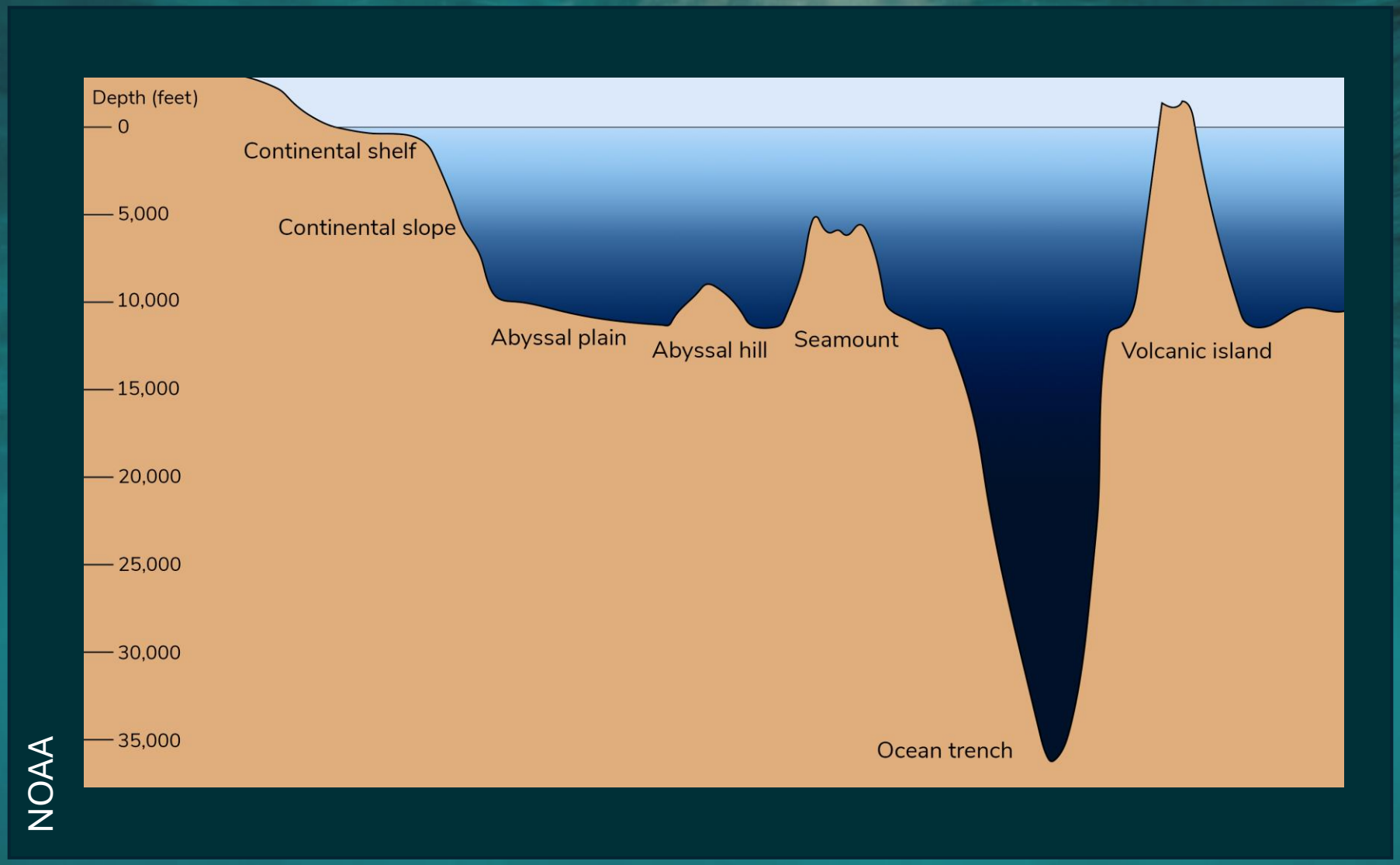
Illuminating the deep ocean

A voyage of discovery to the depths and back

