

Blue Growth - Blue BioTech

Methodological advances to assess sustainably use the oceans, seas and marine resources

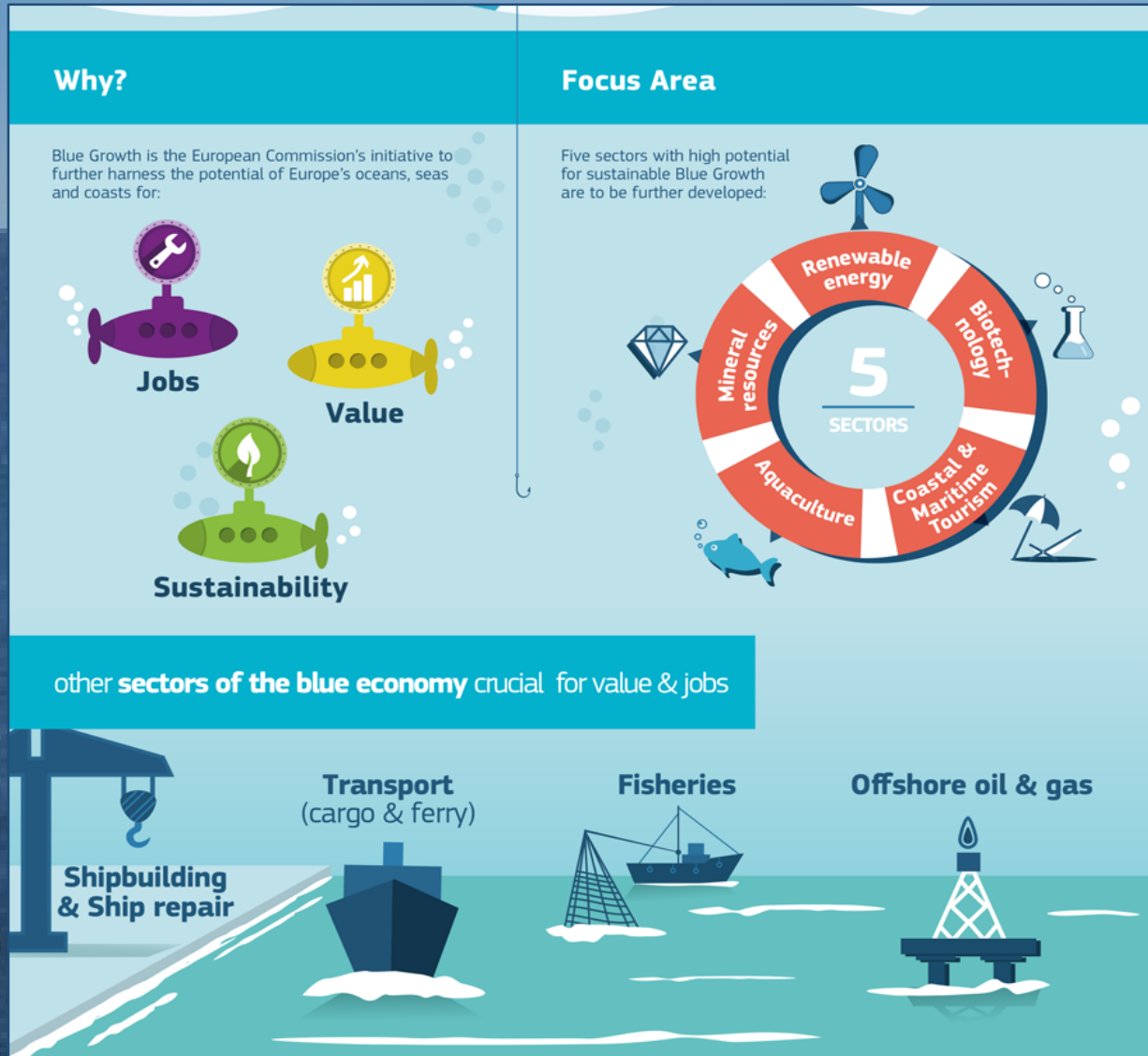
International learning Camp, Blue Growth Sector Session - Blue BioTech

26 March 2021

Helena Adão- MARE-University of Évora

Blue Growth Strategy

Sustainability of the marine environment



Blue Growth

Develop sectors that have a high potential for sustainable jobs and growth, such as:

Aquaculture; coastal tourism; marine biotechnology; ocean energy; seabed mining

Drivers of the Blue Economy

Why to **assess** sustainably use the oceans, seas and marine resources?



Drivers of the Blue Economy

- **Aquaculture**
- Coastal tourism
- Marine biotechnology
- Ocean energy;
- Seabed mining

Why to assess sustainably use the oceans, seas and marine resources

Drivers of the Blue Economy

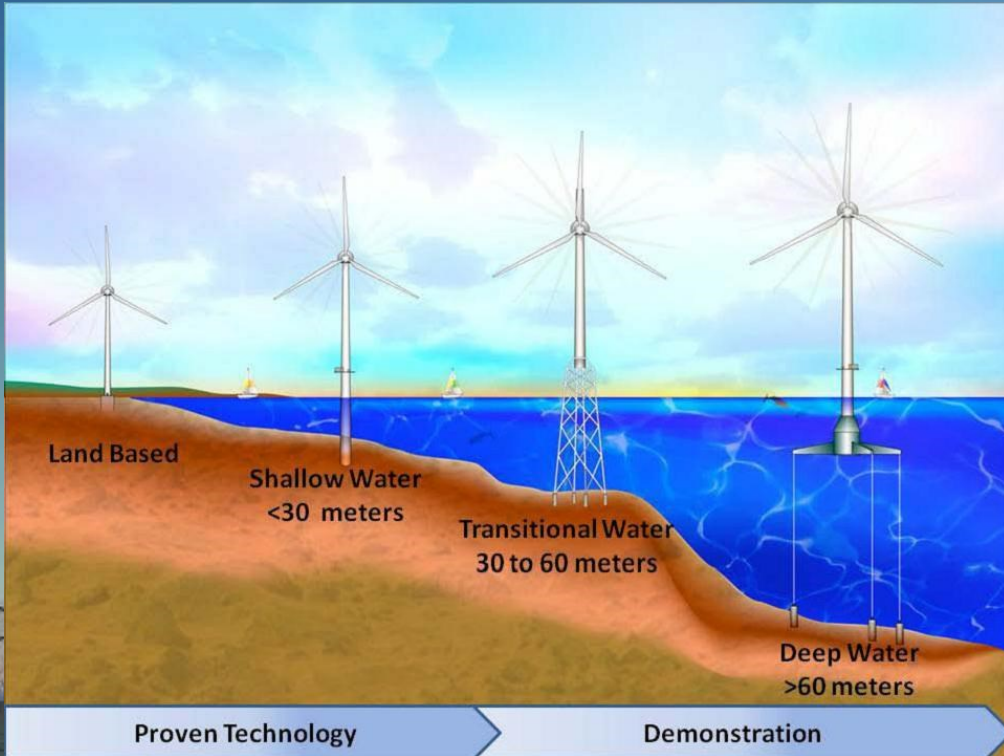
- **Aquaculture**
- Coastal tourism
- Marine biotechnology
- Ocean energy;
- Seabed mining



