

## **Protecting the Earth's living systems** **Restoring the Oceans**

**Prof. Helen Findlay**

Representing science from a wide ocean community



# The Ocean is important!

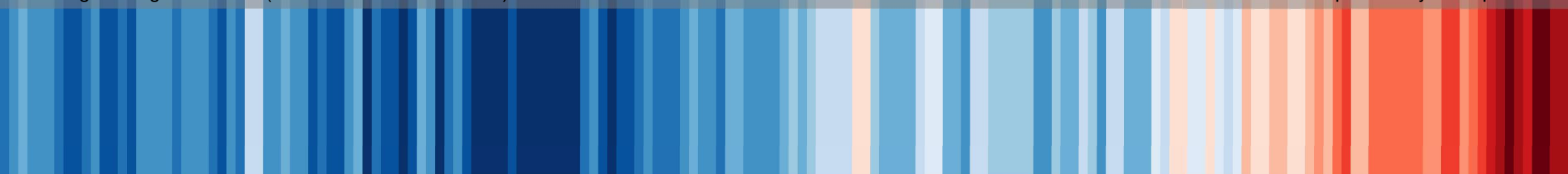
Google Earth, 2024



Research excellence supporting a sustainable ocean

Warming of the global ocean (>1.2 °C from 1850 to 2022)

<https://showyourstripes.info/>



1860

1890

1920

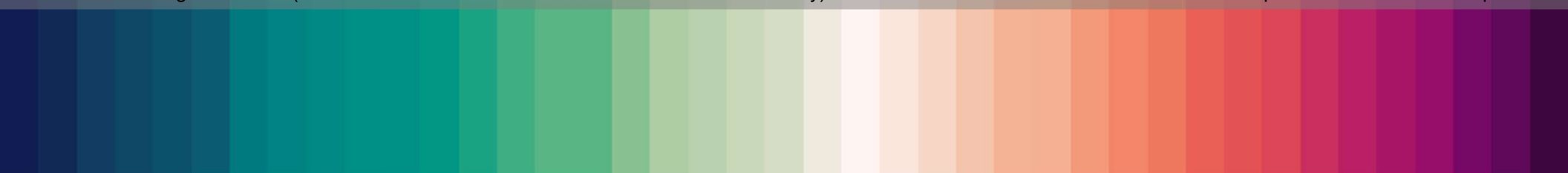
1950

1980

2010

Acidification of the global ocean (0.071 decrease from 1982 to 2022 = 18% increase in acidity)

<https://oceanacidificationstripes.info/>



1983

1990

2000

2010

2020

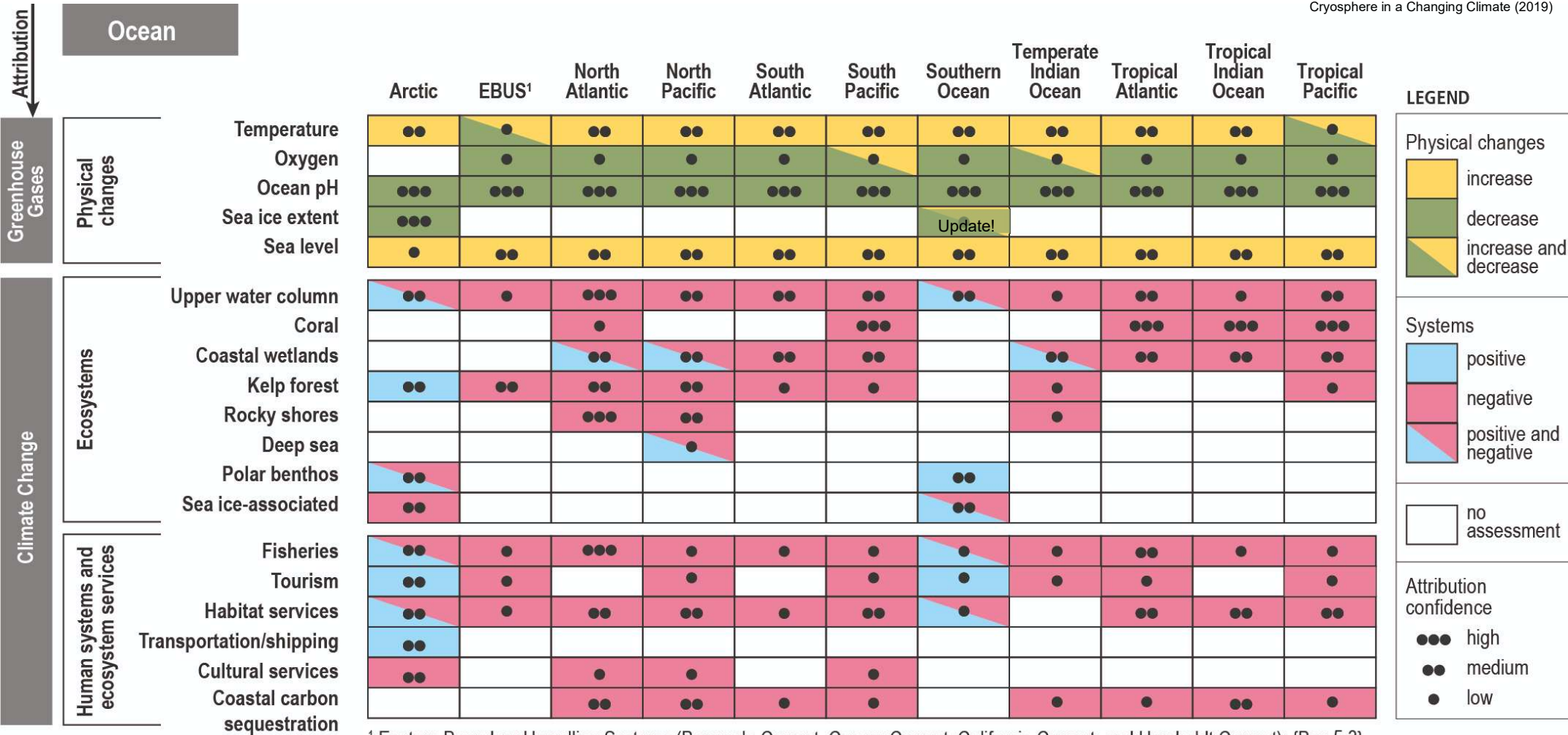
Biodiversity loss of global of vertebrate species from terrestrial, freshwater and marine habitats (69% decline from 1970 to 2018)

