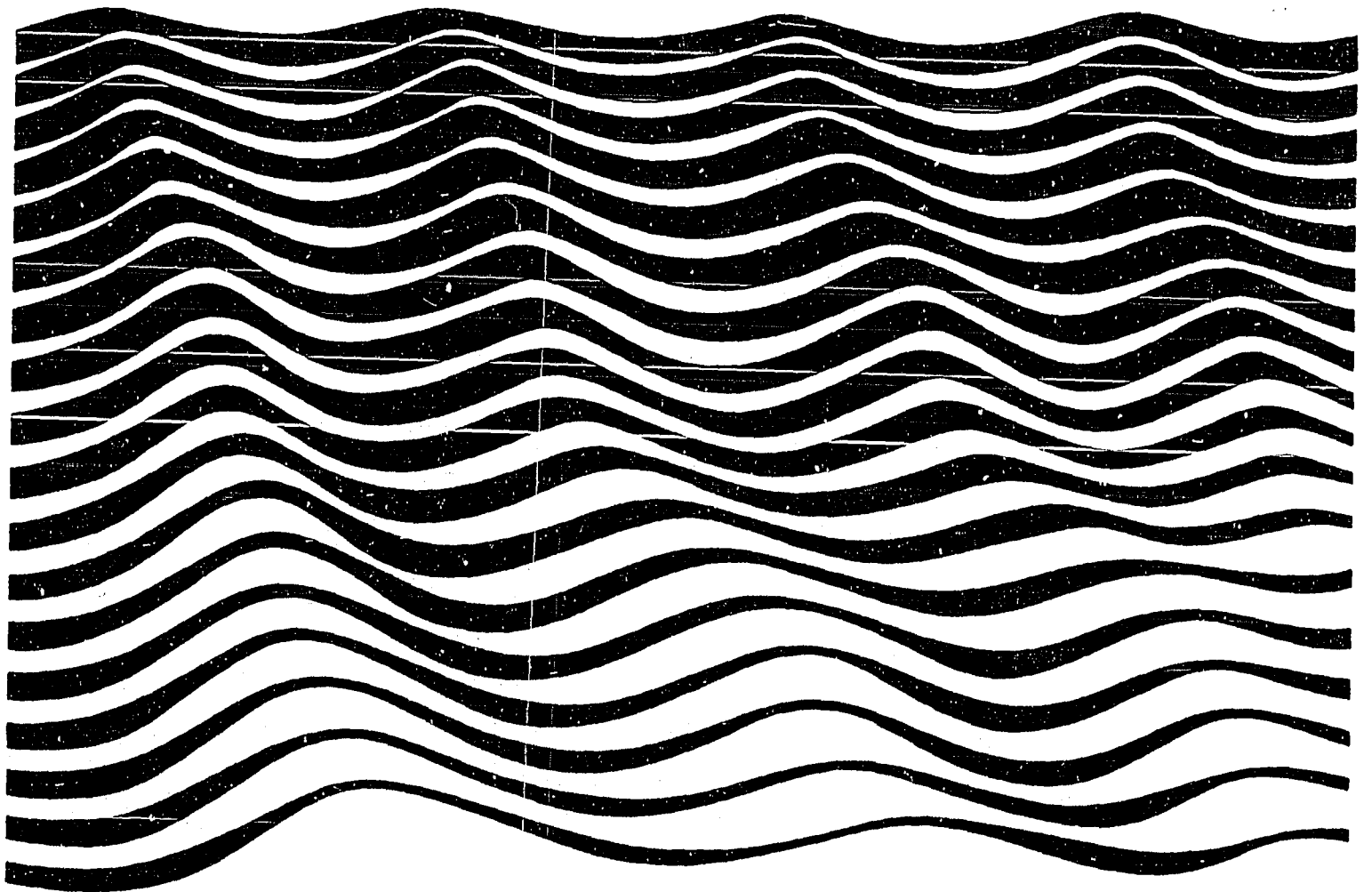


European subregional co-operation in oceanography



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22	European subregional co-operation in oceanography. Report of a working group sponsored by the Unesco Scientific Co-operation Bureau for Europe and the Division of Marine Sciences	1975	—

European subregional co-operation in oceanography

Report of a working group
sponsored by the
Unesco Scientific Co-operation
Bureau for Europe and the
Division of Marine Sciences

Trieste, Italy
3-5 July 1974

PREFACE

This series, the Unesco Technical Papers in Marine Science, is produced by the Unesco Division of Marine Sciences as a means of informing the scientific community of recent developments in oceanographic research and marine science affairs.

Many of the texts published within the series result from research activities of the Scientific Committee on Oceanic Research (SCOR) and are submitted to Unesco for printing following final approval by SCOR of the relevant working group report.

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I. REPORT OF THE WORKING GROUP

A working group of experts in oceanography met in Trieste from 3 to 5 July 1974 to make scientific recommendations on marine science activities in the sub-region of South-eastern Europe. The group was organized pursuant to a proposal by the "Meeting of Experts on European Sub-Regional Cooperation in Science" held by Unesco in Paris, 27-28 May 1974. The working group was convened by Dr. Morelli of the "Osservatorio Geofisico Sperimentale" in Trieste and the meeting took place in the International Centre for Theoretical Physics, Trieste, Italy. The list of participants is given in Annex II.

Opening of the Meeting

The meeting was opened by Dr. Morelli. Dr. Budini, Deputy Director of the International Centre for Theoretical Physics, Trieste, welcomed the participants. Dr. Morelli then introduced the participants and suggested procedure and an agenda. Dr. Morcos introduced the subject matter by describing the objectives of the group as expressed by Unesco in its proposal to elicit sub-regional cooperation in science. Dr. Marussi provided information on the background and philosophy of the sub-regional cooperation in South-Eastern Europe.

Dr. Morelli called for comments on the provisional agenda which he had suggested in his convening letter. It was accepted in the sense of a structural guide to the group's discussion. It was decided that the Convenor, Dr. Morelli could best act as Chairman, and Dr. Hopkins was elected Rapporteur.

Participants provided information on marine science facilities and national and international collaborative programmes in their respective countries (see Annex I).