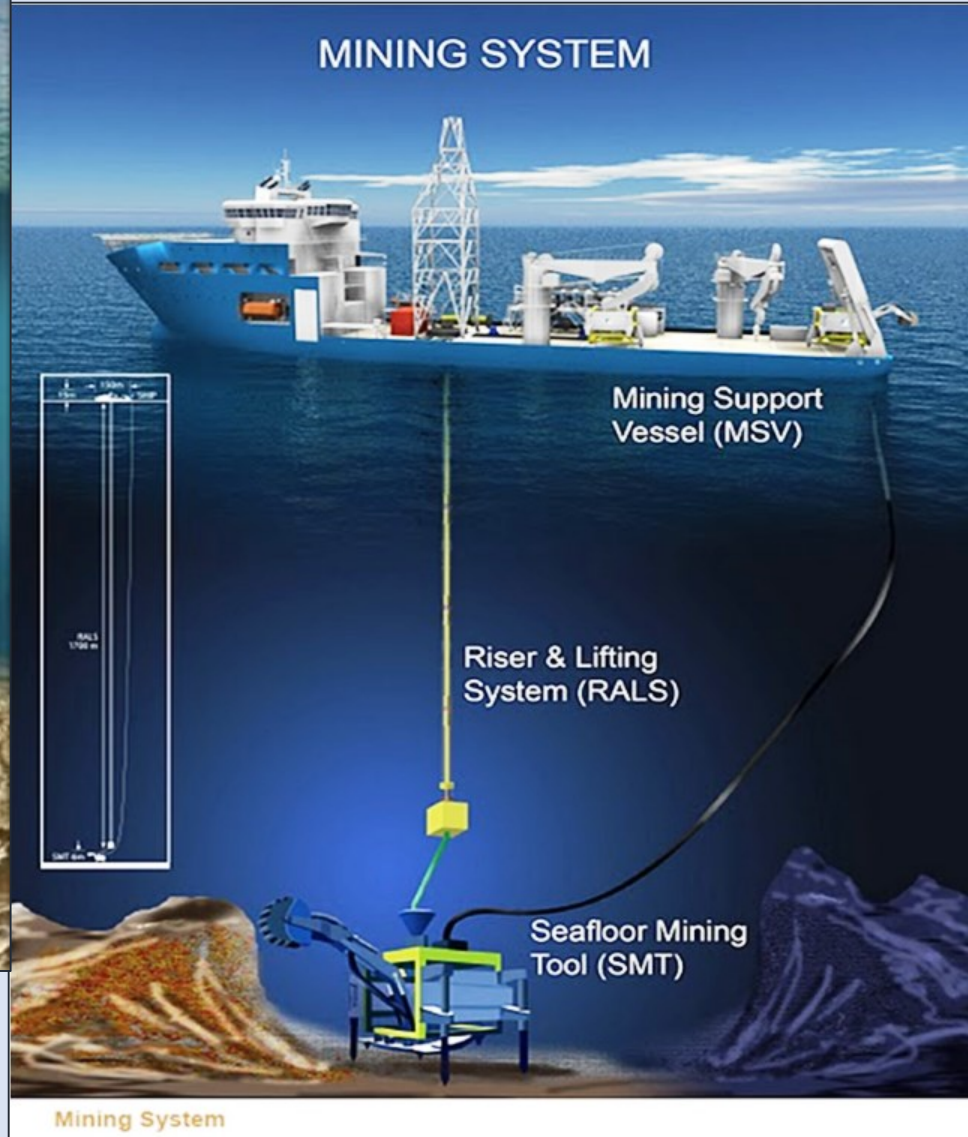
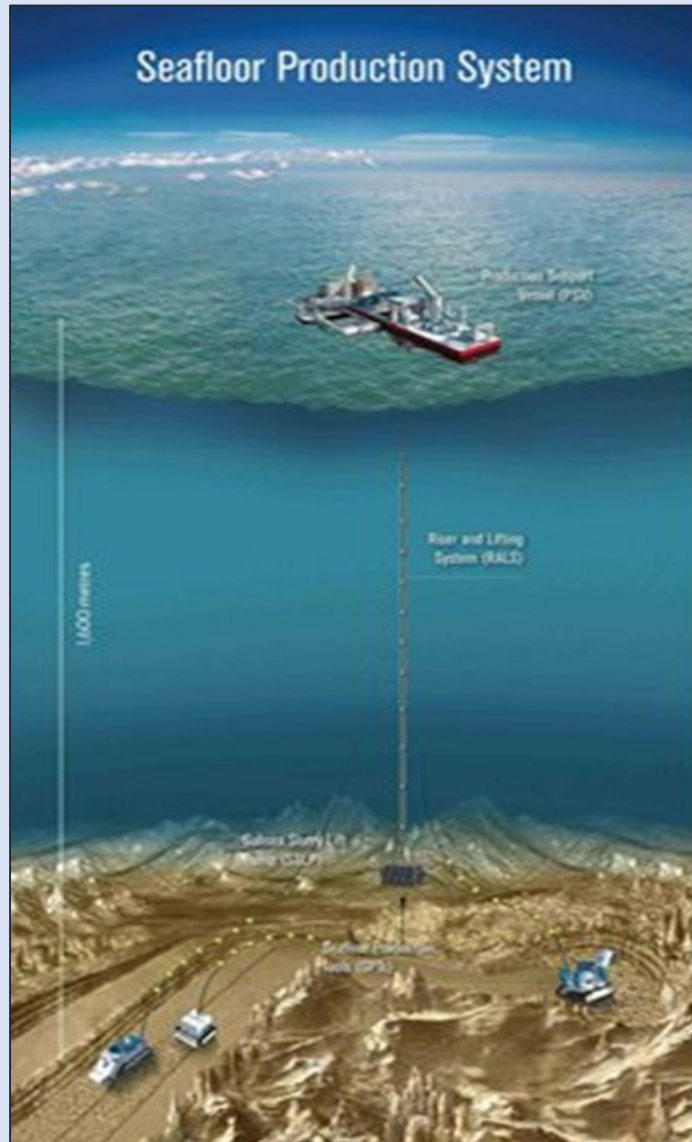
Why to assess sustainably use the oceans, seas and marine resources

Drivers of the Blue Economy

- Aquaculture
- Coastal tourism
- Marine biotechnology
- **Ocean energy;**
- Seabed mining



Why to assess sustainably use the oceans, seas and marine resources



Drivers of the Blue Economy

- Aquaculture
- Coastal tourism
- Marine biotechnology
- Ocean energy;
- **Seabed mining**



Why to **assess** sustainably use the oceans, seas and marine resources



Sediment plumes (dredging effects)

Drivers of the Blue Economy

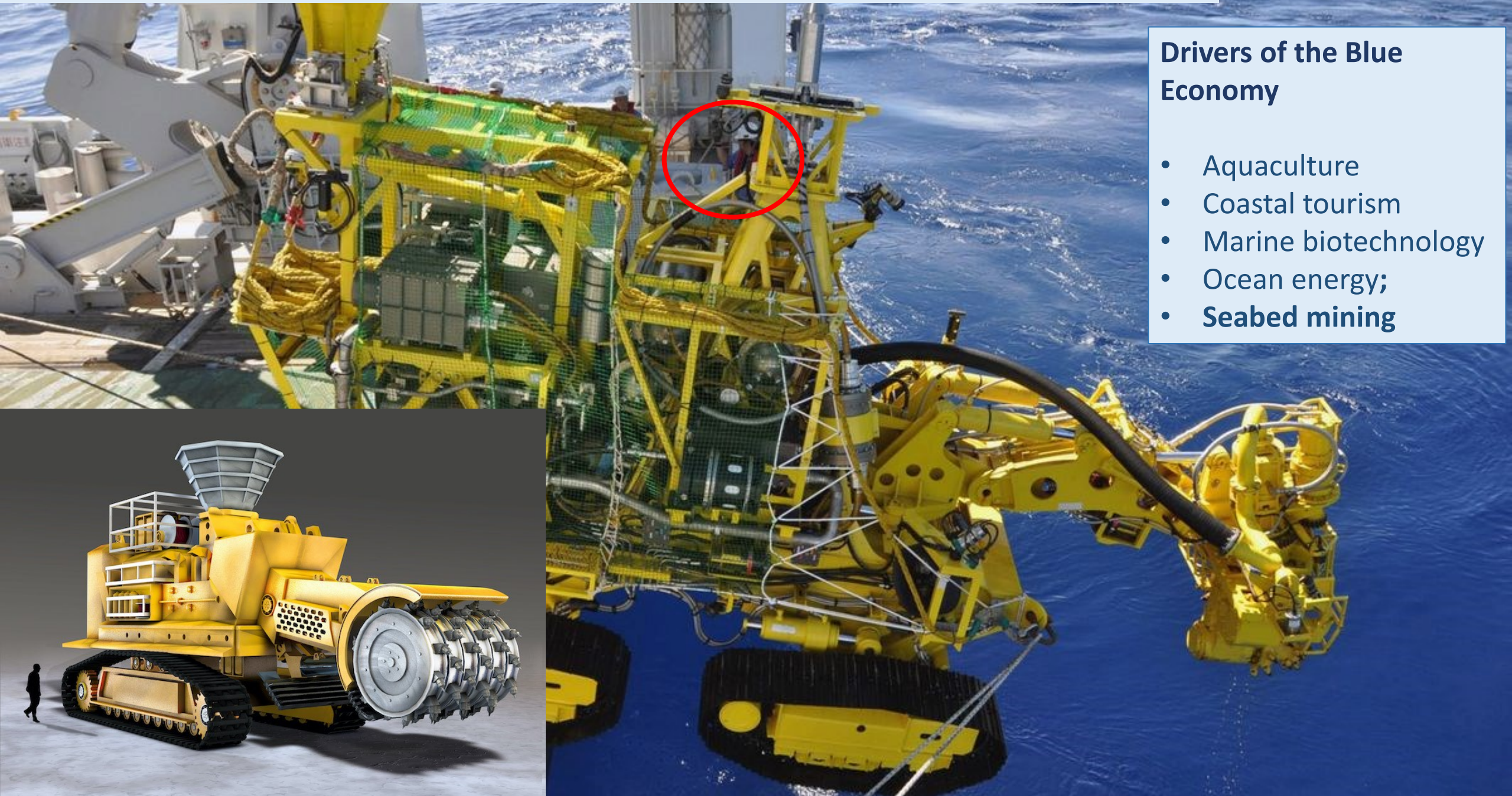
- Aquaculture
- Coastal tourism
- Marine biotechnology
- **Ocean energy;**
- **Seabed mining**



