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**WORKPLAN AND PROGRESS REPORT ON THE CO-OPERATIVE
MARINE SCIENCE PROGRAMME FOR THE BLACK SEA, 1993-1994**

Pursuant to the Resolution XVII-15 "Regional Black Sea Co-operation Programme", this document provides information on CoMSBlack and a draft proposal for the IOC Black Sea Regional Programme prepared by the IOC Consultant in cooperation with the Academy of Sciences of Bulgaria. The Executive Council is invited to consider this matter under the Agenda Item 4, bearing in mind the available resources.

1 June 1994

**COMSBLACK PLAN OF ACTION for 1994
SUMMARY REPORT****David G. Aubrey, Chairman**

The Cooperative Marine Research Program for the Black Sea (CoMSBlack) continues into its third year of existence with a full research program scheduled, in spite of severe economic difficulties experienced by its member nations. The partners in CoMSBlack have continued to cooperate fully in carrying out the research mission, and have all contributed high quality scientific results to the program.

Last year, 1993, was a notable year for CoMSBlack because of the successful start of a complementary research program, NATO TU-Black Sea, which began to receive funding starting this year. NATO TU-Black Sea is a five-year research program directed towards developing a successful ecosystem model of the entire Black Sea, for use in management and international policy questions. NATO TU-Black Sea is directed by Dr. Umit Unluata, of the Institute of Marine Sciences, Middle East Technical University, Erdemli, Turkey. Dr. Unluata is a founding member of CoMSBlack, and is the Executive Committee member to CoMSBlack from Turkey. The objectives of NATO TU-Black Sea are within the scope of those identified by CoMSBlack as part of its overall objectives. That funding was obtained to carry out specific well-targeted research goals of the CoMSBlack program is a testimony to the manner in which CoMSBlack may be expected to work in the future. NATO TU-Black Sea is an independent program under the NATO umbrella, though some facilitation takes place through CoMSBlack where appropriate. These two complementary programs will work closely together in the years to come; Dr. Unluata's participation in both programs will help assure close coordination between activities.

1993 also saw other significant developments in the Black Sea. In this year the Program Coordination Unit (PCU) for the Black Sea Global Environmental Facility (GEF) was established in Istanbul. CoMSBlack is cooperating closely with the GEF, and working hard on coordination of Black Sea research efforts. Cooperation includes work on a Black Sea bibliography, establishment of a Black Sea GIS, and creation of a data base management system for Black Sea data. Dr. Vladimir Mamayev, a former CoMSBlack scientist, is now working in the GEF in Istanbul, helping to assure successful coordination between the GEF and CoMSBlack.

Other notable start-ups in the Black Sea include the European Community's EROS 2000 project, which will transition to the Black Sea from the Mediterranean Sea in 1994. Since 1991, CoMSBlack has maintained close ties with the European Community on Black Sea affairs; the new EROS 2000 program is an outcome of the interest of western Europe in this neighboring sea. Coordination with EROS 2000 is accomplished both directly through Brussels and through the GEF's coordination meetings (one of which was held in January, 1994 in Istanbul). In addition to EROS 2000, the European Community is also active in the Black Sea through its PHARE efforts. Both of these efforts include participation by CoMSBlack partners, assuring commonality of methods and enhancing communication between programs.

CoMSBlack participants have experienced severe financial pressures due to evolutions in their socio-economic conditions. Inflation has pressured all Black Sea countries this past year, and economic pressures have affected national academic activities. Facilities and scientific personnel are being diverted for more immediate economic use and gain, adversely affecting continuation of some research activities. In spite of these pressures, though, CoMSBlack has continued to be active and to work closely with all participating institutions. In order to continue to be successful,

however, some of the needs of the member countries must be addressed. These needs continue to evolve as CoMSBlack matures, but some important needs include:

- Payment for use of ships (historically, CoMSBlack has not paid for ship use, leaving that as an individual member country contribution).
- Partial payment for scientists participating in CoMSBlack (reflecting the need for salaries adequate to keep scientists in science).
- New equipment and facilities: being partially addressed by new programs such as NATO TU-Black Sea, new equipment and facilities are required for intercalibrated scientific results and state-of-the-art science.
- Educational and exchange programs amongst participating states to enable more fruitful collaboration in science. Existing exchange programs are sporadic and responsive to opportunities, rather than being carefully thought-out, optimized exchanges.
- Communications must be improved. NATO TU-Black Sea will help solve some communications programs, but only for the major NATO TU-Black Sea partners. Other participants also require improved capabilities for free and open communication.

