



Acronym: COLUMBUS

Title: Monitoring, Managing and Transferring Marine and Maritime

Knowledge for Sustainable Blue Growth

Grant agreement n° 652690

## Relevant knowledge gathered in the framework of COLUMBUS project to address MSFD-Descriptor 11. Energy including Underwater Noise

May 2017

### All rights reserved

This document may not be copied, reproduced or modified in whole or in part for any purpose without the written permission from the COLUMBUS Consortium. In addition to such written permission to copy, reproduce or modify this document in whole or part, an acknowledgement of the authors of the document and all applicable portions of the copyright must be clearly referenced.

### Acknowledgement

The work described in this report has been funded by the European Commission under the Horizon 2020 Framework Programme.



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 652690. This output reflects the views only of the author(s), and the European Union cannot be held responsible for any use which may be made of the information contained therein.

## CONTENTS

EXECUTIVE SUMMARY.....	3
PROJECTS WITH KNOWLEDGE OUTPUTS RELATED TO MSFD-D11 .....	4
SOUNDMAR.....	4
NEXOS.....	5
COMMON SENSE .....	6
AQUO.....	8
SONIC.....	11
ANIMALSOUNDSSENSORS.....	12
CONCEAL.....	13
PROJECTS RELATED TO MSFD-D11 .....	14
ADAM4EVE .....	14
BESST .....	15
CETACEAN STRESSORS.....	15
OAEEx .....	15
ODEMM .....	16
SILENV.....	17
TRIPOD.....	17
ECOSOUND .....	18
Modelled Mapping of Continuous Underwater Noise Generated by Activities .....	18



## EXECUTIVE SUMMARY

This dossier provides a broad overview on how the knowledge generated from, mainly, the Seventh Framework Programme for Research and Development (FP7) has addressed the Marine Strategy Framework Directive (MSFD)-Descriptor 11. *Energy including underwater noise*. Projects have been grouped in two different categories, one category named “Projects with results related to MSFD-D11 ” includes projects from which the knowledge outputs (KO)\* have been identified following the COLUMBUS knowledge transfer methodology. The other category named “Projects related to MSFD-D11” includes a selection of projects for which no specific KOs could be collected but that may be worth for consideration as they were classified as potentially relevant to MSFD-D11 by the project coordinators. The EurOcean [Marine Knowledge Gate](#), COLUMBUS assignment of projects to its structure of Competence Nodes, COLUMBUS deliverable 5.3 “Overview of FP7 projects relevant to major Marine and Maritime Regulations: MSFD, MSPD and CFP and Blue Economy activities and CORDIS, have been the major information sources used to carry out this analysis. A basic description of each of the projects and knowledge outputs is provided. The knowledge outputs included in the dossier have been classified in five different research lines: 1) Impacts or exposure of underwater noise on biota, 2) Ocean acoustic monitoring systems, 3) Noise modelling, 4) Underwater noise footprint generated by ships and 5) Underwater noise data. The following color key has been applied to highlight the aforementioned categories:

LEGEND	
	Impacts/exposure of underwater noise on biota
	Ocean acoustic monitoring systems
	Noise modelling
	Underwater noise footprint generated by ships
	Underwater noise data

**\*Knowledge Output:** A unit of knowledge or learning generated by or through research activity. They are not limited to de-novo or pioneering discoveries but may also include new methodologies/processes, adaptations, insights, alternative applications of prior know-how/ knowledge. Definition from the MarineTT project, precursor of COLUMBUS



This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 652690. This output reflects the views only of the author(s), and the European Union cannot be held responsible for any use which may be made of the information contained therein.

## PROJECTS WITH KNOWLEDGE OUTPUTS RELATED TO MSFD-D11

### SOUNDMAR

**TITLE:** Sound use for orientation by marine fauna, an ecosystem approach considering anthropogenic noise

**PROGRAMME:** FP7      **THEME:** PEOPLE-Marie Curie Actions

**START YEAR:** 2010      **END YEAR:** 2013

**PROJECT COORDINATOR:** Cristina Domínguez Conde (University of La Laguna, Spain)

**PROJECT MANAGER:** Natacha Aguilar de Soto (University of La Laguna, Spain)

**WEBSITE:** Not available      **Contact Information:** [naguilar@ull.es](mailto:naguilar@ull.es)

**Short Abstract:** This project has monitored levels of broadband background noise in marine Nature 2000 sites and investigate whether the design of these sites is effective at protecting fauna from noise pollution. **More info at:** [cordis.europa.eu/project/rcn/93092\\_en.html](http://cordis.europa.eu/project/rcn/93092_en.html).



**Short Title:** Acoustic behaviour, ecology and ethophysiology of cetaceans.

**Description:** Beaked whales and Bryde's whales were studied with suction-cup attached acoustic and movement recording tags. Results were analysed together with data previously gathered of beaked and pilot whales and of bottlenose dolphins in the Canary Island.

