Navigating the Future V as inspiration and direction for marine science in the Ocean Decade

EMB Third Thursday Science Webinar

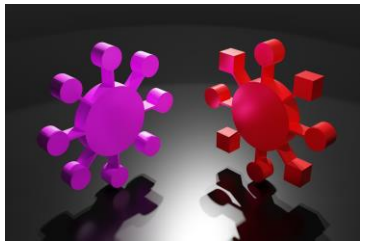
19 August 2021

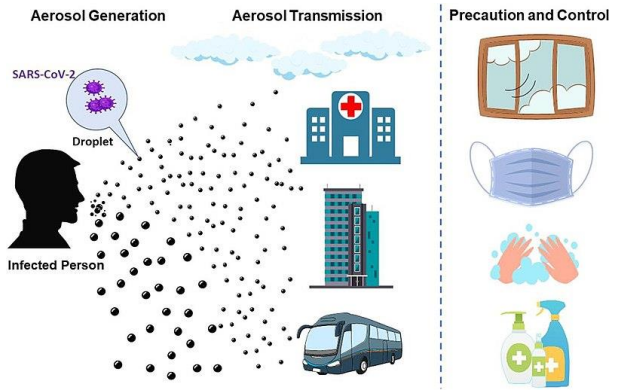
VLIZ
Vlaams Instituut voor de Zee vzw
Flanders Marine Institute

2020-2021

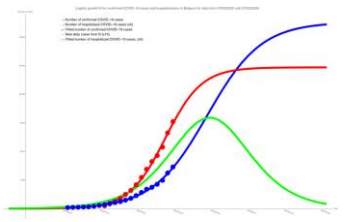
Societal challenge

Many scientific questions





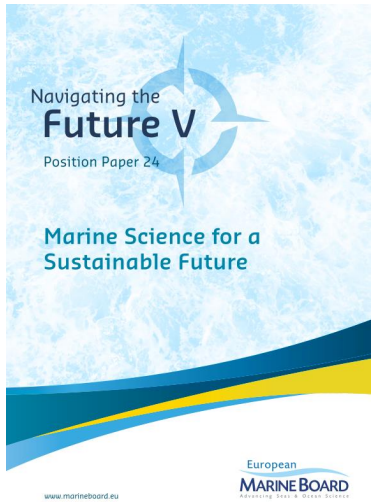
Fast scientific breakthroughs



2019-2030

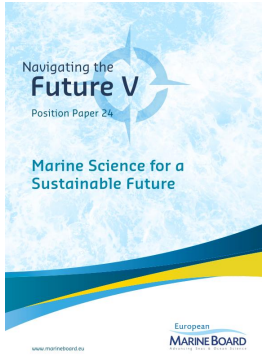
Societal challenges

Scientific questions…



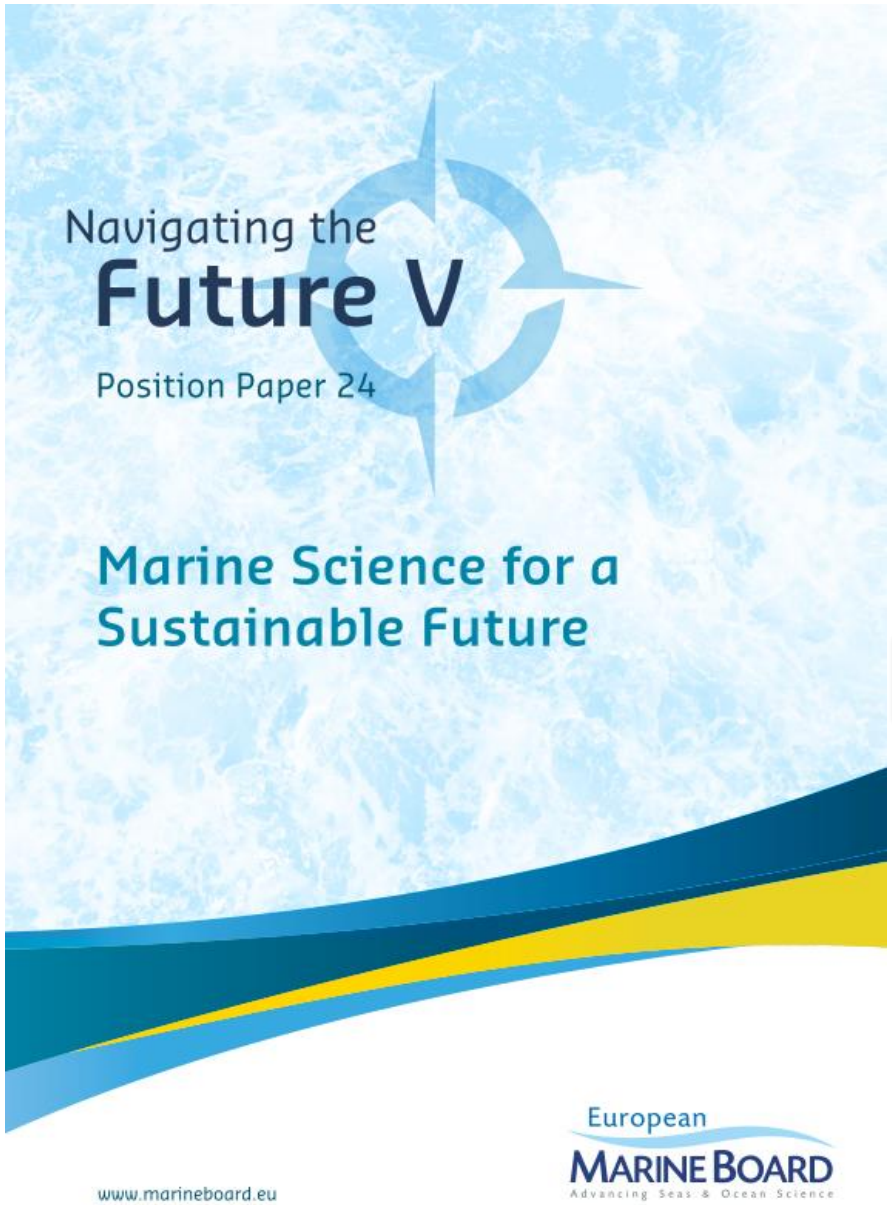
… on to scientific breakthroughs!