CoMSBlack will continue to seek funding to help address these member needs. IOC has been one source of such funding, providing targeted funds for meetings, preparation of documents and books, travel, and the like. Other funds come from efforts spawned from CoMSBlack, such as NATO TU-Black Sea. More funds are being sought from other sources, both international and national. CoMSBlack continues to play an active role in encouraging and brokering various fund-raising efforts. To continue to be a major player in the Black Sea, however, CoMSBlack will require some continued support from one or more agencies, at a level sufficient to permit free communication and coordination.

Scientific efforts planned for 1994 are varied and extensive. Some representative plans for 1994 include:

CoMSBlack 1994a: This research cruise, conducted in April and May, had participation by Turkish, Bulgarian, Romanian, and Ukrainian ships, and covered much of the Black Sea. Coordinated by Dr. Leonid I. Ivanov of the Marine Hydrophysical Institute of Sevastopol, Ukraine, the cruise focused on the Spring phytoplankton bloom on the Northwest Black Sea shelf. A data exchange is planned for later in 1994, and a data intercomparison/intercalibration meeting will be planned for later this year as well. CoMSBlack 1994a was a joint activity with NATO TU-Black Sea.

Istanbul Oil Spill of March, 1994: In March, 1994, an oil spill occurred in Istanbul after a tanker accident near the Bosphorus Straits. Though the spillage of oil was small in volume, the potential for adverse harm was significant. CoMSBlack communicated through the GEF and IOC to provide scientific input into the oil spill response, as needed.

Ecosystem Modeling Meeting, 23-25 March, 1994: Cosponsored by NATO TU-Black Sea, IOC, ONR/Europe, and CoMSBlack, an ecosystem modeling meeting was hosted by Dr. Emil Stanev of the University of Sofia, Bulgaria; Dr. U. Unluata of IMS/METU; and Dr. David G. Aubrey of CoMSBlack/Woods Hole Oceanographic Institution. This institutional meeting, held in Sofia, Bulgaria, brought together scientists from the region and from abroad to discuss a strategy for ecosystem modeling in the Black Sea for the next four years. A proceedings volume is now being prepared with the results and scientific papers from this meeting. EROS 2000 was also represented during this meeting.

Black Sea Bibliography: CoMSBlack, with funding from IOC, in conjunction with the PCU/GEF in Istanbul, has nearly finished preparation of a Bibliography for the Black Sea from 1974 to present. Conceived from Dr. V. Mamayev's experiences while working in Woods Hole, this bibliography has contributions from all Black Sea countries. The book is being prepared at the

Marine Hydrophysical Institute in Sevastopol, Ukraine, under the leadership of its Director, Dr. Valery Eremeev. Publication of the volume is expected during summer, 1994.

Hydrogen Sulfide in the Black Sea: Also funded in part by IOC, a special volume has been prepared describing the hydrogen sulfide issues in the Black Sea. Edited by Drs. Bezberodov and Eremeev from MHI, Sevastopol, and Dr. Aubrey of CoMSBlack/Woods Hole, this volume will be published by IOC in the summer of 1994. The volume is the first in English that describes the different processes associated with formation of deep and shallow hydrogen sulfide in the Black Sea, as well as the biological and chemical implications of such processes.

Deep Sea Research special volume on Oceanographic Variability in the Black Sea: Dr. Aubrey is editing another special volume of Deep Sea Research, focusing on the variability in the Black Sea. Contributions have been received from authors from most of the Black Sea countries, as well as external contributors. This volume will be published in late 1994, or early 1995. The subject matter includes many disciplines.

Planning and coordination activities: Funds permitting, CoMSBlack continues to conduct planning and coordinations activities for its program. Two types of meetings are generally held: Executive Committee meetings to plan implementation of CoMSBlack activities, as defined by the Steering Committee with broader participation by all Black Sea countries. The last CoMSBlack Executive Committee meeting was held in October, 1993; the next one will be held in fall/winter, 1994, as the funds permit. A Steering Committee meeting will be held in summer, 1994, if funds permit.

