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ECOSYSTEM MANAGEMENT : PROPOSAL FOR UNDERTAKING A COORDINATED FISHING AND RESEARCH EXPERIMENT AT SELECTED SITES AROUND ANTARCTICA

Abstract

This paper is presented to provide a basis for discussion of the experimental management approach. The experimental approach should enable management guidelines to be based on the best available scientific advice derived from experience and scientific research. Several criteria are suggested as a guide in selecting suitable sites for management experiments. An example experiment site, Prydz Bay, is discussed in detail. The proposed experiment in the Prydz Bay is in two phases, each of five years duration. During the first phase the level and type of fishing effort should be held constant while the ecology of the site is documented, population levels and trends of the target and key consumer species assessed and complementary research undertaken to further refine a conceptual and quantitative ecological model of the experimental site. In the second phase of the experiment the system could be manipulated through planned variation to the fishing pressure and, possibly, by the co-harvesting of selected consumer species. The effects of this manipulation would be studied to establish relationships between key members of the community and the results used to develop a plan of management for that sub-system.

AMENAGEMENT DE L'ECOSYSTEME : PROPOSITION POUR UNE EXPERIENCE COORDONNEE DE PECHE ET DE RECHERCHE SUR DES SITES SELECTIONNES DANS DIVERSES REGIONS DE L'ANTARCTIQUE

Résumé

Ce document constitue une base de discussion sur l'approche expérimentale de l'aménagement. Cette approche devrait permettre de baser les lignes directrices d'aménagement sur l'avis scientifique le plus autorisé, lui-même fondé sur l'expérience et la recherche scientifique. Plusieurs critères sont suggérés qui pourraient servir de guide dans la sélection des sites appropriés aux expériences d'aménagement. Un site expérimental type, la Baie de Prydz, est examiné en détail. L'expérience scientifique proposée sur les lieux de la Baie de Prydz se décompose en deux phases, chacune étant prévue pour une durée de cinq ans. Au cours de la première phase, le niveau et le type d'effort de pêche devraient être constants pendant les travaux de documentation sur l'écologie du site, les niveaux de populations et les tendances des espèces cibles et des

espèces prédatrices clés devraient être évalués et les recherches complémentaires entreprises pour perfectionner un modèle écologique conceptuel et quantitatif du site expérimental. Dans la seconde phase de l'expérience, le système pourrait être manipulé à l'aide d'une variation organisée de l'intensité de la pêche et, éventuellement, par la capture d'espèces prédatrices sélectionnées. Les effets de cette manipulation seraient étudiés afin d'établir les rapports existant entre les membres clés de la communauté, et les résultats serviraient à développer un plan de contrôle pour ce sous-système.

УПРАВЛЕНИЕ ЭКОСИСТЕМОЙ: ПРЕДЛОЖЕНИЕ О ПРОВЕДЕНИИ КООРДИНИРОВАННОГО ПРОМЫСЛОВО-ИССЛЕДОВАТЕЛЬСКОГО ЭКСПЕРИМЕНТА НА ОТОБРАННЫХ УЧАСТКАХ В АНТАРКТИКЕ

Резюме

Настоящий документ представлен с целью обеспечения основы для обсуждения экспериментального подхода к управлению. Экспериментальный подход должен содействовать тому, чтобы руководства по управлению были разработаны по наилучшим имеющимся научным рекомендациям, полученным на основании опыта прошлых лет и научных исследований. Для отбора участков, пригодных для проведения экспериментов по управлению, предлагаются несколько критериев. Подробно рассматривается залив Прюдз, приведенный в качестве примера экспериментального участка. Предлагаемый эксперимент в заливе Прюдз состоит из двух этапов, каждый продолжительностью в пять лет. На первом этапе следует поддерживать постоянный уровень и тип промысловых усилий, регистрируя в то же время данные по экологии участка, оценивая уровни популяций и тенденции изменений в целевых и основных видах-потребителях, и проводя дополнительные исследования с целью более глубокого усовершенствования концептуальной и количественной экологической модели экспериментального участка. На втором этапе эксперимента системой можно будет управлять путем запланированного изменения интенсивности промысла и, возможно, путем сопутствующего промысла определенных видов-потребителей. Последствия подобного управления будут изучены в целях определения взаимосвязей между основными элементами этого сообщества; результаты этих исследований будут использованы при разработке плана управления этой подсистемой.

