Possibilities of integration of monitoring requirements by other EU and national legislation

Deliverable D1.3
of the COMMON SENSE project

Marcin Wichorowski[1], Sławomir Sagan[1], Joanna Piwowarczyk[1], John Barton[2], Laia Piñol[3], Alberto Ribotti[4]*, Fabio Antognarelli[4], Andrea Satta[4], Paolo Magni[4]

[1] IOPAN, Poland
[2] Tyndall, Ireland
[3] Leitat, Spain
[4] CNR, Italy

* corresponding author: Alberto Ribotti, alberto.ribotti@cnr.it

The COMMON SENSE project has received funding from the European Union's Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

COMMON SENSE
MARINE SENSORS - MARINE MONITORING

Acronym: COMMON SENSE
Title: COST-EFFECTIVE SENSORS, INTEROPERABLE WITH INTERNATIONAL EXISTING OCEAN OBSERVING SYSTEMS, TO MEET EU POLICIES REQUIREMENTS
Grant agreement n° 614155

Deliverable 1.3

Possibilities of integration of monitoring requirements by other EU and national legislation

01-Oct-2016

Project co-funded by the European Commission within the Seventh Framework Programme (2007-2013)	
Dissemination Level	
PU Public	**X**
PP Restricted to other programme participants (including the Commission Services)	
RE Restricted to a group specified by the consortium (including the Commission Services)	
CO Confidential, only for members of the consortium (including the Commission Services)	

The COMMON SENSE project has received funding from the European Union's Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

COMMON SENSE
MARINE SENSORS - MARINE MONITORING

Authors:	Marcin Wichorowski[1], Sławomir Sagan[1], Joanna Piwowarczyk[1], John Barton[2], Laia Piñol[3], Alberto Ribotti[4], Fabio Antognarelli[4], Andrea Satta[4], Paolo Magni[4] [1]IOPAN, [2]Tyndall, [3] Leitat, [4]CNR
Reviewer:	John Barton
Work package:	1
Task:	1.3
Lead parties for Deliverable	IOPAN
Contractual Date of delivery to EC:	31/10/2014
Actual Date of re-delivery to EC:	01/10/2016
Revision Number	1.5

Document Revision History

Date	Issue	Change Records	Authors
2014-07-02	1.0	Created document, structure, chapter headings, description of several projects, programs, vessels for oceanography	John Barton
2014-07-06	1.1	Description of several projects, programs, vessels for oceanography	Marcin Wichorowski, Sławomir Sagan
2014-09-15	1.2	Added further contributions from partners and began wholesale formatting	Marcin Wichorowski, Sławomir Sagan, Joanna Piwowarczyk, Laia Piñol
2014-10-29	1.3	Added final contributions from partners	Marcin Wichorowski, Sławomir Sagan, Joanna Piwowarczyk, Laia Piñol
2014-10-30	1.4	Added Introduction, Conclusions and Executive Summary	Marcin Wichorowski
2016-09-20	1.5	Streamlined description of relevant projects and programmes, added analysis on possibilities of integration of sensors to meet monitoring requirements	Marcin Wichorowski, Sławomir Sagan, Joanna Piwowarczyk,

Acknowledgement

The work described in this report has been partially funded by the European Commission under the Seventh Framework Programme, Theme OCEANS 2013.2; Innovative multifunctional sensors for in-situ monitoring of marine environment and related maritime activities. IOPAN work was partially funded by the Polish Ministry of Science and Higher Education, from financial resources allocated for years 2014-2017.

COMMON SENSE
MARINE SENSORS - MARINE MONITORING

EXECUTIVE SUMMARY

Deliverable 1.3 provides inventory of legal regulations, initiatives, developed projects and technologies having potential influence on sensors design processes. Report focus on possible integration of monitoring requirements by other EU and national legislation.

Structure of the report consist of:

1. Inventory of EU directives bringing legal regulations providing requirements for having potential influence on sensors design and measurement methodology in reference to parameters demanded, spatial and temporal resolution of data and availability of information for potential users,
2. Inventory of conventions adopted by European Countries, approaching to reach and keep Good Environmental Status, having impact on monitoring processes and fostering development of technical infrastructure,
3. Analysis of national legislation implementing EU directives and representing approach to develop appropriate infrastructure for monitoring duties
4. Inventory of projects developing technologies having potential influence on sensors design, measurement and monitoring methodologies.
5. Inventory of innovative technologies, initiatives and ongoing policy developing processes as source of requirements for perspective technology development

These identified items are drivers of new technologies development processes. Sensors, as a part of bigger systems and infrastructures interoperating each other have to conform regulations formulated in legal acts in the context of parameters measured, condition of operation, interaction with environment as object of examination, transmission protocols and data collections terminating data acquisition, processing, storage and information extraction and exchange processes.

Objectives

The objective of the report is to provide inventory of regulations, directive and conventions having potential influence on sensors design, measurement and monitoring methodologies development having potential influence on sensors design processes.

Rationale

New developments in the field of technology, measurement and monitoring methodologies, policy and law regulations, possibilities and demands for integration of monitoring requirements by other EU and national legislation, and interoperability challenges are factors determining perspectives of sensors development. Report on regulations, directive and conventions having potential influence on sensors design will include the analysis of possibilities of integration sensor's functionality to meet monitoring requirements and to help to distinguish sensitive or vulnerable areas where monitoring is necessary according to identified ecosystem properties.

The COMMON SENSE project has received funding from the European Union's Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

COMMON SENSE
MARINE SENSORS - MARINE MONITORING

CONTENTS

The COMMON SENSE project has received funding from the European Union's Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

COMMON SENSE
MARINE SENSORS - MARINE MONITORING

1. INTRODUCTION

1.1. Background

The COMMON SENSE project aims to support the implementation of European Union marine policies such as the Marine Strategy Framework Directive (MSFD) and the Common Fisheries Policy (CFP). The project has been designed to directly respond to requests for integrated and effective data acquisition systems by developing innovative sensors that will contribute to our understanding of how the marine environment functions.

The core project research will focus on increasing the availability of standardised data on: eutrophication; concentrations of heavy metals; micro-plastic fraction within marine litter; underwater noise; and other parameters such as temperature and pressure. This will be facilitated through the development of a sensor web platform, called the *Common Sensor Web platform.*

The project outcome will provide a general understanding and integrated basis for sensors cost effective development. Overarching aim is:

- to obtain a comprehensive understanding and an up-to-date state of the art of existing sensors;
- to provide a working basis on “new generation” technologies in order to develop cost-effective sensors suitable for large-scale production;
- to identify requirements for compatibility with standard requirements as the MSFD, the INSPIRE directive, the GMES/COPERNICUS and GOOS/GEOSS.

1.2. Organisation of this report

This report provide inventory of legal regulations, initiatives, developed projects and technologies having potential influence on sensors design processes. Report focus on possible integration of monitoring requirements by other EU and national legislation and consist of: regulations, directive and conventions having potential influence on sensors design, measurement and monitoring methodologies development. Report will include the analysis of possibilities of integration sensor's functionality to meet monitoring requirements.

The COMMON SENSE project has received funding from the European Union’s Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

COMMON SENSE
MARINE SENSORS - MARINE MONITORING

2. EU LEGISLATIONS AND JOINT INITIATIVES IN RELATION TO SENSORS DESIGN MEASUREMENT AND MONITORING METHODOLOGIES

The range of other than MSFD regulations (as EC directives, national legislations) served as a basis of sensors design and observation methodologies currently deployed in the Member Countries both as part of monitoring programs as well as part of research activities. The scope of those regulations are much broader than those targeted by the MSFD. It is of value then to narrow the identification to those sensors and observation methodologies that conform to the needs and goals of MSFD. In parallel it allows to identify the possibilities of integration of sensor's functionality to meet monitoring requirements both stemmed from MSFD and imposed by other EU and national regulations.
The following table shows in the integrated way cross-dependence between current regulations / conventions / relevant programs and four MSFD Descriptors of interest of the COMMON SENSE project. The details of sensors or observation methods and prospects for their integrations are presented in the subsequent chapters

	D5: Eutrophication	**D8: Contaminants**	**D10:Marine litter**	**D11: Underwater noise**
MSFD definition:	"Human-induced eutrophication is minimised, especially adverse effects thereof, such as losses in biodiversity, ecosystem degradation, harmful algae blooms and oxygen deficiency in bottom waters."	Concentrations of contaminants are at levels not giving rise to pollution effects. Contaminants in fish and other seafood for human consumption do not exceed levels established by Community legislation or other relevant standards.	Properties and quantities of marine litter do not cause harm to the coastal and marine environment.	hydro-morphological, physical and chemical properties of the ecosystems, including those properties which result from human activities in the area concerned, support the ecosystems as described above. Anthropogenic inputs of substances and energy, including noise, into the marine environment do not cause pollution effects; Introduction of energy, including underwater noise, is at levels that do not adversely affect the marine environment.
WFD	x	x	x	
Bathing Directive	x	x	x	
RoHS		x	x	
Regional				

The COMMON SENSE project has received funding from the European Union's Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

COMMON SENSE
MARINE SENSORS - MARINE MONITORING

Conventions:				
HELCOM	x	x	x	x
OSPAR	x	x	x	
Barcelona Convention	x	x	x	x
Aberdeen Declaration	x	x		
National legislation:				
Spain	x	x	x	x
Poland	x	x	x	x
Ireland	x	x	x	x
Projects:				
SHOAL	x	x		
…Eurofleets 2		x	x	x
SeaDataNet 2		x		x
ODIP	x	x	x	x

2.1. EU directives

2.1.1. INSPIRE

Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE) was published in the official Journal on the 25th April 2007. The INSPIRE Directive entered into force on the 15th May 2007

To ensure that the spatial data infrastructures of the Member States are compatible and usable in a Community and trans-boundary context, the Directive requires that common Implementing Rules (IR) are adopted in a number of specific areas (Metadata, Data Specifications, Network Services, Data and Service Sharing and Monitoring and Reporting). These IR are adopted as Commission Decisions or Regulations, and are binding in their entirety. The Commission is assisted in the process of adopting such rules by a regulatory committee composed of representatives of the Member States and chaired by a representative of the Commission.

Regulation has been amended many times and consolidated text has been published as Commission Regulation (EU) No 1253/2013 of 21 October 2013 amending Regulation (EU) No 1089/2010 implementing Directive 2007/2/EC as regards interoperability of spatial data sets and services.

The INSPIRE Directive addresses 34 spatial data themes needed for environmental applications. These themes are subdivided in the three annexes of the Directive:

Annex I

1. Coordinate reference systems
2. Geographical grid systems
3. Geographical names
4. Administrative units
5. Addresses
6. Cadastral parcels
7. Transport networks

The COMMON SENSE project has received funding from the European Union's Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

8. Hydrography
9. Protected sites

Annex II

1. Elevation
2. Land cover
3. Orthoimagery
4. Geology

Annex III

1. Statistical units
2. Buildings
3. Soil
4. Land use
5. Human health and safety
6. Utility and governmental services
7. Environmental monitoring facilities
8. Production and industrial facilities
9. Agricultural and aquaculture facilities
10. Population distribution and demography
11. Area management/restriction/regulation zones & reporting units
12. Natural risk zones
13. Atmospheric conditions
14. Meteorological geographical features
15. Oceanographic geographical features
16. Sea regions
17. Bio-geographical regions
18. Habitats and biotopes
19. Species distribution
20. Energy resources
21. Mineral resources

where emphasised entries are relevant for sensors design and measurements methodologies.

Each EU member state designated a national INSPIRE contact point, usually a public authority, to be responsible for contacts with the Commission in relation to INSPIRE. The role of the contact points is to provide results about the transposition of INSPIRE into national legislation. The contact points are also responsible for providing regular information about the implementation of INSPIRE in the given country and report on behalf of the Member State to the Commission.
Specific guidelines for parameters, infrastructure and measurement methodology are provided through INSPIRE Monitoring Indicators – Guidelines Document by Monitoring and Reporting Drafting Team and European Commission - Eurostat.