Why to **assess** sustainably use the oceans, seas and marine resources

Drivers of the Blue Economy

- Aquaculture
- Coastal tourism
- Marine biotechnology
- Ocean energy;
- **Seabed mining**



Legislative Tools (EU) to assess sustainably use the oceans, seas and marine resources

- Maritime spatial planning and integrated coastal management in EU Member States
- Water Framework Directive
- Natura and Habitats Directives
- Biodiversity Strategy

- Integrated Maritime Policy
- Strategy on Climate Change Adaptation
- Renewable Energy Directive
- Motorways of the Sea Initiative Common fishery Policy

Marine Strategy Framework Directive (MSFD) Protecting European`s Seas and Oceana

25.6.2008

EN

Official Journal of the European Union

L 164/19

DIRECTIVES

~~DIRECTIVE 2008/56/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL~~

of 17 June 2008

establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive)

(Text with EEA relevance)

Achieve “Good Environmental Status” GES

GES means

that the **different uses made of the marine resources** are conducted at a sustainable level, ensuring their continuity for future generations.

- Ecosystems, including their hydro-morphological (i.e. the structure and evolution of the water resources), physical and chemical conditions, **are fully functioning and resilient to human-induced environmental change**;
- The **decline of biodiversity** caused by human activities is prevented **and biodiversity is protected**;
- Human activities introducing substances and energy into the marine environment **do not cause pollution effects**.
- **Noise from human activities** is compatible with the marine environment and its ecosystems.

MSFD What is new ?

Achieve “Good Environmental Status” GES

GES means in practice

TO ASSESS 11 qualitative descriptors

1. Biological diversity 	2. Non-indigenous species 	3. Population of commercial fish/shellfish 	4. Elements of marine food webs 
5. Eutrophication 	6. Sea floor integrity 	7. Alteration of hydrographical conditions 	8. Concentrations of contaminants 
Good Environmental Status	9. Contaminants in fish/seafood for human consumption 	10. Marine litter 	11. Introduction of energy including underwater noise 

KNOWLEDGE

- Scientific knowledge about the European Seas **is the basis** for understanding and protecting them.
- Science and Policy need to be **closely linked** in order manage **natural marine resources**

Methodological advances to assess sustainably use the oceans, seas and marine resources

WE NEED ASSESSMENT AND MONITORING ADVANCE TOOLS

The **assessment** of state is required at three main ecological levels:

- **Species**
- **Habitats**
- **Ecosystems**  **Interactions (GAP Knowledge)**

1. Biological diversity 	2. Non-indigenous species 	3. Population of commercial fish/shellfish 	4. Elements of marine food webs 
5. Eutrophication 	6. Sea floor integrity 	7. Alteration of hydrographical conditions 	8. Concentrations of contaminants 
Good Environmental Status	9. Contaminants in fish/seafood for human consumption 	10. Marine litter 	11. Introduction of energy including underwater noise 

RESEARCH THEMATIC LINES

Research Group:
River Basins

Grupo Research Group:
Coastal Systems and Ocean

Hydraulics, Hydrology and
Sedimentary Environments

Biodiversity and Ecosystem
Functioning

Aquaculture and Fisheries

Environmental Risk

**Biotechnology and Resources
Valorisation**

**Technological Tools for
Exploration and Monitoring**

Governance and Literacy





R&D PROJECTS

ADVANCE TOOLS FOR TECHNOLOGICAL TOOLS FOR EXPLORATION AN MONITORING



UNIVERSITY OF ÉVORA

MIGRACORV

Integrated approach to study the movement dynamics of the meagre

FishNoise

Impact of anthropogenic noise on fish fitness

EVOLAMP

Genomic footprints of the evolution of alternative life histories in lampreys

D4Ss

Food-web approaches to assess the functional benthic ecosystem interactions for Marine and Coastal management



