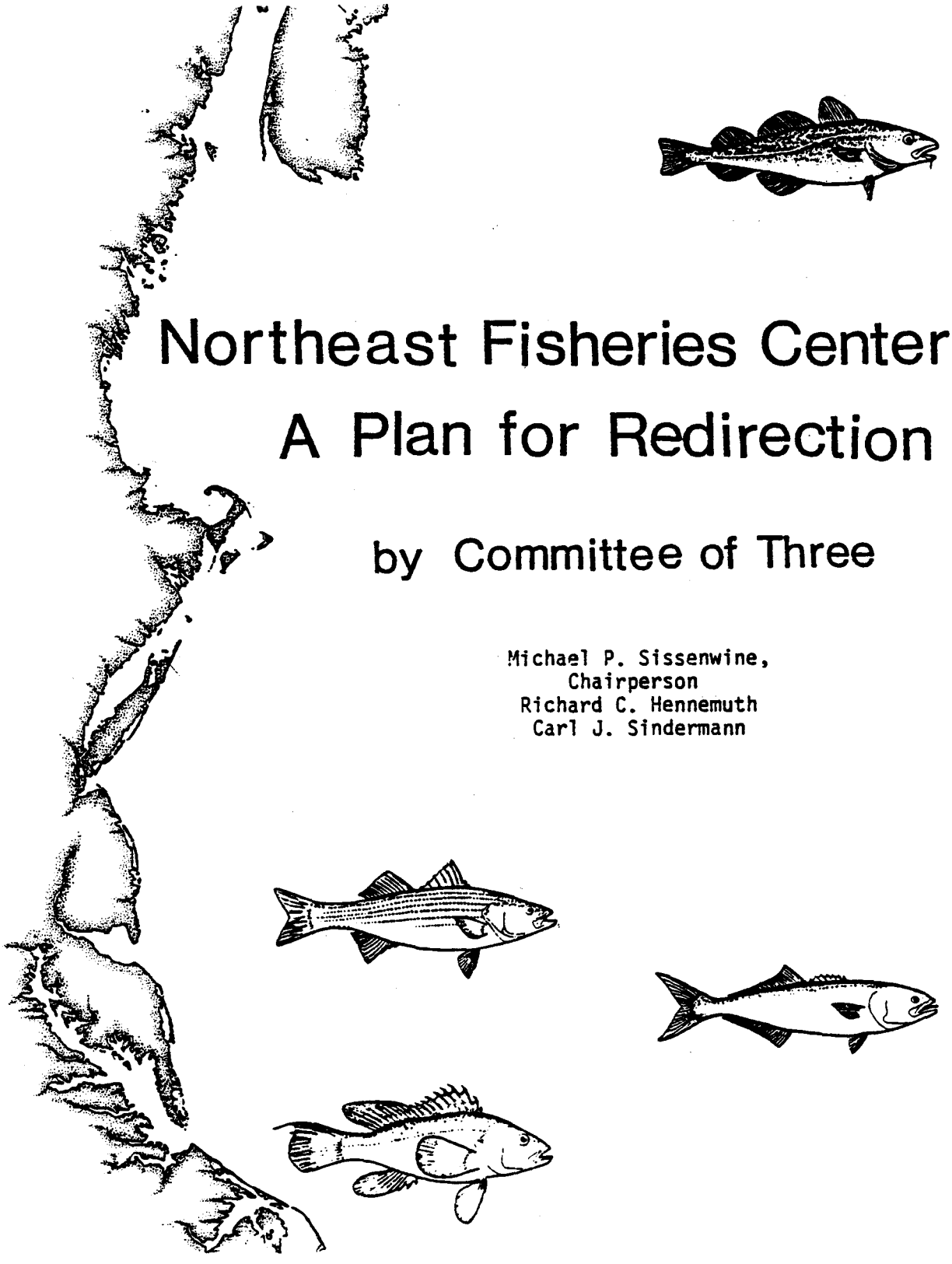

# Northeast Fisheries Center: A Plan for Redirection

## by Committee of Three

Michael P. Sissenwine,
Chairperson
Richard C. Hennemuth
Carl J. Sindermann

**United States Department of Commerce**
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northeast Fisheries Center
Woods Hole, Massachusetts 02543

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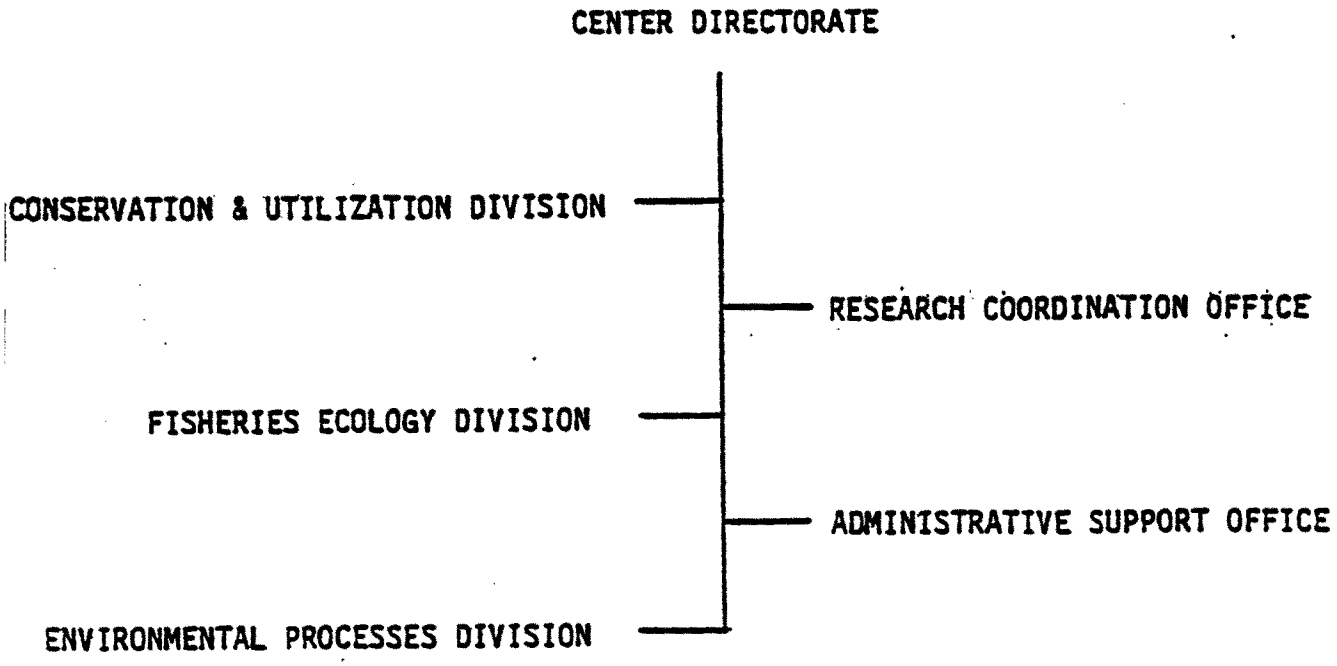
## EXECUTIVE SUMMARY

The Director of the Northeast Fisheries Center (NEFC) appointed a Committee of Three to evaluate the Center's organization and performance relative to its mission. The deliberations of the Committee were based on the NEFC Program Review (October 3-6, 1983); technical reviews of environmental assessment (i.e., habitat conservation-pollution), remote sensing and automated data processing activity; and issue papers concerning broad-scale ichthyoplankton sampling, redirection of NEFC recruitment processes studies, ecosystem modeling, environmental studies, pathobiology, utilization research, recreational fisheries, future needs of the National Systematics Laboratory, Atlantic Environmental Group, and alternatives for reprogramming aquaculture research.

The Committee of Three identified several concerns. The term "concerns" implies apprehension and uncertainty, not necessarily the determination that a problem exists. The concerns were partitioned into three categories: organization, mission and performance.

Some organization concerns were the large number of positions supervised by the Director, the disparity in the size of program units, lack of consistency in program orientation toward either problems or scientific disciplines, a focal point for scientific coordination and planning,

integration of habitat conservation-pollution studies with marine ecosystems and resource assessments studies, a focal point for recreational fisheries activity, coordination of physical oceanographic research, centralization of automated data processing. Based on its evaluation of organization concerns, the Committee of Three recommends that the NEFC restructure into three divisions supported by two offices.




The proposed organization is designed to function as a vertically integrated team; the product is information in support of the mission of the National Marine Fisheries Service. The Conservation and Utilization Division will provide information on the status of fisheries and fishery resources, and their potential and future outlook relative to fishing, fish habitat, and fish quality. The Fisheries Ecology Division will focus on the processes (natural and man-induced) that determine the ecological basis of fishery resource

production and the response of these processes to natural variables and anthropogenic activity. The emphasis of the Environmental Processes Division will be the physical, chemical, and biological environment of fishery resources, how it varies, and how it is affected by anthropogenic activity. Information will flow from the Environmental Processes Division to the Fisheries Ecology Division to the Conservation and Utilization Division. The Center Directorate, the Research Coordination Office, and the Administrative Support Office will be responsible for managing the Center. The Research Coordination Office will facilitate communication beween the three divisions and externally.

The proposal reduces supervisory responsibility of the NEFC Director by more than 50%. The disparity in the size of program units at the division level is virtually eliminated. Some disparity in the size of investigations will remain, but still less than the order of magnitude differences that exist in the current organization. The proposed divisions are multidisciplinary scientific teams focused on specific problem areas, although some investigations will be scientific discipline-oriented.

The Research Coordination Office provides a focal point for scientific coordination and planning. The proposed vertically integrated organization should facilitate integration of research concerning the effects of fishing, natural environmental factors, and anthropogenic agents. In particular, habitat conservation-pollution research will be addressed more in the context of fisheries ecology. Physical oceanographic research will be better coordinated since the research will be concentrated within one division.

The proposal includes a Recreational Fisheries Coordinator, although it does not recommend establishing a recreational fisheries unit. Divisions and

investigations will assume greater responsibility for their own automated data processing needs, although a centralized unit will still be maintained.

Some mission concerns relate to aquaculture research, utilization research, and research on inshore species or habitats which are not subject to federal jurisdiction. The Committee of Three evaluated the recently adopted NEFC mission statement and related documents. It concluded that aquaculture research for the purpose of food production is outside the mission of the NEFC. Nevertheless, the Aquaculture Division contains unique expertise which can be used for other purposes, while still conducting some liaison activity which is relevant to the aquaculture industry. It is recommended that these resources be reprogrammed for the purpose of understanding the processes that determine recruitment of valuable molluscan shellfish.

The Committee of Three concluded that the NMFS mission of achieving optimum utilization of living marine resources cannot be achieved within the Northeast Region without some technological assistance. The problem is inherent in the infrastructure of the industry (e.g., it depends on a fluctuating common property resource, it is comprised of relatively small companies which cannot afford to maintain research capability, it competes with subsidized import products, and it is a relatively small market for major U.S. manufacturers which develop new technology).

The Committee of Three concluded that the NEFC and NMFS mission merits significant attention to inshore waters in cooperation with states. Inshore activity is appropriate when it concerns: 1) fisheries resources which are important to the Exclusive Economic Zone (EEZ); 2) critical habitat of species of the EEZ; 3) species or habitat issues of interjurisdictional importance, particularly those relevant to the Atlantic States Marine Fisheries

Commission; and 4) problems requiring unique scientific expertise that it is impractical for individual states to maintain.

Some of the performance concerns relate to the value and use of data collected by the NEFC, progress in developing a dynamic multispecies simulation model, the productivity of physical oceanographic research, research on the effects of pollution on fisheries, NEFC responsiveness to recreational fisheries problems, automated data processing, and the emphasis of resource assessment activity on single species assessments of current status. The value of data depends on the questions that are being asked. Therefore, it is important to assess data collection programs as questions evolve, and this will be an important role of the Research Coordination Office. The Committee of Three concluded that the NEFC can improve the level of information by more fully utilizing its data bases.

The Committee of Three noted that the Resource Assessment Division staff has increased its multispecies fishery modeling capability substantially in the last few years. It is recommended that this staff assume responsibility for multispecies models, while the Research Coordination Office should coordinate modeling activity throughout the Center.

The Committee of Three recommends that physical oceanographic research place greater emphasis on analysis instead of data collection. The potential use of numerical models as a framework for analyzing data should be reassessed.

NEFC habitat conservation-pollution oriented research needs to be more focused, with greater emphasis on biological indicators with the potential for being interpreted in terms of population and fishery effects. Future research

should have three foci: monitoring, experimental studies, and synthesis. The experimental studies and syntheses should be focused on "case studies."

NEFC research relevant to recreational fisheries problems should remain integrated with other activities, although a Recreational Fisheries Coordinator should be appointed. The NEFC should support regionalization of the recreational fisheries statistics collection program, and should consider the operation of an inshore survey vessel in cooperation with states.

The Committee of Three recommends decentralizing ADP capability and responsibility. The role of microcomputers should be reexamined. The Committee of Three concluded that the total level of funding for ADP activity is inadequate.

The Center's Resource Assessment Division staff is overcommitted. Due to the perceived needs of Regional Fishery Management Councils, ASMFC, the Regional Office, and others, there is a heavy emphasis on single species assessments of current status. This detracts from capability to address long-term scientific problems. As a step toward alleviating the problem Resource Assessment Division staff should conduct an inventory of their activities and develop a prioritized workplan.

Several recommendations of the Committee of Three will require reprogramming of resources. Additional funds are needed for economic studies, implementation of a Regional Recreational Fisheries Statistics Collection Program, dedicated staff as coordinators and communicators, and a greater commitment to automated data processing. In addition, the NEFC should consider operating a coastal research vessel in cooperation with states and implementing a program in population genetics. Through increases in efficiency and changes in progam emphasis, there is the potential for

reprogramming funds from habitat conservation-pollution research, physical oceanographic research, and experimental studies of recruitment processes of molluscan bivalves (current Aquaculuture Division). Ultimately, it is probably necessary for the NEFC to consolidate laboratories.

While this report is focused on problems and proposed solutions, it is the conclusion of the Committee of Three that the NEFC is a healthy institution which is essential to fulfilling the mission of the National Marine Fisheries Service.

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## BACKGROUND

In order for a scientific institution to remain relevant and to be managed effectively, it is necessary to routinely examine its organization, mission, and performance. For this reason, the Northeast Fisheries Center (NEFC) conducted a program review on October 3-6, 1983. Following the review the Center Director appointed a Committee of Three (COT) to: 1) evaluate the results and gather additional information, as necessary, to address questions raised by the review; 2) prepare a mission statement for the NEFC; 3) propose the redirection of research and the restructuring of the Center organization, as necessary, in order to address concerns raised by Item 1 and to be consistent with Item 2.

This document summarizes the findings of COT. It is intended to guide the redirection of the NEFC, recognizing that implementation will require greater involvement of the Center leadership.

The document is divided into seven sections. Following the introduction, the information base considered by COT is described. The next section identifies concerns that came to light during the deliberations of COT. The three sections that follow evaluate these concerns as they relate to the NEFC organization, mission, and performance, and make recommendations for the solution of problems. The final section of the document discusses the overall plan recommended by COT and indicates some practical problems relative to implementation.

## INFORMATION BASE

The information initially available to the Committee of Three was a series of comments on the NEFC Program Review, prepared by panel members and the NEFC Center Director. These comments were collated and evaluated. Based on the results of the Program Review, the COT solicited, through the Center Director, additional information from program leaders. This information was in the form of issue papers and technical reviews. In addition, members of COT had numerous informal discussions with NEFC staff. These sources of information, in addition to the diverse professional experience of the COT members, were the basis of the Committee's deliberations and recommendations.

The results of the program review, of technical reviews of habitat conservation-pollution, remote sensing, and automated data processing activities, and of a series of issue papers are included as appendices. A brief summary of each appendix is given below.

Appendix I. - NEFC Program Review - Summary of Results and Response of Committee of Three (COT)

This appendix is a collation of written comments prepared by NEFC Program Review Panel members (Joseph Angelovic, Spencer Apollonio, William Aron, Izadore Barrett, Thomas Billy, William Hargis, John Everett, George Grice, Edward Houde, and Douglas Marshall) and the Center Director. It also includes a response to each comment by COT.