<https://biodiversitystripes.info/>



1970

2018

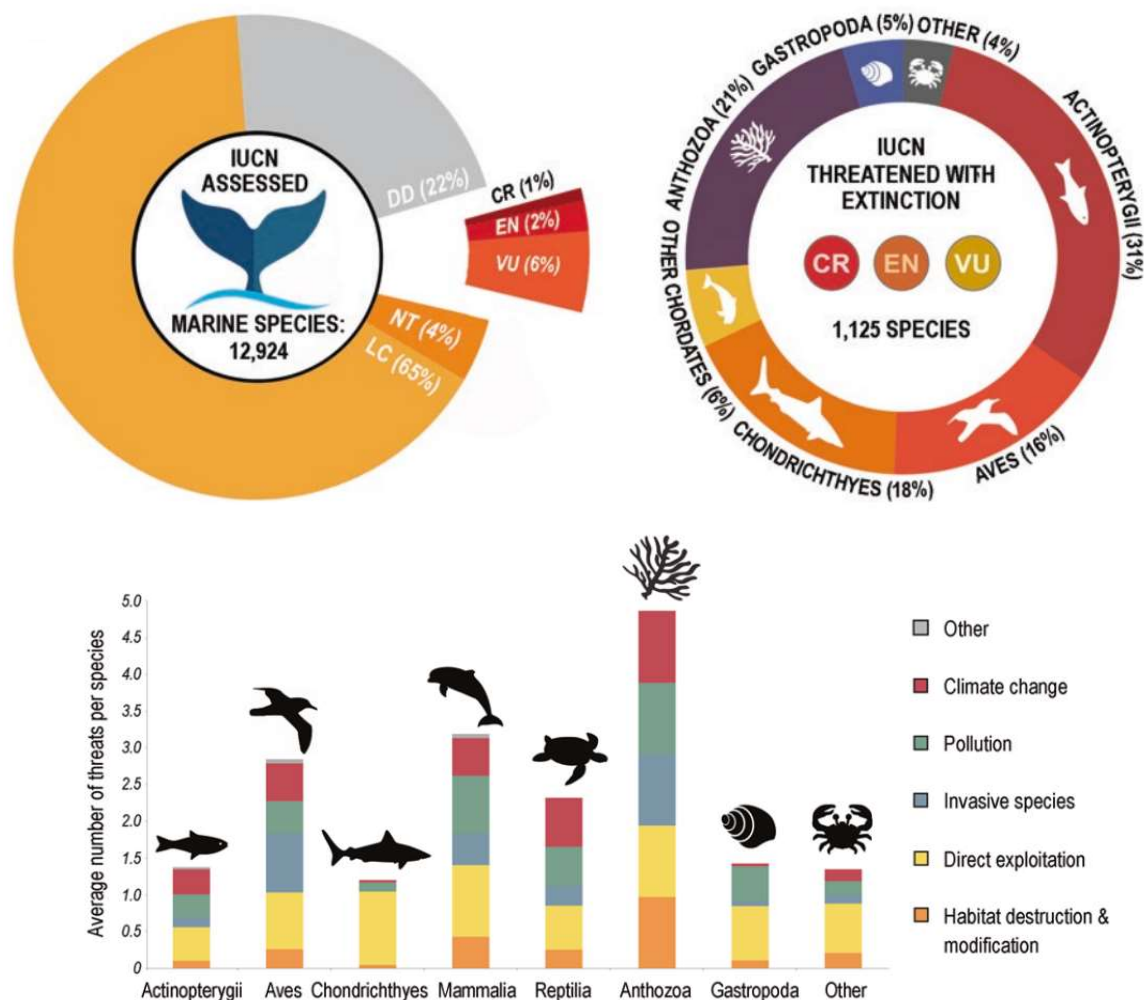


<sup>1</sup> Eastern Boundary Upwelling Systems (Benguela