General Comments and Recommendations

Discussions were conducted on the difficulties involved in international research due to various restrictions imposed by governments. It was agreed that the working group recommend that further cooperation take into consideration the inter-disciplinary nature of marine science when formulating programme details by seeking qualified representatives of all aspects of the science. This might be done by forming specific subgroups in different disciplines.

It was hoped that the coincidental interest of the sub-regional group on the Adriatic Sea should not be considered as exclusive of other marine areas. Indeed the need for comparative studies with other areas should be encouraged, particularly should an increase in the membership of the sub-regional group result in a subsequent enlargement of those marine areas bordered by member countries.

Dr. Morcos, representative of Unesco, briefed the meeting on the relevant activities of the Intergovernmental Oceanographic Commission and on the Unesco Programme in Marine Sciences. It was noted that the activities of FICSAS in the Adriatic Sea which are being considered as a sub-regional project of the joint IOC/FAO (GFCM)/ICSEM Cooperative Investigations in the Mediterranean (CIM) will be discussed fully at the next session of the International Co-ordination Group for CIM.

Discussion on the Formation of a Co-ordinated Programme in Oceanography

The various participants raised the potential problems involved in formulating co-ordinated oceanographic programmes, particularly those related to the Adriatic Sea.

Dr. Riedl stressed the inter-disciplinary nature of the problem as well as the various social and political repercussions which would no doubt take place if scientific attention was not given to matters of pollution. He added that the choice of indicator parameters and the availability of input data from all boundaries would be critical in constructing a valid pollution model.

Dr. Branica suggested that an outline be made of our present knowledge of the various water masses and coastal zones by defining the degree and variability of degradation in these areas, and by selecting the most pertinent physical, biological and chemical parameters. Dr. Battaglia underlined the importance of an ecological approach, particularly in describing the impact of the human disturbance on the marine ecosystem. He also pointed out that the Adriatic model might be applied to other marine areas.

Dr. Kečkeš brought up the importance of marine management and suggested this as a feasible and ultimate goal. However, in order to accomplish this, it is necessary to understand the system and know its inputs; it is in this regard that the scientific and political problems arise.

Dr. Piechura described cooperative efforts in the Baltic and emphasized the enormity of the tasks involved. Dr. Beldescu underlined the need to discuss problems of a common nature to increase the breadth of their applicability. Dr. Stirn warned that to direct efforts towards only one objective, namely pollution, might jeopardize the development of scientific programmes. Therefore, he suggested two categories of proposed activity:

- (a) basic scientific research, regardless of ultimate application, and
- (b) pollution studies, including aspects of marine resource exploitation.

Dr. Frassetto suggested the alternative of beginning with one or a few specific projects of common interest and proceeding slowly towards unified inter-disciplinary efforts. He also stressed the value of starting with existing cooperation between institutes.

Dr. Zore-Armanda brought to the attention of the group the remarkable amount of existing data and work accomplished in the Adriatic. She proposed the creation of 10 more permanent stations throughout the Adriatic, and stressed the need for external inputs, for example, data exchange with the rest of the Mediterranean.

Dr. Hopkins mentioned our responsibility, as marine scientists, to anticipate marine problems associated with environmental pollution, to aid in the determination of priority needs for basic research. He suggested that a great deal of international collaboration could be accomplished simply through the exchange of data and methodology, by intercomparisons, and by discussing new approaches to marine research.

Dr. Riedl proposed to consider the problem on three levels:

- (a) the construction of an overall model of the Adriatic. This would involve collaborative data gathering expeditions, data exchange, selection of indicator parameters, definition of inputs, etc...
- (b) the study of the flexibility of sub-environments within the system. This would mean defining the adaptability and function of certain sub-systems or processes, and relating them to the entire Adriatic system.
- (c) a consideration of the evolution of the system. The increased urban waste disposal has the effect of adding energy to the system which in turn generates an evolutionary stress. This aspect must be considered in terms of marine management and exploitation.

Taking these discussions into account the group formulated a general programme which is outlined below.

II. PROPOSAL FOR A COOPERATIVE PROGRAMME

1. Introduction

Background information

Regional cooperation already exists in oceanography, co-ordinated both by national bodies and international ones, (for example the Federation of the Institutions Concerned with the Study of the Adriatic Sea - FICSAS).

In the context of the environmental sciences, oceanography is the field where maximum inter-disciplinary and international cooperation is needed, but in which - at least until now - a minimal level of effectiveness has been attained.

Within the framework of European Sub-regional Cooperation, a programme in oceanography is therefore proposed.

The programme is presented in two parts:

1. A general plan devoted to basic research, graduated in time and taking into account the existing facilities and real needs for improvement.
2. A specialized one, devoted to the immediate application of a pollution and monitoring study of the Adriatic Sea.

Programme

The following programmes were proposed and discussed:

- 2.1. Joint basic oceanographic programme
- 2.2. Joint adriatic pollution research and monitoring programme
- 2.3. Comparative studies
- 2.4. Education and advanced training

Institutional Arrangements

- 3.1. Sub-Regional Centre for Physical Oceanography
- 3.2. Sub-Regional Centre for Marine Pollution Studies

2. Programme

2.1. Joint basic oceanographic programme

The aim of this programme is to understand the Adriatic Sea as a total living system, in order to support, protect and monitor it for the benefit of man.

With those perspectives in mind, the working group envisions international collaboration in all areas of the Adriatic Sea and in all the basic fields of marine sciences. It seems strongly desirable to support this international collaboration not only in the international waters of the Adriatic, but particularly within the coastal or national waters on both sides of the sea. Since these areas are the most endangered, it seems very desirable that the authorities responsible for the realization of this task assist in over-coming any legal obstacles.

It is obvious that the Adriatic Sea must be studied in its entirety for both scientific and economic reasons, and therefore definite international collaboration is essential. Furthermore, if this is accomplished it will certainly serve as a model for other areas of subregional interest.

From the point of view of establishing a basic research programme in the Adriatic Sea as an oceanographic space "model", it is imperative to investigate:

- the natural physical processes involved in the transportation and circulation of material and energy;
- the natural chemical composition (macro and micro components) and the physico-chemical processes, and
- the natural (biological) life cycles (qualitative and quantitative definition).

