ODYSSEA

Creating products and knowledge for the Mediterranean

ΔΗΜΟΚΡΙΤΕΙΟ ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΡΑΚΗΣ
DEMOCRITUS UNIVERSITY OF THRACE

FROM MARINE LITTER TO MICROPLASTICS : THE ODYSSEA PROJECT CONTRIBUTION AND THE LITTERFREE APPROACH

URBAN-WASTE Project Meeting, Kavala, Greece

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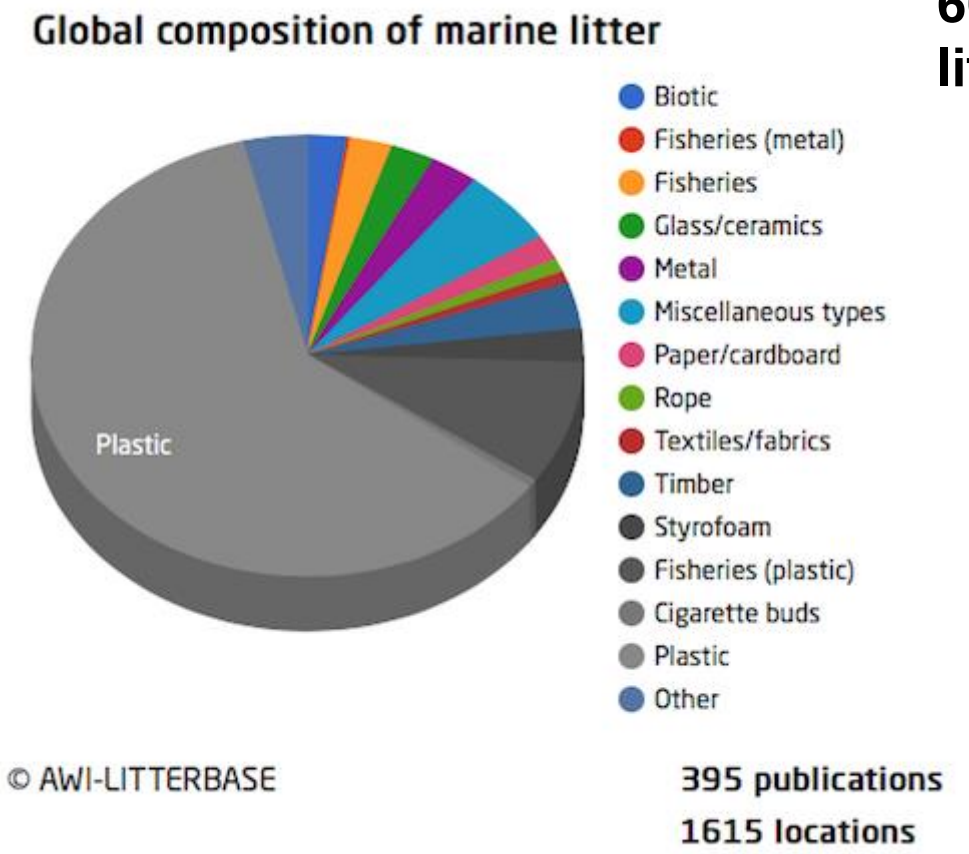
Background and Emerging Concepts

ODYSSEA

- Over the last ten years we have produced more plastic than during the whole of the last century.
- 50 percent of the plastic we use, we use just once and throw away.
- We currently recover only five percent of the plastics we produce.
- 46 percent of plastics float and it can drift for years before eventually concentrating in the ocean gyres.
- It takes 500-1,000 years for plastic to degrade in sea.
- 80 percent of pollution enters the ocean from the land.
- Plastic constitutes approximately 90 percent of all trash floating on the ocean's surface, with 250,000 pieces of plastic per square km.
- One million sea birds and 100,000 marine mammals are killed annually from plastic in our oceans.

Marine Litter Composition



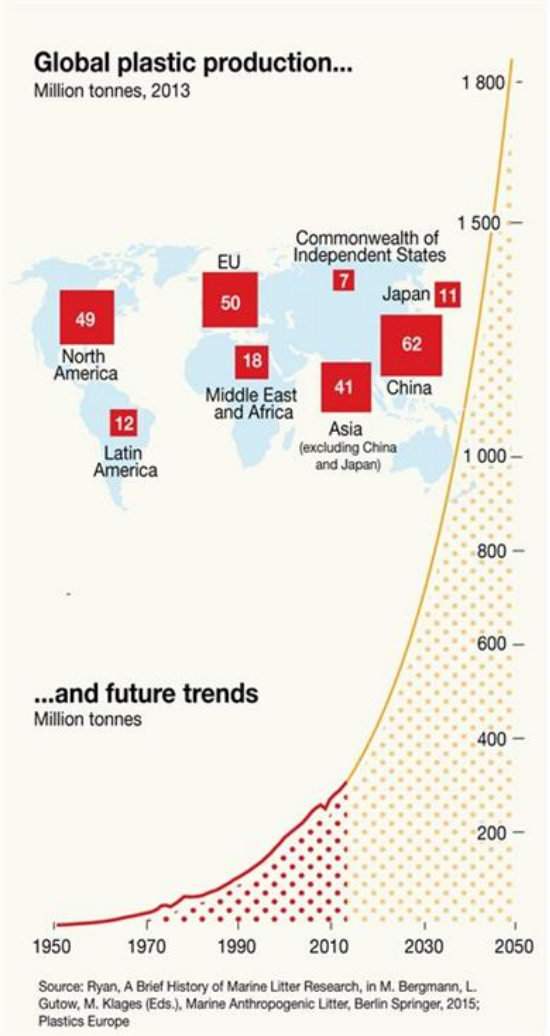
60-80% of marine litter is plastic

Global Plastic Production

Global plastic production (excluding certain fibers) was a mere 1.7 million tonnes in 1950;
increased to 47 million tonnes in 1976;
raised to 204 million tonnes in 2002 and reached 322 million tonnes in 2015 (PlasticsEurope, 2016).

Waste plastics that do not enter appropriate reuse or recycling loops on land eventually are released into rivers and coastal waters.

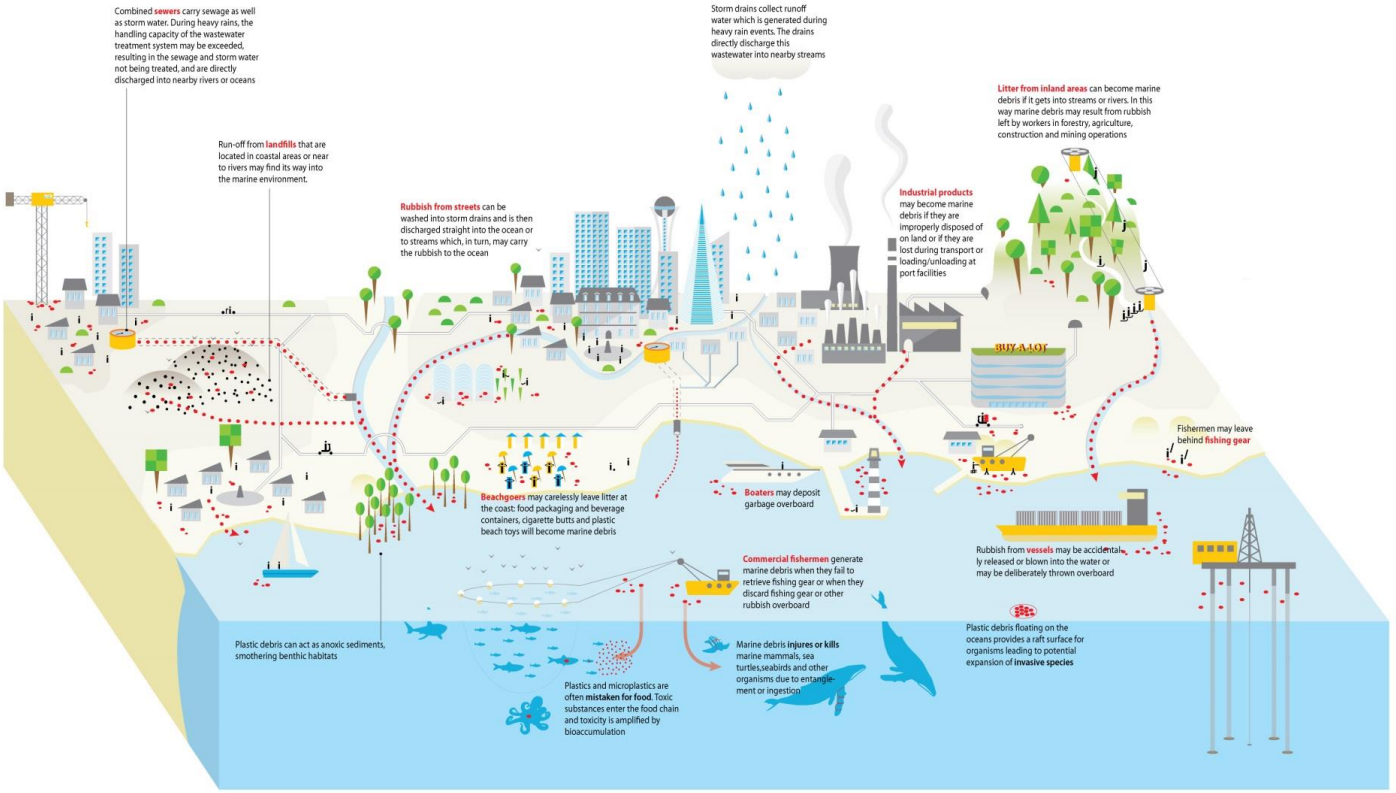
Tourism, maritime transport and abandoned fishing gear also contributes to marine plastic pollution