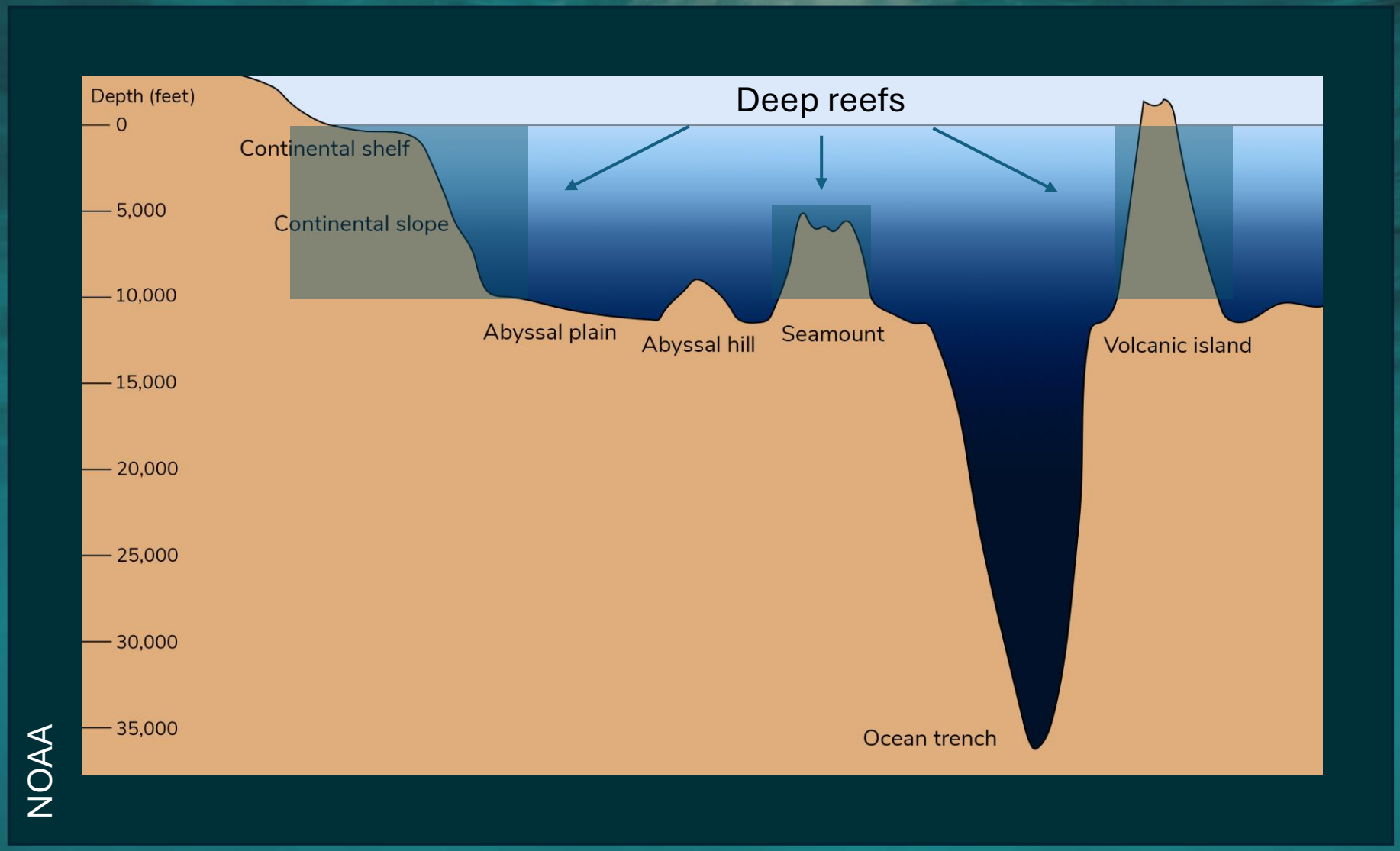
Lucy Woodall: Associate Professor in Marine Ecology and Policy