2.1.2. Marine Strategy Framework Directive

Directive 2008/56/EC Of The European Parliament And Of The Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive) state that the marine environment is a precious heritage that must be protected, preserved and, where practicable, restored with the ultimate aim of maintaining biodiversity and providing diverse and dynamic oceans and seas which are clean, healthy and

The COMMON SENSE project has received funding from the European Union's Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

productive. In that respect, this Directive should, inter alia, promote the integration of environmental considerations into all relevant policy areas and deliver the environmental pillar of the future maritime policy for the European Union. MSFD foster integration of systems and interoperability through item 21: *"It is crucial for the achievement of the objectives of this Directive to ensure the integration of conservation objectives, management measures and monitoring and assessment activities set up for spatial protection measures such as special areas of conservation, special protection areas or marine protected areas"*.
MSFD provides also Indicative list of characteristics, pressures and impacts:

Physical and chemical features	• Topography and bathymetry of the seabed, • annual and seasonal temperature regime and ice cover, current velocity, upwelling, wave exposure, mixing characteristics, turbidity, residence time, • spatial and temporal distribution of salinity, • spatial and temporal distribution of nutrients (DIN, TN, DIP, TP, TOC) and oxygen, • pH, pCO2 profiles or equivalent information used to measure marine acidification.
Habitat types	• The predominant seabed and water column habitat type with a description of the characteristic physical and chemical features, such as depth, water temperature regime, currents and other water movements, salinity, structure and substrata composition of the seabed, • identification and mapping of special habitat types, especially those recognised or identified under Community legislation (the Habitats Directive and the Birds Directive) or international conventions as being of special scientific or biodiversity interest, • habitats in areas which by virtue of their characteristics, location or strategic importance merit a particular reference. This may include areas subject to intense or specific pressures or areas which merit a specific protection regime.
Biological features	• A description of the biological communities associated with the predominant seabed and water column habitats. This would include information on the phytoplankton and zooplankton communities, including the species and seasonal and geographical variability, • information on angiosperms, macro-algae and invertebrate bottom fauna, including species composition, biomass and annual/seasonal variability, • information on the structure of fish populations, including the abundance, distribution and age/size structure of the populations, • a description of the population dynamics, natural and actual range and status of species of marine mammals and reptiles occurring in the marine region or subregion, • a description of the population dynamics, natural and actual range and status

The COMMON SENSE project has received funding from the European Union's Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

	of species of seabirds occurring in the marine region or subregion, • a description of the population dynamics, natural and actual range and status of other species occurring in the marine region or subregion which are the subject of Community legislation or international agreements, • an inventory of the temporal occurrence, abundance and spatial distribution of non-indigenous, exotic species or, where relevant, genetically distinct forms of native species, which are present in the marine region or subregion.
Other features	• A description of the situation with regard to chemicals, including chemicals giving rise to concern, sediment contamination, hotspots, health issues and contamination of biota (especially biota meant for human consumption), • a description of any other features or characteristics typical of or specific to the marine region or subregion.
Physical loss	• Smothering (including smothering by man-made structures, disposal of dredge spoil), • sealing (including sealing by permanent constructions).
Physical damage	• Changes in siltation (e.g. by outfalls, increased run-off, dredging/disposal of dredge spoil), • abrasion (e.g. impact on the seabed of commercial fishing, boating, anchoring), • selective extraction (e.g. exploration and exploitation of living and non-living resources on seabed and subsoil).
Other physical disturbance	• Underwater noise (e.g. from shipping, underwater acoustic equipment), • marine litter.
Interference with hydrological processes	• Significant changes in thermal regime (e.g. by outfalls from power stations), • significant changes in salinity regime (e.g. by constructions impeding water movements, water abstraction).
Contamination by hazardous substances	• Introduction of synthetic compounds (e.g. priority substances under Directive 2000/60/EC which are relevant for the marine environment such as pesticides, anti-foulants, pharmaceuticals, resulting, for example, from losses from diffuse sources, pollution by ships, atmospheric deposition and biologically active substances), • introduction of non-synthetic substances and compounds (e.g. heavy metals, hydrocarbons, resulting, for example, from pollution by ships and oil, gas and mineral exploration and exploitation, atmospheric deposition, riverine inputs), • introduction of radio-nuclides.
Systematic or intentional release of substances or both	• Introduction of other substances, whether solid, liquid or gas, in marine waters, resulting from their systematic or intentional release or both into the marine environment, as permitted in accordance with other Community

The COMMON SENSE project has received funding from the European Union's Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

	legislation and/or international conventions.
Nutrient and organic matter enrichment	• Inputs of fertilisers and other nitrogen — and phosphorus-rich substances (including such inputs from point and diffuse sources, including agriculture, aquaculture, atmospheric deposition), • inputs of organic matter (including sewers, mariculture, riverine inputs).
Biological disturbance	• Introduction of microbial pathogens, • introduction of non-indigenous species and translocations, • selective extraction of species, including incidental non-target catches (including by commercial and recreational fishing).

2.1.3. Bathing Waters Directive

Directive 2006/7/EC Of The European Parliament And Of The Council of 15 February 2006 concerning the management of bathing water quality and repealing Directive 76/160/EEC state that appropriate and timely information on the results of the monitoring of bathing water quality and risk management measures in order to prevent health hazards, especially in the context of predictable short-term pollution or abnormal situations. New technology that allows the public to be informed in an efficient and comparable way on bathing waters across the Community should be applied (item 8). For the purpose of monitoring, harmonised methods and practices of analysis need to be applied. Observation and quality assessment over an extended period are necessary in order to achieve a realistic bathing water classification (item 9)

Approach of deployment of new technologies in water quality management has been proposed in scientific works, e.g. Real Time Management of Bathing Water Quality in Barcelona.

2.1.4. RoHS

EU legislation restricting the use of hazardous substances in electrical and electronic equipment (RoHS Directive 2002/95/EC) and promoting the collection and recycling of such equipment (WEEE Directive 2002/96/EC) has been in force since 2003. The EU Parliament adopted the Directive 2011/65/EU of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment – Recast Directive – RoHS 2. Text has been consolidated with EEA relevance.

RoHS 2 contain regulations of high importance for sensors design (as part of industrial monitoring system and potential source of impact to environment), development and exploitation.

According to Article 4,p.1 Member States shall ensure that EEE placed on the market, including cables and spare parts for its repair, its reuse, updating of its functionalities or upgrading of its capacity, does not contain the substances listed in Annex II. There is excluded group of devices defined in Article 4: Paragraph1 shall not apply to cables or spare parts or the repair, the reuse, the updating of functionalities or upgrading of capacity of the following:

a) EEE placed on the market before 1 July 2006;

b) medical devices placed on the market before 22 July 2014;

The COMMON SENSE project has received funding from the European Union's Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

c) in vitro diagnostic medical devices placed on the market before 22 July 2016;

d) monitoring and control instruments placed on the market before 22 July 2014;

e) industrial monitoring and control instruments placed on the market before 22 July 2017;

f) EEE which benefited from an exemption and which was placed on the market before that exemption expired as far as that specific exemption is concerned.

Applications exempted from the restriction in Article 4(1) are listed in the Annex III of the Directive with specified exemption and scope and dates of applicability.

2.2. Pan-European and Regional Conventions

2.2.1. HELCOM

The Helsinki Commission (HELCOM) is the most prominent transnational, intergovernmental organisation dedicated to the protection of the Baltic Sea from all sources of pollution. HELCOM is the governing body of the "Convention on the Protection of the Marine Environment of the Baltic Sea Area"- commonly known as the Helsinki Convention. HELCOM can point to numerous achievements through policy, e.g. stricter controls on industry (permits are now compulsory for industrial emissions), improved joint monitoring of the state of the marine environment, and elimination of illegal discharges by ships into the Baltic Sea.

HELCOM Joint Coordinated Monitoring System, part of the HELCOM Monitoring And Assessment Strategy, provide principles for developing and exploit new technologies to deploy monitoring system infrastructure.

Chapter 6 of the convention describe usage of autonomous systems and other new observation techniques. According to this:

1 Remote sensing and autonomous measuring devices already in use in environmental monitoring and operational oceanography, such as ferry-boxes, buoys, passive samplers, fixed platforms, and coastal radars are efficient means to increase spatial and temporal coverage of observations.

2 Automated measuring devices, sensors and other equipment are costly and usually need regular maintenance. Sharing of investments, maintenance and data is the way to increase cost-efficiency and reliability of the measurements. There is also a clear advantage to share the platforms between institutes responsible for meteorological, oceanographic and environmental observations.

3 Data collected by the already operational unattended systems, such as the Alg@line ferry-box network, could be used more efficiently by national institutes for the monitoring of their territorial and EEZ waters by increasing joint planning of sampling, sharing of laboratory analysis and the data exchange.

4 Joint production of remote sensing images and assessment products should be agreed and responsibilities should be divided between the partners, including delivery of ground truth data.

5 Observations made by the public, accompanied by appropriate QA procedures, could be used for HELCOM monitoring purposes.

The COMMON SENSE project has received funding from the European Union's Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

COMMON SENSE
MARINE SENSORS - MARINE MONITORING

2.2.2. OSPAR

The Convention for the Protection of the marine Environment of the North-East Atlantic (the 'OSPAR Convention') was open for signature at the Ministerial Meeting of the Oslo and Paris Commissions in Paris on 22 September 1992. It was adopted together with a Final declaration and an Action Plan. The OSPAR Convention entered into force on 25 March 1998. It replaces the Oslo and Paris Conventions but Decisions, Recommendations and all other agreements adopted under those Conventions will continue to be applicable, unaltered in their legal nature, unless they are terminated by new measures adopted under the 1992 OSPAR Convention.

Contained within the OSPAR Convention are a series of Annexes which deal with the following specific areas:

Annex I: Prevention and elimination of pollution from land-based sources;

Annex II: Prevention and elimination of pollution by dumping or incineration;

Annex III: Prevention and elimination of pollution from offshore sources; and

Annex IV: Assessment of the quality of the marine environment.

From the perspective of sensors development Annex IV enforce member parties to define and implement programmes of collaborative monitoring and assessment-related research, to draw up codes of practice for the guidance of participants in carrying out these monitoring programmes and to approve the presentation and interpretation of their results; to carry out assessments taking into account the results of relevant monitoring and research and the data relating to inputs of substances or energy into the maritime area which are provided by virtue of other Annexes to the Convention, as well as other relevant information; to seek, where appropriate, the advice or services of competent regional organisations and other competent international organisations and competent bodies with a view to incorporating the latest results of scientific research; to cooperate with competent regional organisations and other competent international organisations in carrying out quality status assessments..

In 2000, to fulfil obligations under Annex IV to the OSPAR Convention the OSPAR Commission published the first comprehensive Quality Status Report on the quality of the marine environment of the OSPAR maritime area.

The following documents within the OSPAR framework could help to the implementation of the monitoring of eutrophication parameters within the MSFD:

• OSPAR (1997a, b, c, d & e) has developed eutrophication monitoring guidelines, among others for nutrients and oxygen.

• Monitoring data are used in the Common Procedure (OSPAR, 2005) for the identification of the eutrophication status and for the calculation of the relevant to nutrients, Ecological Quality Objectives (EcoQO) (OSPAR, 2009a).

• OSPAR, through its Joint Assessment and Monitoring Programme (JAMP), has developed guidelines for monitoring contaminants in biota and sediments

• Nutrients monitoring in the seawater is also covered by this convention

• Other references point to external literature are found in OSPAR's QSR 2010.

The COMMON SENSE project has received funding from the European Union's Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

- The Hazardous Substances Strategies (including heavy metals):

  - Move towards the cessation of discharges, emissions and losses of hazardous substances by 2020.
    OSPAR countries were required to implement best available techniques and best environmental practices and to achieve specified limit values for emissions and discharges for major industrial sources e.g. heavy metals.

  - The ultimate aim is to achieve concentrations of hazardous substances in the marine environment near background values for naturally occurring substances and close to zero for man-made substances.

  - Other references point to external literature are found in OSPAR's QSR 2010.

- Concerning underwater noise OSPAR states the following in the QSR 2010 report:

  - Levels of underwater noise are thought to be increasing internationally. Regions II and III seem to be the most affected by noise-generating human activities and there are signs of effects on marine life. Levels of noise in Regions II and III are likely to increase. OSPAR Contracting Parties should cooperate to monitor and investigate these effects and develop guidance on options for mitigation of noise and its effects.

  - It is foreseen that by 2017 a plan for underwater noise will be published for the Atlantic region.

- Concerning marine litter OSPAR states the following in the QSR 2010 report:

  - Marine litter is a persistent problem that affects the entire marine environment and its ecological effects are not fully understood. OSPAR should extend marine beach litter monitoring to all Regions.

  - OSPAR has developed monitoring guidelines for marine litter on beaches (2009b) and supporting photo guides (OSPAR, 2009). An OSPAR Fulmar EcoQO has a fully developed methodology with related monitoring guidance (OSPAR, 2008d; van Franeker et al., 2011)

  - OSPAR should extend its marine litter monitoring on beaches to all Regions and consider including it in its Coordinated Environmental Monitoring Programme, taking into account the monitoring requirements of the EU Marine Strategy Framework Directive. This may result in a requirement to monitor the water column and the seabed. OSPAR should support the implementation of international and EU legislation, initiatives such as UNEP's (Regional Seas Programme) work on marine litter, and ongoing research into litter in the deep sea and the ecological effects of micro-plastics.

