JERICO initiative – why and what?

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Operational Oceanography for Blue Growth

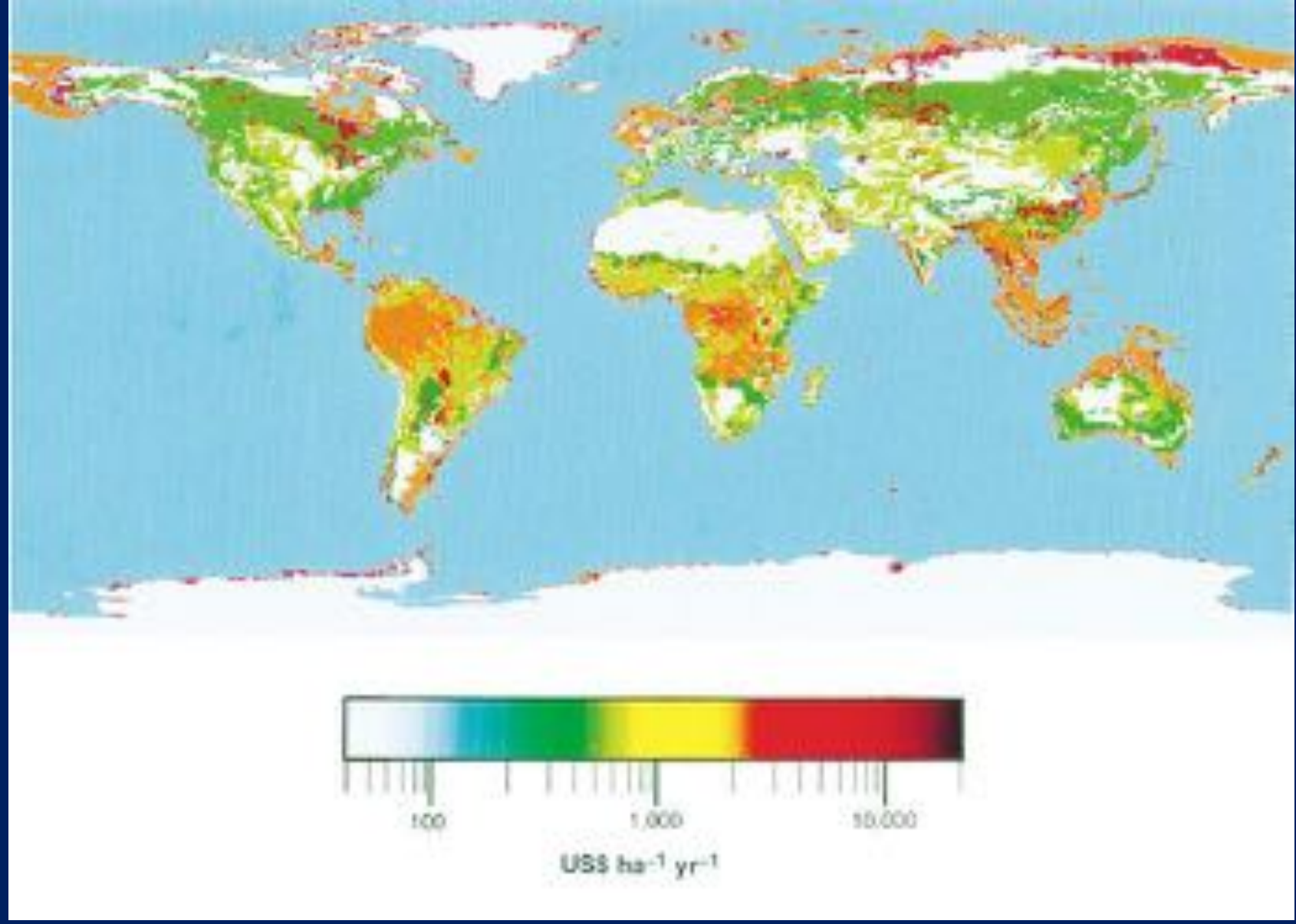
The why?

JERICO, JERICO-NEXT and then…

Toward a joint European Research Infrastructure for Coastal Observatories

The economical importance of the coastal ocean

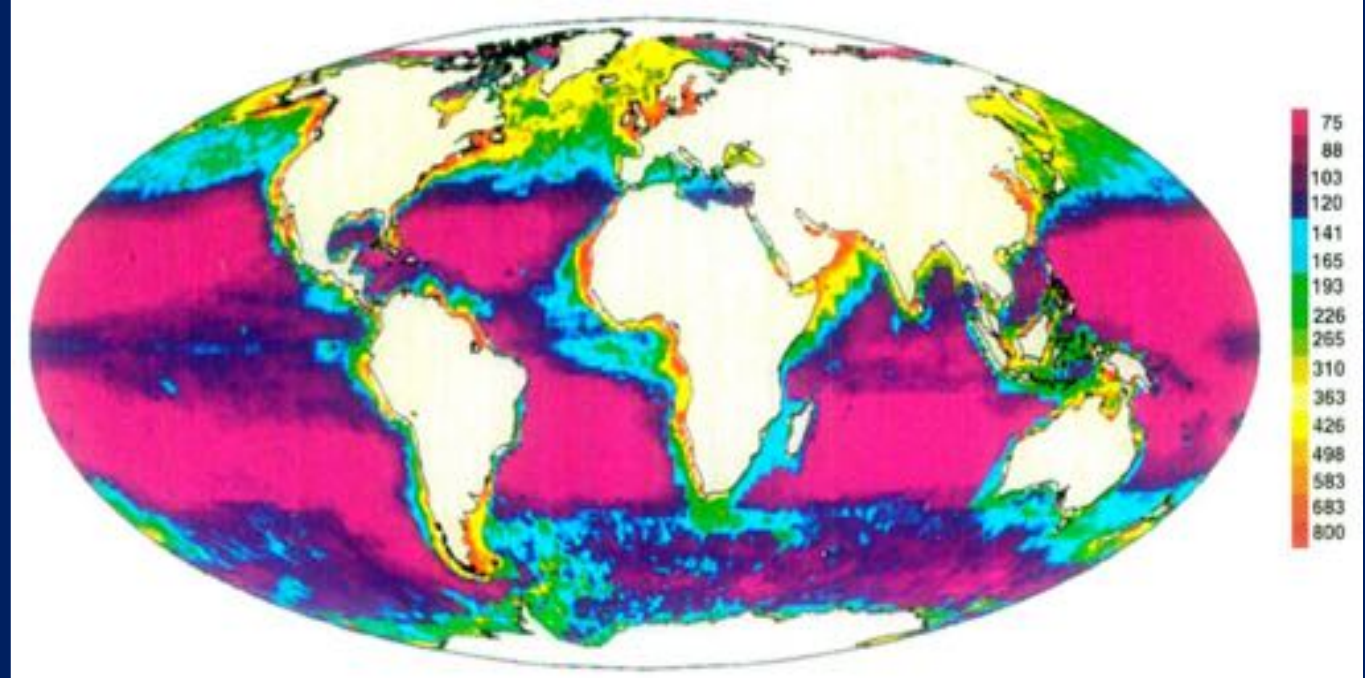
- Multiplicity of services
- Food
- Transport
- Recreation
- …
- Value * 16 / open ocean
- Value * 5 / terrestrial systems



- Estimated economical value of the coastal ocean: 4052$ $ha^{-1}.year^{-1}$
- Estimated economical value of the open ocean : 252$ $ha^{-1}.year^{-1}$
- Estimated economical value of terrestrial systems: 804$ $ha^{-1}.year^{-1}$

The ecological & biogeochemical importance of the coastal ocean

Primary Production



- 8% of the surface of the world ocean

Secondary Production

- 25% 1^{ary} production
- 70% vegetal biomass
- 50% CO_2 fixation
- 80% of carbon burial

Threats affecting the coastal ocean

a multiplicity of disturbances (inter) acting at different spatial and temporal scales