Brussels, November 2017

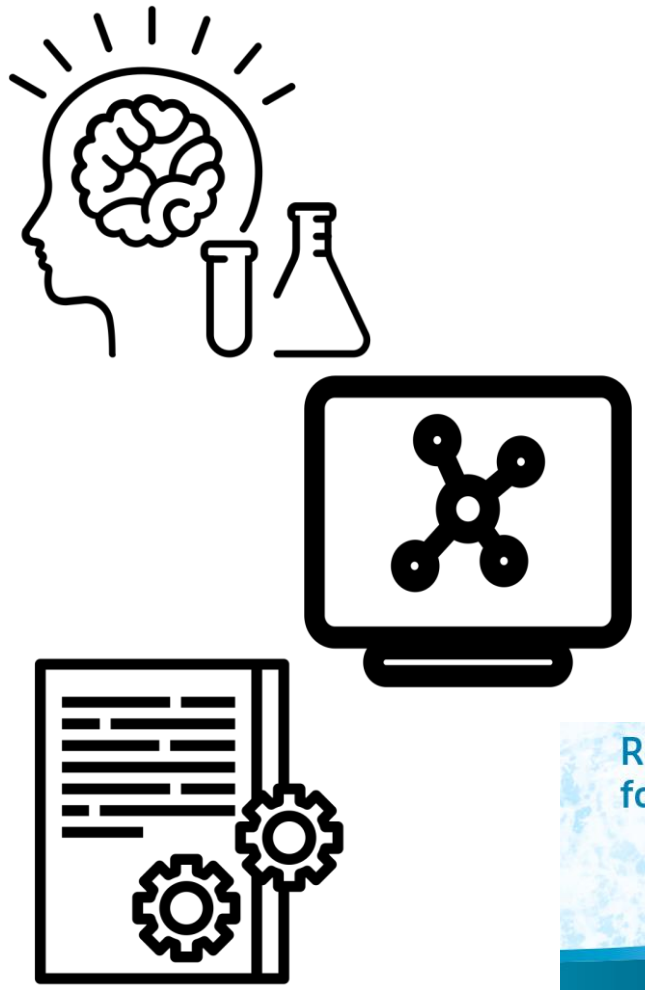


Eur 2019 CEAN

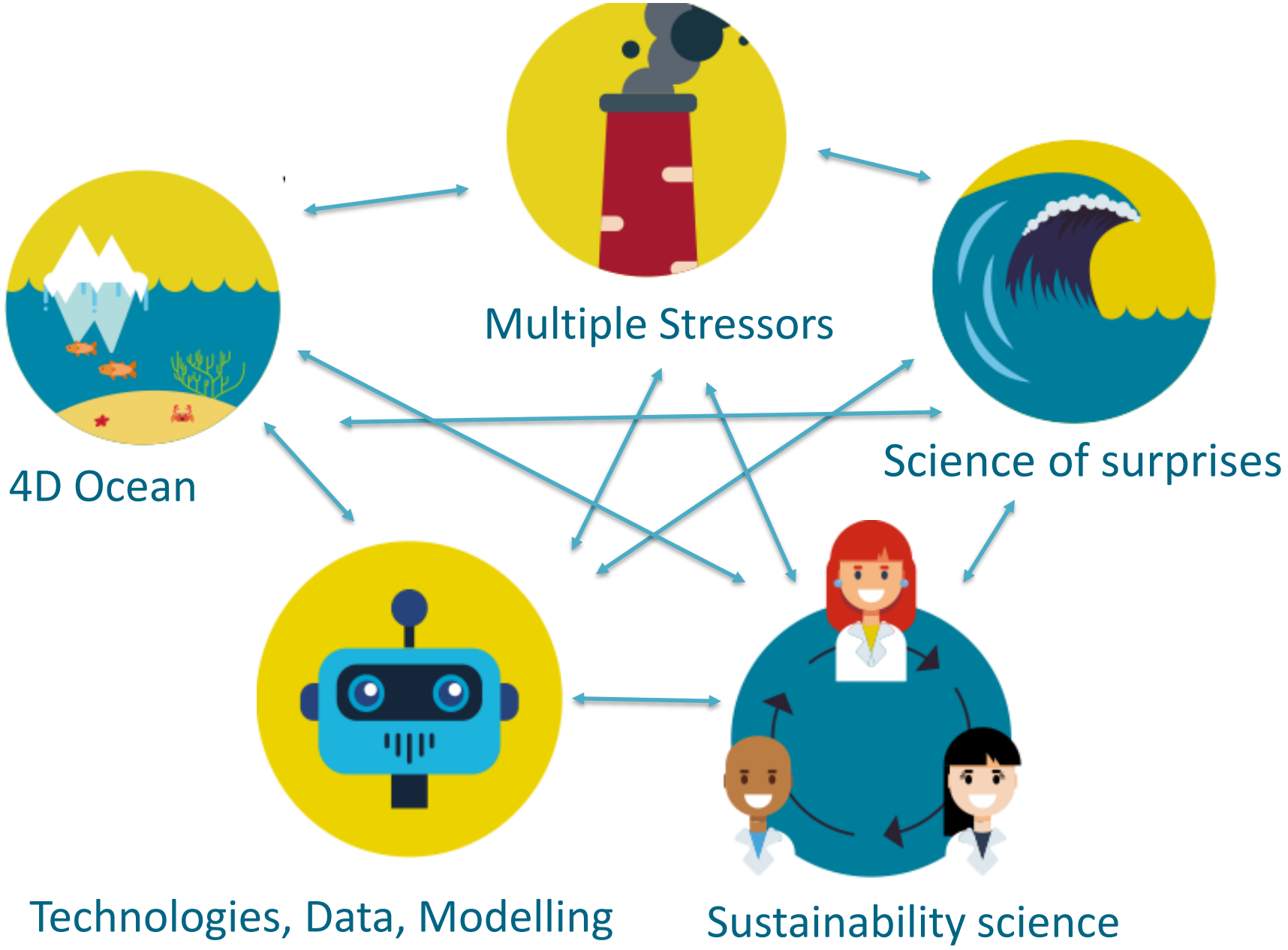
Paris, June 2019



Internet, August 2021



Key scientific topics – knowledge gaps



Main research fields mid-term horizon

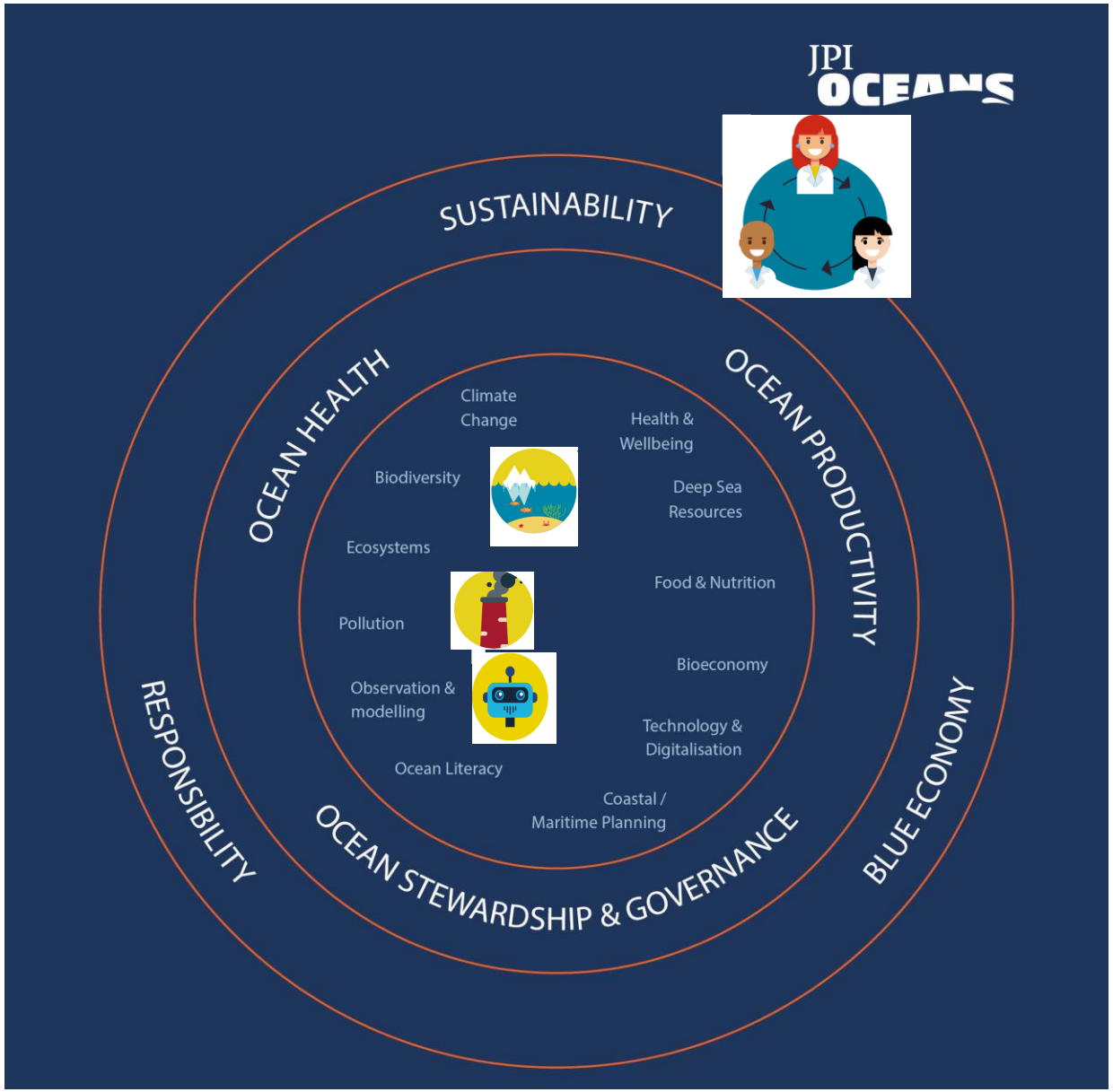
Ocean and climate change

Sustainable living resources

Human activities and the ocean

Resonating of Navigating the Future V in Science Policy,

Research Programmes and Strategies



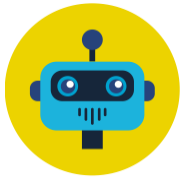
http://jpi-oceans.eu/draft-strategy-framework-beyond-2020

Strategy Framework 2021-2025

- Ocean health: ‘understanding of the **structure, function, and connectivity** of marine ecosystems’, ‘functional links ecosystems – physical processes – biogeochemical environment’

- ‘Current and emerging environmental pressures’, ‘**cumulative effects** assessments’

- Ocean productivity: ‘Understanding and **predicting** changes to the ocean environment’, ‘ocean **observation**, monitoring and numerical **modelling**’

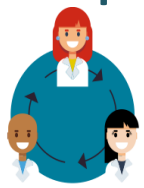
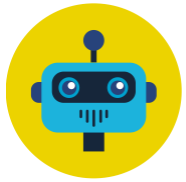


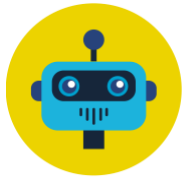
http://jpi-oceans.eu/draft-strategy-framework-beyond-2020

BANOS
Baltic and North Sea Coordination and Support Action

The Baltic and North Sea Strategic Research and Innovation Agenda
BANOS SRIA 2021

- A1.1 Food Web Interactions
- A1.2 Multiple Drivers of Change
- A1.3 Adaptation Potential to Environmental Change
- A2.1 Pollution Impact, ‘mixtures of chemicals, multiple decade
- A2.4 Sustainability Challenges
- A3 Digital Ocean: AI, Modelling, Tipping points
- A4 Monitoring: observations, sensors, technologies
- C2.1 Transformation in support of wellbeing and sustainability

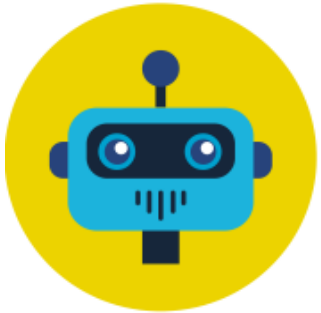





http://www.banoscsa.org

Mission Starfish 2030: Restore our Ocean and Waters

- Filling the knowledge and emotional gaps: ‘aim […] to fully map, sequence, observe and predict our ocean, seas and rivers’
  - Modelling infrastructures,
  - Observation streamlined, data pooled and accessible
  - High-resolution forecasting
  - 50% DNA of ocean life sequenced and available
  - Interactive platform: Digital Twin of the Ocean



- Active cooperation and co-ownership

https://op.europa.eu/en/web/eu-law-and-publications/publication-detail/-/publication/672ddc53-fc85-11ea-b44f-01aa75ed71a1

Horizon Europe Work Programme 21-22
Cluster 6

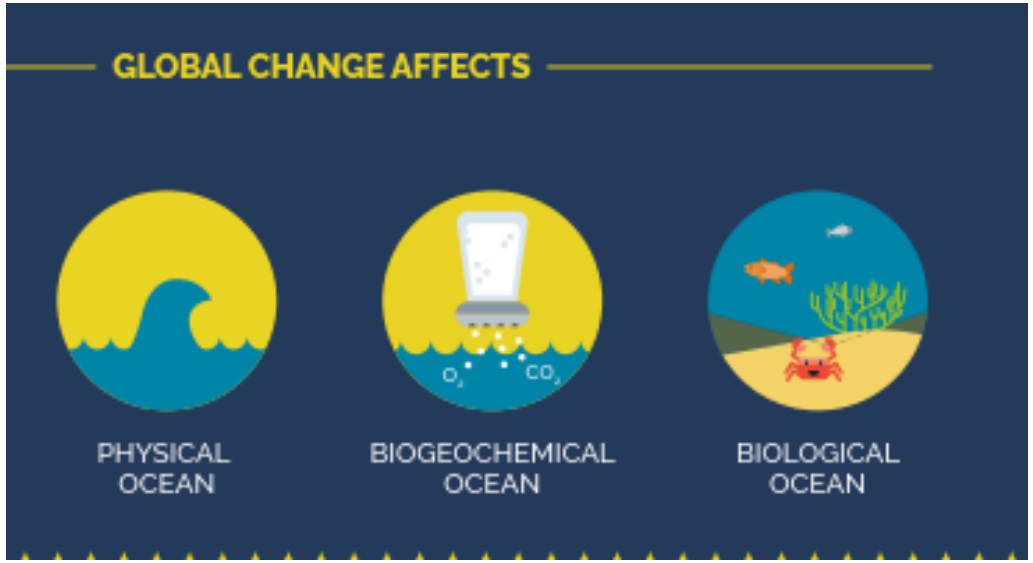
- 2021-BIODIV01-01: global biodiversity genomics
- 2021-BIODIV01-03: marine biodiversity and ecosystem services
- 2021-BIODIV01-04: cumulative stressors marine biodiv. and ES
- 2022-BIODIV01-01: observation & mapping marine biodiversity
- 2022-CLIMATE-01-02: oceanic carbon cycle
- 2021-COMMUNITIES-01-04: socio-economic empowerment users of the sea
- 2022-COMMUNITIES-01-03: marine ecosystem service valuation, conservation and restoration