Current, Canary Current, California Current, and Humboldt Current); {Box 5.3}

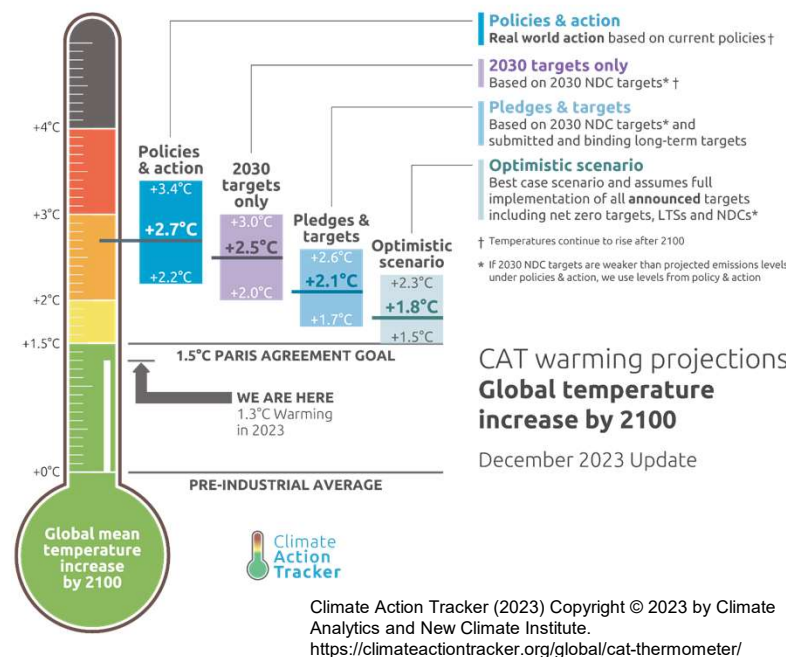
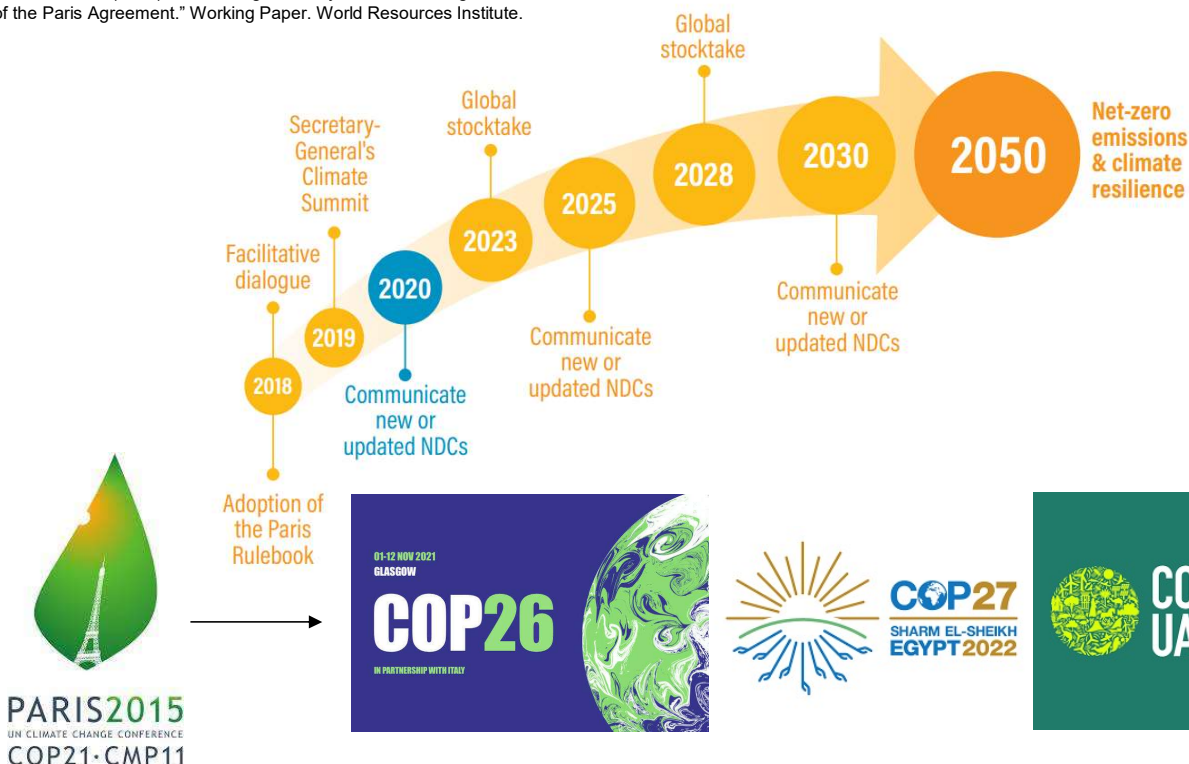