Appendix I identifies a number of concerns. It questions the complexity of the NEFC Table of Organization. It identifies a need for better communications, coordination, and integration between programs. It also notes a need for better communication with constituencies (e.g., Regional Fishery Management Councils, recreationalists, the public) and recommends greater

interaction with the academic community. On the other hand, the appendix notes that external interactions with constituencies and academics are part of the general over-commitment problem of NEFC scientists.

The appendix indicates that the heart of the NEFC program should be resource assessment activity in support of fisheries management, although it would be shortsighted to ignore important habitat conservation issues and the long-term need for a scientific underpinning for fisheries science and management. It notes that the Resource Assessment Division is too busy conducting too many and too frequent assessments. The division needs greater opportunity to conduct time invariant research. With regard to the Marine Ecosystems Division, it concurs with the redirection of recruitment processes research towards post-larval fish, but it notes the need to do a better job of evaluating the broad-scale ichthyoplankton sampling surveys, and the vast amount of data that has already been collected (e.g., ichthyoplankton, physical oceanographic, food habits). With regard to the Environmental Assessment Division, it indicates a need for a more definite focus, particularly with regard to outputs and their value. Monitoring alone is not sufficient. There is a need for greater integration and more attention to prioritization of activities. With regard to other Center programs, there is a general need for sharper focus, and in some cases integration within major programs.

Appendix II. - Action Items Recommended by Committee of Three and Adopted by Center Director

As a result of the NEFC Program Review, the Committee of Three recommended, and the Center Director adopted, 19 action items (Appendix II). The action items called for technical reviews of environmental assessment activity, automated data processing activity, and remote sensing activity. It

identified several avenues of redirection of resource assessment activity, and called for the Marine Ecosystems Division to prepare issue papers on recruitment processes and the MARMAP I surveys. In addition, several programs were to prepare statements of their perceived mission. In the case of the Aquaculture Division, the Committee of Three was to prepare an issue paper identifying their reprogramming options. The action items also included establishing more formal contact with Sea Grant, Fishery Management Councils, and other NMFS Centers; and for technical (peer) and constituency oriented reviews.

Appendix III. - MARMAP I Evaluation

This appendix concerns MARMAP I, i.e., broad-scale sampling of ichythyoplankton and zooplankton. It consists of six items.

The first item is a memo from the Marine Ecosystem Division Chief establishing a working group. The working group is to conduct a thorough evaluation of the MARMAP I program over the course of several months. The second item is a memo from the Marine Ecosystem Division Chief responding to the program review panel's perception "that the magnitude of ecosystem and environmental monitoring is not justified by the results that have been obtained to date." The memo argues that the standardized surveys provide a means for indexing relative abundance of all fish species within a large ecosystem. The surveys are analogous to standardized bottom trawl surveys and the two methods should be viewed as complementary components of a battery of methods necessary for monitoring spatial and temporal patterns of the ecosystem. Half of the survey effort is implemented in a "piggyback" mode simultaneously with bottom trawl surveys. Comparable ichthyoplankton surveys are conducted by the other three fisheries centers, and several other nations.

The third item documents a detailed plan for evaluating back calculations of spawning stock biomass from MARMAP I larval catches. The plan calls for a series of computer simulations to examine the robustness (with respect to assumptions) of the estimation procedure.

The fourth item is a list of proposed studies and reports to be prepared based on MARMAP I survey results. These include evaluations of the survey method, simultaneous analysis of ichthyoplankton and hydrographic data, assessment of spawning biomass for target species, characterization of distribution and abundance of a target species, contributions used to characterize ecosystems which may be subject to habitat degradation (e.g., RAP Water Management Unit Characterization).

The fifth item concerns the efficiency of NEFC MARMAP I survey. The question of efficiency can be addressed based on geographic coverage, sampling frequency over time, or sampling intensity. Item 5 only considers the first of these three. It concludes that the current geographic coverage of MARMAP I surveys is appropriate, although the information content of data collected in the central and northeast portions of the Gulf of Maine is less than elsewhere. In addition, surveys do not extend seaward enough to encompass the entire spawning area of silver hake nor southward enough for the entire spawning area of weakfish. Full coverage of weakfish spawning is considered impractical.

The sixth item concerns the precision of estimates of total egg production based on eggs caught during MARMAP I surveys. It is a thorough statistical analysis applied to Atlantic mackerel, silver hake, and yellowtail flounder. Estimates of total production have an average coeffecient of variation of 31%, comparable to other independent assessments of stock size.

The analysis does not consider the precision of estimates derived from larval catches.

The Committee of Three concurs that broad-scale ichthyoplankton sampling (such as the MARMAP I program) is an important component of a multifaceted monitoring program for large marine ecosystems. Nevertheless, further evaluation is still necessary. The NEFC should place a relatively high priority on implementing several of the analyses identified in Appendix III. In order to do so, more progress must be made towards developing an accessible data base.

Appendix IV. - Redirection of NEFC Recruitment Studies

This appendix concerns the redirection of NEFC recruitment studies. It includes a memo by the Marine Ecosystems Division Chief establishing a working group, a transmittal memo for the issue paper prepared by the working group, and the issue paper itself. The transmittal memo reiterates that the NEFC concurs with the Review Panel's conclusion that more emphasis should be placed on post-larval fish and notes that this redirection is already underway. It also emphasizes the importance of a close coupling of physical and biological studies.

The issue paper reviews a number of arguments that lead to the conclusion that more emphasis should be placed on post-larval fish, although it notes that events during the egg and larval stage may be critical during some years. For example, 1982 was a year when virtually no haddock larvae were found on Georges Bank and the resultant year class of haddock appears to be extremely poor.

It is proposed to carry out sampling of few target species throughout the first year of life in order to develop "a life table." The proposed target

species are haddock, cod, and yellowtail flounder from Georges Bank, all of which spawn during spring. Their physical and biological environments will be measured simultaneously. It is important to identify predators, since it is believed that predation is the proximate cause of most mortality.

The most immediate problem is to develop a quantitative sampler for post-larval fish. A number of alternatives have been identified; 10-meter MOCNESS, 6-foot IKMT, and Boothbay depressor trawl. Several field testing cruises are planned during summer 1984.

The issue paper hypothesizes that the variation in the degree of recirculation of water through the Great South Channel results in differential retention and survival of early life stage cod and haddock on Georges Bank and directly influences recruitment. It also notes several other physical factors that may influence recruitment (e.g., elevated temperatures may cause eggs to hatch sooner and larvae and juveniles to grow more rapidly than usual, and consequently be subject to predation for a shorter period of time). It is proposed that physical oceanographers conduct current meter studies to determine the degree of variability of the recirculation of water in the Great South Channel, analyze existing hydrographic data in order to describe variability, and conduct restrospective analyses of hydrographic data in relationship to recruitment time series.

MARMAP I surveys will continue to serve as a basis for estimating egg and larval mortality. They will also provide a characterization of the biological environment within which recruitment processes occur. The Marine Ecosystem Division's computer modeling capability will be redirected to focus on growth and survival in the first year of life.

The Committee of Three concurs with the proposal to redirect recruitment processes studies. It is particularly important to develop a quantitative sampler for post-larval fish.

With regard to physical oceanography, COT felt that the issue paper provided inadequate justification for the hypothesis that recruitment is significantly influenced by recirculation through the Great South Channel. The deployment of current meters for the purpose of testing this hypothesis seems premature. In fact the linkage between purposed physical and biological studies appears to be lacking. COT felt that it was most important to get on with the analysis of existing hydrographic data. Retrospective studies of physical and biological time series are useful, but they do not require the specialized expertise of physical oceanographers. More progress will be made through retrospective studies if physical oceanographers focus their attention on developing more relevant time series of physical variables as identified by biologists (e.g., monthly indices of residence time or water column stability for Georges Bank).

Appendix V. - Issue Paper on Ecosystem Modeling

This appendix includes two items. The first item proposes that NEFC ecosystem modeling activity have three foci; recruitment processes, multispecies fishery interactions, and assessment of risk due to habitat degradation. A modeling coordinator is also proposed.

The second item describes past, present, and future ecosystem modeling activity of the Marine Ecosystems Division. In the past, the NEFC has benefited greatly from insights achieved by constructing and revising energy budgets of Georges Bank. On the other hand, attempts to develop a dynamic

multispecies simulation model of the fish community of Georges Bank have been less successful.

In the future, the Marine Ecosystems Division plans to focus on recruitment processes. These models will provide a framework for analyzing: 1) ichthyoplankton data collected during broad-scale surveys (MARMAP I) and during process-oriented studies, 2) results of laboratory experiments with larvae and juveniles, 3) physical oceanographic data, and 4) data characterizing the predation field. There will also be retrospective analyses of various physical and biological factors and year-class strength time series. While numerical hydrodynamic models will be considered (e.g., in cooperation with the EPA Laboratory at Narragansett), an empirical approach based on field measurements will be emphasized.

The Committee of Three agrees that multiple foci for modeling are appropriate and that a coordinator is necessary. In general, the proposed redirection of modeling efforts by the Marine Ecosystem Division is appropriate, although COT feels that more emphasis should be placed on numerical hydrodynamic models and the basis for them.

Appendix VI. - Environmental Assessment Activity

This appendix includes 11 items. The first 10 items are a memo reflecting the COT chairperson's impressions based on the Environmental Assessment Technical Review, and additional comments provided by nine observers or participants in the review. Item 11 is an issue paper on environmental studies in the NEFC. It identifies several options for the future.

The technical review of environmental assessment activity clearly demonstrates that there are areas of degraded habitat, particularly inshore.

It also demonstrated biological effects. These accomplishments are the result of numerous sound scientific investigations conducted by the NEFC.

The primary concern indicated by the technical review is that environmental studies are contributing little more than their collective sum. The problem is that environmental assessment activity is too diffuse. There should be more of a focus on solving specific problems. The need is to determine the hitherto elusive effect of anthropogenic activity on populations and the benefits achievable from fisheries.

NEFC environmental assessment activity is a component of the Northeast Monitoring Program (NEMP). One of the goals of NEMP is the development of a more cost effective monitoring program. The studies that have already been conducted provide a sound basis.

Environmental assessment activity should have three foci: monitoring, experimental studies, and synthesis. Experimental studies and synthesis should be focused on "case studies." The results of monitoring should be instrumental in identifying case studies. Instead of looking for still additional indices of biological stress, a plan should be developed, based on a subset of existing indices, which: 1) are relatively easy to measure or observe, 2) are clearly associated with areas of habitat degradation, and 3) have the potential of being interpreted in terms of population and fishery effects. With respect to the third criteria, biological effects on reproduction and early life stage survival have the greatest potential. In short, the effects of habitat degradation on fishery resources should be viewed more in the context of fisheries ecology.

The Issue Paper on Environmental Studies provides background on the role of the NMFS and NEFC, and identifies five options for future program emphasis and organization. NMFS has recently published a Habitat Conservation

Policy. The Policy establishes the goal of maintaining or enhancing the capability of the environment to support fish and shellfish populations. This will be accomplished by assuring that habitat conservation is considered as an integral part of NMFS programs, including Fishery Management Plans, by cooperating with other NOAA program elements, and by conducting environmental and ecological research and monitoring.

The NEFC has a substantial environmental assessment research program. Proportionally, it is greater than any other Center--and rightfully so--since the Northeast is where human impacts are greatest because of the sheer number of people and the extent of industrialization. The principal focus for research on anthropogenic effects on habitat and productivity is the Environmental Assessment Division. The Marine Ecosystems Division is concerned with the effects of the natural environment on productivity. Environmental research, both natural and anthropogenic, is pertinent to virtually all of the programs and activities of the NEFC.

One of the important roles of the NEFC is monitoring. The premise is that continuing long term monitoring is a federal responsibility which is not apt to be assumed by other groups, and the data from monitoring forms an integral base for other research programs. Much of the emphasis of environmental studies of the NEFC has been in the monitoring mode (e.g., "Ocean Pulse" monitoring of the health of coastal waters). Care must be taken, however, to assure that monitoring does not become an end in itself. Research to date has provided evidence of the effects of selected pollutants on survival and physiology of marine animals in experimental situations, and some evidence of localized effects on populations, but a clear association of pollution and species abundance have not yet been demonstrated, except in the

most heavily polluted zones. This remains a major research and monitoring problem to be addressed by the NEFC.

The Office of Ocean Assessment of NOAA (OAD) is a partner of the NEFC in environmental studies. Since 1979, research has been coordinated within the framework of the Northeast Monitoring Program (NEMP). Cooperation is essential, particularly since there is a perceived overlap in the role of the two organizations.

An issue that faces both NEFC and OAD is the appropriateness of environmental studies in inshore waters subject to state jurisdiction. It is clear that habitat degradation has primarily occurred in inshore waters. Some valuable fishery resources subject to federal jurisdiction depend on inshore habitat.

In order to plan future environmental studies within the Northeast Fisheries Center, it is necessary to address the question of a discipline versus a problem orientation for Center programs and organization. At present, the NEFC has a mixture of both (e.g., the Pathobioloby Division is discipline-oriented, the Environmental Assessment Division is problem-oriented). One option is to continue the present mix of programs with minor modifications, with about the same commitment to environmental studies. An important modification would be the extension of the present Ocean Pulse monitoring to coastal/estuarine waters through cooperative programs with states, other NOAA elements, and the Environmental Protection Agency. The Marine Ecosystems Division, Environmental Assessment Division, and the Atlantic Environmental Group would continue to focus on biological factors, pollution-related environmental factors, and natural physical factors, as they effect fish production, respectively, The important negative aspect of this option is that there is inadequate linkage between programs.

A second option would be to achieve linkage by establishing an analytical group within the Center to deal with population dynamics and ecosystem modeling. The orientation of the analytical group would be toward quantifying impacts in terms of definable and measurable risk to society. The analytical group would reduce the dependence on OAD for analytical support of the NEFC. On the other hand, the analytical group might be viewed as usurping the function of NEFC programs. A third option would be to maintain the current division structure, but reorient some of the ongoing research of the Environmental Assessment and Marine Ecosystems Divisions towards a frontal attack on specific problems of quantifying the effects of pollutants. This approach would achieve integration through case studies.

A fourth option would group all direct fisheries-related research under "Status of Stocks," but would continue to separate studies of natural environmental factors from man-induced factors. While this option would be disruptive (resulting in dissolving or severely reducing the size of some programs), it would bring together fisheries-related activities and physical oceanographic research.

The fifth option would structure the Center according to a problem-orientation. Programs would be partitioned between fisheries management and environmental management. An important negative aspect of option five is that it is an attempt to treat the effects of the natural environment, pollution, and fishing on productivity of fishery resources as independent.

Combinations of these options identified are possible. All the options have positive and negative aspects, and none emerge as a clear choice. Nevertheless, analysis of the options does help to address some persistent problems. Future environmental studies should consolidate or improve coordination of NEFC physical oceanographic research. Responsibility for

studies of the effects of pollution on eggs and larvae must be clarified, and ultimately coordinated or consolidated with studies of the effects of natural environmental factors. More quantification of the effects of pollution on habitat and fishery resources is necessary.

Appendix VII. - Atlantic Environmental Group

This appendix is a memo from the Director of the Atlantic Environmental Group to the Committee of Three. The memo responds to specific questions raised by COT's evaluation of the NEFC program review as indicated in action items documented by Appendix II.

The mission of AEG is to assemble, portray, analyze, and synthesize long-time series of meteorlogical and oceanographic data, to provide the information to fishery scientists, and to assist in the development of diagnostic and predictive models of fish stock abundance or habitat quality. There is relatively little overlap between AEG and the physical oceanographic activities of the Marine Ecosystems Division. The focus of AEG is on time series of data which characterize the broad-scale physical environment. AEG activity is mainly based on archives of data, except for the data which are obtained by their "ship of opportunity" program. Oceanographers of the Marine Ecosystems Division are more concerned with physical processes than temporal trends.

AEG could not support the physical oceanographic needs of the NEFC with its current resources, but it would be feasible to consolidate AEG and other physical oceanographers of the NEFC. If AEG were integrated into a major Center program element (Marine Ecosystems Division, Environmental Assessment Division) then its focus would become much narrower.

