

Not to be cited without  
permission of the authors<sup>1</sup>

Canadian Atlantic Fisheries  
Scientific Advisory Committee

CAFSAC Research Document 86/9

Ne pas citer sans  
autorisation des auteurs<sup>1</sup>

Comité scientifique consultatif des  
pêches canadiennes dans l'Atlantique

CSCPCA Document de recherche 86/9

## **Attempts to Integrate Biology and Socio-Economics Within CAFSAC**

by

R. Mahon

Marine Fish Division  
Bedford Institute of Oceanography  
P.O. Box 1006, Dartmouth  
Nova Scotia B2Y 4A2

<sup>1</sup>This series documents the scientific basis for fisheries management advice in Atlantic Canada. As such, it addresses the issues of the day in the time frames required and the Research Documents it contains are not intended as definitive statements on the subjects addressed but rather as progress reports on ongoing investigations.

Research Documents are produced in the official language in which they are provided to the Secretariat by the author.

<sup>1</sup>Cette série documente les bases scientifiques des conseils de gestion des pêches sur la côte atlantique du Canada. Comme telle, elle couvre les problèmes actuels selon les échéanciers voulus et les Documents de recherche qu'elle contient ne doivent pas être considérés comme des énoncés finals sur les sujets traités mais plutôt comme des rapports d'étape sur les études en cours.

Les Documents de recherche sont publiés dans la langue officielle utilisée par les auteurs dans le manuscrit envoyé au secrétariat.

### Abstract

At the inception of CAFSAC there was recognition of the need for integration of biology and economics in fishery management. Since then, there have been several attempts at such an integration. These have included suggestions of appropriate organizational structures, and the initiation of pilot projects in Newfoundland and Maritimes Regions. These efforts have failed to have any continuing effect on the advisory process. Lack of input from economists, and the perception on the part of CAFSAC that biologists should not divert their effort into study of the economic aspects of fisheries, are the main reasons for the failure to integrate biology and economics. Individuals continue to pursue these lines of research but there is still no appropriate forum for evaluation of their work.

### RESUME

Au moment de la création du CSCPCA, on avait pris conscience de la nécessité d'intégrer la biologie et l'aspect économique dans la gestion des pêches. Depuis lors, plusieurs tentatives ont été faites dans cette voie. On a, notamment, proposé la mise sur pied de structures organisationnelles adéquates et lancé des projets pilotes à Terre-Neuve et dans la région des Maritimes. Ces efforts n'ont toutefois pas eu d'effets durables sur le processus consultatif, l'intégration ayant échoué principalement à cause, d'une part, de l'insuffisance de l'apport des économistes et, d'autre part, de la position du CSCPCA selon laquelle les biologistes ne devraient pas détourner leurs efforts vers l'étude de l'aspect économique des pêcheries. Bien que certaines personnes continuent individuellement à oeuvrer dans cette direction, on ne dispose toujours pas des moyens appropriés d'évaluer leur travail à cet égard.

## Introduction

The first CAFSAC Advisory Document (CAFSAC 1980) declares that:

"The Steering Committee must ensure that CAFSAC does not confine itself to setting TACs on year-by-year stock assessments. It must strive to incorporate a considerable future orientation into its activities and reflect that, in the form of options, in its advice. It must also strive to bring the broadest interpretation of fisheries science into the main stream of direct advice through consolidation and integration."

This document lists a "consideration of fisheries socio-economic modelling", among the necessary activities of CAFSAC. Ultimately terms of reference refer only briefly to economic objectives, but, the responsibility of CAFSAC in taking the initiative for progressive management is quite explicit (Appendix 1).

Since its inception, CAFSAC in particular, and Atlantic fisheries in general, have experienced several attempts at integrating biological and socio-economic analyses in support of management advice.

The purpose of this review is to provide a brief account of relevant activities of CAFSAC, of the ideas which have emerged, and of the fate of attempts to put some of the ideas into action.

## Integrating Biology and Economics

October 1978: The first significant activity by CAFSAC in the direction of integration of biological and economic advice was sponsorship of a special session entitled "Integration of Biological and Economic Input to Fisheries Management" held on October 27th, 1978, and attended by both biologists and economists. The introduction to the unpublished session report reads as follows:

"In July of 1975 the federal Cabinet considered and approved a new orientation for fisheries management and development. The new approach was summarized in the public document, 'Policy for Canada's Commercial Fisheries,' in May of 1976.

