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Knowledge for Sustainable Blue Growth
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EXECUTIVE SUMMARY

Funded under the EU Horizon 2020 programme, COLUMBUS (www.columbusproject.eu) was a 36-month EU project (March 2015 - February 2018), involving 25 partners with a budget of €4 million.

Developed to “monitor, manage and transfer marine and maritime knowledge for sustainable blue growth”, COLUMBUS’s main objective was to carry out a large-scale pilot of Knowledge Transfer activities using a robust, replicable and process orientated methodology – the COLUMBUS Knowledge Transfer methodology. To do so, COLUMBUS put in place nine full-time (minimum 24 person-months each) Knowledge Transfer Fellows, one for each Competence Node: Aquaculture, Fisheries, Marine Biological Resources, Marine Environment and Futures, Marine Governance and Management, Marine Monitoring and Observation, Marine Physical Resources, Marine Tourism, and Maritime Transport and Logistics. Working together as a remote team and active network, this combined critical mass team were tasked with learning and applying the COLUMBUS Knowledge Transfer methodology on identified Knowledge outputs collected due their potential to overcome important bottlenecks or challenges affecting the marine and maritime sectors covered by each Competence Node.

The European Commission approached the COLUMBUS partnership asking for support in collecting descriptions of knowledge generated by the ‘Oceans of Tomorrow’ projects. Once collected the knowledge would populate a pilot version the European Commission’s marine and maritime information sharing platform¹.

The Ocean of Tomorrow initiative aimed “to foster multidisciplinary approaches and cross-fertilisation between various scientific disciplines and economic sectors on key cross-cutting marine and maritime challenges.” 32 projects were funded € 197 million under this initiative from which the nine COLUMBUS ‘Knowledge Fellows’ identified 546 Knowledge Outputs by December 2015. 463 of these Knowledge Outputs, were considered ‘exploitable results’ by the European Commission.

Knowledge Outputs from a third of the Oceans of Tomorrow were transferred by the COLUMBUS project during its lifetime (March 2015 – February 2018). These are described as part of the 48 stories of the COLUMBUS Knowledge Transfer activity which are published on the COLUMBUS website².

¹ https://cordis.europa.eu/packs/marine-information-platform_en.html

² http://www.columbusproject.eu/CCV6_FINAL.pdf





INTRODUCTION

Europe's 70,000 km of coastline, two oceans and four seas contribute heavily to our wealth and well-being. It is a critical source of food and energy and a vital medium for the global transportation of goods. In fact, the EU's maritime regions account for some 40% of its GDP and population (COM, 2007) 574)³. Maritime transport, offshore energy, tourism, coastal development, resource extraction, fisheries and aquaculture are all examples of activities of blue economies. However, these activities – despite their obvious benefits – are also exploitative, incurring impacts on the marine environment. Tomorrow's oceans will be subject to greater exploration than the oceans of today – but, unfortunately, this also means they will also be subject to greater exploitation.

'The European Strategy for Marine and Maritime research' (COM (2008) 534)⁴ – a strategy which underpins the 'Integrated Maritime Policy' (COM, 2007) – provides a reference framework for marine and maritime research and recognises that excellence in science and innovation can support a thriving and sustainable maritime economy. Furthermore, the 'Blue Growth' agenda – also a focus of the Integrated Maritime Policy – strives to enhance the great economic potential of our seas and oceans. It is a key component for contributing to the 'Europe 2020'⁵ goal of smart, inclusive and sustainable growth for Europe.

Commissioner Geoghegan-Quinn stated in 2010, "Just as oceans ignore borders, marine sciences and technologies are by their nature cross-cutting and involve many disciplines. There is no other way but to look beyond traditional sector-specific research to foster sustainable growth of maritime activities."⁶

A key initiative in this context was the launch of the Oceans of Tomorrow (FP7-OCEAN) cross-thematic calls in the European Commission's Seventh Framework Programme (2007-2013; known as 'FP7'). The Oceans of Tomorrow initiative featured the participation of business partners – small and medium-sized enterprises specifically – and promoted greater public engagement in the responding proposals.

The Oceans of Tomorrow calls cut across five themes: Food, Agriculture and Fisheries, and Biotechnology (KBBE); Nanosciences, Nanotechnologies, Materials and new Production Technologies (NMP); Energy; Transport; and Environment. A total budget of € 197 million ±10% was committed to the Ocean of Tomorrow calls that were funded in four rounds, one each year from 2010 to 2013. 21 call topics were released over the four-year period. These calls and associated budgets are presented in Annex 1. 32 projects were funded by the European Commission and cost € 197 million; whilst their total value reached € 264 million (according to CORDIS), a third more in added-value (Annex 2).

