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Lead Authors	A. Novellino
Contributors	G. Pieri, C. Lemos, M. Martinelli, F. Martins, M. Ntoumas, S. Să, F. Misurale, G. Daputo
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Name	Role	Action	Date
Flavio Augustos Bastos da Cruz Martins	WP9 leader - Reviewer	Approve	
Catarina Lemos	Technical & Innovation Manager - Reviewer	Approve	
Gabriele Pieri	Project Coordinator - Reviewer	Approve	
Oscar Papini	WP9 reviewer	Review and approve	

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DEC	Websites, patents, filing, etc.	
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NAUTILOS - New Approach to Underwater Technologies for Innovative, Low-cost Ocean observation is an H2020 project funded under the Future of Seas and Oceans Flagship Initiative, coordinated by the National Research Council of Italy (CNR, Consiglio Nazionale delle Ricerche). It brings together a group of 21 entities from 11 European countries with multidisciplinary expertise ranging from ocean instrumentation development and integration, ocean sensing and sampling instrumentation, data processing, modelling and control, operational oceanography and biology and ecosystems and biogeochemistry such, water and climate change science, technological marine applications and research infrastructures.

NAUTILOS will fill-in marine observation and modelling gaps for chemical, biological and deep ocean physics variables through the development of a new generation of cost-effective sensors and samplers, the integration of the aforementioned technologies within observing platforms and their deployment in large-scale demonstrations in European seas. The fundamental aim of the project will be to complement and expand current European observation tools and services, to obtain a collection of data at a much higher spatial resolution, temporal regularity and length than currently available at the European scale, and to further enable and democratise the monitoring of the marine environment to both traditional and non-traditional data users.

NAUTILOS is one of two projects included in the EU's efforts to support of the European Strategy for Plastics in a Circular Economy by supporting the demonstration of new and innovative technologies to measure the Essential Ocean Variables (EOV).

More information on the project can be found at: <https://www.nautilus-h2020.eu/>

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● EXECUTIVE SUMMARY

NAUTILOS WP9 is designed to demonstrate and quantify how the new sensors, the new integration in platforms and the new observation approaches can improve the modelling (hydrodynamic, biogeochemical, plastic pollution) and to set up NAUTILOS new data interoperability and legacy towards European Marine data Integrators.

NAUTILOS has designed Task 9.5 - Data Integration in European Platforms, Data Legacy – that moves from the outcome of WP8 and elevates these NAUTILOS tools to the next level within the European Marine data framework.

This activity also includes the development of key performance indicators to measure and assess the system performances, according to demonstration needs and requirements.

These KPIs have to cover information like how long it takes from the NAUTILOS data production to its availability in the European Marine Data Infrastructures (e.g. EMODnet), the amount of data that need further tiers of validation, the amount of data that is included in the SeaDataNet network of National Oceanographic Data Centres and IODE collections, the number of publications etc.

D9.6 presents the first assessment on KPIs as defined in D9.5.

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● LIST OF ACRONYMS AND ABBREVIATIONS

Abbreviation	Definition
DAC	Data Assembly Center
DMP	Data Management Plan
DOI	Digital Object Identifier
EI	Expected Impacts
KPI	Key Performance Indicator
TRL	Technology Readiness Level

1. INTRODUCTION

NAUTILOS is focusing on 17 instrumentation/tools that can operate from shallow coastal waters to open and deep-sea sites, providing complete datasets for studying the marine ecosystem functions and advanced data products and tools.

There is not a unique method to monitor the project performance and more indicators have to be designed for better tracking the project impact at different levels. To this end NAUTILOS had already identified a number of measurable objectives, and outcomes.

KPIs have to monitor the number of developed sensors, if they are implementing the planned technology breakthrough (and reaching the planned TRL), if they are covering the targeted EOVs, if they are producing new valuable data, if this data is consumed by policy and directive assessment programs, by marine data infrastructures, by other projects and researchers, etc.

Most of these KPIs are already tracked under D10.1 and periodic reports, D9.5 defined an extended set of KPIs to capture the following categories:

- Data and data product acquisition
- Data product development
- Data and data product delivery through portal and web services
- Data impact

This Deliverable D9.6 presents the first assessment on these KPIs.

1.1. GENERIC PROJECT KPIS

- Amount of new data produced

At the period of writing (autumn 2023), NAUTILOS backend is hosting 18 new datasets. Some of these are test datasets, some others are already final-validated datasets. Dataset name is indicating the type and scope of data (see also DMP for further details).

