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This issue of Harmful Algae News is devoted to information on HAB research funded by the European Commission (EC).

The EC Research Directorate-General, Environment and Sustainable Development Programme, has developed a science initiative called EUROHAB which provides an umbrella for a cluster of projects funded under the various programmes of the EC.

With this special issue of Harmful Algae News the EC and IOC wish to improve the international awareness of European HAB research and hopefully compliment access to the results, European research institutions and their researchers.

The detailed documentation of EUROHAB can be found in two publications published by the EC, the ‘EUROHAB Science Initiative’ and the ‘EUROHAB Science Initiative, Part B’. The first publication provides the context and goals of the EUROHAB initiative. It also provides a summary of HAB’s in European marine and brackish waters and identifies the most pressing gaps in knowledge for an improved management of HAB’s in Europe. The ‘Part B’ provides information on national and international programmes and activities on HABs within the European Union and an up-to-date list of the research and infrastructural requirements necessary for the understanding and management of HABs.

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WHY A SPECIAL ISSUE ON EUROHAB?

Cover photos:

Upper left: Bloom of the toxic dinoflagellate Dinophysis spp in a Norwegian Fjord.
Photo courtesy of Ø. Paulsen.

Lower left: A high biomass bloom of the prymnesiophyte Phaeocystis pouchetii deposited on a Belgian beach.
Photo courtesy of V. Rousseau.

Right: A high biomass bloom of the toxic cyanobacteria Nodularia spumigena in the Baltic Sea.
Photo courtesy of U. Larsson
All around Europe’s coasts - as well as at many other world-wide marine waters - the health authorities regularly issue warnings limiting or banning fishing, swimming or eating seafood. The culprit is a mass development of various types of microscopic algae that scientists group together under the generic name of Harmful Algal Blooms or HABs. These blooms not only represent a health risk for humans, but some are behind the killing of high-priced cultivated fishes and shellfish with major economic losses and/or ecological disasters as a consequence.

Faced with the spread of HABs, the European Commission decided that action was needed. At an international meeting in Kalmar (Sweden) during November 1998, it launched EUROHAB, the European Science Initiative on Harmful Algal Blooms. It aims to generate and co-ordinate the required research to manage better the effects of toxic/harmful micro-algae in the marine and brackish waters of the EU.

Four major priorities were set: To understand the mechanisms of HABs occurrence, to assess the causes - both natural and anthropogenic - of their proliferation, to study if some of the HABs are likely to be promoted by fishery activities, and to compile databases to monitor the development of the phenomena in time and space. The EUROHAB Science initiative was described in a publication of the European Commission in 1999.

Besides the European funding, several national research programmes on HABs were carried out sometimes independently of one another. It became then evident that joining forces, resources and funding, through co-ordination between national and European research programmes was a key factor for the understanding and management of HABs occurrence in Europe and became one of the main objectives of EUROHAB. Co-ordination between national and European research is also one of the main objectives of the European Research Area.

For this purpose, the second publication dedicated to EUROHAB initiative, provides information on national HAB programmes and EC projects in the European Union. It also provides an up-to-date list of the research and infrastructural requirements necessary for the understanding and management of the appearance of HABs in Europe’s marine and brackish waters. Two and a half years after the start of the initiative, EUROHAB includes research projects, workshops and studies from the Environment and Sustainable Development programme with a European funding of 10 millions EURO. The European Commission/DG Research is promoting today, through EUROHAB, both high-level research and networking on HAB issues needed at the European level.

C. PATERMANN
Director, Environment and Sustainable Development Programme
In order to consider the possibilities of reducing the occurrence and impact of harmful algal blooms in Europe, there is an urgent need to understand the mechanisms by which they are harmful.

**The goals of EUROHAB are:**

To define the unique characteristics of some HAB species that enable them to out compete and dominate the plankton communities.

To distinguish between natural causes versus anthropogenic impact (over enrichment of nutrients and metals by eutrophication, over fishing, global warming) on the bloom formation and toxicity of harmful algae (HA).

To understand the interactions between HAB and the food web which determine the outcome of HAB.

To develop databases in order to establish the extent to which HAB are increasing in frequency and extent.

To co-ordinate national and international efforts in Europe, and with other international programmes, for the management and mitigation of the effects caused by harmful microalgae.

**Why is there a Need for Co-ordinated Research on HAB in Europe?**

Many countries share European marine waters, and there are no physical barriers dividing the waters among them. Even if certain countries are not sharing the same sea, currents are continuously transporting water masses from one country to the next. Thus, a HAB population in one country might be triggered by nutrients originated in another country. Nutrients are also transported by winds. Another process possibly triggering HAB is the transport of merchandise by shipping. The amount of ballast water in large modern ships potentially contains seed populations of harmful algae enough to initiate a bloom in another marine area when discharged in exchange for cargo.

EUROHAB is formulated to generate the required research to manage better the effects of toxic/harmful marine microalgae in the marine and brackish waters of the EU.

In each maritime country of the European Union, considerable efforts are devoted to harmful algal bloom monitoring and related research. Some European countries also have developed national plans. However, the somewhat limited scale of these observations allows very few general conclusions to be drawn.

European scientists participate actively in various international groups and fora where research on harmful algae is discussed and ideas exchanged. With the establishment of an increasing number of national (EU and non-EU), regional, and international initiatives, it becomes increasingly important to gather and focus the many national efforts in Europe.

In the United States, there is the ECOHAB1 national programme, which is sponsored by the NSF2 to provide co-ordination and guidance for research on questions related to ecosystem health in regions threatened by toxic and harmful algae. The ECOHAB programme deals with both research and policy.