Plastic Pathways

ODYSSEA

Plastic debris in the ocean: a multiplicity of sources and pathways



Garbage-catching Floating Dams

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Marine Microplastics

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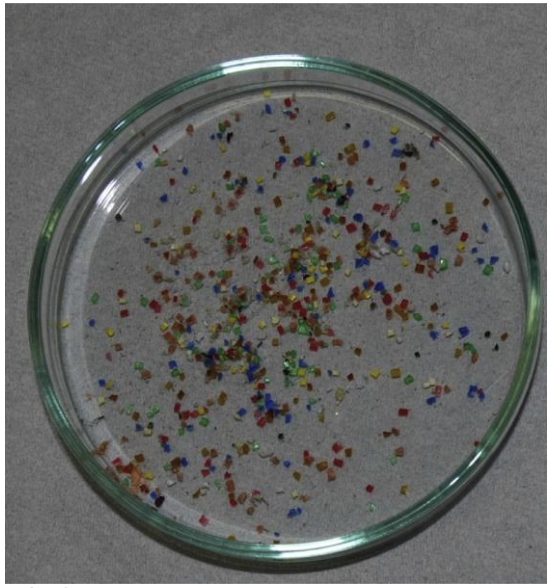
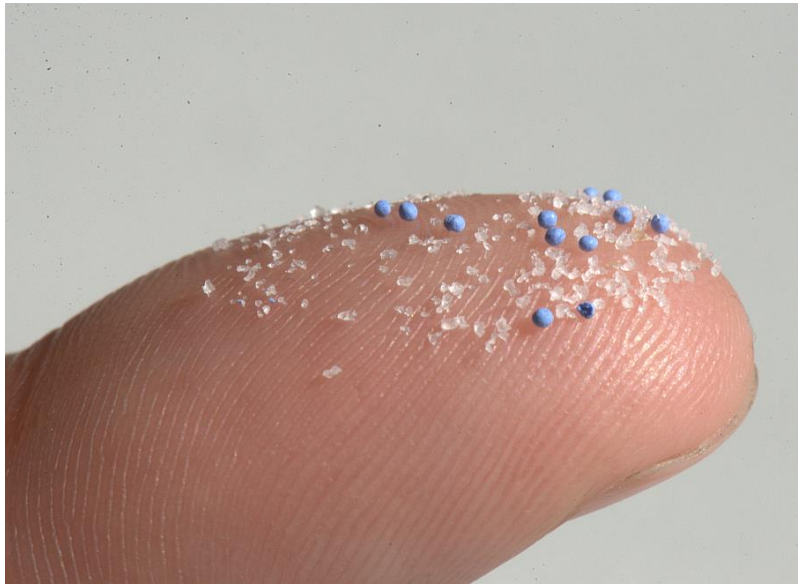
The fraction of plastic debris that are <5 mm in the largest dimension or diameter are commonly referred to as microplastics (United Nations Environment Program 2013). They can classified into different shape classes such as fragment, film, fiber, foam, and pellet.

Their numbers range from 250,000 up to 1,000,000 microparticles per sq.km floating at the sea surface



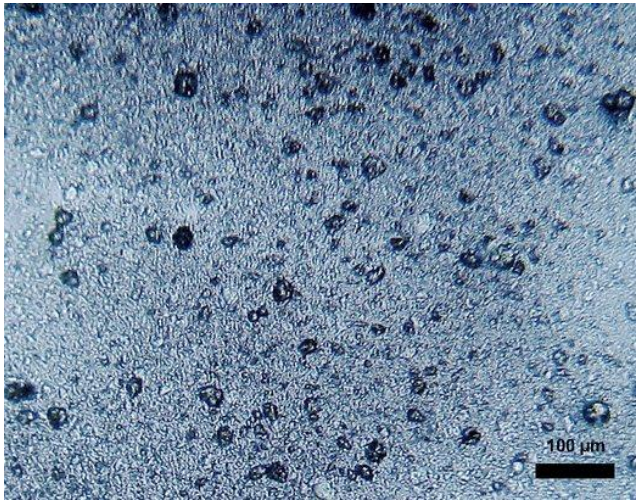


Marine Microplastics

Synthetic clothes when washed release approximately 700,000 microfibers entering the sewage system and ultimately the sea.

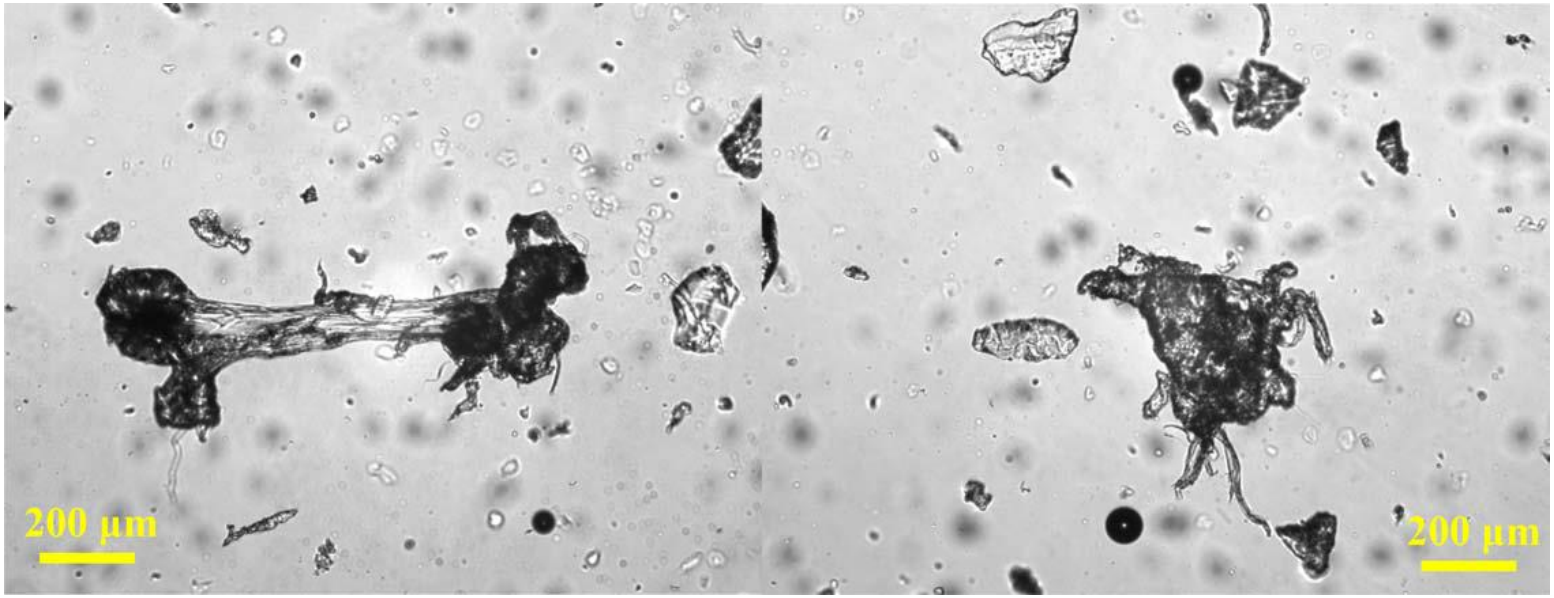
Marine Microplastics

Peeling creams and many cosmetics contain microplastic spheres washed off and entering the sewage system and ultimately the sea.



Marine Microplastics

ODYSSEA



Photomicrographs of variously shaped and size microplastics harvested from a body wash product

Marine Microplastics

Polypropylene (PP) and polyethylene (PE) appear to be two dominant classes of marine microplastics, reflecting their ubiquitous application as packaging materials.

Marine Microplastics

ODYSSEA

Objective

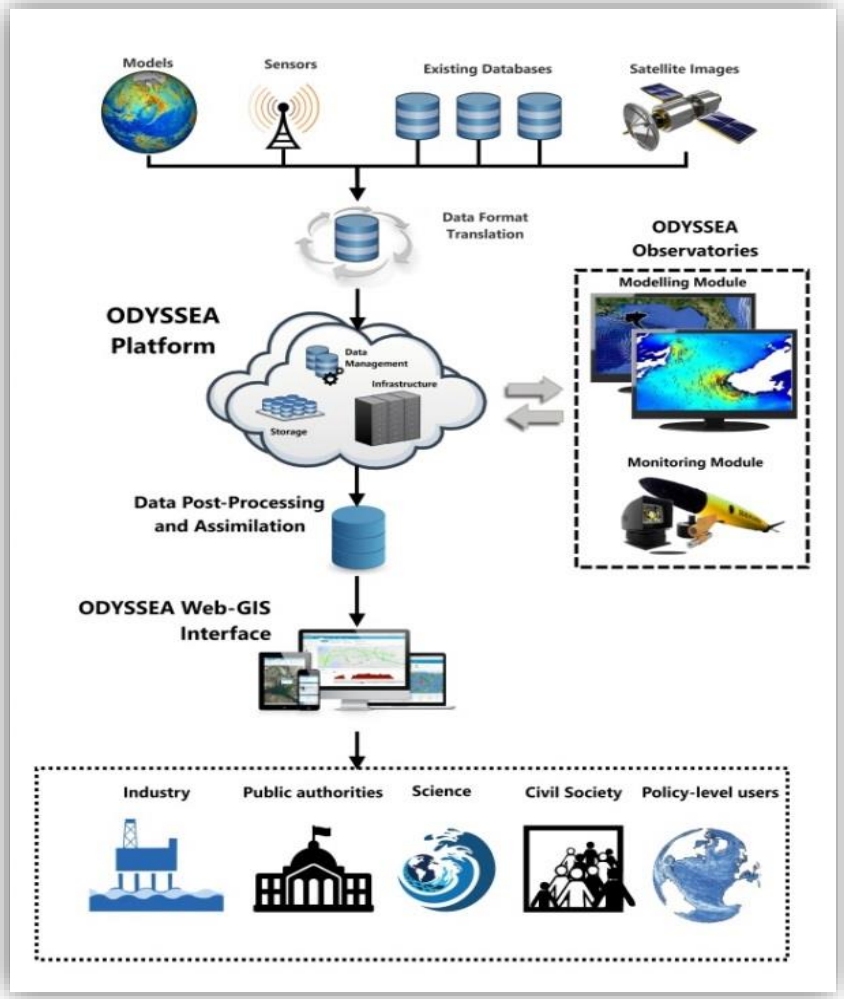
ODYSSEA

- ODYSSEA is a user-centred project aiming to make Mediterranean marine data easily accessible and operational to multiple end-users, by
- harmonizing existing Earth Observing systems,
- upgrading operational oceanographic capacities,
- supporting EU policy implementation,
- improving interoperability in monitoring,
- fostering blue growth jobs creation, and
- opening participation to non-EU member states.

What is ODYSSEA ?

ODYSSEA is a system bridging the gap between operational oceanography capacities and the need for information on marine conditions from the community of end-users.

ODYSSEA's ambition is to develop an **interoperable, fully-integrated and cost-effective multiplatform network of observing and forecasting systems** across the Mediterranean basin, addressing both the open sea and the coastal zone.