AEG and the Pacific Environmental Group (PEG) were organized to conduct studies along the entire Atlantic and Pacific coasts, respectively. There have been limited interactions or responsibilities extended between the AEG and Southeast Fisheries Center. Because of the lack of long-term data bases and the SEFC's need to obtain recent data, the probability of significant interactions with the Southeast Fisheries Center in the near future seems small, although the SEFC has not been requested to comment on their needs.

Appendix VIII. - Molluscan Aquaculture in the Northeast, and Future Research Direction from Milford (CT) Laboratory of the Northeast Fisheries Center

This appendix contains an issue paper concerning aquaculture research in the Northeast Fisheries Center. According to a statement of the NMFS position on aquaculture, aquaculture for the purpose of food production is beyond the agency's mission, although NMFS will disseminate aquaculture-related information and technological advances gained from its fisheries research. Therefore, it is necessary for the NEFC to select an alternative direction for its aquaculture research effort.

The issue paper notes the long history of aquaculture research in the Milford Laboratory, the strong industry support for this activity, and alludes to the potential that aquaculture research may reemerge as a legitimate endeavor for a federal laboratory. Therefore, while current policy dictates the need to reprogram, it would be prudent to maintain the essence of the aquaculture expertise that now exists. In particular, selective breeding experiments on oysters should be maintained so that existing stocks are not irreversibly lost.

The issue paper identifies six options for reprogramming:

1. The present mix of programs could be retained with suppression of the term "aquaculture."
2. A new program thrust, called "experimental shellfish biology," could be planned and instituted.
3. Ongoing research in genetics could be augmented.
4. All Milford research could be reoriented toward pollution effects.
5. Ongoing aquaculture-funded programs could be integrated with those of other Center divisions.
6. Research could be reoriented towards coastal/estuarine ecology, with major attention to Long Island Sound.

Positive aspects of the first option are that it requires no major reorientation and is likely to have industry support. On the other hand, it's only a cosmetic solution.

Option 2 would provide some much needed resources to address the recruitment problem for valuable molluscan bivalve fishery resources. On the other hand, additional field-oriented resources will be necessary in order to investigate recruitment processes of molluscan bivalves. Another negative aspect of Option 2 is that some "constituency backlash" can be expected.

With regard to Option 3, while there is a need for greater emphasis on fisheries genetics, the existing aquaculture staff is not well suited to the studies of population genetics (which is where the greatest need exists). Furthermore, salinity and water quality limit the potential laboratory studies of some of the most economically important species.

Option 4 is feasible. One-third of the Milford Laboratory is already conducting pollution-oriented research. In the past, the Aquaculture Division was redirected toward pollution studies. On the other hand, there is a real

problem of the extent to which the NEFC should be involved in pollution-oriented research.

While Option 5 would provide additonal resources to support other divisions of the Northeast Fisheries Center, it would be extremely disruptive. It would destroy the productive focus that now exists within the Aquaculture Division.

Option 6 would provide needed research on Long Island Sound, it offers numerous opportunities for cooperation with academia, and it is politically viable. On the other hand, the present staff of the Aquaculture Division is not suited to a field-oriented program.

An evaluation of the options indicates that Option 2 is most advantageous. Experimental molluscan biology that focuses on recruitment processes is relevant to the NEFC and NMFS mission, it makes effective use of the existing staff, it provides a research focus that requires a minimum of reprogramming, it will not sacrifice the unique expertise that now exists in the Aquaculture Division, and the degree of legislative-constituency resistance will probably be acceptable.

Appendix IX. - NEFC Automated Data Processing Technical Review

This appendix consists of four items. The first is a memo reflecting the COT chairperson's impressions based on the NEFC ADP review. The second and third items are comments by two non-NEFC reviewers. The fourth is minutes of the technical review.

The review indicates that the NEFC has made significant progress in achieving its ADP needs. This progress has resulted from the combined efforts of the Center's ADP unit and program staff. Nevertheless, there are several serious concerns: 1) system stability, 2) cost over-runs, 3) communication

between the ADP unit and program, 4) limited use of microcomputers, 5) an unclear basis for prioritizing ADP needs, 6) the use of multiple data base management languages, 7) lack of an interactive data base for linking various types of research vessel data, 8) lack of cost-effective ADP support for the Oxford, Gloucester and Milford laboratories, and 9) others.

Many of the problems relate to the centralization of ADP capability and responsibilities. With centralization, the cost of ADP is not viewed as part of the cost of collecting data; it is difficult to set priorities; it isn't clear who is accountable. The NEFC should decentralize its non-system ADP activity. It should reexamine the role of microcomputers. It is important to recognize that the underlying cause of the NEFC ADP problem is that inadequate resources have been applied to implement the existing ADP plan. Either more resources are necessary or a more realistic plan needs to be adopted.

Appendix X. - Issue Paper on the Role of Pathobiology in the Northeast Fisheries Center

This appendix considers the role of disease as a factor in determining population abundance, and alternatives for the orientation of NEFC disease research. At present, the Pathobiology Division is investigating disease and environmental stress, fish pathology, shellfish pathology, microbial ecology, and parasitology, and disease of larval molluscs. Although the division is relatively small, it is the largest single assemblage of people in the National Marine Fisheries Service or elsewhere devoted to understanding the role of diseases in the sea.

The issue paper identifies three options for the future orientation of pathobiology studies. These are: 1) to continue present program emphasis except to reduce the commitment to aquaculture disease research; 2) to reorient a substantial part of the program towards quantitative studies of

disease effects, particularly on early life stages; and 3) to reorient substantial parts of the program towards diagnostic services to states and industry. The present pathobiology program is almost evenly divided between fish and shellfish, and includes study of pollution indicators, pathogen life cycles, histopathology, diseases of shellfish larvae in culture, and environmental influences.

The advantage of Option 1 is that it would have a relatively minor effect on the existing staff and would ensure acquisition of quantitative information on shellfish and finfish. On the other hand, progress toward estimating the role of disease in determining fish abundance (particularly through recruitment) will be slow.

The second option would require: 1) documentation of quantitative effects of disease outbreaks on population abundance; 2) examination, through field and laboratory studies, of the quantitative effects of egg and larval diseases on survival and abundance; and 3) a study of the effects of pollution-associated diseases, closely integrated with diseases in natural populations, since the interaction component may be large. Option 2 would represent an attempt to confront a basic and persistent problem in fisheries biology--effects of disease on recruitment and abundance. It will result in closer integration between pathobiologists and resource assessment scientists. There will be a reduction in the amount of descriptive work on new or inadequately described marine diseases. It will require substantial reeducation of pathobiologists whose background and training are primarily descriptive.

The third option will provide a valuable service. These activities are conducted now on an ad hoc basis. Option 3 will result in shift from a research orientation to a service orientation.

The issue paper concludes that the NEFC pathobiology capability should be focused on two closely related research areas...quantification of disease effects on stock abundance, and pathological effects of pollution on fish and shellfish. The Committee of Three concurs that more quantification of pathobiology research is necessary. The population effects of natural- and pollution-induced diseases needs to be estimated. While the NEFC should not provide diagnostic services on an ongoing basis, it is necessary to use its expertise in order to help states and private industry to develop standards for monitoring the health of organisms that are exchanged between ecosystems.

Appendix XI. - Utilization Research

This appendix consists of a document prepared by the Acting Chief of the Resource Utilization Division. The document describes the current organization of the division and some aspects of the infrastructure of the New England fishing industry which make utilization research necessary in order for NMFS to achieve its mission.

The Resource Utilization Division is divided into four programs. These are Fishery Engineering, Fishery Biochemistry, Processing and Preservation Technology, and Standards and Specifications. The Fishery Engineering Program is working to improve the efficiency of harvesting gear. An important aspect of the research is to reduce the need for discarding at sea. The Fishery Biochemistry Program is primarily devoted to studying the chemical and microbiological aspects of quality, preservation, wholesomeness, and nutrition. The focus is on species which have the potential for increased utilization by domestic harvesters. The second aspect of the program concerns the potential harmful chemicals in seafood which could affect marketability and safety. The Processing and Preservation Technology Program bridges the

gap between laboratory research and industry applications. Work is closely coordinated with the harvesting and processing industry. The standards and specification program is working to develop standards to help assure consumers of high quality products. These standards also help the domestic industry to compete in a quality conscious worldwide market. These standards are the basis of the USDC Inspection Program.

The major purpose of the Utilization Division is related to determining the value of resources now and in the future. Fishery resources are known to fluctuate widely. Fluctuations can rapidly affect the total value of the resource for both commercial and recreational use. The industry lacks incentive to invest in the development of technology for utilizing non-traditional species, since the future condition of the resource and the demand for it is so uncertain. The general lack of technological sophistication in the industry can be attributed to the fact that the majority of the industry is comprised of small businesses and cannot afford to maintain research capability. Even the largest fish companies perform very little research, and almost none of this ongoing research goes beyond basic quality control. The situation leads to a major time lapse and serious financial difficulty when converting from one species to potential replacement species or developing new processes for products. The Utilization Division has a successful history of alleviating some of these problems which are inherent in the New England fishing industry.

The major issues facing the fishing industry in the near future relate to: 1) optimizing the use of traditional resources, 2) expanding the use of non-traditional resources, 3) maintaining a share of the marketplace through the improvement of seafood quality and wholesomeness, and 4) improving competitiveness with foreign products through technological advances to

increase productivity and efficiency. The Utilization Division is addressing all of these issues.

Appendix XII. - Issue Paper on NEFC Recreational Fisheries Program

The Committee of Three commissioned an ad hoc working group (Anthony Pacheco (Chairperson), Stu Wilk, Jack Casey, John Boreman) to prepare an issue paper on NEFC recreational fisheries activity. The result constitutes this appendix. It reviews the history of NMFS (and its predecessors') activity related to recreational fisheries problems, and cites the NMFS policy statement which reaffirms the Agency's commitment to work toward solution of these problems. Within the NEFC, the Resource Assessment Division has prepared a five-year plan to better serve its recreational fisheries constituency. The plan calls for improved communications, improved precision and accuracy of the marine recreational fisheries data base, and special studies to improve knowledge and understanding of population dynamics of recreationally caught species. A total of 19 specific items are listed in the plan.

The issue paper recommends new initiatives in three areas: abundance estimation, recreational statistics, and information transfer. Improved abundance estimates and environmental measurements are necessary for coastal waters. The current limit of NEFC survey sampling is about 15 fathoms. This leaves the area where most recreational fisheries occur unassessed. The issue paper recommends that the NEFC provide a coastal vessel to conduct inshore surveys cooperatively with states. This would facilitate standardization of methods and gear.

The issue paper recommends that a larger commitment should be made to improving the accuracy and precision of recreational fisheries statistics.

These statistics have been collected under the purview of the Central Office. Regionalization should improve the quality of the results, but a substantial commitment of funds from the NEFC may be necessary.

The NEFC should provide tangible products concerning recreational fisheries to the public. Examples may include brief bulletins and public information documents. The NEFC should target national groups, sport-fish dedications, head and charter boat operators, National Fishermen's Yearbook, and newspapers.

The issue paper recommended against mass disentangling of the recreational fisheries related projects from the Center organization. What is more important is awareness building.

COT concurs with the recreational fisheries issue paper. The five-year plan of the Resource Assessment Division should be expanded to represent the entire NEFC. More importantly, resources must be reprogrammed in order to accomplish the objectives of the plan, and the recommendations of the issue paper.

Appendix XIII. - Future Needs of the National Systematics Laboratory

This appendix consists of a memo from the Director of the National Systematics Laboratory to the Committee of Three. It proposes that the National Systematics Laboratory include expertise in ichthyology, carcinology and malacology; a laboratory director; and a support staff of five. In order to achieve this goal, the addition of one technician and one systematist (ichthyologist or malacologist) is necessary. This would require about an additional $40,000.

Appendix XIV. - NEFC Remote Sensing Activity

This appendix consists of six items. The first item is the minutes of the special Board of Directors meeting devoted to remote sensing. Item 2 is a memo from the NEFC Director raising questions (e.g., how important is NEARSS, how much real time data is needed, should remote sensing be broadly integrated, how much can NEFC afford?). Item 3 is an issue paper describing the NEARSS communication network. Items 4-6 are two reports of remote sensing activity within the Marine Ecosystems Division and one report on the Atlantic Environmental Group. A number of key issues emerged.

Is remote sensing information useful? The answer is clearly yes. It is currently being used by three NEFC programs. It provides synoptic measurement of surface events, and for some purposes surface measurements are adequate to characterize the water column. The problem is one of maintaining perspective about remote sensing. While it is a useful tool, it must be viewed as a means towards an end. There are also important limitations (e.g., because of cloud cover it cannot be used to characterize mean conditions during a significant period of the year).

What is the difficulty with using remote sensing when applicable? The problem is essentially access. While other components of NOAA (i.e., NESDIS) have responsibility for exploring the usefulness of remote sensing, they have not been able to deal effectively with user needs. The problem is that the ocean science community is a small constituency. Therefore, all four of the NMFS fisheries centers have had to make ad hoc arrangements for access with varying degrees of success. In the Northeast Region, the NEFC has taken the lead in developing a system to achieve access.

To what degree is access an NEFC responsibility? The sense of the items in Appendix XIV is that the NEFC initiative in the past has been valuable, but

that it is unrealistic for the Center to continue to carry the burden for the region in the future.

Where does remote sensing activity fit in the NEFC organization? Since remote sensing is a tool, it should be applied within programs to the extent that their objectives merit its use and they can afford it. The consensus of the Board of Directors was that the Atlantic Environmental Group should take lead responsibility for central coordination of remote sensing activity.

How much can the NEFC afford? The answer depends on how valuable the tool is perceived to be by the programs that use it. The NEFC should continue to support NEARSS in principle; it cannot afford to fund the entire cost of access. With regard to the FY1984 budget, the consensus of the Board of Directors was to fund the NEARSS communication network and buy one terminal to support the upcoming NOAA experiment (approximately $65,000).

## CONCERNS

The program review, three technical reviews, several issue papers, and deliberations of the Committee of Three reflect positively on the Northeast Fisheries Center. Nevertheless, several concerns were raised. The term "concerns" implies apprehension and uncertainty, not necessarily determination that a problem exists. COT partitioned the concerns into three categories: organization, mission and performance (Table 1).

Organization concerns relate to the Table of Organization of the NEFC and the functional role of program elements. The overriding questions are of effectiveness, accountability, coordination, and manageability. Mission concerns relate to the importance of NEFC activities relative to short- and long-term goals of the National Marine Fisheries Service. Do the activities contribute to achieving NMFS's goals? What would be the adverse effect if NEFC did not conduct these activities? Performance concerns relate to the quality and quantity of products and services that are produced by NEFC activities. The question is whether or not NEFC performs what it is doing satisfactorily.

TABLE 1. ORGANIZATION, MISSION AND PERFORMANCE CONCERNS ABOUT THE NORTHEAST FISHERIES CENTER

## ORGANIZATION

0.1. THE NEFC DIRECTOR HAS SUPERVISORY RESPONSIBILITY FOR A LARGE NUMBER (I.E, 15) OF POSITIONS.

0.2. THERE IS A LARGE DISPARITY IN THE SIZE OF PROGRAM UNITS.

0.3. THE FUNCTION OF LABORATORY DIRECTORS NEEDS REVIEW.

0.4. PROGRAMS LACK CONSISTENCY IN THEIR ORIENTATION TOWARD EITHER PROBLEMS OR SCIENTIFIC DISCIPLINES.

0.5. THE ORGANIZATION LACKS A FOCAL POINT FOR SCIENTIFIC COORDINATION AND PLANNING.

0.6. THE ORGANIZATION DOES NOT FACILITATE INTEGRATION OF HABITAT CONSERVATION-POLLUTION STUDIES INTO MARINE ECOSYSTEMS AND RESOURCE ASSESSMENT STUDY, OR VICE VERSA.

0.7. SEVERAL PROGRAM UNITS ARE DEVELOPING MATHEMATICAL MODELS WITHOUT A FORMALIZED VEHICLE FOR COORDINATION.

0.8. IT IS UNCLEAR WHERE INVESTIGATIONS OF FISHERIES ECONOMICS FIT IN THE ORGANIZATION.

0.9. THE NEFC LACKS A FOCUS FOR RECREATIONAL FISHERIES ACTIVITIES.

0.10. SEVERAL PROGRAMS CONDUCT PHYSICAL OCEANOGRAPHIC RESEARCH WITHOUT A FORMAL VEHICLE FOR COORDINATION.

0.11. AUTOMATIC DATA PROCESSING (ADP) ACTIVITY IS CENTRALIZED LEADING TO PROGRAMS NOT TAKING RESPONSIBILITY FOR THEIR OWN NEEDS.