  - The identification of those areas worthy to be monitored in terms of micro-plastics as well as the monitoring methodologies and systems to be implemented will be defined further on, once monitoring programs have started and more information on this issue is available.

2.2.3. Barcelona Convention

Barcelona Convention – Convention for the Protection of the Mediterranean Sea Against Pollution – has been adopted in 1976 by Parties composing Mediterranean Action Plan. Barcelona Convention

The COMMON SENSE project has received funding from the European Union's Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

provided seven protocols addressing specific aspects of mediterranean environmental conservation completing the MAP legal framework:

1) Dumping Protocol (from ships and aircraft)
2) Prevention and Emergency Protocol (pollution from ships and emergency situations)
3) Land-based Sources and Activities Protocol
4) Specially Protected Areas and Biological Diversity Protocol
5) Offshore Protocol (pollution from exploration and exploitation)
6) Hazardous Wastes Protocol
7) Protocol on Integrated Coastal Zone Management (ICZM)

In 1995 Barcelona Convention has been altered and new document Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean has been adopted. The Convention's main objectives are:

- to assess and control marine pollution
- to ensure sustainable management of natural marine and coastal resources;
- to integrate the environment in social and economic development;
- to protect the marine environment and coastal zones through prevention and reduction of pollution, and as far as possible, elimination of pollution, whether land or sea-based;
- to protect the natural and cultural heritage;
- to strengthen solidarity among Mediterranean coastal States;
- to contribute to improvement of the quality of life.

Barcelona Convention rise obligations of the party bodies to take up action against pollution originating from vessels and aircrafts and establish monitoring systems and conservation of biological diversity. Article 13 of the Declaration foster technological cooperation of partners:

1. The Contracting Parties undertake as far as possible to cooperate directly, or when appropriate through competent regional or other international organisations, in the fields of science and technology and to exchange data as well as other scientific information for the purpose of this Convention.

2. The Contracting Parties undertake to promote the research on, access to and transfer of environmentally sound technology, including clean production technologies, and to cooperate in the formulation, establishment and implementation of clean production processes.

3. The Contracting Parties undertake to cooperate in the provision of technical and other possible assistance in fields relating to marine pollution, with priority to be given to the special needs of developing countries in the Mediterranean region.

2.2.4. Aberdeen Declaration

Aberdeen Declaration has been undersigned during conference EurOCEAN2007. This declaration concerned mobilising existing and establishing new ocean observatory and data collection systems to better understand the pace and impact of climate change on the oceans and impacts on the wider earth system. Among the needs identified demand for the European Marine and Maritime Science, Research, Technology and Innovation Strategy has been expressed.

The COMMON SENSE project has received funding from the European Union's Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

An integrated Maritime Policy needs a comprehensive and supportive Marine and Maritime Science, Research, Technology and Innovation Strategy. The challenge for the European Commission, the Member States and the European Marine Science and Technology Community is to support the preparation of this comprehensive and integrated Strategy which should identify short- and long-term priorities and incorporate the following components:

• identify and prioritise the scientific challenges and opportunities, in terms of both basic and applied research including a multi-disciplinary and inter-disciplinary approach, and embracing engineering, legal and social and economic sciences, to support a dynamic maritime economy. These priorities should inform both EU (e.g. FP7) and Member State Marine Research Funding Programmes, and be the basis for joint EU-Member State Programmes (e.g. ERA-NET+, Article 169 projects);

• support the development of integrated cross-Directorate initiatives linking sectoral policies (e.g. fisheries and aquaculture, renewable energy, transport, space) research and enterprise policies and the environment to support a holistic and coherent approach when addressing marine and maritime issues on the global, regional, national and local scales;

• provide a framework, building, for example on ERA-NETS, Technology Platforms and other EU instruments, to further Community and Member State funding and co-operation in support of cross-sectoral and multinational research projects and partnerships to address key challenges at global, regional, national and local scales;

• identify and establish appropriate knowledge and technology exchange mechanisms to strengthen the links between research and industry turning knowledge (the product of research) into value added products and services and creating income and jobs. It must foster knowledge and technology transfer and the development of an in-house research and innovation capability in indigenous European maritime industries through the establishment and resourcing of appropriate support mechanisms;

• include a Marine and Maritime Foresight mechanism to regularly review new developments in emerging science and technology, their implications and the opportunities offered, and the identify the major drivers and lead markets;

• actively foster relationships with coastal states and in particular with neighbouring states with whom Europe shares regional seas, e.g. the Black Sea and the Mediterranean;

• formulate a policy framework for active engagement of European scientists in the global context;

• identify the specialised pan-European research infrastructures (e.g. specialised research vessels, subsea technologies, satellite and in-situ ocean observing systems, sustained monitoring and data collection, databases and information portals, high performance computing, modelling and land based facilities) required to meet identified challenges and opportunities and seek to maximise the shared use and efficiency of Europe's research infrastructures, including those proposed under the current ESFRI Roadmap and I3 initiatives;

• promote human capacity building, and the related issues of attractive research careers and researcher mobility, to ensure that appropriate highly-skilled researchers and support personnel are available to underpin economic and environmental developments in the marine and maritime sector;

• address the concerns of young researchers and support the inclusion of marine modules in the educational system at all levels, including life-long learning;

The COMMON SENSE project has received funding from the European Union's Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

• support the delivery of effective governance of the marine environment, engaging scientists, policy makers and the public to enable shared understanding and informed decision making based on sound scientific knowledge.

Aberdeen Declaration introduced European Marine Observation and Data Network (EMODN) – EMODNet at present.

2.3. National Legislation

2.3.1. Spain

The MSFD (Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008) was transposed in Spain, in the year 2010, by means of the Marine Environment Protection Law (Ley 41/2010, de 29 de diciembre, de Protección del Medio Marino). The main objective of this law is to reach or keep a Good Environmental Status (GES) by 2020. With this aim in view marine strategies are developed constituting the planning tools for the marine environment.

The Ministry of Agriculture, Food and Environment (Ministerio de Agricultura, Alimentación y Medio Ambiente – MAGRAMA) is the authority responsible for the MSFD implementation in Spain.
The MSFD requires an ecosystem approach applying scientific methods for the biological organization including processes, functions and interactions between organisms and their environment. Human beings are included as a part of this wide definition of ecosystem. This approach helps to create equilibrium between conservation and sustainable uses of natural resources.

The JRC tasks groups (TG) have generated a report for every Descriptor in order to advise on criteria and methodological standards concerning GES definition. Based on these reports and on consultation made to the Regional Seas and the Member States, the European Commission has published the COMMISSION DECISION of 1 September 2010 on criteria and methodological standards on good environmental status of marine waters (2010/477/EU).The 2010/477/EU establishes the specific attributes associated to every criteria and, when possible those criteria include the applicable standards.

The Marine Environment Protection Law states that the sectoral policies affecting the marine environment will have to be compatible and to be adapted to the marine strategies objectives. This implies an active participation and collaboration of those Administrations that develop activities within the marine environment framework. In order to facilitate the national coordination for the implementation of the marine strategies, and according to the article 22 of the Marine Environment Protection Law, it has been created the Inter-ministerial Commission of Marine Strategies (CIEM – in Spanish) that aims at coordinate the development, implementation and monitoring of the marine environment planning.

Spain is planning to create a database platform in order to unify marine monitoring arising data being interoperable with other data platforms such as OSPAR database and WISE-WFD database marine database according to the Aarhus Convention.

The Ministry of Agriculture, Food and Environment developed, in 2012,the following documents for each of the 5 marine sub-divisions (North Atlantic, South Atlantic, Estrecho and Alborán, Levantino-Balear and the Macaronesia -Canary) in order to develop the specific and general marine strategy for the Spanish water bodies:-

- An Initial Assessment (Article 8 of the DIRECTIVE 2008/56/EC)

The COMMON SENSE project has received funding from the European Union's Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

- An analysis of the essential features and characteristics (Article 8(a) of the DIRECTIVE 2008/56/EC).
- An analysis of the predominant pressures and impacts (Article 8(b) of the DIRECTIVE 2008/56/EC).
- An economic and social analysis (Article 8(c) of the DIRECTIVE 2008/56/EC).

- GES definitions are presented in another additional document for each descriptor (Article 9 of the DIRECTIVE 2008/56/EC).
- Establishment of environmental targets and indicators (Article 10 of the DIRECTIVE 2008/56/EC).
- In addition, there are three framework documents applicable to all sub- divisions: one general, one on marine mammals and one on birds.

2.3.2. Ireland

Statutory document used to transpose the MSFD into Irish law is S.I. No. 249 of 2011 European Communities (Marine Strategy Framework) Regulations 2011.

This regulation in straight forward way adopt Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive). In particular this act contains indicative list of characteristics, pressures and impacts potentially relevant to development of sensors corresponding to MSFD inventory.

2.3.3. Poland

Agency responsible for environmental assessment in Poland is Chief Inspectorate of Environmental Protection. Pursuant to Article 23 of the Act of 20 July 1991 on the Inspection for Environmental Protection, the Chief Inspector of Environmental Protection is responsible for developing long-term programmes under the State Environmental Monitoring to implement the tasks arising from separate legislative acts, international commitments and other needs resulting from the National Environmental Policy. The Inspectorate has prepared and deployed "The State Environmental Monitoring Programme for years 2013-2015" (SEM) implementing the provision of Article 23 paragraph 3 point 1 of the Act of 20 July 1991 on the Inspection for Environmental Protection (Journal of Laws of 2007 No 44, item 287, as amended).

An important substantive task in the SEM cycle in the years 2013-2015 is the full implementation of the EU regulations concerning environmental monitoring included in the recently published directives. In the case of the air quality subsystem, it includes, among others, the implementation of the system measuring and assessing PM2.5 air pollution, while in the case of water monitoring – the follow-up of the works aiming to fully implement the requirements of the Water Framework Directive as well the works consisting in investigating and assessing the status of the waters of the Baltic Sea in connection with the need to implement not only the requirements of the Helsinki Convention, but also the Marine Strategy Framework Directive.

The legal basis integrated the SEM with the environmental management system applying the following model: D-(driving force), P-(pressure), S-(state), I-(impact) and R-(response) within a

The COMMON SENSE project has received funding from the European Union's Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

shorter and longer period of time, simultaneously changing it into the tool serving to assess the National Environmental Policy. Irrespective of its functional division, the SEM includes the tasks arising from the National Environmental Policy, while environmental information originating from the SEM serves to evaluate the efficiency of the environmental policy implemented in the country

The data generated under the SEM are used by local government authorities and government administration for the purposes of operational environmental management applying legal instruments such as: the procedure concerning environmental impact assessments, permits to discharge substances or energy into the environment, the programmes and plans aiming to protect the environment as a whole and its specific elements, spatial development plans. Moreover, the data generated under the SEM are used to monitor the efficiency of the activities and strategic planning in the area of environmental protection. Additionally, they constitute the basis for strategic environmental impact assessments and they are applied to plan sustainable development at all management levels. What is more, the collected data are employed for the purposes associated with regional development as well as the use of structural and cohesion funds.

In order to obtain as detailed and reliable information on anthropogenic pressures on the environment as possible, the pressures block will serve to implement the tasks associated with obtaining the data on:

- the sources and loads of the substances released into the air for the purposes of annual assessments and assessments aiming to determine a proper air quality assessment method;
- the sources and loads of the substances discharged into waters or land as well as water abstractions;
- national emissions of pollution into the air and waters;
- the sources of energy emissions released into the environment;
- the data necessary to assess waste management.

Obtaining the information on the national emissions of pollutants into waters aims to document the type and quantity of pollutants discharged into waters, which is essential to:

- verify the location of measurement sites and modify monitoring programmes in compliance with the status of pressures in the sub-basin district,
- track the changes in the loads of pollutants discharged into waters in river basins,
- determine the balance of pollutants discharged from the sub-basin district into the Baltic Sea, and consequently, collect the data for the purposes associated with the Helsinki Convention and the implementation of Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (the Marine Strategy Framework Directive) (OJ L 164, of 25.06.2008, p. 19).

