a policy nature must be made by the Council relating to the issue of administration. The following questions may be relevant to this issue depending upon the nature of the management system.

1. Is it economically desirable to impose restrictions on the fleet that, by design, result in production (or harvesting) being spread throughout the period? Under a quota system should catch per unit of effort be regulated during the period to keep the fishery open?
2. Could desired limitations to species removals be meaningfully achieved through the use of economic incentives/disincentives?
3. Are the measures employed to control the removals of various species consistent with existing fishing practices? Will unnecessary discarding of one species occur because the quotas for several species typically caught together are independently determined?

Since Council decisions on the administration of the management system not only affect the net earnings of fishermen but also the total costs of management (including enforcement costs), it is important that considerable discussion be directed toward the kinds of questions noted above.

1.5.5. The Limitation of Access or Entry to the Fishery Under Regulation

The Council has determined that the issue of limited entry shall be addressed in the development of all Fishery Management Plans. Over two years of management experience with groundfish, it has become clear that the expansion of the fleet has had an impact on the Council's ability to effectively manage the fishery under the existing management system. Moreover, further expansion of the fleet can be expected to increase the difficulty of administering the management system and inhibit the achievement of the management objectives.

Associated with this policy issue are two areas of principal concern.

1. The relationship between open access to the fishery and both net benefits accruing to the users of the fishery resources, and the management considerations articulated by the Council (i.e. freedom of decisionmaking, inducement of diversification, minimization of management costs, etc.).
2. The specific form of access control, if any, that should be considered for the Atlantic demersal finfish fishery.

Clearly a policy decision with respect to limited access will impact on the operational aspects of management as well as the net income of the fleet over the plan period. This policy area interfaces with the determination of appropriate multiple year harvest strategies (Section 5.2.) in that the criteria for evaluating impacts must anticipate future levels of vessel participation. Hence these two policy areas must be addressed simultaneously by the Council. Discussion of the limited access issue must further recognize that current participants in the fishery may be unwilling to accept restrictions aimed at "optimal" utilization of the resource over time when there is uncertainty with respect to their relative share of the resource in the future.

1.5.6. Appropriate Basis for Managing a Multiple Species Fishery

Management of the groundfish resource under the FCMA has been characterized by single species quota management with appropriate administrative measures to achieve some degree of equitability among fleet sectors. For the various species under regulation, quotas were independently established based upon a compromise between biologically justified levels of harvesting and the economic needs of the industry. Quotas established in this manner were in some cases found to be inconsistent and unrelated to the manner in which relevant species were commercially harvested. These inconsistencies made compliance with the management system difficult and cumbersome and resulted in industry misreporting and discarding.

As a result of this management experience, the need for multi-species management become apparent. Two generalized approaches to multi-species, fisheries system management have been suggested. The first approach, known as the biomass approach, favors establishing an overall quota (or expected catch) from the entire resource based upon the production available from all species which may be encountered by the

fishery. The second approach seeks to establish quotas (or expected catch levels) for each or a combination of the regulated species, but attempts to make these quotas consistent among species, and sensitive to fishing practices and species composition by geographical area.

Initially these approaches appear to be significantly different; however, both approaches recognize common objectives in the current management context. As such, both approaches seek to derive the maximum benefits from the harvesting and utilization of the overall fishery resource, and in so doing, recognize the need to "protect" highly valued species. The chief difference in the two approaches is the perspective they employ in seeking to achieve the management objectives. The "biomass" approach attempts to react to events in a fishery. It allows the fishery initial flexibility; however, because relative values of the species in the biomass differ significantly, trends in the harvest of certain species could require the imposition of highly restrictive constraints to modify the harvesting practices. Conversely, the second approach places its emphasis on actively controlling the harvest of key species or species groups (typically through catch or effort allocations), based upon a careful analysis of trends in stock abundance and fishery practices by geographical area and seasonal period.

Both approaches require considerable information with respect to the status of commercially valued and vulnerable species, with estimates of acceptable levels of harvest. Because the second approach uses this information to directly control the harvest of key species, it is better able to avoid the need for corrective measures costly to the industry. Both approaches require continued monitoring of the fish stocks and catches to improve the effectiveness of the management system. However, because the "biomass" approach relies on monitoring to reactively adjust for the excessive capture of some species, the control exerted is loose, and concerns are justifiably raised as to the ability of this approach to achieve the management objectives outlined in Section 1.4.

