

JOINT OPERATIONAL ENVIRONMENT MONITORING AND FORECAST SYSTEM FOR THE GULF OF FINLAND

*Juha-Markku Leppänen*¹⁾ & *Karri Eloheimo*²⁾

1) *Finnish Institute of Marine Research, PO Box 33, FIN-00931 Helsinki, Finland*

2) *Finnish Environment Institute, PO Box 140, FIN-00251 Helsinki, Finland*

Environmental problems in the region

The Gulf of Finland has eutrophied during the last decades. Plankton biomass has increased and toxic phytoplankton blooms are common. In the littoral zone, marked changes in the species composition have occurred. Strong fouling and sliming of fishing gears cause problems for the fishermen. Eutrophication and building of dams in rivers have changed the composition of fish stocks. Currently the amount of blue mussel (*Mytilus edulis*) is decreasing on the Finnish coast of the Gulf of Finland. At the same time alien species have invaded the area. Some of them, especially the zebra mussel *Dreissena* and the zooplankton species *Cercopagis* and *Bythotrephes*, may form a potential risk for the ecosystem and the economic use of the sea.

Three countries, Finland, Estonia and Russia monitor the state of the Gulf of Finland. The traditional monitoring programmes produce relevant data for long-term trend analysis on some variables. However, they have proved to be unreliable to detect rapid changes in the ecosystem, e.g. toxic blooms of phytoplankton. In addition, the comparability of the results obtained by various laboratories has shown to be problematic.

A new co-ordinated, effective and target oriented monitoring programme, a joint operational forecasting system and an information exchange network will provide comprehensive information on the state of the Gulf of Finland for environmental management purposes.

Concept for the joint monitoring programme

The new programme includes monitoring of eutrophication and its effects as well as harmful substances in the environment.

The ecosystem of the Gulf of Finland is highly fluctuating. The strong seasonality, small-scale variation in hydrography, and the patchy distribution of organisms presume that the sampling strategy should cope with the various spatial and temporal scales in the ecosystem.

An extensive network of stations covers the open and coastal waters of the Gulf of Finland. The stations are visited by research vessels to map the distribution of e.g. water stratification, nutrient reserves, benthic fauna and concentrations of heavy metals and chlorinated organic compounds etc.

Unattended operating analysers are installed on several ferries to record surface water quality with high spatial (ca. 100 m) and temporal (ca. 1 day) resolution. The systems provide on-line information on the variability in phytoplankton, hydrography and nutrients.

Automated oceanographic buoys are used to record waves, hydrography including currents and vertical particle flux with high temporal resolution at fixed positions.

At present, NOAA/AVHRR and SAR satellite images are used to monitor the horizontal distribution of water masses and upwellings, the extent of the sea ice cover and oil spills. NOAA/AVHRR images are used successfully to detect the surface accumulations of blue-green algae. In the near future, new ocean colour sensors will improve especially the algal bloom monitoring.

Aerial surveys by frontier guard aircraft are used to detect oil and other chemical spills as well as plankton blooms.

In order to guarantee the comparability and reliability of the data collected in the programme, a comprehensive quality assurance programme is included. It comprises procedures for in house quality control and joint intercalibrations.

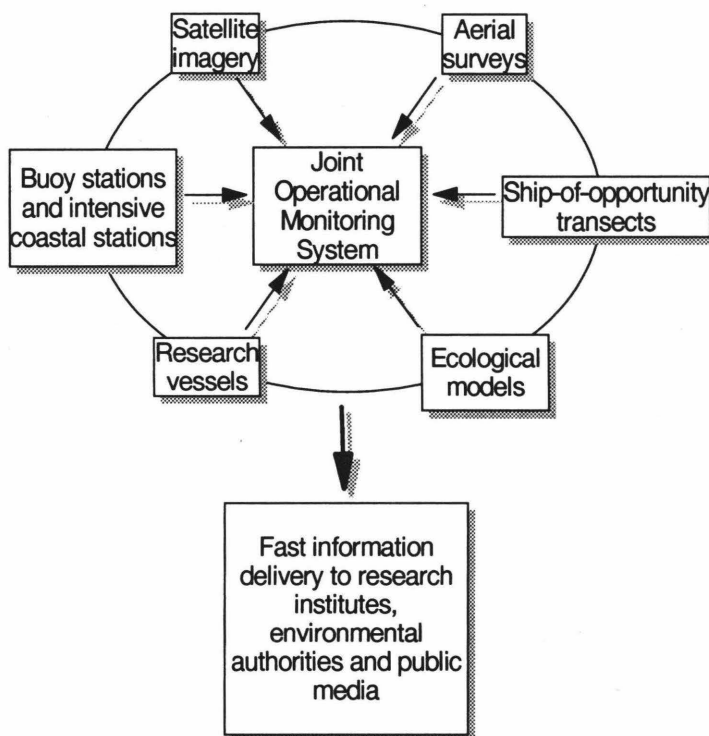


Fig. 1. Concept of the Operational Monitoring System for the Gulf of Finland

Operational forecast system

The aim of the operational forecast system is to link the information from the various monitoring systems and mathematical models. It will produce operational early warning forecast on exceptional events such as toxic plankton blooms and transport of harmful substances e.g. in connection with accidents. It is also planned to make prediction on the long-term development of the ecosystem with various loading scenarios for planning the management and to act as an interactive tool for fundamental research.

The forecast system is still under construction. It operates in a similar way as the weather forecast systems. The inputs for the model system for short-term forecasts are 1) weather forecast, 2) high resolution observations (e.g. frequently visited or automated fixed stations and regular ship-of-opportunity surveys), 3) remote sensing (satellite imagery and surveillance aircraft), and 4) specific loading information.

Internet is used for rapid exchange of information and data between the research institutes and environmental authorities. A specific Web site (<http://www.fimr.fi/algaline/algaline.htm>) is used to give frequently updated information to the media and public.