The obligation to measure and assess the quality of surface waters within the framework of the State Environmental Monitoring arises from Article 155a paragraph 2 of the Water Law Act of 18 July 2001 (Journal of Laws of 2005 No 239, item. 2019, as amended) hereinafter referred to as the Water Law Act. Paragraph 3 of this Article specifies that surface water quality monitoring with respect to physicochemical, chemical and biological elements fall within the competence of a vivid ship

The COMMON SENSE project has received funding from the European Union's Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

inspector of environmental protection. The monitoring aims to establish the basis for the activities serving to improve the status of waters and protect waters against pollution, also against eutrophication caused by the influences of the household and municipal sector and agriculture as well as against industrial pollutants, including salinity and the substances particularly hazardous to water environment.

The scope and manner of measurements and the criteria for the assessment of the status of water bodies are specified by the regulations to the Water Law Act:

- the Regulation of the Minister of the Environment of 4 October 2002 concerning the requirements that should be met by inland waters constituting the environment for the living of fish under natural conditions (Journal of Laws of 2002 No 176, item 1455);
- the Regulation of the Minister of the Environment of 4 October 2002 concerning the requirements to that should be met by marine inland waters and coastal waters constituting the environment for the living of crustacean and molluscs (Journal of Laws of 2002 No 176, item 1454);
- the Regulation of the Minister of the Environment of 23 December 2002 concerning the criteria to determine the waters vulnerable to pollution with nitrogen compounds from agricultural sources (Journal of Laws of 2002, No 204, item 1728);
- the Regulation of the Minister of the Environment of 27 November 2002 concerning the requirements that should be met by surface waters used to supply people with drinking water (Journal of Laws of 2002, No 204, item 1728);
- the Regulation of the Minister of the Environment of 23 July 2008 concerning the criteria and the manner to assess the status of ground waters (Journal of Laws of 2008, No 143, item 896);
- the Regulation of the Minister of the Environment of 20 August 2008 concerning the manner to classify the status of surface water bodies (Journal of Laws of 2008 No 162, item 1008);
- the Regulation of the Minister of the Environment of 13 May 2009 concerning the forms and manner to monitor surface water and groundwater bodies (Journal of Laws of 2009 No 81, item 685);
- the Regulation of the Minister of the Environment of 22 July 2009 concerning the classification of the ecological status, ecological potential and chemical status of surface water bodies (Journal of Laws of 2009, No 122, item 1018);

There are no specific regulations concerning the scope and manner to measure and assess the state of water sediments in the case of rivers and lakes.

In the course of the SEM, within at least one annual cycle, examinations will encompass all surveillance measurement and control sites of rivers, transitional waters and coastal waters, a part of surveillance sampling sites located in lakes and operational sampling sites. The operational measurement and control sites located in the surface water bodies where there exists or has existed the source of pollutants and where there may take place the discharge of the substances especially hazardous to water environment, particularly priority substances, or where the results of surveillance monitoring show that one of these substances occurs in the amount exceeding permitted concentration levels, will be subject to examinations focusing on these substances every year. The examinations at

The COMMON SENSE project has received funding from the European Union's Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

special-purpose operational monitoring sites will be conducted with the frequency corresponding to the objectives for which a given point has been established. However, in the case of the sites assessing the waters for the living of fish under natural conditions, they have to be carried out at least once every 3 years (i.e. each point will be covered by at least one annual monitoring cycle within the period of three years). The special-purpose sites assessing the waters serving to supply people with drinking water should be examined once a year.

Within the frame of SEM three relevant tasks are identified:

- The measurements and assessment of the status of transitional and coastal waters
- The measurements and assessment of the hydro-morphological elements of all surface water types
- The measurements and assessment of the quality of the marine environment of the Baltic Sea

The parameters that will be investigated within the framework of the programme include, among others, temperature, salinity, currents, transparency, oxygen, hydrogen sulphide, pH, nitrogen and phosphorous compounds, dissolved silicates, chlorophyll a, phyto- and zooplankton, macrophyto- and macrozoobenthos, heavy metals, persistent organic compounds, radionuclide contents in marine water, optionally – fish fauna and microbiology. In comparison to the previous years, the number of monitored hazardous substances will be increased in connection with the provisions of the Baltic Sea Action Plan adopted by the Helsinki Commission. The scope and frequency of measurements will differ depending on a given parameter and it will be established separately for each station. Each year, there will be the total of approx. 10000 determinations.

Block	Task
STATE	
Subsystem	The measurements and assessment of the quality of the marine environment of the Baltic Sea
Water quality monitoring	
Law	• The Environmental Protection Act of 27 April 2001 (Journal of Laws of 2008, No 25, item 150, as amended) – Articles 26; • The New Convention of 9 April 1992 on the protection of the marine environment of the Baltic Sea area (Journal of Laws of 2000 No 28, item 346); • The Water Law Act of 18 July 2001 (Journal of Laws of 2005 No 239, item. 2019, as amended); • The Regulation the Minister of the Environment of 4 October 2002 concerning the requirements to that should be met by marine inland waters and coastal waters constituting the environment for the living of crustacea and molluscs (Journal of Laws of 2002 No 176, item 1454).

The COMMON SENSE project has received funding from the European Union's Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

	• The Regulation the Minister of the Environment of 23 November 2010 r. concerning methods and frequency of environmental information updates (Journal of Laws of 2010 No 227, item 1485)

Objective scope

The examinations of the status of the marine environment of Poland's Baltic Sea area conducted at national level are Poland's contribution into the international Integrated Monitoring Programme of the Baltic Sea COMBINE. They include the monitoring of a deep-sea zone (examination stations in the area of the Gotland Basin, the Bornholm Deep and the Gdansk Deep) and the programme consisting in the examinations of the coastal area, bays and reservoirs (the Gdansk Bay, the Pomerania Bay, Vistula and Szczecin Lagoons at the sites excluded from monitoring within the framework of the task "The measurements and assessment of transitional and coastal waters) and supplementing the programme implemented under the subsystem "The monitoring of surface water quality." The programme will consist in the measurements of physicochemical conditions, i.e. temperature, salinity, oxygen concentration, Secchi depth, the contents of nutrients, heavy metals and persistent organic compounds. Moreover, biological elements of the marine environment will be observed, i.e.: phytoplankton, zooplankton, phytobenthos, zoobenthos and the level of hazardous substances in water and marine organisms as well radionuclide contents in water and sediments. Optionally, examinations will focus on fish fauna and microbiology. The obtained data will serve to perform the annual assessment of the status of the Baltic Sea environment.

In 2013 were examined physicochemical conditions of water body: temperature, salinity, oxygen, Secchi disks, nutrients, concentration of heavy metals and persistent organic pollutants. Biological parameters: of marine environment: phytoplankton, zooplankton, phytobenthos, zoobenthos, harmful compounds dissolved in water body and concentrated in marine species, concentration of radionuclides.

In connection with the coming into force of Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (the Marine Strategy Framework Directive), the preliminary assessment of marine waters will have been completed basing on physicochemical indicators, biodiversity and hydro-morphological elements. This assessment will also employ the data obtained following the implementation of the task "The measurements and assessment the status of transitional and coastal waters."

Implementing entities

Measurements	Database	Supervision and assessment
CIEP Central Laboratory for Radiological Protection (CLRP) (radionuclides in sediments and organisms) - optionally	Institute of Meteorology and Water Management (IMWM) Gdynia – Oceanographic Database CIEP	CIEP in cooperation with IMWM

The COMMON SENSE project has received funding from the European Union's Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

COMMON SENSE
MARINE SENSORS - MARINE MONITORING

Submission of measurements/assessment results			
Entity submitting results	Type and form of submitted measurements results	Frequency of submitting measurements results (min)	Place to submit measurements results
CIEP CIEP CIEP (or via HELCOM data bank)	- the results of examinations in an electronic form in the format required by CSO; - the results of examinations in an electronic form in the format required by HELCOM; - the results of examinations in an electronic form in the format required by EEA	- once a year in accordance with the Statistical Research Programme -once a year – once a year	CSO HELCOM EEA

Table.1 The measurements and assessment of the quality of the marine environment of the Baltic Sea

2.4. Programs and projects

The inventory of programs and projects was done aiming at identifying those inspired by the MSFD and targeted for development of sensors or platforms and observation methodologies to meet MSFD monitoring requirements. Hence the time scope of the inventory was narrowed to starting year of 2009, as MSFD was published in 2008.

Identified projects were financed by a range of programs as FP7, LIFE, COST and national funding. Projects were targeted on D8: Contaminants (12), D11: Underwater noise (6), D5 Eutrophication (4) and D10: Marine litter (4). Most of the projects were focused on development of monitoring systems and methodologies or platforms, much less of them were aimed at development of a new sensors.

Three projects were aimed at development sensors for contaminants: Rearguard, BRAAVOO and SCHeMA and two for underwater noise: SMS and ANIMALSOUNDSENSORS.

No research projects were identified for development sensors for D5: Eutrophication and D10: Marine litter.

2.4.1. Eurofleets II

Project EUROFLEETS2 "New operational steps towards an alliance of European research fleets", grant agreement no: 312762, starting at 01/03/2013, duration 48 months.

The COMMON SENSE project has received funding from the European Union's Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

The development and funding of marine research infrastructures under a common strategic framework is a crucial issue. European research fleets could all together be considered as a unique distributed infrastructure really competitive with its international counterparts as the US one Research vessels represent very expensive assets with high development, investment, operation, maintenance and implementation costs. A continued investment flow is vital to maintain and possibly increase Europe's research capacity (European Science Foundation, 2007). Research vessels are necessary for marine science to maintain observation systems (biogeochemistry, physics, biology), to monitor oceanographic parameters, to deploy sophisticated equipments in the deep sea, to carry out specific observation missions and to collect rare and sensitive biological samples. Their role is expanding with the development of in-situ operational observation (moorings, floats, gliders, seabed observatories) they might be particularly useful to respond to some MSFD obligations.

A high availability of oceanographic fleets, associated marine equipment, coordinated strategy and access to facilities are essential for a high quality of the research at sea. A pan-European Distributed Research Vessels Infrastructure with a common strategy and development plan is necessary in order to be able to provide European researchers and industries with unique marine research facilities and user services. The objective should be the significant improvement of marine research, related tools and technologies for marine resource observation, exploration and development and the convergence on common scientific and technical standards in marine research. A strong innovation impact could be achieved only by pulling resources and infrastructures, according also with the statements of the EU Integrated Maritime Policy (Aberdeen Declaration, 2007) and the "Innovation Union", one of the seven flagship initiatives of Europe 2020 strategy.

Within Eurofleets 2 there are identified activities corresponding to CommonSense scope of interest, covered by one of the Project's objectives "Enhancing the impact of research infrastructures on innovation by fostering the involvement of industry with specific activities, both as a user (e.g. development and testing of new equipment or deep-sea exploration for new energy or mineral resources) and as a supplier of such facilities."

.The use of the 3D HD data for 3D optical modelling and mosaicking of the ocean with innovative algorithms, dealing with calibration, texture and blending corrections is a new research target which requires advanced signal processing and software implementations. Two innovative developments will be carried out, based on one hand on a new high density Lithium Polymer package integrated in a gel matrix, with the ad hoc pressure compensated electronics for battery management, and on the other hand a very high density solution based on real Li-Ion technology, packaged in oil within flexible cells, easy to integrate within all submarine frames. SMEs are associated to these developments.

The main objective of EUROFLEETS2 JRA's is to develop software and data services that implement all technologies that weren't mature enough when starting EUROFLEETS1 JRA developments, with the goal to improve the on-board end user facilities and also the integration of the research vessels with the European marine data centres network as information providers. Two main challenges have been identified to achieve this objective:

- The use of Open Geospatial Consortium Sensor Web Enablement standards for data, metadata and data services combined with the Unidata NetCDF standards, the ISO 191xx and the SeaDataNet CSR/CDI metadata standards;
- The implementation of a semantic framework to be used on-board as link at the vocabulary level between the mentioned standards and also as a knowledge base to develop user

The COMMON SENSE project has received funding from the European Union's Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

application interfaces. The JRA3 will go beyond the present state of the art by the work planned in three different tasks:1 “Developing new features in EARS”: Will enrich the EUROFLEETS Automatic Reporting System (EARS) by introduction of an ontology system as the basis for event coding and user interface construction improving the user-friendliness of the system. The resulting knowledge base, interlinking and extending existing vocabularies will be served to the scientific community. 2 “Standardisation of the data acquisition process”: By the use of Open Geospatial Consortium Sensor Web Enablement (SWE) technologies will enrich the metadata products that describe the onboard data acquisition systems, and will constitute the first link in the chain of data/metadata from vessel to data centres with an e-access approach. 3 “Development of direct e-access to data during survey”: Focused on e-access technologies, it will provide an e- research perspective to access the onboard data services from a shore site (data centres, research institutions, management sites) increased through on-line interaction of the on-board equipment. To stimulate the coordinated development, deployment and networking of the environmental research infrastructures, EUROFLEETS2 will establish partnership with other EC environmental integrating activities such as ACTRIS and IAGOS to furthermore harmonise standards and protocols.