Increase in Temperature

Sea level rise

Coastal Erosion

Acidification

Eutrophication

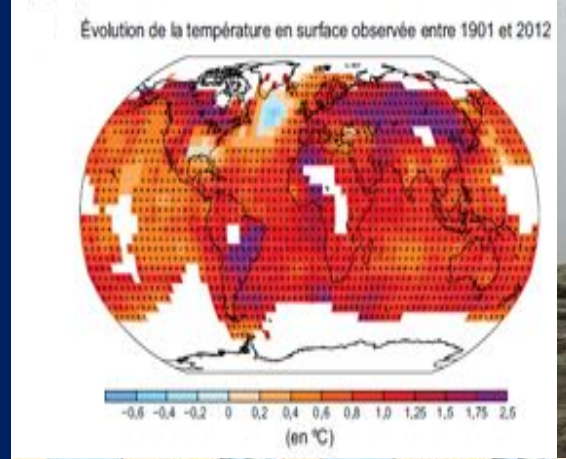
Habitat loss

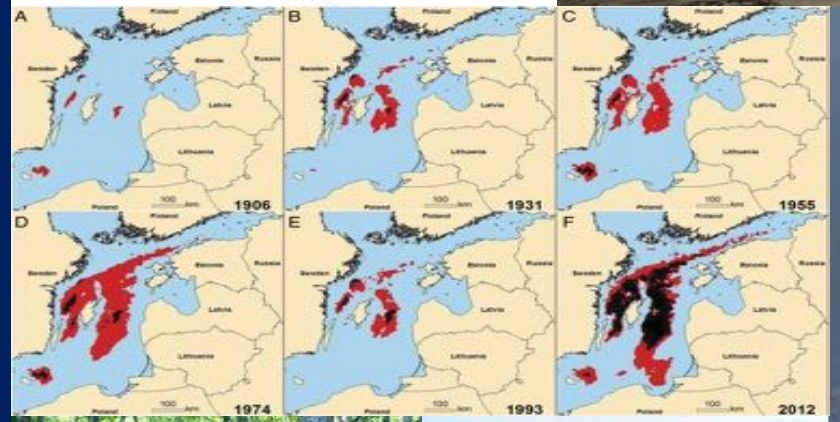
Chemical Contamination

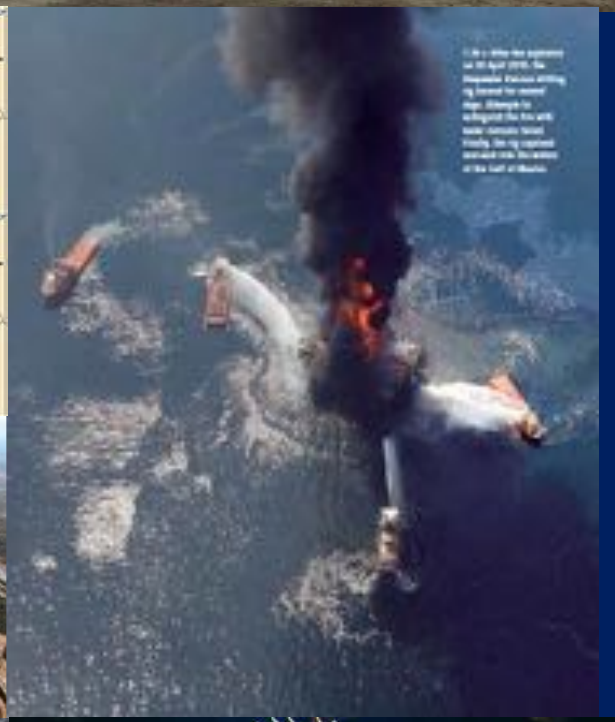
Macro, micro and nano litter

Invasive species

…





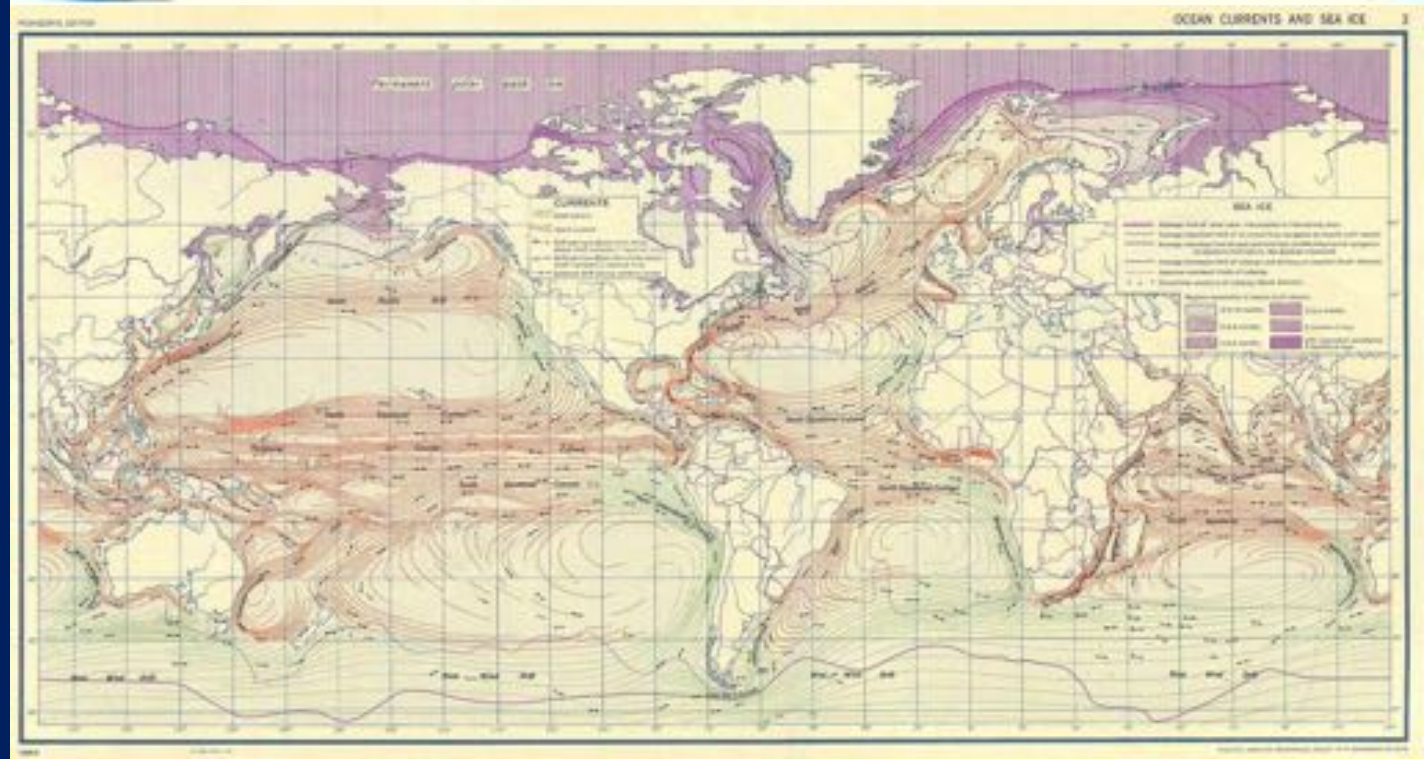


Contradictory political concerns regarding the coastal ocean

Political/ economical sovereignty

- Economical exclusive areas
  but…
- Major global environmental issues
- Connexion through dispersion
- Necessity of international actions

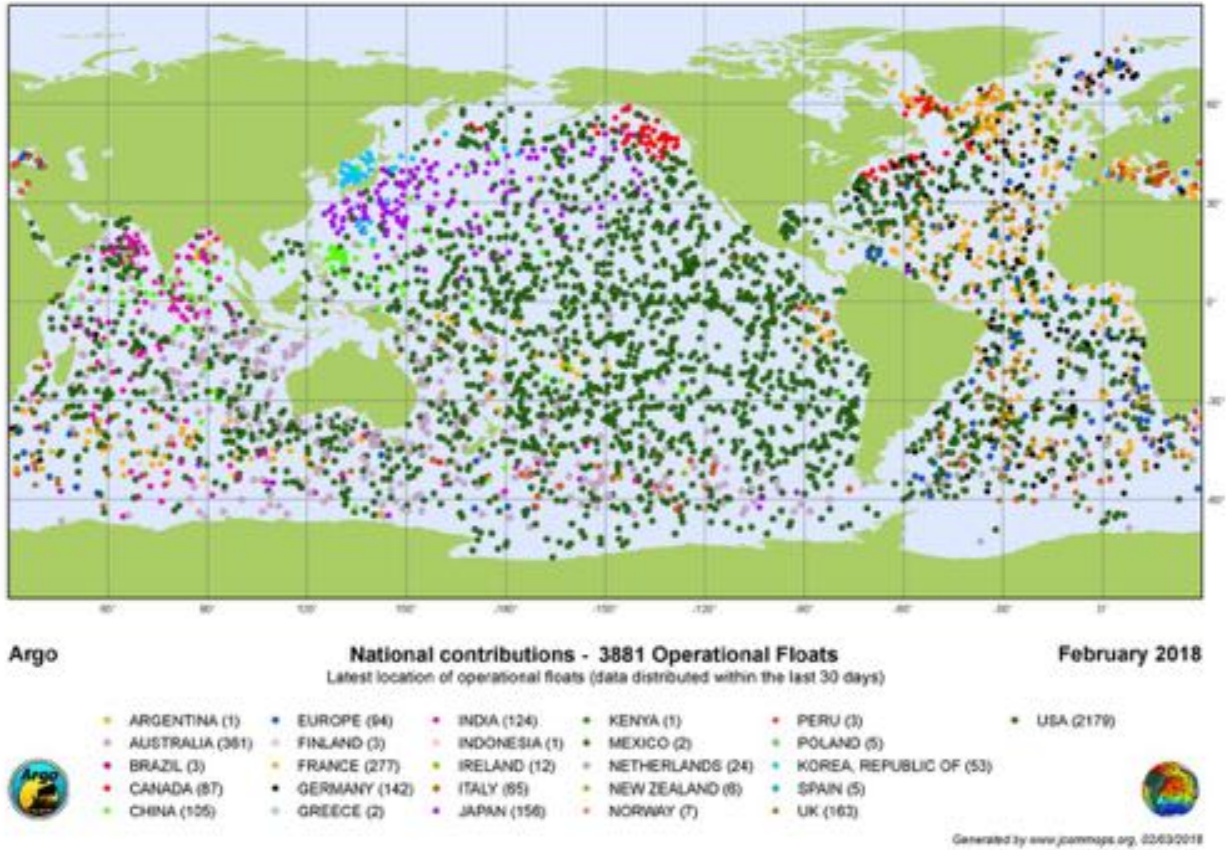
Dispersion: trans-nationality

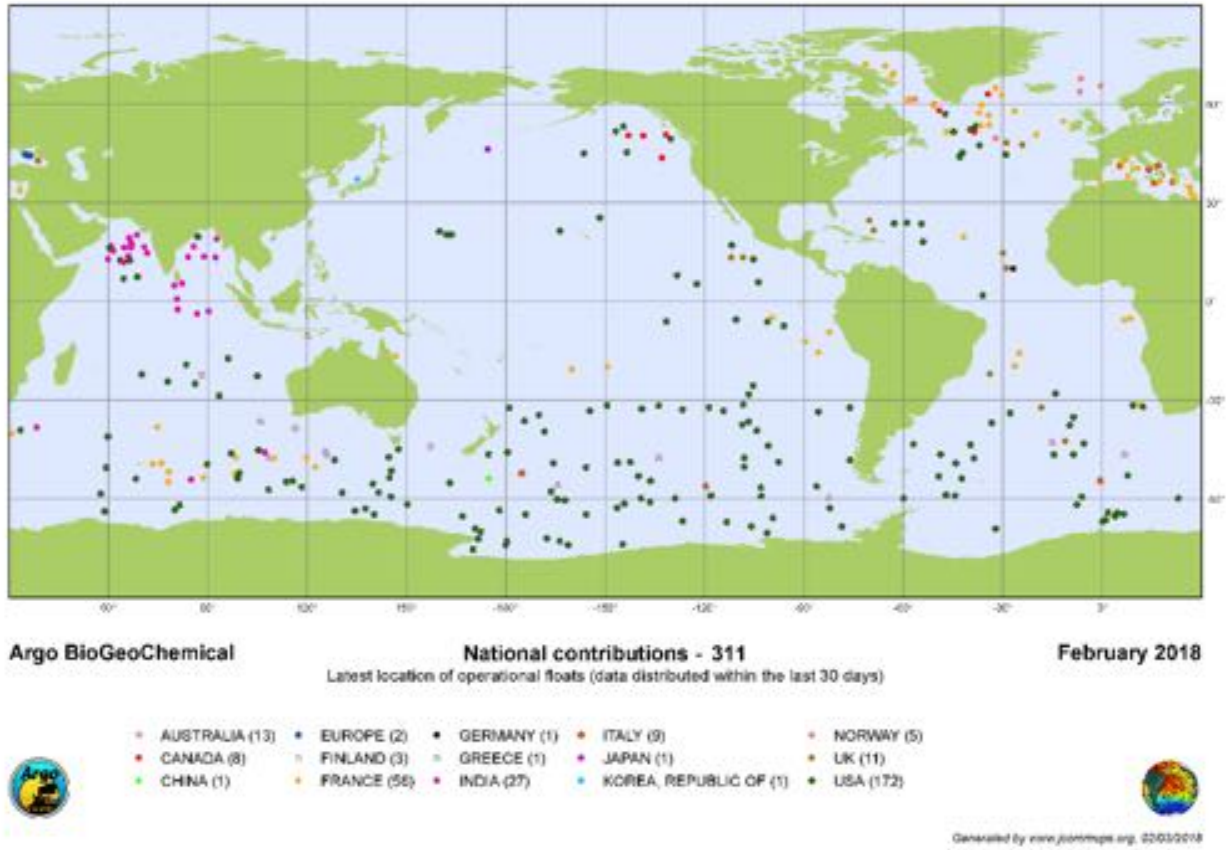


The Marine Strategy Framework Directive (1)

The Marine Srategy Framework Directive aims to achieve Good Environmental Status of the EU's marine waters by 2020 and to protect the resource base upon which marine-related economic and social activities depend.