- Delay between the data acquisition and data availability (timeliness) on data infrastructures

Although NAUTILOS is still far from finishing, there are already some campaigns-datasets that are valuable for NAUTILOS stakeholders:

- Animal borne instrument datasets collected around the Valdes Peninsula
- Animal borne instrument datasets collected around the Azores
- Adriatic Fishery and Oceanography Observing System (AdriFOOS) datasets collected in the Adriatic Sea

- number DOIs in NAUTILOS

NAUTILOS assigns a DOI to all the public deliverables. At the time of writing, the list includes the following:

Table 1. Metrics on the NAUTILOS docs in Zenodo (@13/09/2023)

	https://zenodo.org/record/	views	downloads
D1.1 - 10.5281/zenodo.7162213	https://zenodo.org/record/7162213	18	18
D1.2 - 10.5281/zenodo.7163583	https://zenodo.org/record/7163583	16	19
D.1.3 - 10.5281/zenodo.7163625	https://zenodo.org/record/7163625	40	41
D1.4 - 10.5281/zenodo.7163673	https://zenodo.org/record/7163673	22	33
D1.6 - 10.5281/zenodo.7886901	https://zenodo.org/record/7886901	7	7
D1.9 - 10.5281/zenodo.7886929	https://zenodo.org/record/7886929	9	8
D1.10 - 10.5281/zenodo.7163783	https://zenodo.org/record/7163783	20	23
D2.1 - 10.5281/zenodo.7163906	https://zenodo.org/record/7163906	40	24
D3.1 - 10.5281/zenodo.7224501	https://zenodo.org/record/7224501	12	14
D5.1 - 10.5281/zenodo.7224543	https://zenodo.org/record/7224543	14	16
D5.8 - 10.5281/zenodo.7224624	https://zenodo.org/record/7224624	21	15
D8.1 - 10.5281/zenodo.7211768	https://zenodo.org/record/7211768	17	20
D8.2 - 10.5281/zenodo.7211792	https://zenodo.org/record/7211792	11	19
D8.3 - 10.5281/zenodo.7211798	https://zenodo.org/record/7211798	13	20
D8.4 - 10.5281/zenodo.7211817	https://zenodo.org/record/7211817	16	15

D8.5 - 10.5281/zenodo.7224664	https://zenodo.org/record/7224664	13	13
D8.6 - 10.5281/zenodo.7224676	https://zenodo.org/record/7224676	11	18
D8.7 - 10.5281/zenodo.7224688	https://zenodo.org/record/7224688	24	26
D8.8 - 10.5281/zenodo.7224700	https://zenodo.org/record/7224700	24	19
D8.9 - 10.5281/zenodo.7224729	https://zenodo.org/record/7224729	30	40
D9.5 - 10.5281/zenodo.7886949 (v.2 - 10.5281/zenodo.7889278)	https://zenodo.org/record/7889278	12	16
D10.1 - 10.5281/zenodo.7163695	https://zenodo.org/record/7163695	12	23
D10.2 - 10.5281/zenodo.7224747	https://zenodo.org/record/7224747	21	26
D10.4 - 10.5281/zenodo.7886990	https://zenodo.org/record/7886990	8	17
D10.5 - 10.5281/zenodo.7886996	https://zenodo.org/record/7886996	8	8
D10.8 - 10.5281/zenodo.7887010	https://zenodo.org/record/7887010	6	7
D11.1 - 10.5281/zenodo.7211802	https://zenodo.org/record/7211802	16	18
D11.2 - 10.5281/zenodo.7887016	https://zenodo.org/record/7887016	7	7
D11.6 - 10.5281/zenodo.7887025 (v.2 - 10.5281/zenodo.7887035)	https://zenodo.org/record/7887035	16	16
D11.8 - 10.5281/zenodo.7887043	https://zenodo.org/record/7887043	6	7

This will be extended by assigning a DOI to all the digital contents (presentations, videos, posters).