**Knowledge Type:** Scientific Publications

**Link:** [cordis.europa.eu/result/rcn/57926\\_en.html](http://cordis.europa.eu/result/rcn/57926_en.html)

**Short Title:** Monitoring of distribution and abundance of cetaceans using acoustic surveys

**Description:** The vocal behaviour of beaked whales and Bryde's whales allowed the monitoring of their distribution and abundance using acoustic surveys

**Knowledge Type:** Scientific Publications

**Link:** [http://cordis.europa.eu/result/rcn/57926\\_en.html](http://cordis.europa.eu/result/rcn/57926_en.html)

**Short Title:** Impacts on anthropogenic noise on marine invertebrates

**Description:** Experiment on the effect of low frequency noise on the development of marine larvae provided the first evidence that noise exposure during larval development produces body malformations in marine invertebrates

**Knowledge Type:** Scientific Publications

**Link:** [http://cordis.europa.eu/result/rcn/57926\\_en.html](http://cordis.europa.eu/result/rcn/57926_en.html)



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 652690. This output reflects the views only of the author(s), and the European Union cannot be held responsible for any use which may be made of the information contained therein.

**Short Title:** Human impacts and conservation measures: ship collision

**Description:** Development of a study with acoustic tags of Brydes' whales in the Hauraki Gulf (New Zealand) where ship collisions constitute the highest factor of human impact for this protected species. Results provided the first quantification of the foraging behaviour of this species and based the design of impact-risk mitigation measures for ship-strikes in the Gulf. These measures are being developed in a social forum involving stakeholders from the government, academy, shipping companies and social groups.

**Knowledge Type:** Scientific Publication

**Link:** Constantine *et al.* 2015. Mitigation of vessel-strike mortality of endangered Bryde's whales in the Hauraki Gulf, New Zealand. *Biological Conservation* 186, 149-157

## NEXOS

**TITLE:** Next generation, Cost-effective, Compact, Multifunctional Web Enabled Ocean Sensor Systems Empowering Marine, Maritime and Fisheries Management

**PROGRAMME:** FP7      **THEME:** ENVIRONMENT

**START YEAR:** 2013      **END YEAR:** 2017

**PROJECT COORDINATOR:** Eric Delory (PLOCAN - Oceanic Platform of the Canary Islands, Spain)

**WEBSITE:** <http://www.nexosproject.eu/>

**Contact Information:** info@nexosproject.eu

**Short Abstract:** The general objective of NeXOS is to develop new cost-effective, innovative and compact integrated multifunctional sensor systems (ocean optics, ocean passive acoustics, and sensors for an Ecosystem Approach to Fisheries (EAF)), which can be deployed from mobile and fixed ocean observing platforms, as well as to develop downstream services for the Global Ocean Observing System (GOOS), Good Environmental Status (GES) of European marine waters (Marine Framework Strategy Directive) and the European Common Fisheries Policy (CFP). **More info at:** [cordis.europa.eu/project/rcn/111405\\_en.html](http://cordis.europa.eu/project/rcn/111405_en.html)



## MAIN KNOWLEDGE OUTPUTS

**Short Title:** NeXOS sensor A1: Low-power multifunctional hydrophone

**Description:** Compact, low power multifunctional passive acoustics sensor system, enabling on-platform measurement and characterisation of underwater noise and several soundscape sources, for platforms with limited autonomy and/or communication capability

**Knowledge Type:** Product

**Link:** [nexosproject.eu/sites/default/files/NEXOS\\_A1%20Flyer.pdf](http://nexosproject.eu/sites/default/files/NEXOS_A1%20Flyer.pdf)



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 652690. This output reflects the views only of the author(s), and the European Union cannot be held responsible for any use which may be made of the information contained therein.

**Short Title:** NeXOS sensor A2: Real time waveform streaming and pre-processing hydrophone array

**Description:** Compact multifunctional passive acoustics sensor system, enabling real-time waveform streaming for the measurement of underwater noise and several soundscape sources, for platforms with unlimited autonomy and/or communication capability

**Knowledge Type:** Product

**Link:** [www.nexosproject.eu/sites/default/files/Factsheet\\_1st\\_update.pdf](http://www.nexosproject.eu/sites/default/files/Factsheet_1st_update.pdf)

**Short Title:** Sound processing C code library

**Description:** Open-source embedded C code library for Acorn RISC Machine (ARM) based systems, performing embedded sound preprocessing

**Knowledge Type:** Software/modelling tool

**Link:** [cordis.europa.eu/result/rcn/174760\\_en.html](http://cordis.europa.eu/result/rcn/174760_en.html)

**Short Title:** Underwater sound data

**Description:** Underwater sound data used for validating new sensors NeXOS A1 and A2 will be made public available in the Central Eastern Atlantic

**Knowledge Type:** Data

**Link:** [cordis.europa.eu/result/rcn/174757\\_en.html](http://cordis.europa.eu/result/rcn/174757_en.html)

## COMMON SENSE

**TITLE:** Cost-effective sensors, interoperable with international existing ocean observing systems, to meet EU policies requirements