Among the policy objectives identified in Annex 1 of that document are three of particular significance.

1. Incorporation in resource-management models, not only of biological and environmental, but also of major social and economic components of the system.
2. Basing total allowable catches (TACs) and annual catch quotas on economic and social requirements (including the requirements for stability), rather than on the biological-yield capability of a fish stock or stocks.
3. An equitable distribution of access to resource use among geographic areas and groups, eg. vessel and gear types.

Although some tentative "first steps" have been made in this direction over the past three years, the more urgent critical issues of the day have tended by and large to detract from significant progress. For example, the intensive preparations and program

development prior to and after the extension of jurisdiction on January 1, 1977, have involved essentially the same regional and headquarters staff in Fisheries and Marine Service who would have been expected to lead the development of new approaches towards social and economic optimization of the resource. Accordingly, for the Atlantic fisheries little or no progress was made from 1975 to 1978 on the achievement of these policy objectives.

During the latter part of 1977 the former SADM of Fisheries and Marine Service launched a project on the "Enhancement of Management Capability" for the purpose of orienting fisheries managers towards an increased recognition of the social and economic dimensions of management. Part of this project was the organization of the Powell River, B.C. seminar on "Managing Fishing Effort" in August of 1978. That seminar, attended by leading fisheries economists from academic and international circles and including several FMS staff, reviewed the state-of-the-art of fisheries economics and the Proceedings serve to provide a useful background document. A follow-up in-house seminar is currently being planned for early 1979 in Atlantic Canada.

A second related initiative undertaken in 1978 was the review of FMS Extension of Jurisdiction research, surveillance and enforcement programs, and the development of a bio-economic methodology for a benefit/cost analysis of departmental management programs. This review and analysis involved some 40 to 50 regional and headquarters biologists, economists and resource managers. It resulted in a Treasury Board Submission titled, "Economic Development of Canada's Offshore Fisheries - Resource Management" (EDCOF), and succeeded in gaining approval for \$21 million and 268 person-years for departmental offshore programs in 1979-80."

The session continued with three presentations and concluded with a discussion.

Paper 1: Towards an optimum yield - a bio-economic approach to offshore fisheries management, by W.G. Doubleday. The results of the bio-economic modeling undertaken as part of the EDCOF analysis were presented. They address the general issue of how the management of stock biomass can be undertaken in economic terms.

Paper 2: Control of access and dissipation of economic rent, by D.A. Pepper. A brief overview of the fundamentals of fisheries economic theory including the concepts of Maximum Economic Yield (MEY) and economic rent was provided.

Paper 3: Resource Harvesting Policy, by D.R. Bollivar. This was a report on the recently completed Atlantic Fleet Development Study resulted in the following general recommendations: (a) starting for the 1980 Fishing Plan, the government should change the basis of resource management to one that introduces in a major way the economic considerations of resource harvesting, (b) the need for government financial assistance must be eliminated, and (c) there is a need to increase the independent ownership of the fishing fleet.

During the discussion it was generally agreed that there was a strong need to develop the capacity to integrate biology and economics. Opinions differed on the appropriate degree and extent of CAFSAC involvement and how this additional responsibility would affect CAFSAC's primary mandate of providing scientific advice to management. It was generally agreed that neither headquarters nor the regions had a well-developed economic analysis capacity and that a major additional problem would be development of the

social and economic data bases.

The session report outlined three options, and their pros and cons, for achieving the integration of biological and economic input to fisheries management (Appendix 2). In response to these two further options were proposed (Appendix 2). Briefly the five options were:

- 1) An economic analysis component within CAFSAC.
- 2) A bioeconomic analysis component within CAFSAC.
- 3) A new parallel organization, the Canadian Atlantic Fisheries Economic Advisory Committee.
- 4) Integration on a project by project basis dictated by need.
- 5) Interdisciplinary planning group for Atlantic Coast Fisheries Management (outside CAFSAC).

January 1979: The session report was reviewed at a special meeting of participants with the CAFSAC Steering Committee. This meeting noted that the widespread application of bioeconomic considerations implied in the first three options of the above would require more resources than presently available. It was also observed that although CAFSAC represented a mature biological organization for the giving of management advice and had recently been enhanced by the allocation of additional resources for the extension of fisheries jurisdiction, departmental economic analysis units had not been comparably enhanced. Integration of biology and economics was seen as a complex area of applications where progress could best be made step by step through the achievement of precise objectives. Hence, the Steering Committee concluded that it was too early to implement the structural options and that these should be the subject of further discussion after experience had been gained from specific case studies.