LA ADMINISTRACION DEL ECOSISTEMA : PROPUESTA PARA LLEVAR A CABO UN EXPERIMENTO COORDINADO DE PESCA Y DE INVESTIGACION EN LUGARES SELECCIONADOS ALREDEDOR DE LA ANTARTIDA

Resumen

Este documento se presenta a fin de proveer una base para debatir sobre el enfoque de la administración experimental. El enfoque experimental debería permitir que las pautas administrativas estuviesen basadas en el mejor asesoramiento científico disponible derivado de la experiencia y de la investigación científica. Se sugieren varios criterios como una guía para seleccionar los lugares adecuados para los experimentos de administración. Se debate en detalle la Bahía Prydz, como ejemplo de lugar de experimentación. El experimento propuesto en la Bahía Prydz tiene dos etapas, cada una de cinco años de duración. Durante la primera etapa el nivel y tipo de esfuerzo de pesca debería mantenerse constante mientras que se documenta la ecología del lugar, se evalúan los niveles de población y las tendencias de las especies objetivo y especies consumidoras clave, y se inicia una investigación suplementaria para perfeccionar aún más un modelo ecológico conceptual y cuantitativo del lugar del experimento. En la segunda etapa del experimento el sistema podría ser manipulado por medio de una variación planeada de la presión pesquera y, posiblemente, por medio de la recolección conjunta de especies consumidoras selectas. Los efectos de esta manipulación serían estudiados para establecer relaciones entre los miembros claves de la comunidad y los resultados se utilizarían para desarrollar un plan de administación para ese sistema secundario.

ECOSYSTEM MANAGEMENT : PROPOSAL FOR UNDERTAKING A COORDINATED FISHING AND RESEARCH EXPERIMENT AT SELECTED SITES AROUND ANTARCTICA

1 INTRODUCTION

In recent years there have been great advances in our understanding of the Antarctic marine ecosystem by national and international research programs. Through the intensive research programs of BIOMASS, knowledge of the distribution and abundance of key organisms in the pelagic ecosystem and of the factors affecting these populations has been expanded. CCAMLR is directed at rational management and attention must now be focussed on the role and impact of harvesting operations in the ecosystem. This will require the integration of research and fishing operations and results derived from programs must have predictive, rather than purely descriptive, application.

In a discussion paper tabled at the second meeting of the Scientific Committee (presented here as SC-CAMLR-III/INF..), Australian scientists discussed a number of alternative harvesting strategies and considered the possible consequences of each on the basis of current knowledge of the structure and dynamics of the Antarctic marine ecosystem. The paper proposed consideration of an experimental approach, involving different harvesting strategies on different stocks as a way to quantify the response of the ecosystem. It was suggested that this experimental approach, involving well documented fishing operations and associated research programs, could provide the basis of an ecosystem approach to management.

The experimental proposal arose out of what the Australian scientists perceived as a limited number of strategies available to the Scientific Committee in its task of seeking to implement the ecosystem approach adopted by the Convention. Alternative strategies, such as imposing interim (and possibly arbitrary) catch limits while developing a more detailed quantitative model of the entire ecosystem, or adopting stock specific strategies based on Maximum Sustainable Yield theories, would not address the fundamental questions still surrounding the concept of ecosystem management. Nor would they provide, in the scientists' view, a coherent approach to all the management issues which will confront the Scientific Committee and Commission in their efforts to give effect to Article II of the Convention. This is not to say that these approaches have no place in the Scientific Committee's range of options. Indeed, catch limits, reserved areas, quantitiative models and stock-specific strategies are important parts of the experimental approach proposed. A diversity of approaches need to be pursued as, on the basis of current knowledge, no single management strategy, impact assessment technique or predictive algorithum holds the key to ensuring the conservation and sustained rational use of the Antarctic ecosystem.

This paper is presented to provide a basis for discussion of the experimental management approach. An example experiment site, Prydz Bay, is discussed in detail. A number of sites and experiments are possible and it is proposed that members with interests in, and detailed knowledge of, other areas of the Antarctic could develop proposals for those areas. Control sites also need to be identified to determine whether activity in one area has an impact on adjacent or distant locations. Suggested criteria for the selection of experimental sites are presented.