# Marine biodiversity loss

Status of Marine Biodiversity in the Anthropocene, Luypaert et al. (2019)



Fransen, et al. (2017). "Enhancing NDCs by 2020: Achieving the Goals of the Paris Agreement." Working Paper. World Resources Institute.



**“keeping a global temperature rise this century well below 2 ° C above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 ° C”**

**“enhance resilience to climate impacts, many of which will be unavoidable due to greenhouse gases already emitted”**

**“align financial flows in the world with these objectives”**



United Nations  
Framework Convention on  
Climate Change

## 23 Targets for 2030

### Protection: 30% by 2030

Today, an estimated 7.65% of the ocean is covered by marine protected areas (MPAs)

### Invasive Species

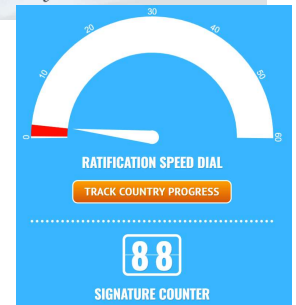
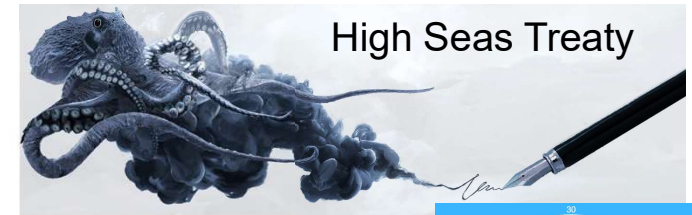
Reduce the establishment and introduction of invasive alien species by 50% by 2030

### Reduce pollution

Excess nutrient loads  
Hazardous chemicals  
Plastic pollution

### Manage sustainably

Reduce harmful subsidies  
Indigenous rights



### National biodiversity strategies and action plans

Include Nature-based solutions

### Global Biodiversity Framework Fund

final finance target seeks to mobilise "at least \$200bn per year" by 2030 from "all sources"