**PROGRAMME:** FP7      **THEME:** ENVIRONMENT

**START YEAR:** 2013      **END YEAR:** 2017

**PROJECT COORDINATOR:** LEITAT Maritime Division, Spain

**WEBSITE:** [commonsenseproject.eu](http://commonsenseproject.eu)      **Contact Information:** [leimar@leitat.org](mailto:leimar@leitat.org)

**Short Abstract:** The COMMON SENSE project will contribute to support the implementation of the Marine Strategy Framework Directive (MSFD) and other EU policies (e.g. Common Fisheries Policy), providing easily usable across several platforms, cost-effective, multi-functional innovative sensors to detect reliable in-situ measurements on key parameters by means of methodological standards. **More info at:** [cordis.europa.eu/project/rcn/110790\\_en.html](http://cordis.europa.eu/project/rcn/110790_en.html)



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 652690. This output reflects the views only of the author(s), and the European Union cannot be held responsible for any use which may be made of the information contained therein.

## MAIN KNOWLEDGE OUTPUTS

**Short Title:** Analysis of the MSFD implementation process and development of marine monitoring programmes

**Description:** Report on how current and future monitoring efforts related to eutrophication, marine litter, contaminants and noise address MSFD needs effectively and efficiently

**Knowledge Type:** Report (Deliverable 1.2)

**Link:** The report will be made available at <http://commonsenseproject.eu/project-info/commonsense-results> when it is accepted by the EC

**Short Title:** Review and analysis of existing observing initiatives, programmes, systems, platforms currently set and working in marine environment

**Description:** Comprehensive analysis of the existing sensors and technologies currently widespread adopted in marine environment monitoring

**Knowledge Type:** Report (Deliverable 1.4)

**Link:** The report will be made available at <http://commonsenseproject.eu/project-info/commonsense-results> when it is accepted by the EC

**Short Title:** Review and analysis of existing sensors and technologies currently set and working in marine environment

**Description:** Comprehensive analysis of the existing sensors and technologies currently widespread adopted in marine environment monitoring. A technical report based on peer-reviewed publications and books.

**Knowledge Type:** Report (Deliverable 2.1)

**Link:** The report will be made available at <http://commonsenseproject.eu/project-info/commonsense-results> when it is accepted by the EC

**Short Title:** COMMON SENSE underwater noise sensor

**Description:** This cost-effective sensor directly responds to current marine monitoring challenges and provides new ways to assess the overall health of marine environments.

**Knowledge Type:** Product

**Link:** Sensor profile is available at

[http://www.commonsenseproject.eu/images/CommonSense/Media/Sensor\\_Profiles/factsheet-No2\\_noise-and-reference-sensors\\_v5.1\\_WEB.pdf](http://www.commonsenseproject.eu/images/CommonSense/Media/Sensor_Profiles/factsheet-No2_noise-and-reference-sensors_v5.1_WEB.pdf)



## AQUO

**TITLE:** Achieve QUIeter Oceans by shipping noise footprint reduction

**PROGRAMME:** FP7      **THEME:** TRANSPORT

**START YEAR:** 2012      **END YEAR:** 2015

**PROJECT COORDINATOR:** DCNS, France



**WEBSITE:** <http://www.aquo.eu/>      **Contact Information:** christian.audoly@dcnsgroup.com

**Short Abstract:** The final goal of AQUO project is to provide to policy makers practical guidelines, acceptable by shipyards and ship owners to mitigate underwater noise footprint due to shipping, to prevent negative consequences to marine life. Exploitation of the AQUO project results is expected to have significant impacts, meeting the requirements of the MSFD. **More info at:** [http://cordis.europa.eu/project/rcn/104629\\_en.html](http://cordis.europa.eu/project/rcn/104629_en.html)

### MAIN KNOWLEDGE OUTPUTS

**Short Title:** Improved models to represent underwater radiated noise levels (source levels) of different categories of vessels with respects to size and speed.

**Description:** The noise emission of a ship into water, according to its type, size, is represented by a noise level in a parametric form along frequency and speed. These models are key inputs for the "Ocean underwater shipping noise footprint" predictive models.

**Knowledge Type:** Report

**Link:** Deliverable D2.8 and R2.9 available at [www.aquo.eu](http://www.aquo.eu) (section: Propeller & Other Noise Sources)

**Short Title:** Improvement of predictive methods of propeller noise, including cavitation effects and interaction with the hull, using numerical modelling

**Description:** The methods developed can be used at the design stage of a propeller to predict its underwater radiated noise level and the conditions where propeller cavitation phenomena appear.

**Knowledge Type:** Report

**Link:** Deliverable D2.3 available at [www.aquo.eu](http://www.aquo.eu) (section: Propeller & Other Noise Sources)

**Short Title:** Improvement of predictive methods of propeller noise, including cavitation effects and interaction with the hull, using scale model experiments in laboratories

**Description:** Different facilities have been used successfully to predict underwater noise radiated from a propeller using a scale model, with comparison to scale one. One important result is that an adequate setting of pitch/rotation speed on a CPP (controlled pitch propeller) allows reducing radiated noise with almost suppression of cavitation.