In addition to ECOHAB (US) and EUROHAB (Europe) a new international Programme GEOHAB (The Global Ecology and Oceanography of Harmful Algal Blooms) was recently being developed under the sponsorship of the IOC and SCOR. It aims to meet some of the most urgent research needs on the ecology of HABs worldwide.
Current EUROHAB Research Projects

BIOHAB
Biological Control of Harmful Algal Blooms in European Coastal Waters: Role of Eutrophication.

Expected deliverables: BIOHAB will result in sound knowledge of biological factors affecting the gains and losses of HAB-species. The results obtained in BIOHAB will provide information on key-HAB-species production of allelopathic and grazing deterrent substances, mixotrophy and their interaction with the bacteria and viruses. The obtained information in BIOHAB might provide potential ways of controlling HABs, e.g. in aquaculture sites.

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STRATEGY
New strategy of monitoring and management of HABs in the Mediterranean Sea

Expected deliverables: To develop and sustain a monitoring system in confined waters would provide the clues, not only the increment of some species in the Mediterranean but its human introduction. If the proposal confirms the significant influence of areas modified by human activities on HAB events, new measures of coastal management should have to be formulated. STRATEGY would provide the basic knowledge for a new conception of monitoring and management. The outcome would be a new HAB framework for decision-making.

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DOMTOX (project completed)
Importance of organic matter from terrestrial sources for the production, community structure and toxicity of phytoplankton; role of micropredators for transmission of toxins to commercial shellfish and fish larvae

Strategy: The riverine influences were studied in the context of the entire estuary. Field studies were combined, to understand nutrient cycling in the estuary (experiment at sea) with land based (mesocosm) and laboratory experiments. The first stage of the project consisted of a field program to gather sufficient information on important aspects of the physics, chemistry and biology of the targeted sites. Second stage of the project (often running in parallel with the first) consisted of laboratory handling and analysis of samples, mesocosm experiments, acquisition of supporting information, construction of a project database and submitting of project data in the database.

Expected deliverables: To determine the sources, distribution of nutrients and relate nutrients and physical parameters to algal dynamics. To determine the relative importance of terrestrial input of DOM loading from human activities and natural processes to toxic phytoplankton bloom events. To determine if increasing terrestrial input of DOM to the sea is responsible for occurrence and abundance of potentially toxic phytoplankton species.

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FATE
Transfer and Fate of Harmful Algal Bloom (HAB) Toxins in European Marine Waters

Expected deliverables: The quantitative information obtained in the FATE-project will advance the knowledge on how algal toxins are transported and degraded in the water column, sediments and different organisms. The FATE-project will also give information on techniques to mitigate HABs in order to protect aquaculture of fish and shellfish. This new knowledge will contribute to develop water management/coastal ecosystem management policies in Europe.

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HABILE
Harmful Algae Blooms Initiation and Prediction in Large European Marine Ecosystems


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LIFEHAB (project completed)
Life history of microalgal species causing harmful blooms

Expected deliverables: The main output is to put together the study capacity and the current knowledge of life strategies of HAB species. This imply to identify the most appropriate methodologies and research strategies to elucidate the role of life cycle strategies and behavior in bloom dynamics and to reach conclusions and recommendations that can help to future research. The expected result is the publication of a document, where the state of knowledge and future directions of research will be considered.

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ECOHARM
Socio-economic impact of Harmful Algal Blooms in European marine waters

Expected deliverables: ECOHARM will produce a database of HAB events with potential negative socio-economic effects in Europe over the last decade. From these events, a few well-documented cases will be selected for a detailed study of their socio-economic effects. A general accounting framework will be developed to estimate socio-economic effects of HABs to estimate the total socio-economic effects of HABs in Europe in the past. The framework will be available to assess future impacts of HABs

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NUTOX (project completed)
Effect of nutrient ratios on harmful phytoplankton and their toxin production

Summary of Results: The Project has been focusing on the interactions between harmful algal bloom (HAB) forming species and the changes of nutrient (nitrogen, phosphorus) conditions in European coastal ecosystems related to human activities. The main objectives of NUTOX were to determine if the increase of nitrogen (N) and phosphorus (P) in relation to silica in marine coastal waters has favored the occurrence of blooms of non-siliceous harmful algal bloom (HAB) forming species (i.e. dinoflagellates, haptophytes, cyanobacteria), and how ratios affect toxin production in some of these species. From the NUTOX results, we concluded that the ultimate solution to decrease the intensity of harmful algal blooms and their toxin production is to decrease both N and P input to European coastal waters (i.e. to decrease eutrophication) and restore the balance between N and P accordingly to the Redfield ratio (N:P =16: 1).

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HARMFUL INTRODUCTIONS BY SHIPS (project completed)
Testing Monitoring Systems for Risk Assessment of harmful Introductions by Ships to European Waters

Summary of Results: One key objective of the Concerted Action was to test monitoring systems for sampling ballast water. Two major intercalibration workshops compared sampling techniques. The second key issue was to gain more insight on species composition in ballast water during ship voyages. This was achieved by ocean-going workshops. A public awareness was launched, preparing a video, a leaflet, flyers, press releases, newsletter articles of International Aquatic Societies, an Internet homepage (visit the homepage at: http://members.aol.com/sqollasch/index.htm) and several posters. A book on case histories, listing species previously introduced to European waters, was prepared especially to address harbour and regulatory authorities. Assessment of potential control measures (treatment) to reduce risks arising from ballast water releases included the evaluation and development of guidelines for ballast water treatment options.

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