The meeting recommended the establishment, under the auspices of CAFSAC, of a working group with core membership of one biologist and one economist from each Atlantic region and Ottawa, and the following terms of reference (Some economists expressed reservations about the proposed reporting relationship):

- (1) The working group should examine general prospects for the incorporation of social and economic considerations into management advice.
- (2) The working group should carry out detailed bioeconomic analysis aimed at the provision of management advice for two or three selected fisheries.
- (3) The selected fisheries should be chosen on the basis of availability of data, expertise, and high probability of success.

CAFSAC Steering Committee supported the recommendation, and the working group was set up as detailed above.

### Deciding on Specific Pilot Projects

February 1979: The working group met. The economic representative from the Maritimes region advised that his attendance at the meeting was in the role of "observer" as the Region could not participate due to lack of man-power and other unresolved issues. Notwithstanding this lack of unanimity, it was agreed to proceed to consideration of agenda items.

After much discussion of possible alternatives, the following projects were selected:

1. The Grand Banks flatfish fishery.
2. Bay of Fundy scallop fishery.
3. Bay of Fundy herring fishery.

The Grand Bank Flatfish Project was selected as it would demonstrate the problem of maximization of benefits to the fleet versus the processing plants (or a combination). It was also a project that essentially involved one country, one gear, one tonnage class vessel but two species fishery. This project would enable a close examination of single species management of a two species fishery. The benefits to be derived by managing both species in more direct proportion to each other (i.e. overexploiting one species a little in order to optimize the other) may outweigh the benefits of attempting to optimize the catches of each species separately.

The Bay of Fundy Scallop Project was selected to investigate the impact of a fluctuating resource on the long term optimal investment in plant and fleet size under several constraints: (i) various biological assumptions as to the factors determining resource supply: density dependent vs density independent recruitment; (ii) no exogenous source of supply or resource from other fisheries; (iii) a fixed but limited sub-allocation from an outside resource (i.e. The Georges Bank Scallop Fishery); and (iv) other inputs (i.e. lobster, groundfish, etc., resource availability).

The Bay of Fundy Herring project was selected to illustrate the trade-off in benefits between gear types on stock size and age.

It was agreed the specific objectives and project parameters would be decided by the individual working teams but that the teams should be guided by the general issues raised in the project selections and ultimately provide management with a series of options surrounding each project. It was also agreed that each working group would take an early initiative to outline data requirements to the appropriate statistical Divisions at either the Regional or Headquarters levels.

Later in February 1979: The CAFSAC Steering Committee supported the working group recommendations and advised the Atlantic Directors General

Committee of this initiative.

### The Fate of the Projects

March 1979: The CAFSAC Steering Committee heard a status report of the Working Group projects:

Grand Bank Flatfish Fishery - The planning for the project was underway and implementation would commence about April 15th. Tentative plans for completion were July 15th.

Bay of Fundy Scallop Fishery - The biologists for the project had been named and consideration was being given to contracting out the economic expertise to Dr. Richard L. McGaw, of Moncton who wrote his thesis on "An econometric model of the North American scallop industry."

Bay of Fundy Herring - The biologist and economist had been named, but no details were as yet available.

A senior economist present at the meeting expressed the following concerns: i) That this approach to the integration of bio-economic input to fisheries management could interfere with normal fishery assessment, ii) There was a lack of economic data in the Maritimes on which to base the economic aspects of modelling, and while work was underway to improve this situation, sufficient information would not be available for another three years to provide more than ad hoc advice on fishing vessel economics, and iii) That a segmented portion of the fishery was being considered when it may have been more appropriate to conduct a holistic review of the fishery involved.

At the same meeting, economic representatives were named to the Groundfish, Pelagic, Invertebrates and Marine Plants, and Anadromous, Catadromous, and Freshwater Fisheries subcommittees. This initiative did not have any discernable effect on the work of these committees, however.

September 1979: The CAFSAC Steering Committee heard the following report on the Working Group Projects.