NAUTILOS DMP considers the submission of validated datasets to a repository that can assign a DOI, and, at the time of writing, the following NAUTILOS related (in situ based) datasets have been assigned a DOI:

<https://doi.org/10.17882/73008>

<https://doi.org/10.3390/s23020935> - <https://doi.org/10.13127/misc/73>

1.2. DATA MANAGEMENT KPIs

Table 2. Data Management KPIs

number of NAUTILOS datasets submitted to EMODnet Ingestion	2
number of NAUTILOS datasets published as EMODnet Ingestion phase 1	-
number of NAUTILOS datasets published as EMODnet Ingestion phase 2	-
number of registered datasets DOI in NAUTILOS (*)	2
number of NAUTILOS citations (DOI or prj code) (**)	133

*) see previous section

**) List of NAUTILOS related scientific communications (from Publish or Perish) at the end of the document.

2. SPECIFIC OBJECTIVES (SO) KPIS

SO1: Develop and demonstrate improved observing systems in coastal and shelf-sea environments

- NAUTILOS sensors are going to improve our understanding of environmental change and anthropogenic impacts related to aquaculture, fisheries, and plastic litter in coastal and shelf-sea environments
- Demonstration will be performed in Adriatic Sea, Aegean Sea, Baltic Sea, Coast of Norway and Archipelago of the Azores islands
- Integration platforms ships of opportunity, fixed platforms, unmanned vehicles, and animals

The SO1 KPI is:

Table 3: SO1 KPI

	Description	Target	Status	Comments
DOW SO1.1	Number of sensors and samplers developed for coastal and shelf sea environments	13	13	1. Fluorometric Sensors/dissolved oxygen (HESSO) 2. Dissolved Oxygen and Fluorescence Sensors (NKE) 3: Downward-looking multi/hyperspectral and laser induced fluorescence sensors and cameras (NIVA) 4. Passive broadband acoustic recording sensor for noise monitoring (AQUATEC) 5. Passive acoustic event recorder (porpoise & dolphin clicks for abundance estimation) (AQUATEC) 6. Active Acoustic Profiling Sensor (AQUATEC) 7. Sampler for phytoplankton and other suspended matter (NIVA) 8. Animal-borne instruments (CEiiA/CNRS)

				9. Carbonate system/ocean acidification sensors (NIVA) 10. Silicate Electrochemical Sensor (NKE) 11. Sampler for Nanoplastics and Microplastics (SCT) 13. Deep ocean CTD (UL-FE) 14. Deep ocean low-level radioactivity sensor (HCMR)
DOW SO1.2	Number of field demonstrations at coastal and shelf-sea sites carried out	4	3	

Table 4: SO1 KPIs for data management and dissemination

Demo Site	Number of generated datasets for field of demonstration			Integration platform
	aquaculture	fisheries	plastic litter	
Adriatic Sea		1		ships of opportunity
				fixed platforms
				unmanned vehicles
				animals
Bay of Biscay				ships of opportunity
Aegean Sea				ships of opportunity
				fixed platforms
				unmanned vehicles
				animals
Baltic Sea				ships of opportunity
				fixed platforms
				unmanned vehicles
				animals
Coast of Norway				ships of opportunity
				fixed platforms
				unmanned vehicles
				animals
Archipelago of the Azores islands				ships of opportunity
				fixed platforms
				unmanned vehicles*

		1		animals
--	--	---	--	---------

*) some preliminary tests without a specific focus yet

SO2: Develop and demonstrate improved observing systems in the open ocean and deep-sea environments

- Long-term observation in open-ocean and deep-sea environments (below 2000m)
- sampler for phytoplankton and other suspended matter, silicate electrochemical sensor, deep ocean CTD, deep ocean low-level radioactivity sensor and finally demonstrated in deep sea deployments using lander and Argo floats platforms supported by R/Vs missions.

The SO2 KPI is:

Table 5: SO2 KPI

	Description	Target	Status	Comments
DOW SO2.1	Number of deep-sea capable (>2000 m water depth rated) sensors developed and demonstrated	4	1	Sensors are in the integration phase
DOW SO2.2	Number of field demonstrations at deep-water sites (>200 m water depth) carried out	3	1	Sensors are in the integration phase

Table 6: Advanced KPI specifies the details of the SO2

Sampler/Sensor	Reached depth (during NAUTILOS field demonstrations)	Cost of technology
Phytoplankton and other suspended matter		
Silicate electrochemical sensor		
Deep ocean CTD		
Deep ocean low-level radioactivity sensor		

SO3: Develop and demonstrate improved observing systems for anthropogenic debris (i.e. macro-, micro-, nano-plastics)

- microplastic sensor
- micro- and nano-plastic sampler technologies
- NIR scanner device for citizen science