**Knowledge Type:** Report

**Link:** Deliverable D2.5 available at [www.aquo.eu](http://www.aquo.eu) (section: Propeller & Other Noise Sources)



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 652690. This output reflects the views only of the author(s), and the European Union cannot be held responsible for any use which may be made of the information contained therein.

**Short Title:** Assessment of the sensitivity of different marine animals to underwater radiated sound (cod, harbour porpoise, cephalopods), and derivation of criteria.

**Description:** Controlled bio-acoustic experiments have been conducted, improving the current knowledge on the sensitivity of three marine species to underwater sound.

**Knowledge Type:** Report

**Link:** Deliverables D 4.2, D4.3, D4.4, D4.5 available at [www.aquo.eu](http://www.aquo.eu) (section: Marine Life)

**Short Title:** Set-up and technique for measuring the noise of ship hull-propeller interaction at model scale in atmospheric towing tank.

**Description:** A laboratory technique to study the interaction between a ship hull and a propeller using a scale model has been defined and used successfully in the scope of the project.

**Knowledge Type:** Report

**Link:** Deliverable D2.5 available at [www.aquo.eu](http://www.aquo.eu) (section: Propeller & Other Noise Sources)

**Short Title:** List of recommended mitigation measures for the reduction of underwater radiated noise of vessels for protection of marine life, while keeping fuel efficiency.

**Description:** A practical guide of recommended solution for the mitigation of underwater noise emission from ships, in order to protect life, is provided. The solutions address either the design of future vessels, either the operational settings or retrofit issues for existing vessels. The consistency of the noise control measures with fuel efficiency is also taken into account.

**Knowledge Type:** Guidelines/Standards

**Link:** Deliverables D5.3, D5.5, D5.8 and R5.9 available at [www.aquo.eu](http://www.aquo.eu) (section: Guidelines)

**Short Title:** Definition of the concept of "Ocean shipping noise footprint", and associated indicators.

**Description:** The project has proposed a clear definition of the "Ocean shipping noise footprint" allowing to characterize the Good Environmental Status in a maritime area, regarding underwater noise

**Knowledge Type:** Guidelines/Standards

**Link:** Deliverables D1.2 and D1.6 available at [www.aquo.eu](http://www.aquo.eu) (section: Noise footprint)



**Short Title:** Methodology for defining a regulation regarding the control of underwater noise due to shipping in a given maritime area for protection of marine life.

**Description:** A methodology for defining a regulation regarding the control of underwater noise due to shipping in a given maritime area for protection of marine life has been developed and applied in the scope of the project to derive practical guidelines. That methodology is now ready to be actually implemented, provided actual deployment in some test maritime areas.

**Knowledge Type:** Guidelines/Standards

**Link:** Deliverable D5.8 available at [www.aquo.eu](http://www.aquo.eu) (section: Guidelines)

**Short Title:** Ocean shipping noise footprint assessment tool: Method and tool for the assessment of the impact on marine life of underwater noise due to shipping in a maritime area.

**Description:** A software tool has been developed, able to run either in real time, either for simulation, allowing the prediction of underwater noise and impact on marine life related to shipping (through AIS data). The tool is validated and calibrated using long-term in-situ recording of underwater noise.

**Knowledge Type:** Report

**Link:** Deliverables D4.5 and 1.6 available at [www.aquo.eu](http://www.aquo.eu) (sections: Marine Life and Noise footprint, respectively)

**Short Title:** List of recommended mitigation measures for the reduction of underwater noise due to shipping in maritime areas for protection of marine life.

**Description:** A practical guide of recommended solution for the mitigation of underwater noise from shipping, in order to protect life, is provided. The core solution is regulatory, consisting of a real-time assessment of underwater noise in a maritime area of interest using a predictive model, combined with ship traffic control measures in order to match good environmental status criteria.

**Knowledge Type:** Guidelines/Standards

**Link:** Deliverables D5.7, D5.8 and R5.9 available at [www.aquo.eu](http://www.aquo.eu) (section: Guidelines)

**Short Title:** Standard for the accurate measurement of ship underwater radiated noise (source level) of ships in deep and shallow waters.

**Description:** A procedure is proposed for the accurate measurement of ship underwater radiated noise. The improvements by comparison to previously existing procedures are that it is applicable in both deep and shallow waters. Furthermore an assessment of the uncertainty and repeatability has been given.

**Knowledge Type:** Guidelines/Standards

**Link:** Deliverable D3.1 available at [www.aquo.eu](http://www.aquo.eu) (section: On-site measurements)



**Short Title:** Experiments at sea: Underwater radiated noise levels of six different vessels (including two commercial vessels) and related on-board noise and vibration recordings.

**Description:** Underwater radiated noise levels of six different vessels (including two commercial vessels) and related on-board noise and vibration recordings has been obtained through experiments at sea.

**Knowledge Type:** Report

**Link:** Deliverable D3.3 available at [www.aquo.eu](http://www.aquo.eu) (section: On-site measurements)

**Short Title:** Experiments at sea: Direct observation of propeller cavitation, in relation to ship noise and vibration, for two vessels (one large research vessel and a coastal tanker).