COASTNET

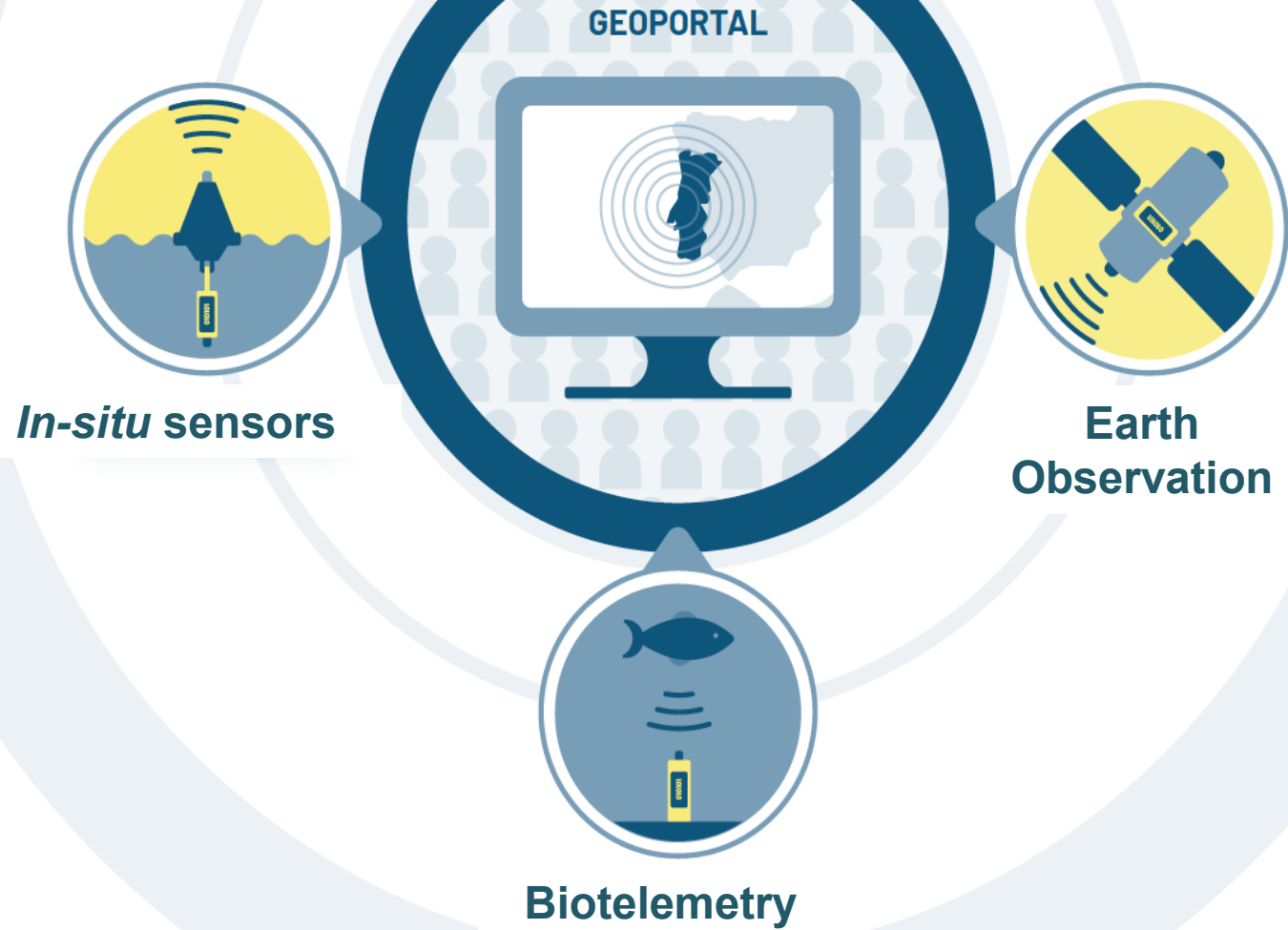
COASTAL MONITORING NETWORK

Portuguese Coastal
Monitoring Network



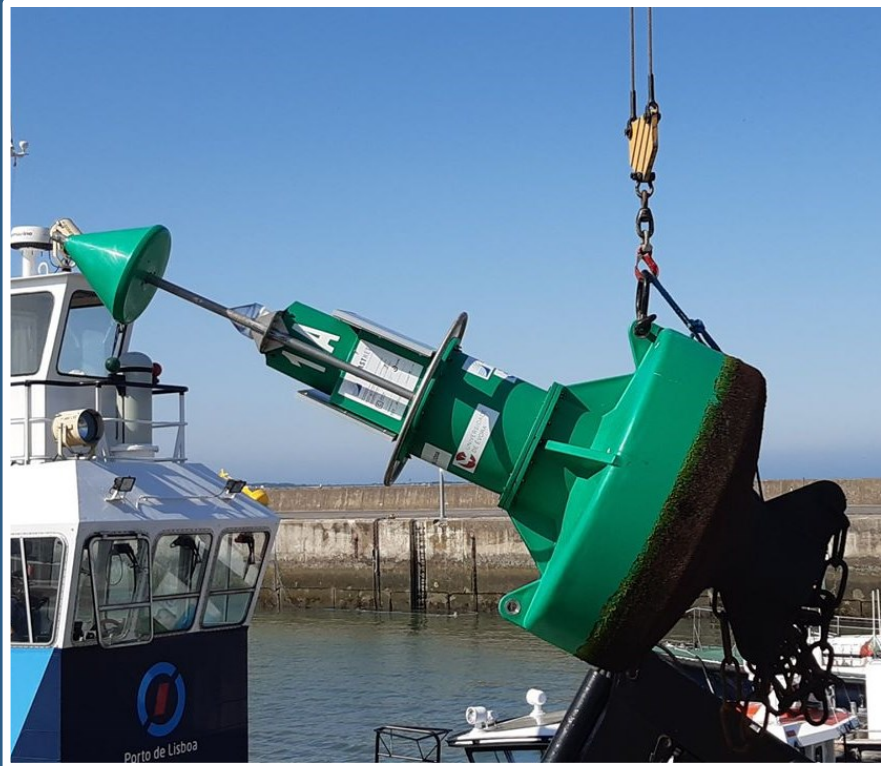


Lines of Action:





Environmental and Biological Monitoring System (EBMS)



Objectives

- Continuous and autonomous measurement of environm. parameters
- Key parameters for studying the structure of aquatic biological communities
- 3 estuarine systems
- 3 buoys in each system that cover the salinity gradient



Measurement and Data transmission



Measurements every
15 min



Data storage at logger



Data transmitted (GPRS)
4 times per day



Data available in the
Geoportal



- ✓ NRT (NRT)
- ✓ Time Series



Portuguese Tracking Network



- **For what?** Monitoring movement of aquatic organisms;
- **Where?** Coastal zone, estuaries and rivers;
- **How?** Record of acoustic signal transmitted by animal tags

Acoustic Transmitter



Acoustic Receiver



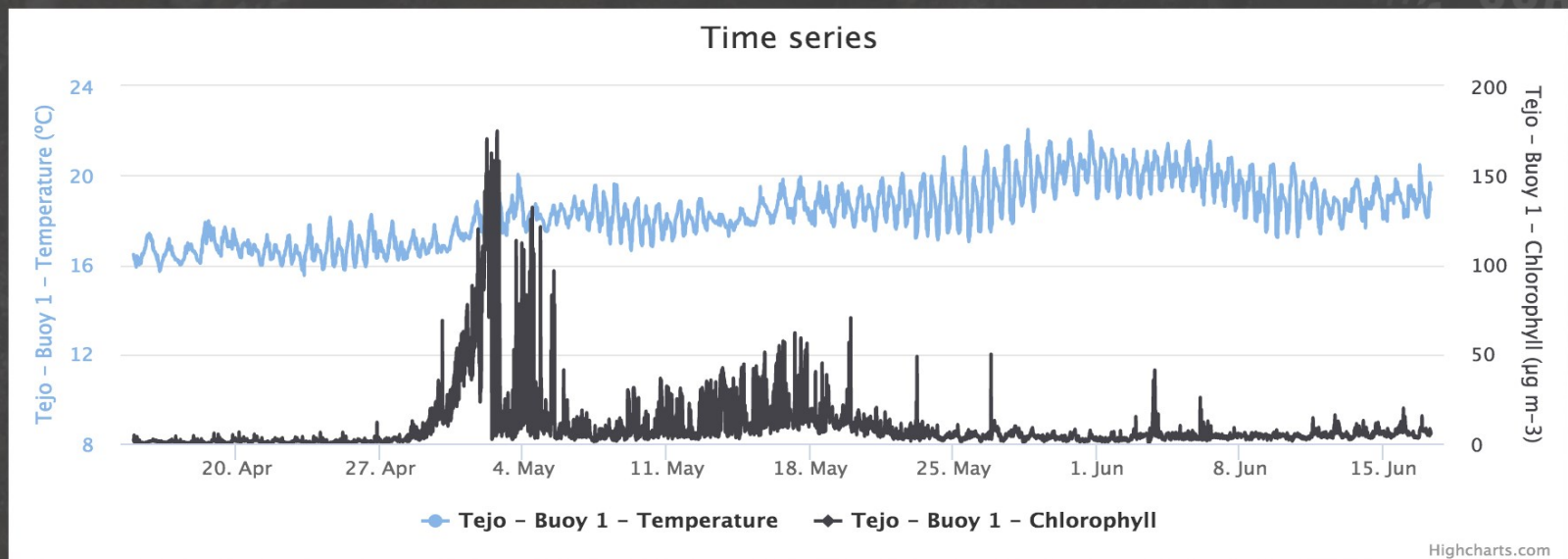
HELP

Tejo - Buoy 1 - Temperature

lite In-situ Sensor Biotele

- Mondego
- Tejo ✓
- Buoy 1 ✓
- pH
- Temperature ✓
- Salinity
- Dissolved oxygen
- Chlorophyll ✓
- Buoy 2
- Buoy 3