Grand Bank Flatfish Fishery: Due to secondment of the Economist to Ottawa, the project would probably have to be abandoned due to lack of resources. In the interest of maintaining some momentum, an economic technician had been assigned to the project. This essentially meant that this project would then start from scratch, with a indefinite protracted completion date.

Bay of Fundy Scallop Fishery: An initial economic report had been completed by a summer student hired for this purpose. The report was being reviewed and would be forwarded to the committee when it was finalized.

Bay of Fundy Herring Fishery: No consultations had taken place as yet. Commencement date of the project was unknown. The biologist was still

waiting to be contacted by the economist concerned.

The Steering Committee restated that they viewed the examination of bio-economic integration into the review process as important and suggested several lines of action to maintain the projects.

November 1979: The last report on these projects was heard by the Steering Committee.

**Grand Banks Flatfish Fishery:** The economist assigned to the project was working on the background information.

**Bay of Fundy Herring:** An Ottawa representative will be contacting the Marine Fish Division in December to work out the details of what is to be addressed.

**Bay of Fundy Scallop Fishery:** The cost earning study has been completed and will be reviewed at a later date.

#### **The Redfish Mesh Selection Study: Something Completely Different**

February-October 1981: Industry requested CAFSAC to review the economic benefits of various mesh sizes in the fishing industry. A Working Group was formed which solicited data from the fishing and processing industry and carried out a bioeconomic analysis. The analysis was reviewed by the Groundfish Subcommittee in October and by Steering Committee later that month. The biological conclusions were clear. However, it proved difficult to determine what mesh sizes the industry had been using in previous years. Consequently, it was difficult to advise on possible benefits/losses of proposed mesh size changes.

#### **Collaboration Between Economic and Biological Research**

April 1981: The CAFSAC Steering Committee turned its attention once again to the question of integration of biological and economic advice. This time in response to communications amongst the respective Assistant Deputy Minister and Director General in Ottawa. The Steering Committee invited the continuing attendance of an economist from Ottawa at its meetings.

June 1981: The economist first attended the Steering Committee meeting where he indicated that there was a necessity for better collaboration between the biological and economic sectors of the fisheries management process and that economic participation in CAFSAC was seen as one method of providing some integration. It was agreed he and Dr. Doubleday would prepare a joint discussion paper on this subject for presentation at the November meeting of the Steering Committee.

January 1982: Two discussion papers; "Key fisheries economic and marketing issues" by D.S. Puccini, and "Towards integration of social, economic, and biological analysis in fisheries management advice and program planning" by D. Knowles and W.G. Doubleday, were put before the Steering Committee.

The paper by Puccini gave a broad overview of current and future key areas of marketing and economic research and analysis for Canadian fisheries. It did not attempt to get into the specifics of individual fisheries and their problems. The paper by Knowles and Doubleday, on the other hand, made a number of quite specific suggestions under three broad headings:

- (i) Analytical program planning.
- (ii) Joint biological and economic analysis of regulatory measures.
- (iii) Education of investors, policy measures, and the fishing industry.

March 1982: The Director General of the Economic Development Directorate addressed the Steering Committee on the issue of collaboration between economic and biological research. He noted that the topic was currently under consideration by senior management. Some problem areas and factors to be considered were: Task Force on Atlantic Fisheries recommendations, lack of economic manpower in DFO, dilution of assessment responsibilities, and lack of data. The importance of clearly defined objectives for fishery management in general and for bioeconomic modelling in particular was emphasized.

Again there was concern about CAFSAC becoming involved in economic analysis and it was suggested that economic inputs might be most appropriate under the auspices of the Operations Directorate. There was also the concern that a new initiative toward bioeconomic analysis may degrade the quality of biological advice due to manpower limitations.

The Research Director, Newfoundland Region noted that a Resource Management Committee, comprised of the Director General and Directors of Research, Economics, Operations and Development, had recently been formed and would provide a forum for integration of these aspects of fishery management in the Newfoundland Region.

### **FEAC is Formed**

October 1982: CAFSAC Steering Committee was briefed on the formation of the Fisheries Economic Advisory Committee (FEAC). This was to be a forum for:

- i) providing economic advice to senior management;
- ii) facilitating inter-regional awareness of issues, ideas and studies underway;
- iii) managing joint research projects and advising Directors on

priorities;

- iv) ensuring a consistent approach to methodology and standards; and,
- v) critically reviewing the work of economists.