Clearly the data on stock dynamics and harvesting are subject to imprecision and inaccuracy which impact on the efficacy of both approaches. The second approach appears to have the advantage of not relying on the latest available catch and survey data, which is typically preliminary and subject to error, to establish controls on the fishery.

The policy area of adopting an appropriate basis for managing a multiple species fishery is, therefore, subject to concerns for the degree of control that a management system should exercise over the fishery. The approaches outlined differ very little with respect to the data and analysis required for management, but because of their perspectives, have different implications for the achievement of management objectives. The choice between approaches involves a trade-off between perceptions of undesirable attributes associated with an overt management system involving catch or effort controls, and the risk associated with coarse control over the harvest of key commercial species with implication for nonachievement of management objectives.

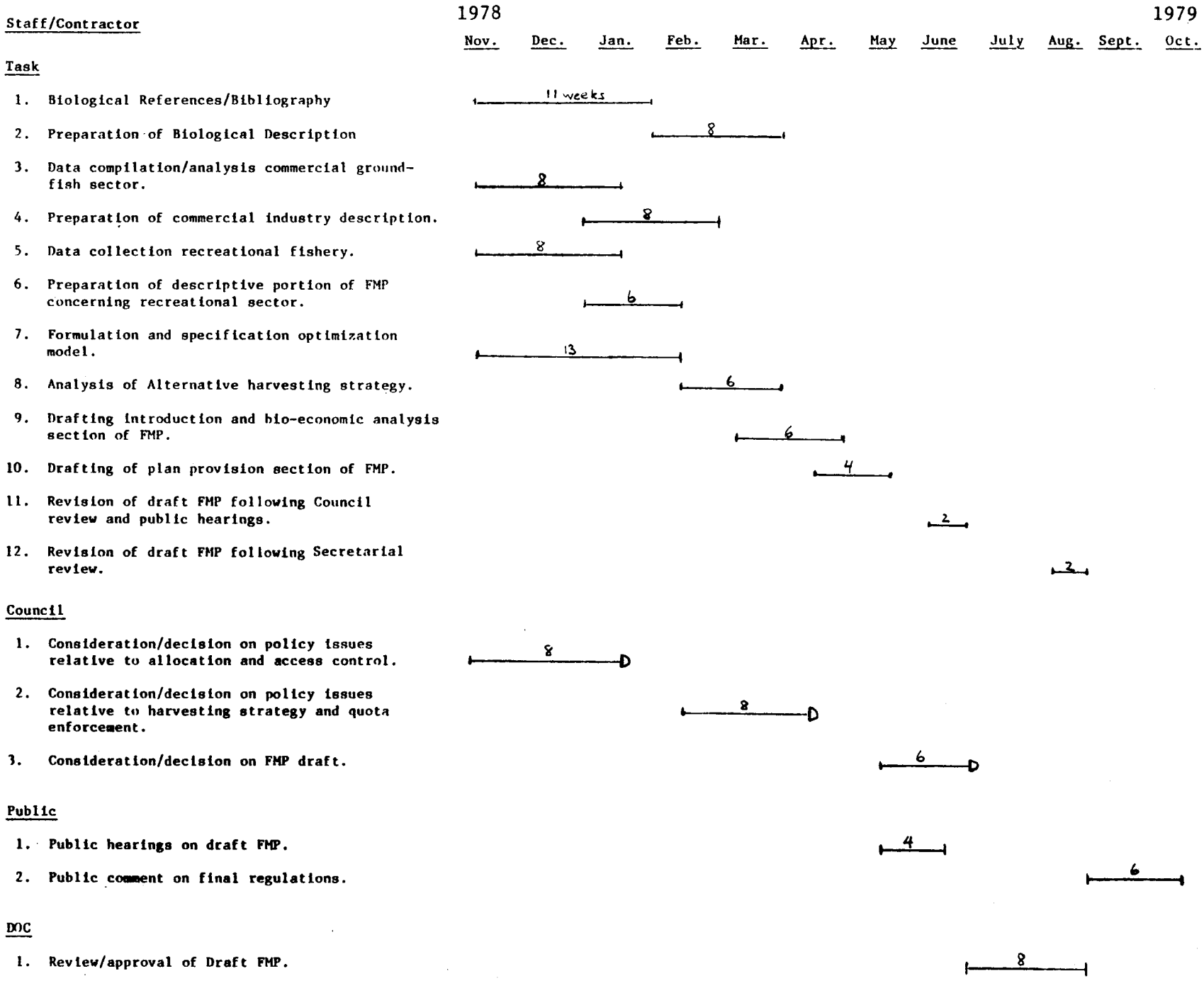

Figure 1. Time schedule for individual work tasks in support of groundfish FMP development

Task	Description	Status	Target Dates for Completion
1	Biological Referencing/Bibliography	Completed	1 February
2	Preparation of the Description Portion of FMP Concerning Fish Resources and Their Habits	Initiated 2/1	1 April
3	Collection, Compilation, and Analysis of Data/Information Supporting Description of the Structure of the Commercial Groundfish Industry	In Progress	1 March
4	Preparation of Descriptive Portion of FMP Concerning the Commercial Industry Structure and Performance	In Progress	1 April