Standardisation is crucial factor fostering equipment and data interoperability. In this sense its concerns have gained increasing attention for an effective deployment and use of marine research infrastructures. The EUROFLEETS2 development of innovative and standardised software is combining all necessary functionalities for sensors calibration, processing and display of scientific data acquired during cruises and exporting the results to the main marine networks. It will permit in liaison with SeaDataNet:

- Acquisition and processing of data from ship sailing instruments, common sensors on board ship (temperature, salinity), multi beam echo sounders data for bathymetry and imagery, sensors on board submarines instruments (ROVs, AUVs), photos and videos, and for each data on a geo- referenced basis;
- Data import/export through satellite ways and standardised connection with on shore data centres headed up by SeaDataNet;
- The standardisation efforts to integrate information on the diversity of microorganism and large-scale genomic data from remote sensing and fleet operation will allow the scientific community, for the first time, to perform research on the molecular scale based on comprehensive European oceanographic data;
- The EUROFLEETS projects contribute to the development of protocols for experimental tests: Guidelines and generic design will be realised for eco RRV design;
- EUROFLEETS2 is committed to better organising fleets and equipment coordination and sharing in Europe in order to establish common practices and develop standardised monitoring tools;
- High technology generic equipment e.g. new 3D HD TV smart camera and new battery pack for underwater systems, payload for underwater systems;
- On board software for processing and display the scientific data. The improvement of standardisation will lead to multiple benefits such as the better coordination of activities, the reduction of costs, and the improvement of facilities quality and marine research.

The COMMON SENSE project has received funding from the European Union’s Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

2.4.2. SHOAL – Search and Monitoring of Harmful contaminants, other pollutants and leaks in vessels in port using a swarm of robotic fish.

FP7, 2009–2012, Contact: Tyndall, Cork University, IR

The aim of the SHOAL project is to develop robotic fish that can monitor pollution in ports. The robotic fish will be equipped with chemical sensors to find pollutants in the water and modems to create an ad hoc network for communication with a shoal of fish. This will allow the shoal of fish to build up a broad map of pollutants moving through the port in real-time, whilst adapting to changes in environmental conditions in the port. SHOAL will use advanced swarm intelligence techniques to control the robots, utilising hybrid particle swarm/ant colony optimisation techniques in order to coordinate the group efficiently and adapt quickly to changes in the environment. This will benefit not only monitoring operations in ports across the EU, but also lead to important advances in robotics, chemical analysis, underwater communications and robot intelligence. The established methods for the detection of pollutants in waters are based on sampling and analysis of discrete water samples. The analysis is performed in laboratories located remotely away from the sampling sites and frequently the chemical analysis is personnel-dependent, time-consuming and expensive. Specific aims within SHOAL are to explore and develop novel chemical sensor subsystems which can be integrated with the overall robot concept being developed. Thus miniaturized sensors and sensor arrays as well as novel membrane strategies for provision of chemical sensitivity and anti-fouling behaviour are being examined. Given that the state-of-the-art is all lab-based methods, the proposed suggestions will go far beyond the state-of-the-art by implementing these lab-based methods in situ on board the robotic fish.

The final results of the project were not published yet, however the information /expertise gathered by the project may be useful for sensors and observation methodologies development within CS fore keywords: chemical sensor, anti-fouling.

2.4.3. SeaDataNet

SeaDataNet 2 FP7 project, grant agreement 283607, started on October 1st, 2011 for a duration of 4 years

The overall objective of the SeaDataNet II project is to upgrade the present SeaDataNet infrastructure into an operationally robust and state-of-the-art Pan-European infrastructure for providing up-to-date and high quality access to ocean and marine metadata, data and data products originating from data acquisition activities by all engaged coastal states, by setting, adopting and promoting common data management standards and by realising technical and semantic interoperability with other relevant data management systems and initiatives on behalf of science, environmental management, policy making, and economy. SeaDataNet is undertaken by the National Oceanographic Data Centres (NODCs), and marine information services of major research institutes, from 31 coastal states bordering the European seas, and also includes Satellite Data Centres, expert modelling centres and the international organisations IOC, ICES and EU-JRC in its network. These 40 data centres have been engaged in data management for many years and have the essential capabilities and facilities for data quality control, long term stewardship, retrieval and distribution.

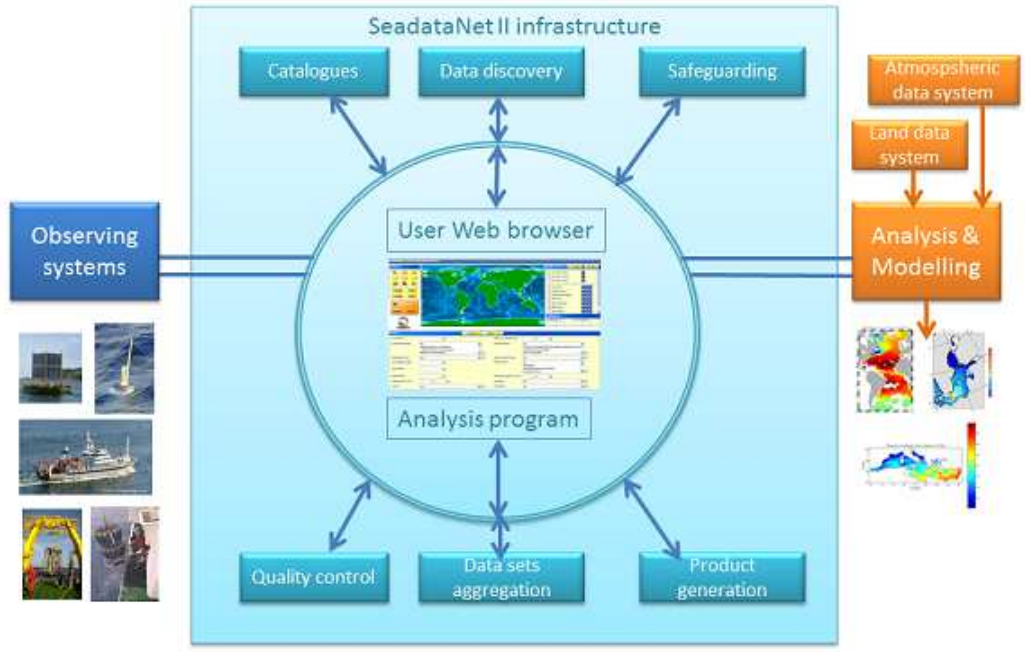
SeaDataNet II will undertake activities to achieve data access and data products services that meet requirements of end-users and intermediate user communities, such as GMES Marine Core Services (e.g. MyOcean), establishing SeaDataNet as the core data management component of the EMODNet infrastructure and contributing on behalf of Europe to global portal initiatives, such as the IOC/IODE

The COMMON SENSE project has received funding from the European Union's Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

– Ocean Data Portal (ODP), and GEOSS. SDN also aims to achieve INSPIRE compliance and to contribute to the INSPIRE process for developing implementing rules for oceanography.

The marine observing system is highly fragmented: in the countries bordering the European seas of the partnership, more than 600 scientific data collecting laboratories from governmental organisations and private industry have been identified. They collect data by using various sensors on board of research vessels, submarines, fixed and drifting platforms, airplanes and satellites, to measure physical, geophysical, geological, biological and chemical parameters, biological species etc. The collected data are neither easily accessible, nor standardised. They are not always validated and their security and availability have to be insured in the future.

Drawing **Errore. Non è stata specificata alcuna sequenza.**: Infrastructure of SeaDataNet 2, (source: http://www.seadatanet.org)



Therefore SeaDataNet is a standardised system for managing the large and diverse data sets collected by the oceanographic fleets and the automatic observation systems. The SeaDataNet infrastructure network and enhance the currently existing infrastructures, which are the national oceanographic data centres of 35 countries, active in data collection. The networking of these professional data centres, in a unique virtual data management system provide integrated data sets of standardised quality on-line. As a research infrastructure, SeaDataNet contributes to build research excellence in Europe.

SeaDataNet 2 aims to upgrade the present SeaDataNet infrastructure into an operationally robust and state-of-the-art Pan-European infrastructure for providing up-to-date and high quality access to ocean and marine metadata, data and data products by: setting, adopting and promoting common data management standards realising technical and semantic interoperability with other relevant data management systems and initiatives on behalf of science, environmental management, policy making, and economy

The COMMON SENSE project has received funding from the European Union's Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

SeaDataNet II will adopt family of OGC standards specifications called 'Sensor Web Enablement' (SWE) which includes detailed information about the sensors making measurements and the platforms that carry the sensors using the Sensor Model Language (SensorML), general models and XML encodings for sensor Observations and Measurements (O&M), and a protocol to provide access to observations from sensors and sensor systems in a standard way (Sensor Observation Service (SOS)). Than SDN2 define specific SeaDataNet profiles for the SensorML and Observations & Measurements models that then can be applied by operators of operational observation systems to describe in more detail their observations and to provide standardised access to these observations using the SOS service protocol. In practice, the SensorML and O&M metadata will be attached to the core CDI discovery format as extensions, giving users of the SeaDataNet portal more usage information on specific observations and a way for direct access to the related data streams from operational sensor systems, such as real-time met-ocean networks and underway data from systems onboard research vessels.

Definition activities will include:

• Define SensorML profiles to describe instrument and sensors used in the field of marine observation, both for automatic systems such as floats, buoys, sea-floor and coastal observatories, vessel mounted devices and for manual observations. These definitions will be conducted via strong relationships with other groups and projects, active in marine observation, and with sensor manufacturers when useful such as ESONET/EMSO, EuroArgo, FerryBox, MyOcean, Geo-Seas, etc, in order to reach a very large agreement which can be proposed and considered as a real reference in the marine community via the IOC-IODE. These sensor descriptions will be implemented in the SeaDataNet CDI discovery service as extensions and applied where appropriate and feasible (i.e. for recent observations). The SensorML part may be queried using SOS requests.

• Define O&M data models adapted to the marine observation data such as water column vertical profiles, time series, and vessel underway data. Specifications of these models will be studied according to the work already conducted by other groups in related domains such as fresh water, atmosphere, terrestrial and marine geology, to be based on the same core principles and to be proposed as a common specification for the marine community through IOC-IODE. Implementation of these models will be conducted both for the OGC SOS protocol and for OpeNDAP (Open-source Project for a Network Data Access Protocol) which is already widely used in the Ocean/Atmosphere community (Operational Oceanography).

• The 3 SOS mandatory 'core' operations: GetObservation, DescribeSensor, and GetCapabilities will be implemented. The CDI service will be used as a service registry to access these SOS services. TheGetObservation operation will provide a convenient access to the real-time data that are managed at the distributed data centres and monitoring agencies (EuroGOOS members and others), also for machine to machine communications. This implies that related data centres / operators have to install and configure SOS services locally. The SOS GetObservation can also be used to provide advanced services to human users such as data visualisation, whereby visualisation types must be adapted to the different O&M defined models.

An alternative for operators of monitoring systems might be to install and configure OpeNDAP services locally with observations in NetCDF (CF) data files, queried via THREDDS from the CDI portal services to provide access and delivery to their real-time and near-real-time data sets. As part of

The COMMON SENSE project has received funding from the European Union's Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

the definition process SeaDataNet II is engaged in the OGC Interoperability Program to test, validate and refine the solutions developed on the basis of OGC standards.

2.4.4. ODIP

The EU FP7 ODIP project is developing an Ocean Data Interoperability Platform. ODIP aims to establish an EU / USA / Australia/ IOC-IODE coordination platform, to achieve the interoperability of ocean and marine data management infrastructures. ODIP will demonstrate this coordination through several joint EU-USA-Australia-IOC/IODE prototypes that would ensure persistent availability and effective sharing of data across scientific domains, organisations and national boundaries. ODIP is undertaken by representatives of the leading marine data management infrastructures in Europe (such as SeaDataNet, Geo-Seas, MyOcean), USA (such as US NODC, IOOS, R2R) and Australia (such as IMOS) and IOC-IODE (ODP).
The ODIP platform organises international workshops to foster the development of common standards and develop prototypes to evaluate and test selected potential standards and interoperability solutions. The ODIP partnership also provides a forum to harmonise the diverse regional systems, while advancing the European contribution to the global system.