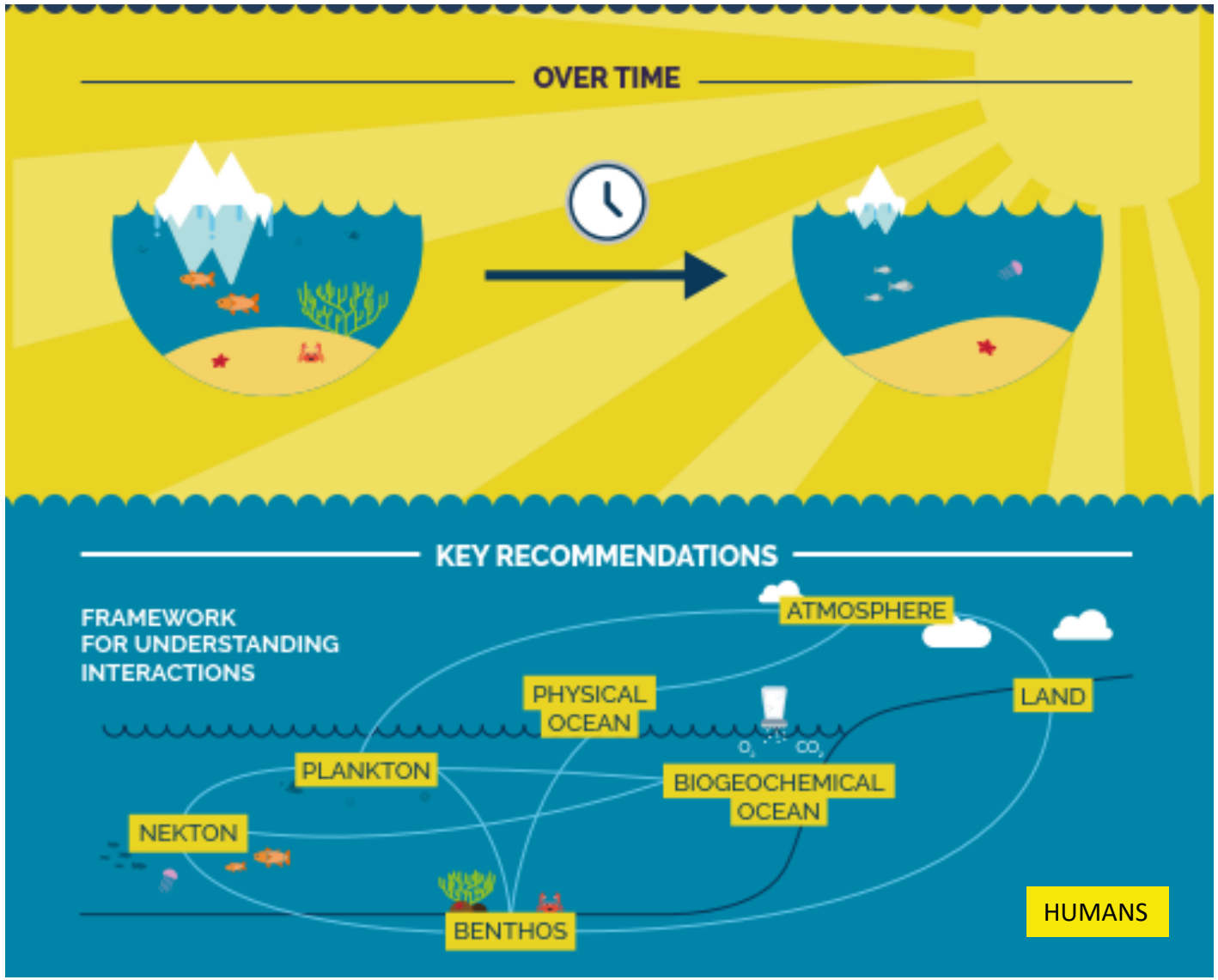
https://op.europa.eu/en/web/eu-law-and-publications/publication-detail/-/publication/672ddc53-fc85-11ea-b44f-01aa75ed71a1

Research inspired by or contributing to recommendations from

Navigating the Future V

A four-dimensional and connected ocean





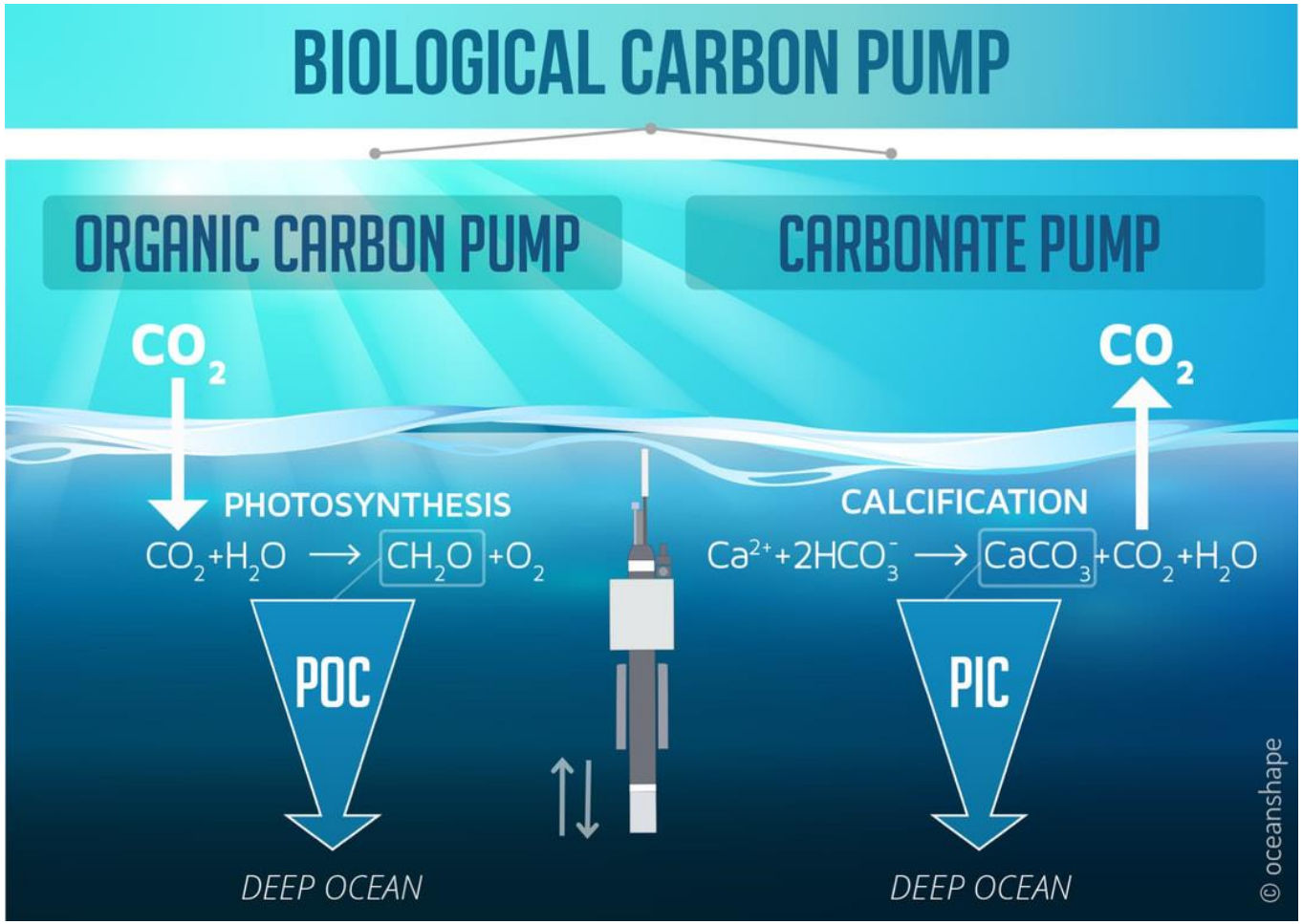
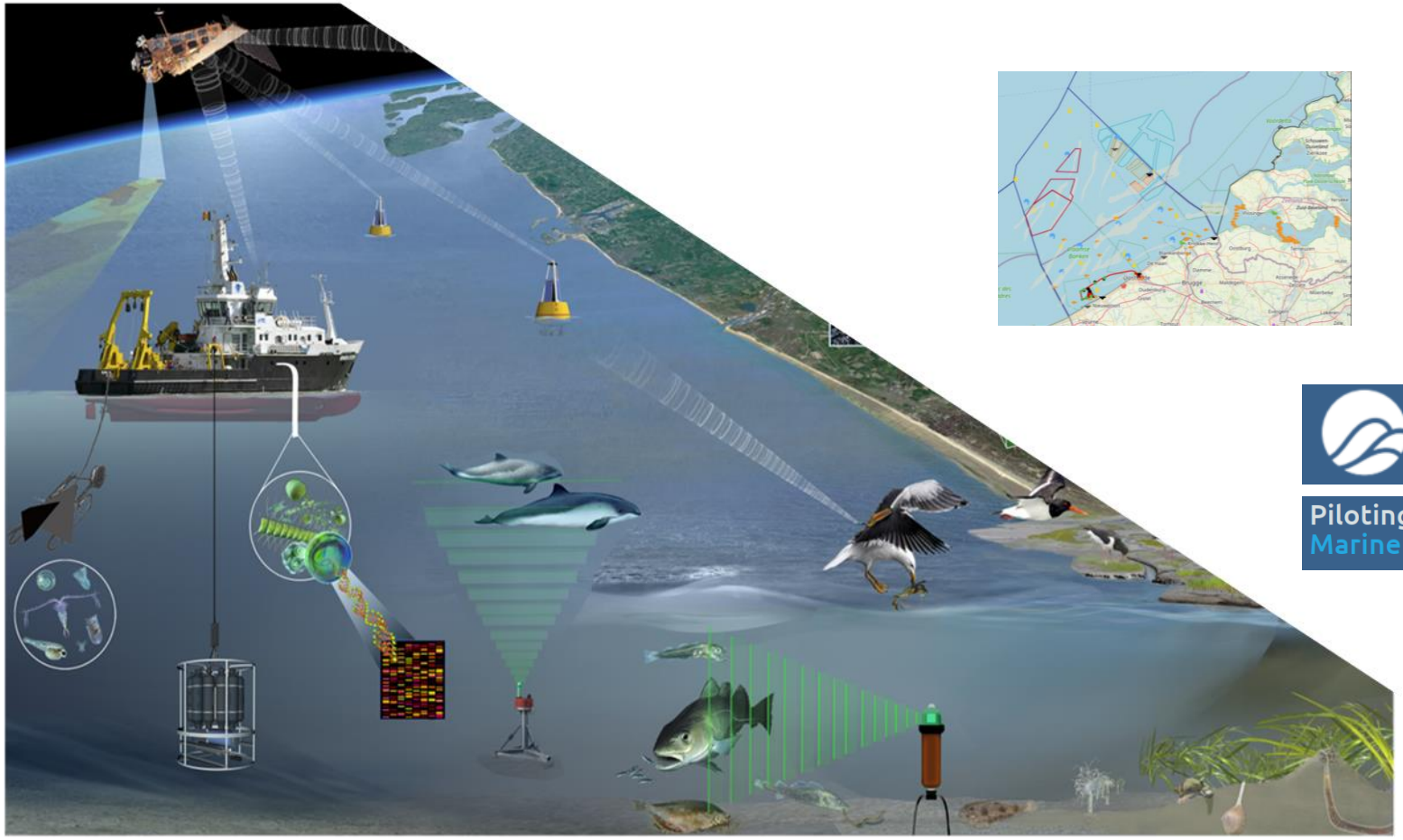


Image Griet Neukermans

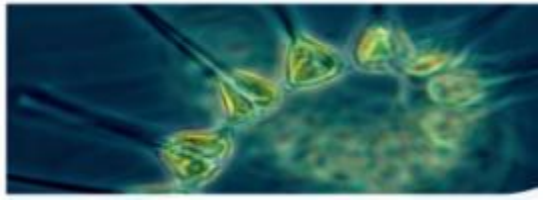
https://www.ugent.be/en/research/research-ugent/eu-trackrecord/h2020/erc-h2020/carbocean.htm

High quality long-term biodiversity and ecosystem data series



Blue-Cloud

Piloting innovative services for
Marine Research & the Blue Economy



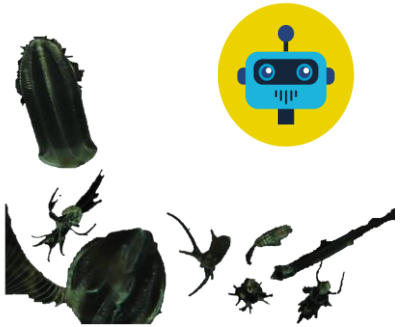
ZOO- AND PHYTOPLANKTON EOV PRODUCTS

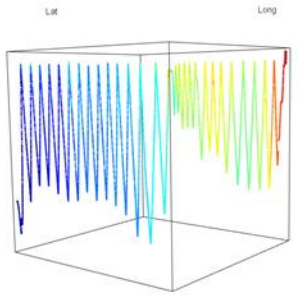
Producing phytoplankton, zooplankton and nutrients EOV products which contribute to improve knowledge and quantitatively reduce uncertainty regarding the present state of the marine plankton ecosystems and their response to ongoing and future climate change.