2 SITE SELECTION

The following criteria are suggested as a guide in selecting suitable sites for management experiments:

a The site should be relatively discrete, ie, on a basis of water circulation or depth (ocean plateau or basin), and have some indication that the community in that area may be largely independent of adjacent communities, at least so far as short-term recruitment is concerned.

b The site should be biologically significant (ie containing one or more aggregations of species which are commercially exploitable, are of potential commercial interest or are consumers of such species.).

c Historical biological, oceanographic and commercial data from the site should be available to CCAMLR.

d The site should be accessable with a minimum of logistic problems.

e The site should contain communities suitable for combining experimental fishing and monitoring programs.

On the basis of these criteria a number of sites in the Southern Ocean could be considered suitable for experimental management. These include areas adjacent to the islands of the Scotia Arc and around South Georgia and also regions of the Southern Indian Ocean.

The region between 55°E and 110°E is one with which Australia is familiar and believe would be suitable for such an experiment. Accordingly a detailed proposal has been developed for this region as an example.

3 EXPERIMENT DESIGN: PRYDZ BAY EXAMPLE

3.1 OVERVIEW

The proposed experiment in the Prydz Bay Gyre is in two phases, each of five years duration. During the first phase the level and type of fishing effort should be held constant while the ecology of the site is documented, population levels and trends of the target and key consumer species assessed and complementary research undertaken to further refine a conceptual and quantitative ecological model of the experimental site. In the second phase of the experiment the system could be manipulated through planned variation to the fishing pressure and, possibly, by the coharvesting of selected consumer species. The effects of this manipulation would be studied and the results used to develop a plan of management for that sub-system.

3.2 DESCRIPTION OF THE PRYDZ BAY SITE

For the purpose of an experiment the Prydz Bay region can be considered to extend between Enderby Land and the West Ice Shelf (55°E to 110°E) and from the Antarctic Coast northwards an appropriate distance beyond the fishing areas. Prydz Bay itself is dominated by a wide continental shelf and is the site of a clockwise gyre. The coast of Prydz Bay is dominated by the Amery Ice Shelf and to a lesser extent the Publications Ice Shelf.

The region has been studied in considerable detail by scientists from the USSR and Japan and more recently during the BIOMASS experiments by

Australia, France, South Africa and Japan. Historical data from expenditions including the Discovery, BANZARE and commercial whaling exist also.

Along the coast are a series of ice-free areas including the Vestfold Hills and the Larsemann Hills. The Australian Antarctic station Davis is situated in the Vestfold Hills. These ice-free areas and off-shore islands are used as nesting sites for sea birds and penguins. Weddell Seals pup in the ice-free areas and Elephant Seals haul out along these coasts. The area is currently used for whaling and krill fishing.

3.3 PRESSURE ON FOOD BASE

It is proposed that, from the commencement of the experiment, the krill fishing effort in the area be held constant for a five year period. The level of effort to be applied would be determined by those countries involved in the harvest, in consultation with the Scientific Committee.

Well documented records of fishing intensity and catch rates will continue to provide detailed information on variations in the distribution and abundance of krill. The "Inventory of Existing Logbooks and Proposals for Basic Information" prepared at the 1983 meeting of the Scientific Committee (Annex 8 of the 1983 Report) is suggested as a basis on which to design logbooks for use in the experimental area.

3.4 RESPONSES OF SELECTED CONSUMER SPECIES

Vital to this experiment is that simultaneously with the application of a selected level of fishing pressure on the food base of the system, there should be carefully planned monitoring of selected consumer species, checking for changes either in nutritional state, growth rate, or in population size, structure, age at maturity, etc.

After consideration of available information, particularly the responses received from SCAR on the Questions on Birds and Seals developed at the 1983 meeting of the Scientific Committee, four species are recommended as suitable for monitoring programs. Emphasis would be placed on monitoring population numbers, breeding success and relevant condition factors.

EMPEROR AND ADELIE PENGUINS: Selected rookeries in the Prydz Bay area to be monitored (partly automated) for both winter and summer feeding success.

CRABEATER SEALS: Studies of feeding ecology and censuses of seals in the pack ice.

MINKE WHALES: Continuation in the 60°E-85°E sector of the sighting surveys by dedicated cruises of the kind established by IWC Scientific Committee in recent years.