³ COM (2007) <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52007DC0575>

⁴ COM (2008) 534: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0534:FIN:EN:PDF>

⁵ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:2020:FIN:EN:PDF>

⁶ http://europa.eu/rapid/press-release_SPEECH-10-415_en.htm





Funded under the EU Horizon 2020 programme, COLUMBUS (www.columbusproject.eu) is a 36-month EU project (March 2015 - February 2018), involving 25 partners with a budget of €4 million. Developed to “monitor, manage and transfer marine and maritime knowledge for sustainable blue growth”, COLUMBUS’s main objective was to carry out a large-scale pilot of Knowledge Transfer activities using a robust, replicable and process orientated methodology – the COLUMBUS Knowledge Transfer Methodology. The result being qualitative case studies that illustrate how the project activities have successfully transferred knowledge to policy, industry, science and society, resulting in impacts that measurably contribute to “Blue Growth”.

Comprising eight work packages shown in Figure 1, COLUMBUS is centred on a Knowledge Transfer cycle (Work Packages 4, 5 and 6), where Knowledge Outputs are collected, analysed and transferred to a targeted audience, to create impact. The COLUMBUS Knowledge Transfer Methodology ensures that the transfer of knowledge is progressive, strategic, coordinated and effective.

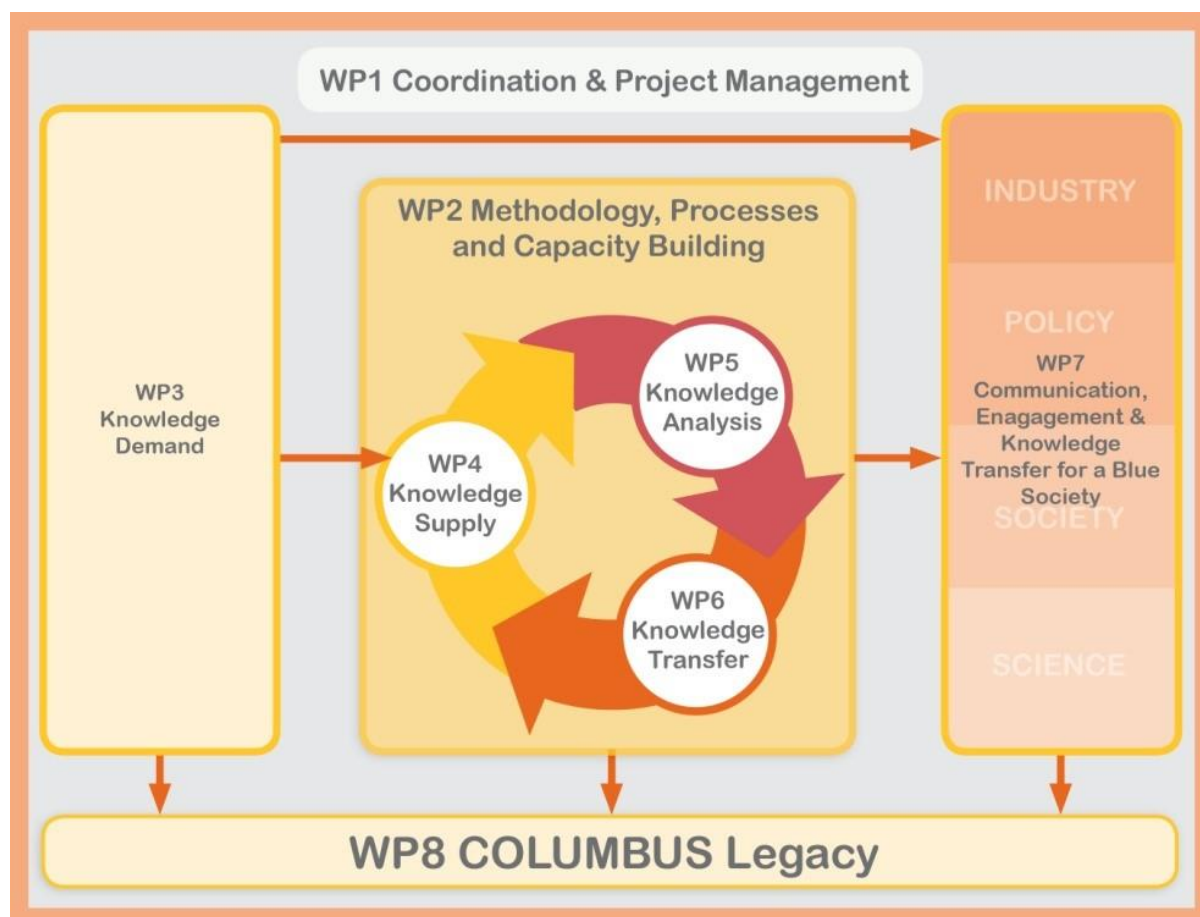


Figure 1: Structure of the COLUMBUS project





Central to this methodology is a team of Knowledge Transfer Fellows, whose role it is to perform the collection, analysis and transfer activities. Nine full-time (minimum 24 person-months each) Knowledge Transfer Fellows were employed from October 2016, one for each Competence Node: Aquaculture, Fisheries, Marine Biological Resources, Marine Environment and Futures, Marine Governance and Management, Marine Monitoring and Observation, Marine Physical Resources, Marine Tourism, and Maritime Transport and Logistics⁷. Working together as a remote team and active network, this combined critical mass team used a multi-disciplinary approach – the COLUMBUS Knowledge Transfer Methodology – to help achieve measurable impact and to develop a blueprint for future activities in this field of work. These efforts would ultimately contribute to the development of a thriving and sustainable marine and maritime economy.

PILOT COLLECTION EXERCISE