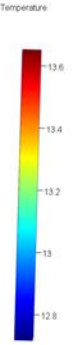
https://www.blue-cloud.org/demonstrators/zoo-and-phytoplankton-eov-products

Interactions physical, biological and biogeochemical ocean + humans

Zooplankton 3D distribution and steering factors



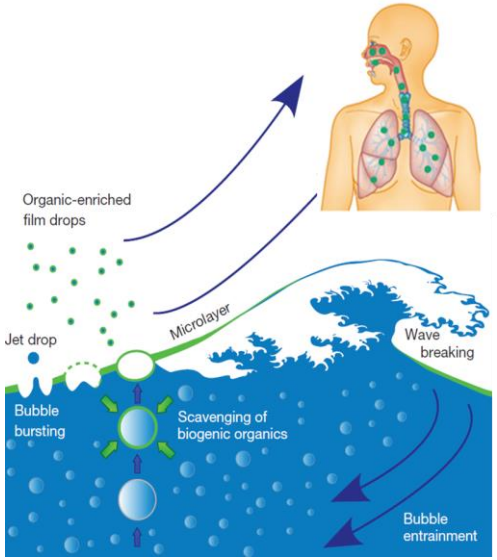




Images Anouk Ollevier

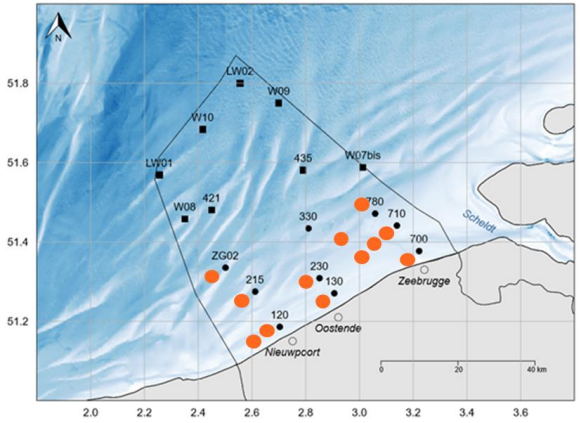
Video plankton recorder

Sea spray aerosols



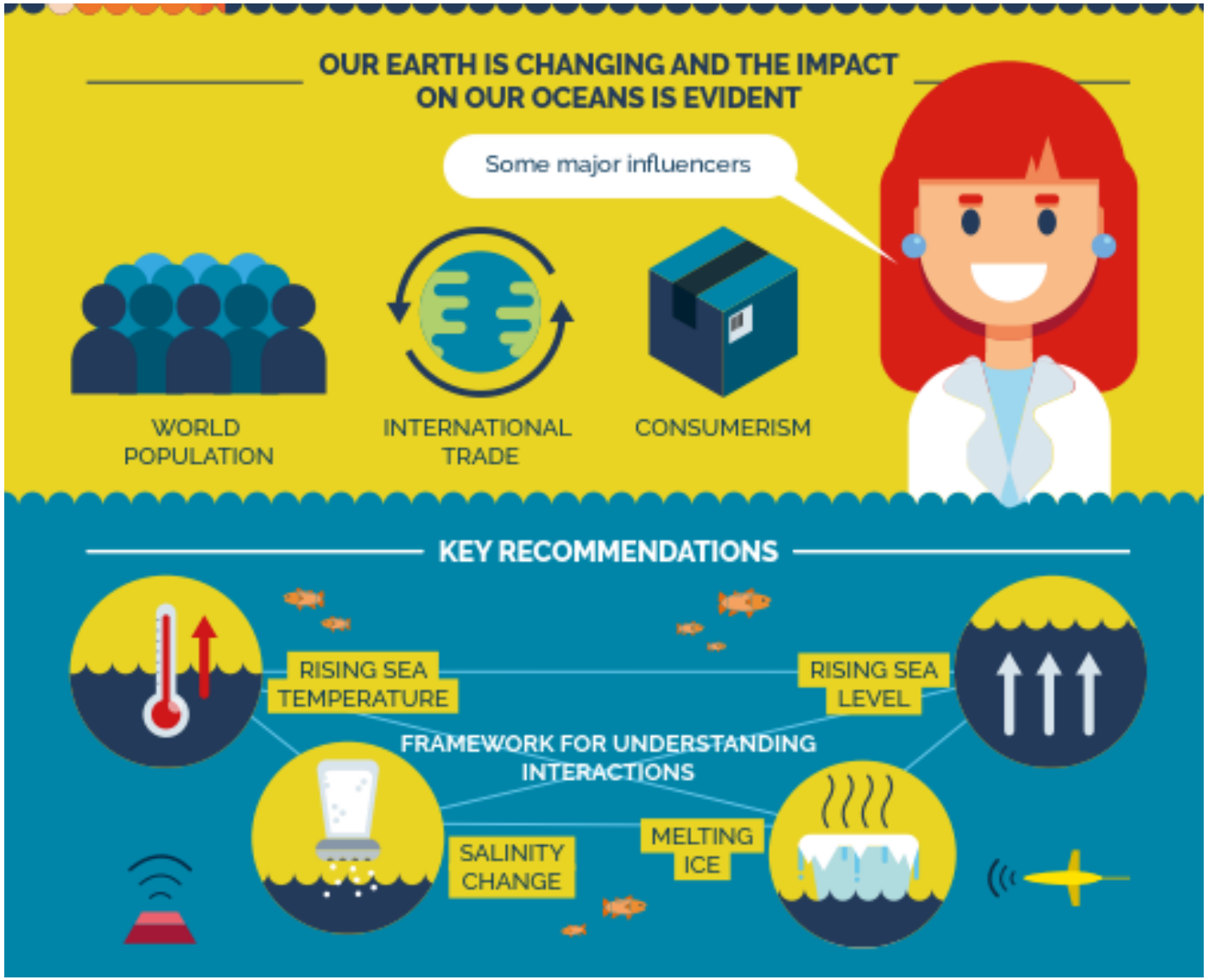
Adapted from Wilson et al., 2015

Functional variation microeukaryotic plankton



Images Michiel Perneel

A multi-stressed and rapidly changing ocean



iAtlantic
INTEGRATED ASSESSMENT OF ATLANTIC MARINE ECOSYSTEMS IN SPACE AND TIME

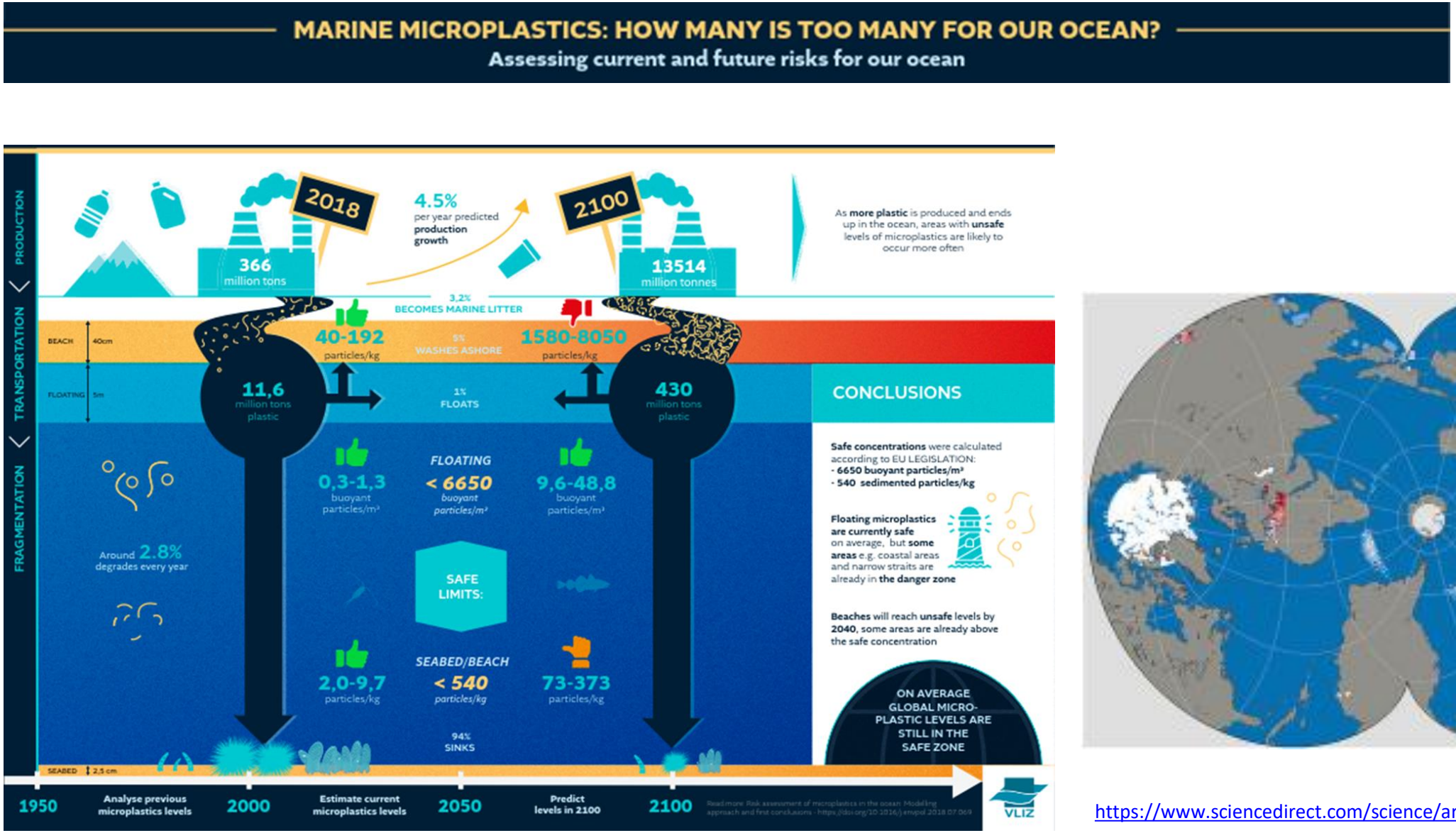
Horizon2020

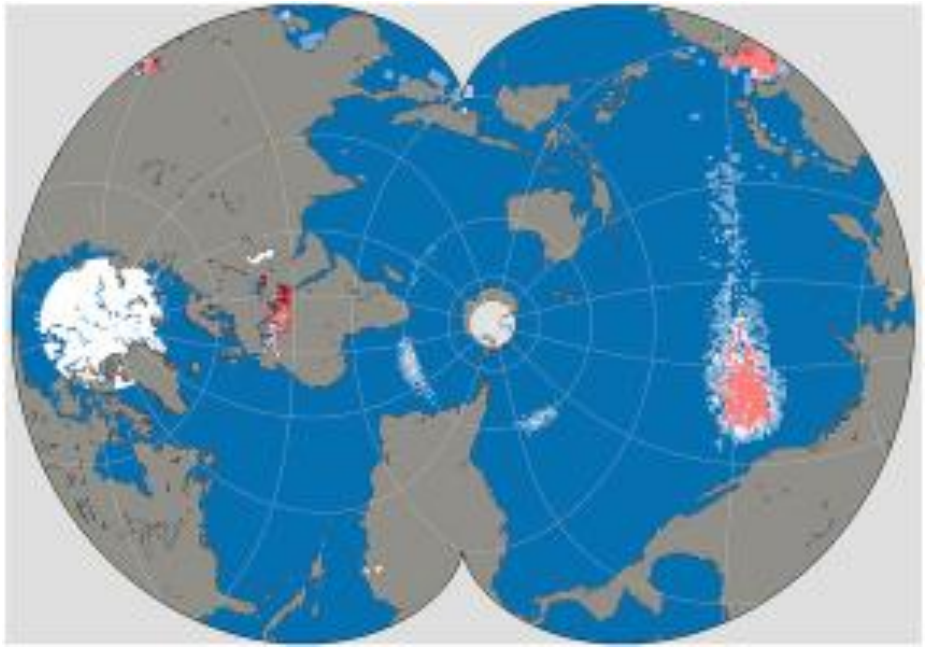
Our oceans are increasingly exploited for energy, food and minerals. Images courtesy (L-R) Equinor, Jonathan Noack and USGS.