The Committee is national in scope and its members include all Directors of Economic Services (six in all), and representation from HQ economics groups. The Research Director, Ottawa Region was a member. The Chairman was to report to the ADM, Fisheries Economic Development and Marketing Service. This was viewed as a positive step, particularly as FEAC and CAFSAC had two members in common to aid in the integration of activities (CAFSAC 1983).

### The Topic Surfaces Again

October 1984: The Marine Ecosystems and Environment Subcommittee met to consider approaches to the inclusion of fishery interactions in management advice (Mahon 1985). The workshop expressed a general concern over the lack of an appropriate forum for interaction of biologists with experts in relevant socio-economic fields.

March 1985: The above concern was discussed by the Steering Committee. The point that the ability of biologists to interpret fishery data would be enhanced by socio-economic input was emphasized. The Steering Committee requested that this point be developed and documented at a subsequent meeting of MEES.

November 1985: The Marine Ecosystems and Environment Subcommittee met to consider the benefits of and approaches to increasing the interaction of biologists and economists. Three papers, including this one, were presented. The others were: Biology and Socio-Economics: The 4WX Herring Fisheries as a Case Study, by P.M. Mace, and Bio-Economic Modelling in Fisheries Management, by J. McGlade.

The case of the 4WX herring fishery provided several examples of where information on market conditions, fishing costs, etc., might be used in formulating management advice, not just in setting TACs but in advising on other aspects, such as how to prevent the roe fishery from decimating individual spawning stocks. It was obvious from this paper that the questions of how, when, and where the catch was taken were of far more immediate importance to this fishery than the total catch biomass.

The discussion of McGlade's paper focussed on whether CAFSAC had, or had any intention of developing, the means to cope with the complexity and unpredictability which characterize most fisheries and which may often result from the interaction of biology and economics. Of particular concern was the need for addressing longer term objectives of management. Tools for examining these aspects of fishery management are being developed, and will result in the availability of new kinds of information to fishery managers. They will enable managers to explore the possible

consequences of implementing various management strategies given the observed complexity and unpredictability. Managers will be faced with the need to base decisions on tradeoffs between risk and returns. As more realistic methods of assessing risk become available some of the responsibility for evaluating the tradeoffs can be shifted to the fishing industry.

Considering the history of past attempts at integration of biology and economics the subcommittee was reluctant to propose a scheme. However, it noted that in the face of the ongoing development of such approaches to evaluation of management options, CAFSAC will undoubtedly find an increasing amount of socio-economic information coming before the various subcommittees. The subcommittee expressed concern about the ability of CAFSAC to properly evaluate this material.

### Discussion

CAFSAC has a clearly stated obligation to look beyond the provision of annual TAC advice towards the future needs of the fishing industry. Current thinking suggests that this should involve ways of combining biological and economic information in the provision of both short term advice and longer term scenarios for strategic planning. This review shows that in principle the importance of going beyond population dynamics has been of continuing concern and that there have been several attempts to initiate activities of this kind. These have had no significant impact on the provision of advice. The main reasons for their failure are a lack of committed input from economists, apparently due to a lack of manpower and resources, and a reluctance to divert the effort of CAFSAC assessment biologists into the study of fishery economics. Nonetheless, individuals continue to pursue projects with substantial bio-economic components. As these reach the point of being applicable, there will be a growing need for a forum for their evaluation.

### Reference

- CAFSAC, 1980. Advisory Document 77/1, pp. 1-8. In: CAFSAC Advisory Documents 1977-1979. CAFSAC Secretariat, Dartmouth, N.S..
- CAFSAC, 1983. Annual Report - Vol. 5 for 1982. CAFSAC Secretariat, Dartmouth, N.S..
- Mahon R. (ed.). 1985. Towards the inclusion of fishery interactions in management advice. Can. Tech. Rept. Fish. Aquat. Sci. No. 1347: 221 pp.