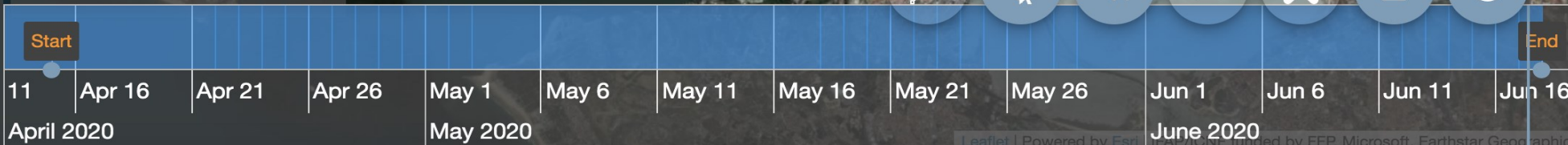
Lat: 38.701 Lon: -9.266



HELP

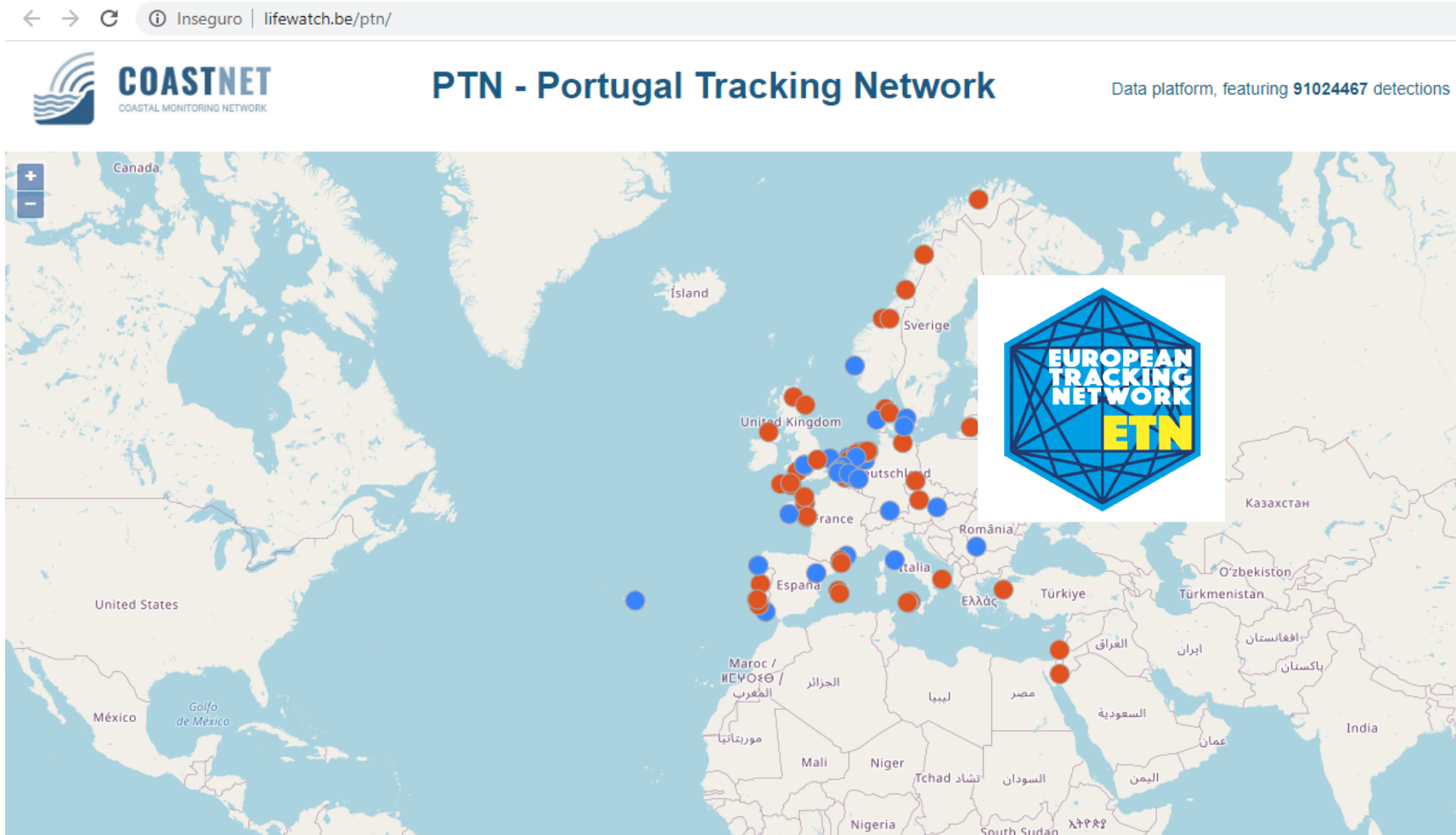
Get Data [Tejo - Buoy 1 - Temperature] CLOSE

Start Date: 4/15/2020 End Date: 6/18/2020





Data sharing Platform

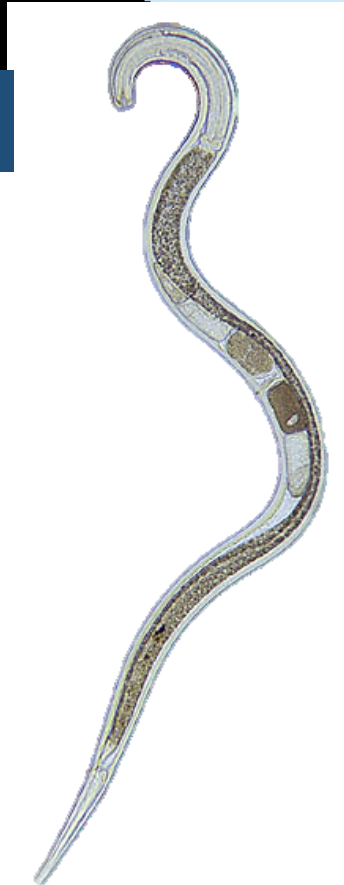


Project R&D

Development of a **novel molecular tool** for the rapid assessment of the biodiversity changes of benthic nematodes assemblages

Marine Nematodes as a “model “ for Marine Ecology

Nematodes reflect changes in environmental conditions, which make them strongly informative to assess the ecological integrity



The nematode abundance is high but only a few thousand species are currently described



The morphological identification is extremely complex



The conventional analysis, using microscope, requires a taxonomic expertise and has an enormous time-consuming

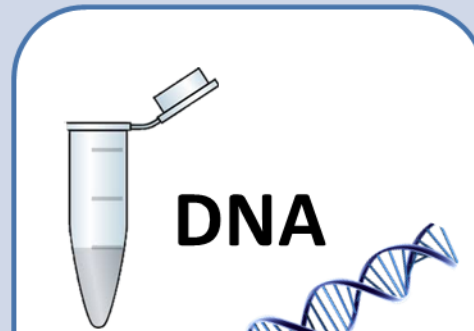
It is urgent the development of new tools for a rapid assessment of the biodiversity changes of benthic nematodes assemblages