Sensor and samplers will be respectively demonstrated in the coastal areas of Norway, Gulf of Finland and Aegean Sea, as well as through citizen science efforts on an explorer cruise ship that transects Northern European Seas. The SO3 KPIs are:

Table 7: SO3 KPI

	Description	Target	Status	Comments
DOW SO3.1	Number of cost-effective, portable micro and nanoplastics sensing and sampling technologies developed and demonstrated	3	2	3. Downward-looking multi/hyperspectral and laser induced fluorescence sensors and cameras (NIVA) 11. Sampler for Nanoplastics and Microplastics (SCT)
DOW SO3.2	Number of field demonstrations carried out for micro- and nano-plastics detection	3		

Table 8: Advanced KPI specifies the details of the SO3

Demo Site	Number of datasets for Sampler		
	Microplastic sensor	micro- and nano-plastic sampler technologies	NIR scanner device for citizen science
Norway			
Gulf of Finland			
Aegean Sea			
Transects Northern European Seas			

SO4: Develop and demonstrate improved observing systems in commercial operations, i.e. fishing vessels, aquaculture facilities, ships of opportunity

- New generation dissolved oxygen and chlorophyll a fluorescence sensor
- sampler for phytoplankton and other suspended matter
- hyperspectral and laser induced fluorescence sensors
- ocean acidification sensors
- microplastic sensors
- marine mammal passive click recorder

The SO4 KPI is:

Table 9: SO4 KPI

	Description	Target	Status	Comments
DOW SO4.1	Number of sensors and samplers developed and demonstrated on vessels of opportunity and commercial facilities	5	2	*
DOW SO4.2	Number of field demonstrations carried out with vessels of opportunity and commercial facilities	3	1	**

* <https://data-nautilus-h2020.eu/erddap/tabledap/AdriFOOS.html> https://data-nautilus-h2020.eu/erddap/tabledap/adrifoos_test.html

** https://data-nautilus-h2020.eu/erddap/tabledap/AdriFOOS_profiles_2012-2020.html (2021 on are supported by NAUTILOS)

Table 10: Advanced KPI specifies the details of the SO4

# of datasets	Demo Site				
	Italian waters	French waters	Greek waters	Norwegian waters	Baltic waters
dissolved oxygen	X	X			
chlorophyll a fluorescence	X				
phytoplankton					
hyperspectral and laser induced fluorescence sensors					

ocean acidification sensors					
microplastic sensors					
passive click recorder					

SO5: Develop and demonstrate improved observing systems that utilise animal-borne instruments

- Oxygen sensors on animal tags deployed in the archipelago of the Azores islands as well as in the Valdes Peninsula in Argentina.

The identified SO5 KPI are exhaustive, therefore no other KPI for data management and dissemination are proposed. SO5 KPI are:

Table 11: SO5 KPI

	Description	Target	Status	Comments
DOW SO5.1	Number of sensing devices (oxygen sensors) demonstrated as part of animal-borne instrument campaigns	1	1	*
DOW SO5.2	Number of deployments in the oceans at regions of interest on a variety of animals for a richer dataset than currently available	60	9	
DOW SO5.3	Amount of data retrieved from the animals and to feed into NAUTILOS data and modelling activities, inserted into the MEOP initiative and sharing with the wider community	1TB	350MB	

* https://data-nautilus-h2020.eu/erddap/tabledap/elephant_seals_OCT_2021.html

SO6: Quantitatively assess the potential improvements on ocean simulation, ocean forecasting and remote sensing derived from NAUTILOS developments

- Observing System Simulation Experiments (OSSE) to statistically assess the impact of data quality (accuracy, precision, completeness, relevance, and fit to use) in different scenarios and analysed from a cost-benefit perspective. SO6 KPI is already exhaustive:

The identified SO6 KPI are exhaustive, therefore no other KPI for data management and dissemination are proposed. SO6 KPI are:

Table 12: SO6 KPI

	Description	Target	Status	Comments
DOW SO6.1	Number of physical and biogeochemical model implementations benefiting from new sensors and observing strategies emerging from NAUTILOS	5	65%	OSSE methodology is used, Synthetic observations are extracted from the Nature Run using new sensors characteristics. OSSE Experiments are being conducted to evaluate model improvement due to NAUTILOS observations. Preliminary results show significant improvements
DOW SO6.2	Number of marine plastic pollution model implementations benefiting from new sensors and observing strategies emerging from NAUTILOS	2	65%	OSSE methodology is used, Synthetic observations are extracted from the Nature Run using new sensors characteristics OSSE Experiments are being conducted to evaluate model improvement due to NAUTILOS observations. Preliminary results show significant improvements

SO7: Appropriately collate, process, and archive all primary environmental data generated during NAUTILOS to ensure that it is maximally Findable, Accessible, Interoperable, and Reusable.