5	Data Collection/Compilation - Recreational Groundfish Fishery	In Progress	1 March
6	Preparation of Descriptive Portion of FMP Concerning the Recreational Sector of the Groundfish Industry	In Progress	15 March
7	Formulation and Testing of a Mathematical Programming Model to Analyze Alternative Harvesting Strategies	In Progress	15 March
8	Analysis of Alternative Harvesting Strategies Including Bioeconomic Assessments Not Covered by Programming Model	To be Initiated 3/15	15 April
9	Drafting of Introductory and Bioeconomic Analysis Portions of FMP (Sec. 1,2)	To be Initiated 3/15	15 April
10	Drafting of Plan Provisions (Section 3)	To be Initiated 5/1	Pending Council decisions on management strategy

Figure 2. Progress report on Atlantic groundfish FMP development—February 1, 1979

	Cod	Haddock	Yellowtail	Whiting	Fluke	Flounder	Scup	Hake	Pollock	Butterfish	Redfish
Eastern Maine	**	**				**		**	**		
Rockland & County	**	*		**		*		*	-		-
Boothbay Area	*	**	**	**		*		*	*		*
Portland & County	*	*	*	**		*		*	-		-
York County	**	**	**			*		**	**		
Gloucester & County	-	-	-	*		-		-	*		*
Boston & County	-	-	-	**		-		*	-		-
South Shore	-	*	-	**	**	-	**	**	*		
Provincetown	-	*	-	*	*	*	**	*	**	**	*
South Cape Cod	*	*	*		**	*	*		*	**	
New Bedford & County	-	*	-		*	*	**	*	*	**	**
Newport & County	-	*	-	*	-	*	*	*	*	**	**
Pt. Judith & County	*	*	-	*	-	*	**	*	**	*	
Total New England	-	-	-	*	*	-	*	*	*	*	-

1/ ** = pronounced seasonality.
* = seasonality.
\- = no seasonality.

2/ A blank refers to none or insignificant landings.

Figure 3. Seasonality classifications of fisheries for individual species by ports, 1970-76[1,2]