From morphological to molecular analyses



Vouchering



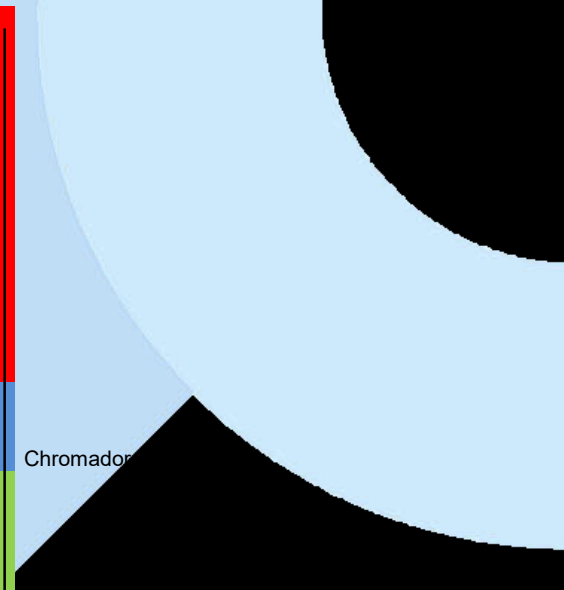
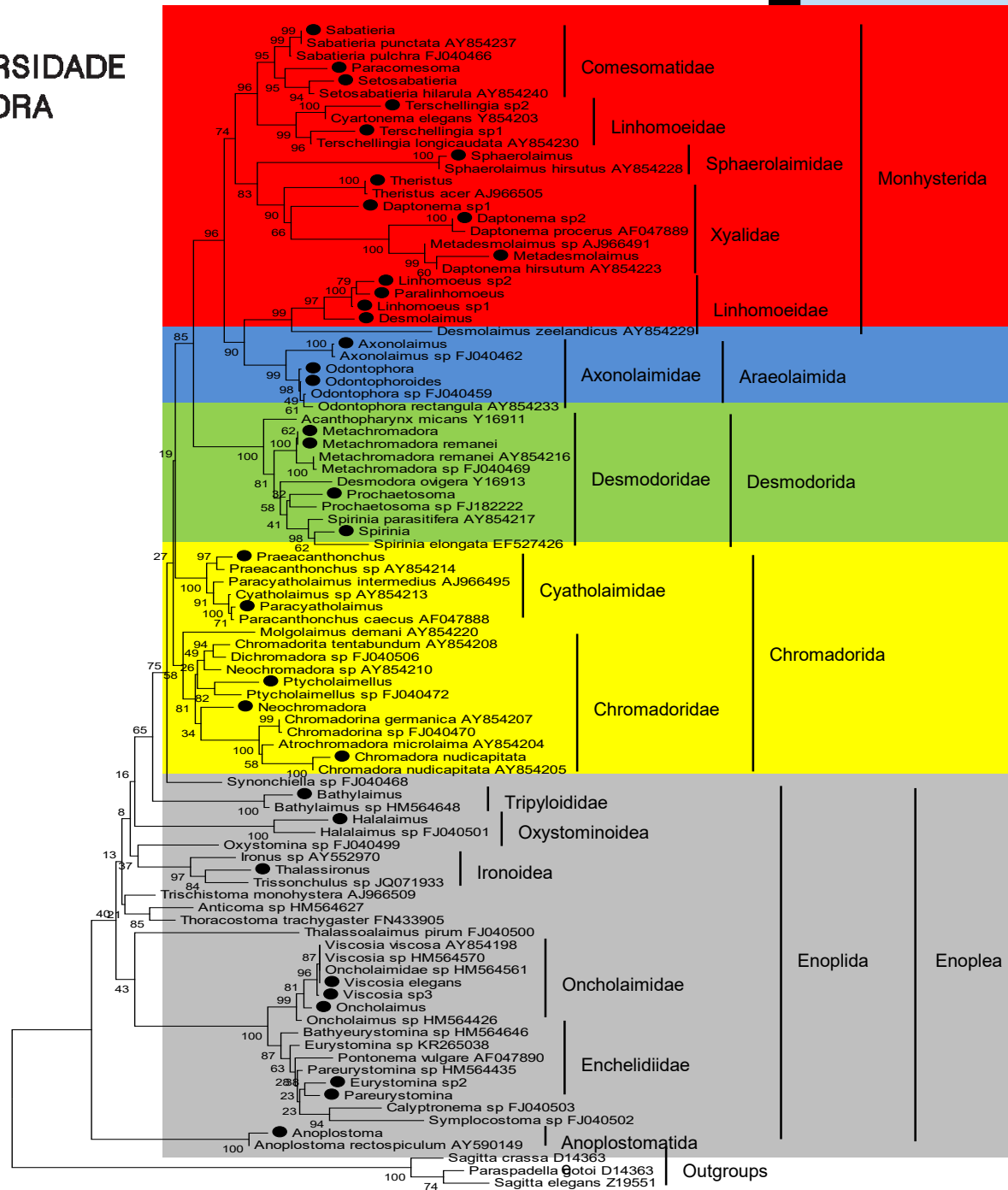
DNA



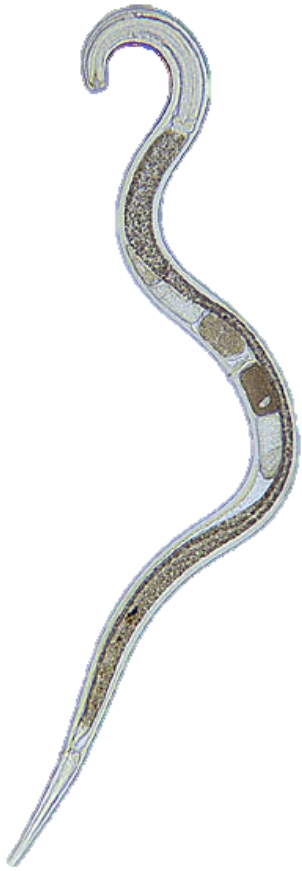
Barcoding



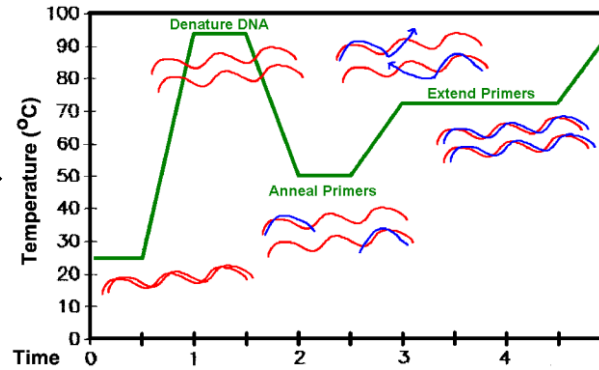
Barcoding 18S gene of the community



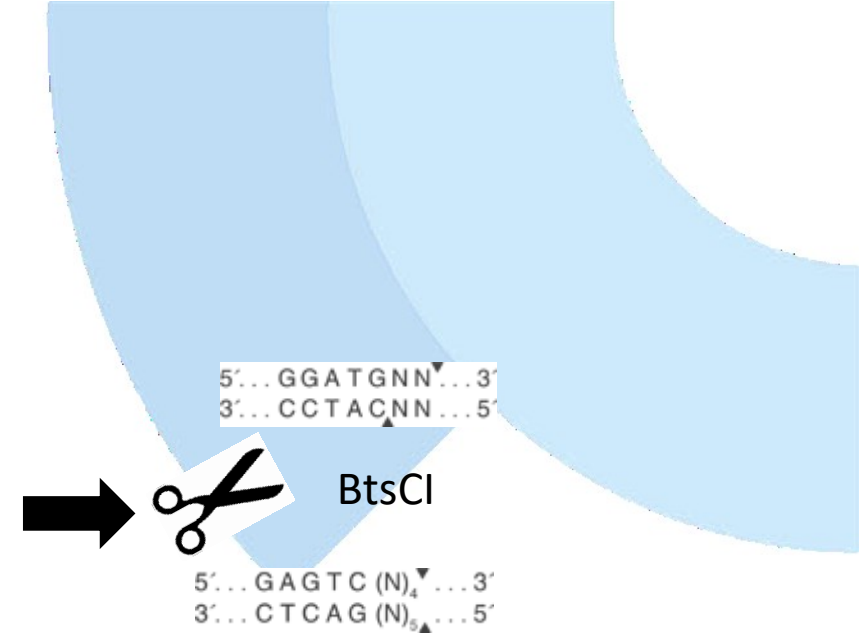
Using dT-RFLP to characterise nematode assemblages and identify changes in biodiversity (Descriptor 1)



DNA extraction

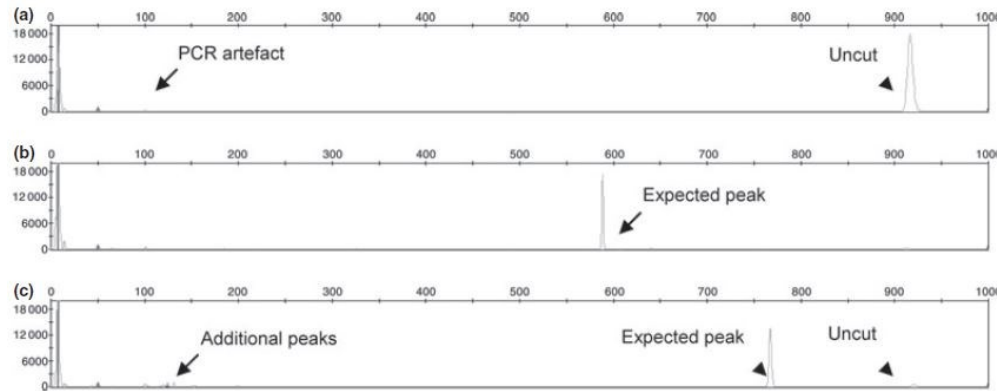


PCR with fluorophore labelled primers



BtsCI

PleI



Capillary sequencer

Donn S, Neilson R, Griffiths BG, Daniell TJ. A novel molecular approach for rapid assessment of soil nematode assemblages – variation, validation and potential applications. *Methods in Ecology and Evolution* 2012,3:12-23.