CoMSBlack Program Office: This Program Office continues to be located at the Woods Hole Oceanographic Institution, where the Chairman is located. Funds for the Program Office are derived from a variety of national and international sources, though no single agency provides significant support for this office. This office is responsible for communications, workshop planning and coordination, fund-raising, publications (maintaining a publications list of CoMSBlack publications), Steering and Executive Committee meetings, etc. Ms. Pamela Barrows helps run the CoMSBlack Program Office.

Experts involved in this IOC work (Workshop on Modeling, Planning meeting, Bibliographic preparation):

BIBLIOGRAPHY:

Bulgaria: S. Moncheva, E. Demirov, D. Trukchev, and A. Konsulov (all from Institute of Oceanology, Varna, Bulgaria); \$500.

Romania: A. Bologa, V. Diaconu, T. Cristescu, and colleagues (all from Romanian Marine Research Institute, Constantza, Romania) \$500.

Ukraine: V. Eremeev and colleagues (Marine Hydrophysical Institute, Sevastopol), Center for Marine Pollution (Odessa; funded under contribution from GEF). \$2400.

Russia: N. Tumanseva and colleagues (Inst. of Oceanology, Moscow; funded under contribution from GEF).

Georgia: Hydrometeorological Center (Tbilisi; funded under contribution from GEF).

IOC BLACK SEA REGIONAL PROGRAMME

1. INTRODUCTION

In accordance with IOC Resolution XVII-15 a work plan, **The IOC Regional Programme for the Black Sea**, is proposed with a view to establishing an IOC Regional Committee for the Black Sea. The Programme has been proposed by the Secretariat of IOC in co-operation with the organisers of the International Conference with a Workshop Co-operation Project for Integrated Research and Monitoring of the Black Sea in Varna, Bulgaria, in September 1994, when the Regional Programme will be discussed.

The significance of the IOC Regional Programme for the Black Sea is determined by a number of circumstances, the most important being:

- The special natural features of the Black Sea, such as:
 - (i) The ratio of the water catchment area to the surface area of the Black Sea is 5 to 1, i.e. an order of magnitude higher than the ratio for the global ocean.
 - (ii) The high river discharge and the isolation of the Black sea from the world ocean cause an exceptionally strong water stratification.
 - (iii) As a result of the poor ventilation 90% of the water masses in the Black Sea is anoxic, thus constituting the largest body of anoxic water masses in the world.
 - (iv) The humid climate of the Black Sea watershed and the high river discharge result in a high level of terrigenous sedimentation in the Black Sea;
 - (v) The specific geological structure and the recent history of the Black Sea is marked by features of a micro-ocean passing through stages of lacustrine and marine phases of development, and representing a contemporary model of ancient metallogenic and oil and gas generating basins
- Increasing anthropogenic influence which, together with the specific natural features, deteriorate the environmental status of the sea and in some regions (especially in the North-western sector) cause a critical environmental situation, particularly with regard to eutrophication.

- The Black Sea comprises a wide spectrum of living and non-living resources (including hydrocarbons), as well as resources for recreational activities); which, considering the urban development and economic structure of the coastal area, sets the stage for a major social and economic development for the coastal states of the Black Sea.
- A generally new situation in international relations, resulting from the coming into effect of the Convention for Protection of the Black Sea against Pollution and the start of the Black Sea economic collaboration.
- The increased interest in studies of Black Sea problems, not only in the Black Sea coastal states but also in international organisations and among scientists from countries outside the region. As a consequence, a number of programmes and projects are carried out in the Black Sea at the present time.
- The complexity of the processes and the unique phenomena in the region call for establishment of a long term programme for environmental studies and monitoring of the Black Sea.