- Adopted 17 June 2008
- Based on the sustainable development concept
- Implementation based on 6 year cycles including a monitoring (observation?) phase





Argo

- *3881 floats*
- *Global coverage*
- *Mostly P, T and S, occasionally O_2*

Argo BioGeoChemical

- *311 floats*
- *Non global coverage*
- *O_2, nitrate,pH ,Chl a, SPM, Irradiance*

Observation of the open ocean: ARGO floats

European Multidisciplinary Seafloor and water column Observatory

- *Reduced number of sites*
- *Partly inshore*
- *Mostly physical and geological*
- *Limited number of biological/biogeochemical parameters*

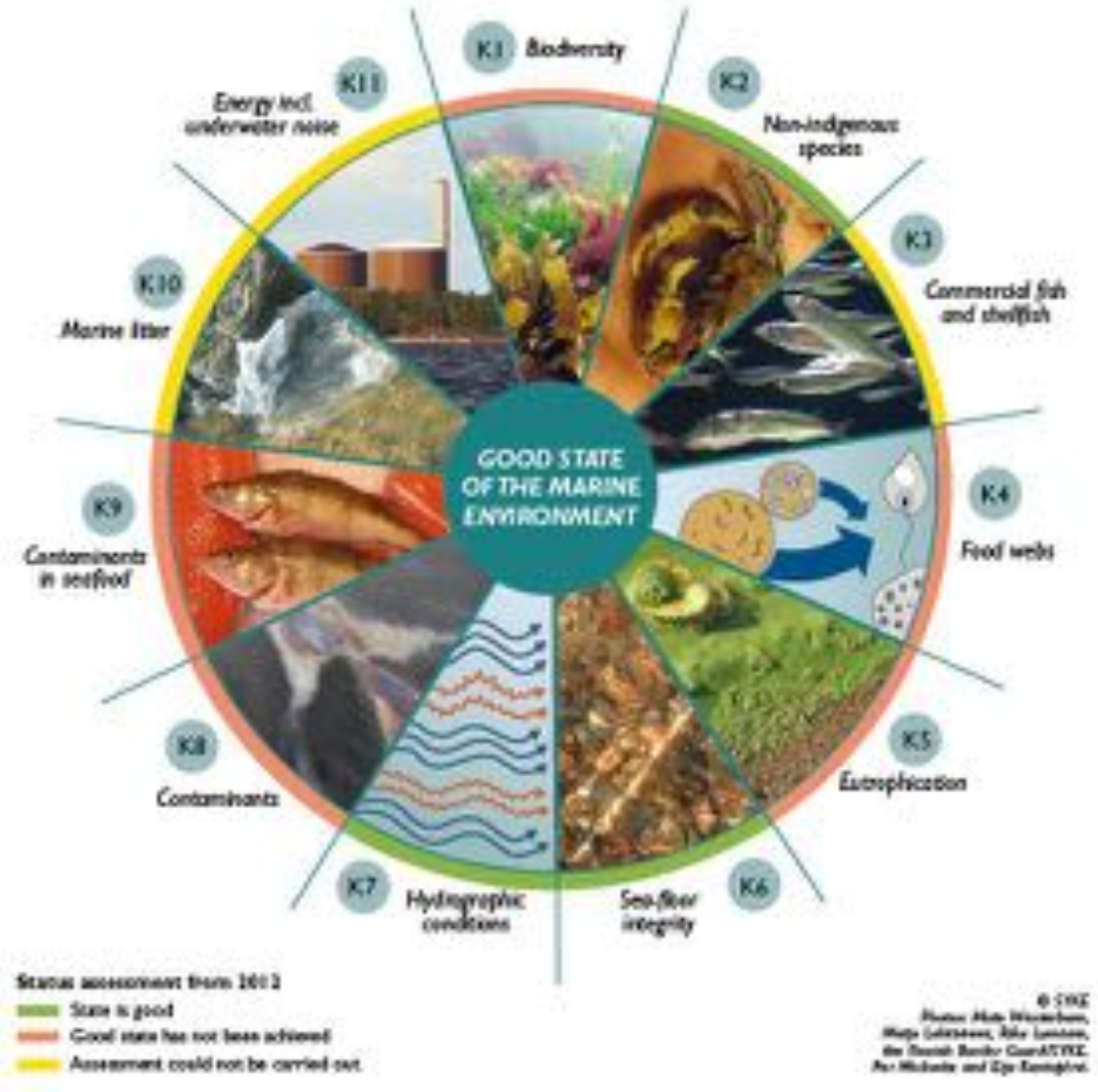
FIXed point Open Ocean Observatories

- *Limited number of sites*
- *Meteorology, wind*
- *Current, waves*
- *O_2, fluorescence, pCO_2*

Observation of the (mostly) open ocean: EMSO and FIXO3

The Marine Strategy Framework Directive (2)

- Based on 11 descriptors including 5 biological ones
- 9 descriptors non currently monitored by open ocean observation infrastructures
- This is first reflecting the lack of automated measurements for most biological/biogeochemical parameters
- However, the challenge is not only technological but also refers to some of the specificities of the coastal ocean in terms of strategy



The spatial heterogeneity of the coastal ocean

- High diversity of systems
- Lack of modelling frame for most compartments/processes
- Require maximal possible extensive spatial coverage for most environmmental issues

Natural vs anthropised

Sandy vs rocky

Sheltered vs exposed

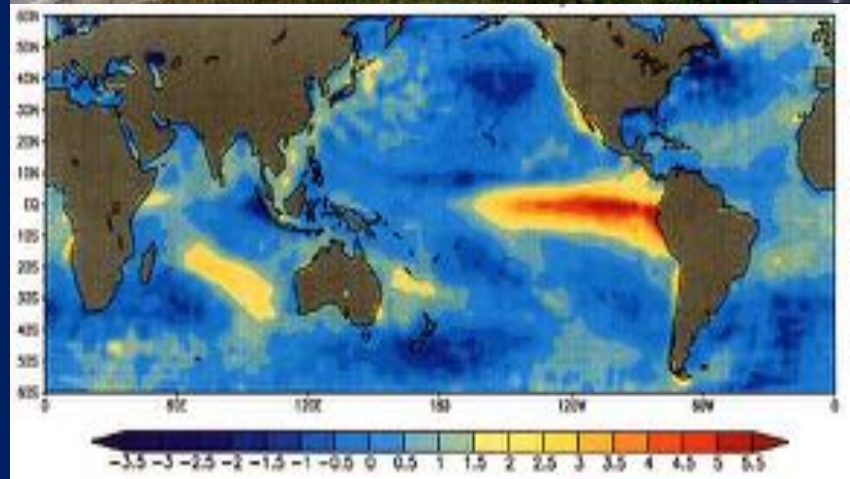
The temporal dynamics of the coastal ocean

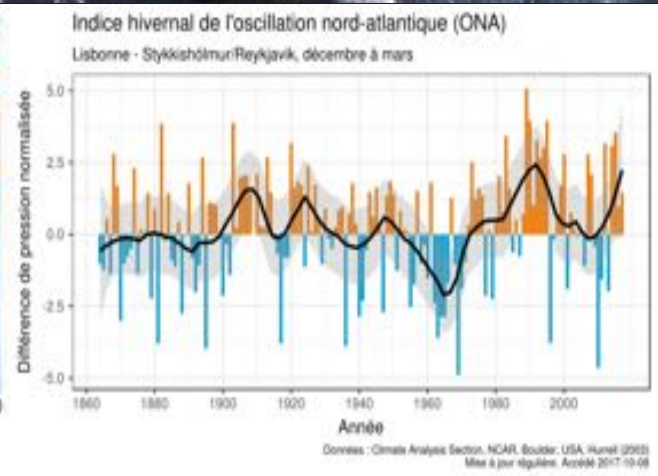
Short term

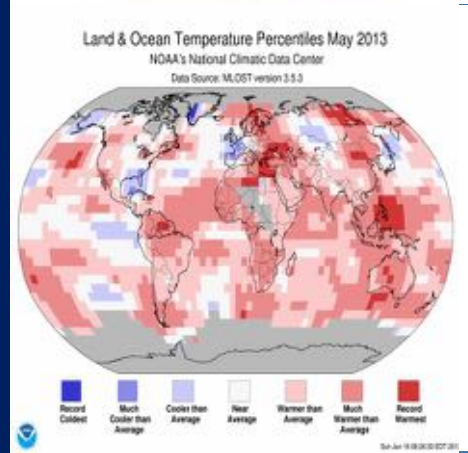
Mid term

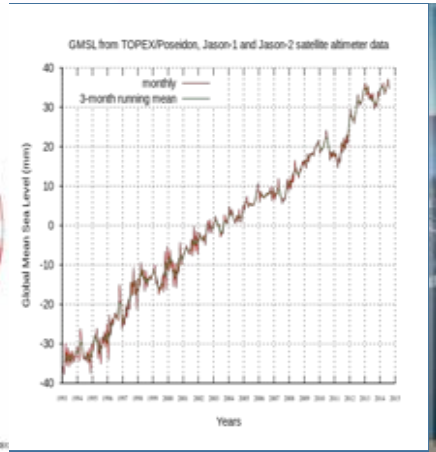
Long term

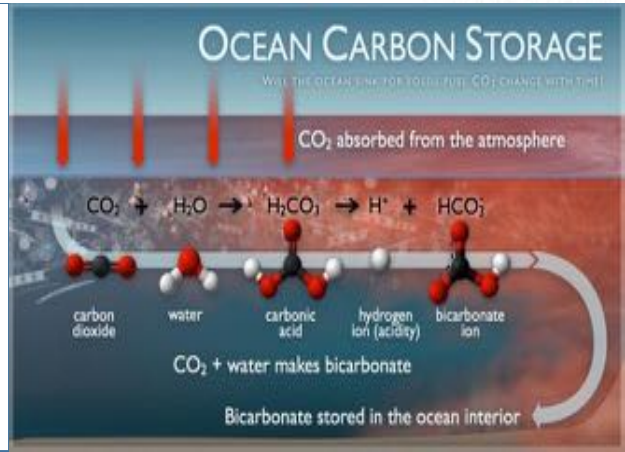
- Acts at different time scales
- Integration time vary between compartment and processes
- Non linearity, tipping points
- Necessity of coordinating observation strategies