A. Physical oceanography

In order to explain physical processes for use in any particular area or programme, it is necessary to understand first the general physics and processes of the Adriatic Sea as a whole. This includes the dynamics of the two fluids, air and water, and their interaction with the land.

In fact, because of its shallowness, of its local meteorological conditions, and of the land morphology, the Adriatic Sea is particularly subject to very significant changes both in seasonal and in longer terms.

The study can therefore be achieved only through research synoptic in time and space. Representative fixed stations at locations indicated by numerical models and based on historical data, are recommended to obtain the required time series. Joint multiship cruises are recommended to obtain the required space series. Standardized and properly calibrated instruments should be used for the measurement of basic parameters in the lower atmosphere and in the water column.

Some suggested topics to be pursued are the following:

- large-and small-scale processes of air-sea interaction and energy budget;
- general circulation (including three dimensional space and time dependence);
- mass transport and water property budgets, applicable also to estuarine dynamics;
- approaches to modelling and analysis of physical fields such as wind density, sea surface elevation, and so on.

Co-ordinators: Dr. Frassetto,
Consiglio Nazionale delle Ricerche
Venice, Italy

Dr. Zore-Armanda,
Institute for Oceanography and Fisheries
Split, Yugoslavia

B. Chemical oceanography

In the Joint basic oceanographic programme, the chemical composition of sea water is very important, because it results from the complex, natural reactions and steady-state equilibria governed by the chemical, geological and biological processes.

The fundamental problem is that of the naturally occurring chemical composition and physico-chemical processes in the Adriatic Sea, in which an oceanographic space model is highly influenced by the fresh-water system. For fulfilling this aim the broad determination of macro and micro constituents is needed. The physico-chemical characterization (ionic forms, colloid particles, etc...) of the naturally present chemical components in the sea is of great importance because their fate is directly dependent upon prevailing chemical species.

Intercalibration and standardization of applied analytical procedures and development of new instrumental methods and techniques for laboratory research and field observation will be realized by sub-regional research collaboration and exchange of documents and scientists as well as by specialized training and education.

Co-ordinators: Dr. Branica,
Ruder Boskovic Institute
Zagreb, Yugoslavia

Dr. Macchi,
Consiglio Nazionale delle Ricerche (C.N.R.)
Rome, Italy

C. Biological oceanography

Within the framework of international cooperation in the field of basic marine science, it is strongly felt that a programme of biological oceanography should be established in the Northern Adriatic Sea.

The reason for this is the concentration of marine biology laboratories in this area, the density of population, industry and recreation centers, and the damage already caused. It is the aim of this programme

to help overcome the conflict of interests between industry and recreation, and to minimize related adverse effects.

To accomplish this goal the working group recommends a concentration of effort in sorting out natural fluctuation versus human impact, taking into broad consideration all factors and correlations, regardless of whether their applicability is already visible or not.

1) It is planned to produce an overall model of the Adriatic, taking into consideration the input, transmission and output of biologically pertinent parameters. The first goal will be to understand the overall of the dynamics of the system, the tolerance of the biological population and the limits of variability of environmental factors.

2) As pilot projects, it is envisioned to examine the most important biomes in terms of their distribution, structure and dynamics and to foresee their flexibility and tolerance to the impact of human activity.

3) It is planned to focus also on the evolutionary patterns of the possible and probable changes of species, biomes and communities so as to foresee their potential changes within these variations of the Adriatic Sea which are most likely to occur.

The three programmes will be coordinated by:

- Dr. Battaglia,
Istituto di Biologia del Mare
Consiglio Nazionale delle Ricerche,
Venice, Italy
- Dr. Riedl,
Zoologisches Institut der Universität Wien,
Wien, Austria
- Dr. Stirn,
University of Ljubljana
Portoroz, Yugoslavia

D. Geological oceanography

In the near future, it is envisaged that marine geology and sedimentology will also be included in the programme.

2.2. Joint Adriatic pollution research and monitoring programme

The objectives of the programme are to understand the mechanisms of diffusion and concentration of pollutants, and to identify the undesirable effects of pollution on common welfare and resources. All five components of the programme will have the same basic methodology:

- to study the dynamics of water masses and climatic change,
- to study the quality of water masses and their change in time,
- to study the biological effects of pollutants, their changes and trends.

The programme consists of the following five interdependent objects and will be co-ordinated by scientists in the region.

1. "Baseline studies and monitoring programme in Yugoslav coastal waters". The baseline studies are part of the ongoing UNDP-Assisted Project on the "Protection of Human Environment in the Yugoslav Adriatic Region " and the monitoring should be considered as follow-up activity of this project.
(Co-ordinator : Dr. Kečkeš).
2. "Baseline studies and monitoring programme in the Italian coastal waters". A similar project to the one described above; this is to be elaborated and executed by Italian scientists.
(Co-ordinator : to be designated).
3. "Adriatic open water programme". Based on the existing Italian and Yugoslav ship programmes involving longitudinal and transversal transects in the open international waters of the Adriatic.
(Co-ordinators : Dr. Stirn and an Italian counterpart to be designated).
4. "Northern Adriatic programme". Based on the existing Yugoslav-USA (Kveder-Gilmartin) programme and on the Italian programmes in the same area.
(Co-ordinators : Dr. Riedl, Dr. Kveder and an Italian counterpart to be designated).
5. "Adriatic rivers and land-based sources of Adriatic pollution". Based partly on the data from the UNDP - Assisted Project in Yugoslavia and additional new data from Italy and Yugoslavia.
(Co-ordinators : Dr. Keckes and an Italian counterpart).

2.3. Comparative studies

The desirability of comparative studies between work done in the Adriatic and other marine areas is apparent in the following major points agreed upon by the working group:

- (a) that the sub-regional marine area of interest is not exclusively concerned with the Adriatic;
- (b) that the Adriatic Model would serve as an excellent case study;
- (c) that there are aspects of Adriatic research which are immediately applicable to work done elsewhere, as for example by Romania in the Black Sea or by Poland in the Baltic Sea.