**Description:**

**Knowledge Type:** Report

**Link:** Deliverables D3.3 and 2.5 available at [www.aquo.eu](http://www.aquo.eu) (sections: On-site measurements and Propeller and other noise sources, respectively)

**Short Title:** Experiments at sea: long term recording of underwater radiated noise, correlated to ship traffic, using an autonomous buoy.

**Description:** An autonomous buoy has been developed, realized and installed at sea during long periods of time and different maritime areas, allowing real-time information acquisition and transmission (data for both ship traffic and underwater noise).

**Knowledge Type:** Report

**Link:** Deliverable D3.6 available at [www.aquo.eu](http://www.aquo.eu) (section: On-site measurements)

## SONIC

**TITLE:** Suppression Of underwater Noise Induced by Cavitation

**PROGRAMME:** FP7      **THEME:** TRANSPORT

**START YEAR:** 2012      **END YEAR:** 2015

**PROJECT COORDINATOR:** MARIN - Maritime Research Institute (Netherlands)

**WEBSITE:** not available      **Contact Information:** [h.j.prins@marin.nl](mailto:h.j.prins@marin.nl)

**Short Abstract:** The aim of the SONIC project is to develop tools to investigate and

mitigate the effects of underwater noise generated by shipping. The project's first objective is to enhance the understanding of noise generated by a cavitating ship propeller. The second objective is to validate predictions of noise levels for individual ships, and to classify ships based on simplified noise models. The third objective is to map the noise generated by shipping in general and to propose mitigation measures for quietening the oceans. **More info at:** [http://cordis.europa.eu/project/rcn/104925\\_en.html](http://cordis.europa.eu/project/rcn/104925_en.html).



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 652690. This output reflects the views only of the author(s), and the European Union cannot be held responsible for any use which may be made of the information contained therein.

## MAIN KNOWLEDGE OUTPUTS

**Short Title:** Ship Underwater Radiated Noise Database

**Description:** The database [<http://vesselnoise.soton.ac.uk/>] allows access to radiated noise data and the associated metadata, viewable online and also downloadable in spreadsheet format for later analysis.

**Knowledge Type:** Database

**Link:** <http://vesselnoise.soton.ac.uk/>

**Short Title:** SONIC Accurate prediction of noise in design stage of ships

**Description:** Continuing development, validation and advancement of the art of using software models and model-scale test facilities to predict ship radiated noise. Specifically to support the design of cavitation noise reduced ships using physical evidence obtained by using specialist instrumented testing tanks and physical model hulls and propellers in various configurations together with full scale validation testing.

**Knowledge Type:** Exploitable Scientific Result

**Link:** [http://cordis.europa.eu/project/rcn/104925\\_en.html](http://cordis.europa.eu/project/rcn/104925_en.html)

**Short Title:** Prediction of cavitation pattern on propeller blades and hull pressure fluctuation assessment

**Description:** Advancement of knowledge in the development of computational tools for the prediction of cavitation pattern on propeller blades, and hull pressure fluctuation assessment and extrapolation of experimental hydro-acoustic sound levels to unlimited domain.

**Knowledge Type:** Exploitable Scientific Result

**Link:** [http://cordis.europa.eu/project/rcn/104925\\_en.html](http://cordis.europa.eu/project/rcn/104925_en.html)

**Short Title:** Prediction of Energy and Vibration transmission to the ship foundation by machinery

**Description:** Further development of existing methodologies and introduction of power transmission estimation as substitute to the existing methodology

**Knowledge Type:** Exploitable Scientific Result

**Link:** [http://cordis.europa.eu/project/rcn/104925\\_en.html](http://cordis.europa.eu/project/rcn/104925_en.html)

## ANIMALSOUNDSSENSORS

**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 Action

**START YEAR:** 2012      **END YEAR:** 2016

**PROJECT COORDINATOR:** USTAN - University of St Andrews (United Kingdom)



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 652690. This output reflects the views only of the author(s), and the European Union cannot be held responsible for any use which may be made of the information contained therein.

**WEBSITE:** Not available **Contact Information:** ts29@st-andrews.ac.uk

**Short Abstract:** The project will develop an advanced tag that can record sound and animal motion over extended periods of time. They improved the recording duration as well as the sensor capabilities to detect the animal's physical state as well as its habitat. The tags were first tested on captive seals and whales and then improved for use on wild animals. The technology developed in the project will be adapted for use in robotic ocean gliders creating a cost-effective capability for site monitoring, habitat quality assessment, and animal abundance surveys. These sensors may be especially relevant for fulfilling monitoring obligations under the Marine Strategy Framework Directive.

**More info at:** [http://cordis.europa.eu/project/rcn/102422\\_en.html](http://cordis.europa.eu/project/rcn/102422_en.html)

### MAIN KNOWLEDGE OUTPUT

**Short Title:** Long-term sound tag

**Description:** A miniature, low-power sound recording device that can be attached to an animal for multi-week acoustic exposure measurements.