- Amount of data made available and consumed by National Oceanographic Data Centres, EMODnet, SeaDataNet, Copernicus Marine Services, etc.
- Number and type of interoperability interfaces

SO7 KPIs are:

Table 13: SO7 KPI

	Description	Target	Status	Comments
DOW SO7.1	Amount of data transferred to external repositories (i.e. data integrators)	80%	57%	
DOW SO7.2	Qualified data vs uncontrolled data (note: some data may be confidential and not-releasable)	50%	50%	
DOW SO7.3	Publicly accessible data vs total produced data (note: some data might be available after an embargo period to allow scientific production)	80%	100%	NAUTILOS back end is offering full access to available data NAUTILOS Portal allows to access to 85% of all data

SO7 is very pertinent with the specific goal of task 9.6, the advanced KPI for SO7 are indeed the once identified in DOW.

SO8: Promote and enable the widespread adoption of the NAUTILOS developments to the widest possible range of users and stakeholders (UN legislators to citizen scientists)

- Low-cost *in situ* observation technologies for citizens science
- online tools for data and opinion collection
- Policy round table and presentations,
- project-specific capacity building initiatives for young researchers,
- 5 citizen science initiatives

SO8 KPI are:

Table 14: SO8 KPI

	Description	Target	Status	Comments
DOW SO8.1	Number of citizen science campaigns carried out	5	33	12 in Greece 3 in Norway 1 in Germany

				18 in Italy
DOW SO8.2	Number of capacity building activities carried out	2	1	NAUTILOS Summer School
DOW SO8.3	Policy-related initiatives carried out	4	6	*

*EMD2022 19-20/05/2022 Ravenna (Italy)

NAUTILOS Policy Brief at the Ocean Data Week - The Ocean Race Village, 27/07/2023 Genova (Italy)

Horizon Result Booster common policy

Complementary KPI is the number of low-cost¹ in situ observation technologies for citizen science. CS observations are organized in specific datasets that are accessible at:

<https://data-nautilus-h2020.eu/erddap/search/index.html?searchFor=Citizen>

¹ Low-cost technology to enable citizen science is a technology with an affordable cost, i.e. tens of Euros.

SO9: Promote and develop a broad range of collaborations and contributions to international, regional, and national for a concerned with the sustainable management of marine resources and the protection of marine biodiversity with a specific focus on the European Strategy for Plastics in a Circular Economy

- monitoring and mapping of marine plastics, harmonised protocols and validated methods to implement measures under the MSFD.
- Engagement with working ESPACE working groups

The identified SO9 KPI are exhaustive, therefore no other KPI for data management and dissemination are proposed.

SO9 KPI are:

Table 15: SO9 KPI

	Description	Target	Status
DOW SO9.1	Number of collaborations targeted within the timeframe of the project	>30	37
DOW SO9.2	Number of collaborations in relation to ESPCE targeted within the timeframe of the project	>20	25

3. EXPECTED IMPACTS (EI) KPIs

This section presents the progress towards the expected impact (EI) KPIs. Considering that NAUTILOS sensors are entering now into their validation and field demonstration phase, it's too early to consider the use of NAUTILOS sensors in legislation related documents. (Table2).

Table 16. Sensors and TRL

Marine Technologies Demonstrated in NAUTILOS	Starting TRL	Maximum Operating Depth (m)	(Aimed) Ending TRL	Current TRL	IMP
Sensing and Sampling Technologies					
1. Fluorometric Sensors/dissolved oxygen (ref. ST3.1.1)	3	250 m	7	5	2.1
2. Dissolved Oxygen and Fluorescence Sensors (ref. ST3.1.2)	5	600 m	8	6	2.1
3. Downward-looking multi/hyperspectral and laser induced fluorescence sensors and cameras (ref. T3.2)	4	subaerial	7	4-5	2.1
44. Passive broadband acoustic recording sensor for noise monitoring (ref. ST3.3.1)	4	1000 m	7	5	2.1
5. Passive acoustic event recorder (porpoise & dolphin clicks for abundance estimation) (ref. ST3.3.2)	5	300 m	7	5	2.1
6. Active Acoustic Profiling Sensor (ref. T3.4)	5	1000 m 4	7	5	2.1
7. Sampler for phytoplankton and other suspended matter (ref. T3.6)	3	5500 m	8	6	2.2
8. Animal Borne Instrumens	5	<100 m	9	5	
9. Carbonate system/ocean acidification sensors (ref. T4.1)	5	<100 m	9	6	2.1
10. Silicate Electrochemical Sensor (ref. T4.2)	5	2000 m	8	6	2.1
11. Sampler for Nanoplastics and Microplastics (ref. T4.3)	7	600 m	9	5	2.2
12. Low-cost Microplastic Sensor (ref. T4.4)	3	0	6	6	2.1