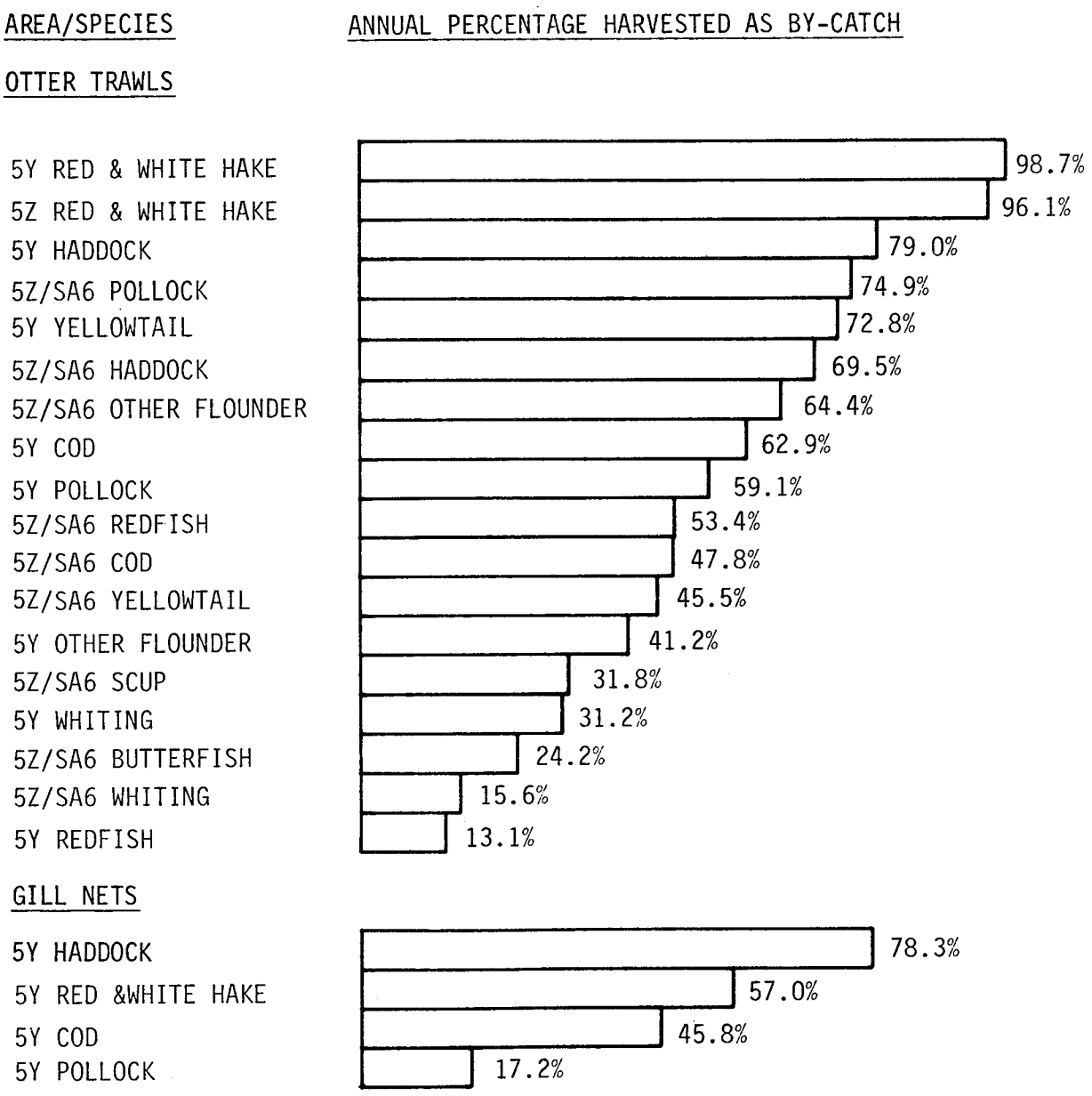

Figure 4. Percentages of total annual catch, in major fishing areas, of various groundfish species taken as "by-catch" by otter trawl and gillnet (i.e.: species making up 50% or less of individual trip catch; 1978).

