AUTONOMOUS NUTRIENT ANALYSIS MONITORING USING A PORTABLE SYSTEM ALONG COASTAL TRANSECTS

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Abstract: Eutrophication can cause adverse effects in the coastal ecosystems, this leads to an accelerated proliferation of opportunistic microbial and macroalgae communities, altering the trophic structure of the marine ecosystems and deteriorating water quality. Consequently, nutrient enrichment risk negatively affects to ecosystem services (Ferreira et al, 2011; Millennium Ecosystem Assessment, 2005; OSPAR, 2017).

The determination of eutrophication risk requires a continuous acquisition of time series of nutrient data to establish environmental trends (EEA, 2014). Most of nutrient probes are commonly used for fixed and floating platforms (Bodini et al, 2015). In the context of the MarRISK project (0262_MARRISK_1_E), we have designed an easy portable system to autonomously measure inorganic nutrients along with other parameters such as pH, temperature and salinity along transects on research vessels. In-situ measuring instruments of this system (SBE45 thermosalinograph, AFT-pH sensor, WIZ nutrient probe) are mounted on a pumping circuit collecting sea-surface waters.

Regarding nutrient analysis, seawater sample is filtered through a fiber cartridge and pumped with a peristaltic pump into a flexible bag before entering in the WIZ analyser. The nutrients probe is programmed for sequential measurement of nitrate+nitrite and phosphate every 40 min. The WIZ probe is based on the automated micro-Loop Flow Reactor technology (patented by Systea S.p.a., Italy) and it is composed of an analytical unit and a reagent canister. Nitrate+nitrite analysis is based on UV-phoreduction and phosphate is determined by OPA fluorimetric method. The main advantages of this probe are the low reagents consumption (in the order of µL) and the analysis of 4 parameters (nitrate+nitrite, nitrite, phosphate and ammonium) using one single unit.

This autonomous system integrated by the WIZ probe-pHmeter-thermosalinograph-GPS is activated manually by a single user only to start and to stop it. This multi-parameter system has been tested in several campaigns in automatic and continuous mode for more than 24 h, showing that it is a powerful tool for biogeochemistry studies in coastal areas.

Key words: Inorganic nutrients, Eutrophication, Coastal risks, WIZ probe; Autonomous analyses.

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References:

Bodini, S., Sanfilippo, L., Savino, E. and Moscetta, P. (2015). Automated micro Loop Flow Reactor technology to measure nutrients in coastal water: state of the art and field application. IEEE Oceans'15 conference, 18-21 May 2015, Genova (Italy).

EEA (2014). Digest of EEA indicators. Technical report, 8/2014. European Environment Agency.

Ferreira, J.G., Andersen, J.H., Borja, A., Bricker, S.B., Camp, J., Cardoso da Silva, M., Garcés, E., Heiskanen, A.S., Humborg, C., Ignatiades, L., Lancelot, C., Menesguen, A., Tett, P., Hoepffner, N. and Claussen,

U. (2011). Marine Strategy Framework Directive, Task Group 5 Report Eutrophication. www.fojo.org/papers/ETG/ETG.pdf

Millennium Ecosystem Assessment (2005). Ecosystems and Human Well-being: Current States and Trends.

Island Press, Washington, D.C.

OSPAR (2017). Eutrophication Status of the OSPAR Maritime Area. Third OSPAR Integrated Report. https://www.ospar.org/documents?v=37502