13. Deep Ocean CTD (ref. T4.5)	4	2000 m	7	6	2.1
14. Deep Ocean low-level radioactivity sensor (ref. T4.6)	4	5000	7	5	2.1
data management and sharing					
- <i>Data Products: Services and tools for data transfer towards external DACs</i>	4	N/A	8	6	2.3
- <i>Modelling Products</i>	7	N/A	9	8	2.3

Table 17. Sensors and legislations

	NAUTILOS Marine Technologies	Task	Variables targeted	Target disciplinary groups	MSFD Descriptor	Delivered/adopted	Proof (e.g. link to document, etc)
1	Dissolved Oxygen Sensors	(ref. Sub-Task 3.1.1 & Sub-Task 3.1.2)	Dissolved oxygen	Marine biogeochemistry	D3 - Population of commercial fish/shell	Chemistry	
				Regulatory environmental monitoring	D4 - Elements of Marine food webs	Physics	
					D5 - Eutrophication		
2	Fluorescence Sensor	(ref. Sub-Task 3.1.2)	Chlorophyll-a fluorescence	Marine biology/ecology	D5 - Eutrophication	Chemistry	
				Regulatory environmental monitoring		Physics	
3	Ocean surface multi/hyperspectral and laser induced chlorophyll-a fluorescence sensors and cameras	(ref. Task 3.2)	Sea surface temperature, Laser induced chlorophyll-a fluorescence, Ocean color	Marine biology/ecology	D4 - Elements of Marine food webs	Physics	
				Regulatory environmental monitoring Ocean colour community	D5 - Eutrophication	Chemistry	
4		(ref. Sub-Task 3.3.1)	Marine noise (anthropogenic and natural sources, including marine mammals, sea	Marine biology/ecology	D11 - Energy and Water noise	Physics	

	Passive broadband acoustic recording sensor		ice cracking, seismic activity, meteorological sources)	Regulatory environmental monitoring	D1 - Biological diversity	Biology	
5	Passive acoustic event recorder	(ref. Sub-Task 3.3.2)	Marine mammal sound detection (porpoise & dolphin clicks for abundance estimation)	Marine biology/ecology	D1 - Biological diversity	Biology	
				Regulatory environmental monitoring			
6	Active Acoustic Profiling Sensor	(ref. Task 3.4)	Suspended particle concentration / distribution (zooplankton, microplastics, organic and inorganic sediment)	Marine biology/ecology Marine pollution	D10 - Marine litter	Chemistry	
					D1 - Biological diversity	Physics	
						Biology	
7	Sampler for phytoplankton and other suspended matter	(ref. Task 3.5)	Concentrated suspended matter samplers for analyses of phyto-pigments, particulate organic matter, microbe biomass and diversity	Marine biology	D1 - Biological diversity	Biology	
				Marine ecological monitoring Climate research	D5 - Eutrophication	Chemistry	
				Marine pollution		Physics	
8	Carbonate system/ocean acidification sensors	(ref. Task 4.1)	pH, pCO ₂ , Total Alkalinity	Marine biogeochemistry Climate research	D1 - Biological diversity	Chemistry	
9	Silicate Electrochemical Sensor	(ref. Task 4.2)	Silicate concentration (Si)	Marine biogeochemistry	D5 - Eutrophication	Chemistry	
10	Submersible Nano- and Microplastics Sampler	(ref. Task 4.3)	Concentrated suspended matter samples	Marine ecology Marine pollution	D10 - Marine litter	Physics	