# THE BIODIVERSITY PLAN

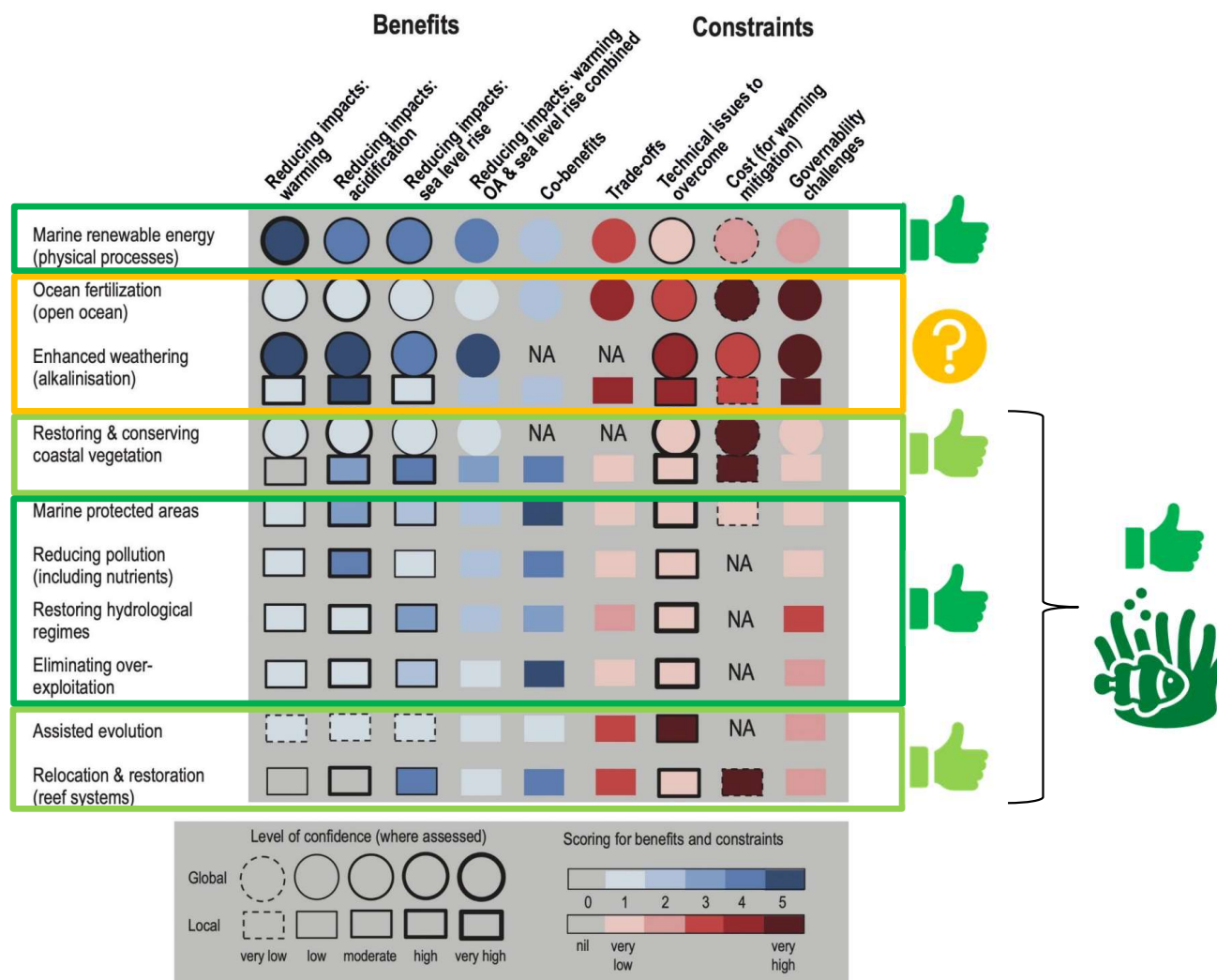
## For Life on Earth

"...halt and reverse biodiversity loss by 2030..."



### Global Plastics Treaty









INSITE - Overall Synthesis Project (2021-2023)



Energy, Environment and Landscapes (2020-2024)

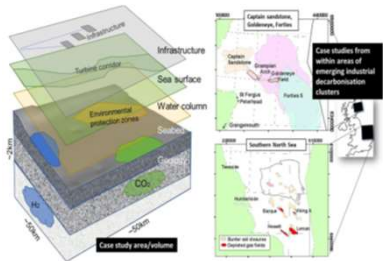
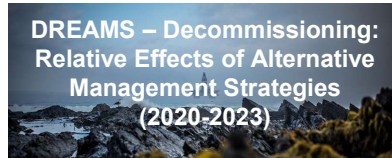


Fig. 1 Project will use case study areas/volumes from within areas of interest to emerging industrial decarbonisation clusters

MOET - Managing the environmental sustainability of the offshore energy transition: a solutions-based approach (2022-2025)