In October 2015, nine full-time ‘Knowledge Transfer Fellows’ were trained in the COLUMBUS Knowledge Transfer methodology where they would collect, analyse and transfer knowledge from marine and maritime projects relevant to their allocated sector. These sectors, or ‘Competence Nodes’, covered nine themes⁸: Aquaculture (Aquark); Fisheries (DTU Aqua); Marine Biological Resources (UPMC); Marine Environment and Futures (PM Jülich); Marine Governance and Management (CETMAR); Marine Monitoring and Observation (Seascope); Marine Physical Resources (Aquaterra); Marine Tourism (MSE); and Maritime Transport and Logistics (CMT).

The European Commission requested that COLUMBUS collect knowledge from the Oceans of Tomorrow projects as a non-contractual request. Of the 32 Oceans of Tomorrow projects, 31 were approached by COLUMBUS, with the 32nd project, ‘CSA Ocean’, being omitted from this collection process, as advised by the European Commission.

The COLUMBUS Knowledge Transfer Fellows received internal training on the collection process, as described by the COLUMBUS Knowledge Transfer Methodology. This is presented in brief in the ‘Guidelines on carrying out COLUMBUS Knowledge Transfer and Impact Measurement’ (Deliverable 2.2⁹). Prior to the Fellows starting the collection process, a letter of support was provided by the European Commission to the Oceans of Tomorrow project coordinators, asking them that they assist COLUMBUS in this activity. A supplementary template was provided, to be returned to the Commission, requesting for information they deemed relevant on the exploitable results (e.g. publications and deliverables) of each project.

⁷ At mid-term review, the number of Competence Nodes reduced to eight, as the marine tourism Competence Node found difficulty in identifying knowledge to transfer.

⁸ The respective organisation that is responsible for delivery of the Competence Node is provided in brackets. Please note that AquaTT took over the management of the Marine Biological Resources Competence Node in late 2016, and the Marine Tourism Competence Node closed at mid-term review,

⁹ <http://www.columbusproject.eu/D2%20%20Guidelines%20on%20carrying%20out%20COLUMBUS%20KT%20v2%20Final%2030.11.15.pdf>





Where completed, this template of exploitable results was provided to the Fellows (without any quality control step) and used to frame an initial desktop collection of Knowledge Outputs. Note that a Knowledge Output is a *“unit of knowledge or learning generated by or through research activity.”* Knowledge Outputs 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”*. These Knowledge Outputs were entered into a Knowledge Output Table (See Annex 3), according to the COLUMBUS Knowledge Transfer Methodology. It was used to populate both the Marine Knowledge Gate and a pilot ‘Information Sharing Platform for Marine and Maritime Research’¹⁰, as well as feed into the subsequent steps of the Knowledge Transfer cycle.

