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# Black Sea Integrated Coastal and Shelf Zone Monitoring and Modeling (INCOM) Program Science Plan



Institute of Biology  
of the Southern Seas  
(NASU), Ukraine



United States  
Department  
of Defense



Marine Hydrophysical  
Institute (NASU) (Ukraine)



Middle East  
Technical  
University  
(METU), Turkey

Central Laboratory  
of General Ecology  
(Bulgarian Academy  
of Science)



Romanian Marine  
Research Institute  
(IRCM)



Black Sea  
Environmental  
Programme  
(BSEP)



Institute of Marine  
Sciences  
(METU), Turkey



Tbilisi State University  
(Georgia)



Institute of Oceanology  
(RAS), Russia

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Science Plan**



*LANDSAT satellite image of the Black Sea in Burgas, Bulgaria*



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Prof. Ilkay Salihoglu  
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## Executive summary

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The Black Sea has experienced the worst environmental degradation of all of the world's oceans during the last three decades. Several years ago, a leading international newspaper called it a "Deadly Soup of Toxic Waste" (Black Sea Environmental Programme, 1993). The environmental situation has become so severe that it is affecting the health, well being, and living standards of the people in the region. The crisis is a direct consequence of both natural and anthropogenic causes, such as the anthropogenic pollution from the enormous increase in the nutrient and pollutant load from three major rivers, the Danube, Dniestr, and Dniepr; industrial and municipal wastewater pollution along the coast; and dumping on the open sea. Environmental deterioration, together with overfishing, has severely reduced fish biodiversity and fishery yields. Tourism also has been affected negatively. Economic losses from pollution exceed \$500 million per year, as estimated by the World Bank.

The continuing environmental deterioration of the Black Sea only can be countered by uniting efforts of the neighboring countries. Our ability to monitor and predict the Black Sea environment increases our ability to manage and protect the area's public health and safety and, ultimately, its sustainable development. Because most of the environmental and oceanographic activities in the Black Sea, however, have already terminated, new programs that use physical, chemical, and biological observations and modeling studies are needed. This document presents a science plan describing the general framework of such a program, the Black Sea Integrated Coastal and Shelf Zone Monitoring and Modeling (INCOM), concentrating particularly on the coastal and shelf waters, which are under direct pressure of the anthropogenic-based pollution. It essentially involves a system of observations and modeling studies designed to (i) improve our knowledge of the physical and biogeochemical systems of the Black Sea, (ii) provide a basis for assessing the state and trends in the marine environment regarding the effects of anthropogenic activities, (iii) identify causes and solutions of pollution problems, (iv) assist decision-makers of regulatory and management agencies for remediating existing pollution, and (v) restore the Sea while stimulating creativity and excellence in research.

INCOM specifically includes the observations and predictions of ecological variables at different trophic levels that underpin exploitable marine resources (particularly primary and secondary biological production), sustainability of critical marine habitats of the coastal zone, regime shifts, and changes in recruitment to fish populations, changes in marine diversity of the coastal zone, impact from anthropogenic stress on the health of the marine ecosystem, including the occurrence of toxic algal blooms, assessment of the capacity of the coastal ecosystem to transform and store particulate and dissolved organic matter, and the effects of changes in external forces on the structure and functioning of coastal ecosystems.

In accordance with its goals, INCOM encompasses a series of subprograms:

**The pollution monitoring program** focuses on biogeochemical-ecological measurements for understanding the present status and future trends in ecosystem processes (i.e., productivity, nutrient fluxes, plankton biomass, and species composition), biodiversity and habitat loss and degradation, changes in community structure, and industrial organics and trace metals. The measurement program includes sampling and monitoring in "hot spots" at coastal and near-shore water, across selected transects, continuous monitoring at platforms, ship-of-opportunity measurements, drifters, and satellites.

**The interdisciplinary modeling program** complements the monitoring program and focuses on a quantitative assessment of important processes controlling biogeochemical fluxes, evaluation of the carrying capacity of the coastal ecosystem to store and transform particulate and dissolved matter, and quantification of the effects of changes in external conditions on the structure and functioning of the coastal ecosystem. In addition to budget models for estimating fluxes of water, nutrients and other material, INCOM includes process-oriented and system-oriented modeling studies. While process models are designed to understand specific physical, chemical and biological

processes, system models attempt to simulate present (now-cast) and/or future (forecast) states of the system as a whole (physical as well as biogeochemical) as realistic as possible.