11	Low-cost Microplastic sensors	(ref. Task 4.4)	Concentration and characterisation of microplastics	Marine ecology Marine pollution	D10 - Marine litter	Chemistry	
12	Deep Ocean CTD	(ref. Task 4.5)	Conductivity, Temperature, Pressure (Salinity and Density derived)	Physical oceanography	D7 - Alteration of hydrographical	Physics	
13	Deep ocean low-level radioactivity sensor	(ref. Task 4.6)	Radon gas, potassium 40K, radium 226Ra and 228Ra, and other natural isotopes	Environmental monitoring	D9 - Contaminants in fish and seafood	-	
14	Integration of existing technologies in animal tagging systems	(ref. Task 5.5)	Temperature, Salinity, Chlorophyll-a fluorescence, Dissolved oxygen	Physical oceanography Marine biology/ecology	D7 - Alteration of hydrographical	Physics	
15	Demonstration of novel equipment for key seabed habitat mapping	(ref. Task 6.2)	Live corals, hard corals, seafloor sponges	Marine biology	D6 - Seafloor integrity	Seabed habitats	
16	Smartphone NIR Scanner	(citizen science application, ref. Task 8.4)	Plastics	Marine pollution	D10 - Marine litter	Chemistry	
17	Visual marine image annotation	(citizen science application, ref. Task 10.4)	Macroplastics, Sponge and cold-water coral cover, major seafloor organism types.	Marine pollution Marine biology/ecology	D10 - Marine litter	Chemistry	

4. COMMENTS

NAUTILOS is working on substantial progress in developing 17 innovative instrumentation and tools capable of functioning in diverse marine environments.

NAUTILOS has assigned DOIs to all public deliverables and related datasets, ensuring traceability and accessibility and its backend currently hosts 18 new datasets, showcasing progress in data acquisition.

This progress report provides preliminary evidence in data accessibility, technological advancements, and its potential integration into legislative frameworks of NAUTILOS. This assessment is going to be done again in one year time to monitor and track the overall impact of the project.

5. APPENDIX 1: REFERENCES AND RELATED DOCUMENTS

ID	Reference or Related Document	Source or Link/Location
1	NAUTILOS D9.5	

Table 18. NAUTILOS related doc as extracted from Publish&Perish

Authors	Title	Year	Source	Publisher	ArticleURL
Martinelli M., Duchêne J., Malardé D., Marty S., King A.L., Ntomas M., Smerdon A., Novellino A., Pieri G.	NAUTILOS Fisheries and Aquaculture Observing Systems. Abstract Number: 5892	2023	Abstract Number: 5892 Session: SS042 Fishing4Data: Fishing Gear as an Oceanographic Data Collection Platform. ASLO 2023 Aquatic Sciences Meeting to be held 4–9 June 2023 in Palma de Mallorca, Spain.	ASLO	https://aslo.secure-platform.com/2023/solicitations/12/sessiongallery/864/application/5892
Aguzzi J., Aristegui- Ezquibela M., Burgos C., Chatzievangelou D., Doyle J., Fallon N., Fífas S., González- Herraiz I., Jonsson P., Lundy M., Martinelli M., Medvešek D., Naseer A., Nava E., Nawri N., Jónasson J.P., Pereira B., Pieri G., Silva C., Tibone M., Valeiras J., Vila Y., Weetman A., Wieland K.	Working Group on Nephrops Surveys (WGNEPS; outputs from 2022 meeting).	2023	ICES Scientific Reports. 5:26. 125 pp.	ICES	https://doi.org/10.17895/ices.pub.22211161
A King, P Jaccard, H Frigstad, T Harvey...	Norwegian Ships of Opportunity Program for marine and atmospheric research	2023		meetingorganizer.copernicus.org	https://meetingorganizer.copernicus.org/EGU23/EGU23-16706.html

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ML Haarr, L Bach, CP Chambers...	Beach litter sources around Nuuk, Greenland: An analysis by UArctic summer school graduate course students	2023	Marine Pollution ...	Elsevier	https://www.sciencedirect.com/science/article/pii/S0025326X23003454
P Penna, F Domenichetti, A Belardinelli...	Dataset of Depth/Temperature profiles obtained in the period 2012–2020 using commercial fishing vessels of the AdriFOOS fleet in the Adriatic Sea (Mediterranean ...	2023	Earth System Science ...	essd.copernicus.org	https://essd.copernicus.org/preprints/essd-2022-458/
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T Tanhua, N Köstner	Action Progress Report# 2	2022		oceanrep.geomar.de	https://oceanrep.geomar.de/id/eprint/57224/1/D9.2_Action_Progress_Report_no2.pdf
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