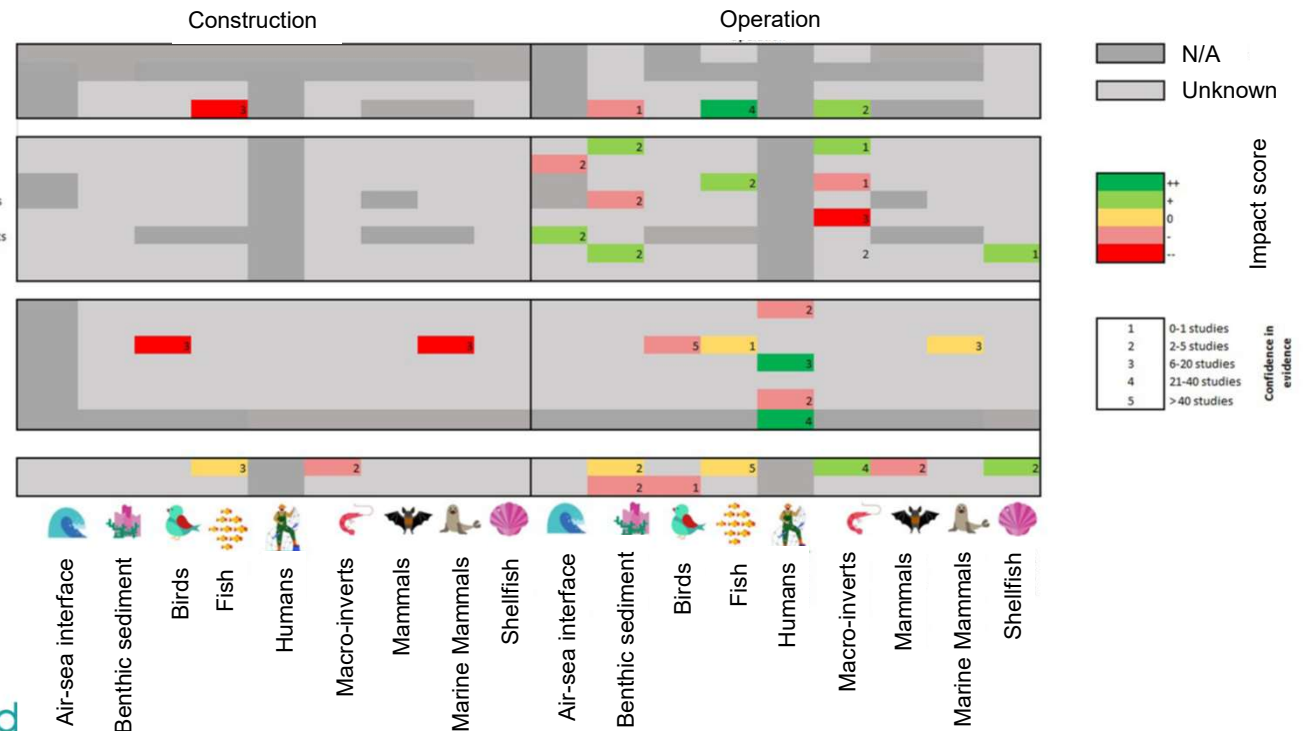


Cultural & scope of acceptance  
Supporting  
Regulating  
Provisioning



PELAgIO - Physics-to-Ecosystem Level Assessment of Impacts of Offshore Windfarms (2022-2025)

## Combining observations, modelling (physical, biological, aquaculture) and ecosystem services



<https://www.pml.ac.uk/Science/Offshore-energy>

Contact: Stephen Watson, stw@pml.ac.uk

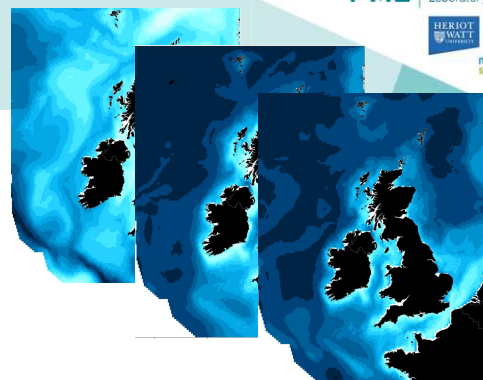
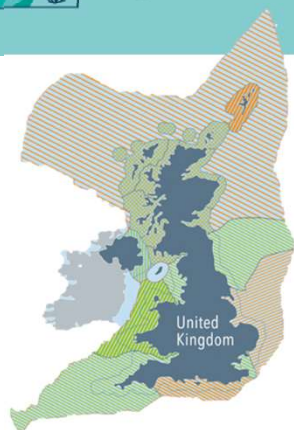
DOI: 10.1016/j.ocecoaman.2024.107023



**OCEANSODA**  
SATELLITE OCEANOGRAPHIC  
DATASETS FOR ACIDIFICATION



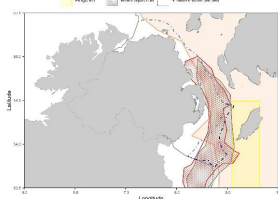
Contact: Helen Findlay, [hefi@pml.ac.uk](mailto:hefi@pml.ac.uk)  
<https://oceanhealth-acidification.org/>  
Doi: 10.1016/j.earscirev.2024.104682



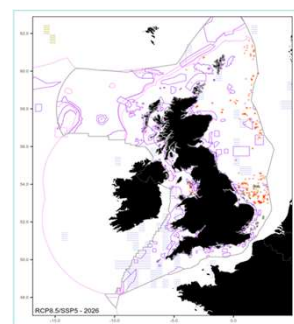
State-of-the-art ocean climate modelling representative of the environment and species of interest to **each sector**.

Sector-specific spatial random-effects meta-analysis of ocean climate modelling.  
*(climate signal detection)*  
method: Queiros et al. 2021 GCB

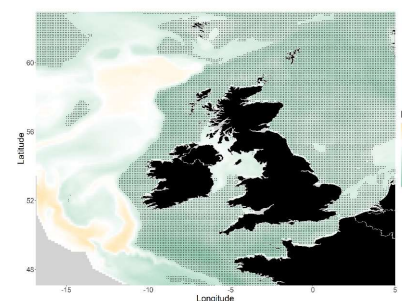
Climate change hotspots  
Bright spots  
Climate change refugia



Which areas present potential for **no-regrets spatial decisions**?