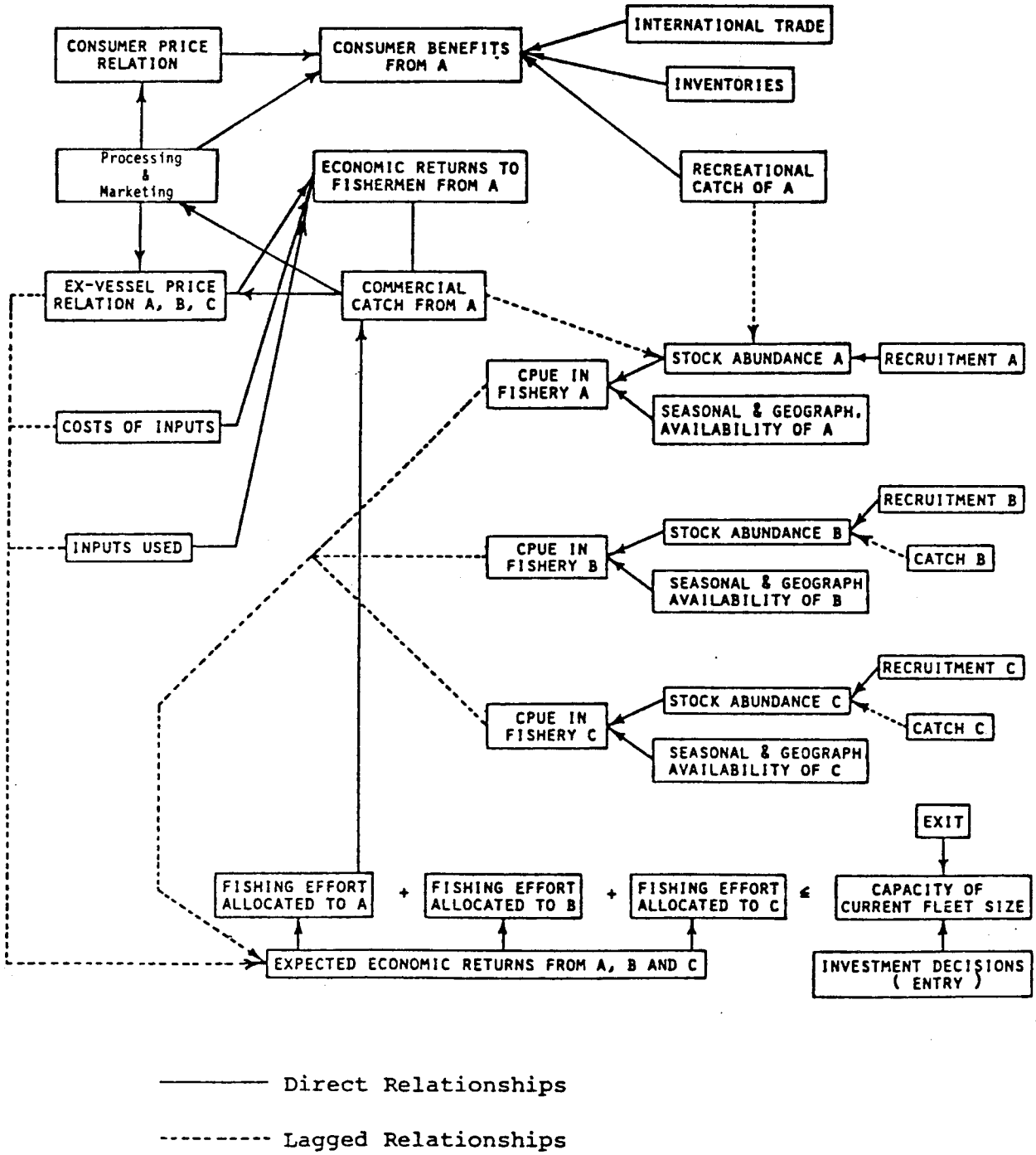

Figure 5. Major components and general relations in a New England groundfish industry model.

Table 1
Summation of the Four (4) Highest Monthly Percentages of the Species Landings
for Each Major Port Area for the Time Periods 1970-76 and 1978