It is within this context that we propose several programme areas which may or may not overlap with those given under headings 2.1. and 2.2. above.

The construction of an Adriatic Model, including the effects of pollution, which:

- (a) would constitute a sub-system model, within the Mediterranean; that is, primarily, to evaluate its relationship to the rest of the Mediterranean;
- (b) might serve as an example of pollution modelling for other similar areas;
- (c) would assist in responding to questions of marine management for the Adriatic itself.

The establishment of cooperative marine research programmes involving:

- (a) other member countries. In these cases work of common interest would be essential. This could involve specific work on common processes such as "river discharge of pollutants into saline environments", or it might involve more general activity such as intercomparison of data and methodology;
- (b) other non-member countries. Programmes between member and non-member countries will no doubt enhance the research capability and effectiveness of member countries.

2.4. Education and advanced training

Within all proposed cooperative projects and attached centers, there is an important part of the programme devoted to advanced training and education, covering specific fields as relevant to proposed projects as well as to the general needs of the scientific community in the Mediterranean and adjacent regions. Therefore, particular emphasis is proposed for such training and education programmes and policies which will meet the needs of developing countries. Consequently, it is proposed to establish a permanent Advisory Committee for Educational Activities of a broad international composition which should, besides its obvious responsibilities, also explore and promote the possibility of including these activities within the framework of the United Nations University.

Proposed Co-ordinators : Dr. Morelli,
Osservatorio Geofisico Sperimentale
Trieste, Italy

Dr. Riedl,
Zoologisches Institut der Universität Wien
Wien, Austria

Dr. Stirn
University of Ljubljana
Portoroz, Yugoslavia.

At the present stage of development, the following fields can be covered by existing facilities and teaching staffs.

Physical oceanography

- (a) In the International Centre for Theoretical Physics, Trieste, a 3-month advanced course in Theoretical Oceanography for international candidates on the Physics of the Oceans and Atmosphere, will be started in January 1975, and will be continued within the framework of the International Centre for Physical Oceanography which is proposed to be established in Trieste.
- (b) Applied and theoretical yearly courses for post-graduate students from developing countries are starting in the 1974-75 academic years at the "Laboratorio per lo Studio della Dinamica delle Grandi Masse" on dynamical processes related to the physical environment and numerical simulation models. The courses include active participation in research programmes aimed at understanding causes and effects of calamity in the Venice area. Study grants are offered by the Italian Government.

Chemical oceanography

Specialized courses on chemical composition, equilibria and processes in natural aquatic systems are offered jointly by the Institute "Ruder Bošković" and the University of Zagreb, giving particular emphasis to the fate and influence on natural conditions from the point of view of bio-geo-chemical cycles of some important constituents. Training and development of instrumental procedures applied to laboratory, ship and field observations form a logical part of this training.

Biological oceanography

From 1971 to 1973, education and advanced training courses were organized in the fields of pure and applied ecology of the coastal area. These courses included studies of marine pollution and national exploitation of living resources and were administered by the University of Ljubljana in cooperation with Unesco's Division of Marine Sciences. A permanent graduate programme, offering a Masters' of Science Degree will be organized in collaboration with the University of Vienna and open to students from all Mediterranean and adjacent countries. A proposal for a Regional Advanced Training Centre at the University of Ljubljana was recognized in Resolution VIII-27 of the International Oceanographic Commission at the Eighth Session of its Assembly in Paris, November 1973.

Organization of advanced training courses in developing countries

The workshop also recommended that cooperation be continued with Unesco in order to organize the courses as described above in other geographic areas of the Mediterranean, if so requested.

Furthermore, arrangements can be made within existing national academic and research programmes for international candidates to be included in on-going research projects as research fellows, both in Italian and Yugoslavian institutions. Foreign students can also be accepted for graduate studies during regular four-semester graduate programmes - M. Sc. in Oceanography at the University of Zagreb and Marine Biology and Oceanography at the University of Ljubljana.

3. Institutional Arrangements

For the execution of the proposed programmes the following institutional arrangements were proposed and discussed:

3.1. Sub-Regional Centre for Physical Oceanography

The Centre will consist of the new International Institute for Physical Oceanography (as it was considered in 1972 by FICSAS, and in 1973 by IOC) and of institutions specialized in the physical oceanography of the Adriatic area. Initially the Centre will be situated at the "Osservatorio Geofisico Sperimentale" in Trieste but it will have at its disposal the facilities of the other institutions in Trieste and Venice. In a later phase, a separate new building with adequate facilities is foreseen. The financial support for the Centre will be from national sources with additional contributions from international funding sources.

The activities of the Centre will be concentrated on:

- Training and education. Post graduate training in physical oceanography using the Miramare International Centre for Theoretical Physics as an example.
- Technical advice in installation of physical oceanographic centres and programmes.
- Co-operation in planning and performing of research projects on request, including modelling.
- Analytical facilities for computer analyses of data and their interpretation.
- Study of special problems, both theoretical and practical, and major projects.

3.2. Sub-Regional Centre for Marine Pollution Studies

It is suggested that within the framework of European Sub-Regional Co-operation in Oceanography, scientific activities related to marine pollution be coordinated by a proposed Sub-Regional Centre for Marine Pollution Studies. The Centre will be composed of those parts of the existing Yugoslav institutions which are relevant to pollution studies and monitoring with the addition of certain services rendered in the execution of the programme.

Local financial sources will be used for the national programmes of the Centre while international funding sources will be sought for the sub-regional programmes of the Centre.

The Centre's programme will be divided into four sections which reflect the present activities of the five national oceanographic institutions and the needs of the subregion.

1. Education. The existing training and educational activities in all fields of oceanography, ranging from under-graduate to post-graduate will be further extended to cover the need of the subregion. Specialized courses and workshops in selected topics.

2. Research. The research activities relevant to the proposed programme will be carried out by the cooperating Yugoslav oceanographic institutions.
3. Documentation. Data collection, storage, retrieval and dissemination. Data bank based on UNIVAC 1110.
4. Monitoring and analytical services. Based on the developed analytical techniques, monitoring and analytical services will be provided for the subregion.