**Knowledge Type:** Prototype

**Link:** <https://www.soundtags.org/>

### CONCEAL

**TITLE:** Chronic Ocean Noise: Cetacean Ecology and Acoustic habitat Loss

**PROGRAMME:** FP7 **THEME:** MARIE CURIE

**START YEAR:** 2010 **END YEAR:** 2012

**PROJECT COORDINATOR:** USTAN - University of St Andrews (United Kingdom)

**WEBSITE:** Not available

**Contact Information:** psh2@st-andrews.ac.uk

**Short Abstract:** The overall aim of CONCEAL is to quantify the ecological consequences to marine mammals, of acoustic habitat degradation due to masking effects of chronic ocean noise in a robust statistical framework. Ambient noise levels (e.g. marine shipping traffic, offshore oil and gas activities, and renewable energy sources) have risen dramatically in the world ocean in recent decades, but evaluating the impacts of this trend on acoustically sensitive marine predators has proven difficult. The proposed project would allow quantification of this threat in a rigorous, repeatable and standardised way that informs species-specific mitigation measures and assists reporting.

**More info at:** [http://cordis.europa.eu/project/rcn/96009\\_en.html](http://cordis.europa.eu/project/rcn/96009_en.html)



University  
of  
St Andrews



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 652690. This output reflects the views only of the author(s), and the European Union cannot be held responsible for any use which may be made of the information contained therein.

## MAIN KNOWLEDGE OUTPUTS

**Short Title:** Mapping cumulative noise from shipping to inform marine spatial planning

**Description:** Based on a simple sound transmission and track data (Automatic Identification System, AIS), cumulative underwater acoustic energy from shipping was mapped throughout 2008 in the west Canadian Exclusive Economic Zone, showing high levels in critical habitats for endangered resident killer whales, exceeding limits of “good conservation status” under the EU Marine Strategy Framework Directive.

**Knowledge Type:** Scientific Publication

**Link:** <http://asa.scitation.org/doi/full/10.1121/1.4758779>

**Short Title:** Clicking in a Killer Whale Habitat: Narrow-Band, High-Frequency Biosonar Clicks of Harbour Porpoise (*Phocoena phocoena*) and Dall’s Porpoise (*Phocoenoides dalli*)

**Description:** A six-element hydrophone array to record harbour and Dall’s porpoises in British Columbia (BC), Canada and harbour porpoises in Denmark was used.

**Knowledge Type:** Scientific Publication

**Link:** <http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0063763>

## PROJECTS RELATED TO MSFD-D11

### ADAM4EVE

TITLE: Adaptive and smart materials and structures for more efficient vessels

**PROGRAMME:** FP7      **THEME:** TRANSPORT

**START YEAR:** 2013      **END YEAR:** 2015

**PROJECT COORDINATOR:** CMT - Center of Maritime Technologies eV (Germany)

**WEBSITE:** <http://www.adam4eve-project.eu/>      **Contact Information:** krause@cmt-net.org

**Short Abstract:** The main idea of ADAM4EVE is to explore the potentials of adaptive materials and structures in ships and pave the way for industrial application. This will allow ships to react more flexible to changing operational and environmental conditions and thus to operate more efficiently and environmentally friendly, while at least maintaining the safety level. Some of the adaptive materials explores are those developed for noise and vibration damping of ship engines to avoid induction of vibrations into the ship hull. Moreover, the use of smart and intelligent materials will allow offering new functionalities, making ships more attractive to operators and passenger.

**More info at:** [http://cordis.europa.eu/project/rcn/104867\\_en.html](http://cordis.europa.eu/project/rcn/104867_en.html)



This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 652690. This output reflects the views only of the author(s), and the European Union cannot be held responsible for any use which may be made of the information contained therein.

## BESST

**TITLE:** Breakthrough in European Ship and Shipbuilding Technologies

**PROGRAMME:** FP7      **THEME:** TRANSPORT

**START YEAR:** 2009      **END YEAR:** 2013

**FINCANTIERI**  
The sea ahead

**PROJECT COORDINATOR:** FINCANTIERI - Cantieri Navali Italiani SpA (Italy)

**WEBSITE:** <http://www.besst.it/BESST/index.xhtml>      **Contact Information:** [Paolo.Guglia@fincantieri.it](mailto:Paolo.Guglia@fincantieri.it)

**Short Abstract:** BESST aims to achieve a breakthrough in competitiveness, environmentally friendliness and safety of EU built ships. A holistic life cycle performance assessment on ship level will guide the technical developments on system level, clustered in System Groups. The results will be integrated in 3 virtual show cases (ship concepts) demonstrating technical solutions as well as life cycle impact compared to current designs. The key areas of technical developments include: Space optimisation and easy maintenance, improving payload to gross tonnage ratio, cost efficient building processes and refurbishment, improved energy efficiency and reduced emissions, noise and vibration, improved reliability through model-based design and condition monitoring optimization of logistic chains improving safety and security.