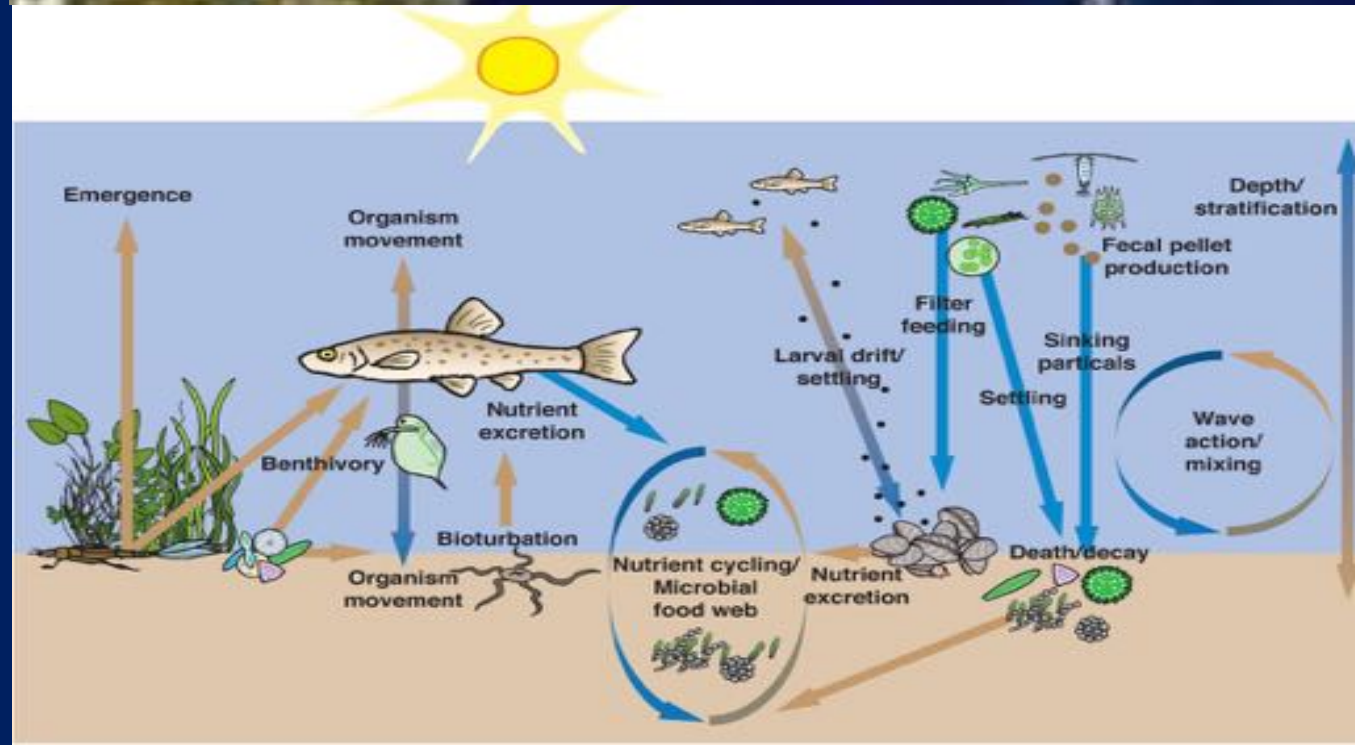


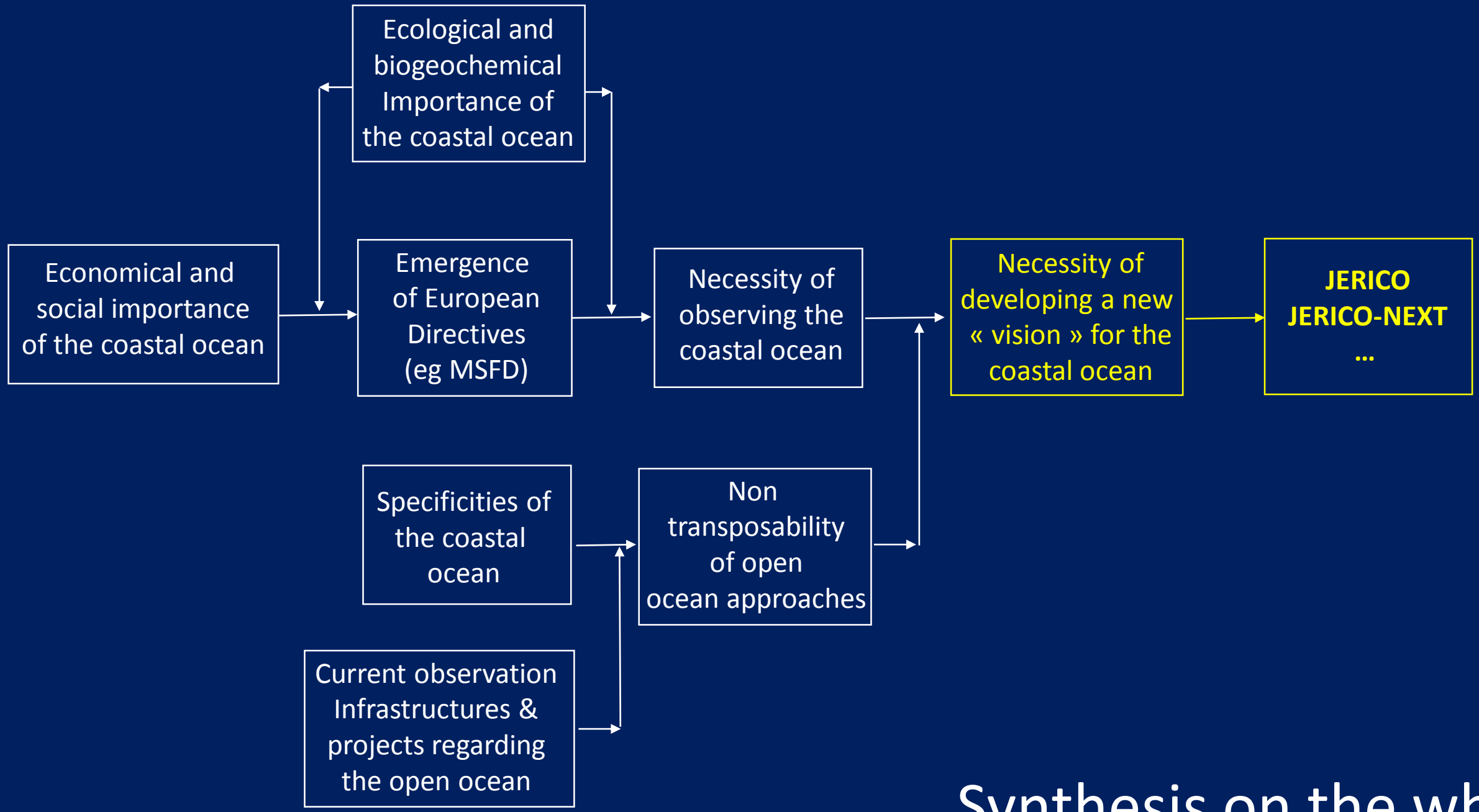
The importance of interfaces in the coastal ocean

- Necessity of monitoring continental inputs (i.e., major rivers) affecting the coastal ocean area under monitoring
- Necessity of coupling the observation of benthic and pelagic systems

Land-Ocean

Benthos-Pelagos



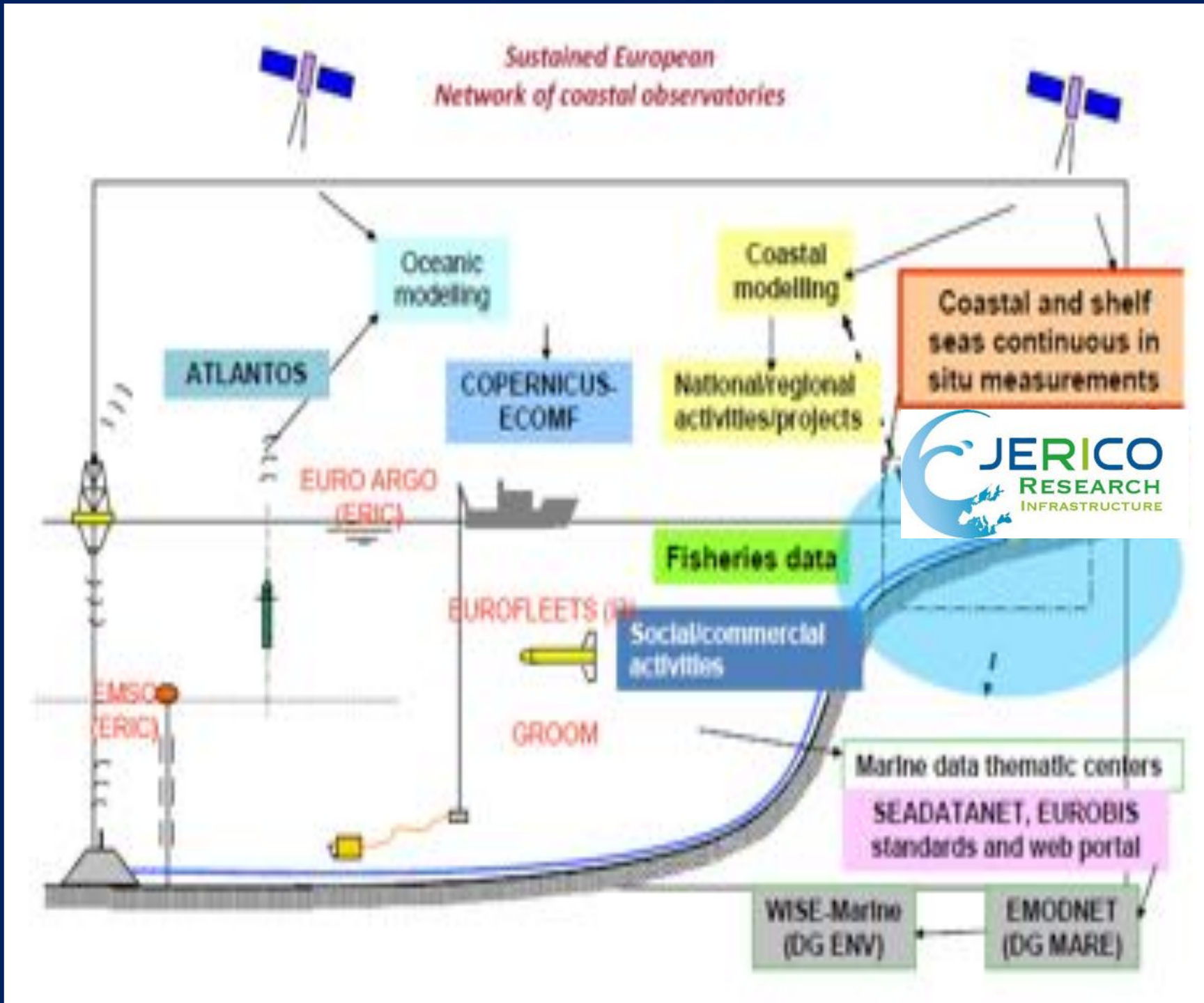


Synthesis on the why?

The what

The positioning of JERICO-RI in the European « lanscape »

- The only EU initiative specifically dealing with the coastal ocean
- Using an integrative and a multidisciplinary approach
- Connected with a large variety of other projects including regional and national ones as well as international data bases

