



Facem in Maribus

International Ocean Institute

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Proposal

SYSTEMS ANALYSIS APPLIED TO
THE MANAGEMENT AND CONSERVATION

OF MARINE RESOURCES

A Joint Project Between

IIASA

and

IOI

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SYSTEMS ANALYSIS APPLIED TO
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OF MARINE RESOURCES

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INTRODUCTION

Marine resources and technologies are playing a rapidly increasing role in international and national economic life.

The technological transformation of the traditional uses (fishing, shipping, military uses, waste disposal, recreation) and the emergence of new uses amount to a veritable "marine revolution," that is, the penetration of the industrial revolution into the oceans.

The coming decades will witness the gradual transformation of fisheries from the stage of a hunting and gathering economy to one based on cultivating aquatic plants and husbanding aquatic animals. The proportion of food and feedstock from aquatic sources in the world food supply is going to grow appreciably.

Technological developments make it possible to extract an increasing number of minerals and metals from the ocean. Ocean mining has notable advantages over land mining, such as avoidance of conflicts with competing land-uses, less environmental degradation, direct access to cheaper transportation, reduced labor cost. It is likely, therefore, that the next 50 years may see a large-scale displacement from land mining to ocean mining.

The extraction of energy from the oceans (tides, waves, currents, temperature and salinity gradients, biomass) offers a huge reservoir of alternative energy resources.

The construction of artificial habitats for industrial, scientific, and recreational purposes.

represents an additional new uses of ocean space.

The discovery of the ocean floor, with its ridges and trenches, and the emergence of plate tectonics theory have changed our perception of the earth and its evolution. Our very conception of the oceans has changed: from a two-dimensional concept, it has become three-dimensional. From a medium of transit and transport, the ocean has become as resource in itself: a resource to which people have begun to extend terrestrial concepts of ownership and sovereignty. The prospect of new wealth, as always, has its concomitant dangers: dangers of conflict, waste, and the degradation of the social and physical environment inherent in change.

Ocean management is a new science. It is broadly interdisciplinary. In the words of Dr. Sidney Holt, "There are growing ecological and physical interactions between fisheries and mariculture; oil, metallic ore, and other hard mineral extraction; energy extraction; navigation; communications; waste disposal; recreational industry; and other ocean uses." And the Programme of Policy Research in Engineering, Science & Technology (PREST) of Manchester University points out that its own work is based "upon the belief that science, technology, economics, politics and law do not act upon each other in a unidirectional, linear manner from science through to law. Rather each interacts with every other..." But the work is yet to be done. To cite one more example, the Office of Technology Assessment of Congress (USA) notes, in Coastal Effects of Offshore Energy Systems: "There are potential conflicts between outer Continental Shelf oil and gas activities and vessel traffic engaged in commercial shipping and fishing activities. However, there has been no comprehensive study and analysis to identify all conflicts and to find ways of resolving them."

Ocean management thus involves, to use the language of the IIASA programme, "interaction of resource, technological and environmental systems, at national regional and global levels." It must provide an integrated framework incorporating

environmental feedbacks, economic considerations as well as legal and institutional aspects. It intersects with IIASA's work in the following areas

- Resources and Environment Area
- Food and Agriculture Program
- System and Decision Sciences Area
- Energy System Group
- Water Management
- Regional Development
- Industrial Development
- Transportation.

as well as minor, completed studies such as the salmon study and the marine worms study.

All these programmes could make a substantial input into the proposed new programme, at the same time they would benefit from it. A programme to apply systems analysis to ocean management could provide a forum stimulating the discussion of common problems in all related sectors, and add a new dimension to each of them. At the same time, it would bring a vitally important contribution to the evolution of a new applied science, ocean management, which, due to its complexity, the interaction of ocean uses, and the interdependence of ocean spaces, necessitates a systemic approach.

METHODOLOGY

Systems analysis applied to the management of marine activities and resources.

1. System specification and description

(the first task is to specify the system

to be studied, to define its limits, describe its structure, and give the best account we can of its working. The term "limits" is of special importance: the position of an objective-system within the larger system of which it is part has to be determined and the relations that hold between it (and its component systems) and the parts of the larger system have to be identified and assessed; but then, considering this inter-penetration, one must set limits to the scope of one's enquiry -- how far into the larger system will the relations of the objective-system be followed? And to what distance shall we go in seeking the origin of influences which bear upon the objective-system? Decisions on these matters are to be made in terms of the order of accuracy of the results required. For some purposes tidal cycles can be well enough predicted, for a particular locality, from a simple analysis of records of tides observed in the past; for other purposes one must go out across the oceans, and even to the moon.)

