# A new system for automatic measurement of biological-chemical parameters from ferry boats

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Operational monitoring of coastal areas and shelf seas is mainly carried out by manual sampling and analysis during ship cruises. In addition, automatic operating measuring systems on buoys allow routine measurement of standard oceanographic parameters, e.g. temperature, salinity, currents and in some cases other parameters, e.g. turbidity, oxygen and chlorophyll fluorescence. These systems are much affected by biofouling and the maintenance/operation costs are quite high mainly due to ship costs.

On the other hand, there are many routes for ferryboats and "ships-of-opportunity" which run quite frequently. Standardised measuring systems on such carriers have several advantages: 1) the measuring system is protected against waves etc., 2) biofouling can be more easily prevented (inline sensors) and 3) most important, the running costs are much smaller since the operation costs of the ship have not to be calculated. There are already some examples for scientific equipment on ferry boats, e.g. in Finland, UK, Norway and the Netherlands. However, most of these systems only measure oceanographic standard parameters automatically and have to take samples for nutrient analysis.

A new system has been developed which overcomes these restrictions. The "German FerryBox" consists of a fully automated flow-through system with different sensors and automatic analysers. For a reliable unmanned operation the system is supervised by an industrial programmable logic control which can shut off the system in case of very severe errors and operates automatic cleaning cycles, e.g. in harbour. At the time being, the FerryBox has sensors/analysers for the following parameters: *water temperature, salinity, turbidity, oxygen, pH, chlorophyll fluorescence, nutrients* (*ammonium, nitrate/nitrite, phosphate, silicate*), *main algal classes* (specific fluorescence). Data acquisition, -storage and telemetry is coordinated by an industrial PC. Data can be transferred to shore and the system can be remotely operated by GSM (mobile phone). Biofouling is prevented by pressure cleaning of the sensors with acidified tap water or under severe conditions (tropics) by chlorination. Sometimes clogging of the water inlet in the ship interface by debris or fish causes problems. Since all flow rates are supervised by the system in such cases a pressure back-flushing cycle is initiated which clears the inlet.

The system had been installed on the ferry Hamburg (Cuxhaven)-Harwich and is under test since November 2001.

Continuous chemical-biological data from the ferry route across the North Sea will provide scientists and monitoring authorities with information on the eutrophication status and enhance the existing knowledge on nutrient and plankton dynamics. Results from recent measurements will be presented and discussed together with future developments which could combine ferry data with remote sensing measurements and apply these data to numerical models.

Keywords: monitoring; oceanographic observations; eutrophication; automated systems.