ANNEX I

EXISTING INSTITUTIONS AND PROGRAMMES

Italy

- 1.1. Trieste : Osservatorio Geofisico Sperimentale
- 1.2. Venice : Istituto di Biologia del Mare
- 1.3. Venice : Laboratorio per lo Studio della Dinamica delle Grandi Masse

Poland

- 2.1. Gdynia : Morski Instytut Rybacki
(Sea Fisheries Institute)
- 2.2. Gdynia : Instytut Meteorologi i Gospodarki
Wodnej Oddział Morski
(Institute of Meteorology and
Water Economy, Marine Division)
- 2.3. Gdansk : Instytut Morski
(Marine Institute)
- 2.4. Sopot : Zakład Oceanologii Instytut
Geofizyki PAN
(Oceanology Station of Geophysical
Institute, Polish Academy of Science)

Romania

- 3.1. Bucharest : Romanian Institute of Marine Research

Yugoslavia

- 4.1. Dubrovnik : Biological Institute
- 4.2. Kotor : Institute for Marine Biology and
Oceanography
- 4.3. Portoroz : Marine Biological Station,
University of Ljubljana
- 4.4. Rovinj and Zagreb : "Ruder Boskovic" Institute
- 4.5. Split : Institute for Oceanography and Fisheries
- 4.6. UNDP - Assisted Project on the "Protection of the Human
Environment in the Yugoslav Adriatic Region".

General

Federation of Institutions Concerned with the Study of the Adriatic Sea
(FICSAS).

ITALY

1.1. Trieste : Osservatorio Geofisico Sperimentale :

Staff : 60

Main fields :

- Marine geophysics

Surface gravity and magnetism : 220,000 km of profiles in the Mediterranean, from Gibraltar to 28° E.

Deep penetration seismic reflection : 22,000km of profiles, throughout the Mediterranean.

Advanced digital processing of all geophysical data.

- Physical and chemical oceanography

Modern equipment in all fields, including continuous measurements. Buoys with digital teletransmission in real time, computer processing.

1.2. Venice : Istituto di Biologia del Mare

The "Istituto di Biologia del Mare in Venice" is the only institution of the National Research Council dedicated to marine biology as a whole, including auxiliary disciplines such as hydrography, chemistry and sedimentology. Research is principally conducted on fundamental aspects, especially as they relate to the most urgent topics of contemporary public interest (productivity studies, pollution research, heredity and environment, carcinogenesis). There is close collaboration in various fields with the Istituto di Biologia Animale (Padua) and the Stazione Idrobiologica (Chioggia) of the University of Padua. International ties are maintained with the Duke University Marine Laboratory at Beaufort (North Carolina, U.S.A.) and with French and Yugoslav institutions. Members of the institute participate in the activities of a series of international research programmes.

The main research projects are :

1. Hydrobiological features, distribution of nutrients, of primary production and of the factors related to river flow in the Upper Adriatic.
2. Relationships between nutrient concentrations, biological parameters and salinity in coastal waters ; research on phyto - and zooplankton in the lagoon of Venice.
3. Effects of pollution on the biological communities in the lagoon of Venice with special emphasis on the selection of bioindicators; investigations on uptake; concentration and loss of hydrocarbons by mussels.
4. Ecology of beach-rocks found in the Upper Adriatic, determination of their origin, conditions of formulation and relation to the adjacent sediments.
5. Ecological genetics; speciation and evolution; colour polymorphism and its adaptative significance.

6. Biochemical polymorphism in fish and other organisms, also for the purpose of detecting the possible effects of pollution on the genetic structure of populations.

The "Istituto di Biologia del Mare" has a staff of 47 (scientists: 18, technicians : 17; administration : 6, boat crews : 6). The library of the Institute has in its holdings about 3,000 books, 1,370 periodicals (700 current) and a collection of about 8,000 reprints. The Institute is responsible for the editing of a journal, "Archivio di Oceanografia e Limnologia", the official organ of the "Consiglio Nazionale delle Ricerche" in the field of oceanography. The Institute has facilities for eight visiting investigators.

Among the more important research facilities are the following:

1. Laboratory equipment :

2 spectrophotometers, 1 spectrofluorimeter, 2 autoanalyzers, 1 gaschromatograph, apparatus for volumetric gas analysis, respirometer, Backman salinometer, analytical balances, various research microscopes including photomicrography, standard microbiological equipment (centrifuges, incubators, autoclaves, etc.), coulter counter, 2 environmental chambers (light, temperature, humidity, one programmable).

2. Computing facilities :

electronic desk calculators including 2 programmable ones (Olivetti), HP-2100-A computer system (Hewlett-Packard).

3. Boats :

R/V "Umberto d'Ancona" (24 m, 85 tons) for oceanographic research in the Upper Adriatic and 4 smaller vessels for inshore and estuarine work.

4. Oceanographic equipment :

oceanographic winch (500 m of 4mm steel cable) and a double-drum deck winch that can be used for light dredging, etc., equipment for in situ measurements of salinity, temperature, incident radiation, turbidity, dissolved oxygen, 2 marine advisor S-18 current meters, Elac Castor LAZ-17 portable ecograph, Ocean Sonix precision depth recorder, standard oceanographic sampling gear.

5. Diving equipment :

both open- and close-cycle underwater breathing apparatus with ultrasonic communication system, 2 decompression chambers.

6. Other equipment :

Xerox 7200 photocopier.

Other Italian institutions involved in marine biology

Research activities in marine biology are being carried out in many institutions throughout Italy. A list is given below for the further information of the reader. More details may be obtained by contacting the director of each institute.

Marine biological research is conducted in the following institutions:

1. Consiglio Nazionale delle Ricerche - C.N.R. (National Research Council)

- Istituto di Biologia del Mare, Venezia
- Laboratorio per lo Sfruttamento Biologico delle Lagune, Lesina
- Laboratorio di Tecnologia delle Pesca, Ancona
- Laboratorio per lo Studio della Corrosione Marine dei Metalli, Genova.