2.4.5. Other programs and projects inventory performed with Marine Knowledge Gate 2.0, managed by the EurOcean.

Title	**Development of concepts and methods for monitoring and assessing selected anthropogenic pressures for the MSFD**
Programme	National
National Programme	UBA Federal Environment Research Plan (UFOPLAN)
Start Year	2012
End Year	2014
Funding	530,000
Funding Organizations	UBA – Federal Environment Agency (Germany)
Funding Countries (Regions)	Germany
Project Coordinator	Claus-Dieter Duerselen
Coordinator Country	Germany
Coordinator Institution	AquaEcology GmbH & Co. KG (Germany)

Main objectives of the project will be the identification of pressure and impact descriptors for which assessment systems are not yet available, such as D2 (non-indigenous/'invasive' species), D6 (sea-floor integrity), D7 (hydrographical conditions), D8 (contaminants) and D10 (marine litter). Existing deficits have to be identified along with possible solutions, for example by developing respective assessment systems. Moreover, an overall assessment of the concept of good environmental status according to the MSFD will be developed, with regard to the results of recent MSFD projects. This work will also include the examination and specification of the indicators of the individual impact descriptors. A further aim of the project will be the definition of quantitative environmental targets and subsequent operationalisation of the respective indicators. Based on the recent assessment work and on existing monitoring programmes, a monitoring concept will be developed in order to effectively ensure the success of the future assessment.

Acronym	EMBOS

The COMMON SENSE project has received funding from the European Union's Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

COMMON SENSE
MARINE SENSORS - MARINE MONITORING

Title	Development and implementation of a pan-European Marine Biodiversity Observatory System
Programme	COST
Action	ES1003
Start Year	2011
End Year	2015
Funding	60,000,000
Project Coordinator	Herman Hummel
Coordinator Country	Netherlands
Other Countries Involved	Belgium; Croatia; Cyprus; Denmark; Estonia; France; Germany; Greece; Ireland; Italy; Latvia; Lithuania; Malta; Norway; Poland; Portugal; Slovenia; Spain; Sweden; Turkey; United Kingdom
Coordinator Institution	NIOZ CEME – Netherlands Institute for Sea Research; Centre for Estuarine and Marine Ecology (Netherlands)

Marine biodiversity varies over large scales of time and space, and requires a research strategy beyond the tradition/capabilities of classic research. Research that covers these scales requires a permanent international pan-European network of observation stations with an optimized and standardized methodology. In EMBOS the needed large-scale network of research locations in Europe will be installed to assess long-term changes in marine biodiversity and their possible causes taking into account natural and anthropogenic gradients, and EMBOS will extend and optimize this observatory system, including novel interdisciplinary approaches for research. The cooperation leads to a focused and cost effective long term research agenda for EU marine observatories, and contributes to ERA, LIFEWATCH and GEOSS/GEOBON actions, and supports legal obligations of the EU regarding the CBD, OSPAR and Barcelona conventions as well as EU directives (Bird and Habitat Directive, WFD, MSFD, ICZM).

Title	Monitoring network for the ecological status quality of the inland, transitional and coastal waters of Greece-Classification of their ecological quality status according to the WFD 2000/60/EK
Programme	National
National Programme	Not available
Start Year	2012
End Year	2015
Funding	Not available
Funding Organizations	Not available
Funding Countries (Regions)	Not available
Project Coordinator	Panayotid Panayotidis
Coordinator Country	Greece
Other Countries Involved	Not available
Coordinator Institution	HCMR – Hellenic Centre for Marine Research (Greece)

HCMR is the legal responsible Institution for the implementation of WFD monitoring project in rivers, coastal and transitional surface waters. The monitoring in coastal/marine waters include 30 operational

The COMMON SENSE project has received funding from the European Union's Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

and 50 surveillance monitoring stations. Sampled parameters include chlorophyll-a (phytoplankton biomass), general physicochemical parameters including nutrients etc, hydro-morphological descriptive elements, macroalgae, angiosperms and benthic macroinvertebrates with the frequencies required according to the Directive Annex V. Some sediment parameters will be sampled also supporting biological elements. Priority substances will be also collected and analysed by the General Chemistry of State for evaluating also chemical status. Biological elements will be classified using intercalibrated metrics according to MedGIG results through ECOSTAT. MSFD Descriptors covered partly or fully by the implementation of the monitoring project include eutrophication, biodiversity, sea floor integrity, non-indigenous species, and contaminants.

Title	Occurrence of micro-plastics in marine sediments from the Lower Saxony Wadden Sea
Programme	National
National Programme	Local Authority
Start Year	2011
End Year	2012
Funding	20,991
Funding Organizations	Not available
Funding Countries (Regions)	Not available
Project Coordinator	Kirsten Dau
Coordinator Country	Germany
Other Countries Involved	Not available
Coordinator Institution	NLWKN – Lower Saxony Water Management, Coastal Defence and Nature Conservation Agency (Germany)

According to the MSFD (2008/56/EC) micro-plastic is a relevant pressure to be considered while describing the environmental status. To date, little is known about the distribution and environmental effects of micro-plastics. The study aimed to determine the occurrence of micro-plastics in the coastal marine environment (sediment) of Lower Saxony.

Acronym	MERIT-MSRL
Title	Methods for monitoring and assessing risks of toxic contaminants in marine ecosystems
Programme	National
National Programme	Not available
Start Year	2011
End Year	2014
Funding	393,000
Funding Organizations	BMVBS – Federal Ministry of Transport, Building and Urban Development (Germany)
Funding Countries (Regions)	Germany

The COMMON SENSE project has received funding from the European Union's Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

Project Coordinator	Ulrike Kammann
Coordinator Country	Germany
Other Countries Involved	Not available
Coordinator Institution	vTI – Thunen Institute (Germany)

The objective of this project was the detection and assessment of risks for the marine ecosystem due to toxic contaminants, in relation to implementation of the European Marine Strategy Framework Directive. In the research project, a concept for the experimental and mathematical investigation of science-based threshold levels for the assessment of pollutant concentrations in the marine environment will be developed. Threshold levels for toxic organic substances from lists of priority substances (OSPAR and HELCOM) are determined experimentally using two test systems: Micro-injection into zebrafish embryos and bacterial detection after chromatographic separation. Logistic models are used for the calculation of threshold levels. The results are closely related to the requirements of the MSFD.

Title	Assessment and Monitoring of Ocean Noise in Irish Waters
Programme	National
National Programme	EPA STRIVE programme
Start Year	2012
End Year	2013
Funding	148,000
Funding Organizations	EPA – Environmental Protection Agency (Ireland)
Funding Countries (Regions)	Ireland
Project Coordinator	Joanne O'Brien
Coordinator Country	Ireland
Other Countries Involved	Spain
Coordinator Institution	GMIT – Galway-Mayo Institute of Technology (Ireland)

Under this project, a data audit will be carried out to identify and catalogue acoustic datasets collected to date in Irish waters. These datasets will be used to generate a baseline of acoustic noise levels primarily based on the frequency band 10Hz to 10KHz. This research is designed to meet Ireland's requirements under the Marine Strategy Framework Directive (MSFD), but will also serve to fulfil requirements under the EU Habitats Directive for marine mammals. All datasets will be modelled for the proportion of days in which anthropogenic sound exceeds 183dB re 1µPapeak between 10 Hz to 10 KHz. At present, no observation stations are identified or fully established in Irish waters, therefore a collaboration will be set up with associate partners Michel Andre from the Laboratory of Applied Bioacoustics (LAB) at the Technical University of Catalonia, Spain (UPC) helping to build capacity within Ireland by carrying out trial deployments of noise monitors. This project will serve to inform management by generating baseline values of noise levels, identify recommendations for future studies and predict how Ireland can acquire and maintain Good Environmental Status by 2020. Expected outcomes include a detailed database and archive of acoustic datasets collected in Irish waters. Datasets will be explored to establish the proportion of days within a defined period that anthropogenic sound exceeds 183dB between 10Hz and 10KHz. An approximate disturbance area for baleen whales will be generated. A database of licensed activities will be created, as well as a register of activities which produce low and mid-frequency impulsive sounds and continuous low frequency

The COMMON SENSE project has received funding from the European Union's Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

sounds. Trial deployments of noise monitors will build capacity in Ireland, and results used to inform policy. Two peer reviewed publications will be delivered.

Acronym	DEVOTES
Title	DEVelopment Of innovative Tools for understanding marine biodiversity and assessing good Environmental Status
Programme	FP7
Theme	ENVIRONMENT – Environment (including Climate change)
Instrument/Contract Type	FP7 – Collaborative Project (generic)
Start Year	2012
End Year	2016
Funding	8,997,984
Project Coordinator	Angel Borja
Coordinator Country	Spain
Other Countries Involved	Belgium; Bulgaria; Denmark; Finland; France; Germany; Greece; Italy; Lithuania; Netherlands; Norway; Portugal; Saudi Arabia; Turkey; Ukraine; United Kingdom
Coordinator Institution	AZTI-Tecnalia – Fundación AZTI-AZTI Fundazioa (Spain)

DEVOTES Project aims at improving understanding of human activities impacts (cumulative, synergistic, antagonistic) and variations due to climate change on marine biodiversity, using long-term series (pelagic and benthic). A major aim of DEVOTES is to test the indicators proposed by the EC, and develop new ones for assessment at species, habitats and ecosystems level, for the status classification of marine waters, integrating the indicators into a unified assessment of the biodiversity and the cost-effective implementation of the indicators (i.e. by defining monitoring and assessment strategies).

Acronym	ME5209
Title	Using Northern fulmars as an ecological monitor of marine litter in line with indicators set for MSFD Descriptor 10
Programme	National
National Programme	International SNS-Fulmar study
Start Year	2010
End Year	Not available
Funding	Not available
Funding Organizations	DEFRA – Department for Environment, Food and Rural Affairs (United Kingdom) Dutch government (Netherlands)
Funding Countries (Regions)	Netherlands United Kingdom
Project Coordinator	Jan van Franeker
Coordinator Country	Netherlands
Other Countries Involved	Belgium; Denmark; France; Germany; Norway; United Kingdom
Coordinator Institution	IMARES – Wageningen UR; Institute for Marine Resources and Ecosystem Studies (Netherlands)

The COMMON SENSE project has received funding from the European Union's Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

COMMON SENSE
MARINE SENSORS - MARINE MONITORING

Abundance of marine litter, in particular plastics found in the stomachs of beached seabirds (Northern Fulmar – Fulmarus glacialis), is used to monitor changes over time and regional patterns in marine debris. This project was initiated in the North Sea and is a formal monitoring tool for the Ecological Objectives (EcoQOs) of OSPAR. It has also become the example of a 'living' indicator for Good Environmental Status (GES) in the European Marine Strategy Framework Directive (MSFD).

Acronym	AQUO
Title	Achieve Quieter Oceans by shipping noise footprint reduction
Programme	FP7
Theme	TRANSPORT – Transport (including Aeronautics)
Instrument/Contract Type	FP7 – Small or Medium-Scale Focused Research Project
Start Year	2012
End Year	2015
Funding	2,999,571
Project Coordinator	Christian AUDOLY
Coordinator Country	France
Other Countries Involved	Belgium; Italy; Netherlands; Poland; Spain; Sweden; United Kingdom
Coordinator Institution	DCNS SA (France)

AQUO project is to provide to policy makers practical guidelines, acceptable by shipyards and ship owners. The list of solutions will be split into solutions regarding ship design (including propeller and cavitation noise), and solutions related to shipping control and regulation. Exploitation of the AQUO project results is expected to have significant impacts, meeting the requirements of the MSFD. The project is supported by relevant methods and tools, which will be used to assess the effectiveness of noise mitigation measures in order to select the most appropriate: - A noise footprint assessment tool will be derived from Quonops an existing operational underwater noise prediction system, connectable with AIS shipping data.