Blue economy GIS data overlay allows management scenario exploration of **within / cross sector interactions & climate effects for each sector**.



**Sectorial climate-resilience maps**  
(present day to end of century)



Contact: Ana Queiros, [anqu@pml.ac.uk](mailto:anqu@pml.ac.uk)  
[www.mccip.org.uk/all-uk/solutions/mspace](http://www.mccip.org.uk/all-uk/solutions/mspace)  
Doi: 10.14465/2023.msp01.spm



## A hyperspectral study of plastic targets on the shoreline

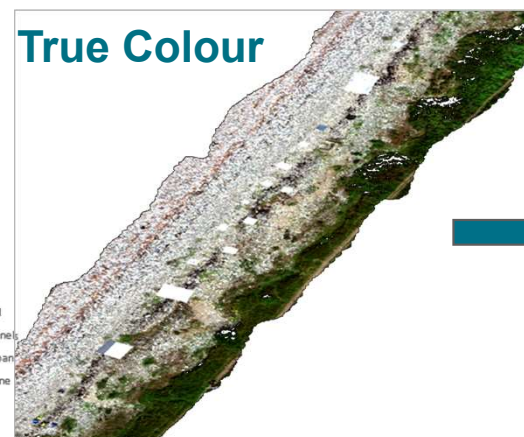
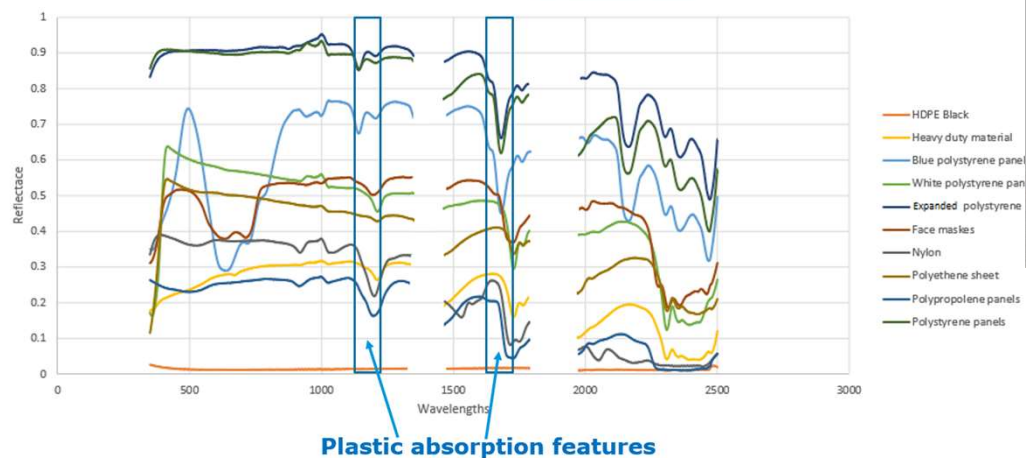


Using **hyperspectral** data collected from drones and handheld spectrometers, exploit **SWIR** plastic features to develop **proxies** for its detection on the shoreline.

**Uncertainty estimates** were derived for each sensor. Assess **subpixel** detection and the requirements of lower cost **multispectral** sensors for plastic detection.

Dataset (collected as part of HyperDrone) and uncertainties are **freely available** at CEDA.

In-situ SVC mean reflectances



Detection

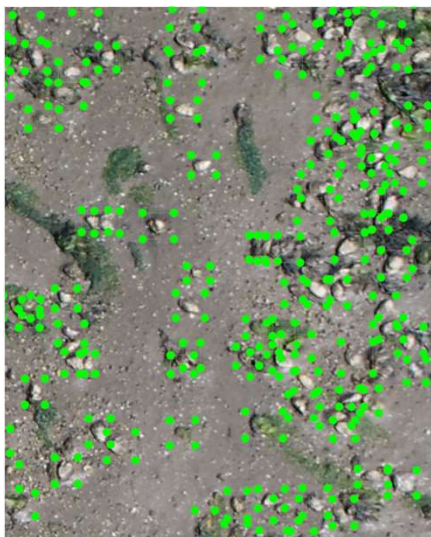


Contact: Aser Mata, [asm@pml.ac.uk](mailto:asm@pml.ac.uk)  
<https://nebula.esa.int/content/hyperdrone>