2. LEGAL GROUNDS OF THE IOC REGIONAL PROGRAMME FOR THE BLACK SEA

The proposal for elaboration of the IOC Regional Programme for the Black Sea is based upon:

- The Resolution of the General Conference of UNESCO (Doc. 27 C/5 1.21 and DR 190 of 1993), which advises "l'adoption d'un Projet régional de recherches intégrées et de surveillance continue relatif à la mer Noire".
- The Resolution XVII-15 of the IOC Assembly, which states:
**"Instructs the IOC secretary to explore ways of assistance in addition to available UNESCO Regular Programme funds, in particular through international and regional funding agencies, to support development of a work plan by a Regional Association for the Black Sea, with a view to establish e Regional Committee for the Black Sea as an IOC regional subsidiary body for co-operation in this region;
 Requests the IOC Executive Council, at its Twenty-seventh session, to consider the further implementation of this resolution in the light of possible co-operation with other international and regional bodies."**

3. OBJECTIVES OF THE PROGRAMME

The general goal of the programme is to provide scientific support for sustainable development of the Black Sea region and for environmentally sound utilisation of its natural resources. The derived major objectives of the programme are:

- To encompass important scientific issues not fully covered by other Black Sea regional programmes, thus enhancing the scope of the Black Sea oceanography on a long-term basis.
- To interact with the activities of other ongoing Black Sea programmes and projects.
- To establish a Black Sea Regional Centre for Oceanographic Data and Information.
- To promote co-ordination (including financial) among states in the region and interested international organisations in scientific studies of priority problems of the Black Sea.
- To assist the governments of the Black Sea states and relevant national and international institutions in their decision making, control and other activities, arising from the Convention for Protection of the Black Sea against Pollution, the Convention on Fishing in the Black Sea, the Declaration on Black Sea Economic Collaboration and other documents with national and international status.
- Promotion of capacity building and training of experts, and co-operation in marine educational programmes in the region.
- Promotion of elaboration and harmonisation of regulations and legislation of the Black Sea states in respect of sustainable development and protection of the environment in Black Sea, and harmonisation of standards and methodology in marine scientific research,

4. STRUCTURE AND SCOPE OF THE PROGRAMME AND RELATED ACTIVITIES

The structure and the scope of the Programme has been designed to avoid overlapping and duplication of on-going activities, and the Programme has taken into account the views and recommendations of the Co-ordination Meeting of Research Activity Sponsors, held in Istanbul, 6-7 January 1994.

The Programme document comprises:

- inventory of international programmes and projects for defining the scope and status of the proposed programme;
- proposals for development of new projects;
- proposal for the establishment of a Black Sea Regional Centre for Oceanographic Data and Information;
- organisation of the activities.

4.1. Status of the Regional Programme

The relationship of the proposed programme to existing and planned scientific activities in the Black Sea region is indicated in Table 1.

The programme should be established as an IOC regional programme, carried out in co-operation among the coastal states of the Black Sea and other interested states and institutions. It is primarily focused on fundamental scientific Black Sea problems and it is a long term programme, without ruling out important short term issues.

The programme is open not only to scientists from all coastal countries of the Black Sea region, but also to other interested organisations, institutions and scientists from outside the region.

4.2. Proposed projects within the framework of Regional Programme

It is suggested that the projects within the Regional Programme should be of a scientific character focused on problems not sufficiently covered by other programmes and projects. Some of the projects which in their problem definition appear similar to existing projects, provide alternative approaches and solutions.

Projects to be considered by the interested parties:

- A.1. Promotion of elaboration and harmonisation of national legislation regulating marine scientific research and protection of the marine environment of the Black Sea, and harmonisation of standards and methodologies in marine scientific research.
- A.2. Scientific aspects of sustainable development and management of the coastal zone
- A.3. Environmental control of the dynamics of living resources in the Black Sea.

A.4. Human health consequences of environmental degradation of the Black Sea environment

A.5. Harmful plankton blooms and harmful plankton in the Black Sea ecosystem.

A.6. Dispersion of sedimentary material in the Black Sea and its evolution in the recent geological history of the basin.

A.7. An Operative system for meteorological, oceanographic and specialised prognoses.

A comprehensive description of the main aspects of the proposed projects is attached in Annex 1.

4.3. Proposal for establishing a Black Sea Regional Centre for Oceanographic Data and Information

The atmospheric and oceanographic processes of the Black Sea region affect all the countries of the region. Joint investigation of these processes and joint acquisition, accumulation, processing and dissemination of both meteorological and oceanographic data would therefore benefit all the coastal states. In cases of forecasting emergency situations, the possibilities of receiving and disseminating meteorological and oceanographic data through the Global Telecommunication System (GTS) of WMO acquire special significance.