ODYSSEA Specific Objectives

1. Develop a platform to discover, integrate and process datasets obtained from an expanded range of existing observation platforms
2. Fill-in data gaps & increase spatial and temporal resolution by establishing ODYSSEA Observatories
3. Develop a prototype ‘chain’ of models providing data never previously reported
4. Expand existing operational monitoring systems capacity
5. Emphasize on biological datasets
6. Combine data to extract secondary indicators
7. Link indicators to EU policies
8. Involve end-users on platform design, data collection and day-to-day operations
9. Train and educate policy-makers and end-users on platform usage
10. Improve professional skills and competences - focus on Northern Africa capacity building

A Sea of Platforms
An Ocean of Datasets

ODYSSEA

EMODnet
European Marine Observation and Data Network

NOAA
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

NASA

JAXA

EGO

Copernicus
Europe's eyes on Earth

USGS
science for a changing world

OneGeology

AquaMaps

ECMWF

BirdLife
INTERNATIONAL

COCO
NET

BODC
British Oceanographic Data Centre
NATURAL ENVIRONMENT RESEARCH COUNCIL

Euro Argo

emso
ERIC
EUROPEAN RESEARCH INFRASTRUCTURE CONSORTIUM

General Bathymetric Chart of the Oceans
GEBCO

JRC
EUROPEAN COMMISSION

FixO3
FIXED-POINT OPEN OCEAN OBSERVATORIES

Geo-Seas

GFCM
CGPM

mongoos

SeaDataNet

UNEP

MAP

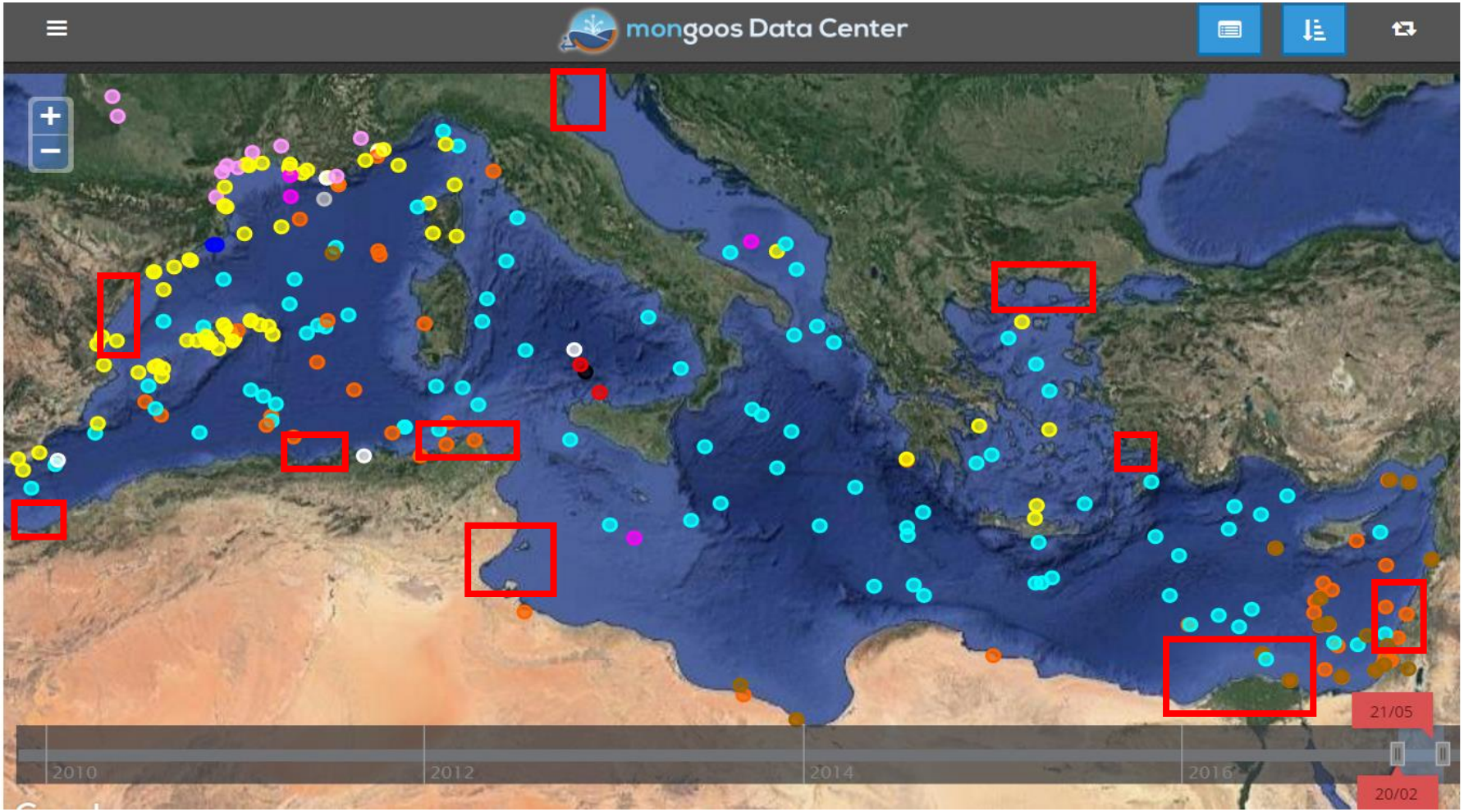
A Sea of Platforms
An Ocean of Datasets

ODYSSEA

1. Systems are fragmented
2. Inhomogeneous Datasets (formats, types)
3. Difficult to access datasets
4. Data stored and maintained by various agencies
5. In most cases, data access requires authorization by agencies
6. Gaps in datasets, especially chemistry and biology
7. Gaps along N. African Middle East Coastlines
8. Mostly static data, collected from past cruises, lack in reporting parameters as micro-pollutants, fisheries, etc, limited satellite data, no meteorological/hydrologic data
9. Lack on data transformation to information
10. Datasets are not linked to EU policy instruments
11. Limited end-users involvement and training

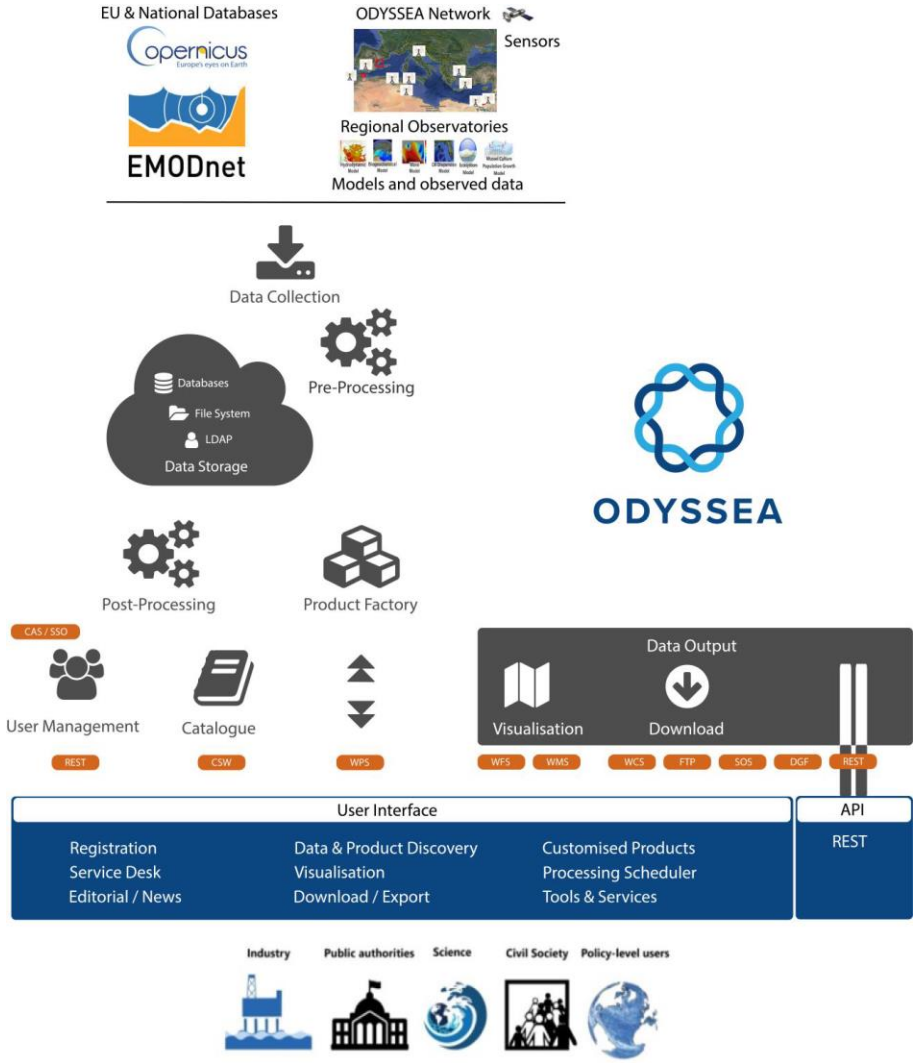
Data Gap Analysis

ODYSSEA



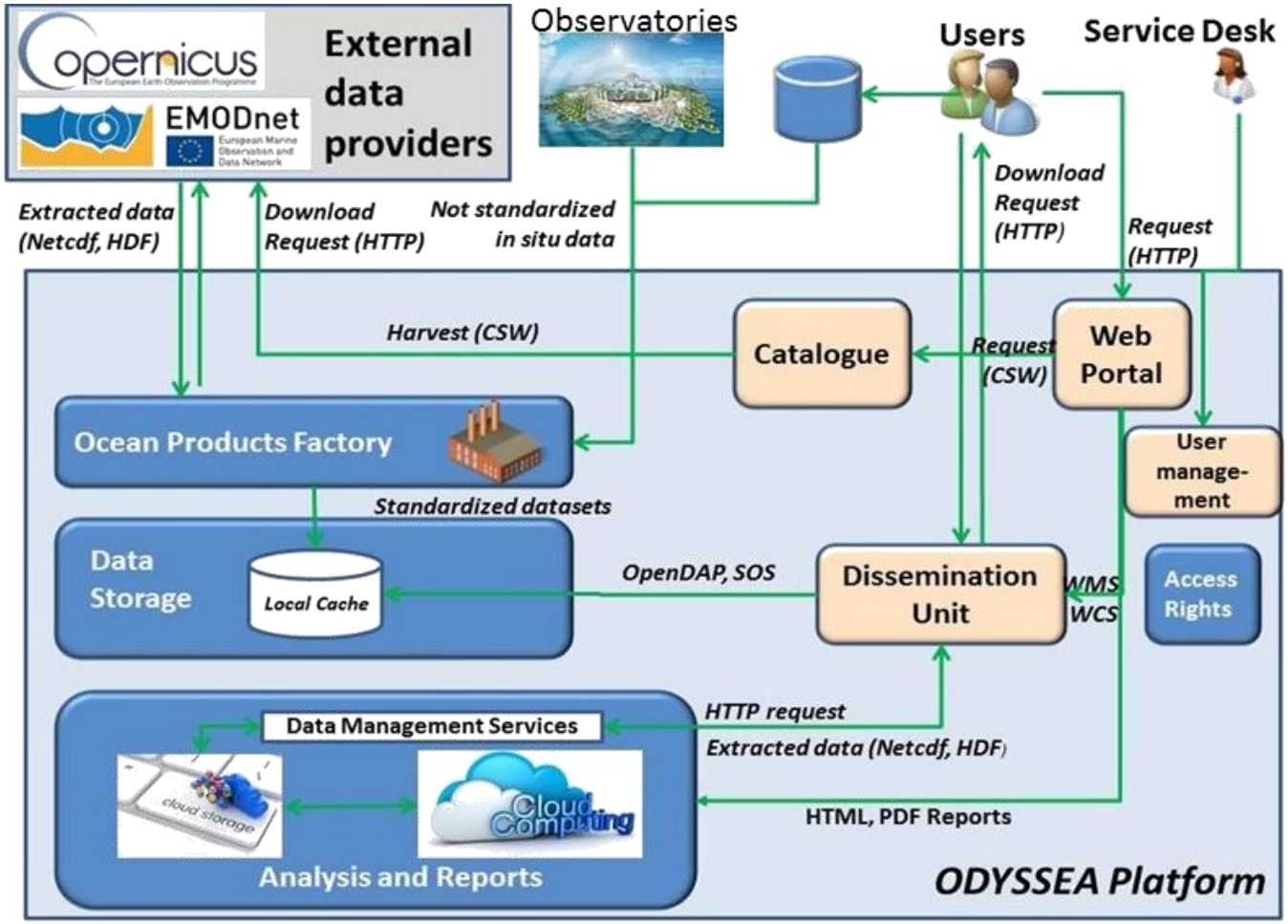
The Platform

1. Integrate marine data from existing databases maintained by Earth Observing facilities,
2. Receive and process novel newly produced datasets (through models, remote sensing and on-line sensors) from nine prototype Observatories,
3. Transform marine data into meaningful information, ultimately developing, testing, validating and disseminating marine data products and services to end-users,
4. Stimulate Blue Growth throughout the Mediterranean basin, creating businesses, advancing science and supporting the societal use of digital information