2. Universities

- Laboratorio di Biologia Marina e Pesca, Fano, Bologna
- Stazione di Biologia Marina del Tirrano, Cagliari
- Istituto di Zoologia, Genova
- Istituto di Anatomia Comparata, Genova
- Istituto di Idrobiologia e Piscicoltura, Messina
- Istituto di Botanica, Napoli
- Cattedra d'Igiene, Napoli
- Istituto di Biologia Animale, Padova
- Stazione Idrobiologica, Chioggia
- Istituto di Zoologia, Parma
- Istituto ed Orto Botanico, Trieste
- Istituto di Zoologia ed Anatomia Comparata, Trieste.

3. Other Institutions

- Laboratorio per lo Studio della Contaminazione Radioattiva del Mare, C.N.E.M. - EURATON, Fiascherino (La Spezia)
- Museo Civico di Storia Naturale, Genova
- Centro Universitario di Biologia Marina, Acquario Comunale, Livorno
- Istituto Sperimentale Talassografico, Messina
- Centro Sperimentale della Pesca, E.S.P.I., Messina
- Acquario Civico, Milano
- Stazione Zoologica, Napoli
- Laboratorio Centrale di Idrobiologia, Roma

1.3. Venice : Laboratorio per lo Studio della Dinamica delle Grandi Masse

The "Laboratorio per lo Studio della Dinamica delle Grandi Masse" was created by the Italian National Research Council in Venice in 1969, simultaneously with the "Istituto di Biologia del Mare".

The objectives are to understand the natural and man-induced mechanisms of the physical environment connected with the physical-safeguard of Venice. These studies concern three geophysical substances - air, water, sediment - and their interactions.

Air-sea-land interaction is the research subject related to physical oceanography. In this respect advanced studies, both theoretical and experimental, have been under way since 1969 in the following topics: circulation, heat budget, coastal processes, wind, waves and tides. Particular programme on short- and long-term research are related to these topics with the aim of acquiring as much useful information as possible to feed into practical, numerical models for prediction. Some preliminary prediction models for land subsidence, for floods from storm surges, for air pollution diffusion, lagoon water dynamics and cyclogenesis are already operative.

The laboratory's staff is 70 and that of the IBM Centre, 14.

The National Research Council oceanographic ships, the Marsile of 800 tons and the Bannock of 1200 tons are used when needed for cruises in the Adriatic and the Ligurian seas. One oceanographic laboratory on a platform was established 8 miles offshore with living quarters for two persons on long-term and four for short-term as well as facilities for long-term measurements of meteo-oceanographic parameters, long-term test of new instruments and sensors and as a calibration point.

A 14 ton, 40 meter high oceanographic spar buoy for telemetering oceanographic and meteorological data is moored in 2600 meters deep water in the center of the Ligurian Sea.

An IBM computer 360/44, presently being enlarged to 360/67, is available at the IMB centre full time.

Summer schools on geophysical fluid dynamics topics have been held every year under the auspices of Unesco.

POLAND

The following institutions are engaged in oceanographic research :

1. Gdynia . Morski Instytut Rybacki
Sea Fisheries Institute

About 50 scientists are carrying out research in physical, chemical, biological oceanography and pollution. The Institute has four ships : R/V "Professor Siedlecki", M/T "Wieczno", M/T "Birkut" and M/T "Lubecki".

2. Gdynia : Instytut Meteorologii i Gospodarki Wodnej, Oddział Morski
Institute of Meteorology and Water Economy, Marine Division

About 20 scientists are working in the field of physical and chemical oceanography, marine geology and meteorology. It has one ship : M/S "Hydromet".

3. Gdsáńk : Instytut Morski
Marine Institute

Besides other problems a few scientists are occupied with coastal processes and marine geology. It has one small ship.

4. Sopot : Zakład Oceanologii Instytut Geofizyki PAN
Oceanology Section of Geophysical Institute,
Polish Academy of Science.

About 20 scientists work in the field of physical and chemical oceanography mainly on theoretical problems. It has one small yacht.

Some oceanographic investigations are also carried out by universities and other marine institutions.

ROMANIA

3.1. Bucharest : The Romanian Institute of Marine Research

The Romanian Institute of Marine Research was created in 1970, and has a staff of approximately 300 persons, including 100 scientists, most of whom are young research workers.

Concerning marine biology, an inventory of flora and fauna has been completed. An ecological study of the Romanian littoral zone of the Black Sea (systematic approach, flow of matter and energy) has begun. Special attention has been given to species of economic importance. Research in aquaculture and acclimatization has also been started.

Studies in physical and chemical oceanography are oriented towards the dynamics of the main chemical components of sea water, as well as of currents, waves and sea level. Among other projects, the Institute is conducting a collaborative programme in marine geology and geophysics. One of its laboratories is also concerned with deep-diving problems from a physiological and technical point of view.

Each year, the Institute publishes a bulletin concerning oceanography and gives prognoses on fish stocks in the Black Sea. Research concerning fishing techniques is in progress.

As they are considered of high priority, activities in oceanographic research are conducted within a national programme and co-ordinated by the National Council for Science and Technology.

YUGOSLAVIA

4.1. Dubrovnik : Biological Institute

Staff : 18, two with Ph.D.

Ship : R/V "Baldo Kosić", length 15m, 25 BRT, 60 HP, 2 crew.
4 scientists.

Main fields of research :

taxonomy and ecology of zooplankton, aquaculture.

Research in the taxonomy and ecology of the Adriatic Zooplankton, comparative studies of plankton from other Mediterranean areas. Toxicological studies on plankton cultures.

Experimental aquaculture on fish and mussels.

4.2. Kotor : Institute for Marine Biology and Oceanography

Staff : 22, two with Ph.D.

Ship : R/V "Nemirna", length 20m, 169 BRT, 250 HP, 5 crew,
9 scientists;

R/V "Istraživač", length 11m, 12 BRT, 36 HP, 1 crew,
1 scientist.

Main fields of research :

hydrography and marine biology. Applied research.

Hydrography and hydrochemistry of the Bay of Kotor and the coastal waters off the south Yugoslav Adriatic coast. Marine microbiology, productivity studies, benthic ecology and fish biology.