0.12. IT IS UNCLEAR THAT REMOTE SENSING, AS A RESEARCH TOOL, SHOULD BE GIVEN SPECIAL EMPHASIS AFFORDED BY AN INDEPENDENT "REMOTE SENSING SYSTEM DEVELOPMENT" TASK.

0.13. ALTHOUGH MOST STUDIES OF FISH BIOLOGY AND FISH POPULATION DYNAMICS ARE CONDUCTED WITHIN THE RESOURCE ASSESSMENT DIVISION, STUDIES OF OCEAN GAME FISH-APEX PREDATORS ARE CONDUCTED WITHIN THE MARINE ECOSYSTEMS DIVISION.

0.14. ALTHOUGH SAMPLES FOR FOOD HABIT STUDIES ARE COLLECTED DURING RESEARCH VESSEL SURVEYS CONDUCTED BY THE RESOURCE ASSESSMENT DIVISION, AND THE DATA IS USED FOR MULTISPECIES ASSESSMENTS, RESPONSIBILITY FOR FOOD HABITS STUDIES RESIDES WITH THE MARINE ECOSYSTEMS DIVISION.

0.15. THE ANALYTICAL AND POPULATION DYNAMICS ORIENTED STAFF IS HIGHLY CONCENTRATED IN THE RESOURCE ASSESSMENT DIVISION, ALTHOUGH THESE SKILLS ARE PERTINENT TO OTHER PROGRAMS.

TABLE 1. (CONTINUED)

0.16. THERE ARE SEVERAL SUBSTANTIALLY INDEPENDENT BENTHIC ECOLOGY STUDIES WHICH LACK FORMAL COORDINATION.

0.17. THERE ARE SEVERAL STUDIES OF PHYTOPLANKTON AND PRIMARY PRODUCTIVITY WHICH LACK FORMAL COORDINATION.

0.18. THERE ARE SEVERAL PROGRAMS APPLYING THE DISCIPLINE OF IMMUNOLOGY WITHOUT FORMAL COORDINATION.

0.19. IT IS UNCLEAR THAT MANNED UNDERWATER RESEARCH TECHNOLOGY, AS A RESEARCH TOOL, SHOULD BE GIVEN THE SPECIAL EMPHASIS AFFORDED BY AN INDEPENDENT PROGRAM REPORTING TO THE CENTER DIRECTOR.

## MISSION

M.1. THE NEFC AQUACULTURE RESEARCH EFFORT FOR THE PURPOSE OF FOOD PRODUCTION HAS BEEN DETERMINED TO BE BEYOND THE NMFS MISSION.

M.2. IT IS UNCLEAR WHETHER OR NOT RESOURCE UTILIZATION RESEARCH IS THE RESPONSIBILITY OF NMFS OR PRIVATE INDUSTRY.

M.3. SOME PATHOBIOLOGICAL AND HABITAT CONSERVATION RESEARCH FOCUSES ON INSHORE SPECIES OR HABITATS WHICH ARE NOT SUBJECT TO FEDERAL JURISDICTION.

M.4. THE APPROPRIATENESS OF NEFC LEADERSHIP IN THE DEVELOPMENT OF NOAA TECHNOLOGY FOR MANNED UNDERWATER RESEARCH (I.E., MURT) HAS BEEN QUESTIONED.

M.5. SOME NEFC RESEARCH CONCERNS SOURCES AND FATES OF ANTHROPOGENIC AGENTS, ALTHOUGH OTHER FEDERAL AGENCIES HAVE PRIMARY RESPONSIBILITY FOR SUCH RESEARCH.

M.6. THE APPROPRIATENESS OF THE NEFC'S LEAD ROLE IN DEVELOPING REMOTE SENSING CAPABILITY IN THE NORTHEAST REGION HAS BEEN QUESTIONED.

## PERFORMANCE

P.1. THE NEFC COLLECTS A VAST QUANTITY OF DATA, BUT IT IS UNCLEAR THAT ALL THE DATA IS NECESSARY OR ITS INFORMATION CONTENT IS FULLY UTILIZED.

P.2. LITTLE PROGRESS HAS BEEN MADE IN THE DEVELOPMENT OF A DYNAMIC MULTISPECIES SIMULATION MODEL WHICH ACCOUNTS FOR TROPHIC INTERACTIONS.

P.3. THE VALUE OF THE OUTPUT FROM THE NEFC PHYSICAL OCEANOGRAPHIC RESEARCH EFFORT TO OTHER NEFC PROGRAMS IS UNCLEAR.

P.4. NEFC ENVIRONMENTAL ASSESSMENT ORIENTED RESEARCH HAS NOT ADEQUATELY EXPRESSED THE EFFECTS OF HABITAT DEGRADATION ON FISHERIES

TABLE 1. (CONTINUED)

P.5. NEFC RESPONSIVENESS TO RECREATIONAL FISHERIES PROBLEMS IS POOR RELATIVE TO COMMERCIAL FISHERIES PROBLEMS.

P.6. PROGRESS IN AUTOMATIC DATA PROCESSING HAS BEEN SLOW, AND SOME DATA BASES HAVE ONLY LIMITED ACCESSIBILITY.

P.7. THE UTILITY OF THE BROAD-SCALE ICHTHYOPLANKTON SAMPLING PROGRAM (I.E., MARMAP I) HAS NOT YET BEEN RIGOROUSLY ANALYZED.

P.8. AFTER TWENTY YEARS OF CONDUCTING STANDARDIZED BOTTOM-TRAWL SURVEYS (MARMAP II), IT IS DESIRABLE TO RE-EVALUATE THE DESIGN, STANDARDIZATION, METHOD OF ANALYSIS.

P.9. RESOURCE ASSESSMENT ACTIVITY PLACES A HEAVY EMPHASIS ON SINGLE SPECIES ORIENTED ASSESSMENTS OF CURRENT STATUS, PARTICULARLY IN REACTION TO SHORT-TERM NEEDS (E.G., FISHERY MANAGEMENT COUNCILS, ENVIRONMENTAL IMPACT ASSESSMENTS, INTERNATIONAL TREATIES AND NEGOTIATIONS).

P.10. THERE IS RELATIVELY LITTLE INTERACTION OF RESOURCE ASSESSMENT SCIENTISTS WITH THE REST OF THE NEFC.

P.11. NEFC PATHOBIOLOGICAL RESEARCH NEEDS TO PROVIDE MORE INFORMATION RELATIVE TO THE DETERMINATION OF NATURAL MORTALITY.

P.12. THE FISHERIES' ECONOMIC RESEARCH EFFORT IS MODEST, AND LACKS A LONG-TERM PLAN.

P.13. THE PUBLIC AND CONSTITIUENCIES ARE NOT AWARE OF NEFC ACTIVITIES AND RESULTS.

Evaluation of Concerns:

The Committee of Three considered each of the 19 organizational concerns listed in Table 1.

0.1 The NEFC Director has supervisory responsibilities for a large number of positions. The Table of Organization at the time of the program review is shown in Figure 1. The figure indicates that the Director supervised four staff, two Assistant Center Directors, and nine program leaders. Four program leaders and the two Assistant Center Directors also serve as Laboratory Directors. This complex and relatively "flat" organization places a heavy supervisory and coordination burden on the Center Director. It is noteworthy that the National Research Council (The Quality of NOAA's Ocean Research and Development Program, an Evaluation, National Academy of Sciences, Washington, D.C., 1977, p. 144) recommended that the NEFC Center Director "should delegate more authority so that fewer people reported directly to him."

In actuality, the significant proportion of the responsibility for supervision and coordination rests with the Assistant Center Directors, but these responsibilities are not line authority in the Table of Organization. COT recommends that the NEFC organization be restructured to reduce the direct supervisory responsibility of the director and facilitate greater coordination.

0.2 There is a large disparity in the size of program units. The smallest is approximately $200,000 while the largest is in excess of $3,000,000. This disparity makes it difficult to achieve uniformity in grade structure and leads to the impression of an organization of "have's and have

not's." Therefore, it is advantageous to reduce the disparity and size of program units to the extent practical.

0.3 Figure 1 indicates that the NEFC is comprised of six divisions, one unaffiliated program (i.e., Manned Undersea Research and Technology), and two national programs (i.e, National Systematics Laboratory and Atlantic Environmental Group). In addition, there are six laboratories (i.e., Woods Hole, Narragansett, Gloucester, Sandy Hook, Milford and Oxford) each headed by a Laboratory Director. In four cases, the Laboratory Directors also serve as Division Chiefs and they are programmatically responsible for at least half (in two cases all) of the research within their facilities. The other two laboratories are headed by Assistant Center Directors who lack line authority over the scientific programs within their facilities. In Woods Hole the Laboratory and Center Administration are combined.

COT considered the feasibility of restructuring the Center such that each laboratory housed a cohesive program that would be led by the Laboratory Director. While this goal is obtainable for some of the smaller laboratories (e.g., Oxford, Gloucester), COT considered it impractical for the larger laboratories (particularly Sandy Hook and Woods Hole). In order to achieve cohesive programs in all laboratories a significant proportion of the staff of the NEFC would have to be relocated. Furthermore, there would be a tendency to allow the size of physical facilities to determine the relative emphasis of programs.

Therefore, COT recommends that laboratories continue to be viewed as work facilities and that their status be minimized in the organization of the Center. The senior position within each laboratory should be designated as Director. The Laboratory Director should be responsible for local external interactions, allocation of space, etc.

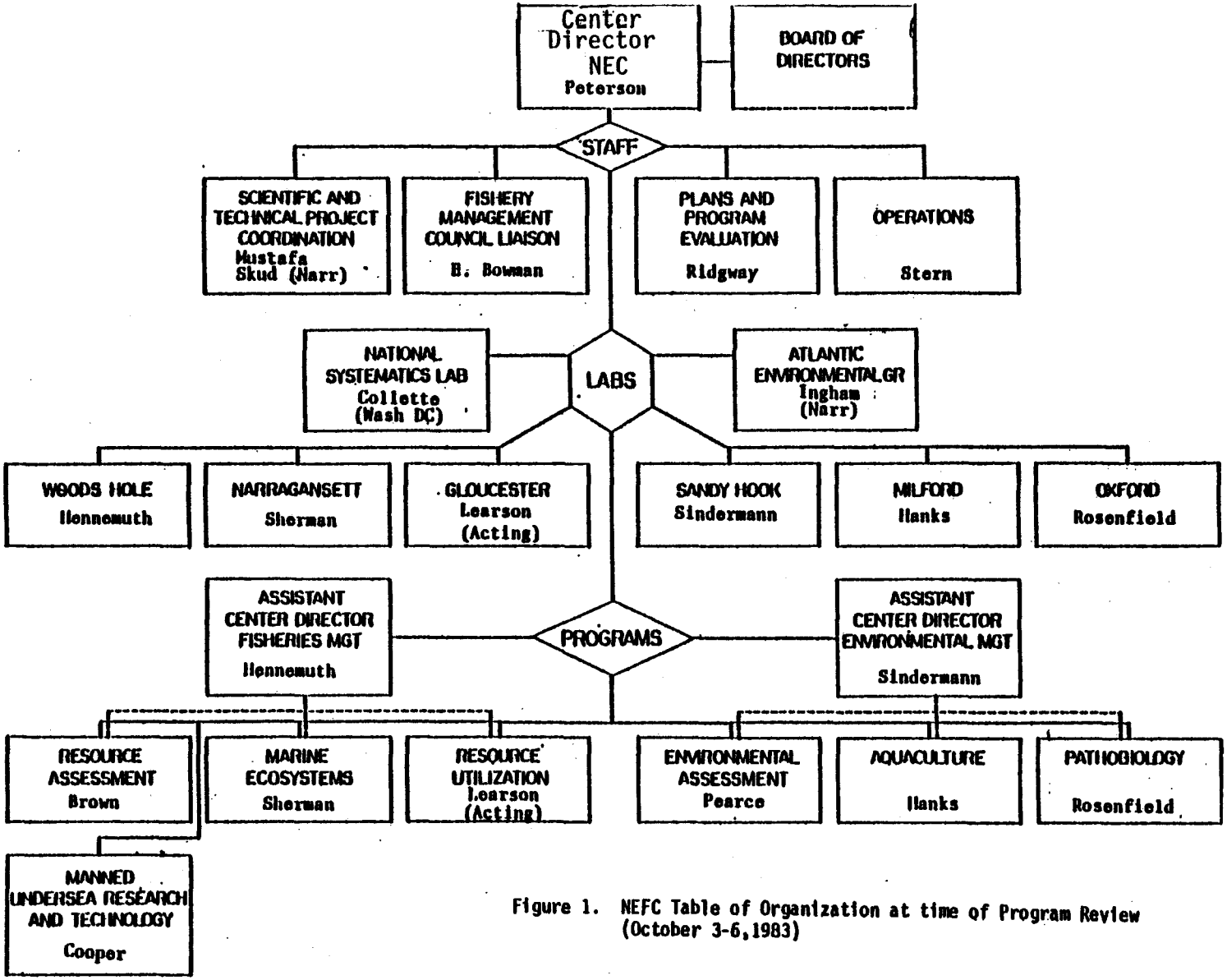



Figure 1. NEFC Table of Organization at time of Program Review (October 3-6,1983)

While the Committee of Three considers the laboratories to be primarily facilities, there will necessarily always exist an identification of the personnel with the lab per se. Thus, for example, the Woods Hole Laboratory has a long tradition and recognition. The Laboratory Director can do much to benefit the mission by maintaining an esprit de corps within the workplace. This would be all the more necessary if the division leaders were all to be located at headquarters (which the Committee of Three has not considered explicitly).

COT also considered the number of laboratories within the NEFC. Support of the Center and its six laboratories accounts for over 20% of the NEFC total budget. Since most of the cost of supporting facilities is fixed, this percentage is likely to increase as the remainder of the Center budget contracts due to budget cuts or inflation. Therefore, COT considers it inevitable that the NEFC reduce its number of facilities as its funding level in pre-inflation dollars contracts. By reducing the number of facilities the NEFC will have greater flexiblity in establishing the priority of its programs, although savings are unlikely in the short term.

COT notes that some laboratories have special capabilities that are necessary for certain types of research (e.g., sophisticated seawater system at Milford, ventilation system for chemical laboratories at Gloucester). These laboratories should be maintained if the NEFC is to continue these types of research.

0.4 The NEFC is inconsistent in its orientation of programs. In some cases, programs are oriented toward scientific disciplines (e.g., Pathobiology). In other cases, programs are oriented toward problems (e.g., Aquaculture, Resource Utilization). COT considered the relative merits of each orientation.

Problem orientation serves to focus activity toward the goal of solving specific constituency problems. In order to solve problems, multidisciplinary teams are usually necessary. With a problem-oriented organization, some redundancy of scientific disciplines between programs is inevitable.

Scientific discpline orientation concentrates specialists together and usually achieves a useful "critical mass." On the other hand, the mission supported by the research is not always clear.

COT recommends an emphasis on problem-oriented programs. Discipline-oriented groups need to be maintained at lower organizational levels (i.e., Investigations Tasks). Communication within disciplines across programs should be facilitated by designated Center coordinators (e.g., modeling, biochemistry).

0.5 The NEFC organization needs focal points for scientific leadership and coordination. Previously, the Center Director assumed this function with Assistant Center Directors taking the lead in specific subject areas. This is not practical with increased emphasis on organization management due to the size of the Center, its scientific complexity, external responsibilities of the director, and the director's management orientation. The position of planning officer could provide leadership and coordination, but by necessity most emphasis is placed on financial planning. Much of the attention of the Board of Directors must focus on the management of the Center instead of its scientific programs.

COT recommends that the NEFC establish a Research Coordination Office. The office would be responsible for scientific planning (not financial planning), coordination between divisions, and coordination of Center activities with constituencies. The office should have capability to conduct

conceptual studies and analyses which synthesize results of the Center programs and provide scientific leadership.