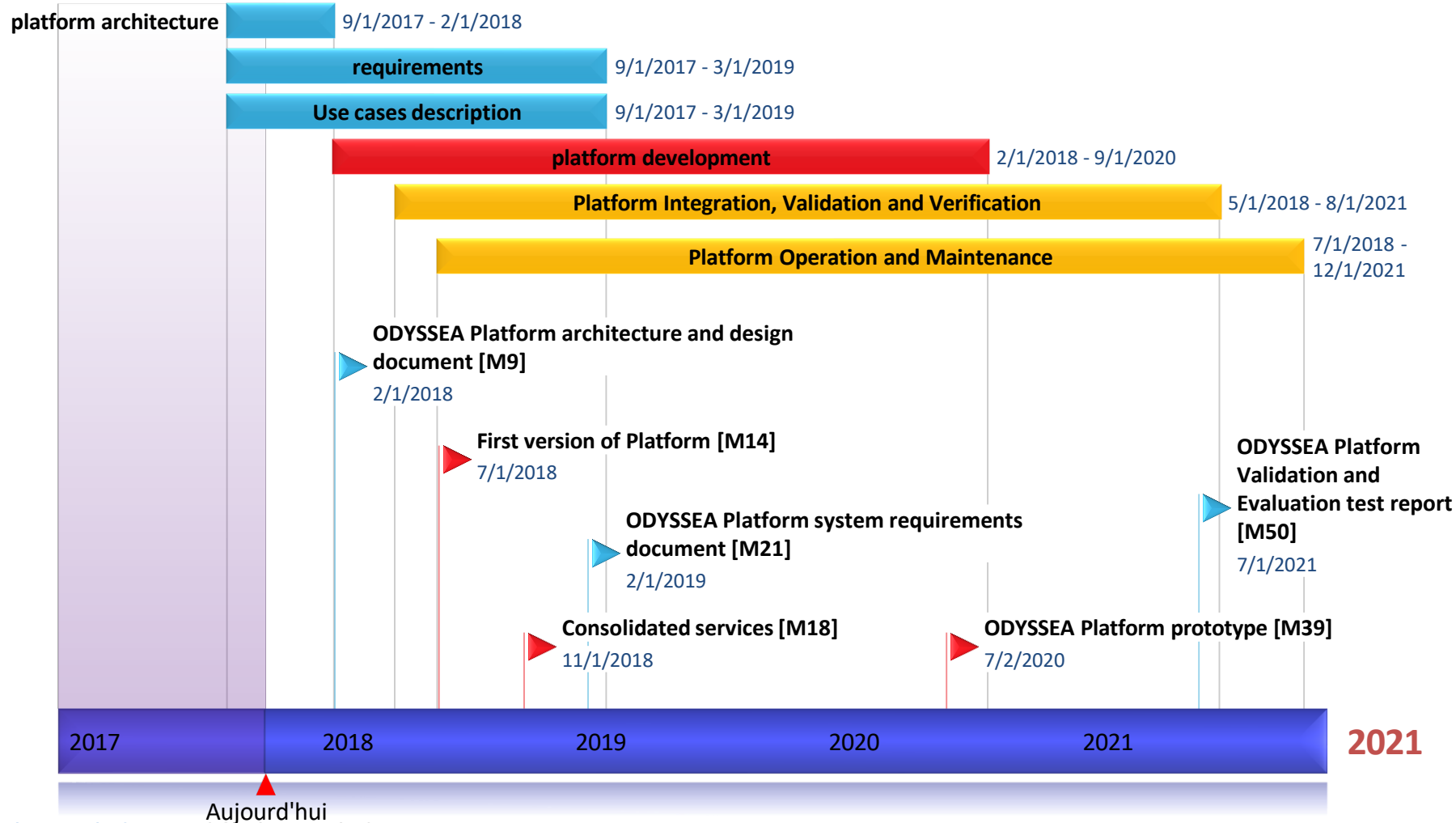


The Platform

ODYSSEA



ODYSSEA Platform RoadMap



The Observatories

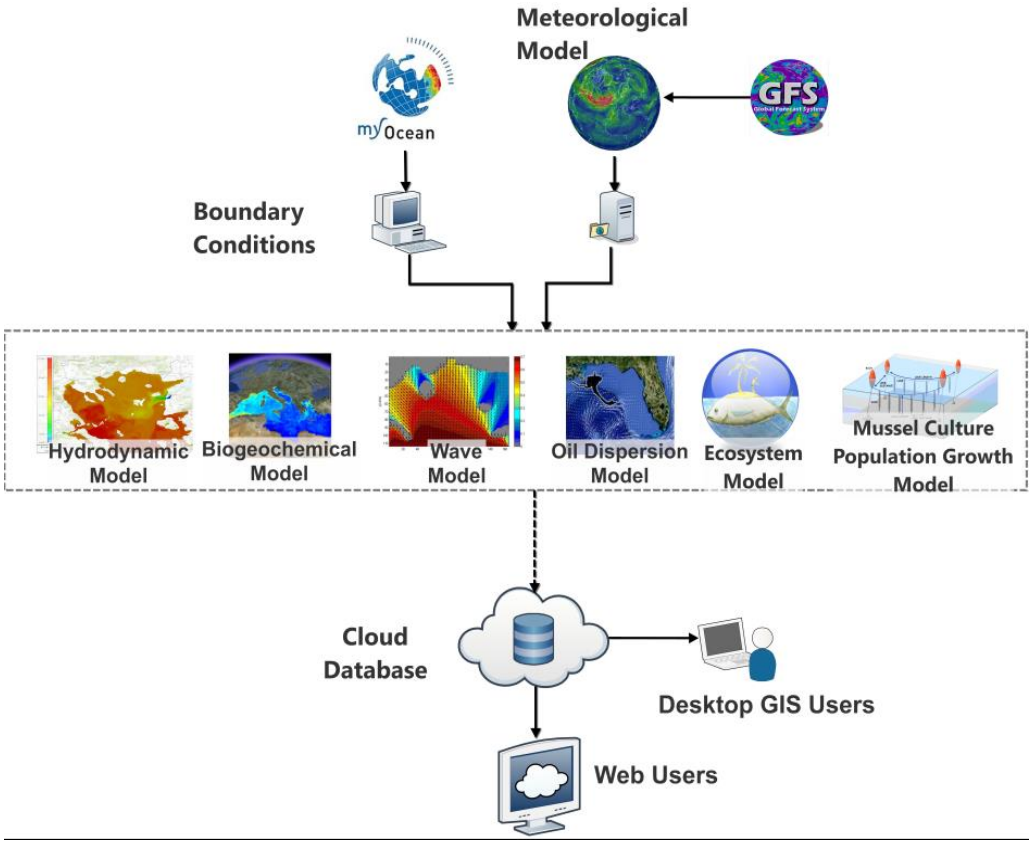
ODYSSEA

- ✓ Comprise a network of 9 observing and forecasting systems,
- ✓ Cover coastal and shelf zone environments,
- ✓ Cover Ecologically-vulnerable systems (MPAs) / systems with increased human pressure,
- ✓ Combine monitoring and modeling activities,
- ✓ Produce new datasets, store, manipulate, make accessible through the ODYSSEA platform,
- ✓ Data with increased temporal and spatial resolution.

The Models

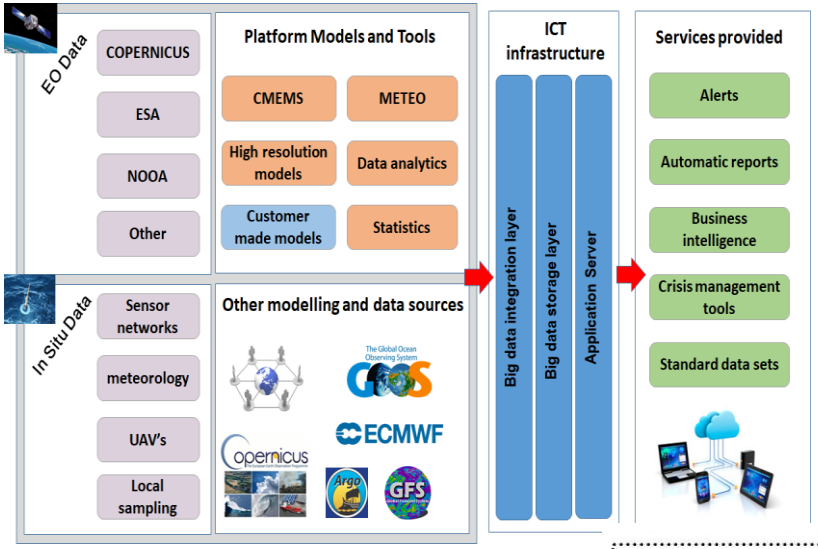
- ✓ A prototype ‘chain’ of operational models will be developed,
- ✓ Link models to existing databases,
- ✓ Provide short- and long-term prognostic results,
- ✓ Manage risks and emergencies in coastal and offshore areas,
- ✓ Meet the requirements of various end-user groups,
- ✓ Report on parameters never previously reported,