Following the desk-based study, Fellows contacted the Project Coordinators and arranged interviews whereby these lists of Knowledge Outputs were discussed, refined and augmented for completeness. These completed Knowledge Output Tables were then returned to the Project Coordinator for validation (confirmed as accurate and complete). 546 Knowledge Outputs were collected in total, and these were provided to the European Commission in December 2015. In January 2016, these Knowledge Outputs were combined and AquaTT and the COLUMBUS European Commission Desk Officer checked the Knowledge Outputs for quality and consistency. On occasion, some Knowledge Outputs were separated into two or more Knowledge Outputs, and those not deemed as ‘exploitable results’ by the European Commission were also removed. In this case, an exploitable result would be considered *“an innovative result coming from a project which have commercial/social significance and can be exploited as a stand-alone product, process, service, etc”*. A total of 463 exploitable results remained and these were uploaded to the ‘Information Sharing Platform for Marine and Maritime Research’.

Annex 2 lists the number of Knowledge Outputs that were collected from each project and the number of exploitable results that were submitted to the European Commission.

Collection and Validation

Approximately a third of the projects (n=10) finished prior to the Knowledge Outputs being collected (December 2015). A further collection phase would be required to ensure that all exploitable results are represented in the Information Sharing Platform. No Knowledge Outputs were collected from the BYEFOULING project as the Project Coordinator stated that they had no knowledge that was ready for collection. Finally, 15 Knowledge Outputs were not validated. This is because the Project Coordinator failed to validate the finalised Knowledge Output Tables. Despite this, however, the activity should still be considered a success given that across the COLUMBUS project approximately 70% of Knowledge

¹⁰ https://cordis.europa.eu/packs/marine-information-platform_en.html





Outputs were validated (Deliverable 4.3¹¹). Furthermore, the fact that all coordinators had been contacted directly by the Head of Marine Resources Unit in the Directorate General for Research and Innovation of the European Commission, in advance of COLUMBUS contacting them, clearly stimulated more proactive engagement.

Type of Knowledge Outputs

The 463 exploitable results were identified in the following formats:

Format of Exploitable Result	Number
Exploitable scientific result	105
Report	89
Scientific Publication	83
Product	27
Software/modelling tools	26
RTD protocol/technical manual	25
Guidelines/standards	23
Other	22
Data	16
Services/tools	16
Prototype	11
Multimedia	8
Book/Review	4
Training activity/learning module	4
Website	1

Exploitable Results

On four occasions, the number of exploitable results identified within the Knowledge Outputs increased (AQUO, BENTHIS, BRAAVOO and ECsafeSEAFOOD) following quality control. On three occasions, only one Knowledge Output was considered an exploitable result (ACCESS, BIOCLEAN and LEANWIND). In the case of four projects, a significant number of Knowledge Outputs were not considered exploitable results as defined by the European Commission (COCONET, CLEANSEA, H2OCEAN, PERSEUS). This exhibits a clear difference between the definition of COLUMBUS' Knowledge Outputs and the European Commission's exploitable results. COLUMBUS recognises the potential exploitation in knowledge whereas an 'exploitable result' must have immediate exploitative value.

¹¹ http://www.columbusproject.eu/COLUMBUS_D4%203_Report_KOs_Identification.pdf





CONCLUSION

Aside from a few project reports and publications, at the time of collection, there was little to no information clearly and publicly available on the specific units of Knowledge generated by the Oceans of Tomorrow projects as many were still underway or had only recently ended. Within three months, 463 exploitable results were available online with open-access, including details on who could possibly benefit from utilising the knowledge and detail the potential impact that could be achieved.

This effort by COLUMBUS highlights the wealth of valuable knowledge that is produced by projects such as the Oceans of Tomorrow cohort. In many cases, this knowledge is not captured in any documented or curated way, nor is it made available to all potential users. The experience indicated that in some cases coordinators were not aware of the value of some of their results, for example, component parts of sensors which could have applications beyond what they had been designed for, nor were they always aware of what was being produced by partners within the same project.

It is of note also that within a 10-week period 546 Knowledge Outputs were collected. This is a significant achievement in a short space of time. This success, however, was largely due to coordinators being much more willing to engage with third parties collecting their Knowledge Outputs when requested to do so by the European Commission. Other factors influencing coordinator feedback include the following: (i) the quality of the existing relationship between knowledge owners and those collecting the Knowledge Outputs; (ii) the level of trust between the knowledge owners and those collecting the Knowledge Outputs; and (iii) the capacity and motivation of the knowledge owner to develop a relationship with those collecting the Knowledge Outputs.

Subsequent work in COLUMBUS has indicated that cold-calling of project coordinators by unknown entities, in the absence of EC support, is not an efficient way of collecting or validating project Knowledge Outputs. To ensure that there is good return on the public investment in research and innovation projects, then a quality-controlled collection and publishing of all Knowledge Outputs should be mandatory for all projects. However, this does represent an effort on the part of the knowledge owners and should be stipulated in the call so that resources can be allocated appropriately.