COT has also recommended that the NEFC establish a Research Council under the chairpersonship of the Director of the Research Coordination Office. The council will meet regularly (e.g., quarterly) to discuss the research emphasis and recommend cooperative activity. The membership of the council should be senior scientists, but not necessarily members of the Board of Directors. Members could be rotated.

0.6 The three largest divisions of the NEFC are the Resource Assessment Division (RAD), the Marine Ecosystems Division (MED), and the Environmental Assessment Division (EAD). The organization does not facilitate integration of EAD activity into MED and RAD activity or vice versa, except at the Director level. This problem was identified by the Environmental Assesssment Activity program review (see Appendix VI).

COT concludes that the problem of habitat conservation-pollution research should be addressed more in the context of fisheries ecology. Therefore, COT recommends that the NEFC organization be restructured so that research on the biological response of animals to anthropogenic stress be integrated with ecological studies that consider responses to natural stress and fishing.

0.7 Several NEFC programs are developing models (e.g., multispecies fisheries models, stochastic recruitment models, physiological recruitment models). In the future, there are likely to be additional models of ocean circulation, bioeconomics, and source, fates and effects of contaminants. The question of whether or not the NEFC should concentrate its modeling efforts into a single unit has arisen.

COT's deliberations and an issue paper on modeling (Appendix 5) indicate that modeling should be an integral part of each major program. In fact,

modeling is the economy of thinking, and it should not be isolated from research planning, activity and reporting.

It is necessary to link models together (e.g., multispecies fisheries models with bioeconomic models, recruitment models with multispecies models, circulation models with source, fates and effects of contaminants models). Clearly, there is a need for Center coordination of modeling activity. The Research Coordination Office (proposed under 0.5) should serve this function.

0.8 At present the NEFC has only a modest fisheries economics research effort. It is supervised by the Assistant Center Director of Fisheries Management. The NEFC intends to expand this activity.

As fisheries economics activity increases from what has been largely a staff function to a research program, it should be more closely aligned with other programs. COT recommends that the Fisheries Economics Program be organizationally associated with Resource Assessment Division activity and Resource Utilization Division activity. This will facilitate the involvement of economists in: 1) the planning of fisheries statistics collection, 2) the development of bioeconomic models of fisheries, 3) the identification of technology needs for increasing U.S. utilization of fisheries resources, and 4) the evaluation of the cost/benefit ratios for new technology.

0.9 The NEFC lacks focus for recreational fisheries activities. At one time, there was a program dedicated to recreational fisheries and the biology of recreational target species.

COT commissioned a working group to consider how the NEFC could improve its actual and perceived performance with respect to recreational fisheries (see Appendix XIII). The working group concluded, and COT concurs, that the NEFC should not reestablish a recreational fisheries program explicitly. Relatively few fisheries are uniquely recreational, and the scientific

approach is largely the same regardless of the recreational or commercial nature of the fishery. It is noteworthy that the National Research Council (1977) concluded that "separation of recreational and commercial programs imposes a handicap on scientific productivity" in its report concerning another NMFS Center.

COT recommends that the NEFC formulize a Recreational Fisheries Coordinator position. This position would serve as the conscience of the Center with respect to recreational fisheries problems and to facilitate communication with recreational constituencies. COT notes that one danger in establishing a Coordinator position is that the position may be viewed as the entire Center recreational fisheries effort. It is important that the incumbent work effectively on behalf of the NEFC.

0.10 The NEFC has several programs conducting physical oceanographic research without a formal vehicle for coordination. The Atlantic Environmental Group (AEG) is concerned with the long-term and broad-scale patterns of ocean climate. Recently, it has used remote sensing as a tool for achieving greater resolution and synoptic observations. The Fisheries Oceanography Investigation of the Marine Ecosystems Division is concerned with the processes that determine ocean circulation (e.g., the linkage between atmospheric and oceanographic processes, the linkage between slope water and continental shelf circulation). On occasions, they have become directly involved with biologists in the study of recruitment processes. Greater involvement is proposed in the new recruitment initiative of the Marine Ecosystems Division (see Appendix IV).

The Biological Oceanography Investigation of the Environmental Assessment Division is using remote sensing to describe near-shore circulation as it is affected by estuarine outflow. This information is useful in determining the

source of contaminants on the continental shelf and in predicting their fate and eventual effects.

At present, the only position with line authority over all three investigations of physical oceanography is the Center Director. COT recommends that the organization be restructured such that there is a vehicle for coordination and integration at a lower organizational level.

0.11 The Automated Data Processing (ADP) system and programming support is centralized. Many of the programs are dependent on the resources of the central unit to meet their own needs. The result is that it is difficult to hold programs accountable for use of ADP and to plan and allocate resources. The ADP Technical Review (see Appendix IX) indicated several additional problems that are exacerbated by the centralization of ADP activity.

Therefore, COT recommends that programs be assigned greater responsibility and resources for meeting their own ADP needs. By doing so, they will have a greater awareness of the cost of ADP as a component of the cost of collecting data.

COT recognizes that there will still be a role for a centralized ADP Unit. The Unit should be responsible for designing and implementing a system that meets the Center's needs. The Unit should consider generic problems that affect all Center programs (e.g., common data base management language, relational data bases for research vessel data, ADP needs on ships). Further details are given in Appendix IX.

0.12 The NEFC has a remote sensing development task which is supervised by the Center Director. Whether or not this special emphasis should be afforded to remote sensing technology was considered during a Special Board of Directors Meeting (Technical Review of Remote Sensing, see Appendix XI) and by COT. The conclusion was that remote sensing activities should be integrated

within the programs that are using this research tool. The primary users are physical and biological oceanographers (see 0.10). The Atlantic Environmental Group should be given lead responsibility for system development.

0.13 Although most of the studies of fish biology and fish population dynamics are conducted within the Resource Assessment Division, studies of ocean game fish-apex predators are conducted within the Marine Ecosystems Division. The reason behind this organizational anomaly seems to be a practical consideration of the location of the Ocean Game Fish-Apex Predator Investigation relative to the location of most Resource Assessment Division activity. Aside from this practical consideration, COT's view is that it is more logical for the Ocean Game Fish-Apex Predator Investigation to be more closely associated with Resource Assessment Division activity.

0.14 The Marine Ecosystems Division has responsibility for food habit studies of juvenile and adult fish. The samples are collected during research vessel surveys conducted by the Resource Assessment Division. The Resource Assessment Division requires food habits data in order to conduct multispecies assessments and to develop multispecies fishery models. Therefore, COT recommends that the NEFC organization be restructured to more closely associate food habits studies of trawl caught fish with resource surveys and multispecies stock assessments.

COT notes that food habits studies of juvenile and adult fish are also pertinent to recruitment processes research of the Marine Ecosystems Division. Therefore, there is some validity to the alternative argument that the food habits studies should remain associated with recruitment processes activity. Nevertheless, there are probably economies of scale to be gained by associating the food habits studies with the resource surveys. Larval and

post-larval food habits studies should remain the responsibility of the Marine Ecosystems Division.

0.15 The analytical and population dynamics-oriented staff of the Center is highly concentrated in the Resource Assessment Division. These skills are necessary in other programs. For example, one reason why progress has been slow in determining the role of disease as a cause of natural mortality of fish is related to the Pathobiology Division's lack of pertinent quantitative and population dynamics skills.

From the organizational point of view, one partial solution to the problem is to place some analytical-population dynamics skilled staff in a Research Coordination Office. This staff could be given special assignments to help stimulate a more quantitative approach by programs which lacked quantitative expertise. On the other hand, this "think tank" approach tends to result in communication barriers between the Center unit and programs.

In addition, the NEFC should be more cognizant of the analytical skills of candidates for positions. Furthermore, staffing levels or the workload of Resource Assessment Division personnel should be adjusted so that they have greater opportunity for cooperative studies with other programs.

0.16 It has been suggested that the NEFC has several substantially independent benthic ecology studies ongoing; e.g., in-house and contract work by the Environmental Assessment Division, the Marine Ecosystems Division, and MURT. COT considered what structural changes in the NEFC organization were necessary in order to improve coordination of benthic ecology studies. It concluded that to the extent that there are problems of coordination within the Environmental Assessment Division, these are problems of performance, not organization. It noted that the benthic ecology studies of the Marine Ecosystem Division have been essentially phased out. There is only one

scientist involved, and he will be reprogrammed when a series of publications documenting previous work have been completed.

With regard to MURT, benthic ecology studies are only a component of their activity. Organizational concerns related to MURT are considered under 0.19.

0.17 The NEFC has several studies of phytoplankton and primary productivity (in-house and by contract within the Environmental Assessment Division, using remote sensing and in the Aquaculture Division). COT considered whether these activities should be consolidated. It concluded that to the extent that there is a problem of coordination within the Environmental Assessment Division, this is a problem of performance, not organization. In accordance with 0.12, COT reiterates its conclusions that remote sensing activity be integrated into programs. Therefore, the application of remote sensing to measuring primary productivity should be consolidated. With respect to phytoplankton studies of the Aquaculture Division, COT concluded that these studies address the nutrition of mollusks which feed on phytoplankton, not the ecology of the phytoplankton. Therefore, consolidation is inappropriate.

0.18 The NEFC has several groups working independently using methods of immunology; e.g., under contract in the Environmental Assessment Division, within the Aquaculture Division, within the Resource Utilization Division. COT considered whether or not these activities should be consolidated or coordinated.

Each program is conducting research for a different purpose. While they are all working in the field of immunology, the actual approaches that are being applied are different. Therefore, COT does not recommend consolidation although a Center-wide coordinator is necessary.

0.19 It is unclear that Manned Undersea Research and Technology, as a research tool, should be given the special emphasis afforded by an independent program reporting to the Center Director. COT considered several alternatives; e.g., consolidation into benthic ecology studies, assignment to the Milford Lab in order to provide field support, assignment to the Resource Utilization Division in order to support gear development.

COT concluded that it is inappropriate for the MURT group to be directly supervised by the Center Director but it is important for the MURT unit to retain its identity. The group is highly versatile and provides a unique capability, not only to NEFC but also to components of NMFS and NOAA.

Although it is valuable for MURT to retain a degree of flexibility in order to work on special projects (i.e., gillnet-recreational fisheries conflict), the program should be more closely associated with a mainstream NEFC research activity. COT concluded that closer association with the research activity of the Milford Laboratory would be useful. If the Milford Laboratory Aquaculture activity is reprogrammed to investigate recruitment processes of molluscs (see M.1), additional field capability will be necessary. MURT could serve this role. Furthermore, with the development of a major underwater research center at the University of Connecticut, the MURT group might benefit from closer association with activity within Connecticut.

## Proposal to Restructure NEFC Table of Organization

Based on its evaluation of organization concerns, the Committee of Three recommends that the NEFC restructure into three divisions supported by two offices (see Figure 2). This organization is designed to function as a vertically integrated team; the product is information in support of the mission of the National Marine Fisheries Service. The Conservation and

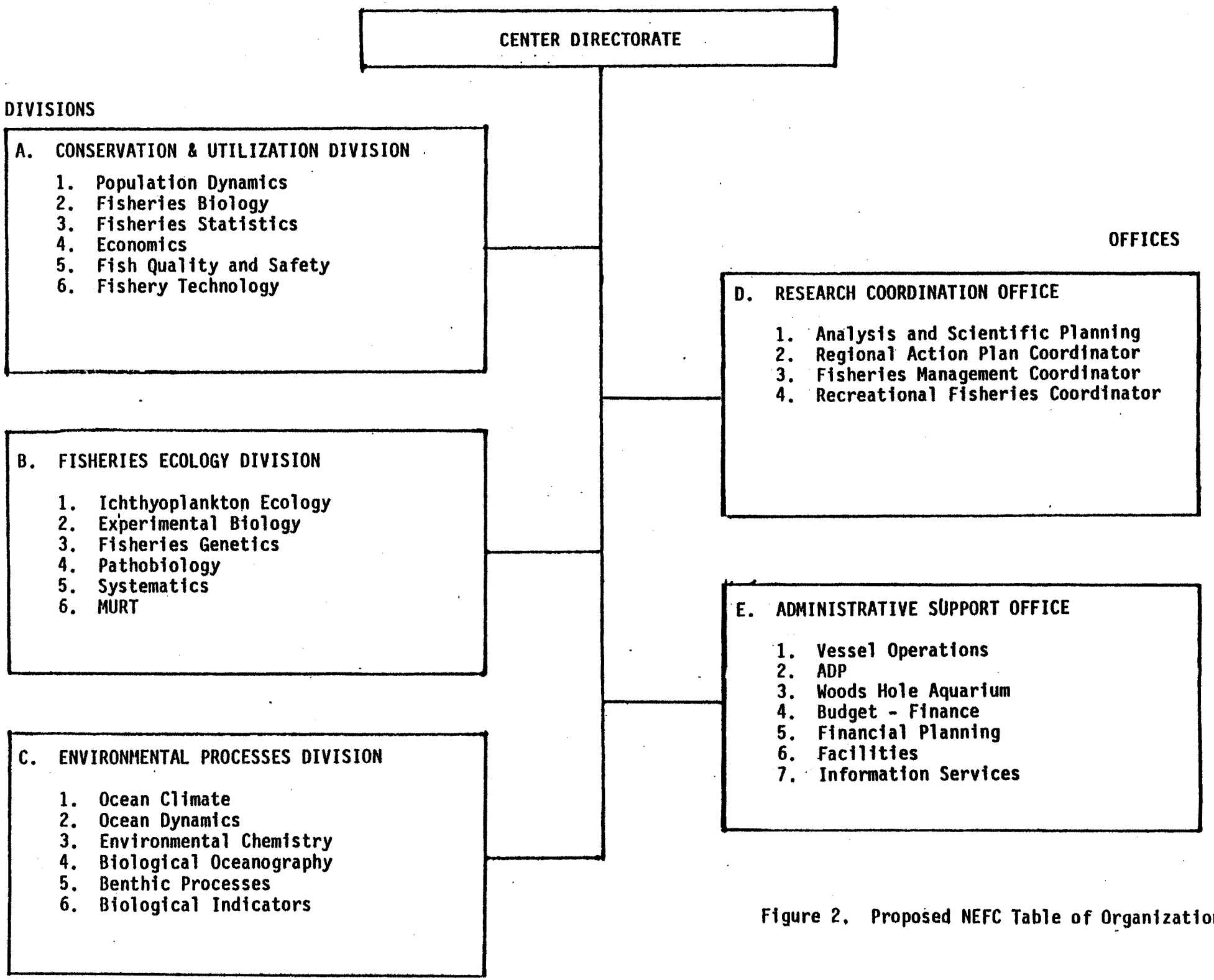



Figure 2. Proposed NEFC Table of Organization

Utilization Division will provide information on the status of fisheries and fishery resources, their potential and future outlook relative to fishing, fish habitat, and fish quality. The Fisheries Ecology Division will focus on the processes (natural and man-induced) that determine the ecological basis of fishery resource productivity, and the response of these processes to natural variables and anthropogenic activity (e.g., pollution and fishing). The emphasis of the Environmental Processes Division will be the physical, chemical and biological environment of fishery resources, how it varies and how it is affected by anthropogenic activity. Information will flow from the Environmental Processes Division to the Fisheries Ecology Division to the Conservation and Utilization Division.