Acronym	Rearguard
Title	Development of a biosensor technology for environmental monitoring and disease prevention in aquaculture ensuring food safety
Programme	FP7
Theme	KBBE – Food, Agriculture and Fisheries, and Biotechnology
Instrument/Contract Type	FP7 – Collaborative Project (generic)
Start Year	2013
End Year	2018
Funding	7,227,437
Project Coordinator	Björn SUCKOW
Coordinator Country	Germany
Other Countries Involved	Belgium; France; Israel; Malta; Netherlands; Spain; Turkey; United Kingdom
Coordinator Institution	ttz – Verein zur Förderung des Technologietransfers an der Hochschule Bremerhaven eV (Germany)

The COMMON SENSE project has received funding from the European Union's Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

COMMON SENSE
MARINE SENSORS - MARINE MONITORING

The objective of the Rearguard project is to develop a highly specific and precise (i.e. quantitative and qualitative) in situ measurement device for currently hard to measure man-made chemical contaminants and biohazards (toxic microalgae, viruses & bacteria, biotoxins & PCBs) that can be used as an early warning system in aquaculture and as an environmental monitor to assess the good environmental status of the sea in compliance with the MSFD. It will be more cost-efficient than current monitoring devices leading to a clear marketing advantage for the European analytical and research equipment industry. The modular system will consist of three different sensor modules (microalgae/pathogens/ toxins & chemicals) integrated into a single, portable device, which saves, displays and sends the collected data real time to a server by means of mobile data transmission and the internet.

Acronym	SMS
Title	Sensing toxicants in Marine waters makes Sense using biosensors
Programme	FP7
Theme	KBBE – Food, Agriculture and Fisheries, and Biotechnology
Instrument/Contract Type	FP7 – Collaborative Project (generic)
Start Year	2013
End Year	2017
Funding	4,144,263
Project Coordinator	Giuseppe PALLESCHI
Coordinator Country	Italy
Other Countries Involved	Belgium; France; Greece; Morocco; Slovenia; Spain; Sweden
Coordinator Institution	University of Rome Tor Vergata (Italy)

SMS will deliver a novel automated networked system that will enable real-time in situ monitoring of marine water chemical and ecological status in coastal areas by the detection of a series of contaminants regulated by the MSFD. SMS will design a multi-modular apparatus that will host in a single unit—the Main Box (MB)—a Sampling Module and an Analysis Module. The former will contain sample collection and treatment components, whereas the latter will include four biosensor sub-modules that will enable detection and measurement of algal toxins and their associated algal species; several hazardous compounds (tributyltin, diuron and pentaBDPE); sulphonamides and a series of standard water quality parameters.

Acronym	JERICO
Title	TOWARDS A JOINT EUROPEAN RESEARCH INFRASTRUCTURE NETWORK FOR COASTAL OBSERVATORIES
Programme	FP7
Theme	INFRASTRUCTURES – Research Infrastructures
Instrument/Contract Type	FP7 – Integrating Activities / e-Infrastructures / Preparatory Phase
Start Year	2011
End Year	2015
Funding	6,500,000
Project Coordinator	Patrick Farcy
Coordinator Country	France

The COMMON SENSE project has received funding from the European Union's Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

Other Countries Involved	Belgium; Bulgaria; Denmark; Finland; Greece; Ireland; Italy; Malta; Netherlands; Norway; Poland; Portugal; Spain; Sweden; United Kingdom
Coordinator Institution	Ifremer – French Research Institute for Exploitation of the Sea (France)

The main objective of JERICO is to propose a Pan European approach for a European coastal marine observatory network, integrating infrastructure and technologies such as moorings, drifters, ferrybox and gliders. Networking activities will lead to the definitions of best practices for design, implementation, maintenance and distribution of data of coastal observing systems, as well as the definition of a quality standard. Harmonisation and strengthening coastal observation systems within EuroGOOS (European Global Ocean Observing System) regions will be sought. Unique twin Trans National Access experiments will be carried out in order to reveal the potential of datasets used in synergy.

Acronym	CITCLOPS
Title	Citizens' observatory for coast and ocean optical monitoring
Programme	FP7
Theme	ENVIRONMENT – Environment (including Climate change)
Instrument/Contract Type	FP7 – Collaborative Project (generic)
Start Year	2012
End Year	2015
Funding	3,839,758
Project Coordinator	Luigi Ceccaroni
Coordinator Country	Spain
Other Countries Involved	France; Germany; Ireland; Netherlands
Coordinator Institution	BDIGITAL – Barcelona Digital Technology Centre (Spain)

The Citclops project aims to develop systems to retrieve and use data on seawater colour, transparency and fluorescence, using low-cost sensors combined with contextual information (e.g., georeferencing) and a community-based Internet platform, taking into account existing experiences (e.g., Secchi Dip-In, Coastwatch Europe and Oil Reporter). Simple and fast methods, to establish the optical properties of seawater, will be developed and used: e.g., the colour through Forel-Ule observations, and transparency through a variant of the Secchi disc. People will be able to acquire data taking photographs of the sea surface on ferries or other vessels, at open sea or from the beach. Wearable digital cameras for aquatic activities, with extended sensing systems, are also proposed as alternative resources for crowd-sourcing data. Data are automatically uploaded through a specific service or application (such as Google+ Instant Upload), archived remotely and processed, and resulting information is accessed through a webpage or a mobile application by end users.

Acronym	ANIMALSOUNDSENSORS
Title	On-animal sound sensors: long-term sound and movement recording tags for studying how environmental noise affects animals
Programme	FP7
Theme	PEOPLE – Marie Curie Actions
Instrument/Contract Type	FP7 – Career Integration Grant (CIG)
Start Year	2012

The COMMON SENSE project has received funding from the European Union's Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

COMMON SENSE
MARINE SENSORS - MARINE MONITORING

End Year	2016
Funding	100,000
Project Coordinator	Trish Starrs
Coordinator Country	United Kingdom
Other Countries Involved	Denmark; Spain
Coordinator Institution	USTAN – University of St Andrews (United Kingdom)

The project propose to develop a unique experimental capability to test if responses to noise can have a cumulative impact on fitness. To achieve this, a highly-integrated tag capable of recording sound, foraging motions and locomotory effort of individual animals over months will be created. The different sensory systems, environmental constraints and strategies of these taxa will help in interpreting how and to what extent noise can change foraging rates and so impact fitness. In the final phase of the project, miniaturized tags will be used on small terrestrial animals and birds to examine the role of predation pressure in shaping noise responses. The project will pair cutting-edge electronic technology with European leadership in field studies of wild animals to create a world-first capability that will provide scientific guidance for marine conservation while also addressing emerging noise concerns in terrestrial animals.

Acronym	BIAS
Title	Baltic Sea Information on the Acoustic Soundscape
Programme	LIFE
Start Year	2012
End Year	2016
Funding	4,577,315
Project Coordinator	Peter Sigray
Coordinator Country	Sweden
Other Countries Involved	Denmark; Estonia; Finland; Germany; Poland
Coordinator Institution	FOI – Swedish Defence Research Agency (Sweden)

The BIAS project is aimed at solving the major challenges related to implementation of the Descriptor 11 of the marine Strategy Framework Directive (Introduction of energy, including underwater noise) in the Baltic Sea. One year of acoustic measurements will be performed covering the whole Baltic Sea. In total 40 sensors will be deployed. The measurements will be taken by adhering to the standard methods that will be established by the project. Likewise, the data will be analysed using standardized signal processing routines. Results will be subjected to a quality control and finally stored in a common data-sharing platform. Tools for handling the descriptor will be developed and implemented on a regional scale.

Acronym	BRAAVOO
Title	Biosensors, Reporters and Algal Autonomous Vessels for Ocean Operation
Programme	FP7
Theme	KBBE – Food, Agriculture and Fisheries, and Biotechnology
Instrument/Contract Type	FP7 – Collaborative Project (generic)

The COMMON SENSE project has received funding from the European Union's Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

Start Year	2013
End Year	2016
Funding	3,529,127
Project Coordinator	Jan van der Meer
Coordinator Country	Switzerland
Other Countries Involved	Germany; Ireland; Israel; Italy; Netherlands; Spain
Coordinator Institution	UNIL – University of Lausanne (Switzerland)

BRAAVOO aims to develop innovative solutions for real-time in-situ measurement of high impact and difficult to measure marine pollutants. The concept of BRAAVOO is based on a unique combination of three types of biosensors, which will enable both the detection of a number of specific marine priority pollutants as well as of general biological effects that can be used for early warning. First, innovative bimodal evanescent waveguide nanoimmuno-sensors will enable label-free antibody-based detection of organohalogens, antibiotics, or algal toxins. Secondly, bacterial bioreporters producing autofluorescent proteins in response to chemical exposure will enable direct detection of alkanes or PAHs from oil, heavy metals, or antibiotics, and can further assess the general toxicity of the water sample. Finally, the photosystem activity of marine algae is exploited to monitor changes induced by toxic compounds.

Acronym	SCHeMA
Title	Integrated in situ chemical mapping probes
Programme	FP7
Theme	ENVIRONMENT – Environment (including Climate change)
Instrument/Contract Type	FP7 – Collaborative Project (generic)
Start Year	2013
End Year	2017
Funding	5,200,489
Project Coordinator	Mary-Lou Tercier-Waeber
Coordinator Country	Switzerland
Other Countries Involved	Austria; France; Germany; Italy; Spain
Coordinator Institution	UNIGE – University of Geneva (Switzerland)

SCHeMA is a multi-disciplinary collaborative project aiming to provide an open and modular sensing solution for in situ high resolution mapping of a range of anthropogenic and natural chemical compounds. Key targets are chemicals that may adversely affect marine ecosystems, living resources and ultimately human health. The SCHeMa tools will enhance ocean observing system capabilities to evaluate the impact of these compounds on marine water quality trends, thereby allowing one to rapidly localise problems and alert targeted groups. To achieve this, SCHeMA will develop: 1) chemical solid state miniaturized sensors functionalised using innovative analytical procedures to insure reliable and selective electrochemical and optical measurements of inorganic (micro-)nutrients/pollutants, VOCs, biotoxins, HABs, species relevant to the carbon cycle, as well as effective minimisation of chemical and physical interferences; 2) micro- and mini-analytical and mechanical fluidic systems; 3) miniaturized multichannel probes, incorporating the new sensors and fluidic systems, based on advanced hardware, firmware and wired/wireless interfaces allowing their plug-and-play integration to moored or free floating devices; 4) ad-hoc ICT solutions allowing remote

The COMMON SENSE project has received funding from the European Union's Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

control of data transfer and mapping system reconfiguration according to the OGC standard; 5) Web-based data information system for data storage, standardization, modelling and user-friendly accessibility by public authorities, scientists and existing observation/monitoring systems.

The COMMON SENSE project has received funding from the European Union's Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

COMMON SENSE
MARINE SENSORS - MARINE MONITORING

3. LOCAL OR NATIONAL MONITORING PROGRAMMES OFFERING POSSIBILITIES OF INTEGRATION NEW SENSOR'S FUNCTIONALITY TO MEET MONITORING REQUIREMENTS.

Monitoring activities on European coastal and sea areas have been led by authorities of different levels and other scientific and non-governmental organisations for many years. Performed as individual's initiative in the past, have well organised form nowadays as national and international programmes. However, these activities are frequently limited due to technological shortcomings and very often are not able to acquire required information as no suitable sensors are available for a deployment. Lowering deployment cost of measuring systems, enhancing interoperability of sensors, extending number of acquired ecosystem properties can change significantly quality of monitoring.

The wider scope of parameters, higher accuracy of data and enhanced quality of information can also help to spot and distinguish sensitive or vulnerable areas of the environment.

3.1. Analysis of the monitoring programmes vs. sensor's functionalities

The following table presents the identified monitoring programmes from the European area in relation to sensors being under development by Common Sense project. The programmes were screened whether they may potentially benefit from newly developed sensors.

The following Table gives an overview of identified monitoring programmes for potential application of sensors developed by Common Sense. The colours code the level of current/planned effort in monitoring of groups of parameters in regards sensors/parameters offered by the Project; green – fully implemented, orange – partially implemented, red – not yet implemented.

As it can be seen, even well established and long-run regional efforts as those on the Black Sea, under by Black Sea Convention (BSC) and Baltic, under HELCOM, lack the full coverage of parameters, as they rely on countries' efforts, notoriously underfunded and frequently understaffed, usually keeping their obligation on the minimum level. Thus, the diagnose of Black Sea monitoring situation presented by European Environmental Agency, (www.eea.europa.eu), may be extended on other regions and countries, as it states: "There are two key problems concerning the Black Sea region and its environmental problems.

The implementation of commitments derived from the existing legal framework remains problematic and the adoption of new instruments is moving at a slow pace. Implementation is also related to the quality of the reporting by countries, underpinned by dedicated monitoring systems and strongly dependent on national priorities and funding." In this situation prospect of delivering on the market the range of low-cost but high quality sensors for observation of the environment shall be welcome with interest.