Data from international programmes, carried out in a specific geographic region are normally accumulated in data centres. There is no such centre in the Black Sea region and moreover, although several international programmes for investigation of the Black Sea are currently implemented, no common structures for joined storage and exchange of the accumulated data exist.

To make full advantage of the information on the Black Sea, development of an adequate structure for acquisition, quality control in common standard, storage and dissemination of the data from all international research programmes of the region is required. It is essential to adapt the general concept, scope and strategy of the programme to the requirements of donors and users and in accordance with the principles of IODE.

One of the basic objectives of the Regional Programme is to establish a Black Sea Regional Centre for Oceanographic Data and Information (BSRCDI), including an Oceanographic Data Bank, which permits archiving, easy access, quick and qualitative restore, control and exchange of data. The centre has to be closely related to the regional structures of WMO and interact closely with the WDC's-Oceanography and other oceanographic centres in the region. A Regional Centre for Oceanographic Data and Information would also play a major role in the future development of Black Sea Activities related to the Global Ocean Observing System. A major responsibility of a regional marine information centre would be to disseminate marine bibliographic references and information to users in the region. The major activities of the BSRCDI would be:

- accumulation and dissemination of data, using the capacity of the telecommunication network and of the existing regional centre of GTS in the Black Sea region;

- quick and easy contact with the operational teams forecasting extreme situations and events caused by natural and anthropogenic factors, including dissemination of emergency information;
- creating an oceanographic data bank for acquisition, control, processing and storage of data obtained by the IOC Regional Programme for the Black Sea, and distributing information and data products on request;
- usage of Geographic Information System (GIS) for specific applications;
- operating major international databases for marine scientific and technical information and scientific references and publications;

5. ORGANISATION, MANAGEMENT AND CO-OPERATION

- (i) The programme for integrated research of the Black Sea should be established as a Regional Programme of the Intergovernmental Oceanographic Commission (IOC) in accordance with IOC Resolution XVII-15.
- (ii) A Regional Committee for the Black Sea as an IOC regional subsidiary body should be established, modelled upon the IOC practice.
- (iii) The IOC Regional Committee for the Black Sea should co-ordinate the scientific activities in the IOC Regional Programme for the Black Sea, taking into account the relevant provisions of the Convention for Protection of the Black Sea against Pollution, the Convention on Fishing in the Black Sea and international programmes carried out by international institutions and organisations (UNESCO, UNEP, IAEA, FAO, UNDP, the World Bank, PHARE, the European Union, etc.).
- (iv) Priorities of regional co-operation:

Terms of reference for the proposed IOC Regional Committee for the Black Sea should be elaborated, taking into account elements such as:

 - Adoption and application of new methods and inter-calibration of scientific methods and equipment;
 - Joint research activities;
 - Joint cruises with research vessels in the Black Sea;
 - Exchange of oceanographic data and information;
 - Networks of scientific institutions in the region;
 - Joint publications and issues;
 - Education of specialists,
 - Conferences, workshops and seminars on topics of the programme;
 - Exchange of scientists.
 - Ensuring adequate financial resources for carrying out the Regional Programme

ANNEX 1**PROPOSED PROJECTS****Project A.1. Promotion of elaboration and harmonisation of national legislation regulating marine scientific research and protection of the marine environment of the Black Sea, and harmonisation of standards and methodologies in marine scientific research.**

The goal of the project is a gradual development of standards and regulations commonly approved by the Black Sea states in accordance with the Convention for Protection of the Black Sea against Pollution and other international treaties on economic co-operation in the Black Sea region.

Main aspects:

- (i) Inventory of the existing legislation regulating marine scientific research and for protection of the marine environment in the Black Sea states.
- (ii) Study of national legislation aimed at development of a comprehensive proposal for harmonisation of legislation and adoption of approved regulations, procedures and mechanisms of their application.
- (iii) Harmonisation of scientific standards and methodology for application in joint marine programmes for the Black Sea.

Project A.2. Scientific aspects of sustainable development and management of the coastal zone

The specific features of the coastal zones in the separate Black Sea states and in the Black Sea region in general emphasise the need to adhere to the concept of sustainable long-term development. The principle that "Sustainable Development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs" has to be translated into relevant systems for management of social development and environment. This can be achieved by multi-disciplinary studies of the factors determining the social, economical and cultural development both in the coastal zones and in the interior of the countries, which directly or indirectly influence or are influenced by the environment of the Black Sea. This complex of factors has to be studied through retrospection, diagnosis, long-term prognosis and establishment of the nature and development of the coastal processes and phenomena.