l.woodall@exeter.ac.uk

The deep ocean



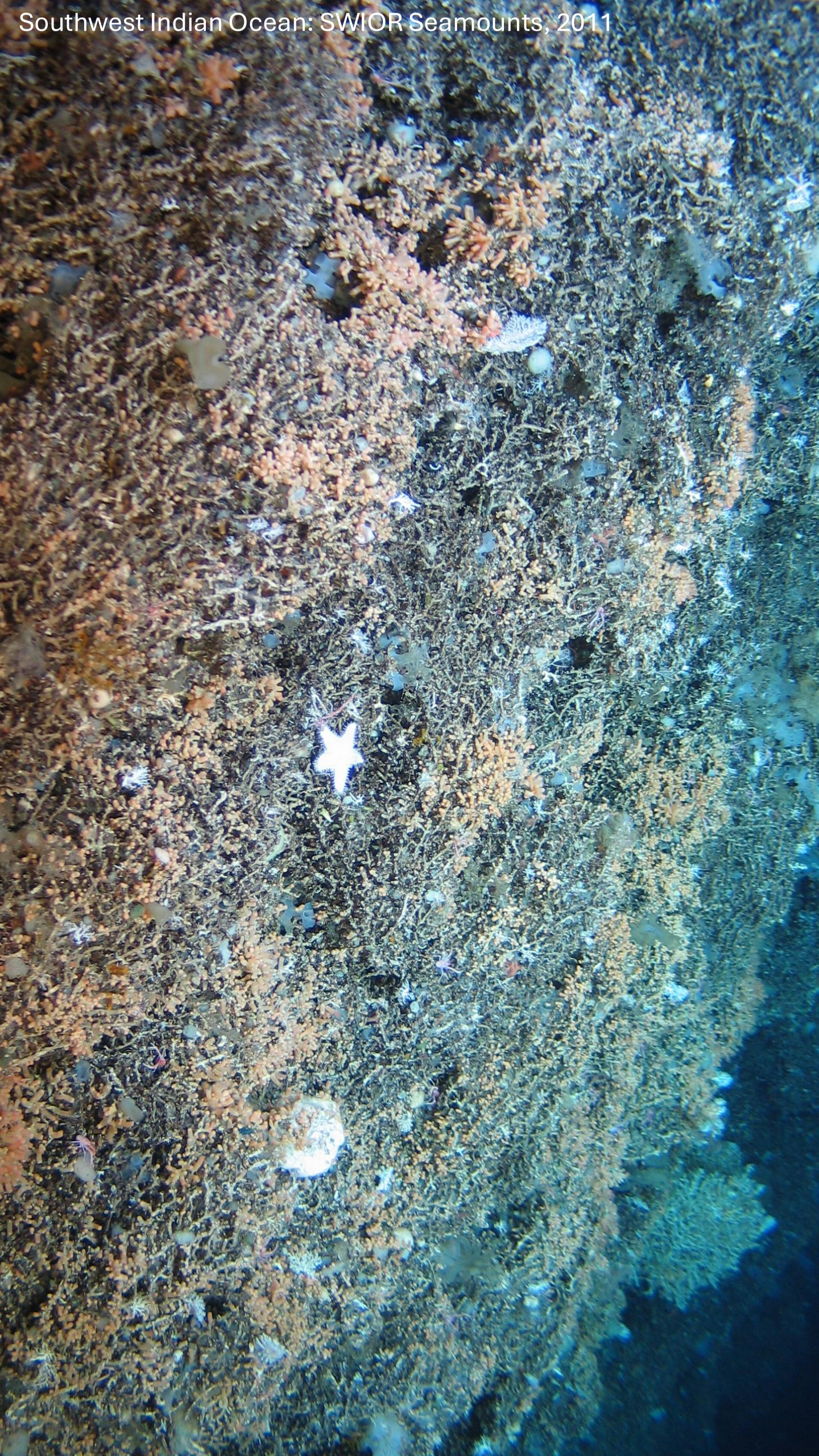
The deep ocean