On 4 May 2015, the EC launched the [Information Sharing Platform on Marine and Maritime Research](#) to support the “[Innovation in the Blue Economy](#)” Communication of May 2014, as well as the European Parliament’s Resolution of September 2015 on “[Untapping the potential of research and innovation in the blue economy to create jobs and growth](#)”. The platform, in its pilot stage, was planned to share available research data and key results from EU-funded projects related to the marine and maritime research sectors.

COLUMBUS would like to take this opportunity to sincerely thank all the Oceans of Tomorrow Project Coordinators for their patience and collaboration.



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ANNEX 1: OCEANS OF TOMORROW CALL TOPICS AND BUDGETS

<i>Call</i>	<i>Topic</i>	<i>Budget /€ million</i>	<i>Maximum number of projects</i>
<i>OCEAN.2010-1</i>	Quantification of climate change impacts on economic sectors in the Arctic	11	1
<i>OCEAN.2010-2</i>	Vectors of change in marine life, impact on economic sectors	12.5	1
<i>OCEAN.2010-3</i>	Sub-seabed carbon storage and the marine environment	10.5	1
<i>OCEAN.2011-1</i>	Multi-use offshore platforms	14	3
<i>OCEAN.2011-2</i>	Marine microbial diversity – new insights into marine ecosystems functioning and its biotechnological potential	9	1
<i>OCEAN.2011-3</i>	Assessing and predicting the combined effects of natural and human-made pressures in the Mediterranean and the Black Sea in view of their better governance	12	1
<i>OCEAN.2011-4</i>	Knowledge-base and tools for regional networks of MPAs, integrated management of activities together with assessment of wind energy potential in the Mediterranean and the Black Sea	9	1
<i>SST.2012.1.1-1</i>	Assessment and mitigation of noise impacts of the maritime transport on the marine environment	6	Not stated
<i>SST.2012.1.1-2</i>	Support to the development of joint programming in marine and maritime research to address cross-cutting sea-related challenges	2	1
<i>KBBE.2012.1.2-09</i>	Integrating the role of marine benthic ecosystems in fisheries management	6	1
<i>KBBE.2012.1.2-12</i>	Providing molecular tools for assessing and monitoring the potential genetic impact of aquaculture on native populations	3	1
<i>KBBE.2012.2.4-01</i>	Contaminants in seafood and their impact on public health	4	1
<i>KBBE.2012.3.5-01</i>	Innovative biotechnologies for tackling oil spill disasters	9	1
<i>KBBE.2012.3.5-02</i>	Biotechnological solutions for degradation of synthetic polymeric materials	3	1
<i>ENV.2012.6.2-3</i>	Innovative tools for understanding and integrated assessment of Good Environmental Status (GES) of marine waters	9	1
<i>ENV.2012.6.2-4</i>	Management and potential impacts of litter in the marine and coastal environment	3	1
<i>ENV.2012.6.2-5</i>	Improve scientific knowledge base to support the implementation of the Marine Strategy Framework Directive	1	1
<i>OCEAN.2013-1</i>	Biosensors for the real time monitoring of biohazard and man-made chemical contaminants in the marine environment	15	Several
<i>OCEAN.2013-2</i>	Innovative multifunctional sensors for in-situ monitoring of marine environments and related maritime activities	15	Several
<i>OCEAN.2013-3</i>	Innovative antifouling materials for maritime applications	15	Several
<i>OCEAN.2013-4</i>	Innovative transport and deployment systems for the offshore wind energy sector	10	1