Main aspects:

- (i) Studies of the cultural heritage and the socio-economic conditions for sustainable development of the coastal areas.
- (ii) Evaluation of the scientific basis for coastal marine ecosystem management.
- (iii) Studies of the impact of urbanisation and tourism on the Black Sea coastal zones, and their role in regional development.
- (iv) The effect of natural and anthropogenic factors in coastal erosion.
- (v) Development of numerical models for coastal management decisions.
- (vi) Application of Geographic Information Systems (GIS) for coastal resource analyses.

Project A.3. Environmental control of the dynamics of living resources in the Black Sea.

The state of the economically important fish species in the Black Sea has deteriorated drastically during recent decades, with significant economic and ecological consequences. At present there are ongoing investigations on possible anthropogenic causes for the situation related to environmental degradation of the environment. The assessment of Black Sea fish stocks is generally performed by application of traditional methods based on catch statistics, but it is possible that a new, ecological approach to stock assessment taking into account environmental conditions (eutrophication, harmful algal blooms, the intensity of upwelling, etc.) might contribute to a better understanding of the underlying causes determining stock sizes, recruitment and survival.

Additional topics for further study in a regional context are: the structure and distribution of the benthic communities, stock assessment and catch projection of *Rapana thomasiana*, estimating the biomass of the mussel *Mytilus galloprovincialis* and its significance as a major natural biofilter (an unique phenomenon for the Black Sea ecosystems), and studies of the macrophytes and their influence on the ecological conditions in the coastal zone.

Main aspects:

- (i) Annual stock assessments and catch projections of commercial living resources using standard catch statistics methodology.
- (ii) Applying a new ecological approach for estimating of TAC by using the models of ECOPATH II, PROBUB and DYNUMERS, which include consideration of the environmental conditions and the marine food web.
- (iii) Estimating the quantitative and spatial distribution, the population structure, the biomass and the filtration capacity of the mussel (*Mytilus galloprovincialis*).

- (iv) Studies of the dynamic predator - prey relationship between *Rapana thomasiana* and *Mytilus galoprovincialis*.
- (v) Estimating the qualitative composition and quantitative distribution of marine algae and their significance as indicator of the ecological state in certain regions of the Black Sea.

Project A.4: Human Health Consequences of Environmental Degradation

The alterations of the water quality as a result of anthropogenic influence and the general degradation of the environments in the coastal zone of the Black Sea present problems for the preservation human health. The importance of the Black Sea coasts for recreation and the threat to the health of tourists as well as for local inhabitants, call for co-operative efforts of the states in the region.

Main Aspects:

- (i) Studies of the relationships between the rate of influx of harmful micro- organisms in the coastal waters used for recreation and the official registration of gastroenteric and skin diseases.
- (ii) The survival of human pathogenic micro-organisms in the specific conditions of coastal brackish waters and beach sand.
- (iii) Establishing a system for hygienic and public health assessment of sand beaches and coastal waters for recreational purposes.
- (iv) Genetic consequences upon different groups of organisms from toxic, mutagenic and cancerogenic agents in Black Sea coastal waters.
- (v) Influence of certain physico-chemical parameters, radionucleides, and heavy metal ions on marine food organisms and on human health.

Project A.6: Harmful plankton blooms and harmful plankton in the Black Sea ecosystem.

Plankton blooms and the occurrence of harmful (noxious and toxic) plankton species have recently gained high scientific and public interest because of recorded incidences of poisoning of shellfish, fish and humans. This has affected mariculture, fisheries, tourism, biodiversity and ecosystem stability, and had repercussions on development and utilisation of marine resources. Scientific studies have indicated anthropogenic causes for the blooms, particularly related to high concentrations of nutrients from land-based sources, as well as to induced toxicity related to changes in chemistry of environment.