- 1.1 The national maritime system
- 1.2 The components of the national maritime system (waters, sea-floor, biota, resources, industries, institutions, artefacts, culture...)

2. System diagnosis

- 2.1 State of the system
- 2.2 System performance

3. Prognosis (includes policy formation)

4. Conservation of and intervention in resources, and management of human activities within the system (includes surveillance)

5. Development projects.

Note: This section was prepared by Dr. Geoffry Kesteven

RESEARCH APPROACH

We have five principal goals in our research:

- to produce a tool for planners and decision makers which should assist them in conceptualizing and quantifying interactions of ocean-space and ocean-resource uses;
- to investigate the interactions of technological transformation of uses of ocean space and resources within the context of environmental consequences;
- to assess priorities;
- to derive legal and institutional implications;
- to integrate ocean management into general economic planning, at various levels of governance.

POINT OF DEPARTURE IN 1982

The work should be based on the work already accomplished by IIASA in the related fields listed above, and on the work already done by IOI, in particular:

Ocean Enterprises, Pacem in Maribus I, Vol. 4

The Mediterranean Marine Environment and the Development of the Region

The New International Economic Order and the Law of the Sea

The Integration of Marine Resources and Ocean Management into Development Strategy

Pacem in Maribus X

Also:

The Integration of Marine Space in National Development Strategies of Small Island States: The Case of the Caribbean States of Grenada and St. Lucia, by the RIO Foundation and Dalhousie Oceans Studies Programme, in cooperation with IOI.

ACTIVITIES IN 1982

Early in 1982, a workshop should be organized, bringing together the interested IIASA Staff with some IOI selected experts, one each for

- . Fisheries (Dr. Sidney Holt, Dr. G. Kesteven)
- . Aquaculture (Dr. Dwiwedi)
- . Oil (Dr. Peter Odell)
- . Mineral mining (Dr. Erich Blissenbach)
- . Shipping (Mr. Awni Behman)
- . Environment (Dr. Stjepan Kečkekeš)
- . Energy (Dr. Silverstein, Mr. Maxwell Bruce, Dr. Roger Charlier)
- . Military uses (Dr. Frank Barnaby, Dr. Michael Morris)
- . Legal & Institutional Aspects (Prof.s Borgese, Pardo, Dr. Ruivo)

The task of the workshop should be to elaborate in greater detail the programme for 1982-83. In general terms this programme should consist of

- The elaboration of case studies:
 - for an extensive Exclusive Economic Zone, with complex demands on ocean management (e.g., India, Japan, Canada)
 - for two adjoining EEZs with overlapping activities and concerns (e.g., Federal Republic of Germany and its neighbors)
 - for a regional sea with peculiar environmental and managerial problems (e.g., the Mediterranean or the North Sea).

This work should be done at IIASA, with

IOI experts spending periods of 1-3 months at IIASA.

ACTIVITIES IN 1983

An attempt should be made to elaborate a generalized model for ocean management, through

- Synthesis of insights on case studies
- Articulation of global perspectives.

EXPECTED RESULTS, 1982

- More refined tools for analysing national and international policies;
- tools to investigate the interaction of technological transformation and economic and environmental concerns;
- Research reports and monographs describing policy insights obtained
- valuable addition to teaching material and methodology for IOI Training Programme
- expansion of institutional network of collaboration.

INTERNAL COOPERATION

All IIASA programmes listed on p. 3.

EXTERNAL COOPERATION

While IIASA and IOI should have the main responsibility for the project, there are a number of other organizations who would be interested and could make constructive contributions. These include the following:

PREST, Manchester University

DOSP, Dalhousie University

Centre for Foreign Policy Studies, Dalhousie University

United Nations Environment Programme (UNEP)

United Nations University (UNU)

RIO Foundation

Institute for Marine & Coastal Studies, University of
Southern California

BUDGET

External funding to the extent of US\$ 150,000
should be secured by the IOI.