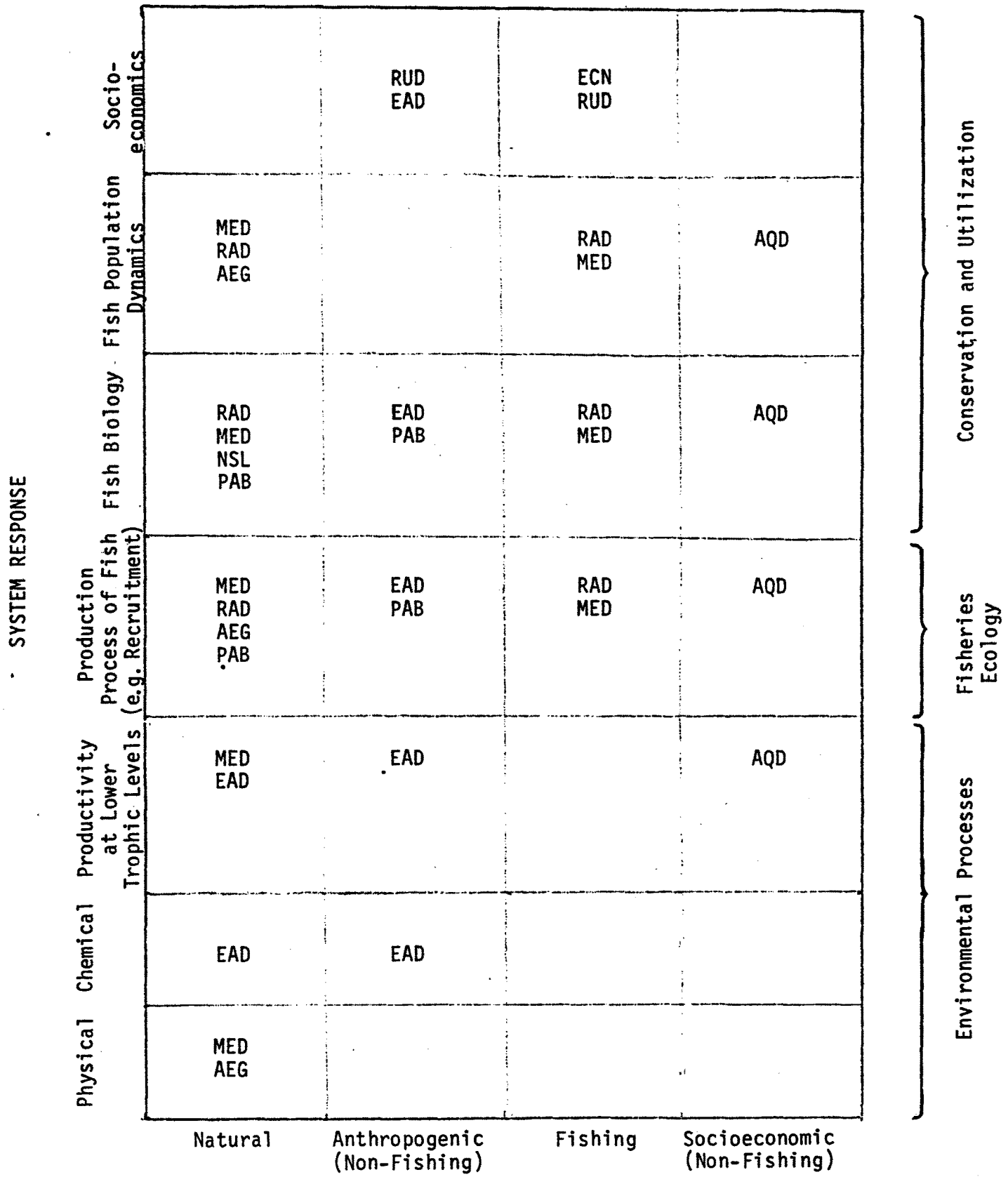
Figure 3 contrasts the proposed divisions with current programs in relationship to problems relevant to NEFC.

The Center Directorate (with advice of the Board of Directors), the Research Coordination Office (with advice of the Research Council), and the Administrative Support Office will be responsible for managing the Center. The Research Coordination Office will facilitate coordination between the three divisions and externally (i.e., with institutions such as Regional Fishery Management Councils, states, other federal agencies, international activity and constituencies). The Administrative Support Office will be responsible for the operational needs of the NEFC.

Figure 2 indicates several elements within each division or office. In most cases, these elements correspond to subdivisions or investigations, although alternative configurations are viable.

The Population Dynamics Investigation of the Conservation and Utilization Division will investigate the responsive populations to fishing and to the environment. Ideally, natural and anthropogenic factors will be considered in

Figure 3. Problems of Concern to NEFC. Problems are defined by combinations of Phenomena and Systems Responses. The areas of major emphasis of current NEFC programs are indicated along with the partitioning of the problem that corresponds to the proposed organization (Figure 2). EAD-Environmental Assessment Division, MED-Marine Ecosystems Division, RAD-Resource Assessment Division, AEG-Atlantic Environmental Group, RUD-Resource Utilization Division, AQD-Aquaculture Division, PAB-Pathobiology Division, NSL-National Systematics Laboratory, ECN-Economics.



a multispecies context. These studies will be primarily analytical, including stock assessments as necessary for fisheries management. They will be based on the results of other investigations within the Conservation and Utilization Division (e.g., fisheries biology, fisheries statistics) and results of the Fisheries Ecology and Environmental Processes Divisions.

The Fisheries Biology Investigation will conduct field and laboratory-oriented research directed at determining age and growth, spatial and temporal distribution, feeding habits, and other biological parameters that affect population dynamics. Ideally, this investigation will consider diseases and gene frequency. Both commercial and recreational target species will be considered, including ocean game fish-apex predators.

The Fisheries Statistics Investigation will collect data characterizing the harvesting sector of commercial and recreational fisheries. These data will be used by both the Population Dynamics Investigation and the Economics Investigation. The Economics Investigation will more closely relate: 1) fisheries resources to fisheries and 2) the harvesting sector to the fishing industry as a whole.

The Fish Quality and Safety Investigation will conduct studies which are necessary in order to assure the public of a wholesome product. Emphasis will be placed on the microbiological and chemical (including potentially harmful anthropogenic agents) aspects of fish products. This will include the research necessary to develop standards.

The Fish Technology Investigation will carry out applied research to improve preservation quality, reduce processing waste, increase harvesting and processing efficiency, and develop products from non-traditional species.

The Ichthyoplankton Ecology Investigation of the Fisheries Ecology Division will focus on recruitment processes, particularly during the pelagic

stage of the first year of life. The investigation will conduct broad-scale surveys to monitor spatial and temporal distribution, field experiments to identify ecological processes that determine growth and survival, and laboratory experiments which characterize response of early life stage fish to biological, physical, and chemical stress.

The Experimental Biology Investigation will focus on the biological response of later life stage (juveniles and adult finfish and shellfish) to stress. The emphasis will be on experimental studies relevant to recruitment processes, particularly of valuable molluscan bivalves. Experiments on response of organisms to stress wil be based on physical and chemical descriptions produced by the Environmental Processes Division.

The Fisheries Genetics Investigation will focus on population genetics. Its studies will include the genetic basis of stock definition and the relationship between phenotype and genotype. The goal is to understand the direct effects of fishing and habitat degradation on gene frequency and the implications for productivity and robustness of fish stocks.

The Pathobiology Investigation will conduct studies in order to understand the role of diseases in marine ecosystems, and as a component of natural mortality. The National Systematics Laboratory and the Manned Undersea Research and Technology Unit will support the Fisheries Ecology Division, the Northeast Fisheries Center, and the National Marine Fisheries Service by providing unique expertise in systematics and in situ observations and experiments. In situ experiments with shellfish will complement laboratory studies of the Experimental Biology Investigation.

Systematics research should logically be combined with the Fisheries Biology Investigation (A.2), but this is not proposed in order to achieve greater balance in the size of divisions and because the National Systematics

Laboratory status of systematics research precludes consolidation within an Investigation. The National Systematics Laboratory could also be assigned to the Research Coordination Office.

The Ocean Climate Investigation of the Ocean Processes Division will characterize the physical environment of the ocean and its spatial and temporal variability. The emphasis will be on developing long (i.e., decades) time series.

The Ocean Dynamics Investigation will focus on the physical characteristics of the ocean with greater spatial and temporal resolution than the Ocean Climate Investigation. The emphasis will be on understanding (e.g., modeling) the processes that cause variability.

The Environmental Chemistry Investigation will focus on the distribution of anthropogenic agents, their "sources" and "fates". The emphasis of the Biological Oceanography Investigation will be the relationship between primary productivity and physical and chemical factors. Ideally, biological oceanography includes zooplankton production, but it is recognized that the primary source of zooplankton samples will be ichthyoplankton surveys.

The Benthic Processes Investigation will consider benthic community structure and productivity, and how it is affected by natural and anthropogenic events occurring in the water column and the sediments. Benthic studies will also be used as indicators of habitat quality.

The Biological Indicators Investigation will monitor habitat quality through biological measurements. They will conduct the research necessary to select and validate biological indicators.

The Analysis and Scientific Planning element of the Research Coordination Office will facilitate more effective use of the scientific resources of the NEFC. This will be accomplished by focusing greater attention on the

identification of the appropriate scientific problems, providing a framework for the synthesis of research, being alert to alternative approaches, and advocating a sound scientific method. Depending on the size and capability of the staff, the Analysis and Scientific Planning element may provide analytical support to the divisons.

Regional Action Plan, Fisheries Management, and Recreational Fisheries Coordinators will also play an important role in problem identification and planning research. Each will serve to identify the needs of constituencies, coordinate activity within the NEFC, and communicate results to users. Coordination of these activities does not necessarily require full time. In such cases, responsibility may be assigned colaterally to an individual within a division, although overall responsibility for coordination would remain with the Research Coordination Office.

The elements of the Administrative Support Office are necessary for the efficient operation of the NEFC. In most cases, details concerning these elements are beyond the scope of this report. However, there are some aspects of the Administrative Support Office that are pertinent to the scientific activities considered herein.

The role of the ADP element should be based on the results of the ADP Technical Review (see Appendix IX). It will be responsible for designing and implementing an adequate ADP system, developing standards (e.g., for microcomputers, data base access), providing expertise to monitor ADP contracts, helping to educate users, and coordinating activities.

The Woods Hole Aquarium element will operate the facility as a public display and education resource. Nevertheless, it is also a valuable experimental facility and this option will be maintained.

The Information Services element will provide the technical basis for distributing information (e.g., graphics, editing, publishing). The Research Coordination Office and the divisions will have primary responsibility for information content.

The Vessel Operations element will be responsible for planning and coordinating the use of NOS and foreign research vessels. If the NEFC adopts the recommendation of the Recreational Fisheries Working Grup (Appendix XIII), then the Vessel Operations element will also be responsible for a coastal research vessel.

Suggested Reallocation of Current NEFC Research Tasks

A suggested reallocation of current NEFC research tasks into the three proposed division is given in Table 2. Only the tasks included in the current six divisions, the Atlantic Environmental Group, the National Systematic Laboratory, the Manned Undersea Research and Technology Unit, Remote Sensing Development Task, and the Economics Task are considered. Other resources currently within the Center Directorate or the tasks of the Assistant Center Directors are not considered. In some cases, these resources support research (e.g., cruise overtime, fisheries genetics, contracts for the collection of fisheries statistics, automated data processing activity of programs). They should be allocated to the appropriate division or office. Furthermore, the suggested reallocation of Table 2 indicates substantial amounts of resources only allocated to the division level. It is assumed that these resources will be allocated to investigations during the implementation stage of this plan.

Most of the suggested reallocations are obvious. In some cases, it will be necessary to divide current tasks. In such cases, Table 2 applies the convention of dividing funds equally. Although this convention may be

Table 2. Suggested reallocation of current (18 April 1984) NEFC tasks to three proposed Divisions. Entries in the Table columns are (1) Current Year Operating Plan Number, (2) Division or Program Code[1], (3) Task Accounting Code, (4) Description of the Task, and (5) Funding Level in thousands of dollars. Total funding for the proposed Divisions and each Investigation is given for the suggested reallocation. An * indicates that a task has been assigned to more than one Investigation. In such case, funding has been arbitrarily divided equally between the Investigations.

| | | | | |
|---|---|---|---|---|
| A. | RESOURCE CONSERVATION & UTILIZATION DIVISION | | | $4,656K |
| A.1. | POPULATIONS DYNAMICS | | | 1,300K |
| 003 | 7 | 18L1C2A70 | FISHERY ANALYSIS/RAD MANAGEMENT | 36 |
| 003 | 7 | 18L1C2A7A | OFFSHORE FISHERY RESOURCES INVESTIGATION | 142 |
| 003 | 7 | 18L1C3A70 | FISHERY ANALYSIS/RAD MANAGEMENT | 20 |
| 003 | 7 | 18L1C3A7C | GEORGES BANK/GULF OF MAINE INVESTIGATION | 219 |
| 003 | 7 | 18L1C5A70 | FISHERY ANALYSIS/RAD MANAGEMENT | 142 |
| 003 | 7 | 18L1C5A74 | SURVEY OPERATIONS | 48 |
| 003 | 7 | 18L1C5A7M | CENTER STAFF ASSISTANT | 50 |
| 003 | 7 | 18L1C5A7S | ATLANTIC SALMON PROJECT | 100 |
| 003 | 7 | 13L1C5A7V | MULTISPECIES INVESTIGATION | 323 |
| 008 | 7 | 18L1A4B5J | STRIPED BASS (TRADE-OFF) | 20 |
| 018 | 7 | 18L1A5T70 | EAST COAST MARINE MAMMAL | 200 |
| A.2. | FISHERIES BIOLOGY | | | $1,295K |
| 003 | 7 | 18L1C2A7J | FISHERY BIOLOGY INVESTIGATION | 325 |
| 004 | 7 | 18L1A6A70 | SURVEY OPERATIONS | 558 |
| 006 | 5 | 18L1C5B50 | ECOSYSTEMS DYNAMICS - See B.1. | 182* |
| 009 | 5 | 28L1A6AM0 | OCEANIC GAMEFISH/APEX PREDATORS | 230 |
| A.3. | FISHERIES STATISTICS | | | $ 898K |
| 131 | 7 | 18L1B1A70 | COMMERCIAL FISHERIES STATISTICS | 69 |
| 131 | 7 | 18L1B1A7P | BIOSTATISTICS | 141 |
| 131 | 7 | 48L1B1A70 | COMMERCIAL FISHERIES STATISTICS | 348 |
| 131 | 7 | 48L1B2A70 | COMMERCIAL FISHERIES STATISTICS | 340 |
| A.4. | ECONOMICS | | | $ 97K |
| 152 | 12 | 18L1B2AV0 | ECONOMICS | 97 |
| A.5. | FISH QUALITY AND SAFETY | | | $ 427K |
| 150 | 8 | 68L3B4M8C | FISHERIES CHEMISTRY | 381 |
| 147 | 4 | 68L1A424J | ENVIRONMENTAL CHEMISTRY | 46 |
| A.6. | FISHERY TECHNOLOGY | | | $ 639K |
| 150 | 8 | 68C3B4M80 | RESOURCE UTILIZATION PROGRAM MANAGEMENT | 86 |
| 150 | 8 | 68L3B4M8T | FISHERIES TECHNOLOGY | 443 |
| 010 | 8 | 28L1A6A80 | SAMPLING & HARVESTING SYSTEMS DEVELOPMENT | 110 |