**The coastal zone management program** plans to develop a coordinated strategy for allocating environmental, sociocultural, and industrial resources to achieve the conservation, rehabilitation, and sustainable multiple use of the coastal zone; it ultimately seeks to improve the state of the coastal environment.

**The fish stock assessment program** is designed to meet some of the needs of the governments trying to increase the contribution of fisheries to their national economies. The main thrust is to develop proper methodology and continuous monitoring capabilities, including personnel training, for acquiring accurate data on fish stocks to assess their possible levels and the environment conditions affecting them.

**The oil-spill monitoring and control program** tries to work further on establishing a regional oil-spill response mechanism and a well-designed regional oil-contingency plan. This is because a major environmental concern that demands further scientific studies in the Black Sea is the risk of transporting oil, together with the poor state of preparedness of the Black Sea countries to cope with possible catastrophic accidents.

**The database management program** is a supplementary program designed to establish an integrated, international database flexible enough for users to locate and recover the information they require in the form of more user-oriented products; to improve quality of data products by better use of existing data and with advanced data-quality control and validation systems; to decrease production costs by sharing the work load; to secure archival methods that retain the value of historical data; and to establish links to other data- and modeling centers for retrieving boundary and forcing fields.

INCOM offers a fairly comprehensive scientific research program oriented toward rehabilitating the environmental degradation and its sustainable development. In addition to strengthening and promoting scientific research and technology transfer in the region, INCOM hopes to help implement the Black Sea Strategic Action Plan (BSSAP) and provide valuable information that assists managers, decision-makers, and the industry in the decision-making process.

## Acronyms

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<b>AVHRR</b>	Advanced Very High Resolution Radiometer
<b>Black Sea-GOOS</b>	regional component of the Global Ocean Observing System
<b>BSEP</b>	Black Sea Environmental Programme
<b>BSREC</b>	Black Sea Regional Energy Center
<b>BSSAP</b>	Black Sea Strategic Action Plan
<b>Cd</b>	cadmium
<b>C-GOOS</b>	Coastal Modules of the Global Ocean Observing System
<b>CoMSBlack</b>	Joint Marine Science Program of Studies in the Black Sea
<b>COD</b>	chemical oxygen demand
<b>CTD</b>	conductivity-temperature-depth
<b>DO</b>	dissolved oxygen
<b>eH</b>	redox potential
<b>EROS</b>	European River-Ocean System
<b>EU</b>	European Union
<b>EuroGOOS</b>	European component of the Global Ocean Observing System
<b>GEF</b>	Global Environment Facility
<b>GLOBEC</b>	Global Ocean Ecosystem Dynamics
<b>GOOS</b>	Global Ocean Observation System
<b>Hg</b>	mercury
<b>HOTO</b>	Health of the Oceans
<b>INCOM</b>	Integrated Coastal and Shelf Zone Monitoring and Modeling
<b>IGBP</b>	International Geosphere-Biosphere Program
<b>IMS</b>	Institute of Marine Sciences
<b>IOC</b>	Intergovernmental Oceanographic Commission
<b>JGOFS</b>	Joint Global Ocean Flux Study
<b>km</b>	kilometer
<b>LMR</b>	Living Marine Resources
<b>LOICZ</b>	Land-Ocean Interaction in the Coastal Zone
<b>m</b>	meter
<b>METU</b>	Middle East Technical University
<b>NATO</b>	North Atlantic Treaty Organization
<b>ODBMS</b>	Operational Database Management System
<b>PAH</b>	Polyaromatic hydrocarbon
<b>PAR</b>	photosynthetically available radiation
<b>Pb</b>	lead
<b>PCU</b>	Program Coordination Unit
<b>POPs</b>	persistent organic pollutants
<b>ppt</b>	parts per thousand
<b>SeaWIFS</b>	Sea-Viewing Wide Field-of-View Sensor
<b>SPACC</b>	Small Pelagic Fish and Climate Change
<b>TSS</b>	total suspended solid
<b>TU</b>	Turkey
<b>UNCED</b>	United Nations Conference on Environment and Development
<b>UNDP</b>	United Nations Development Programme