The concern of international organisations about harmful algal blooms has been manifested by the establishment of the international IOC-SCOR program Harmful Algal Blooms

(HABS), the IOC-FAO Intergovernmental Panel on Harmful Algal Blooms, the International Directory of Experts in Toxic and Harmful Blooms, and several international conferences on toxic marine phytoplankton. Experts from Black Sea countries have also been involved in some of these international activities.

The major objectives for Black Sea studies of harmful algal blooms are related to increase in frequency, magnitude and regions of expansion of the "exceptional blooms" and related marine fauna kills from anoxia, and ecosystem deterioration. There has been a dramatic shift in the plankton species composition, including "invasion" of species new for the Black Sea flora species, and potentially toxic and harmful species have been recorded. This situation calls for co-ordination of research activities on harmful algal blooms among the Black Sea countries.

Main aspects

- (i) Studies of taxonomic, genetic and phenotypic characteristics and variability of the harmful species.
- (ii) Elucidation of the mechanisms of initiation, maintenance and termination of harmful blooms and the key factors involved.
- (iii) Study of plankton bloom dynamics (life cycle, species succession) and its relationship on biological, chemical and physical parameters.
- (iv) Modelling of harmful blooms and their adverse effect on the marine ecosystems.
- (v) Studies of the environmental, eco-physiological, biochemical and genetic bases of biosynthesis of toxin and other biologically active constituents.
- (vi) Mechanisms of adverse effects: The chemical nature of extra metabolites and their impact on water quality and biota-anoxia phenomena.
- (vii) Development of management strategies to minimise environmental and economic hazards of harmful algal blooms.

Project A.6. Dispersion of sedimentary material in the Black Sea and its evolution in the recent geological history of the basin.

The Black Sea is unique with regard to the character of the geological processes in its recent history, and comprehensive studies and interpretation of the processes could provide new information about the mechanism of formation of the so called "black shale environment".

In addition, the Black Sea basin is an object of intensive environmental studies since anthropogenic eutrophication is seen as the main reason for its acute deterioration. For a reliable estimate of this process, the role of the anthropogenic contamination must be distinguished from the natural geological factors in the general formation of a typical Euxinian basin. The study of the dynamics of the development of Euxinian conditions in the

basin in its recent history (from the Early Holocene) will contribute to the correct estimate of the significance of the anthropogenic factor.

Main aspects:

- (i) Studies of suspended matter in the basin, modelling of trajectories of dispersion and sedimentation and its transformation with time.
- (ii) Study of the dispersion of sedimentary material from the main sources (mainly from large rivers in the North-eastern part of the basin) by hydrodynamic transport (especially in the area of influence of the Romelian current).
- (iii) Study of the down slope transport of sedimentary material in the submarine valleys and canyons (especially in the Danube canyon and the large canyons of the Anadolian and Caucasian coasts).
- (iv) Detailed stratigraphic, sedimentological and geochemical studies of sedimentary cores from areas with undisturbed profiles (without discontinuities, formed by regional sedimentary washing of the Pleistocene-Holocene boundary) to obtain new information on the geological processes in the basin related to its transition from lake to marine type of sedimentation and the initiation of Euxinian conditions.
- (v) Geochemical and isotope-geochemical studies of the Euxinian sedimentation in the basin with emphasis on: (i) formation of early diagenesis of the sapropellic sediments; formation of homogenous carbonates and their importance as indicators of sedimentary conditions; (ii) significance and influence of the geochemical boundaries (in micro- and macro scale) on the sedimentation and early diagenetical processes in Euxinian conditions.
- (vi) Sedimentological, geochemical and isotope-geochemical studies in the zones with "avalanche sedimentation", with emphasis on the processes of formation of methane generating sediments.

Project A.7: A Regional Operative System for Meteorological, Oceanographic and Specialised Prognoses