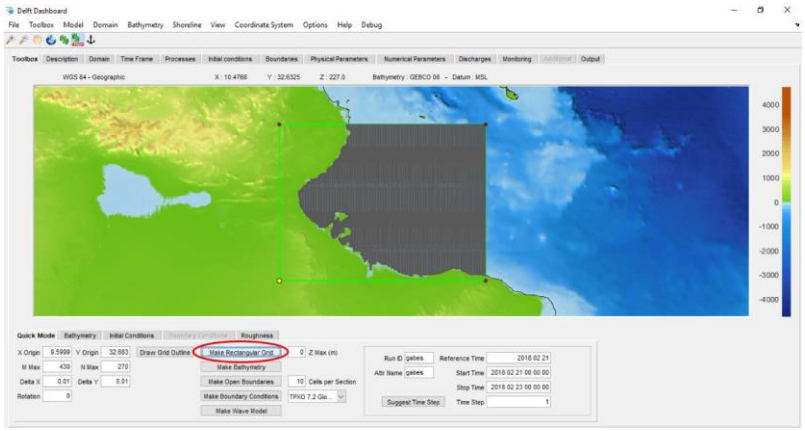
Models: Meteorological (WRF), 3Dhydrodynamic (Delft3D), Wave (SWAN), Oil spill (MEDSLICK-II), Water quality (DELWAQ), Ecosystem models (Ecopath with Ecosim), Fish and Mussel/oyster culture population growth

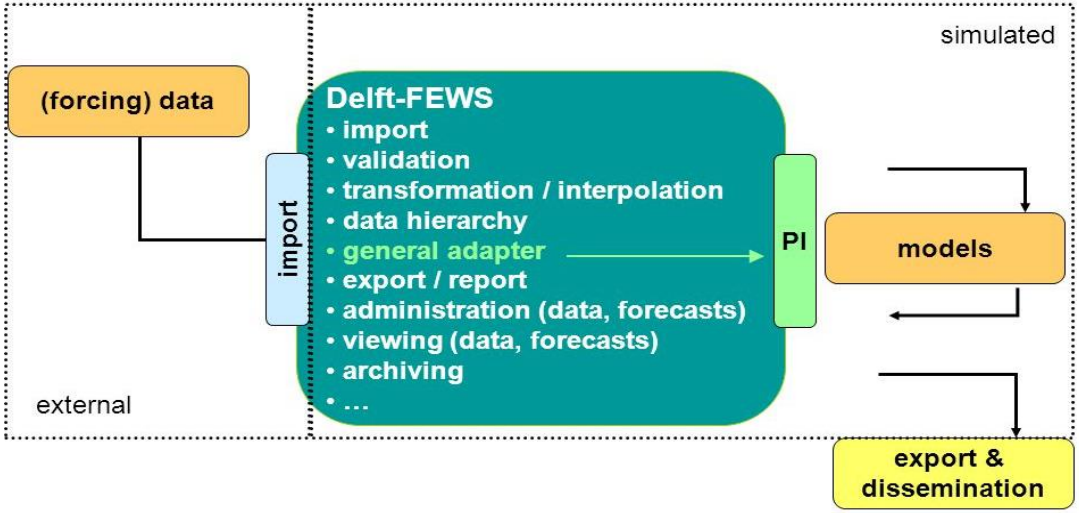


AQUASAFE vs FEWS

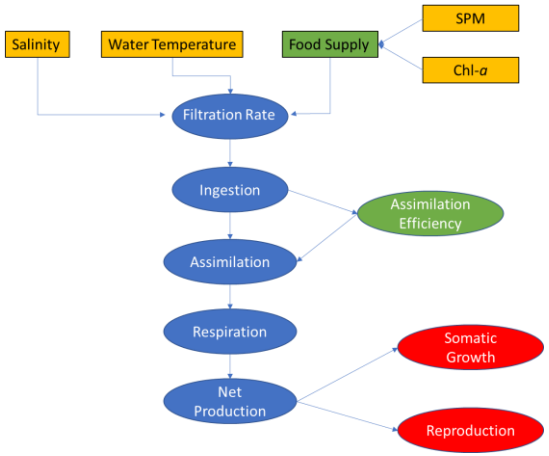
ODYSSEA

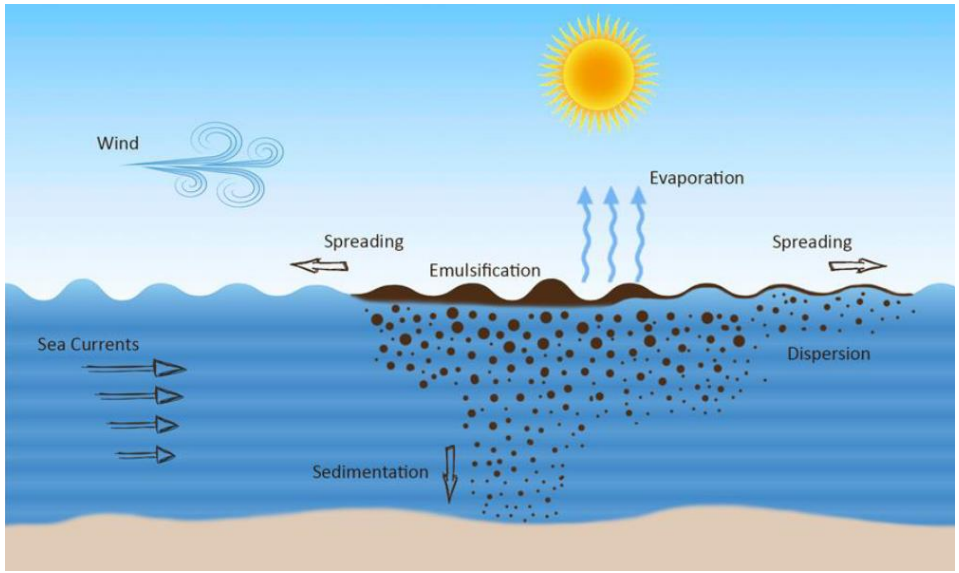


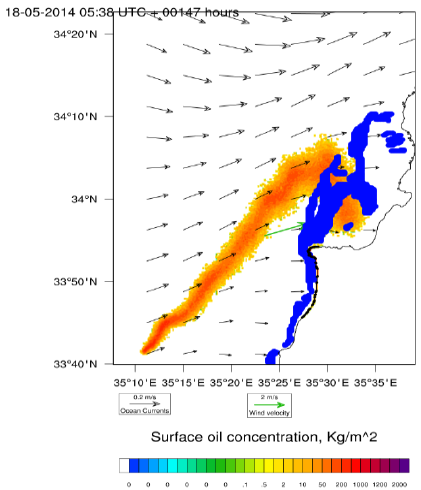


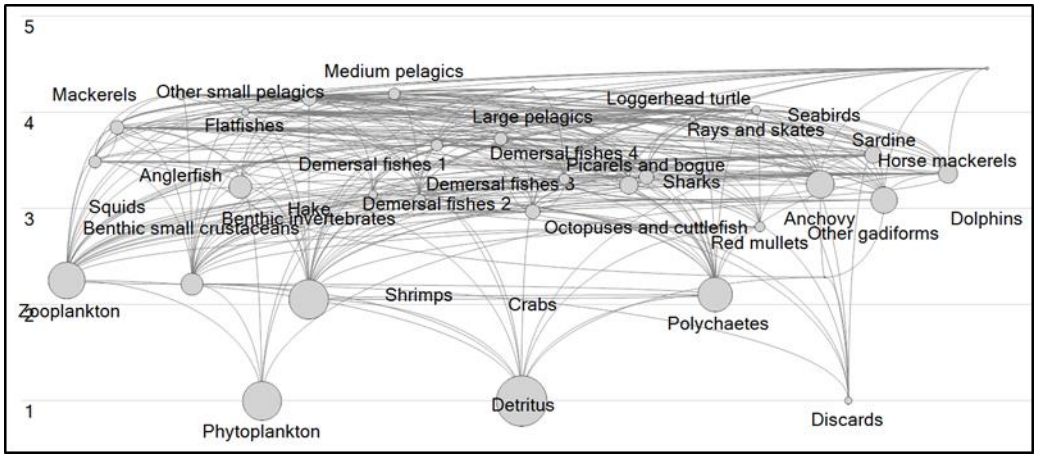


ODYSSEA Modeling System









The Sensors

- ✓ Expand the operational capacity of existing systems,
- ✓ Test the integration of novel sensors, such as fluorometer, hydrophones, submarine cameras, and micro-plastic sensors,
- ✓ Analyze acoustic signals for marine mammals detection and noise monitoring,
- ✓ Use images and videos for benthic organisms and fish species recognition, classification and tracking,
- ✓ Develop static and mobile data collection systems for NRT monitoring.

Develogic's Sea Floor Lander

Alseamar's Sea Explorer

The Sensors

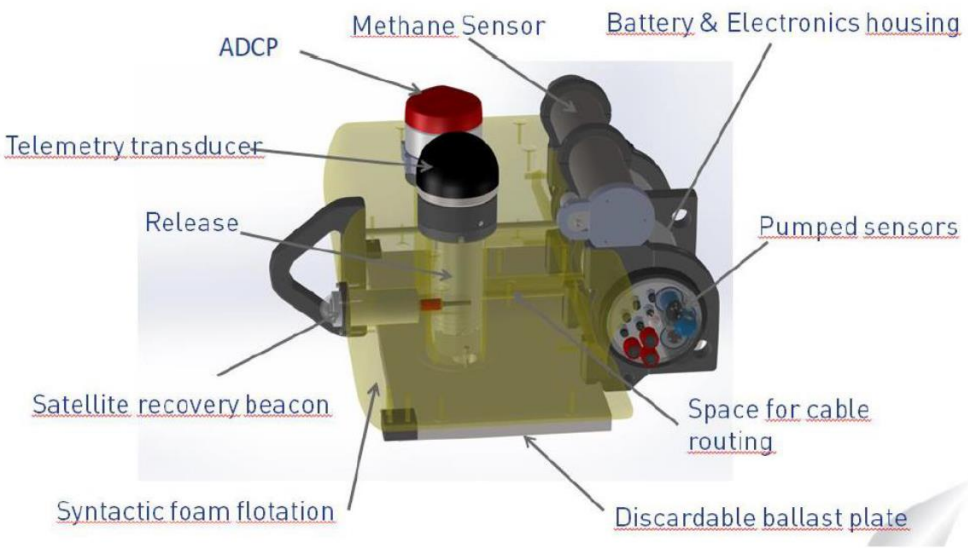
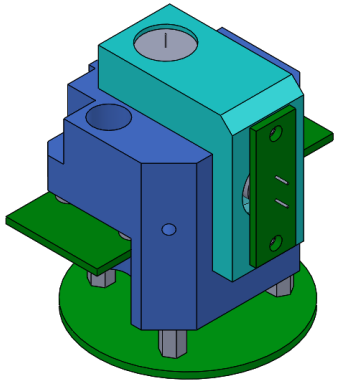
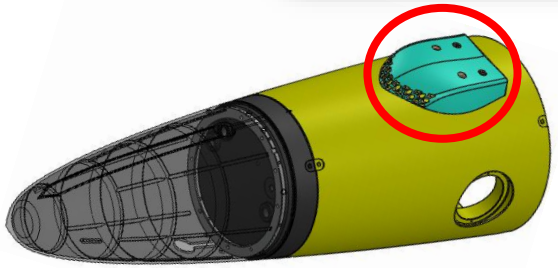


Figure 2. The Modular Seafloor Lander (MSL) and its components and configuration.