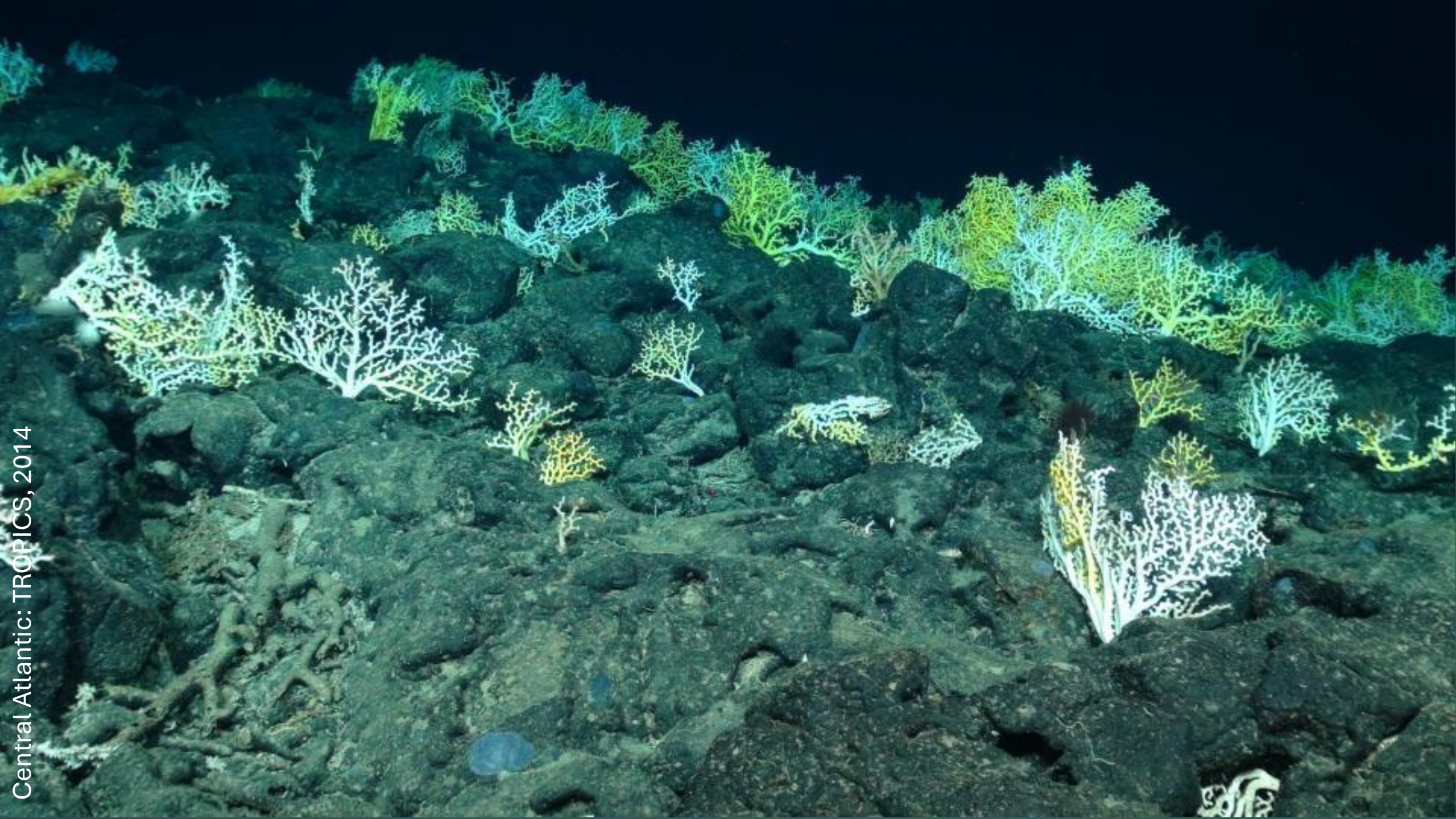
The deep reefs can look this to us

The deep reefs can look this to us

But.....