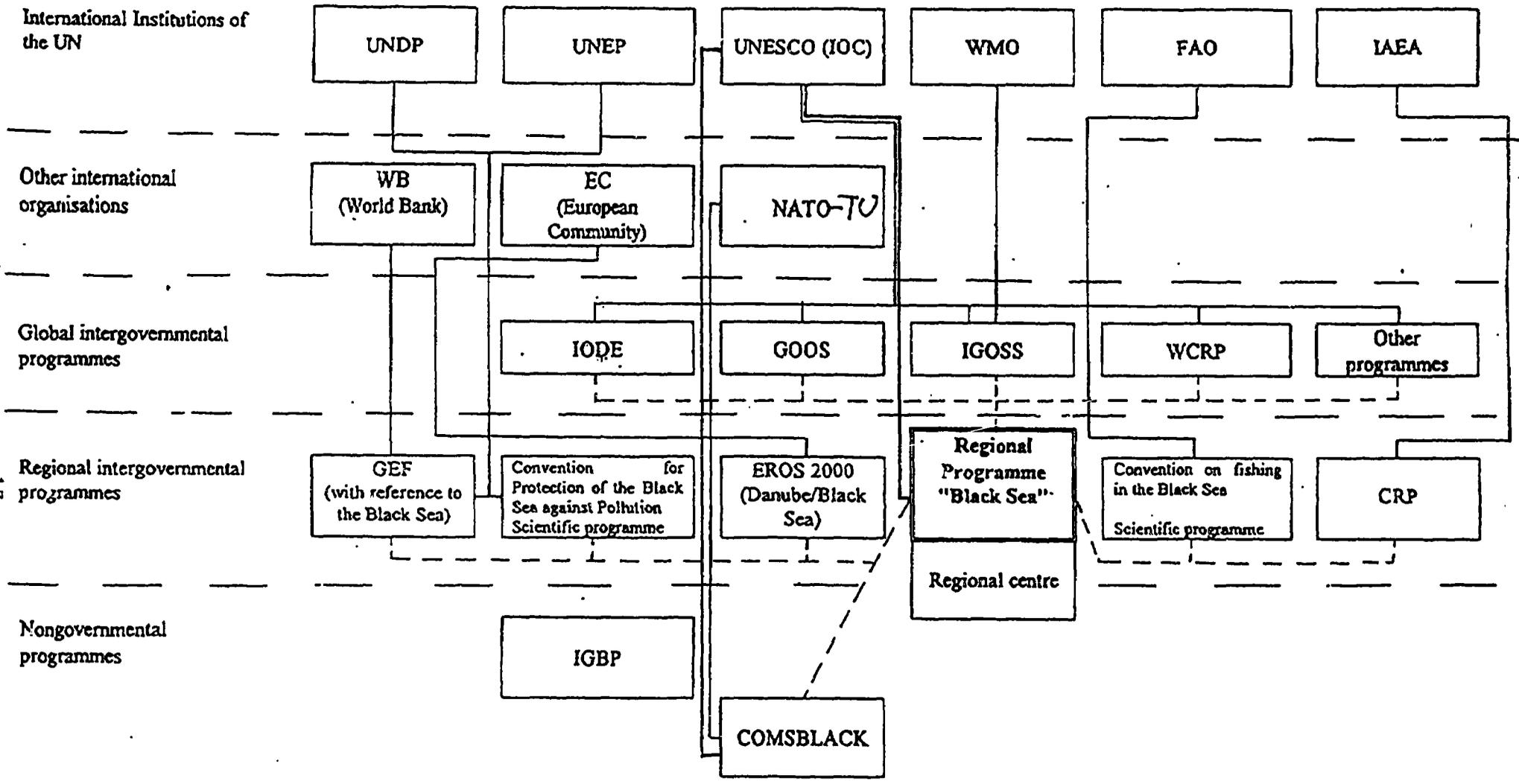
The Black Sea basin is characterised by interesting and very specific processes and phenomena on the boundary of atmosphere, sea surface and the active water layer. The closed character of the basin intensifies the interaction between these processes and emphasises on their mutual determination.

The extreme wind velocities in passing Mediterranean cyclones during the cold part of the year generate high wind waves and changes in the sea level. The exact prognosis of the wind velocities, wind waves and sea level are important for the activities of different fleets working in the offshore and near-shore regions of the basin. The meteorological services of the Black Sea countries issue their own prognoses, based mainly on synoptic methods, but in addition there is a need for operative system for forecasting of events at the regional scale.

Main aspects:

- (i) Development of an operational forecasting system with application of numeric models with the specific meteorological and oceanographic characteristics of the Black Sea.
- (ii) Implementation and adaptation of numeric models for the distribution of different contaminants and river discharge in the Black Sea basin.

LEVELS:



———— management connection
 - - - - - bidirectional information connection

Fig. 1