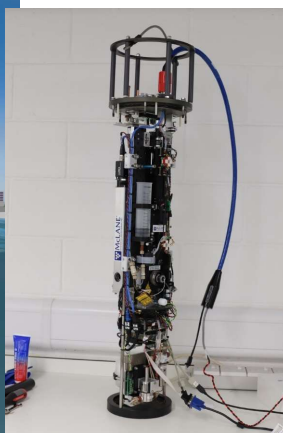
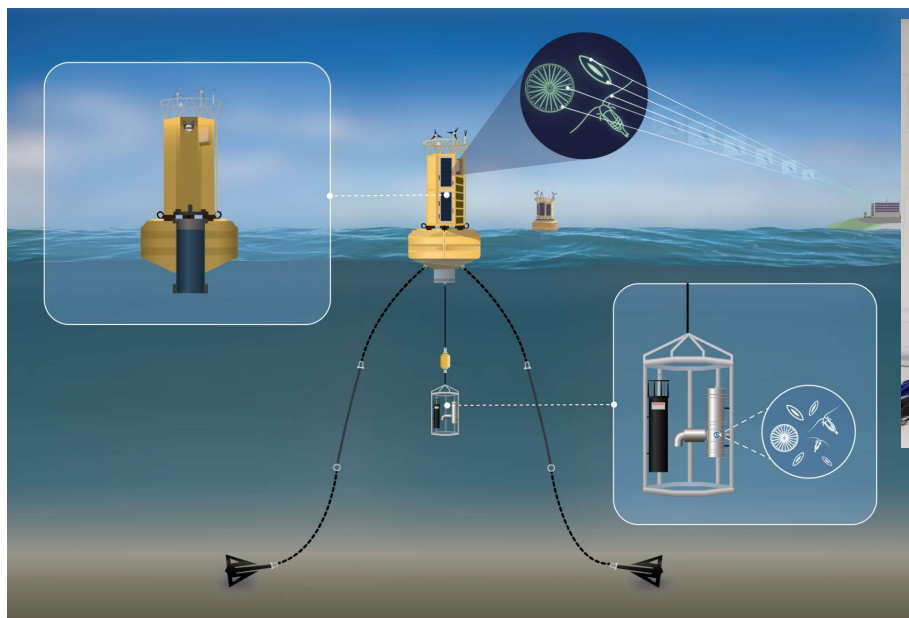
## Pacific Oysters Detection Using Drones

- Pacific oysters are an **invasive species** that can spread to marine protected areas
- AONB responsible for **labour intensive manual population monitoring**
- Model was trained by **collecting many UAV photos of Pacific oysters**, and classifying individual oysters manually
- ~7000 oysters classified manually.

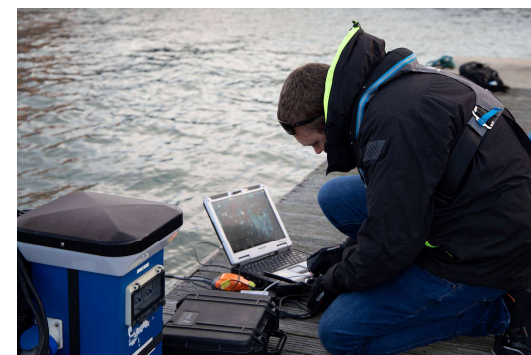
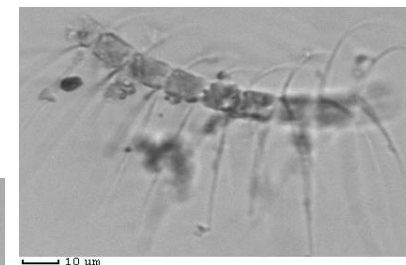
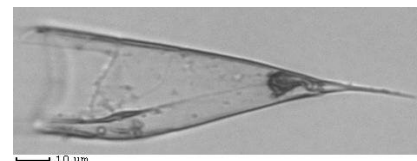


Contact: Aser Mata, [asm@pml.ac.uk](mailto:asm@pml.ac.uk)  
<https://www.pml.ac.uk/science/Digital-Innovation-and-Marine-Autonomy>

## Automated Plankton Imaging and Classification System (APICS)



First images from Plymouth L4 (lab processed)



Contact: James Clark, [jcl@pml.ac.uk](mailto:jcl@pml.ac.uk)  
<https://www.pml.ac.uk/APICS>



“It is time for a new ocean narrative that says **“The ocean is so central to our future. It's too important to neglect.”** In creating a new solution space for the ocean, we can also address broader global problems. In healing the ocean, we can heal ourselves. The ocean sustains and feeds us. It connects us. It is our past and our future.  
***The ocean is not too big to fail, nor is it too big to fix. It is too big to ignore.***”

- Jane Lubchenco, Steven D. Gaines, A new narrative for the ocean. Science 364,911-911 (2019). DOI:10.1126/science.aay2241

**Thank you!**

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