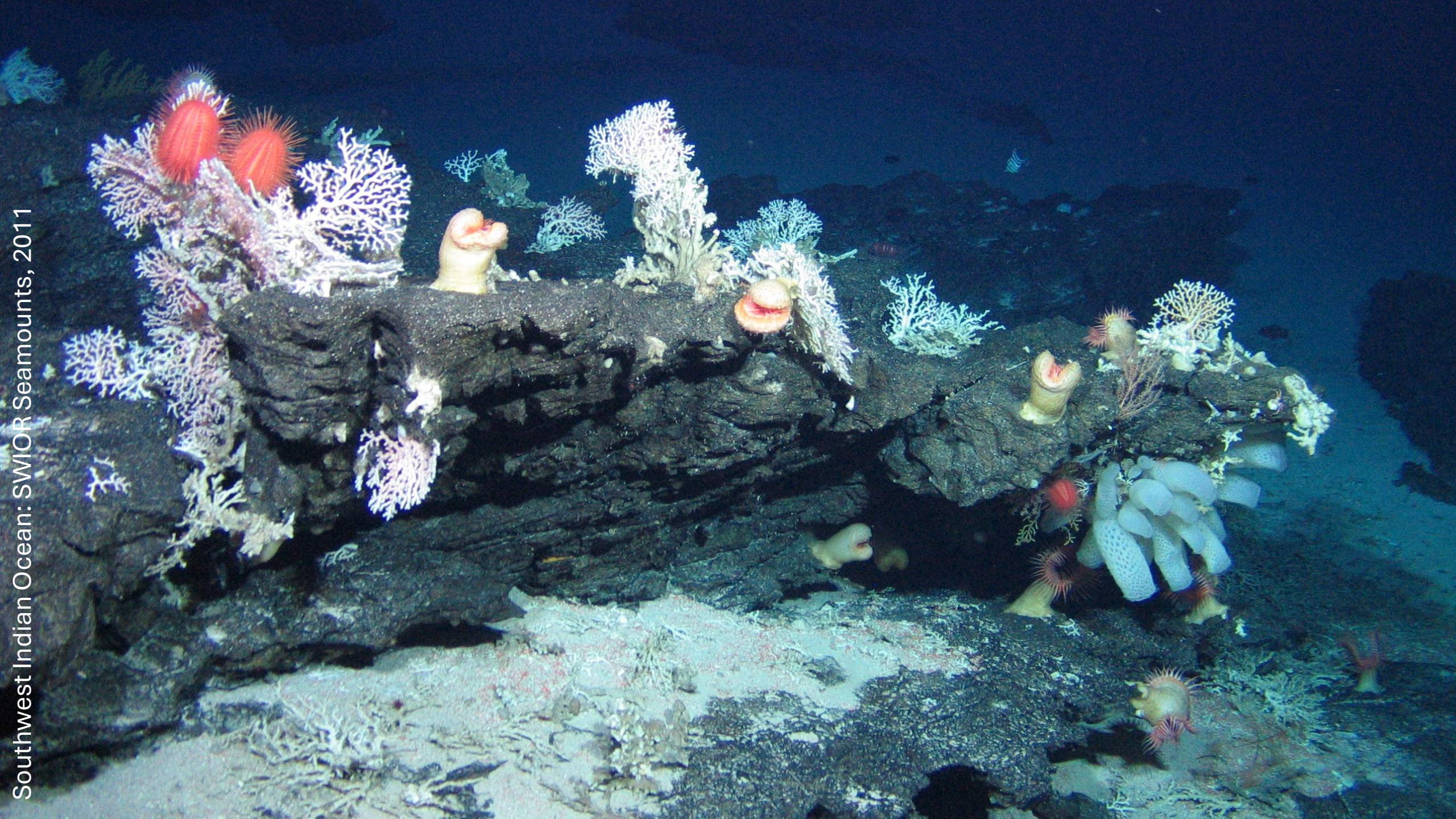

Southwest Indian Ocean: SWIOR Seamounts, 2011


North Atlantic: Deep LINKS, 2016

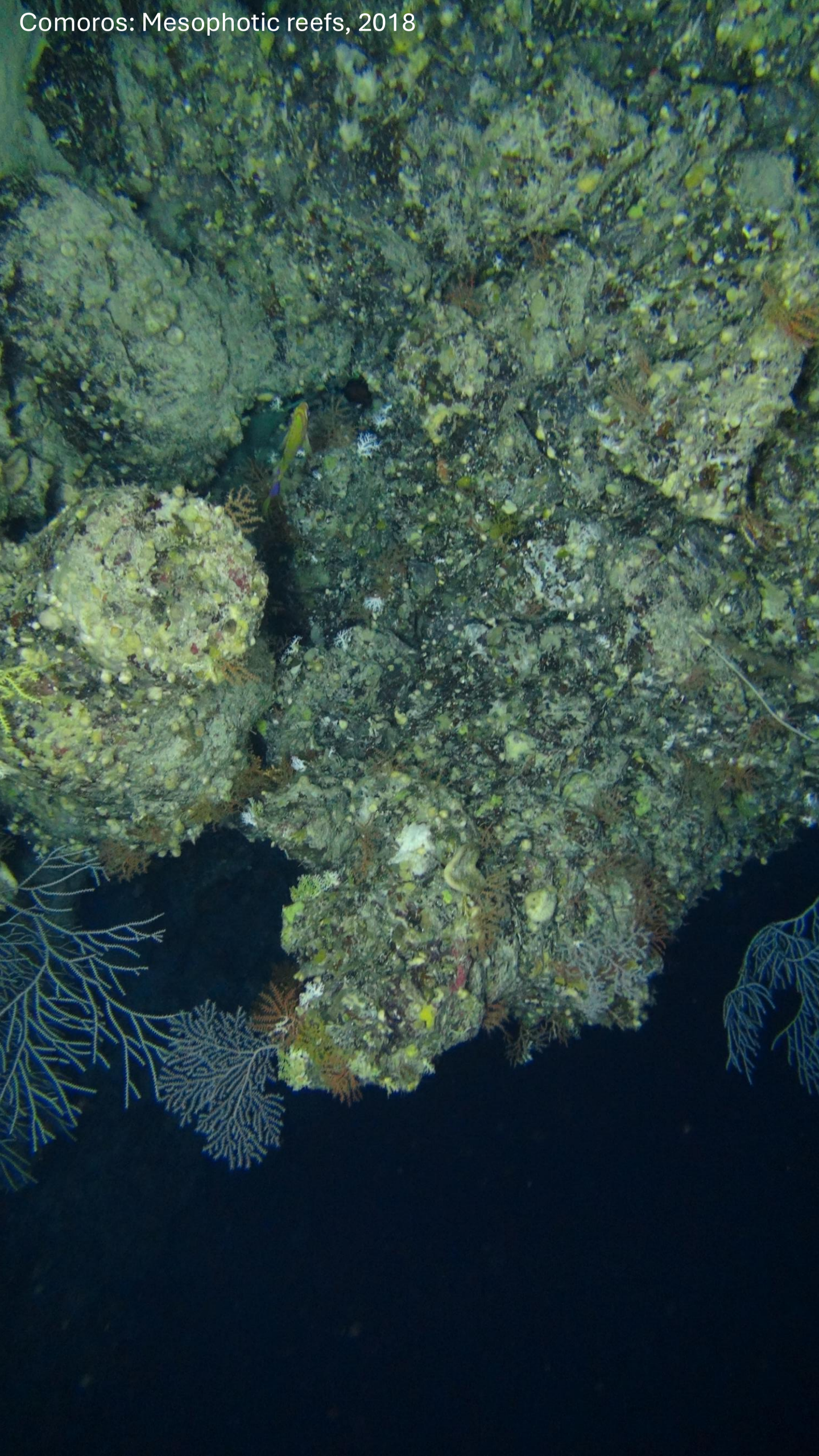

Central Atlantic: TROPICS, 2014


North Atlantic: Deep LINKS, 2016


Weddell Sea: Endurance , 2018



Southwest Indian Ocean: SWIOR Seamounts, 2011


Comoros: Mesophotic reefs, 2018


Bermuda: Seaview Deep reef Survey, 2016



Seychelles: First Descent, 2019



Comoros: First Descent, 2025



South Africa: SMART Zone, 2022



Southwest Indian Ocean: SWIOR Seamounts, 2011



SERPENT Media Archive Project



Southwest Indian Ocean: SWIOR Seamounts, 2011

Where is this?

