

ACTION PLAN FOR THE EASTERN MEDITERRANEAN ECOSYSTEM

A MODEL TO EVALUATE THE IMPACT OF HUMAN ACTIVITY AND
TECHNOLOGICAL DEVELOPMENT ON THE MARINE ENVIRONMENT

Participants

Symposium on the Eastern Mediterranean

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The Eastern Mediterranean Sea is a unique part of the marine ecosystem, one that has been subjected to important geological changes beginning in the Tertiary and more recently to the effects of human activity which have reached a tremendous magnitude. For example, the cutting of the Suez Canal in 1869 and the building of the Aswan High Dam in 1965, both man-made, have led to large-scale ecological changes in the semi-isolated basin of the Eastern Mediterranean.

The Suez Canal, the Bosphorus and the Strait of Sicily are all pathways for the migration of marine organisms to and from the Eastern Mediterranean. The ecological implications of such migration are multiple and complex. The drastic reduction of freshwater and nutrient input resulting from the construction of the Aswan High Dam caused, in a short time span, drastic changes in the hydrographic picture and the productivity of the Eastern Mediterranean. The problem of pollution is increasing, adding to the complexity of evaluating the effects of human activity and technological development. Natural marine resources are changing as a result of the combination of reduced nutrient input, immigration through the Suez Canal and pollution.

Thus the Eastern Mediterranean represents a unique and unequaled model for evaluating the effects of human activity and technological development. Furthermore, the Eastern Mediterranean is a model for the present and the future. Unfortunately, large scale data are not available to allow accurate prediction of changes resulting from human activity and technological development. Nevertheless, the opportunity exists for an assessment of predicted changes and the degree of accuracy in their prediction. Certainly, the Eastern Mediterranean is a natural laboratory not only to model and monitor but to con-

duct studies for rational management of fishery resources and experiments in mariculture.

The scientific papers and discussions during the Symposium on the Eastern Mediterranean demonstrated the capability of the Eastern Mediterranean scientific community to analyze the magnitude of the problems. At the same time it was evident that there exists a lack of scientific data and of appropriate national and regional infrastructure and specialization by which one may evaluate on a multidisciplinary basis the total complexity of the Eastern Mediterranean Sea.

The participants of the Symposium on the Eastern Mediterranean Sea agreed unanimously that there is an urgent need to initiate local and regional, fundamental and baseline scientific investigations in the Eastern Mediterranean.

Towards this end, the participants of the Symposium on the Eastern Mediterranean Sea recommend the following:

1. *Research.* The participants of the Symposium unanimously recommend that ecosystem modelling of the Eastern Mediterranean Sea, beginning at the Strait of Sicily, be initiated. Exploratory investigations are needed to determine basic oceanographic parameters, temporally and spatially, including the identification of indicator species and the mapping of pollution effluents. Data from exploratory studies would then be available for models of large-scale oceanographic processes. The total ecosystem model would include monitoring the effect of pollution, resources management, construction criteria and oceanic modelling.

It is recognized that all the components of the modelling recommended cannot be initiated immediately. Though such modelling represents the mechanism to achieve the ultimate objective, practical priorities are recommended which take into consideration the existing capabilities in the region. It is recommended that each country bordering the Eastern Mediterranean Sea agree:

- a) to sample at regular intervals at one or several standard stations for basic physical and chemical parameters, including main pollutants, primary productivity and plankton biomass. Basic sampling design, standardization and intercalibration must be given priority;
 - b) to participate in making an inventory of marine organisms and setting up reference collections;
 - c) to study at regular intervals the changes in coastal and estuarine sedimentation;
 - d) to participate in the preparation of an inventory of past and existing data accumulated in marine research institutions.
2. *Training and exchange of scientists.* The participants of the Symposium unanimously recommend:
 - a) that the infrastructure of existing marine programmes be strengthened;
 - b) that training courses, using existing Eastern Mediterranean centres of excellence and others be initiated to upgrade the scientific capability;

- c) that exchange of scientists and information between Eastern Mediterranean countries be facilitated through whatever means possible.
3. *Co-ordination and administration.* The participants of the Symposium unanimously recommend that regular consultation be undertaken among marine scientists and marine science administrators from Eastern Mediterranean countries, with the cooperation of governmental, non-governmental and scientific institutions and organizations with an active interest in marine research in the region to identify scientific interest and marine resources.

Scientific research programmes on specific marine research topics proved to be of interest for the region, and in particular for modelling of the marine ecosystem, and should be encouraged under the sponsorship of United Nations specialized agencies, such as UNESCO, FAO and UNEP and in close collaboration with the joint IOC/FAO (GFCM)/ICSEM Cooperative Investigations in the Mediterranean (CIM).

It is essential that the existing facilities and scientific manpower in the region be fully utilized. Duplication of efforts should be avoided through initiating and/or strengthening coordination and cooperation between countries and research institutions having scientific interests in the region.

4. *Funding.* The participants of the Symposium unanimously agree that multiple funding from international governmental and non-governmental organizations as well as private institutions will be necessary to reach the ultimate objective.
5. *Outline of Ecosystem Modelling for the Eastern Mediterranean Sea.*

I. *Exploratory needs*

- A. Runoff inputs and budgets
- B. Flux input and output budgets of salt, nutrients, pollutants, etc, through the Strait of Sicily, Bosporous, Suez and rivers.
- C. Distribution of standard oceanographic parameters for baseline data including:
 - 1. Hydrography
 - 2. Current measurements
 - 3. Sediment regimes
 - 4. Primary productivity
 - 5. Taxonomy
- D. Identification and agreement on indicator species.
- E. Mapping of pollution effluents.

II. *Process models*

- A. Convection and bottom water formation.
- B. Large- and small-scale wind driven and thermohaline circulation.
- C. Eutrophication:

1. Species change and diversity
 2. Perturbation time scales
 3. Effects on primary productivity
 4. Uptake of pollutants by organisms
 5. Nutrient kinetics
- D. Dispersion studies under different flow scales.
- E. Coastal geologic changes.
- F. Contaminant uptake studies:
1. Petroleum
 2. Heavy metals
 3. Trace organic compounds
- G. Air-sea interaction.
- H. Food chain studies.

III. *Total and areal ecosystem models*

- A. Monitoring of the influence of pollution.
- B. Management of living resources.
- C. Construction criteria for coastal facilities.
- D. Oceanic modelling.