Participation in the UNDP - Assisted Project on the "Protection of the Human Environment in the Yugoslav Adriatic Region".

Specialized pollution-oriented research.

Educational activities :

Under-graduate and graduate courses for Yugoslav students in marine biology and oceanography. Several international meetings were held at the Institute.

4.3. Portoroz : Marine Biological Station, University of Ljubljana

Staff : 17, one with Ph.D.

Ship : None, the field research is carried out either with locally rented ships or with ships of the other marine institutions and the Yugoslav Navy.

Main fields of research :

fundamental and applied marine ecology.

An ecological model of the Bay of Piran is being studied in cooperation with research groups from the University of Vienna, the University of Göttingen and the Smithsonian Institution, Washington D.C. A computerized inventory of the Adriatic fauna and flora is in preparation .

Major fields of activity include the biology of pelagic fish, fisheries, and pollution-oriented projects. Among the latter are the transadriatic pollution monitoring programme, the utilization of organic pollutants in mariculture, and in protein extract production, the eco-system modifications of polluted marine environments, and pollution monitoring.

Educational activities :

national and international.

As part of the university programme, graduate and post-graduate curricula are offered in marine biology, oceanography and marine fisheries.

In 1971, and 1973, regional training courses were organized at the graduate level by the "Mediterranean School for Marine Sciences" operated by the Marine Biological Station. Both courses were supported by Unesco and the University of Ljubljana intends to develop the School as a permanent training center for ecological and pollution problems.

4.4. Rovinj and Zagreb : "Ruder Bošković" Institute

Staff : 135, 27 with Ph.D. (out of a total staff of more than 700, only those active in oceanography are given).

Ship : R/ V "Vila Velebita", length 26m, 16 BRT, 200 HP, 5 crew, 8 scientists.

Main fields of research :

basic research in chemical and biological oceanography, applied pollution-oriented research and monitoring.

Chemical composition and the physico-chemical processes underlying the complex physical, chemical and biological properties of the Adriatic Sea. Particular emphasis on nutrients, sea water microconstituents and their specialization under the influence of the semi-estuarine conditions in the Northern Adriatic. Surface phenomena.

Ecology of the Northern Adriatic, with emphasis on benthic communities. Space and time distribution of phytoplankton, and primary productivity. Marine bacteriology. Molecular biology of marine organisms. Ecophysiology and toxicology of fish. Mariculture of mussels.

The "Ruder Bošković" Institute co-ordinates the pollution-oriented research and monitoring executed jointly with the other Yugoslav marine centers as part of the UNDP - Assisted Project on the "Protection of the Human Environment in the Yugoslav Adriatic Region". Within the framework of this five-year project (1972-1976) more than 50 different parameters are studied on 186 oceanographic stations, hundreds of coastal transects and several general transects. The Institute acts as the data bank for the project using a UNIVAC 1110 computer.

Environmental studies resulting in an environmental impact statement are a common practice of the Institute.

Educational activities :

Approximately 25 under-graduate and graduate courses lasting 10-15 days are organized each year at Rovinj. Participants: 80% from abroad; subject : marine biology.

The staff of the Institute, in collaboration with the University of Zagreb, organizes graduate studies in oceanography leading to M. Bc. and Ph.D. Foreign students are welcome.

The Institute provides the nucleus for the planned International Center for Environment Managers, organized to assist developing countries.

The Institute has had a wide experience in organizing summer schools, seminars, workshops, meetings, symposia and conference on various topics, including oceanography.

Publications :

"Thalassia Jugoslavica", devoted to marine and estuarine problems, is published twice a year. Contributions are accepted in standard "scientific" languages.

4.5. Split : Institute for Oceanography and Fisheries

Staff : 65, ten with Ph.D.

Ship : R/V "Bios", length 28m, 162 BRT, 300 HP, 7 crew, 10 scientists,

R/V "Predvodnik", length 18m, 54 BRT, 150 HP, 5 crew, 5 scientists.

Main fields of research :

basic research in physical, geological, chemical and biological oceanography, applied research in exploratory fishing and pollution-oriented studies.

Current measurements and analysis of the dynamics of water movements. Long-term hydrographic programmes on fixed

oceanographic stations. Marine chemistry, particularly nutrient analyses. Geology of the sea bottom. Research in the ecology of phyto -and zooplankton, productivity studies. Fishery biology, particularly larval development and population dynamics. Marine microbiology. Ecology of benthic and planktonic communities. Taxonomy of the Adriatic organisms.

Exploratory fishing using new fishing techniques and improvement of the existing ones.

Research in the utilization of Adriatic resources.

Active cooperation in the UNDP - Assisted Project on the "Protection of Human Environment in the Yugoslav Adriatic Region". Applied environmental studies for special purposes.

Educational activities :

Summer courses in marine biology for Yugoslav students.

Publications :

The Institute publishes as a regular series the Journal Acta Adriatica and its Notes. Both publications are open to outside contributions.

4.6. The UNDP - Assisted Project on the "Protection of the Human Environment in the Yugoslav Adriatic Region".

In 1972, a five-year UNDP - Assisted Project on the "Protection of the Human Environment in the Yugoslav Adriatic Region" became operational. The programme is operated by a nominated Project Manager and the Project's Yugoslav Co-Director. The seat of the Project is in Rijeka.

The "Ruder Bošković" Institute, and particularly its Centre for Marine Research at Rovinj, was selected as the leading institution for the marine sector. The studies in this sector will be executed in close collaboration with four additional institutions selected for their location, special experience and available techniques. These institutions are the Marine Biological Station at Portoroz, the Institute for Oceanography and Fisheries at Split, the Biological Institute at Dubrovnik and the Institute for Marine Biology and Oceanography at Kotor.

Within the framework of the Project, the following objectives have been accepted as guidelines:

- to investigate the mechanisms which govern the changes of specific physical, chemical and biological parameters,
- to determine the correlation between the elevated concentration of pollutants and the observed detrimental effects,
- to establish the general pattern governing the flow of energy and matter in the marine ecosystem,

- to assess the danger to the natural balance in the Adriatic posed by the influx of man-made energy and matter into the marine environment.
- to assist in the formulation of recommendations aimed at the mitigation of the negative impact of pollutants on the marine environment.