	COD		HADDOCK		YELLOWTAIL		WHITING		FLUKE		FLOUNDER		SCUP		HAKE		POLLOCK		BUTTERFISH		REDFISH	
	70-76	78	70-76	78	70-76	78	70-76	78	70-76	78	70-76	78	70-76	78	70-76	78	70-76	78	70-76	78	70-76	78
E. Maine	83.4	96.2	96.2	85.7							82.1	97.8			97.1	99.0	97.9	95.3				
Rockland & County	76.1	58.8	62.1	69.7		89.0	100.0				57.7	49.5			64.5	50.7	46.7	49.4			42.6	49.7
Boothbay Area	68.8	75.5	91.8	79.3	79.4	78.2	97.2	94.1			51.3	66.7			60.0	62.4	65.6	69.3			63.2	49.8
Portland & County	53.7	51.4	64.1	50.8	67.9	73.6	96.9	79.8			51.8	52.4			53.5	50.8	41.2	56.1			44.6	46.3
York County	77.4	66.4	84.2	68.3	81.6	61.0		72.1			63.0	60.4			75.5	70.3	91.3	88.0				89.6
Gloucester & County	38.2	48.9	40.0	45.0	48.0	48.8	69.7	78.0			45.7	56.5			49.1	52.9	56.5	48.5		96.1	50.5	59.0
Boston & County	43.2	49.5	48.6	51.5	49.8	52.9	76.6				44.8	41.3			68.3	68.4	47.8	46.6			44.6	47.9
S. Shore	45.2	40.6	69.2	49.2	44.5	47.1	81.5	87.0	79.6	86.5	46.1	50.3	90.2	93.4	80.0	82.4	65.0	57.8				
Province-town	43.7	52.0	52.6	73.0	41.2	48.9	65.8	81.5	65.3	86.4	51.1	52.0	86.6	99.3	69.3	78.3	84.1	71.4	96.1	95.7	65.5	86.4
S. Cape Cod	53.2	46.3	52.0	71.3	63.2	61.9			85.9	90.5	60.6	68.6	71.1	83.2			64.6	83.6	81.5	92.6		
N.Bedford & County	43.4	43.9	63.3	58.8	39.8	53.5			60.9	70.3	50.4	49.8	79.0	96.8	69.7	92.3	52.5	51.1	80.3		98.2	
Newport & County	47.2	49.6	61.3	62.3	48.7	70.2	61.9	73.4	49.8	61.0	55.4	56.8	69.8	88.0	59.4	72.6	60.6	71.8	87.4	85.7	82.1	100.0
Pt. Judith	66.5	82.5	60.6	100.0	45.6	61.4	52.1	71.7	46.9	58.0	55.9	64.1	81.2	90.3	58.1	60.7	77.7	83.9	57.8	63.3		
Total New England	40.0	44.5	49.5	43.4	39.9	45.6	67.7	65.1	51.6	52.9	49.4	51.6	74.7	82.3	50.3	54.7	50.6	45.9	60.3	63.9	44.3	47.5

Table 2
Estimated Weights of Salt-Water Anglers' Catches in 1960, 1965, 1970 and 1974
(In thousands of pounds)

Species	Area	1960	1965	1970	1974
Cod[2/]	North*	25,190	28,978	35,688	25,194
	South[1/]	5,710	928	230	5,606
Total		30,900	29,906	35,918	30,800
Haddock	North*	1,690	21,390	2,528	NA
	South[1/]	--	--	--	NA
Total		1,690	21,390	2,528	439
Pollock	North*	21,680	9,348	5,584	700+
	South[1/]	--	--	--	NA
Total		21,680	9,348	5,584	1,094
Silver Hake	North*	1,810	4,193	659	NA
	South[1/]	2,160	1,796	1,436	NA
Total		3,970	5,989	2,095	2,370
Summer Flounder	North*	3/	19,128	11,611	19,639
	South[1/]	3/	10,485	7,742	15,261
Total			29,613	19,353	34,900
Winter Flounder	North*	3/	21,838	24,684	15,804
	South[1/]	3/	6,935	12,881	3,080
Total			28,773	37,565	18,884
Red Hake	North*	NA	NA	--	NA
	South[1/]	NA	NA	904	NA
Total		699	1,398	904	421

Adapted from the 1965 & 1970 Salt Water Angling Surveys, Northeastern Regional Survey of Recreational Fishing in Saltwater (1973-1974), and Preliminary Management Plan: Hake Fisheries of the Northwestern Atlantic.

*North = New England and New York

1/ South = New Jersey to Cape Hatteras

2/ Includes Gadus morhua, the Atlantic cod, and Microgadus tomcod, Atlantic tomcod. About 90% of catch is Atlantic cod.

3/ The 1960 SWAS did not breakdown the catch of flounder but rather included both in one category: Flatfishes (order Pleuronectiformes, the soles, and other flounders) North = 40,310,000 and South = 12,380,000.

NA = Not Available.

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