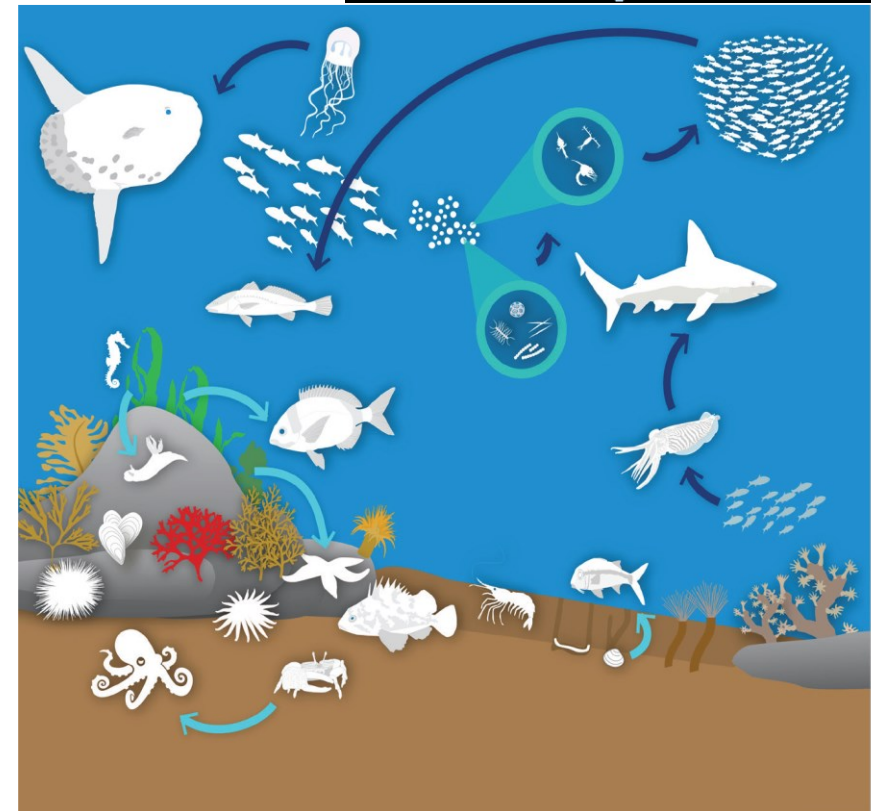
Project R&D

D4Ss

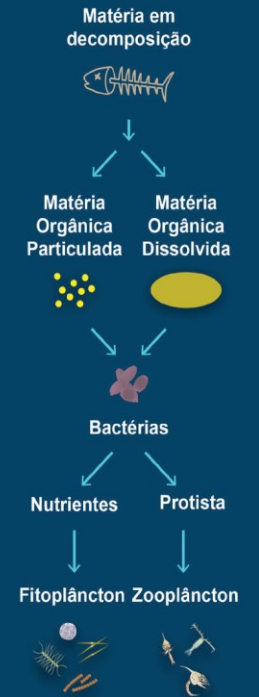
Food-web approaches to assess the functional benthic ecosystem interactions for Marine and Coastal management under the Marine Strategy Framework Directive

Descriptor 4: Food Webs

It is highlighted as the most difficult to implement due to significant lack of knowledge on the functional aspects of marine,



LOOP MICROBIANO



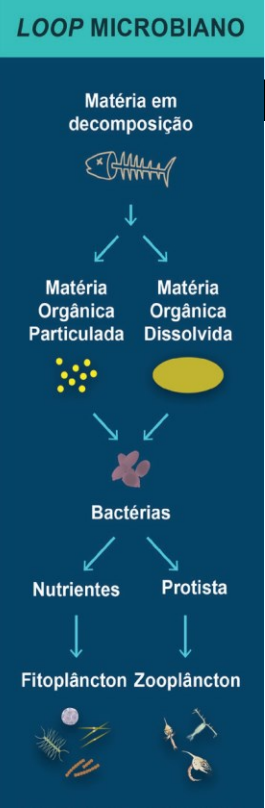
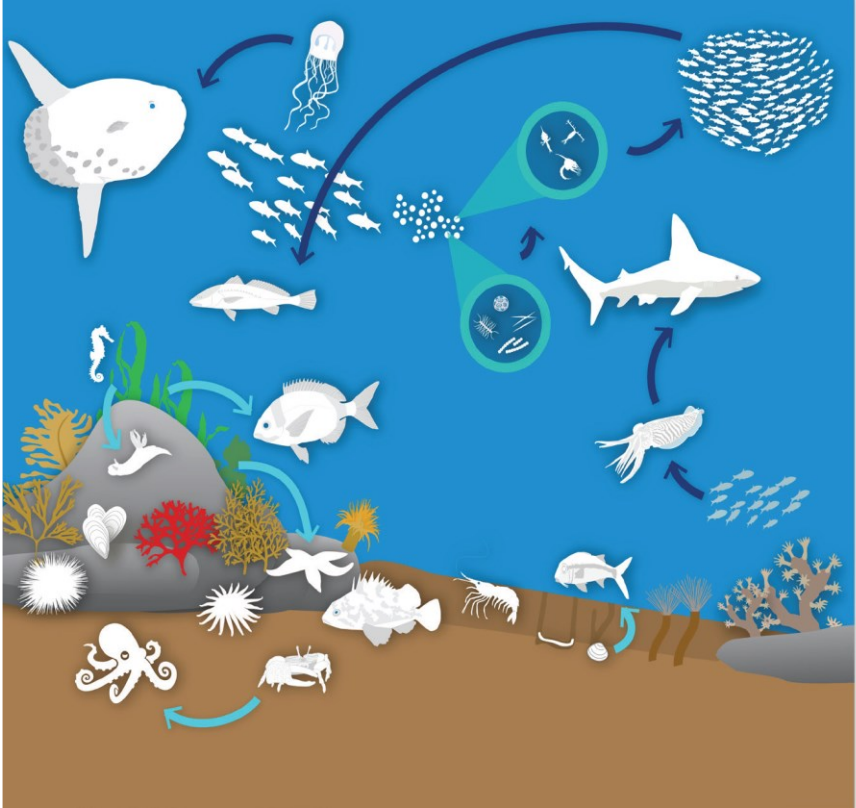
SCIENTIFIC QUESTION

How is shaped the trophic structure under **different sedimentary organic matter condition (quality and content) and microbiome?**