Table 2. (Continued)

| | | | | | |
|---|---|---|---|---|---|
| B. | FISHERIES ECOLOGY DIVISION | | | | $3,631K |
| | 014 | 5 | 28L1A6B50 | PLANKTON ECOLOGY/MED PROGRAM MANAGEMENT | 487 |
| | B.1. | ICHTHYOPLANKTON ECOLOGY | | | $1,235K |
| | | 012 | 5 | 18L1A4BM0 | LARVAL FISH DYNAMICS | 209 |
| | | 012 | 5 | 28L1A4BM0 | LARVAL FISH DYNAMICS | 236 |
| | | 012 | 5 | 48L1A4BM0 | MARMAP I TEMPORARY FUNDS | 2 |
| | | 006 | 5 | 48L1C5B50 | MARMAP I TEMPORARY FUNDS | 20 |
| | | 008 | 5 | 48L1A4B50 | MARMAP I TEMPORARY FUNDS | 7 |
| | | 009 | 5 | 48L1A6AM0 | MARMAP I TEMPORARY FUNDS | 2 |
| | | 014 | 5 | 28L1A6B5P | POLISH SORTING CENTER | 181 |
| | | 014 | 5 | 48L1A6B50 | PLANKTON ECOLOGY | 2 |
| | | 014 | 5 | 48L1A6B5P | MARMAP I TEMPORARY FUNDS | 4 |
| | | 031 | 5 | 18L1A6A50 | MARMAP I/BIOLOGICAL ASSESSMENT | 16 |
| | | 031 | 5 | 48L1A6A50 | MARMAP I/BIOLOGICAL ASSESSMENT | 343 |
| | | 037 | 4 | 28L1A424P | PHYSIOLOGICAL EFFECTS OF POLLUTANT STRESS | 3 |
| | | 006 | 5 | 18L1C5B50 | ECOSYSTEMS DYNAMICS - See A.2. | 182* |
| | B.2. | EXPERIMENTAL BIOLOGY | | | | $ 878K |
| | | 037 | 4 | 38L1A424P | PHYSIOLOGICAL EFFECTS OF POLLUTANT STRESS - See C.6 | 268* |
| | | 147 | 4 | 48L1A424F | BEHAVIOR OF FISHES AND INVERTEBRATES - See C. | 151 |
| | | 149 | 3 | 38L1A1L30 | AQUACULTURE PROGRAM MANAGEMENT | 126 |
| | | 149 | 3 | 38L1A1L3H | SPAWNING AND REARING OF MOLLUSCS | 140 |
| | | 149 | 3 | 38L1A1L3R | NUTRITIONAL REQUIREMENTS OF MOLLUSCS - See C.4. | 110 |
| | | 149 | 3 | 38L1A1L3L | AQUACULTURE GENETICS - See C.6. | 83* |
| | B.3. | FISHERIES GENETICS | | | | $ 0 |
| | B.4. | PATHOBIOLOGY | | | | $ 538K |
| | | 148 | 6 | 58L1A4260 | PATHOBIOLOGY PROGRAM MANAGEMENT | 102 |
| | | 148 | 6 | 58L1A426M | DISEASE AND ENVIRONMENTAL STRESS-See C.6. | 250* |
| | | 149 | 3 | 38L1A1L6W | CONTROL OF MOLLUSCAN DISEASE | 186 |
| | B.5. | SYSTEMATICS | | | | $ 289K |
| | | 080 | 11 | 78L1A3AN0 | NATIONAL SYSTEMATICS LABORATORY | 289 |
| | B.6. | MURT | | | | $ 204K |
| | | 017 | 2 | 18L1A4220 | MURT | 204 |
| C. | ENVIRONMENTAL PROCESSES DIVISION | | | | | $3,470K |
| | 147 | 4 | 48L1A4240 | ENVIRONMENTAL ASSESSMENT PROGRAM MANAGEMENT | 863 |
| | 154 | 12 | 18L1A4BV0 | REMOTE SENSING SYSTEMS | 93 |
| | 154 | 12 | 28L1A4BV0 | UNIFAX LINE/BIGELOW | 7 |

Table 2. (Continued)

| | | | | | |
|---|---|---|---|---|---|
| C.1. | OCEAN CLIMATE | | | | $ 505K |
| | 084 | 10 | 28L1A4BGO | OCEAN CLIMATOLOGY AND MONITORING | 455 |
| | 084 | 0 | 28L1A4BGS | URI REMOTE SENSING | 50 |
| C.2. | OCEAN DYNAMICS | | | | $ 425K |
| | 008 | 5 | 18L1A4B5O | FISHERY OCEANOGRAPHY/ENVIRONMENTAL STUDIES | 316 |
| | 008 | 5 | 28L1A4B5O | UNIFAX LINE/WH | 9 |
| C.3. | ENVIRONMENTAL CHEMISTRY | | | | $ 339K |
| | 147 | 4 | 48L1A424J | ENVIRONMENTAL CHEMISTRY | 339 |
| C.4. | BIOLOGICAL OCEANOGRAPHY | | | | $ 229K |
| | 147 | 4 | 48L1A424G | BIOLOGICAL OCEANOGRAPHY | 222 |
| | 147 | 4 | 28L1A424G | UNIFAX LINE/SH | 7 |
| C.5. | BENTHIC PROCESSES | | | | $ 295K |
| | 147 | 4 | 48L1A424E | COASTAL ECOSYSTEMS | 295 |
| C.6. | ENVIRONMENTAL BIOLOGY | | | | $ 714K |
| | 149 | 3 | 38L1A1L3L | AQUACULTURE GENETICS - See B.2. | 83* |
| | 089 | 3 | 38L1A4230 | CYTOGENETICS | 82 |
| | 037 | 4 | 38L1A424P | PHYSIOLOGICAL EFFECTS OF POLLUTANT STRESS - See B.2. | 268* |
| | 148 | 6 | 48L1A426M | DISEASE AND ENVIRONMENTAL STRESS | 31 |
| | 148 | 6 | 58L1A426M | DISEASE AND ENVIRONMENTAL STRESS-SEE B.4. | 250* |

[1]Division or Program Codes: 0 - Center, 2 - MURT, 3 - Aquaculture, 4 - Environmental Assessment Division, 5 - Marine Ecosystems Division, 6 - Pathobiology Division, 7 - Resource Assessment Division, 8 - Resource Utilization Division, 10 - AEG, 11 - National Systematics Laboratory, 12 - Assistant Center Directors

unrealistic, it is probably adequate to indicate the relative size of the investigations and divisions suggested in Table 2.

It is suggested that four current tasks be divided. At present, the Ecosystems Dynamics Task (18L1C5B50) serves two functions. It conducts laboratory analyses of fish stomachs which have been collected during research vessel trawl surveys, and it develops models and conducts statistical analyses. It is suggested that the former be reallocated to the Fisheries Biology Investigation (A.2) and the latter to the Ichthyoplankton Ecology Investigation (B.1) where it will focus on models of recruitment processes (see Appendix V).

Components of the current Physiological Effects of Pollution Stress Task (38L1A424P) and Diseases and Environmental Stress Task (58L1A426M) are monitoring and conducting studies to validate biological indicators. It is suggested that these functions be reallocated to the Biological Indicators Investigation (C.6) and that the remainder of these two tasks be reallocated to the Ichthyoplankton Ecology Investigation (B.1) and the Pathobiology Investigation (B.4), respectively.

The current Aquaculture Genetics Task (38L1A1L3L) is conducting selective breeding experiments on oysters. While it is important to maintain these oyster cultures (see Appendix VIII), it is suggested that a component of the task be reallocated to the Biological Indicators Investigation (C.6). The Experimental Biology Investigation (B.2) should assume responsibility for oyster cultures. In fact, these laboratory populations may prove to be a useful experimental animal.

None of the tasks considered in Table 2 are suggested for reallocation to the Fisheries Genetics Investigation (B.3). This is because none of them have the necesary population genetics expertise. There are resources elsewhere

within the NEFC which are being used to conduct research in the area of population genetics, but the level of funding is low relative to the size of the suggested investigations of Table 2. Therefore, unless there is a significant reprogramming of funds in order to conduct population genetics research, responsibility for this function should be assigned to either the Experimental Biology Investigation (B.2) or the Population Dynamics Investigation (A.1). The choice depends on the emphasis of population genetics research (i.e., experimental versus analytical).

This report makes no recommendations for the reallocation of resources into the Research Coordination Office and the Administrative Support Office. It is assumed that the Research Coordination Office will be small relative to the proposed divisions. It is anticipated that it will include personnel drawn from throughout the NEFC.

With regard to the Administrative Support Office, it is assumed that current tasks of the Center Directorate and Laboratory support will be reallocated. If the Center makes the decision to operate a coastal research vessel in the cooperative mode with states, then reprogramming of resources will be necessary.

## Relationship of Proposal to Organization Concerns

The proposed restructuring of the NEFC organization and the suggested reallocation of tasks addresses the organization concerns identified in Table 1. The proposal reduces supervisory responsiblity of the NEFC Director to three Division Chiefs, two Office Directors, Deputy Center Director, and personal staff (e.g., secretary). This is a reduction of greater than 50%. The proposal also reduced the disparity in the size of the programs at the Division level. According to the rough estimates in Table 2, the range will

be from about 3.5 to 4.7 million dollars. The disparity between the size of investigations is greater, but still less than the order of magnitude differences that exist in the current organization.

The proposed organization ignores laboratories (except as facilities to conduct research). Tasks are organized into multidisciplinary divisions in order to solve problems. A focal point for scientific leadership and coordination is achieved by establishing an office for this purpose.

The proposal is for a vertically integrated organization. This should facilitate integration of research concerning the effects of fishing, natural environmental factors, and anthropogenic agents. In particular, habitat conservation-pollution research will be addressed more in the context of fisheries ecology.

The proposal provides a focal point for modeling, i.e., the Office of Research Coordination. On the other hand, it does not consolidate modeling activity. The suggested reallocation of tasks provide for some modeling capability within each of the proposed divisions (i.e., Investigation A.1 of the Conservation and Utilization Division, Investigation B.1 of the Fisheries Ecology Division, and Investigation C.2 of the Environmental Processes Division).

It is proposed that economics research be included in the Conservation and Utilization Division. This will facilitate contact with resource assessment and resource utilization activity.

The proposal includes a Recreational Fishery Coordinator. It does not recommend establishing a recreational fisheries unit.

The physical oceanographic research of the NEFC will be consolidated within the Environmental Processes Division according to the proposal. This will improve coordination and result in some efficiencies. It is proposed

that remote sensing activity also be consolidated within the Environmental Processes Division.

According to the proposal, a centralized automated data processing unit would be maintained. Nevertheless, divisions and investigations would assume greater responsibility for their own needs.

The proposal will consolidate all of the field-oriented research on juvenile and adult fish within the Fisheries Biology Investigation. It will also consolidate benthic studies of the Center within the Benthic Processes Investigation. Although the analytical and population dynamics-oriented staff of the Center will remain highly concentrated in a single investigation, the Research Coordination Office will be capable of providing some quantitative support to the other investigations.

According to the proposal, the Manned Undersea Research and Technology Unit will be incorporated into the Fisheries Ecology Division while retaining its identity. Through close association with the Experimental Biology Investigation, it should focus its research on in situ experiments addressing recruitment processes of molluscan bivalves.

# MISSION

## NEFC Mission Statement

Recently the NEFC, with the approval of the National Marine Fisheries Service, has adopted the following mission statement:

> Under the National Marine Fisheries Service mission of "Achieve a continued optimum utilization of living resources for the benefit of the Nation," it is the responsibility of the Northeast Fisheries Center to plan, develop, and manage multidisciplinary programs of basic and applied research designed to:
>
> 1. better understand the living marine resources (including marine mammals) of the Northwest Atlantic Ocean and the environmental quality essential for their existence and continued productivity;
> 2. describe and provide to management, industry, and the public, options for the utilization and conservation of living marine resources and maintenance of environmental quality which are consistent with national and regional goals and needs, and international commitments.
>
> To fulfill its mission the Center shall: (1) develop the scientific basis to determine and provide information on the status of stocks/ populations of living marine resources, the status of fisheries for exploited species, the effects of pollution and human alterations on the habitats of the resources, the effects of environmental variability, the quality and safety of fishery products, and the enhancement of anadromous fishery resources; (2) collect, document, and interpret scientific and economic data as technical support for management plans, international negotiations, and fishery development programs; (3) provide technical advice, review, and monitoring of fishery plans and grant programs; (4) pursue fundamental research on specified topics; and (5) maintain strong relations with the academic community and the industry (through grants, contracts and cooperative programs as appropriate) and with the users and the general public. The Center shall cooperate with the other Fisheries Centers of the National Marine Fisheries Service in the sharing of expertise and in multi-Center programs consistent with national goals and needs and international commitments.

Evaluation of Mission Concerns

The Committee of Three considered each of the six mission concerns listed in Table 1 in light of the NEFC mission statement.

M.1. The Committee of Three's discussion of the concern that NEFC aquaculture research for the purpose of food production is beyond the mission of the National Marine Fisheries Service was guided by Appendix VII. The Aquaculture Division contains unique expertise which can be used for other purposes, while still conducting some basic research which is relevant to the aquaculture industry. The NMFS policy statement on aquaculture authorizes liaison activity for the transfer of results of research to the industry.

The Committee of Three considered six options for reprogramming the Aquaculture Division. Based on the information contained in Appendix VII, COT recommends that the division be reprogrammed to conduct experiments primarily for the purpose of understanding the processes that determine recruitment of valuable molluscan shellfish. According to the proposed reorganization plan described earlier, components of the Aquaculture Divison which are now conducting experiments on molluscan bivalves, including resources from the Aquaculture Genetics Task that are necessary to maintain oyster cultures, will be reallocated to the Experimental Biology Investigation (B.2). The remainder of the genetics research of the Aquaculture Division will be allocated to the Biological Indicators Investigation (C.6). Aquaculture research concerning the control of molluscan diseases will be reallocated to the Pathobiology Investigation (B.4).

M.2. It is clear that research concerning quality and safety of fishery products is within the NEFC's mission (see Mission Statement). The question is, to what extent is utilization technology research for the purpose of developing new products or more efficient harvesting and processing methods

within the mission? It has been argued that research and development of this nature is the responsibility of the private sector.

The mission of the National Marine Fisheries Service is to achieve a continuing optimum utilization of living marine resources for the benefit of the nation. It is clear that this objective will not be achieved for some of the resources of the Northeast Region without technological help from the National Marine Fisheries Service (see Appendix XI). The problem is inherent in the infrastructure of the industry. The industry is dependent on a common property resource which fluctuates widely. This causes uncertainty in the availability of traditional and nontraditional fishery resources, thus adding to the uncertainty of achieving an adequate return on research and development investment. Furthermore, the industry is composed of relatively small companies which cannot afford to maintain research capability. They compete with import products which are subsidized by foreign governments. From the point of view of major U.S. manufacturers, the fishing industry represents a relatively small market. Therefore, there is little incentive outside the fishing industry for developing new technology. For example, the U.S. refrigeration industry has little incentive to develop at-sea refrigeration from an engine exhaust heat exchanger.

Therefore, the Committee of Three concludes that research concerning utilization technology is within the NEFC mission to the extent it is necessary to achieve continuing optimum utilization of living marine resources of the northeast region. COT recommends that the proposed Utilization Technology Investigation (A.6) adopt a set of criteria for evaluating to what extent its research projects could be achieved by private industry. These criteria would be used as one basis for judging whether an individual project was within the NEFC mission.

M.3. Some NEFC research concerns inshore species or habitats which are not subject to federal jurisdiction. This situation is particularly common for research concerning pathology and habitat conservation.

The Committee of Three considered the role of the NEFC in coastal and estuarine waters. It concluded that the NEFC and NMFS mission merits significant attention to inshore waters in cooperation with states. Inshore activity is appropriate when it concerns: 1) fishery resources which are also important to the exclusive economic zone (EEZ), 2) critical habitat of species of the EEZ, 3) species or habitat issues of interjurisdictional importance, particularly those relevant to the Atlantic States Marine Fisheries Commission (ASMFC), and 4) problems which require unique scientific expertise that it is impractical for individual states to maintain. With regard to criteria number four the NEFC has provided an ad hoc disease screening and diagnosis service for organisms exchanged between ecosystems. The service is necessary because individual states lack expertise, and the health of entire ecosystems could be threatened by the careless introduction of a disease. COT recommends that the NEFC formalize research to develop health standards and work with states through ASMFC to formulate a plan for applying these standards.

There is evidence that estuaries are viewed as being increasingly important to federal activity (e.g., the development of a NOAA policy statement on estuaries). The reaffirmation of a NMFS commitment to recreational fisheries problems also requires greater emphasis on inshore waters. COT notes that the Recreational Fisheries Working Group (see Appendix XII) recommended that the NEFC support a coastal research vessel to conduct inshore fishery resource surveys cooperatively with states. The NEFC should consider expanding this effort beyond resource surveys to include habitat conservation and disease studies.

M.4. The appropriateness of the NEFC leadership in the development of NOAA technology for manned underwater research and technology has been questioned. The Committee of Three concluded that this concern should be addressed within NOAA, not the NEFC. Most of the operational support for MURT comes from NOAA and private sources. The NEFC receives adequate benefit from the availability of the unique expertise of MURT to justify personnel costs. COT recommends that MURT develop a plan for research on recruitment processes of molluscan bivalves.

M.5. The NEFC is conducting research concerning the "sources" and "fates" of anthropogenic agents (see Appendix VI), although other federal agencies have primary responsibility for such research. The Committee of Three concluded that the NEFC has inadequate resources to investigate all aspects of the "source," "fate," and "effects" problems of pollution. Furthermore, the NEFC has unique capability and responsibility for the "effects" part of the problem. Therefore, the NEFC should not dilute its effort by focusing on "sources" and "fates." Unfortunately, the NEFC has found it necessary to monitor anthropogenic agents (i.e., characterize "fates" and to a lesser degree identify "sources") in order to describe the chemical environment responsible for observed biologial effects. Ideally, this chemical monitoring should be carried out by other agencies.