The COMMON SENSE project has received funding from the European Union's Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

COMMON SENSE
MARINE SENSORS - MARINE MONITORING

Country/Area	Programme	T,P, pH/pCO_2	Heavy Metals	Nutrients	Microplastics	U, Noise nnonoise
Black Sea	BSIMAP - Black Sea Integrated Monitoring and Assessment Programme					
North Sea	Trilateral Monitoring and Assessment Programme (TMAP)					
Baltic	HELCOM *Monitoring* and Assessment Strategy					
Denmark	Nation-wide aquatic monitoring programme - monitoring of coastal and open marine waters					
Finland	Monitoring of Finnish coastal waters					
Finland	Monitoring of the open sea					
France	National sea water quality monitoring network - RNO					
France	French seashore phytoplankton monitoring - REPHY					
Germany	Bund/Länder Messprogramm für die Nordsee					
Greece	MED POL in the Aegean and Ionian Sea and the Salonic Gulf					
Ireland	General Quality of Estuarine and Coastal Receiving Waters					
Ireland	Bathing waters					
The Netherlands	National surface water monitoring programme Monitoring of marine waters					
Norway	Trend monitoring of the Norwegian coastal areas					
Norway	Arctic Monitoring and Assessment (AMAP)the Barents Sea & northern fjords					
Sweden	Nation-wide pelagical frequent monitoring					
UK	UK National Marine Monitoring Plan					

All the programmes have the sea water temperature on their list of obligatory parameters; if they are marked in 'orange' it denotes lack of measurements of pH or CO2, which are offered in Common Sense portfolio. Those, being the indictors of acidification processes are of importance in observation of the climate warming, hence the offer of reliable and portable sensors is expected to be met with interest from the administration and scientific community.

Heavy metals observation are performed in most of identified programmes, few of them cover Pb and Hg only. Notably, apparently in monitoring programs in Denmark and Sweden heavy metals are not measured while in Ireland they are measured in numbered locations or occasionally.

All the listed countries and programs have at least one of national monitoring programme with the purpose of assessing concentration of nutrients in water column. However, nutrients are not routinely measured in Arctic. However, the growing interest in researching of ocean processes in Arctic as an indicators of climate warming may soon trigger the demand for the sensors.

The most clear feature emerging from the table is a lack of monitoring of microplastics and underwater noise. Those parameters, despite being adopted by MSFD in 2008, still cannot find its way to monitoring programmes and practices. Several reasons may be attributed for, as the lack of agreed methodology, limited or still discussed scientific background knowledge and, last but not least, lack of reliable and standardized instrumentation. The latter may be especially attributed to case of

The COMMON SENSE project has received funding from the European Union's Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

microplastics, where several methods and existing instrumentation, usually designed for other types of particles, is employed for observations.

Concluding, the sensors for microplastic, underwater noise and heavy metals have the best chance to emerge as those in high demand if the monitoring efforts will be pressed to continue. Much depends on the decisiveness of regulators at the EU level for pressing the governments for full implementation of MSFD. From the other side, public awareness of growing pollution of environment, pressure form the NGOs or the general public is the important and sometimes equally powerful voice 'from the bottom' for adoption of full range of parameters defining the GES, as outlined in MSFD. Foreseeing the positive outcome of this political and societal development, at the Project level, the wide presentation of the prototype sensors, along with developed controlling hardware and software shall be firmly and consequently executed, taking the opportunities of conferences, fares and thematically corresponding public events. The offered functionalities of the sensors developed by the Common Sense project fit directly the expected demand from prospect users.

The COMMON SENSE project has received funding from the European Union's Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

4. TECHNOLOGICAL AND POLICY DEVELOPMENTS

4.1. New and upcoming initiatives of policy development

New challenges for data acquisition processes in policy domain are developed in Horizon 2020. Guidelines on Open Access to Scientific Publications and Research Data in Horizon 2020 define Open access as the practice of providing on-line access to scientific information that is free of charge to the end-user and that is re-usable. In the context of research and innovation, 'scientific information' can refer to peer-reviewed scientific research articles (published in scholarly journals) or research data(data underlying publications, curated data and/or raw data). This policy have potential influence on sensors design and interoperability of measurement systems enforcing open standards in data protocols and measurement control processes.

The Open Research Data Pilot deployed within Horizon2020 aims to improve and maximise access-to and re-use of research data generated by projects. Participating projects will make their research data available on a voluntary basis, as specified in their Data Management Plans. They will also be required to make the data needed available to validate the results presented in scientific publications. In this context interoperability and standardisation are crucial factors of data exchange processes.

Areas of the 2014-2015 Work Programme participating in the Open Research Data Pilot are:

- Future and Emerging Technologies
- Research infrastructures – part e-Infrastructures
- Leadership in enabling and industrial technologies – Information and Communication Technologies
- Societal Challenge: Secure, Clean and Efficient Energy – part Smart cities and communities
- Societal Challenge: Climate Action, Environment, Resource Efficiency and Raw materials – except raw materials
- Societal Challenge: Europe in a changing world – inclusive, innovative and reflective Societies
- Science with and for Society

4.2. Telecommunication and transmission protocols

Open Geospatial Consortium, Inc. (OGC) is brewing initiative called Sensor Web Enablement (SWE). It is unique and revolutionary framework of open standards for exploiting Web-connected sensors and sensor systems of all types: flood gauges, air pollution monitors, stress gauges on bridges, mobile heart monitors, Webcams, satellite-borne earth imaging devices and countless other sensors and sensor systems. Opportunities for adding a real-time sensor entity to the Internet have extraordinary significance for science, environmental monitoring, transportation management, public safety, facility security, disaster management, utilities Supervisory Control And Data Acquisition (SCADA) operations, industrial controls, facilities management and many other domains of activity. The OGC consensus standards result in SWE standard specifications.

The models, encodings, and services of the SWE architecture enable implementation of interoperable and scalable service-oriented networks of heterogeneous sensor systems and client applications. In much the same way that Hyper Text Markup Language (HTML) and Hypertext Transfer Protocol (HTTP) standards enabled the exchange of any type of information on the Web, the OGC's SWE initiative is focused on developing standards to enable the discovery, exchange, and processing of sensor observations, as well as the tasking of sensor systems. The functionality that OCG has targeted within a sensor web includes:

The COMMON SENSE project has received funding from the European Union's Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

- Discovery of sensor systems, observations, and observation processes that meet an application's or user's immediate needs;
- Determination of a sensor's capabilities and quality of measurements;
- Access to sensor parameters that automatically allow software to process and geo-locate observations;
- Retrieval of real-time or time-series observations and coverages in standard encodings
- Tasking of sensors to acquire observations of interest;
- Subscription to and publishing of alerts to be issued by sensors or sensor services based upon certain criteria.

Within the SWE initiative, the enablement of such sensor webs and networks is being pursued through the establishment of several encodings for describing sensors and sensor observations, and through several standard interface definitions for web services. SWE standards include:

1. Observations & Measurements Schema (O&M) – Standard models and XML Schema for encoding observations and measurements from a sensor, both archived and real-time.
2. Sensor Model Language (SensorML) – Standard models and XML Schema for describing sensors systems and processes; provides information needed for discovery of sensors, location of sensor observations, processing of low-level sensor observations, and listing of task-able properties
3. Transducer Markup Language (TransducerML or TML) – The conceptual model and XML Schema for describing transducers and supporting real-time streaming of data to and from sensor systems.
4. Sensor Observations Service (SOS) - Standard web service interface for requesting, filtering, and retrieving observations and sensor system information. This is the intermediary between a client and an observation repository or near real-time sensor channel.
5. Sensor Planning Service (SPS) – Standard web service interface for requesting user-driven acquisitions and observations. This is the intermediary between a client and a sensor collection management environment.
6. Sensor Alert Service (SAS) – Standard web service interface for publishing and subscribing to alerts from sensors.
7. Web Notification Services (WNS) – Standard web service interface for asynchronous delivery of messages or alerts from SAS and SPS web services and other elements of service workflows.

OGC SWE standards are implemented for example in SeaDataNet 2 and Eurofleets 2 projects.

4.3. Research platforms and applications

The European Marine Observation and Data Network (EMODNet) is a consortium of organisations within Europe that assembles marine data, data products and metadata from diverse sources in a uniform way. The main purpose of EMODnet is to unlock fragmented and hidden marine data resources and to make these available to individuals and organisations (public and private), and to facilitate investment in sustainable coastal and offshore activities through improved access to quality-assured, standardised and harmonised marine data. EMODnet is an initiative from the European Commission Directorate-General for Maritime Affairs and Fisheries (DG MARE) as part of its Marine Knowledge 2020 strategy. EMODNet deploys standards and technologies developed within

The COMMON SENSE project has received funding from the European Union's Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

SeaDataNet and SeaDataNet 2 projects and makes strong impact on the standardisation of measurement processes. EMODNet is divided into seven domains: Bathymetry, Geology, Seabed Habitats, Chemistry, Biology, Physics and Human Activities.

EMODNET data products are obtained with SeaDataNet DIVA software tool (Data-Interpolating Variational Analysis). The analyses products are stored as NetCDF CF files and made available as WMS layers for easy browsing and adding. The EMODNET Chemical portal core services give access to the integrated maps of selected parameters. A WMS Registry listing all WMS services (NetCDF CF files available as WMS layers, CDI service available as WMS layers providing location of specific observation) guarantees full integration between EMODNET Chemical components (CDI, CAMIOON and VIEWER), but also between the EMODNET portals. Data layers are provided to support MSFD.

EMODNet Chemistry contains data on Synthetic Compounds, Heavy Metals, Hydrocarbons, Radionuclides, Fertilizers, Organic Matter, Dissolved Gases, Plastics and Other Parameters

5. CONCLUSIONS

Legal acts identified in Deliverable 1.3 (EU directives, national regulations and conventions) are drivers of new technologies development processes. Sensors, as a part of bigger systems and infrastructures interoperating each other, should correspond with these processes and deliver efficient and cheap solution to give the best response for environment monitoring demands.
There are many initiatives, very often cooperating each other, trying to elaborate the most efficient way to organise technical infrastructure enabling monitoring processes to be deployed.

6. REFERENCES

- Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)
- Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive)
- Directive 2011/65/EC of The European Parliament And Of The Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (recast)
  (Text with EEA relevance)
- INSPIRE Monitoring Indicators – Guidelines Document, Monitoring and Reporting Drafting Team and European Commission -
- Directive 2008/56/EC Of The European Parliament And Of The Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive)
- Directive 2006/7/EC Of The European Parliament And Of The Council of 15 February 2006 concerning the management of bathing water quality and repealing Directive 76/160/EEC
- Real Time Management of Bathing Water Quality in Barcelona, Gutiérrez, E.; Malgrat, P.; Suñer, D.; Otheguy, P., NOVATECH 2010

The COMMON SENSE project has received funding from the European Union's Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

- Statutory Instruments. S.I. No. 249 Of 2011 European Communities (Marine Strategy Framework) Regulations 2011
- Regulation of the Minister of the Environment of 4 October 2002 concerning the requirements that should be met by inland waters constituting the environment for the living of fish under natural conditions (Journal of Laws of 2002 No 176, item 1455);
- Regulation of the Minister of the Environment of 4 October 2002 concerning the requirements to that should be met by marine inland waters and coastal waters constituting the environment for the living of crustacea and molluscs (Journal of Laws of 2002 No 176, item 1454);
- Regulation of the Minister of the Environment of 23 December 2002 concerning the criteria to determine the waters vulnerable to pollution with nitrogen compounds from agricultural sources (Journal of Laws of 2002, No 204, item 1728);
- Regulation of the Minister of the Environment of 27 November 2002 concerning the requirements that should be met by surface waters used to supply people with drinking water (Journal of Laws of 2002, No 204, item 1728);
- Regulation of the Minister of the Environment of 23 July 2008 concerning the criteria and the manner to assess the status of groundwaters (Journal of Laws of 2008, No 143, item 896);
- Regulation of the Minister of the Environment of 20 August 2008 concerning the manner to classify the status of surface water bodies (Journal of Laws of 2008 No 162, item 1008);
- Regulation of the Minister of the Environment of 13 May 2009 concerning the forms and manner to monitor surface water and groundwater bodies (Journal of Laws of 2009 No 81, item 685);
- Regulation of the Minister of the Environment of 22 July 2009 concerning the classification of the ecological status, ecological potential and chemical status of surface water bodies (Journal of Laws of 2009, No 122, item 1018);
- OGC® Sensor Web Enablement: Overview And High Level Architecture. Mike Botts, George Percivall, Carl Reed, John Davidson. OGC 07-165, 2007
- Guidelines on Open Access to Scientific Publications and Research Data in Horizon 2020, 11 December 2013
- Guidelines on Data Management in Horizon 2020, 16 December 2013

The COMMON SENSE project has received funding from the European Union's Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.