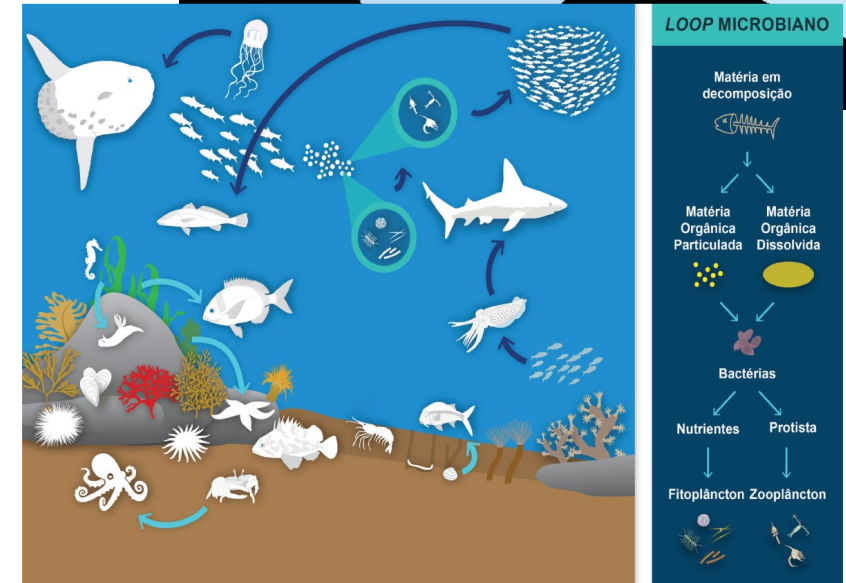
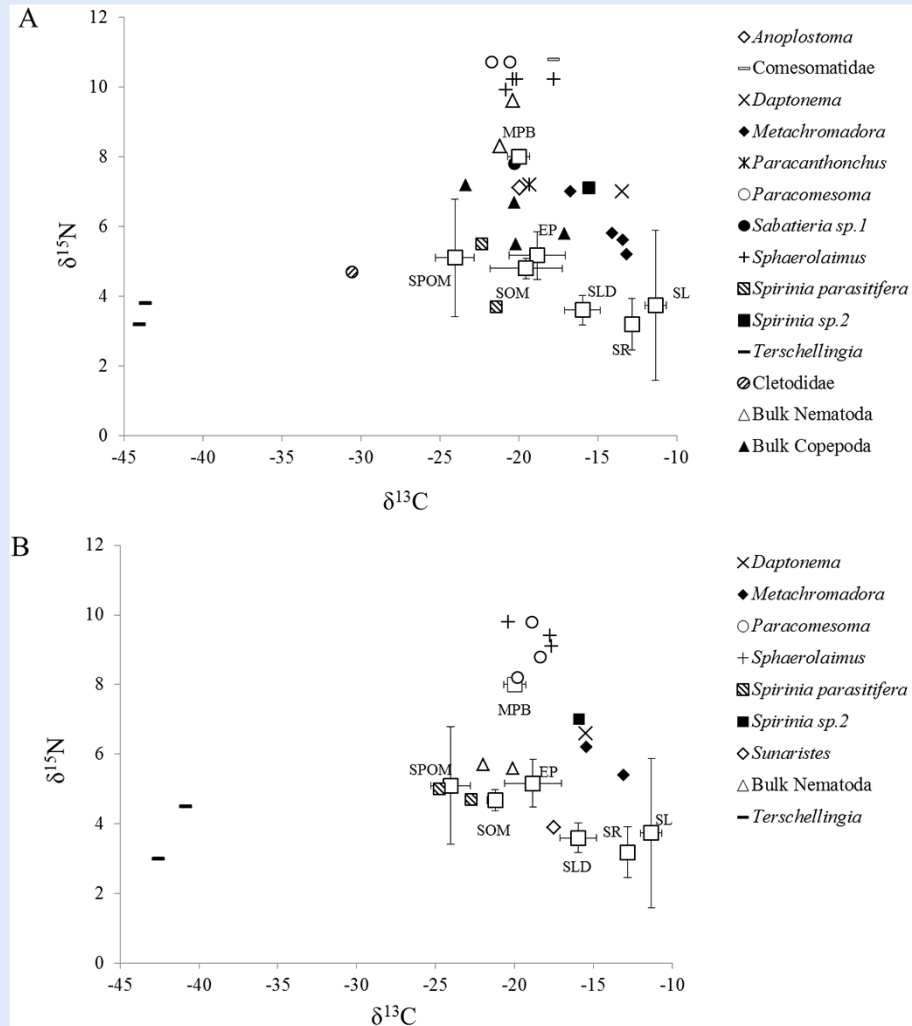
ADVANCES METHODOLOGIES

- **Ecology of Isotope Analysis** (Spatial differences in $\delta^{13}C$ and $\delta^{15}N$)

The stable isotope ecology have been used to identify sources and pathways of organic matter flow in estuaries and oceans.

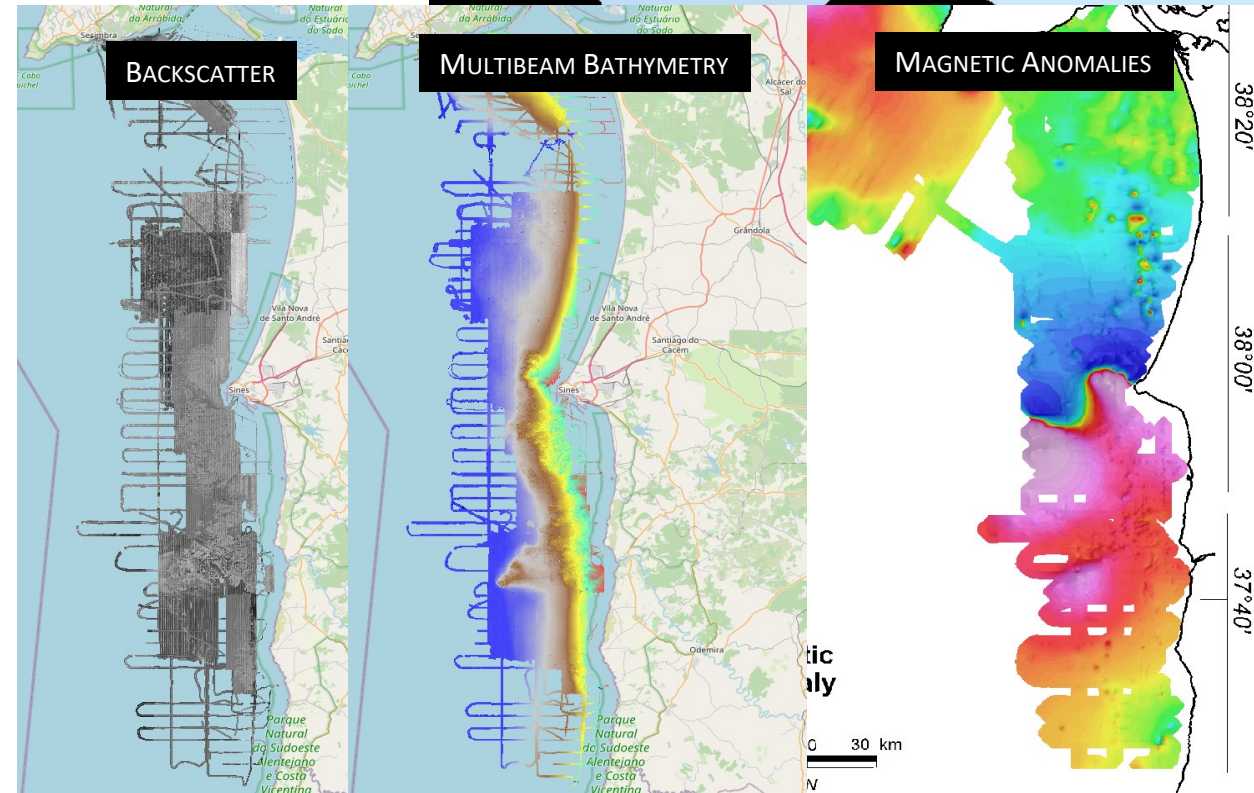
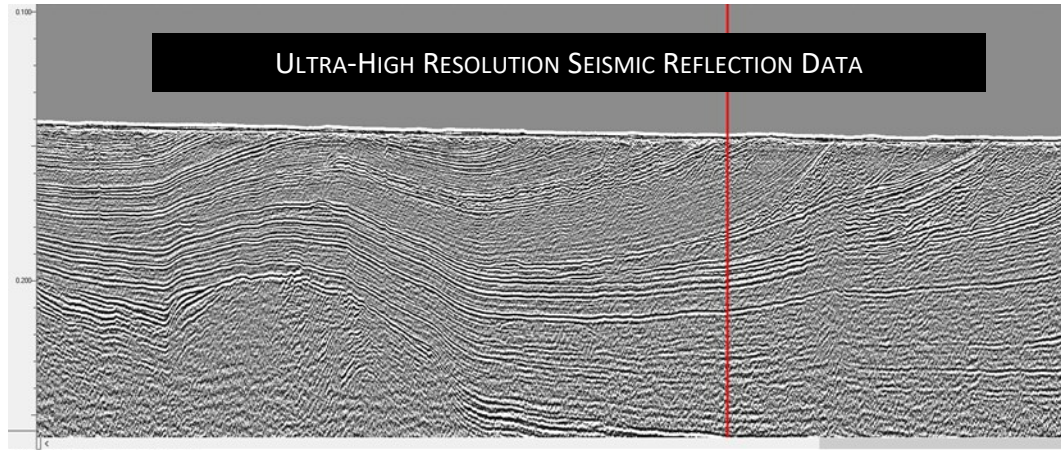


Biplots of $\delta^{13}\text{C}$ / $\delta^{15}\text{N}$ of meiobenthos from the upper 2 cm and their potential resources in seagrass beds and bare sediments



MINEPLAT

Assessment of mineral resources potential of the Alentejo continental shelf sedimentary cover





DIGITAL ELEVATION MODEL OF MULTIBEAM BATHYMETRY FROM THE ALENTEJO CONTINENTAL SHELF BETWEEN SINES AND VILA NOVA DE MILFONTES

Cofinanciado por:



POTENCIAL EM RECURSOS MINERAIS NA
PLATAFORMA CONTINENTAL ALENTEJANA