**More info at:** [http://cordis.europa.eu/project/rcn/94135\\_en.html](http://cordis.europa.eu/project/rcn/94135_en.html)

## CETACEAN STRESSORS

**TITLE:** The independent and interactive effects of multiple stressors on reproduction and development in cetaceans

**PROGRAMME:** FP7      **THEME:** PEOPLE-MARIE CURIE

**START YEAR:** 2011      **END YEAR:** 2014

ZSL  
**INSTITUTE**  
OF ZOOLOGY

**PROJECT COORDINATOR:** ZSL - Zoological Society of London; Institute of Zoology (United Kingdom)

**WEBSITE:** Not available      **Contact Information:** [tim.blackburn@ioz.ac.uk](mailto:tim.blackburn@ioz.ac.uk)

**Short Abstract:** This project will systematically quantify a range of potential causal factors underpinning the low female fecundity rates of the common dolphin *Delphinus delphis* in North East Atlantic and New Zealand populations by directly assessing stress and reproductive hormone levels, nutritional condition, reproductive and health status using state of the art (histo) pathological, molecular and other analytical techniques on samples obtained from a large number of postmortem examinations.

**More info at:** [http://cordis.europa.eu/project/rcn/99577\\_en.html](http://cordis.europa.eu/project/rcn/99577_en.html)

## OAEx

**TITLE:** Ocean acoustic exploration

**PROGRAMME:** FP7      **THEME:** MARIE CURIE ACTION

**START YEAR:** 2009      **END YEAR:** 2012

**PROJECT COORDINATOR:** CINTAL UAlg - University of Algarve; Centro de Investigação Tecnológica do Algarve (Portugal)



**WEBSITE:** <http://www.siplab.fct.ualg.pt/proj/oaex.shtml>      **Contact Information:** [scintal@ualg.p](mailto:scintal@ualg.p)



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 652690. This output reflects the views only of the author(s), and the European Union cannot be held responsible for any use which may be made of the information contained therein.

**Short Abstract:** The OAEEx joint research programme aims at developing synergies and reinforcing collaboration between the EU, Brazil and Canada in the field of ocean acoustic monitoring and marine technologies. In this context the OAEEx programme will contribute towards a global ocean, particularly in the exchange of experience on the usage of ocean acoustics for geophysical exploration, ocean circulation monitoring and underwater acoustic communications. The OAEEx programme allows the transfer of knowledge and information between partners in order to improve and complement their individual expertise for application in ongoing and perspective projects. More specifically, European and Canadian groups have developed techniques on ocean environmental monitoring by acoustic sensing and/or using underwater acoustic communications that could be integrated and applied to monitor the challenging and strategic site of Cabo Frio in Brazil, long time studied by the Brazilian partners using conventional oceanographic tools. **More info at:** [http://cordis.europa.eu/publication/rcn/17085\\_en.html](http://cordis.europa.eu/publication/rcn/17085_en.html)

## ODEMM

---

**TITLE:** Options for delivering ecosystem-based marine management

**PROGRAMME:** FP7      **THEME:** ENVIRONMENT

**START YEAR:** 2010      **END YEAR:** 2013

**PROJECT COORDINATOR:** University of Liverpool (United Kingdom)

**WEBSITE:** <http://www.liv.ac.uk/odemmm/>      **Contact Information:** leonie.robinson@liv.ac.uk



**Short Abstract:** The overall aim of the ODEMM project is to develop a set of fully-costed ecosystem management options that would deliver the objectives of the Marine Strategy Framework Directive, the Habitats Directive, the European Commission Blue Book and the Guidelines for the Integrated Approach to Maritime Policy. This will be achieved by: (i) providing a comprehensive knowledge base to support policy for the development of sustainable and integrated management of European marine ecosystems; (ii) developing Operational Objectives to achieve the High-Level Policy Objectives set by the MSFD and the HD, and with reference to the proposed Maritime Policy; (iii) identifying Management Options (individual management tools and combinations of tools) to meet the Operational Objectives; (iv) providing a risk assessment framework for the evaluation of Management Options and to assess the risk associated with the different options; (v) conducting a cost-benefit analysis of a range of Management Options using appropriate techniques; (vi) identifying stakeholder opinions on the creation of governance structures directed towards implementation of the ecosystem approach, and to elaborate different scenarios for changing governance structures and legislation to facilitate a gradual transition from the current fragmented management approach towards fully integrated ecosystem management; (vii) documenting the steps necessary for the transition from the current fragmented management scheme to a mature and integrated approach, and providing a toolkit that could be used to evaluate options for delivering ecosystem-based management; and (viii) communicating and consulting on the outcomes of the project effectively with policy makers and other relevant user groups

**More info at:** [http://cordis.europa.eu/project/rcn/93904\\_en.html](http://cordis.europa.eu/project/rcn/93904_en.html)



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 652690. This output reflects the views only of the author(s), and the European Union cannot be held responsible for any use which may be made of the information contained therein.

