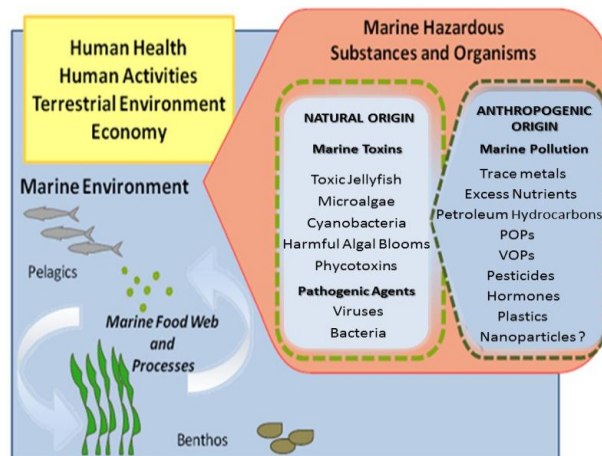


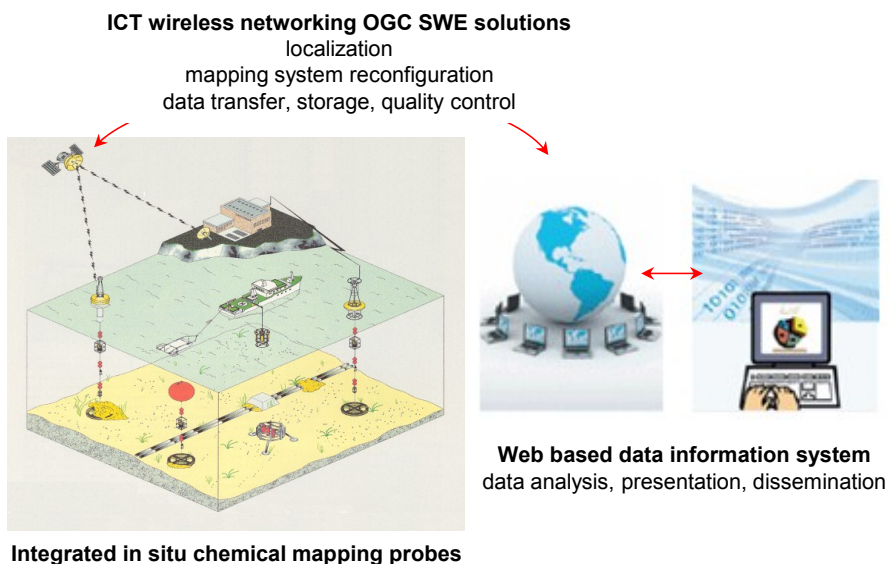
Background

Marine environments are highly vulnerable and influenced by a wide diversity of anthropogenic and natural substances and organisms that may have adverse effects on the ecosystem equilibrium, on living resources and, ultimately, on human health. Identification of relevant types of hazards at the appropriate temporal and spatial scale is crucial to detect their sources and origin, to understand the processes governing their magnitude and distribution, and to ultimately evaluate and manage their risks and consequences preventing economic losses.



SCHeMA vision

SCHeMA aims at providing an open and modular sensing solution for *in situ* high resolution mapping of a range of anthropogenic and natural chemical compounds that may have feedback (synergic) interaction: toxic and/or essential Hg, Cd, Pb, As and Cu trace metal species; nitrate, nitrite, and phosphate nutrients; species relevant to the carbon cycle; volatile organic compounds; potentially toxic algae species and toxins. The SCHeMA system will consist of a plug-and-play adaptive wired/wireless chemical sensor probe network serving as a front-end for gathering detailed spatial and temporal information on water quality and status based on a range of hazardous compounds. An ad-hoc ICT wireless networking solution and web-data information system will allow system localization and reconfiguration; data transfer, logging, storage, standardization, evaluation, modelling, and user-friendly accessibility.



The SCHeMA system will be designed so that it can operate from different facilities, i.e.: platform, moored buoy, boat, unmanned surface or submersible vehicles, and landers. It will acquire a wealth of information, at high spatial and temporal resolution, on a range of chemical hazardous compounds coupled to environmental master variables. Such a rich database offers the possibility to gain insights into phenomena that are currently poorly understood but are significant for understanding aquatic ecosystems functioning, for predictions of toxicological impact and, ultimately, for sustainable management based on scientific knowledge.

SCHeMA will contribute to enhance ocean observing capabilities and support policies of several EU directives.

SCHeMA specific objectives

SCHeMA is structured according to a fourfold objective:

- Development of an array of novel chemical sensors taking advantage of various innovative analytical solutions such as:
 - (bio)polymer-functionalized gel-integrated sensors for direct, reagent-free, voltammetric detection of toxic/essential fractions of a range of trace metals (inorganic and methyl mercury; inorganic arsenic species; dynamic fraction of cadmium, lead and copper);
 - solid state ion-selective membrane sensors for i) direct detection of CO₂, CO₃²⁻, total alkalinity; and ii) reagent-free, potentially calibration-free, detection of nutrients (nitrate, nitrite, phosphate) when coupled to an on-line desalination module;
 - mid-infrared optical sensors for the detection of harmful VOCs;
 - optical devices involving selective reversible immobilization of target molecules to sense relevant algae species and biotoxins (saxitoxin, ovatoxin / palytoxin).
- Incorporation of the novel sensors into miniature, low power consumption, multichannel probes based on Eco-Design-ISO/IEC standards and EnOcean technology as well as energy harvesting devices.
- Development of dedicated wired/wireless communication network and web-based front-end system compatible with EU standard requirements (OGC-SWE, INSPIRE, EMODnet, sensorML, SEIS).
- Evaluation, optimization, validation and demonstration of the SCHeMA sensing tools and integrated system via short and long-term field applications in Atlantic and Mediterranean coastal areas.

SCHeMA expected outcomes

- *Product-based* – a suite of powerful field-validated submersible chemical sensor probes and a smart multi-sensor probe Hw/Sw interface platform ready for post-industrial production;
- *Applied* – water quality assessment of various marine ecosystems and identification of the critical parameters considered relevant for successful management of water quality;
- *Scientific* – a better understanding of the bio-geochemical processes occurring in selected EU coastal areas that is fundamental to predict the impact of land-based pollution on water quality of vulnerable coastal ecosystems and for the development of knowledge-based protective policies for the marine environment;
- *Socio-economic* – promotion of new skills and jobs; new collaborations and business opportunities in the world market of marine sensing and monitoring.



Project title: Integrated In Situ Chemical Mapping Probes

Project acronym: SCHeMA

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