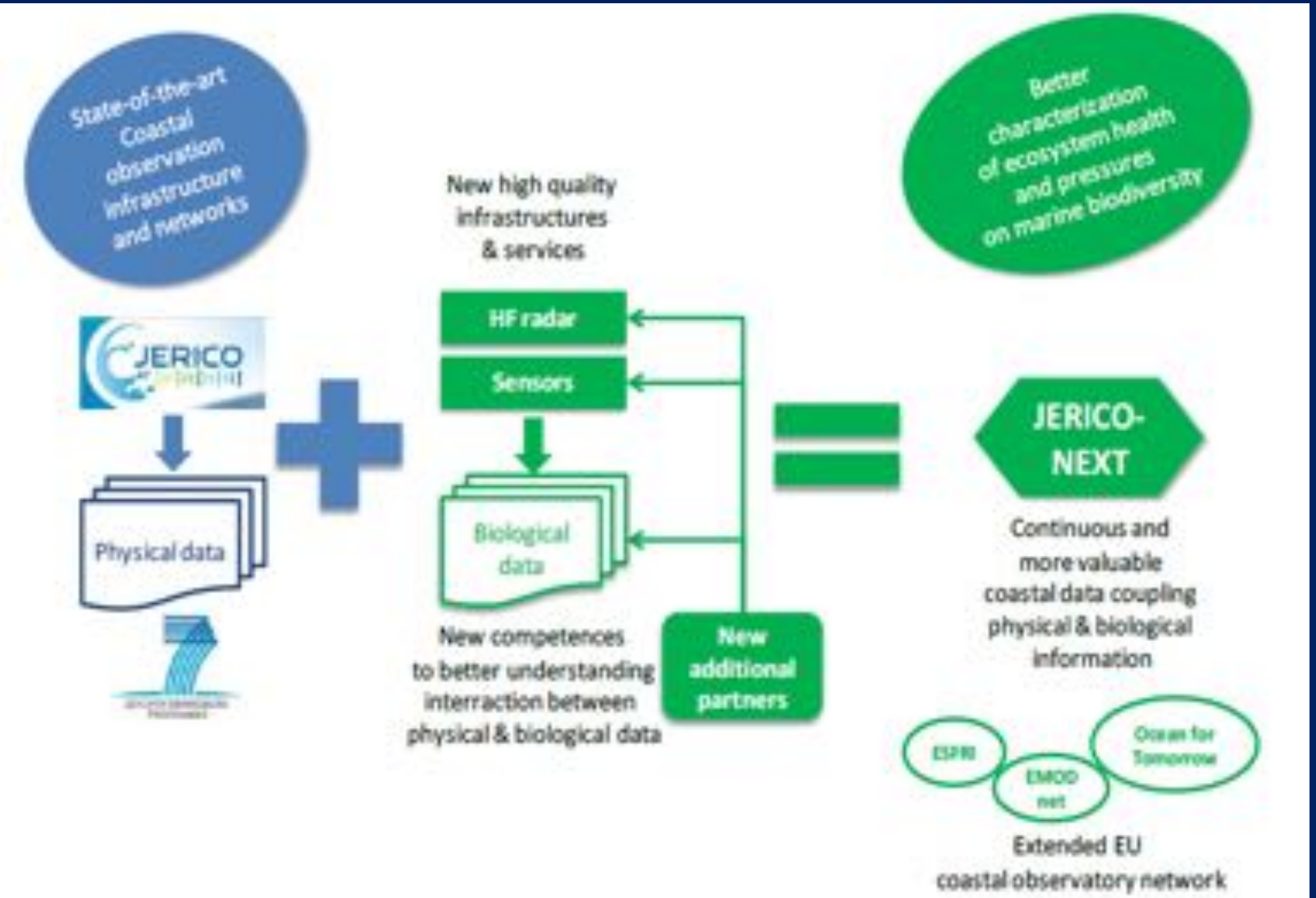


JERICO: a FP7 project
JERICO-NEXT: a H2020 project

- May 2011 - April 2015
  Sept. 2015- Aug. 2019
- 6.5M€
  10M€
- 29 partners
  34 partners
- Extensive coverage of EU
  Coastal ocean

- **8 years of effort**
- **16.5M€ spent by the EU**
- **Not over !?**

The transition between JERICO and JERICO-NEXT



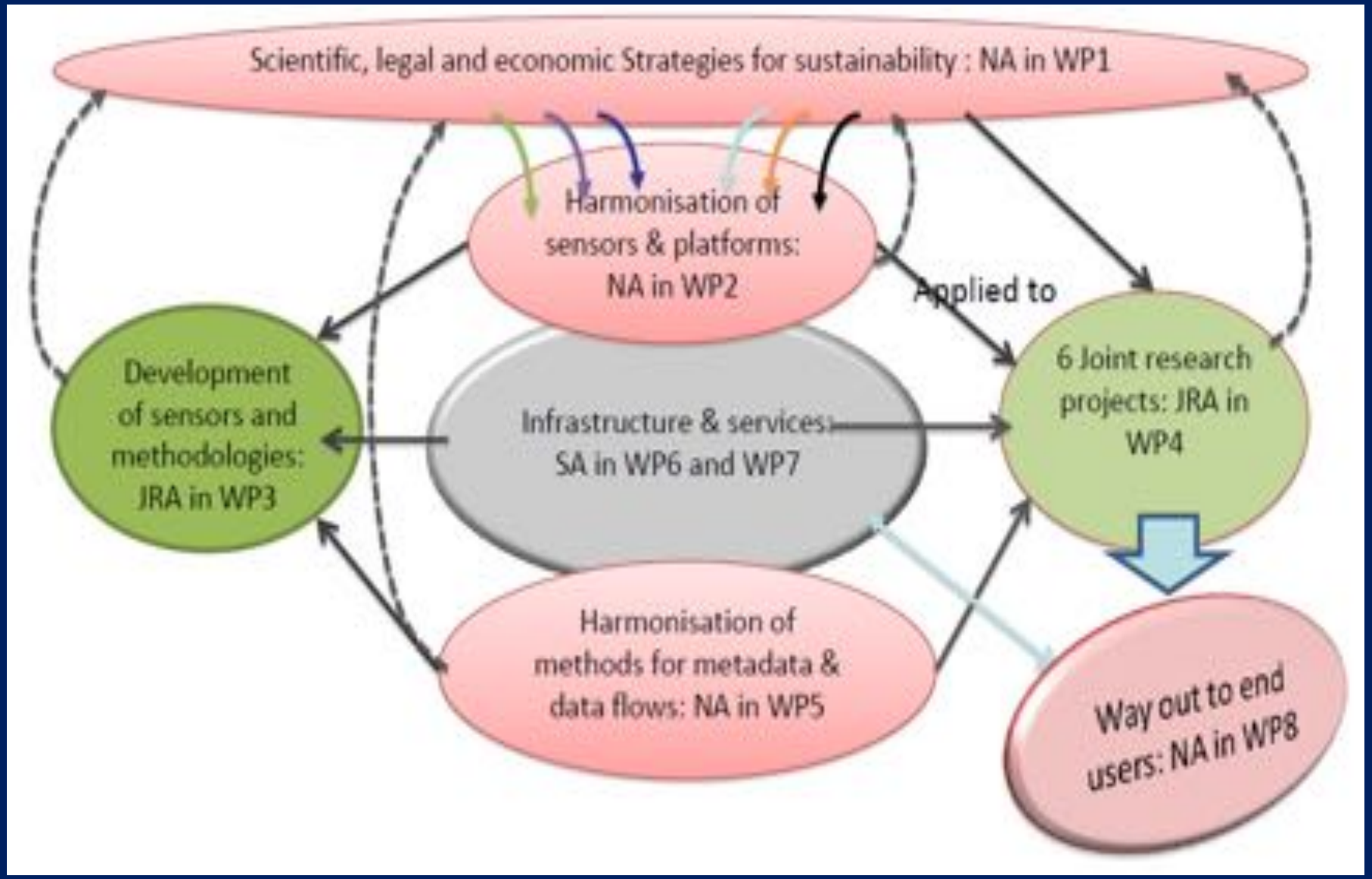
- JERICO mostly dealt with physical and chemical parameters with some technological developments in the field of biology
- JERICO-NEXT considered a larger set of physico-chemical platforms and sensors
- In line with the MSFD, JERICO-NEXT went one step further by stating that ***" we cannot understand the complexity of the coastal ocean if we do not understand the coupling between physics, biogeochemistry and biology."***

The structuration of JERICOnext

JERICOnext is an infrastructure project: 3 main components

- *Networking Activitie*
- *Service (Transnational & Virtual Access)*
- *Joined Research Activities*

9 Work Packages



Difficulties in coupling physical biogeochemical and biological observations

- The acquisition of almost all biogeochemical and biological variables are not yet fully automated, which results in low spatial and temporal coverages and delays in data availability. There is thus still a critical need for developing new technologies especially in the field of biogeochemical and biological observations.

But not only !!!

- Biological compartments and both biogeochemical and biological processes have their known spatial scales and integration times. The *a posteriori* coexistence of physical and biogeochemical observations is likely to proove not sufficient to reach JERICO-NEXT's main objective. There is a clear and urgent need for developping coordinated integrated strategies