- Baseline investigations: **observations** and **modelling**
- Lab **experiments** single and **multiple stressors effects** on species and ecosystems
- Identify **tipping points** for deep-sea ecosystems

https://www.iatlantic.eu/our-work/work-packages/impacts-of-multiple-stressors-on-atlantic-ecosystems/

New stressors: risk assessment, time and space





https://www.sciencedirect.com/science/article/pii/S026974912036187X

Modelling impact on ecosystem services

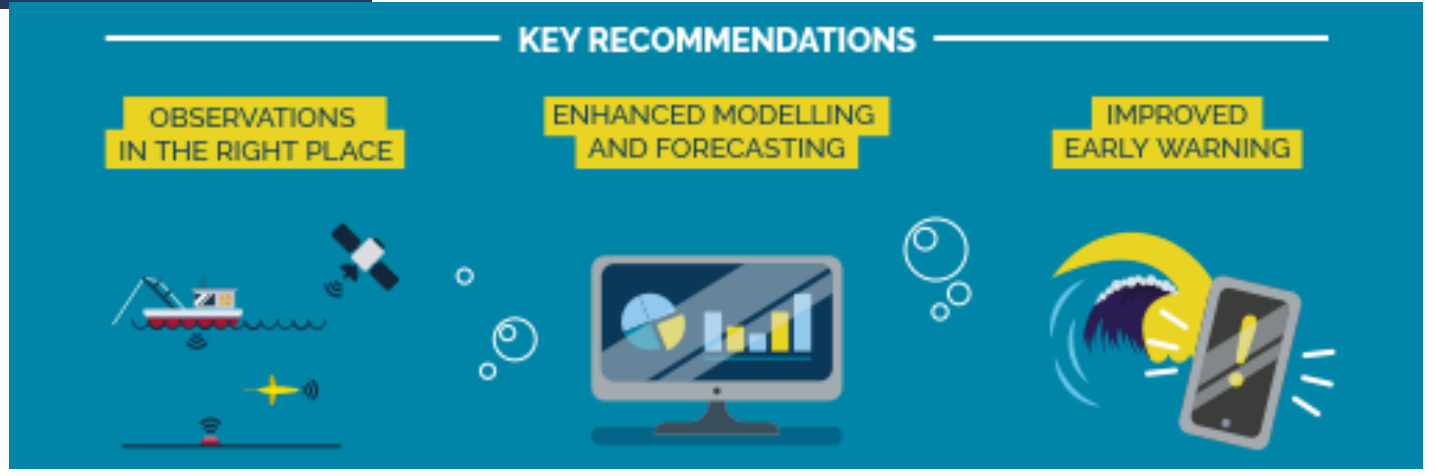
PIXABAY (Jatblad)

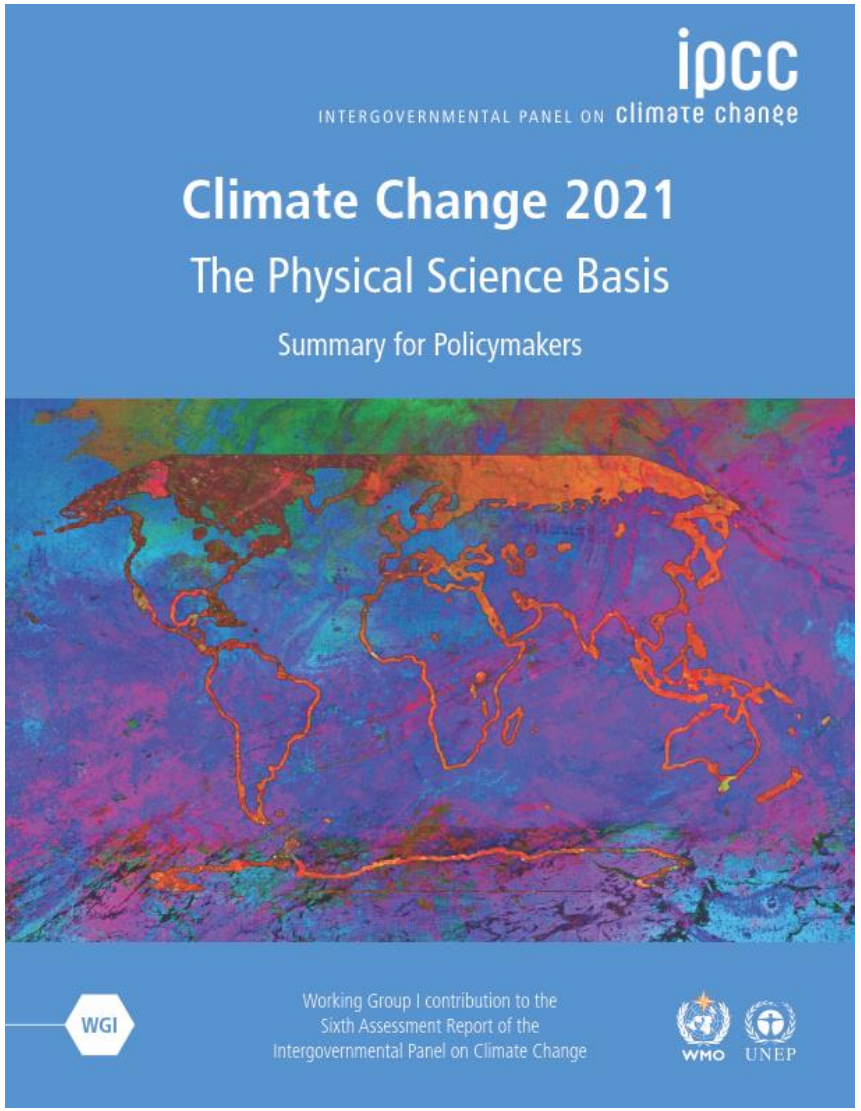
SUMES project

Data – ecosystem services modelling – risk assessment – interactions – life cycle assessment

Decision framework for sustainable Blue Economy Development Belgian North Sea

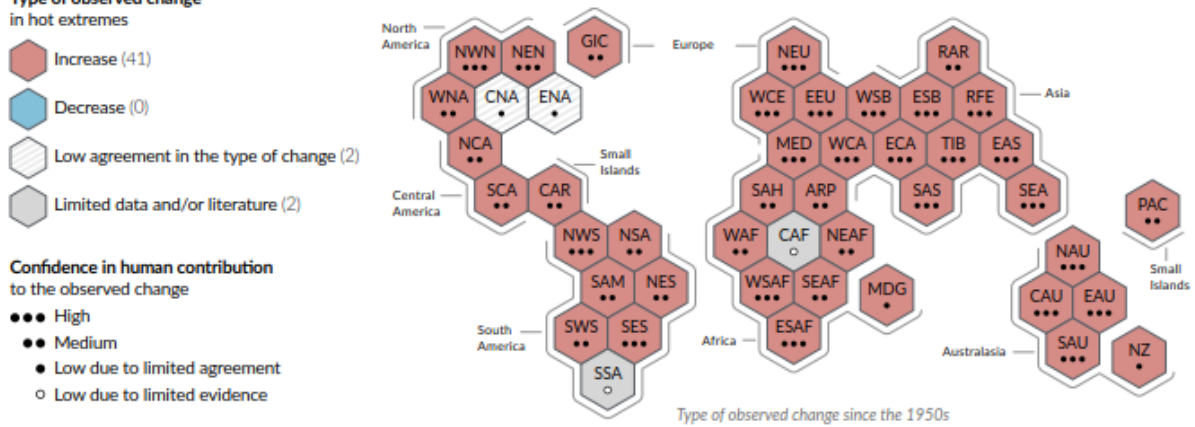
Science of surprises





A.3 Human-induced climate change is already affecting many weather and climate extremes in every region across the globe. Evidence of observed changes in extremes such as heatwaves, heavy precipitation, droughts, and tropical cyclones, and, in particular, their attribution to human influence, has strengthened since AR5.
{2.3, 3.3, 8.2, 8.3, 8.4, 8.5, 8.6, Box 8.1, Box 8.2, Box 9.2, 10.6, 11.2, 11.3, 11.4, 11.6, 11.7, 11.8, 11.9, 12.3} **(Figure SPM.3)**

a) Synthesis of assessment of observed change in **hot extremes** and confidence in human contribution to the observed changes in the world's regions



Meteotsunami research

Natural Hazards (2021) 106:1087–1104
https://doi.org/10.1007/s11069-021-04679-9

EDITORIAL

Check for updates

Special issue on the global perspective on meteotsunami science: editorial

Ivica Vilibić[1] · Alexander B. Rabinovich[2,3] · Eric J. Anderson[4]