The Sensors

ODYSSEA will develop a prototype monitoring module:

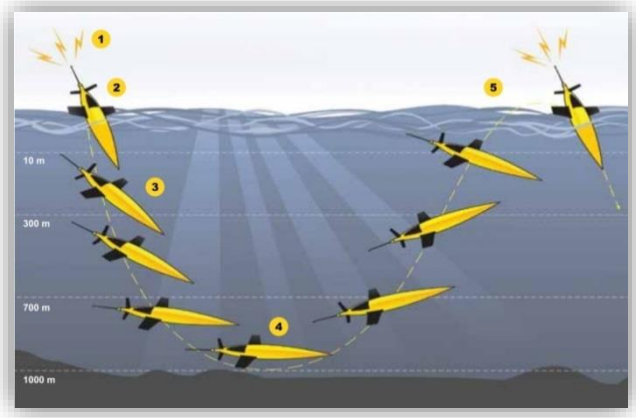
- Two data collection systems: static and mobile
- Deployed at each ODYSSEA Observatory
- Continuous real-time monitoring at each site
- Surface platforms include typical sensors as: temperature, salinity, DO, turbidity, fluorometer.
- Bottom platforms additionally will include ADCP and novel sensors for emerging pollutants, such as micro-plastics, submarine cameras and hydrophones.
- To reduce costs and to ensure active participation of end-users on ODYSSEA platform, existing facilities (onshore and offshore) will be used to deploy static sensors.

ODYSSEA Monitoring Systems

The Sensors

A series of gliders will be used to monitor physical, chemical, biological and acoustical parameters at selected Observatories
SEA EXPLORER will move at a speed of 1 knot, covering the surface, the whole water column and the benthos.

Mobile Sensors



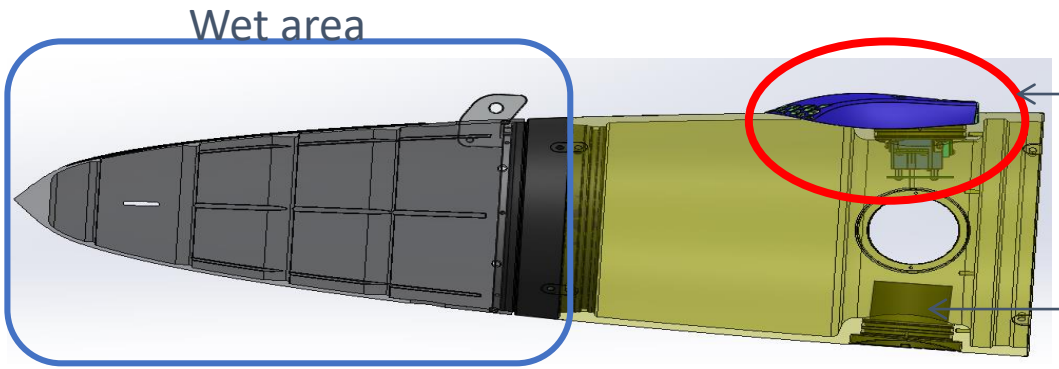
ODYSSEA Monitoring Systems

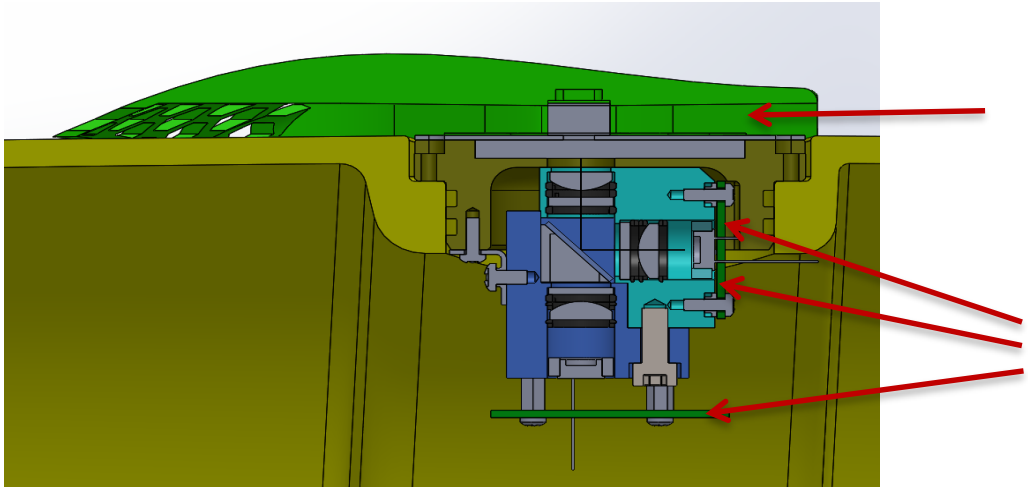
Three glider payloads will be tailored:

1. GPS, CTD, DO, Phyto, SPM, CDOM , Turbidity
2. PAM, camera
3. CTD, micro plastic

The Sensors

ODYSSEA





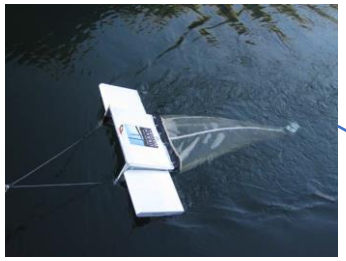
MP Acquisition system

Electronics (PCBs)

State of the art

COMMON SENSE
MARINE SENSORS - MARINE MONITORING

Manta



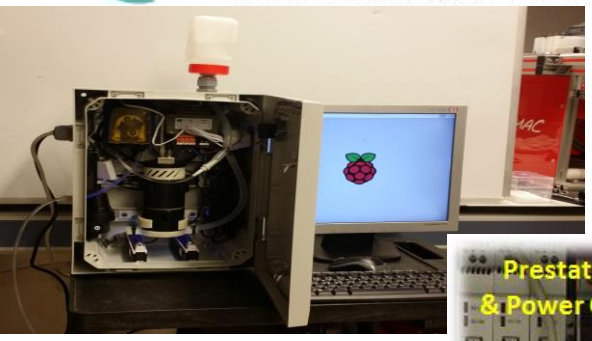
telescopic sampling pole

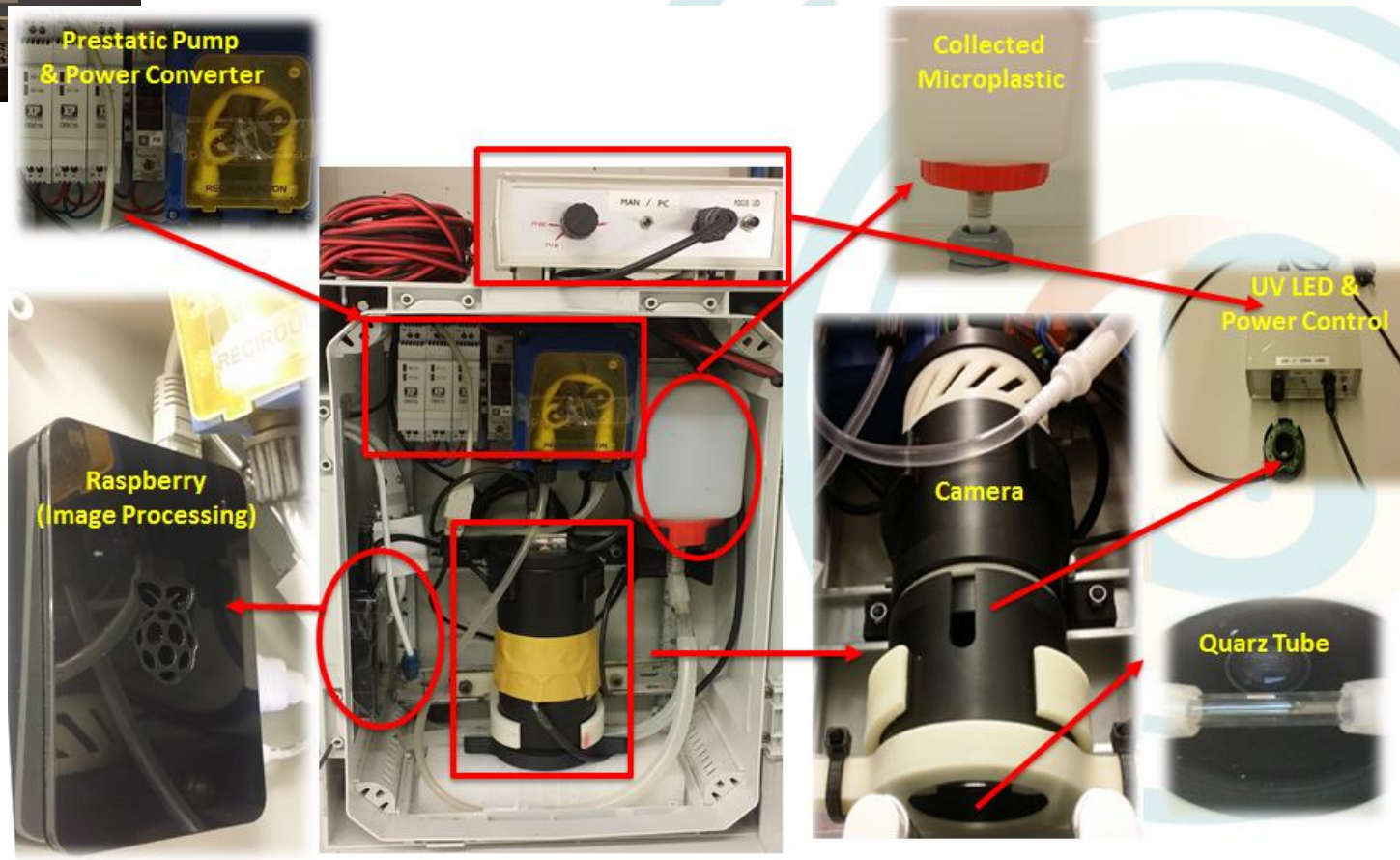
Acquisition → Transport → Analysis

This project has received funding from the European Union's Seventh Programme for research, technological development and demonstration under grant agreement No 614155.