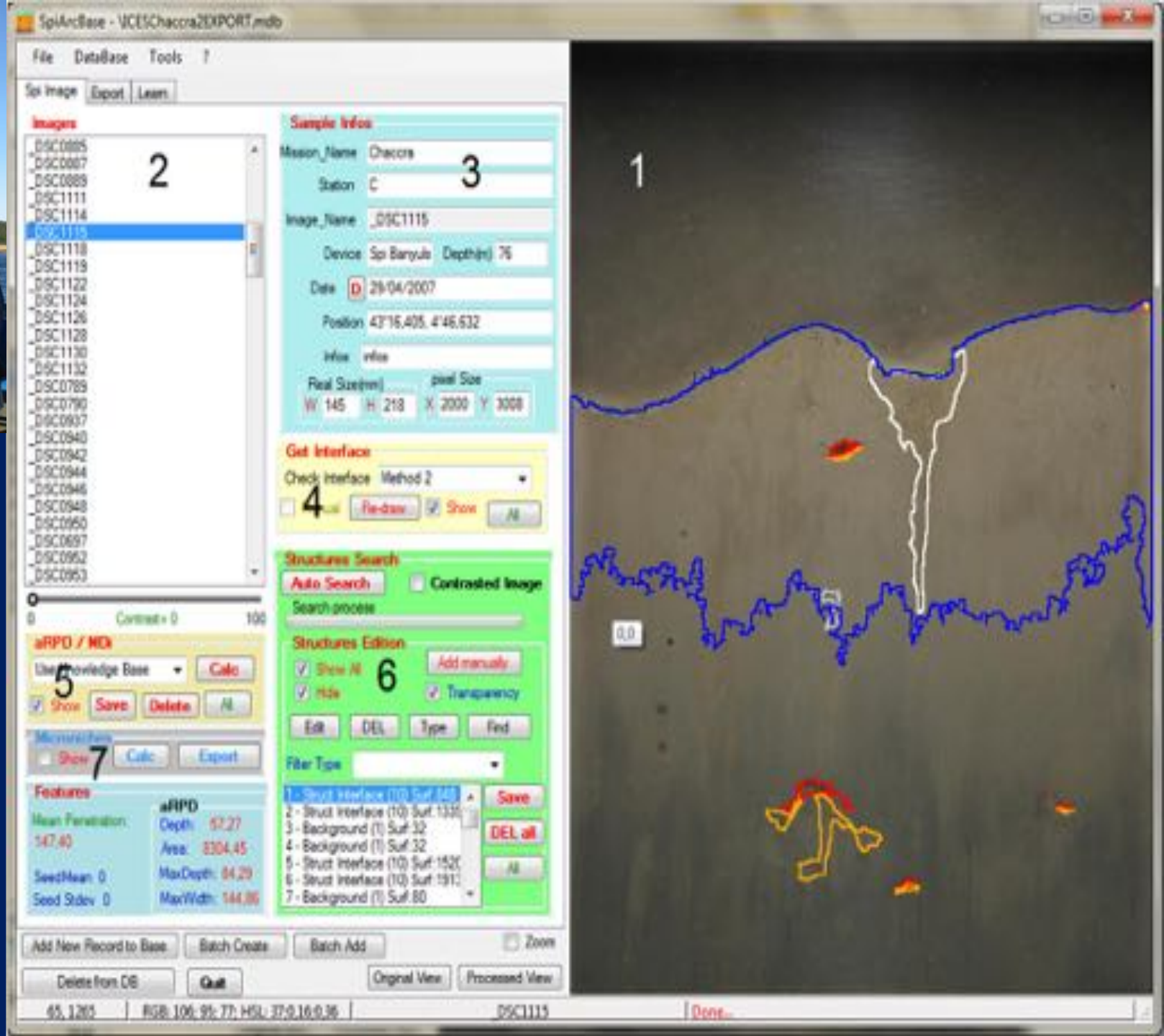
JERICO-NEXT technological component

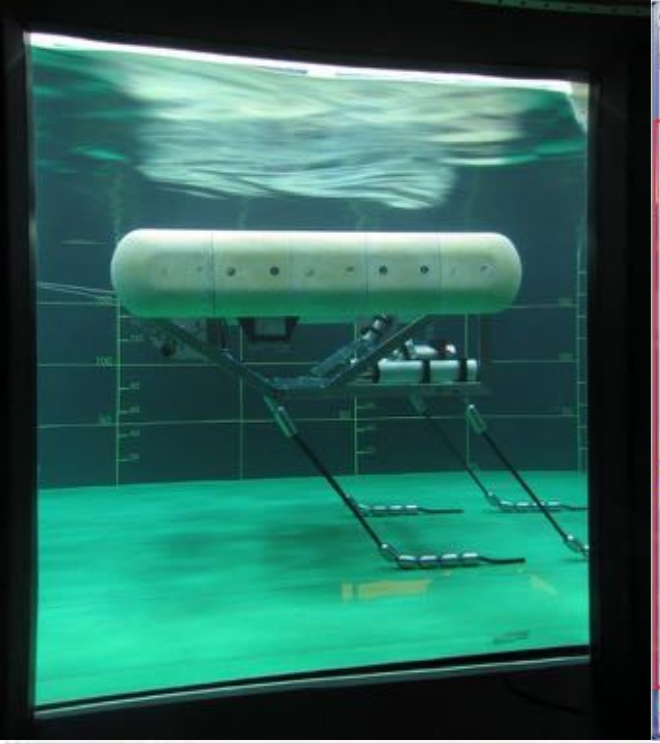
- Increased access to cutting edge technologies through TNA and VA (WP 6 & 7)
- Harmonisation (WP 2 & 5)
- Definition and dissemination of best practices (WP 2)
- New specific developments (WP3)

- ✓ (semi-) automated phytoplankton observations
- ✓ HF radars
- ✓ Profiling coastal waters
- ✓ Microbial and molecular sensors
- ✓ Combined sensors for carbonate systems
- ✓ Benthic compartments and processes
- ✓ Observing System Simulation Experiments

DEVELOPMENT OF A SPECIFIC SOFTWARE FOR THE INTERPRETATION OF SEDIMENT PROFILE IMAGES (SPI)

- SPI: *in situ* 2D images of vertical slices of the sediment column
- Can be used to infer the health of benthic habitats (sound alternative to benthic fauna analysis)
- The interpretation of SPI is operator-dependent
- Development of the SPIArcBase software within JERICO





DEVELOPMENT OF A MOBILE VIDEO PLATFORM AND OF AN ASSOCIATED SOFTWARE

- PAGURE mobile video carrier (JERICO-NEXT, IFREMER)
- CVAB software (JERICO, CNRS UB)
- Application to the spatial mapping and the assessment of the vitality (based on their colors) of corals

JERICO-NEXT Joined Research Activity Projects (WP 4)

- These projects have been developped to gain practical experience from tackling observation issues based on multidisciplinary approaches
- They also often constitute practical tests for JERICO and JERICO-NEXT technological developments
- Their outputs will feed the JERICO-NEXT scientific strategy

Six JRAPs dedicated to:

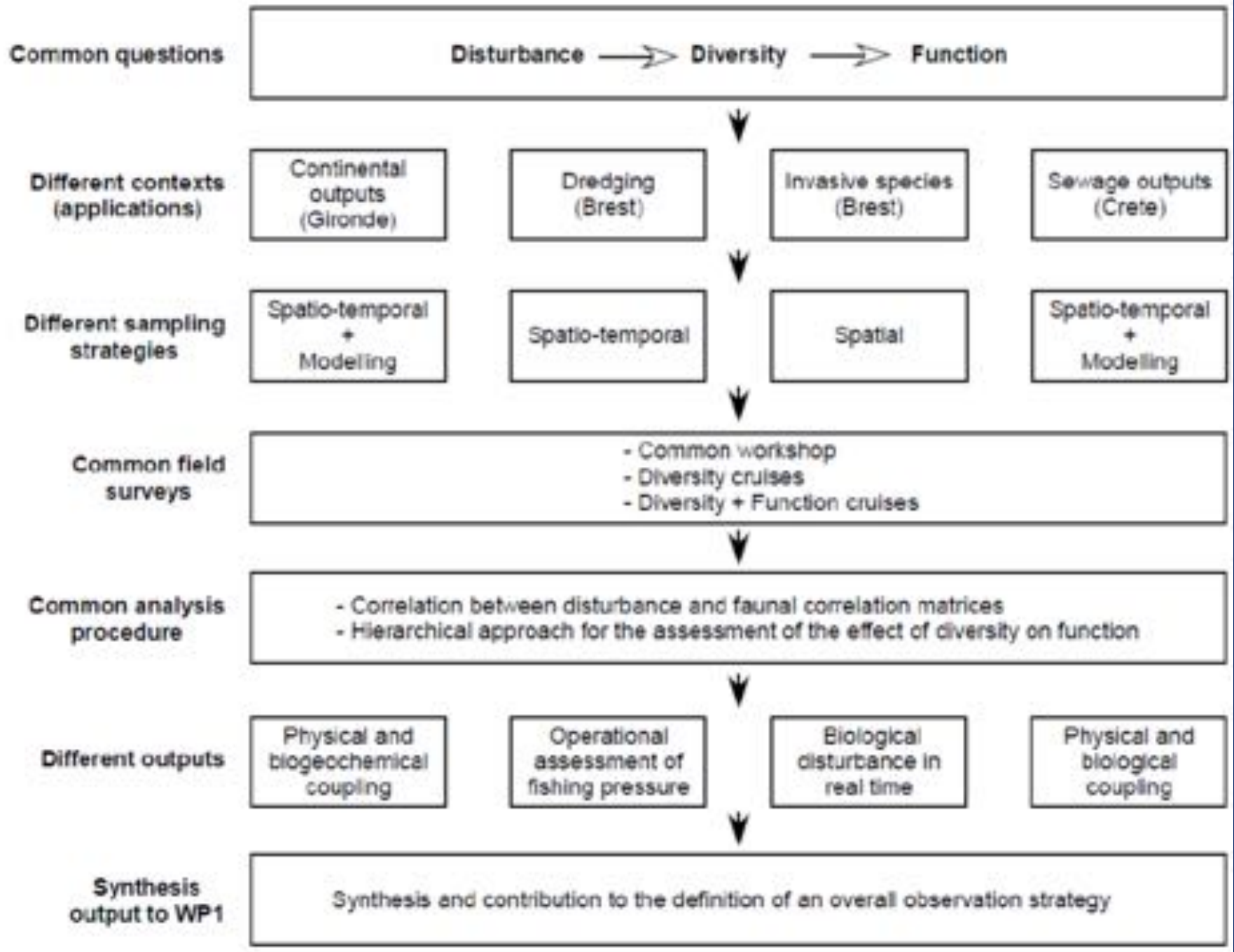
- Pelagic biodiversity
- Benthic biodiversity
- Chemical contaminant occurrence and related biological responses
- Hydrography and transport
- Carbon fluxes and carbonate system

MSFD

- Operational oceanography

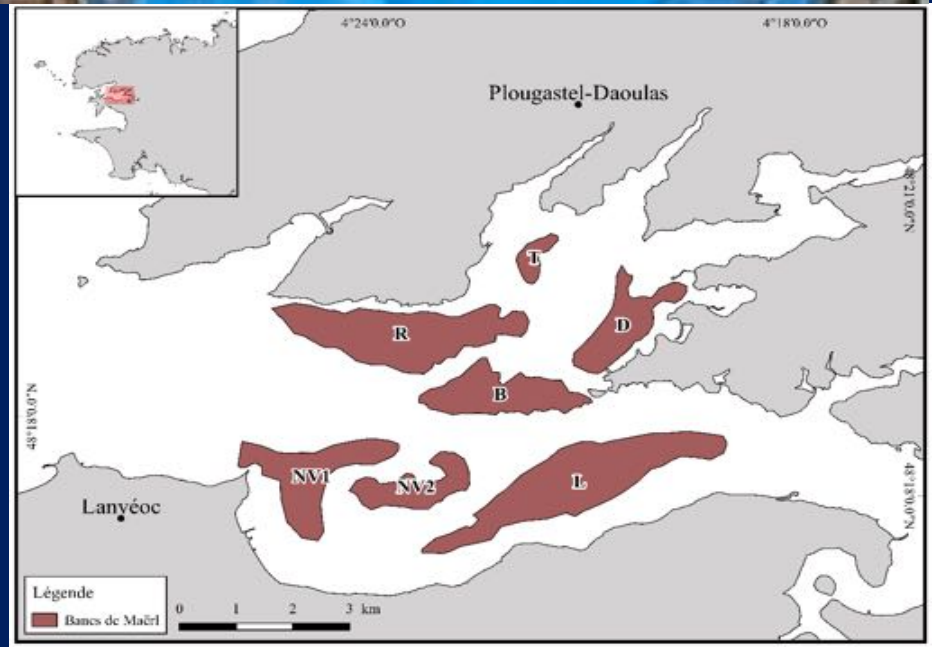
General structuration of JERICO-NEXT JRAP 2