Received: 4 March 2021 / Accepted: 4 March 2021 / Published online: 17 March 202
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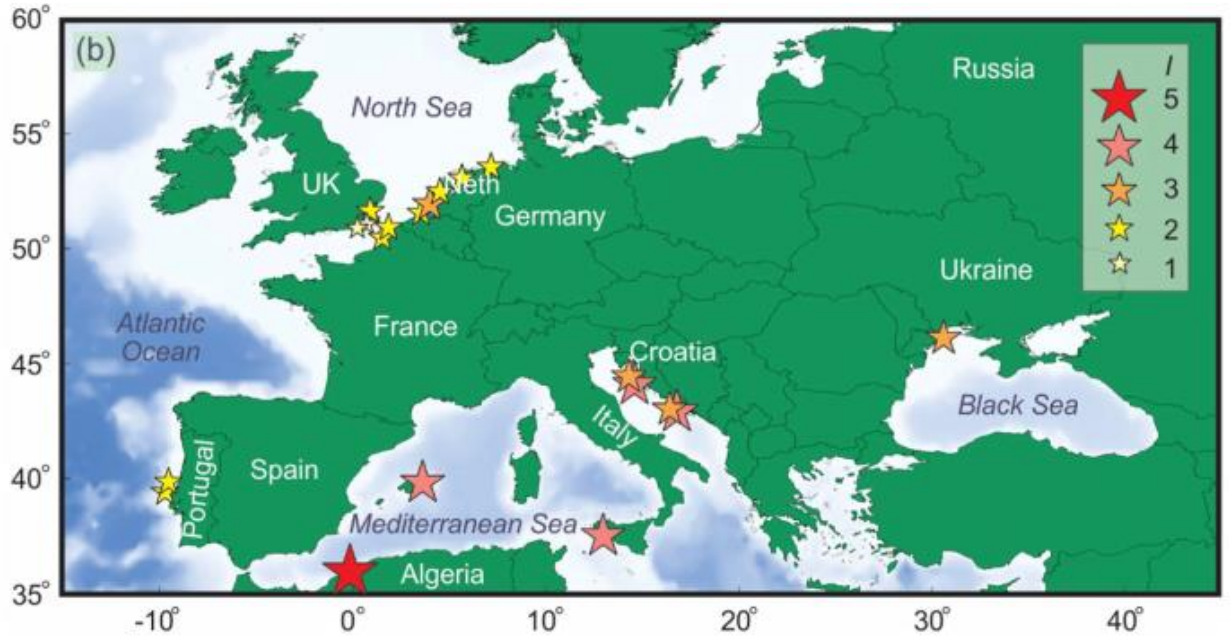
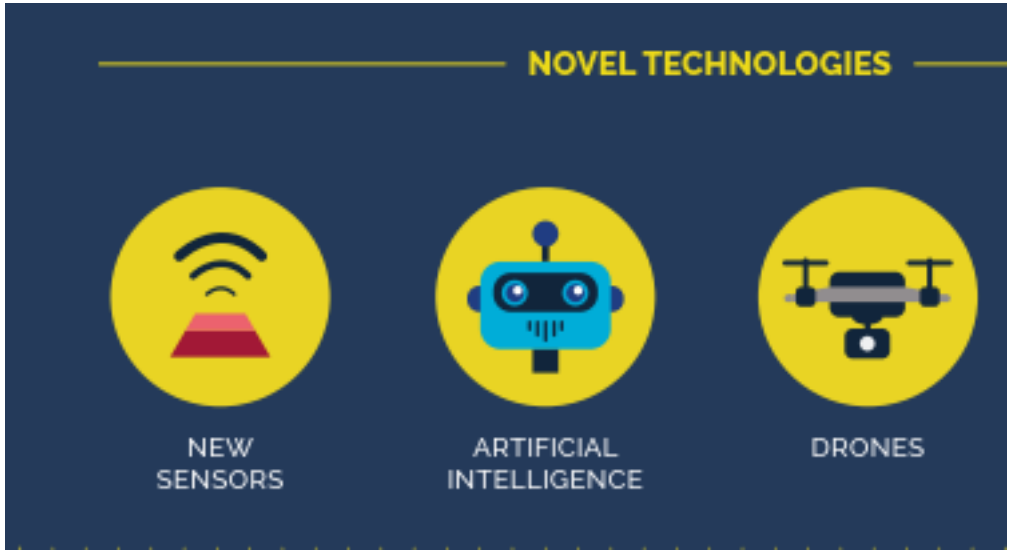
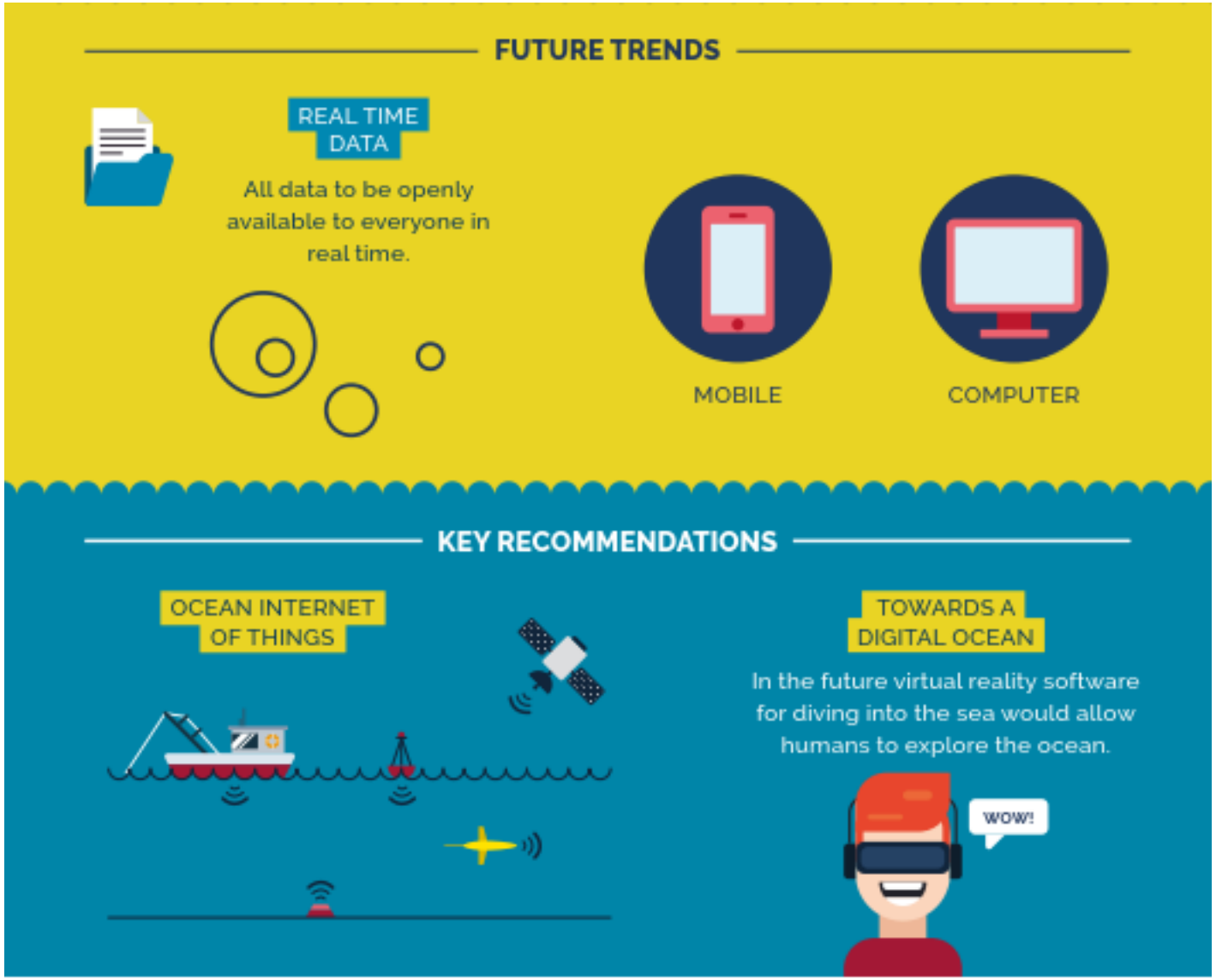


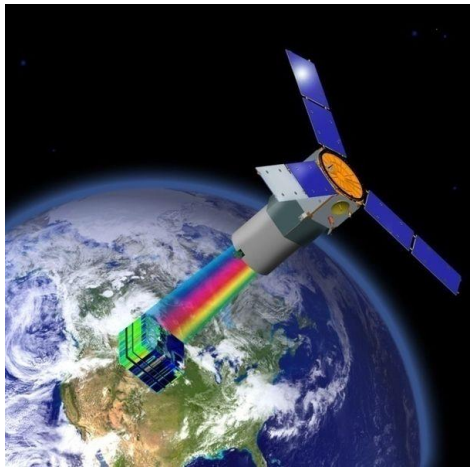
Fig. 2 Geographical distribution of the intensity (*I*) of meteotsunami events described in the present special issue: **a** the world and **b** Europe. The intensity is determined mostly by the destructive consequences of the event

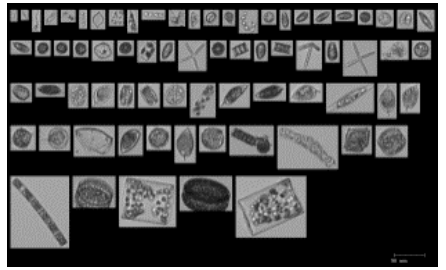
Novel technologies, data and modelling for ocean research