## SILENV

---

**TITLE:** Ships oriented innovative solutions to reduce noise and vibrations

**PROGRAMME:** FP7      **THEME:** TRANSPORT

**START YEAR:** 2009      **END YEAR:** 2012

**PROJECT COORDINATOR:** DCNS SA (France)

**WEBSITE:** Not available **Contact Information:** loic.mer@dcnsgroup.com

**Short Abstract:** The project focused on the reduction of the environmental impact of ships. To achieve its goal, the project set out to investigate all maritime noise-related annoyances. The team of



researchers surveyed noise pollution level on board ships, in the environment of ports and in the water. They also developed modelling methods to calculate the damaging effect of noise at a distance. As a result, the team proposed a 'green label' applicable to most types of ships. The application of this label including noise and vibrations requirements as well as associated guidelines, should significantly limit ship-produced noise. This action stands to drastically improve the health and safety of fishermen and comfort for passengers, and reduce the negative effect of noise pollution on marine ecosystems in the future.

**More info at:** [http://cordis.europa.eu/result/rcn/91202\\_en.html](http://cordis.europa.eu/result/rcn/91202_en.html)

## TRIPOD

---

**TITLE:** Triple energy saving by use of CRP, CLT and POPded propulsion

**PROGRAMME:** FP7      **THEME:** TRANSPORT

**START YEAR:** 2010      **END YEAR:** 2013

**PROJECT COORDINATOR:** VTT - Technical Research Centre of Finland (Finland)

**WEBSITE:** Not available **Contact Information:** antonio.sanchez@vtt.fi



**Short Abstract:** The main objective of the TRIPOD project is the development and validation of a new propulsion concept for improved energy efficiency of ships. The ship propulsion efficiency will be optimized through the advanced combination of three existing propulsion technologies. In particular TRIPOD explores the feasibility of a novel propulsion concept resulting from the integration of two promising EU grown technologies (podded propulsion and tip loaded endplate propellers) in combination with energy recovery based on counter-rotating propeller (CRP) principle. The three existing technologies have been used separately and are known to improve the overall ship propulsion efficiency as compared to conventional propulsion. However, they have never been combined together in a single propulsion package. As a result of the investigation tools will be developed to assess the optimal use of propulsive energy from environmental and economic viewpoints both for new designs and for the retrofitting of existing ships with the novel propulsion concept.

**More info at:** [http://cordis.europa.eu/project/rcn/96666\\_en.html](http://cordis.europa.eu/project/rcn/96666_en.html)



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 652690. This output reflects the views only of the author(s), and the European Union cannot be held responsible for any use which may be made of the information contained therein.

## ECOSOUND

---

**TITLE:** Ecosystem mechanisms of noise impact on marine fauna

**PROGRAMME:** H2020 **THEME:** MARIE CURIE ACTIONS

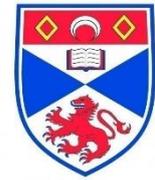
**START YEAR:** 2015 **END YEAR:** 2017

**PROJECT COORDINATOR:** USTAN - University of St Andrews (United Kingdom)

**PROJECT MANAGER:** Natacha Aguilar de Soto

**WEBSITE:** <https://creem2.st-andrews.ac.uk/person/na30/>

**Contact Information:** [naguilar@ull.es](mailto:naguilar@ull.es)



University  
of  
St Andrews

**Short Abstract:** Defining a Good Environmental Status for ocean noise within the EU Marine Framework Strategy is challenged by our limited knowledge about noise effects on marine fauna. ECOSOUND proposes that there are two broad types of mechanisms of noise impact on individual animals, both with potential population-level effects: bottom-up, i.e. noise responses that operate at the genetic, cellular or physiological level, which are likely to be conserved across taxa; and top-down, i.e. behavioural reactions driven by the life style of each species, which may result in physiological damage and even death. ECOSOUND will study bottom-up effects exploring if noise may induce morphological changes in several invertebrate taxa, selecting study species known to show phenotypic plasticity when exposed to stressors. Identifying developmental mechanisms of noise-effects is critical to predict potential common physiological paths over a wide range of taxa. Top-down effects will be investigated by comparing the life style of four species of deep-diving whales, and developing models to identify the reasons and potential consequences at the individual and population level of the different vulnerability of these species to noise. Results are relevant for the EU Marine Framework Strategy in the emergent field of management of ocean noise.

**More info at:** [http://cordis.europa.eu/project/rcn/196047\\_es.html](http://cordis.europa.eu/project/rcn/196047_es.html)

## Modelled Mapping of Continuous Underwater Noise Generated by Activities

---

**TITLE:** Modelled Mapping of Continuous Underwater Noise Generated by Activities

**Funded by:** Marine Management Organization. An executive non-departmental public body in the United Kingdom, sponsored by the Department for Environment, Food & Rural Affairs.

**Short Abstract:** This project explored quantification and mapping of underwater noise in the South marine plan areas. The principle output of the project was a Geographic Information System (GIS) tool based on transparent methodology that can produce a dataset of underwater noise level and distribution in the South marine plan areas.

**More info at:** <https://www.gov.uk/government/publications/underwater-noise-1097>



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 652690. This output reflects the views only of the author(s), and the European Union cannot be held responsible for any use which may be made of the information contained therein.