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ANNEX 2: DETAILS OF OCEANS OF TOMORROW FUNDED PROJECTS

ACRONYM	Title	ID	Dates	Total cost /€m	EC contribution /€m	Topic	Total KOs	Validated KOs	Exploitable results	Collector
ACCESS	Arctic Climate Change, Economy and Society	265863	03/11-02/15	€ 14,848,399.48	€ 10,978,468.00	Quantification of climate change impacts on economic sectors in the Arctic	8	8	7	PM Jülich
AQUATRACE	The development of tools for tracing and evaluating the genetic impact of fish from aquaculture	311920	11/12-10/16	€ 3,927,338.00	€ 2,999,184.60	Providing molecular tools for assessing and monitoring the potential genetic impact of aquaculture on native populations	10	10	10	Aquark
AQUO	Achieve Quieter Oceans by shipping noise footprint reduction	314227	10/12-09/15	€ 4,199,734.70	€ 2,999,571.00	Assessment and mitigation of noise impacts of the maritime transport on the marine environment	16	16	16	AquaTT
BENTHIS	Benthic ecosystem fisheries Impact Study	312088	10/12-09/17	€ 7,784,925.51	€ 5,994,250.00	Integrating the role of marine benthic ecosystems in fisheries management	11	11	11	DTU Aqua
BIOCLEAR	New BIOTEchnologiCal approaches for biodegrading and promoting the Environmental biotransformation of synthetic polymeric materials	312100	09/12-08/15	€ 3,925,096.90	€ 2,995,988.00	Biotechnological solutions for degradation of synthetic polymeric materials	7	7	7	PM Jülich
BRAAVOO	Biosensors, Reporters and Algal Autonomous Vessels for Ocean Operation	614010	12/13-11/16	€ 4,564,917.00	€ 3,529,127.00	Biosensors for the real time monitoring of biohazard and man-made chemical contaminants in the marine environment	12	12	13	Seascope



ACRONYM	Title	ID	Dates	Total cost /€m	EC contribution /€m	Topic	Total KOs	Validated KOs	Exploitable results	Collector
BYEFOULING	Low-toxic cost-efficient environment-friendly antifouling materials	612717	12/13-11/17	€ 9,959,644.00	€ 7,447,584.00	Innovative antifouling materials for maritime applications	0	0	0	CMT
CLEANSEA	Towards a Clean, Litter-Free European marine Environment through Scientific Evidence, Innovative Tools and Good Governance	308370	01/13-12/15	€ 3,788,527.71	€ 2,986,570.99	Management and potential impacts of litter in the marine and coastal environment	18	18	11	MSE
COCONET	Towards Coast to Coast NETworks of marine protected areas (from the shore to the high and deep sea), coupled with sea-based wind energy potential	287844	02/12-01/16	€ 11,323,365.68	€ 9,000,000.00	Knowledge-base and tools for regional networks of MPAs, integrated management of activities together with assessment of wind energy potential in the Mediterranean and the Black Sea	55	55	25	CETMAR
COMMON SENSE	Cost-effective sensors, interoperable with international existing ocean observing systems, to meet EU policies requirements	614155	11/13-02/17	€ 6,089,977.10	€ 4,664,072.00	Innovative multifunctional sensors for in-situ monitoring of marine environments and related maritime activities	10	10	10	AquaTT
CSA OCEANS	CSA Health and Productive Seas and Oceans	314194	09/12-08/15	€ 2,337,279.60	€ 1,999,925.00	Support to the development of joint programming in marine and maritime research to address cross-cutting sea-related challenges	0	0	0	n/a
DEVOTES	DEvelopment Of innovative Tools for understanding marine biodiversity of assessing good Environmental Status	308392	11/12-10/16	€ 12,086,862.36	€ 8,997,984.62	Innovative tools for understanding and integrated assessment of Good Environmental Status (GES) of marine waters	21	21	21	CETMAR



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ACRONYM	Title	ID	Dates	Total cost /€m	EC contribution /€m	Topic	Total KOs	Validated KOs	Exploitable results	Collector
ECO2	Sub-seabed CO2 storage: Impact on Marine Ecosystems	265847	05/11-04/15	€ 13,978,174.12	€ 10,500,000.00	Sub-seabed carbon storage and the marine environment	6	6	6	AquaTT
ECseaSEAFOOD	Priority environmental contaminants in seafood: safety assessment, impact and public perception	311820	02/13-01/17	€ 5,085,238.82	€ 3,999,874.00	Contaminants in seafood and their impact on public health	50	50	50	AquaTT
EnviGuard	Development of a biosensor technology for environmental monitoring and disease prevention in aquaculture ensuring food safety	614057	12/13-11/18	€ 7,177,126.82	€ 5,523,461.00	Biosensors for the real time monitoring of biohazard and man made chemical contaminants in the marine environment	11	11	11	Aquark
H2OCEAN	Development of a wind-wave power open-sea platform equipped for hydrogen generation with support for multiple users of energy	288145	01/12-12/14	€ 6,501,858.76	€ 4,525,934.00	Multi-use offshore platforms	11	11	8	Aquatera
KILLSpill	Integrated Biotechnological Solutions for Combating Marine Oil Spills	312139	01/13-12/16	€ 12,442,645.02	€ 8,996,599.00	Innovative biotechnologies for tackling oil spill disasters	15	0	0	UPMC
LEANWIND	Logistics Efficiencies And Naval architecture for Wind Installation with Novel Developments	614020	12/13-11/17	€ 14,768,953.00	€ 9,986,231.00	Innovative transport and deployment systems for the offshore wind energy sector	27	27	26	Aquatera
MARIABOX	MARine environmental in-situ Assessment and Monitoring tool BOX	614088	02/14-01/18	€ 7,137,921.51	€ 5,175,858.00	Innovative multifunctional sensors for in-situ monitoring of marine environments and related maritime activities	13	13	13	Seascope