NEW VERSION SENSOR

COMMON SENSE
MARINE SENSORS - MARINE MONITORING





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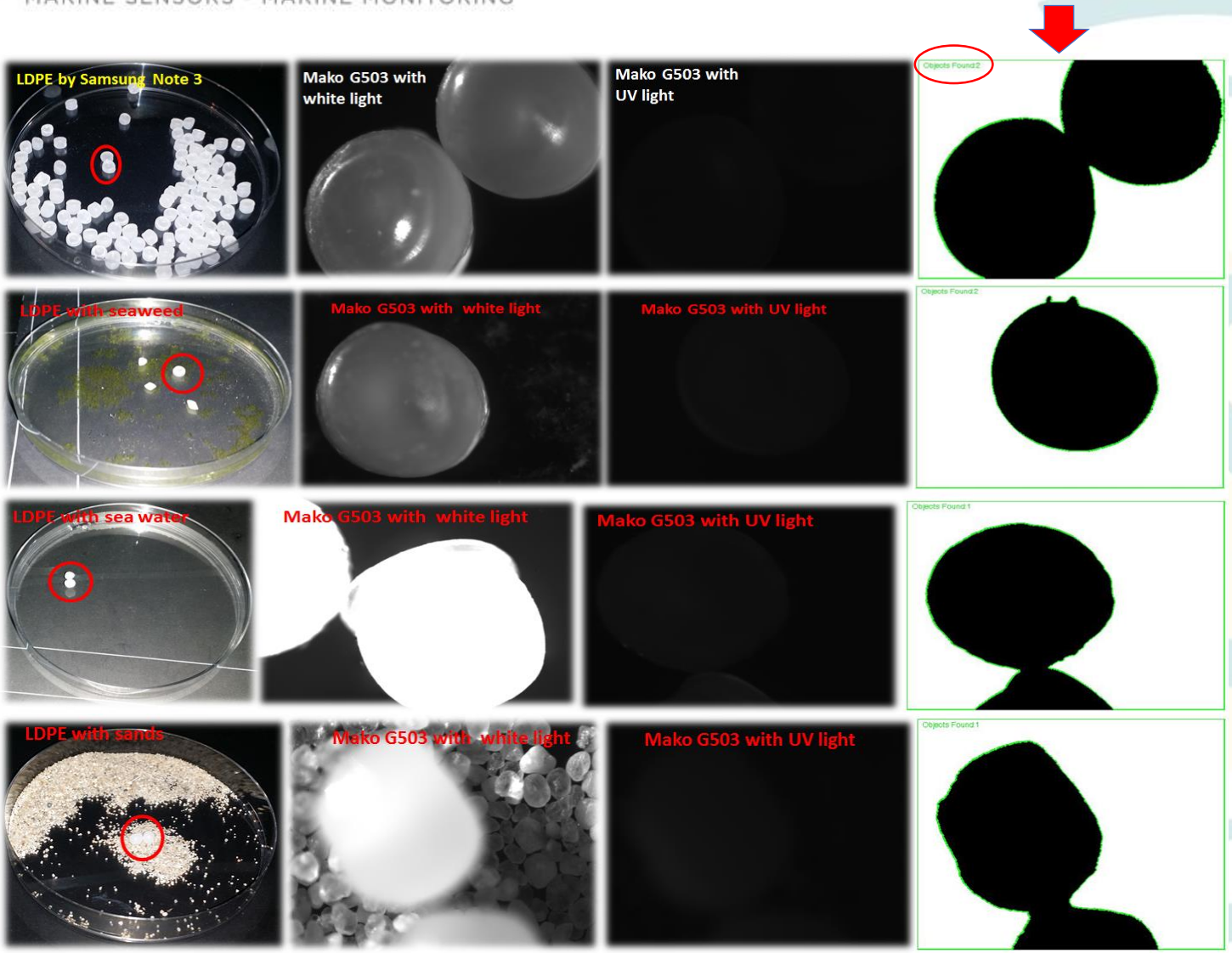
COMMON SENSE
MARINE SENSORS - MARINE MONITORING

MICROPLASTICS ANALYSER

DETECTION & QUANTIFICATION



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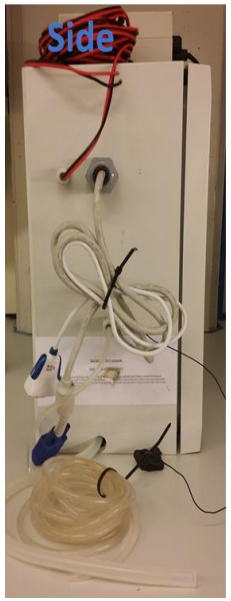
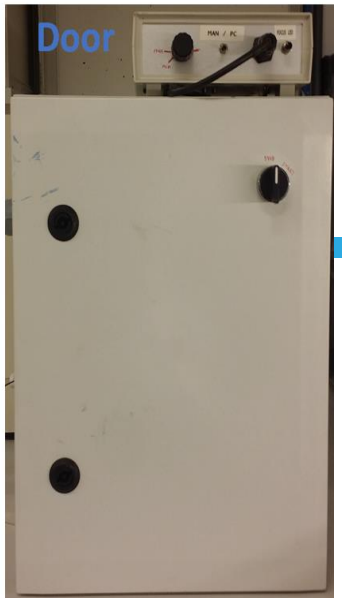
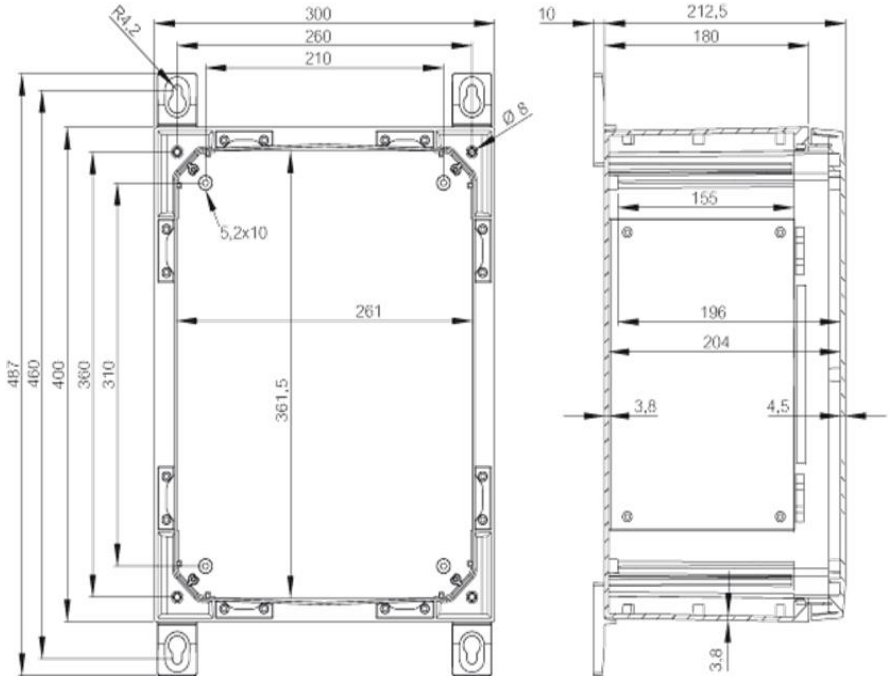
www.commonsenseproject.eu





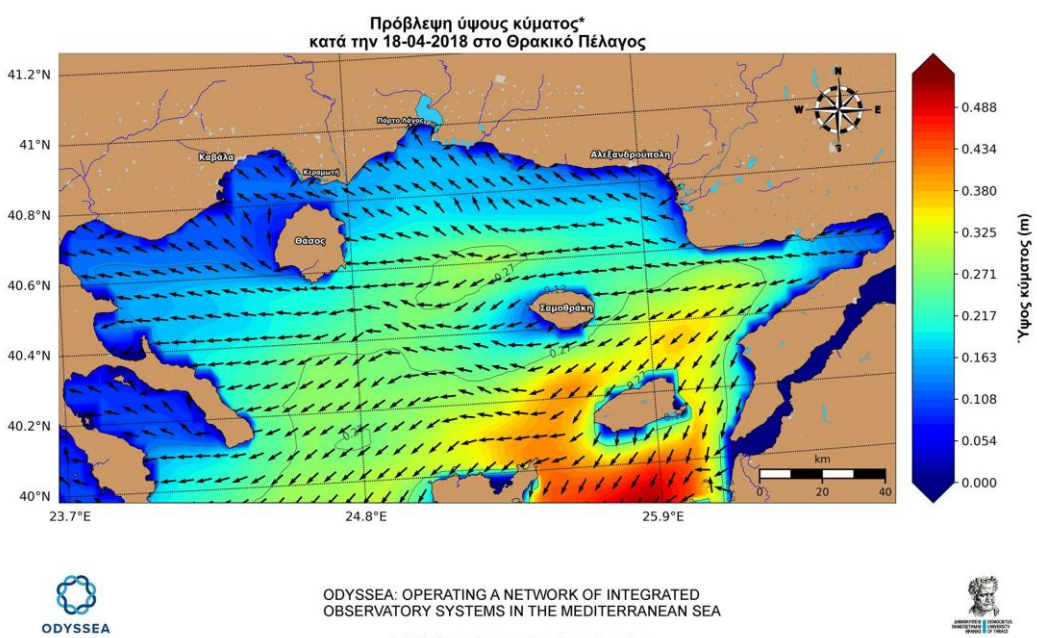


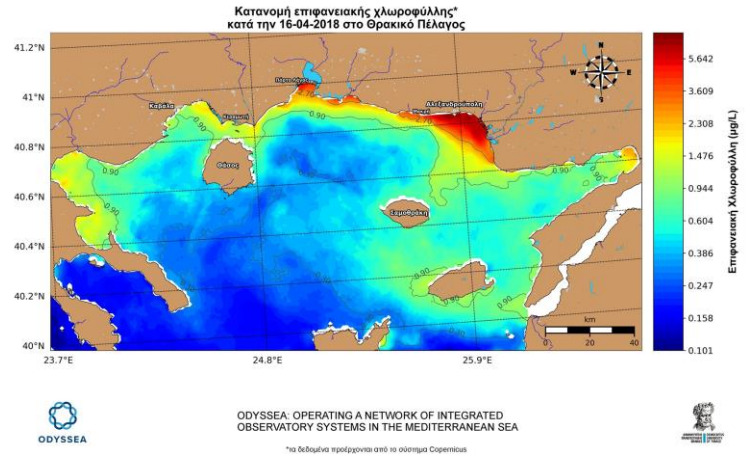
Microplastic Sensor --Technical Description

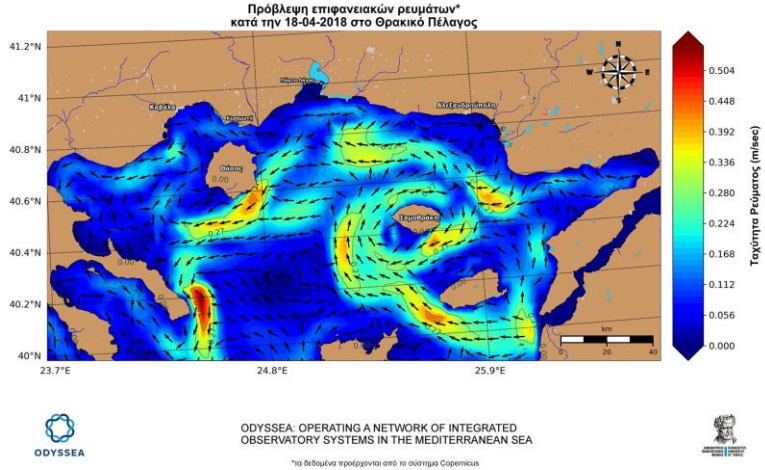
Microplastic Sensor system is used to detect and quantify the Microplastic by optical interrogation techniques. The system is to enhance real-time sample acquisition and data processing automatically