HUMPBACK WHALES: Continuation of aerial monitoring of this stock carried out each winter until 1982 off the west coast of Australia.

3.5 COMPLEMENTARY RESEARCH PROGRAMS

In addition to the high priority food base-selected consumer programs discussed above, there will also be a need, and opportunities, for research programs on specific aspects of the ecosystem. It is suggested that research programs on oceanography, krill biology, primary production and the role of fish in the coastal Antarctic ecosystem should continue

(or be established). As far as possible these studies should be integrated with the fishing experiment and use made of both dedicated research vessels and trawlers.

Attention should also be given to the role of migratory species and the flow of nutrients and biomass between the experimental area and adjacent areas.

4 IMPLEMENTATION

It is proposed that members of CCAMLR having an interest in this sector of the Antarctic marine ecosystem co-operate in an integrated research program studying the responses of key consumers to known levels of fishing pressure.

Data from both the food base and selected consumer species would be supplied to CCAMLR and, when three years data were available, the Scientific Committee would prepare a preliminary assessment of trends in krill stock and consumer populations. The Scientific Committee would then, on the basis of those assessments and other information supplied by members, prepare predictive assessments of the effects of:

1 a gradual or immediate increase in fishing effort over the next five year period;

2 a gradual or immediate reduction in fishing effort over the next five year period;

3 possible changes to effort or gear characteristics; and

4 possible co-harvesting of selected consumer species in association with 1, 2 and 3 above.

The Scientific Committee would also consider any necessary modifications to the monitoring and data collection aspects of the experiment.

Recommendations, options and comments would then be referred to the Commission to determined the level and nature of harvesting to be applied during the second phase of the experiment.

The proposed experiment is an opportunity for members to further consolidate the scientific cooperation developed through the BIOMASS program and to integrate fishing and research programs in an attempt to effectively implement the goals of the Convention.

Planning for the experiment would need to allow adequate lead times for authorities in the fishing countries to plan shipping arrangements. Members will also be aware of the need to take advantage of the considerable research infrastructure which may be available as the BIOMASS program draws to a close. On this basis, the 1986/87 season would seem an appropriate target date for the start of the experiment.

The following draft timetable is provided as a suggested course for implementation.

1984: Establishment of an ad hoc working group to develop a detailed experimental design.

1985: Scientific Committee to develop detail proposal for transmission to Commission. Fishing nations to consult with Scientific Committee and decide on appropriate effort for first five year phase. Commission to seek members reactions and commitment to participation in experiment.

1986: Finalisation of research plans. Experiments starts - Phase 1. Establishment of Working Group on Data Interpretation and Assessment.

1987: Establishment of data base and refinement of assessment methods. - Phase I continues.

1988: Phase I continues.

1989: Assessment of data begins - Draft report on consumer and stock trends - consideration of options for Phase II - Phase I continues.

1990: Report to Commission on trends, options and recommendation for Phase II fishing effort. Commission recommendation referred to members. - Phase I continues.

1991: Finalise plans for Phase II. Phase II begins.

1992 to 1995 Phase II continues. Report and analysis, Management Plan for experiment area proposed.

Participation would be open to all members. Participants would bear the bulk of the cost arising from additional research and changes to their fishing operations. CCAMLR would coordinate the collection and handling of data from the experiment and provide printing and translation of handbooks, logbooks and other documents.

5 OTHER CONSIDERATIONS

The proposal is one possible approach to the problems presented by ecosystem management. The Scientific Committee will need to consider other options and the possibility of applying a range of experimental techniques in different areas before a coherent plan for all Antarctic waters can evolve.

The experimental management approach elaborated here, builds on the fishing and research operations already initiated and will benefit each participating nation as well as SCCAMLR in developing much needed understanding of predator-prey relationships within the Antarctic marine ecosystem. The scale and diversity of approaches are such that one nation could not be expected to carry out the whole operation.

6 CONCLUSIONS

The experimental approach should enable management guidelines for Antarctic fisheries to be based on the best available scientific advice derived from experience and results of scientific research. Australian scientists believe that this is the type of approach required to satisfy the purpose of the Convention. By concentrating research effort and intensive data collection from fishing operations into an area such as Prycz Bay we believe maximum value for effort will be achieved.

Australian scientists urge the Scientific Committee to consider the value of the experimental management approach put forward in this paper and Prycz Bay as a potential site for such an experiment.