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ACRONYM	Title	ID	Dates	Total cost /€m	EC contribution /€m	Topic	Total KOs	Validated KOs	Exploitable results	Collector
MERMAID	Innovative multi-purpose off-shore platforms: planning, design and operation	288710	01/12-12/15	€ 7,376,567.60	€ 5,483,411.00	Multi-use offshore platforms	9	9	9	Aquatera
MICROB3	Marine microbial biodiversity, bioinformatics and biotechnology	287589	01/12-12/15	€ 11,496,409.35	€ 8,987,491.00	Marine microbial diversity – new insights into marine ecosystems functioning and its biotechnological potential	21	21	21	UPMC
NeXOS	Next generation, cost-effective, compact, multifunctional web enabled ocean sensor systems empowering marine, maritime and fisheries management	614102	10/13-09/17	€ 8,104,266.00	€ 5,906,479.00	Innovative multifunctional sensors for in-situ monitoring of marine environments and related maritime activities	14	14	14	DTU Aqua
PERSEUS	Policy-orientated marine environmental research in the Southern European Seas	287600	01/12-12/15	€ 16,994,500.54	€ 12,973,123.40	Assessing and predicting the combined effects of natural and human-made pressures in the Mediterranean and the Black Sea in view of their better governance	99	99	79	CETMAR
SCHeMA	Integrated in situ chemical mapping probes	614002	10/13-09/17	€ 6,741,554.30	€ 5,200,489.00	Innovative multifunctional sensors for in-situ monitoring of marine environments and related maritime activities	11	11	11	Seascope
SEAFRONT	Synergistic fouling control technologies	614034	1/14-12/17	€ 11,265,469.20	€ 7,995,161.00	Innovative antifouling materials for maritime applications	7	7	7	CMT
SEA-on-a-CHIP	Real time monitoring of SEA contaminants by an autonomous Lab-on-a-chip biosensor	614168	12/13-05/17	€ 7,603,006.08	€ 5,751,459.00	Biosensors for the real time monitoring of biohazard and man-made chemical contaminants in the marine environment	2	2	2	Seascope



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ACRONYM	Title	ID	Dates	Total cost /€m	EC contribution /€m	Topic	Total KOs	Validated KOs	Exploitable results	Collector
SenseOcean	Marine sensors for the 21 st century	614141	10/13-09/17	€ 8,065,330.20	€ 5,924,945.00	Innovative multifunctional sensors for in-situ monitoring of marine environments and related maritime activities	6	6	6	Seascope
SMS	Sensing toxicants in marine waters makes sense using biosensors	613844	12/13-08/17	€ 5,559,819.00	€ 4,144,263.00	Biosensors for the real time monitoring of biohazard and man-made chemical contaminants in the marine environment	7	7	0	Seascope
SONIC	Suppression of underwater noise induced by cavitation	314394	10/12-09/15	€ 4,183,193.60	€ 2,999,972.00	Assessment and mitigation of noise impacts of the maritime transport on the marine environment	16	16	16	MSE
STAGES	Science and Technology Advancing Governance of Good Environmental Status	308473	09/12-08/14	€ 1,119,512.00	€ 999,692.04	Improve scientific knowledge base to support the implementation of the Marine Strategy Framework Directive	12	12	12	CETMAR
TROPOS	Modular multi-use deep water offshore platform harnessing and servicing Mediterranean, Subtropical and Tropical Marine and Maritime Resources	288192	02/12-01/15	€ 6,726,623.82	€ 4,877,911.00	Multi-use offshore platforms	24	24	24	Aquatera
VECTORS	Vectors of Change in Oceans and Seas Marine Life, Impact on Economic Sectors	266445	02/11-01/15	€ 16,581,571.69	€ 12,484,835.00	Vectors of change in marine life, impact on economic sectors	17	17	17	UPMC
				€ 263,745,809.47	€ 197,029,913.65		546	531	463	