Besides these general and long-term objectives, the following concrete and short-term tasks were accepted:

- to establish the present state of pollution in Yugoslav coastal waters (baseline studies),
- to analyse regions which are under heavy stress from pollutants (regional studies),
- to assess the waste-receiving capacity of selected regions,
- to analyse the trends in the concentration of pollutants in coastal zones and in the quality of the marine environment (monitoring).

During the baseline studies (1972-1974), 13 representative coastal regions, almost 100 local and transversal transects throughout the mid-Adriatic will be systematically analyzed for more than 50 parameters. These regions and transects are covered by a grid of 186 fixed stations where the sampling and/or "in situ" analyses will be performed. The frequency of the sampling and analysis depends on the character of the analyzed parameters and the position of the sampling station and will range from weekly to seasonal.

All the available data will be used for the development of a comprehensive model of the biogeocycle of the actual and potential pollutants in the Adriatic Sea. System analysis is selected as the most promising approach to solve this problem.

In addition to the field studies envisaged within the framework of the baseline studies, extensive laboratory investigations are under way to complement the results of the field studies. These contribute considerably to the evaluation of hazard from various marine contaminants in relation to the stability of the ecosystem in the Yugoslav coastal region.

The baseline studies were to continue through mid-1974. By that time it was hoped to have the first results of the system analysis and to use them as guidelines for a monitoring programme. This programme encompasses only the measurement of a few parameters directly relevant to the actual pollution situation in selected key areas. It is envisaged that the monitoring programme would not terminate at the end of the project, but on the contrary it would be strengthened and serve as the basis for a permanent monitoring system for evaluating changes in the quality of the coastal environment.

GENERAL

Federation of Institutions Concerned with the Study of the
Adriatic Sea (FICSAS).

The Federation of Institutions Concerned with the Study of the Adriatic Sea (FICSAS) was formed in February 1972 as a voluntary co-ordinating organization of the institutions involved in the scientific study of the Adriatic Sea.

According to the Statutes of FICSAS, its main objectives are :

- to co-ordinate research projects in order to fill the existing gaps in the investigations,
- to improve the flow of information,
- to co-operate in the high level training and education of scientists,
- to offer laboratory facilities and formal training for scientists of FICSAS members and from developing countries,
- to organize bi-annually scientific symposia devoted to the problems of the Adriatic Sea,
- to organize regional contacts through meetings on special topics,
- to develop suitable analytical services, including the production of standards and substandards.

To date the following institutions have joined the FICSAS:

- Biological Institute
Dubrovnik
Yugoslavia
- Zoological Institute
University of Vienna
Vienna
Austria
- Institute of Biology
University of Ljubljana
Ljubljana
Yugoslavia
- "Ruder Bošković" Institute
Zagreb and Rovinj
Yugoslavia

- Geological-Palaeontological Institute
Georg-August University
Göttingen
Federal Republic of Germany
- Geological Institute
Slovakian Academy of Science
Bratislava
Yugoslavia
- Experimental Geophysical Observatory
Trieste
Italy
- Institute of Comparative Zoology and Anatomy
Trieste
Italy

At present, the seat of the FICSAS is at the Centre for Marine Research of the "Ruder Bošković" Institute in Rovinj. The Executive Board consists of Dr. Kečkes as Chairman, Drs. Morelli and Riedl as members.

At a previous meeting in October 1971, representatives of the member institutions proposed several Adriatic projects and it was agreed to support the creation and/or development of the:

- International Institute for Physical Oceanography at Trieste,
- Regional Science Service Center at Rovinj,
- Institute for Biological Oceanography at Vienna.

ANNEX II

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UNESCO TECHNICAL PAPERS IN MARINE SCIENCE

Titles of numbers which are out of stock

No.		Year	SCOR WG
1	First report of the joint panel on oceanographic tables and standards held at Copenhagen, 5-6 October 1964. Sponsored by Unesco, ICES, SCOR, IAPO	1965	WG 10
2	Report of the first meeting of the joint group of experts on photosynthetic radiant energy held at Moscow, 5-9 October 1964. Sponsored by Unesco, SCOR, IAPO	1965	WG 15
3	Report on the intercalibration measurements in Copenhagen, 9-13 June 1965. Organized by ICES	1966	-
4	Second report of the joint panel on oceanographic tables and standards held in Rome, 8-9 October 1965. Sponsored by SCOR, Unesco, ICES, IAPO	1966	WG 10
5	Report of the second meeting of the joint group of experts on photosynthetic radiant energy held at Kauizawa, 15-19 August 1966. Sponsored by Unesco, SCOR, IAPO	1966	WG 15
6	Report of a meeting of the joint group of experts on radiocarbon estimation of primary production held at Copenhagen, 24-26 October 1966. Sponsored by Unesco, SCOR, ICES	1967	WG 20
7	Report of the second meeting of the Committee for the Check-List of the Fishes of the North Eastern Atlantic and of the Mediterranean, London, 20-22 April 1967 Procès-verbal de la 2e réunion du Comité pour le catalogue des poissons du Nord-est atlantique et de la Méditerranée, Londres, 20-22 avril 1967	1968	-
8	Third report of the joint panel on oceanographic tables and standards, Berne, 4-5 October 1967. Sponsored by Unesco, ICES, SCOR, IAPO	1968	WG 10
10	Guide to the Indian Ocean Biological Centre (IOBC), Cochin (India), by the Unesco Curator 1967-1969 (Dr. J. Tranter)	1969	-
11	An intercomparison of some current meters, report on an experiment at WHOI Mooring Site "D", 16-24 July 1967 by the working group on Continuous Current Velocity Measurements. Sponsored by SCOR, IAPSO and Unesco	1969	WG 21
12	Check-List of the fishes of the North-Eastern Atlantic and of the Mediterranean (report of the third meeting of the Committee, Hamburg, 8-11 April 1969)	1969	-
14	Fifth report of the joint panel on oceanographic tables and standards, Kiel, 10-12 December 1969. Sponsored by Unesco, ICES, SCOR, IAPSO	1970	WG 10