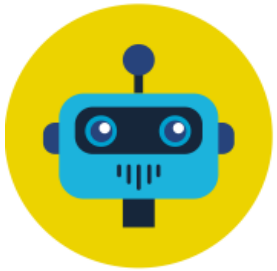
New sensors and data





Data needs for hyperspectral detection of algal bloom diversity across the globe

New sensors, (near) real-time data

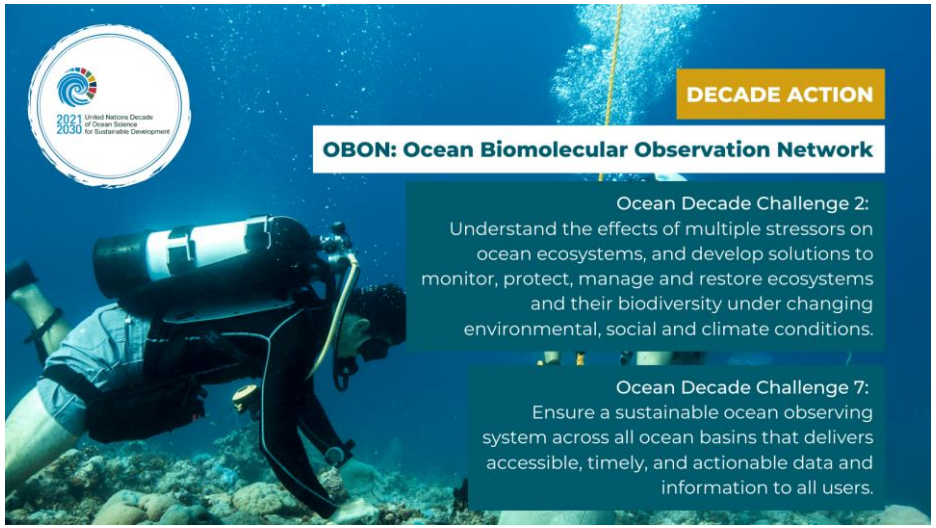


EMBRC
EUROPEAN
MARINE
BIOLOGICAL
RESOURCE
CENTRE

EMO BON

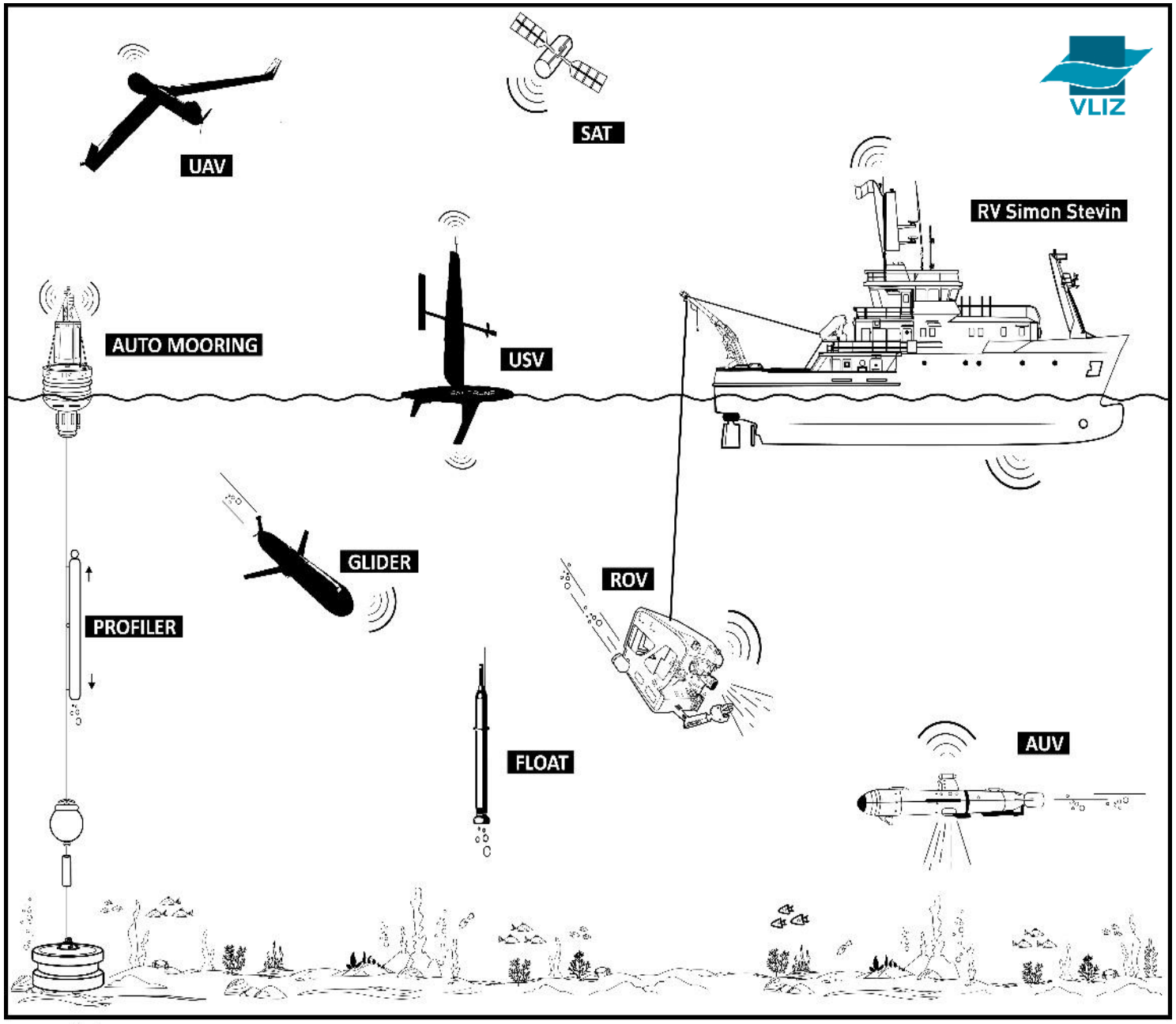
European Marine Omics Biodiversity Observation Network

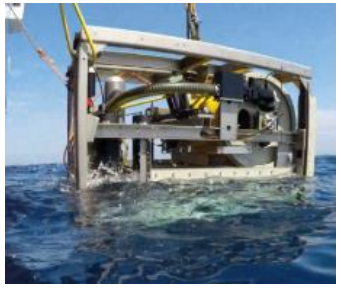
pogo Partnership for Observation of the Global Ocean



https://www.embrc.eu/emo-bon
https://twitter.com/obon_ocean

Robotics, Drones, Ocean Internet of Things





www.vliz.be

Artificial Intelligence, New measurements

Plankton identification

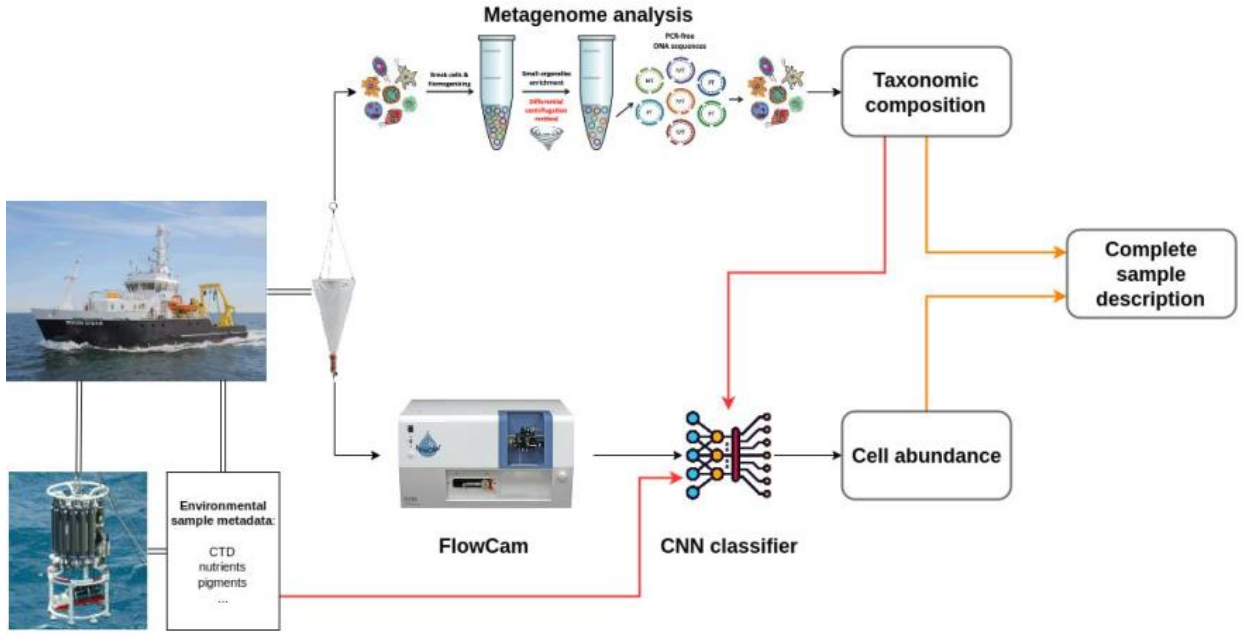
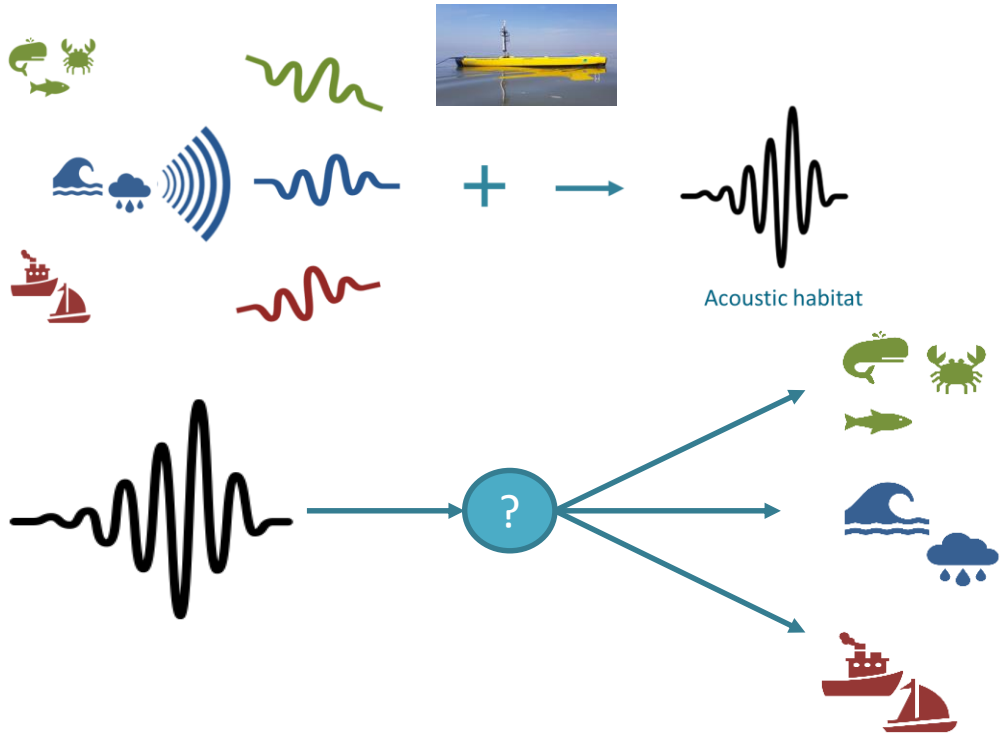