Dimension (mm) (W*L*H)	200*300*400
Input power source	24V DC
Power Consumption	26.58VDC@0.96A ≈ 25W
Operation mode	Automatic operation by implementation of script to execute different routines and procedures
Real-time processing	The processing time is 0.5 s
Water flow speed	The flow rate is 7L/h
Communication Interface	Serial Interface to Smart Sampling Unit (SSU)(NMEA protocal)
Technology	➢ Fluorescence technology to avoid water absorption ➢ UV image real-time acquisition ➢ Detection and quatification MP particals according to fluorescence level ➢ Fluidic filter to detect and store microplastic particles.
Performance	Can detect and quantify 70% of common Microplastics in the sea, including polyethylene, polypropylene, polystyrene, polyester, ploy amide

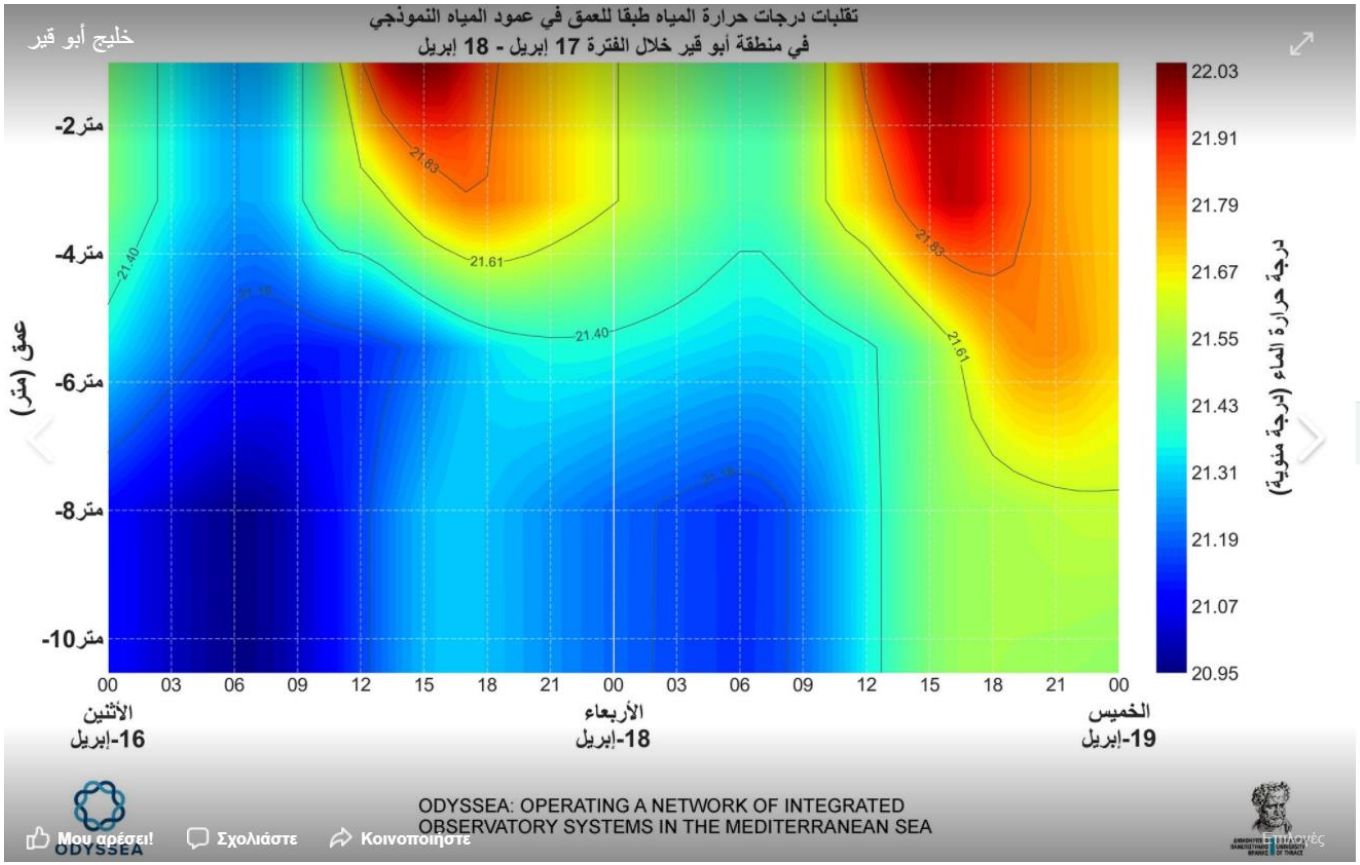
ODYSSEA - Greece



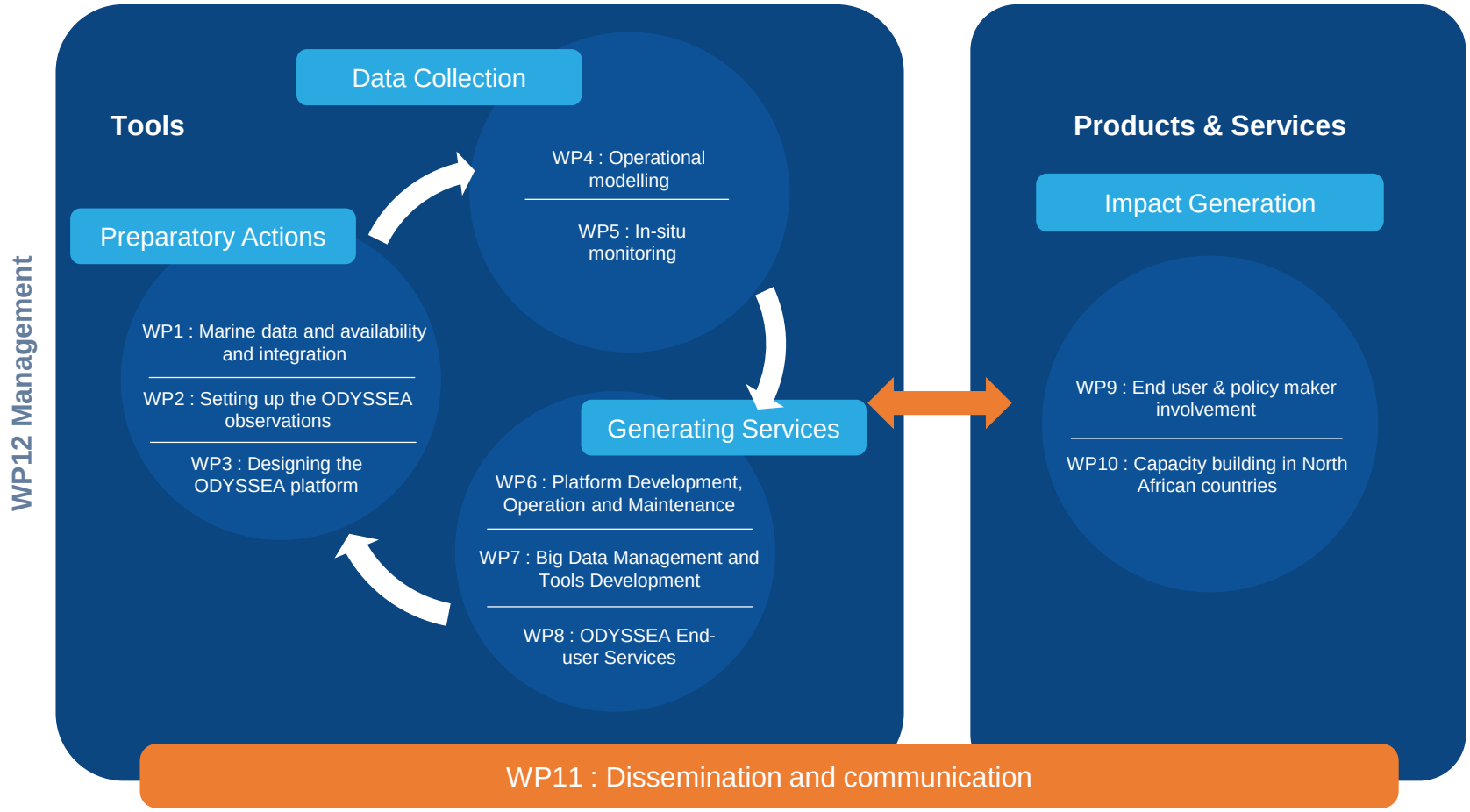




ODYSSEA - Egypt



The ODYSSEA Work Plan



ODYSSEA Consortium

- **Knowledge developers**

DUTH (GR), FORTH (GR), Technion (IS), Sapienza (IT), Deltares (NL), IU (TR), HCMR (GR), UNIBO (IT), AUTH (GR)

- **Technology providers**

Alseamar (FR), Leitat (SP), Hidromod (PT), Develogic (GER), GTD (SP), CLS (FR), Thales (FR), Edisoft (PT), Blue Lobster (UK)

- **Policy makers**

UNEP-WCMC (UK), UNEP RAC-SPA (TUN)

- **Service Providers**

VPF (SP), AGIR (MOR), NSV (ALG), ANDDCVS (TUN), RAED (EG), EcoOcean (IS), SPNI (IS), Agora (IS)

ODYSSEA in Numbers

- 28 partners from 14 countries (6 non-EU)
- 8.398 M € budget
- 54 months duration
- Starting date 1st June 2017
- Ending date 30th November 2021
- 932 PMs in total
- 128 Researchers participating
- 7 Advisory Board members

1st ODYSSEA Summer School – 3-13/9/2018

ODYSSEA

Operational Oceanography for Science, Business and Society

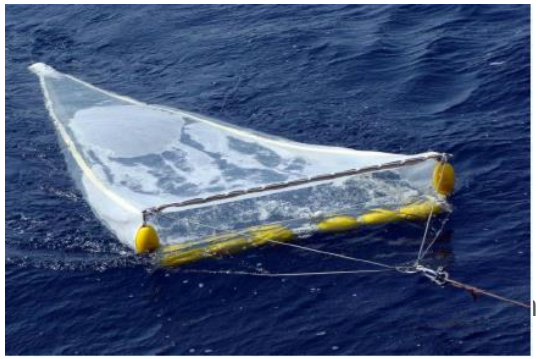
Kavala, Greece!

North Aegean's best kept secret, finally revealed

litterFREE approach

Apply the JRC protocol for MSFD implementation in the field of Marine Litter monitoring

- Descriptor 10.1.1 T1 & T2 for marine litter in beaches (Greece)
- Descriptor 10.1.2 Water T1 for marine litter at sea surface through visual census (Ukraine)
- Descriptor 10.1.2 Water T3 for marine litter at sea surface through towed nets (Georgia)
- Descriptor 10.1.2 Seafloor T1 for marine litter at sea bottom through divers



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THANK-YOU

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