Appendix 1 to  
Advisory Document 77/1

Terms of Reference

1. CAFSAC is responsible for providing scientific advice to the Atlantic Fisheries Management Committee on the management, including the full range of conservation measures taking into account economic objectives, of all stocks of interest or potential interest to Atlantic coast fishermen. Resource management advice will be provided in accordance with specific fisheries management objectives and strategies and will normally be published as a matter of routine.
2. CAFSAC is to serve as the Atlantic focus for development of fisheries resource management science through program development and scientific interchange. As a forum for the advancement of fisheries management science, CAFSAC shall organize workshops and symposia on specific problem areas.
3. In cooperation with FM Headquarters, CAFSAC will serve as a forum for development of proposals for cooperative research and scientific monitoring of foreign fishing in the NW Atlantic. CAFSAC shall advise on the needs for scientific monitoring data, both in quality and quantity required for effective monitoring of fishing activity.
4. CAFSAC will endeavor to ensure liaison with other committees or subcommittees established by the Atlantic Fisheries Management Committee. Such liaison will include mutual referral and it will also include joint meetings with other forums of consultation so as to ensure advice arising from the various lines is as compatible as possible and is consistent with long-term objectives for Atlantic fisheries.
5. In relation to the above functions, CAFSAC will review research priorities and performance in the Atlantic regions and shall advise the Atlantic Research and Resource Directors when changes in priorities, program objectives, or resources appear warranted.

INTEGRATION OF BIOLOGICAL & ECONOMIC INPUT TO FISHERIES MANAGEMENT

OPTION 1

Economic Analysis  
Component within CAFSAC

Pro

1. Inter-disciplinary analysis facilitated
2. Not many (if any) new resources required
3. Easiest and fastest to implement

Con

1. Econ. could be "submerged" under the sheer (bio-) mass of natural science
2. Could reduce CAFSAC effectiveness by enlarging mandate and task
3. Probably would require two chairmen

OPTION 2

Bio-economic Analysis  
Component within CAFSAC

Pro

1. Facilitates development of Bio-Economic Model
2. Innovative and new approach
3. Consistent with 1975 Fisheries Policy statement
4. Better analysis will enhance program funding prospects, e.g. EDCOF

Con

1. May sacrifice professional "purity"
2. Will require major change in established work practices
3. Will take more time than Option 1 to implement (6 months?)
4. New resources must be found (BIOEC's?)

OPTION 3

Economic Analysis Independent of CAFSAC  
New Mechanism (CAFEAC)

Pro

1. Will lead to a necessary upgrading of social/economic analysis in DFO
2. Competition between econ. and bio. may be healthy (or may not)
3. Potential for equal weight to be given to economic assessments and biological assessments by Atlantic D/G's Committee

Con

1. "Two Solitudes" - as in FRB/ Fisheries Service days
2. Will require net new resources (\$ & MY)
3. Will take longer than Option 1 or Option 2 to implement (12 - 24 months?)

Option 4: People involved in CAFSAC appear to be species specific while economists, of necessity, operate as generalists. Interaction between the two disciplines must therefore be on a project by project basis as the need arises rather than participation on specific CAFSAC committees or sub-committees. We should stay away from a situation where economic advisors advise biological advisors. This would not preclude the coming together of both disciplines in some form of a standing committee of CAFSAC to discuss common problems or policies and determining priorities for future joint activities.

Option 5: (by Maritime Region Economists) There should be strong central economics unit in Ottawa. For Atlantic Coast Fisheries Management we favour an interdisciplinary planning group outside of CAFSAC. The latter already has certain clear cut functions which should not be disturbed.

Such a group should report to the ADM Atlantic and the Atlantic DG, and consist of no more than four persons (perhaps five). The criteria for their selection should be as follows:

- (1) There must be at least one representative from each of the following discipline groups: (a) Social scientists (b) Biological Scientists (c) Middle line management.
- (2) There must be one representative from each of the East Coast Regions.
- (3) There must be one representative from Gary Vernon's unit (and possibly one representative from the ADM's headquarters group).

Conditions governing the operations of this group would be as follows:

- (1) There would be rotating membership, with membership terms of two years.
- (2) Membership would be staggered so that in the first term, two of the members would have one year terms.
- (3) The Chairman of the group would be appointed by the ADM.

The functions of this interdisciplinary group would be to:

- (1) Act as catalysts to promote planned rather than crisis management in the Atlantic Region.
- (2) To design alternative management systems for implementation by senior management.
- (3) To make senior management aware of fisheries economics concepts and optimal control techniques that may be successfully implemented in the Atlantic Region in the long and short-run.
- (4) To foster a healthy environment for research relevant to fisheries

management to attain social and economic objectives.

- (5) To undertake projects which have a demonstration effect for fisheries managers.