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ANNEX 3: KNOWLEDGE OUTPUT TABLE

Short Title	Knowledge Output Description	Knowledge Type	Contact Information	Link to Knowledge Output	Sectors & Subsectors	End User	Application	IPR Protection
<p>Please provide a short and concise title to describe the Knowledge Output.</p> <p>Please do not write down expected Knowledge Outputs - please only consider what has been generated as a Knowledge Output.</p> <p>Note that Knowledge Outputs can be non-deliverables or milestones too ('grey knowledge') or multiple Knowledge Outputs could exist within one deliverable, in which case they should be separated.</p>	<p>Try to give a comprehensive description, making the Knowledge Output fully understandable to a non-expert.</p> <p>If relevant please provide detail of where the Knowledge Output differs from its equivalent, e.g. What are the key characteristics of the Knowledge Output? What research is it adding to and what is innovative about the Knowledge Output? (Max 500 characters).</p> <p>The information you collect here will be used by you as a Knowledge fellow, to carry out Knowledge Transfer in your sectors. The amount and type of information will change as you work through different KOs through the COLUMBUS KT methodology. This experience will identify for you what is relevant to include here.</p>	<p>DROPDOWN MENU - Please choose one option. If data or other is chosen please provide detail in Column B.</p>	<p>Please provide contact details of the most relevant person to provide further information if required on the Knowledge Output.</p> <p>If the beneficiary/owner of the Knowledge Output differs from the contact person then please indicate so.</p>	<p>If you can provide a link to the Knowledge Output then please do so, e.g. website address, scientific journal details, etc.</p> <p>If not publicly available currently but will be in the future, please provide details</p> <p>If there are no plans to make publicly available, please state No.</p>	<p>DROPDOWN MENU - Chose as many options as you think would benefit from this Knowledge Output.</p> <p>For each sector chosen please use a separate row.</p>	<p>DROPDOWN MENU - Chose as many options as required from the dropdown list.</p> <p>There can be more than 1 type of End User, e.g. Industry, Scientific Community, Policy Makers, Environmental Managers, Education, Other.</p> <p>For every new End User, create a new row.</p> <p>Options :</p> <ul style="list-style-type: none"> • Education & Training • Environmental Managers & Monitoring • Industry • Policy Makers / Decision Makers • Scientific Community • Civil Society 	<p>Per identified end user, please identify possible applications of your Knowledge Output, which can be more than 1 as well. If you do have more than 1 answer, you could use the rows below your 'initial row' to list them.</p>	<p>Please indicate whether you have applied IPR to this Knowledge Output (applied for a patent, copyright etc), or not.</p> <p>Please leave blank if no IPR has been applied.</p>

Status	End User Description	Potential Impact	Project Exploitation
<p>Please identify whether the Knowledge Output is finalised, is still being generated or whose status/future is unknown. Consider:</p> <ul style="list-style-type: none"> • Is your knowledge conclusive enough that it provides sufficient evidence to make an impact on a Value Chain? • Is there a corroborating body of evidence or are contradicting results available? • Does your knowledge progress beyond the current state-of-the-art/evidence base? • Is more research or demonstration needed to validate the results? <p>If the Knowledge Output is technology based, please indicate TRL level (1-9)</p> <p>If the Knowledge Output could inform evidence based policy, please indicate whether further validation/contextualisation would be required.</p> <p>If the Knowledge Output could be used by the scientific Community to progress its Knowledge base then please indicate whether the Knowledge Output is conclusive or whether further detail would be required.</p>	<p>Try to be as specific as possible, for example for 'Policy Makers' indicate the exact type and level also, e.g. European Commission – DG Research & Innovation / Directorate E (Health) / E1 Strategy</p>	<p>Please provide details of the potential impact this Knowledge Output could have if the end users identified understand and apply the Knowledge Output.</p>	<p>This field is directly related to the identified End users, as the exploitation mechanism could depend on type of End User. In this field indicate past and current activities to reach your identified End User.</p> <p>Please also indicate the end users which were targeted in your exploitation activities and any impact that was achieved.</p> <p>Please also indicate if future exploitation/dissemination activities are planned by the project - this is to ensure no overlap between what the project intends to do and what COLUMBUS can offer in terms of KT.</p> <p>Examples are: publications, events and networking, collaborative research / researcher mobility, consultancy / training courses, licensing, new business / spin-offs, etc</p> <p>Please include urls, reference material, project reports so further investigation can be carried out.</p>