M.6. The NEFC has taken a lead role in the development of remote sensing capability in the northeast region. The special Board of Directors meeting on remote sensing (Appendix XIV) considered whether this role was within the NEFC mission. The conclusion was that access to remote sensing data is a NOAA responsibility and that the NEFC lacks the resources to carry on alone without greater NOAA support. Therefore, the Committee of Three recommends that the

NEFC be a leader in the application of remote sensing technology to fisheries problems, but not in the development of the technology itself.

## PERFORMANCE

The Committee of Three considered each of the 13 performance concerns listed in Table 1.

P.1. The NEFC collects a vast quantity of data. Concern has arisen that all of the data may not be necessary or that information content is not fully utilized. It was difficult for the Committee of Three to evalute the former. The value of the data depends on the question it was intended to answer. Therefore, it is important to reassess data collection programs as questions evolve. An important role of the Research Coordination Office will be to continuously probe to determine how much data are enough. When specific questions are raised, it should be the responsibility of programs to carry out the analyses necessary to provide answers.

The question of how many age determinations of fish are necessary in order to conduct population dynamics research has been raised within the NEFC and elsewhere. Are there alternative models which require fewer age determinations? Are there more effective sampling designs? Answering these questions should be given a high priority.

The Committee of Three concluded that the NEFC is not fully utilizing the data it collects. An important part of the problem is data base management and access. COT recommends that the programs collecting data be held accountable for its management. It is necessary to place greater emphasis on the thorough analysis of existing data bases. Greater emphasis should be

placed on more thorough analyses of research vessel bottom trawl survey data, physical oceanographic data, food habits data, and ichthyoplankton data.

P.2. Progress toward the development of a dynamic multispecies simulation model which takes account of trophic interactions has been low (see Appendix V). The Committee of Three identified several problems:

1. Unrealistic expectations concerning the use of models;
2. Access to data, particularly food habits;
3. Inadequate understanding of fisheries management issues that might be addressed by multispecies models;
4. Inadequate understanding of stock assessment results and methods which are critical components of a multispecies model;
5. Lack of a critical mass to carry out model development, particularly since the Chief of the Ecosystem Dynamics Investigation has been given ad hoc assignments almost continuously;
6. Less than perfect cooperation with the Resource Assessment Divison, resulting from both over-commitment of the Resource Assessment Division and adverse reaction to the "think tank" perception of the modeling group.

COT notes that the current Resource Assessment Division has increased its multispecies fishery modeling capability substantially in the last few years. COT recommends that this capability, as part of the proposed Population Dynamics Investigation (A.1) assume responsibility for multispecies models. These models are a logical extension of multispecies stock assessments. The problem of access to food habits data should be partially alleviated by the proposed reallocation of the function to the Fisheries Biology Investigation (A.2). This will facilitate linkage of food habits and

bottom trawl survey data bases. The Research Coordination Office should coordinate modeling activity throughout the NEFC.

P.3. The NEFC has a substantial research effort in physical oceanography (about $1,000,000 per year). This effort has been necessary because the physical oceanography of the northeast continental shelf had been neglected by academia until recently. Descriptive and process-oriented studies were necessary in order to characterize the environment of fish eggs and larvae in relationship to their survival.

Nevertheless, the Committee of Three is concerned about the NEFC's physical oceanographic research. The NEFC (particularly the Fishery Oceanography Task) has been slow to analyze its data. Yet collection continues without an evaluation of the data's usefulness. NEFC is reluctant to use numerical models as a framework for analyzing data. Such models are increasingly used by other researchers concerned with the physical oceanography of the northeast. The NEFC should evaluate these models rigorously against the data that it has collected. Since it is impractical to routinely monitor variability in ecologically important physical features of the continental shelf, models are necessary so that the system can be simulated from more easily monitored forcing variables (i.e., wind stress, pressure gradients).

COT recommends that the NEFC place more emphasis on analysis. The potential for numerical models should be reconsidered; this might be done in cooperation with academia or other federal agencies. An overview should be developed in order to identify the most critical questions. The overview should consider research problems concerning the dispersion of contaminants and physical mechanisms that might relate to variability in the survival rate of post-larval fish.

P.4. The NEFC should make more rapid progress toward determining the effect of habitat degradation on fisheries. The Committee of Three recognizes that this is a difficult problem. Yet the current research effort is too diffuse and inadequately coordinated. There is not enough emphasis placed on biological indicators with the potential for interpretation in terms of population and fishery effects.

The Committee of Three concluded that it is time to design and implement a new plan. The plan should have three foci: monitoring, experimental studies, and synthesis. Experimental studies and synthesis should be focused on "case studies." The results of monitoring should be instrumental in identifying the case studies. More emphasis should be placed on experiments on early life stages and the reproductive response of adults.

The proposed restructuring of the NEFC organization will result in an integration of environmental assessment-oriented research with research in fisheries ecology. COT considers this integration necessary in order to make both types of research more effective.

Additional information concerning NEFC environmental assessment activity is given in Appendix VII.

P.5. Much of the research of the NEFC is relevant to recreational fisheries problems, but this is not perceived by the recreational industry. The Committee of Three convened a recreational fisheries working group to address the problem. COT concurs with the recommendations of the working group (see Appendix XII).

NEFC research relevant to recreational fisheries problems should remain integrated with the other activities of the Center. A Recreational Fisheries Coordinator should be formally appointed. The NEFC should support regionalization of the recreational fisheries survey. Additional funds will

be required. The NEFC should consider the operation of an inshore survey vessel in cooperation with states.

P.6. The NEFC ADP Technical Review (Appendix IX) indicated several problems. Many of the problems relate to centralization of ADP capability and responsibliity. The Committee of Three recommends decentralization. The programs that collect data must be held accountable for its maintenance and for development of adequate systems for access. While some of the funds currently allocated to the Center ADP Unit should be reallocated to research programs, it must be recognized that the total level of funding of ADP activity within the NEFC is inadequate. Therefore, research programs will have to use a greater proportion of their funds to support ADP needs in the future.

COT also recommends that the NEFC reexamine the role of microcomputers. Since microcomputer technology is advancing rapidly, it will probably be necessary to contract for expertise in this field.

P.7. The utility of broad-scale ichthyoplankton survey data has not yet been rigorously analyzed. Appendix III reviews the status of analyses of these data and proposes future studies.

The Committee of Three recommends that computer simulations be implemented in order to evaluate the accuracy and precision of back-calculated estimates of spawning biomass derived from larval catches (see Item 3 of Appendix III). COT believes that broad-scale ichthyoplankton survey data have many uses in addition to back-calculation of spawning biomass.

P.8. The NEFC has conducted standardized bottom-trawl surveys for about 20 years. The survey design, use of the data, and the method of analysis is relatively static.

The Committee of Three recommends that the proposed Conservation and Utilization Division convene a working group to evaluate standardized bottom-trawl surveys. Several questions need to be addressed. Are there gear changes that are necessary or feasible? Should strata boundaries be changed? What are the relative merits of random sampling versus fixed station sampling? Is the current sampling intensity appropriate? What are the sources of variability, and can some of them be taken account of in order to increase the precision of results? What multispecies aspects of the data base are being overlooked?

With regard to sources of variability, the Committee of Three suspects that trawl performance is an important component. The cost for instrumentation to continuously monitor trawl performance is low relative to the cost of conducting surveys. COT recommends that this capital expense be given a high priority.

P.9. The perception is that resource assessment activity places a heavy emphasis on conducting more than 40 single species assessments of current status, and that this emphasis detracts from its capability of addressing more long-term scientific problems. In reality, most of the assessment effort is directed at about 10 species, and these assessments are perceived necessary by Regional Fishery Management Councils, the Atlantic States Marine Fisheries Commission, and/or the Regional Office. Unfortunately, the Resource Assessment Division staff often finds itself in a reactionary mode attempting to fulfill short-term needs (including environmental impact statements, international treaties and negotiations, and interdisciplinary working groups of the NEFC). The problem could be acutely exacerbated, depending on the settlement of the USA-Canadian Boundary Dispute.

For whatever reason, Resource Assessment Division staff are overcommitted and have not been able to make an adequate investment in identifying and solving long-term problems.

The Committee of Three recommends that the Resource Assessment Division staff conduct an inventory of their activities. From this inventory a prioritized work plan should be developed. Greater priority should be given to solving longer-term scientific problems. In order to do so, either additional resources will be necessary or assessment staff will have to be less responsive to perceived short-term needs.

P.10. There is a perception that Resource Assessment Division scientists have relatively little interaction with the rest of the NEFC. In spite of the overcommitment of Resource Assessment Division staff, the Committee of Three felt that the interactions of assessment scientists beyond their division are comparable to those of other scientists within the NEFC. The problem is that interaction with the Resource Assessment Division is particularly important because of the need to relate the results of the rest of the Center to fisheries management problems and because of the dependence of other divisions on the population dynamics-oriented capability of the Resource Assessment Division. The problem will be partially alleviated by the Research Coordination Office and by the Resource Assessment group (proposed Population Dynamics Investigation A.1) addressing its overcommitment problem.

P.11. The Fisheries Economics Research effort of the NEFC is modest and a long-term plan is lacking. The Committee of Three supports the NEFC decision to increase its research effort. Questions concerning the factors that determine entry and exit from a fishery are important. These factors determine the nature of feedback control within a bioeconomic system, and are important to fisheries management strategy.

P.12. NEFC Pathobiology research needs to provide more information relative to natural mortality during all life stages. At present, the Pathobiology Division is in a qualitative mode. It is not enough to describe diseases, it is necessary to estimate their incidence and mortality rates.

The Committee of Three concludes that the current disease monitoring program during research vessel bottom trawl surveys is not an effective means of estimating natural mortality. The frequency of disease is low, and the relationship of the diseases that are detected to mortality is unknown. Experiments need to be conducted to determine the mortality rate of the most common diseases. These studies should also indicate symptoms of dying fish. If feasible, future monitoring should be directed at fish with unhealthy symptoms.

P.13. The public and constituencies are not aware of NEFC activities and results. The Committee of Three concludes that the NEFC needs a greater outreach effort. Most scientists are not effective communicators to a lay audience. Those that are effective are usually fully committed to other activities. COT recommends that some NEFC staff be dedicated to information transfer. COT notes that NEFC port agents have a good rapport with the commercial fishing constituency. Therefore, they should be viewed as a distribution network for information products.

## DISCUSSION

The Committee of Three evaluated expressed and implied concerns about the Northeast Fisheries Center relative to its organization, mission, and performance. It recommends restructuring the NEFC Table of Organization, reprogramming resources currently used for activities which are beyond the

NEFC mission, and alternative research strategies to improve performance. Although these recommendations are based on a thorough evaluation of a vast amount of information, the Northeast Fisheries Center is a complex research institution. Therefore, the Committee of Three recommends that the report be reviewed and discussed with senior Center scientists.

The performance of NEFC is critically dependent on coordinating its activities. The proposed restructuring of the organization is intended to facilitate coordination. But the proposed three divisions are large, and while this alleviates some of the burden of coordination by the Directorate and the Research Coordination Office, it increases the coordination responsibility, within divisions, of the directors. Within divisions, the proposed investigations will be interdependent. For example, investigations which are responsible for routine data collection (research vessel bottom trawl surveys, fisheries statistics collections, etc.) will depend on other investigations for staffing cruises or evaluating alternative sampling designs.

Integration and coordination is as much or more a matter of effective communication as organization. The distributed nature of the Center requires that we promote common objectives which will bring people more together in a working relationship. One means of doing this might be to form ad hoc ecosystem groups, with a leader, to draw together the various elements which contribute to its description and evaluation. Thus, for example, a Gulf of Maine group would be composed of people contributing data and information on statistics, environment, resources, fisheries, etc., with the objective of describing the system and advising on the area's management and conservation issues. A common product and activity could be identified. Other groups outside the Center could also be effectively included for greater benefit to

all. This approach is an expansion of the water management unit concept that has evolved from the RAP process.

Some of the recommendations of the Committee of Three may be viewed as idealistic. While the Committee considered the scientific capability of the current staff to be adequate to support the mission, it minimized its consideration of their location and specific attributes. These practical considerations are important, and could affect the extent and process by which some of the Committee's recommendations can be implemented at present. The Committee felt that it was important not to limit its thinking by current practical constraints, so that future goals could be identified.

The proposed organization has important implications for the grade structure of the Center. At present, all but one of the Grade 15 positions are supervised by the Center Director. Past interpretations by NOAA personnel classifiers have required supervision of Grade 15 positions by the Center Director in almost all cases, and have indicated overlapping responsibilities of some. If these interpretations are applied to the proposed organization, NEFC may be limited to substantially less than the present number of Grade 15 positions (including the Deputy Center Director).

The Committee of Three feels that while the number of Grade 15 positions in NEFC must be based on accepted Office of Personnel Management classifications, the responsibilities, workload of the Center, and its level of scientific sophistication require highly responsible scientists with the nature that merits a Grade 15, at about the current numbers. The Committee sees the grade level of the proposed investigations as either Grade 14 or 15, depending on the level of scientific capability required to do the job, and the scientific prestige (Factor IV) of the incumbent. It also recognizes the

need for Grade 14/15 positions to accommodate highly qualified scientists who want to continue active research without supervisory duties.

One conclusion of the NEFC Program Review was that there was a need for more interaction with academia, other Centers, Fishery Management Councils, and Sea Grant. Since this conclusion is not considered explicitly within the body of this report, it is highlighted here. The Committee notes that the Center has established or is pursuing several cooperative agreements with academic institutions. It is important that these continue to be used to facilitate cooperation and mutual benefits. Some NEFC laboratories are located within academic settings--with natural affinities for sharing resources. Other unversities provide expertise that NEFC cannot maintain.

There is a need for a formal vehicle for interaction with scientists of other Centers. At one time, NEFC proposed an annual NMFS Research Meeting. This proposal deserves reconsideration.

The recommendations of the Committee of Three require either additional or reprogrammed resources. Additional funds are needed for economic studies; implementation of a regional recreational fisheries statistics collection program, remote data entry from ports, and state/federal statistics collection; upgrading of resource survey technology; and dedicated staff as coordinators and communicators. If NEFC decides to operate a coastal research vessel in cooperation with states, or to implement a program in population genetics, still further resources will be necessary. If the overcommitment of Resource Assessment Division scientists cannot be alleviated, then additional staff will be necessary. It is clear that NEFC needs to commit more resources to automatic data processing, although at some point ADP should pay for itself.

The Technical Review of Environmental Assessment Activity indicated that NEFC could conduct in the long run a more effective monitoring and research program with less resources. This is particularly true if other components of NOAA and the federal government assume greater responsibility for the "source" and "fate" parts of the problem. The Committee of Three also concluded that physical oceanographic research should switch from a field to an analytical mode, at least until existing data has been evaluated.

If the Aquaculture Division is reprogrammed to experimental biological research on molluscan bivalves to address recruitment processes, it is probably possible to conduct the most critical experiments concerning recruitment processes of molluscan bivalves at a lower funding level than is currently used for aquaculture research. All of these will produce some savings, but probably not to the extent necessary.

Ultimately, it is probably necessary for NEFC to consolidate its laboratories. It will save funds used for administrative support, and allow greater flexibility in determining the size of the programs. At present, there is a tendency to maintain a minimum staffing level in each facility, thus distorting program emphasis.

The question of consolidation of laboratories raises a more general issue of how large should the NEFC be. It is the perception of COT that NEFC resources are barely adequate to fulfill its mission. Yet the demand for NEFC products continues to expand. Even if additional resources were made available, there is a question how large and diverse a Center is manageable. COT doesn't have any answers for these questions, but considers them important.

This report focuses on problems and proposed solutions. Nevertheless, it is the unanimous conclusion of the Committee of Three that NEFC is a healthy

institution which is fulfilling an essential part of the mission of NMFS. The Committee has taken the criticisms as constructive, and hopes that it has pointed the way for NEFC to remain vital for the next decade of its existence.

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