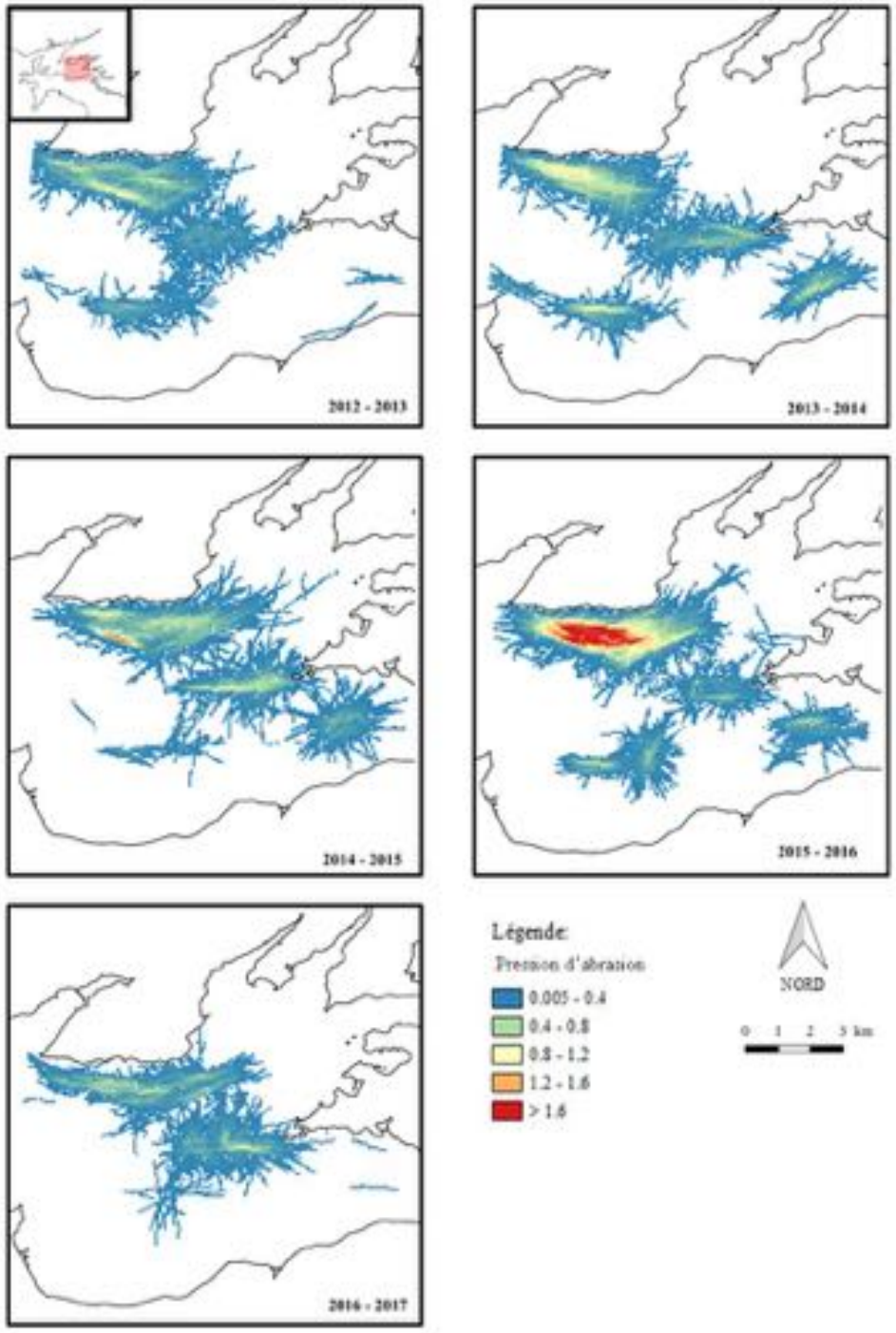
- Dedicated to bentic diversity
- 4 actions
- Common questions
- Different modalities/contexts
- Different sampling strategies
- Common types of field surveys
- Common analytical procedures
- Focus on the Bay of Brest dreging action

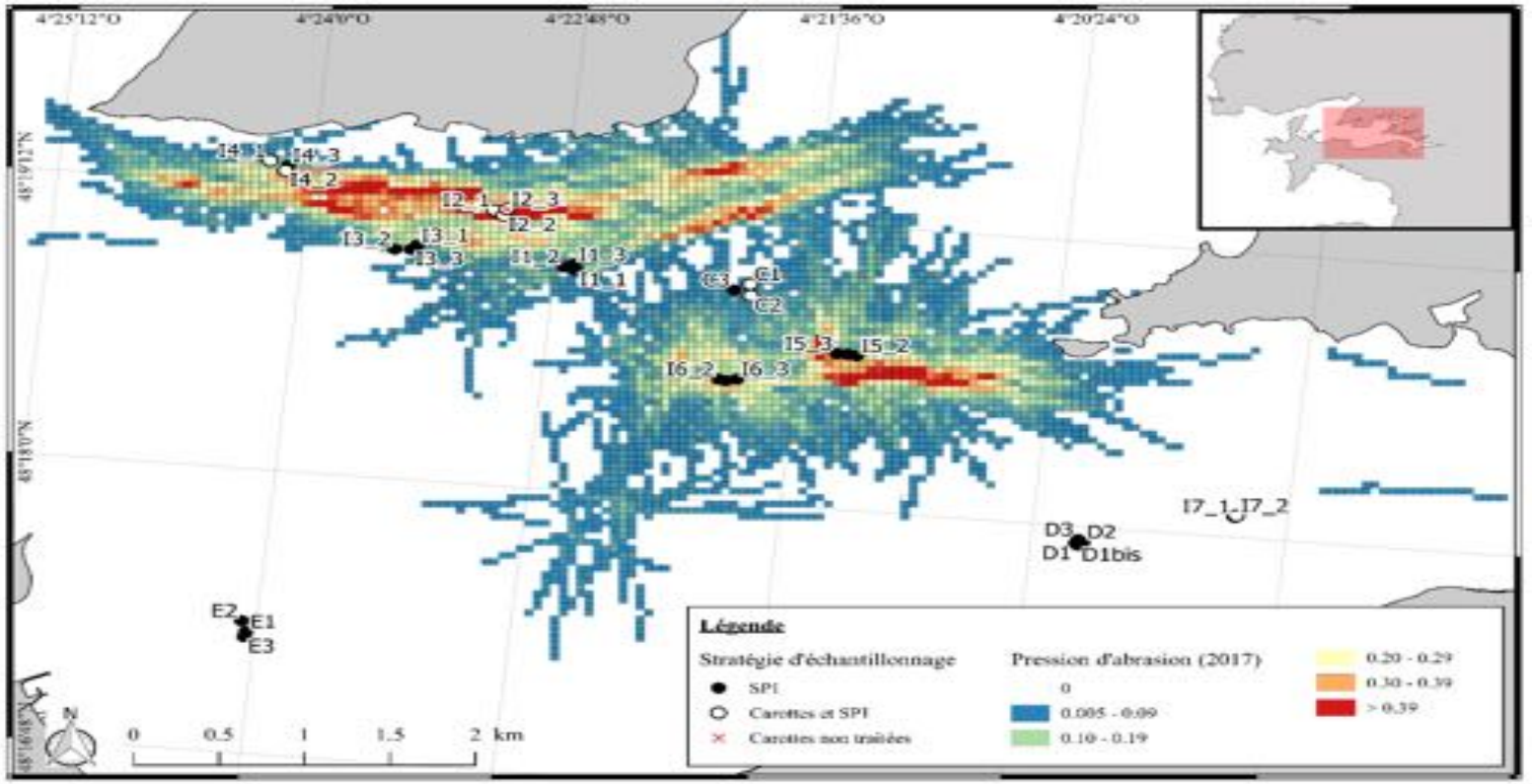


ASSESSING THE EFFECTS OF CLAM DREDGING ON MAERL BEDS IN THE BAY OF BREST (France)

- Maerl: bed forming calcareous algae
- Key stone species, complexifying space
- Biodiversity hotspot
- Long being used in agriculture and for water filtration
- Harvesting prohibited in France since 2010
- Still affected by dredging (fishing of scallops and clams)







MATERIALS AND METHODS

- Dredging presure assessed based on AIS data
- 50*50m grid
- 5 years (2012-2017)
- 30 stations having expirmented different dredging pressures

- These sampling design allow to seek for: (1) a significant correlation between dredging pressure and effects on maerl beds, and (2) the time scale associated with those effects

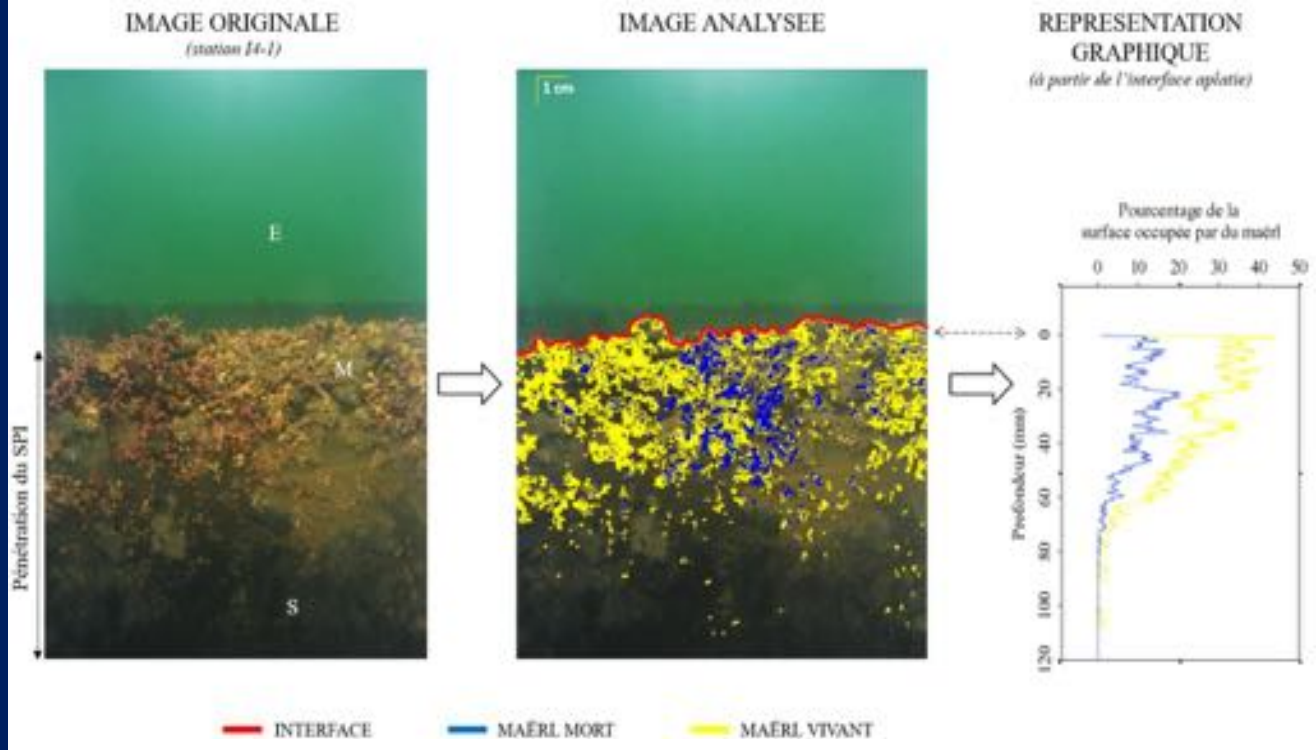
MATERIALS AND METHODS (2)

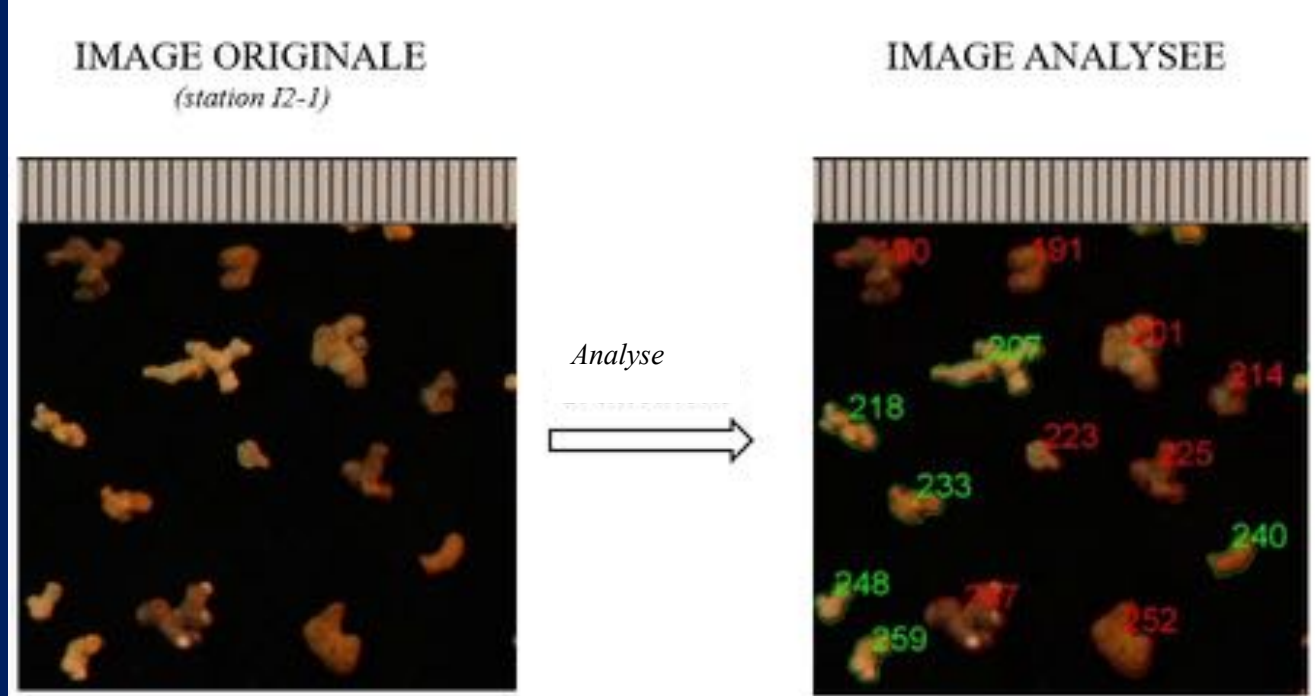
- Use of sediment profile imagery and core samplig (SCUBA diving)
- Use of the specific image analysis software developped within JERICO (SPIArcBase)
- Use of Image J software