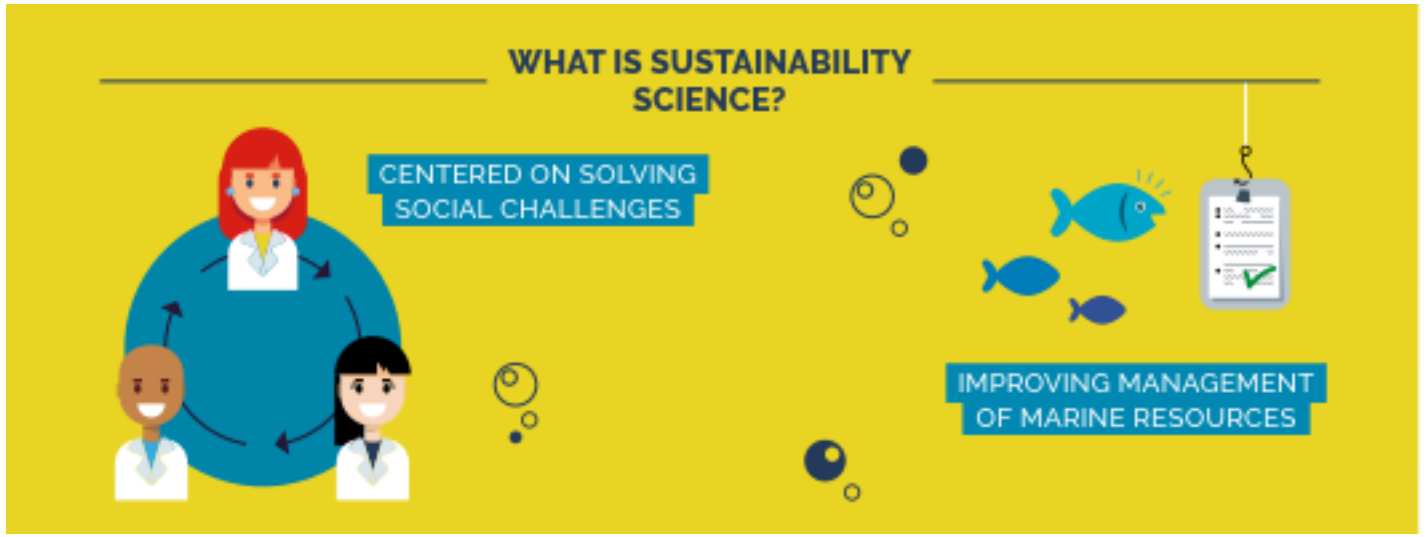
Image Nick Dillen

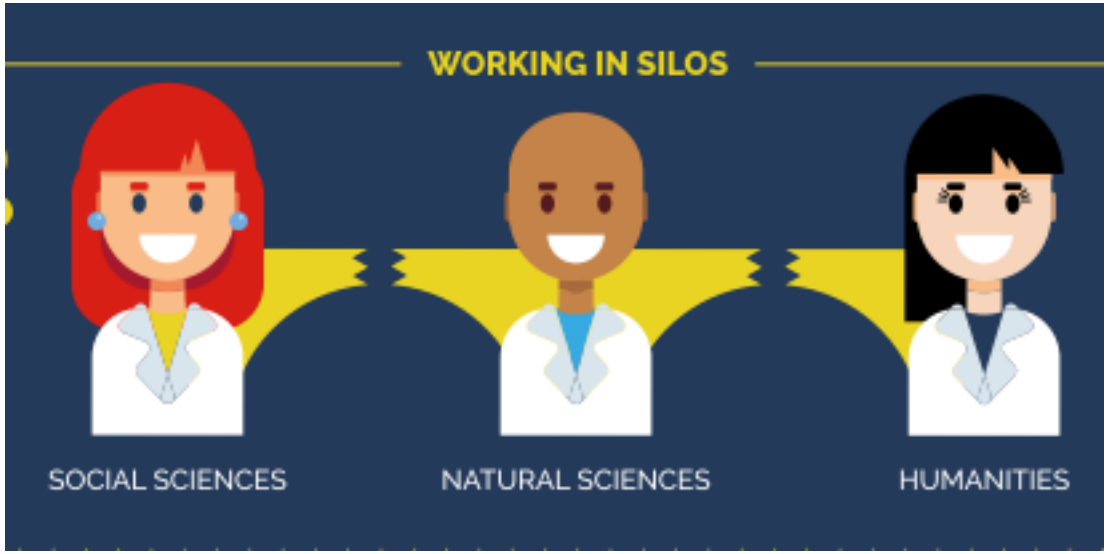
Underwater sound

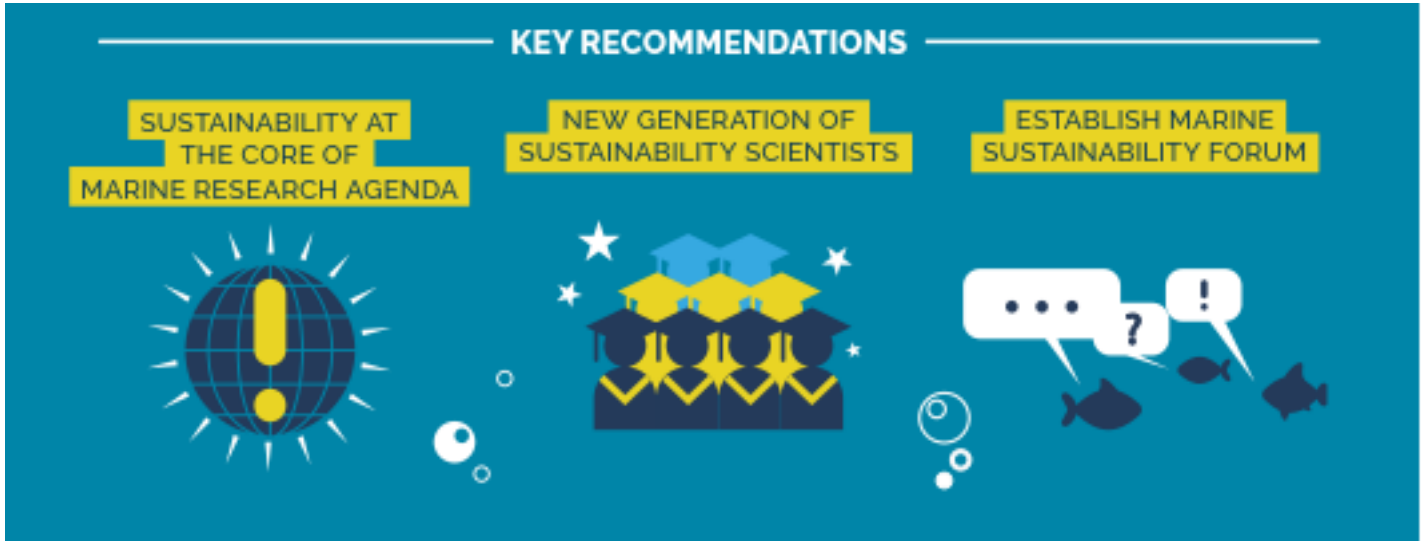


Images Clea Parcerisas

Sustainability science for the ocean





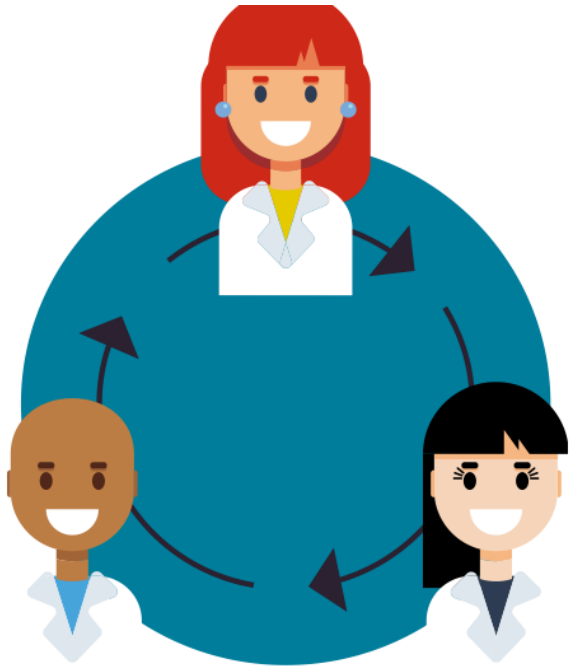


Interreg North Sea Region NSW
European Regional Development Fund
EUROPEAN UNION

NORTH SEA WRECKS

Legal experts

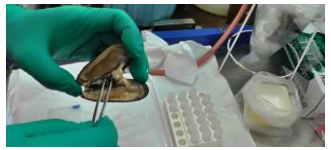
Public bodies in Advisory Board



Geologists

Marine biologists

Toxicologists



Data scientists

Historians

Archaeologists

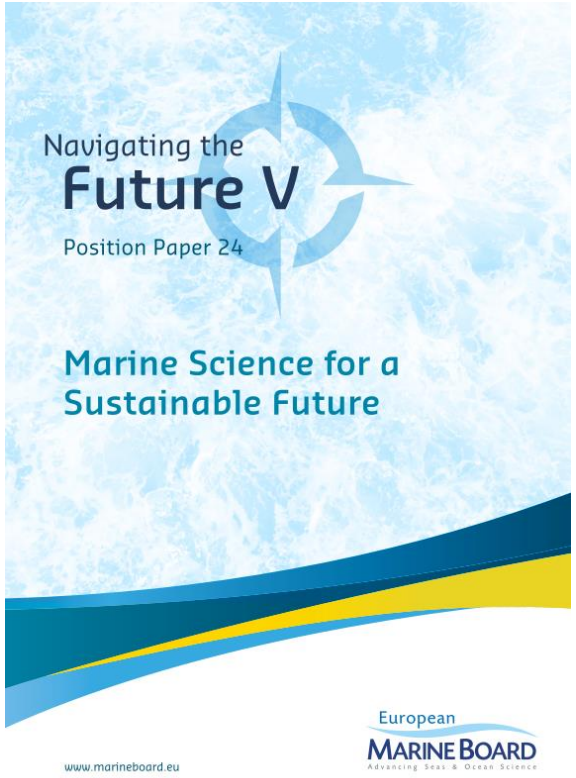
Risk mitigation wrecks and munitions in North Sea

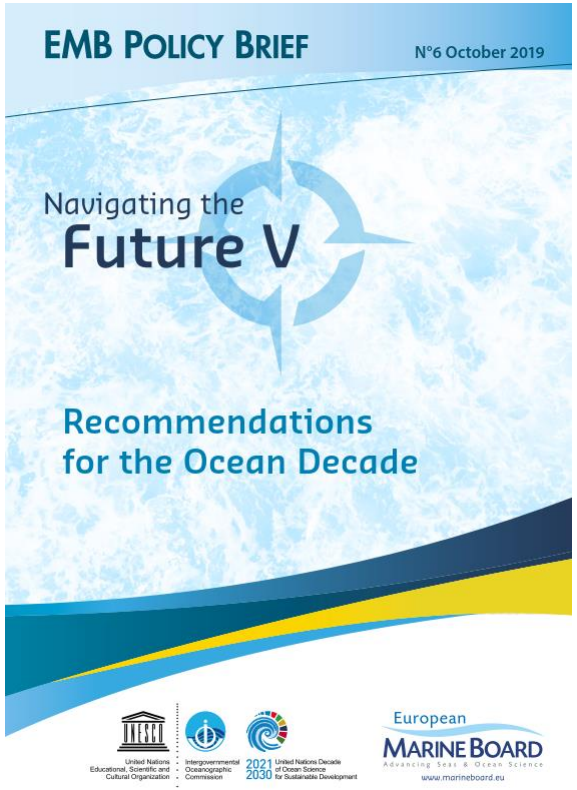
https://northsearegion.eu/nsw/

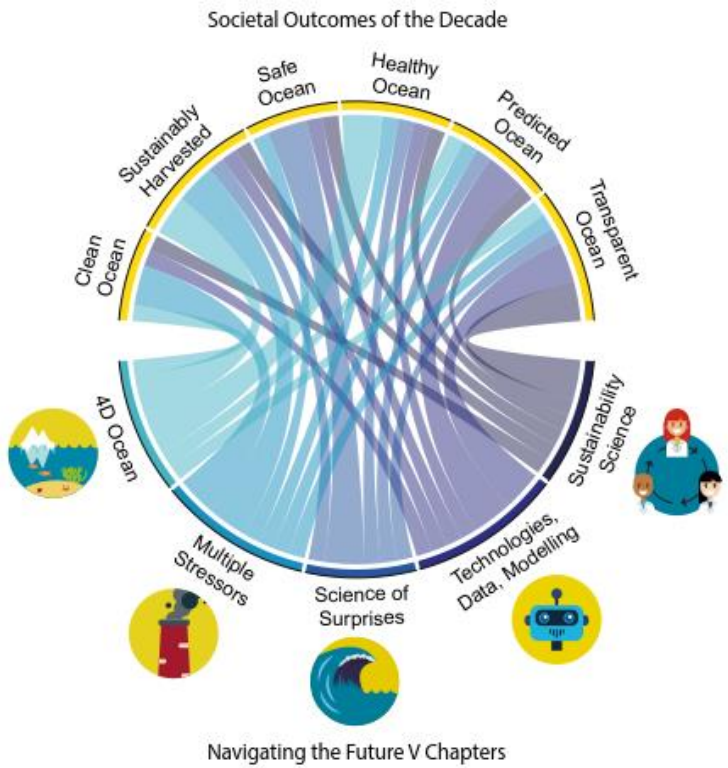
Navigating the further future…

Navigating the further future…

https://www.marineboard.eu/navigating-future-v







Still highly actual and relevant!

Additional Image credits

- Slide 2: Song Tang, Raymond Spekking, Stigin (Wikimedia)
- Slide 3: Ranah Pixel Studio, Ed Harrison, Becris from noun project
- Slide 5: Andrei Yushchenko, Lagot Design from noun project
- Slide 6: Ranah Pixel Studio, By Lamik, Luis Prado from noun project
- Slide 31: Gregor Cresnar from noun project