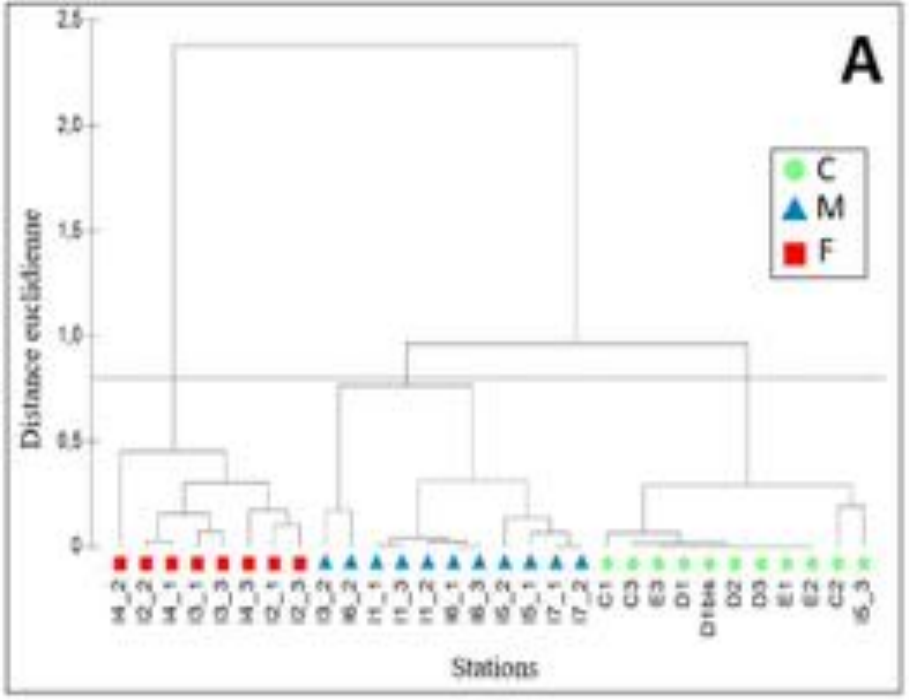
- Continuity between JERICO and JERICO-NEXT

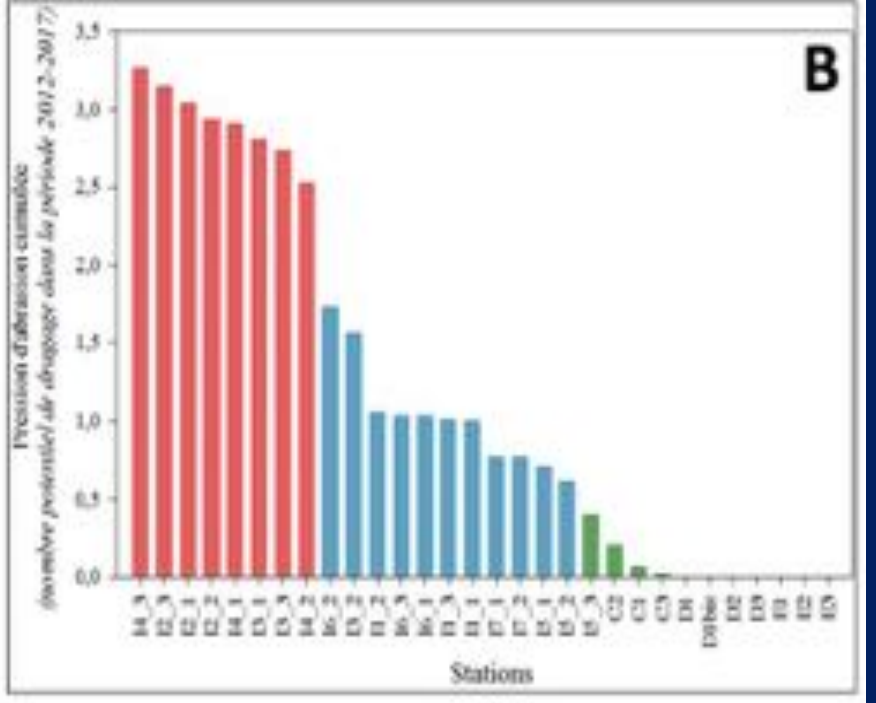
- Maerl vitality (based on its color)
- Size of maerl bits
- Complexity of the shape of maerl bits

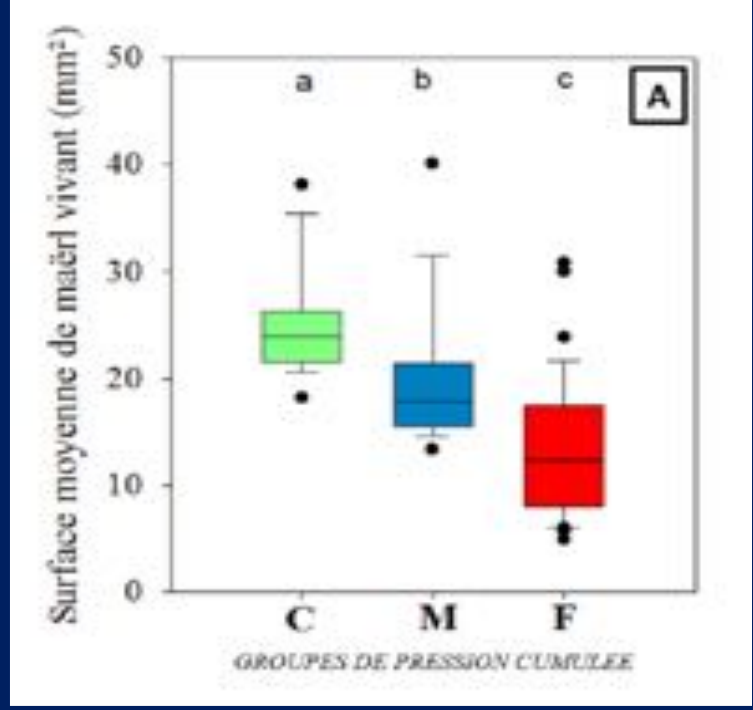
- Description of recorded effects based on dredging pressures (cumulated over 5 years vs historicity)
- Using ascending linear multiple regression models





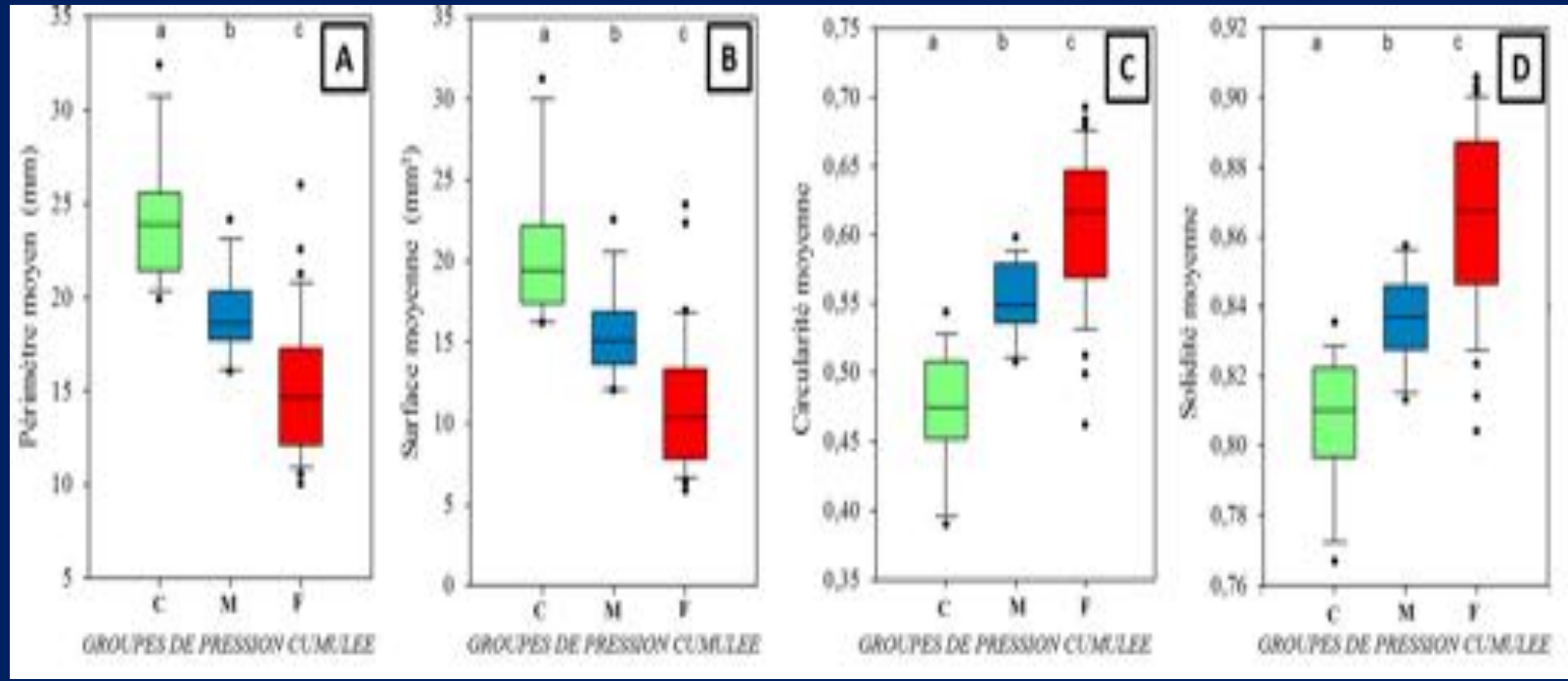






MAIN RESULTS

- 3 groups of stations based on cumulated dredging pressures (C, M, F)
- Negative impact on living maerl
- Diminution of the size of maerl bits
- Simplification of the shape of maerl bits
- These changes tend to be better explained by considering the historicity of dredging rather than cumulated pressures
- What about benthic macrofauna composition?



Synthesis on the what

- Question 1: Which sculpture is the most representative of the JERICO-RI?
- Question 2: Why?