1km



1km

Google Earth

Any different ideas when you see these?



Google Earth



Google Earth

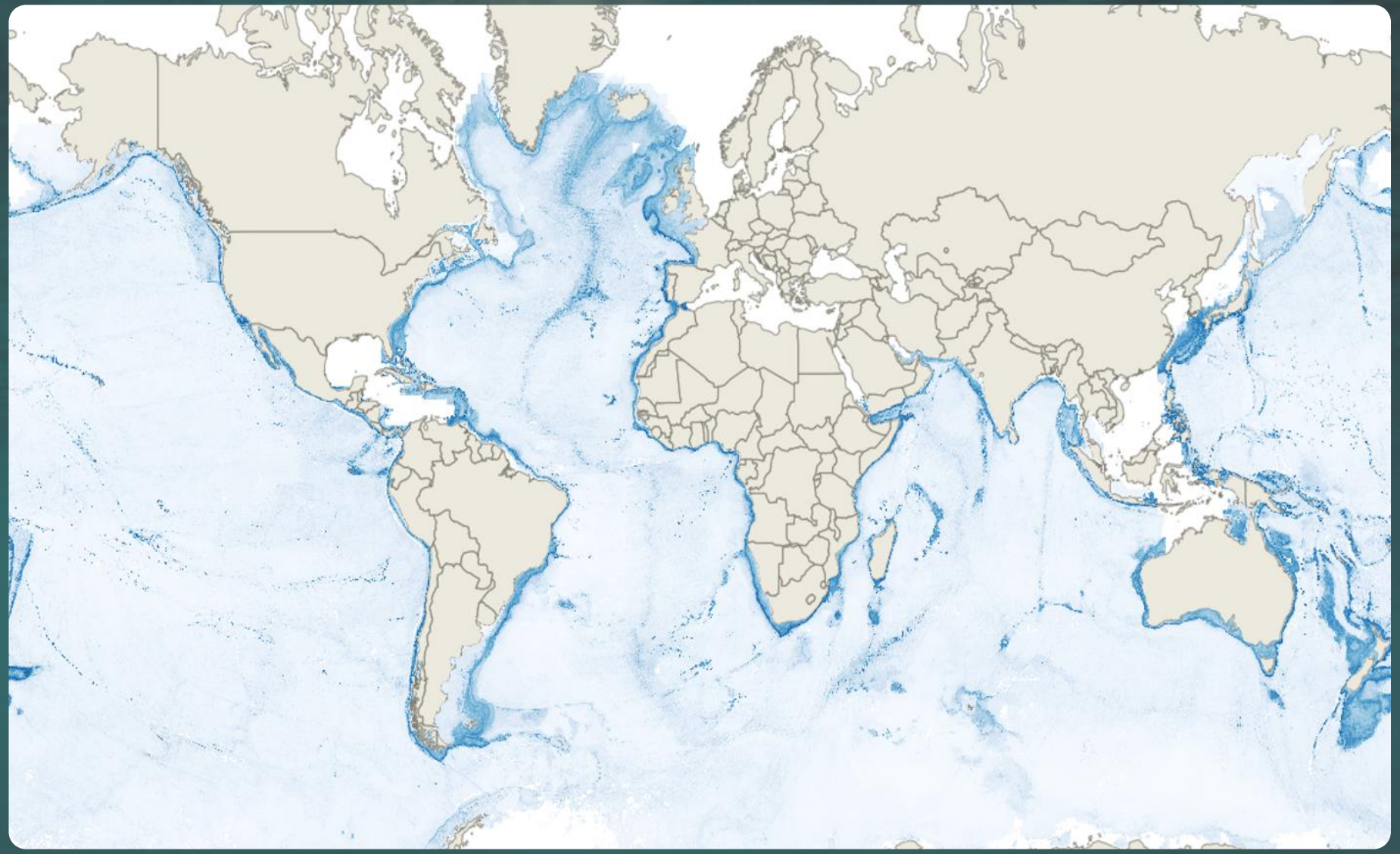


Google Earth


London
Google Earth

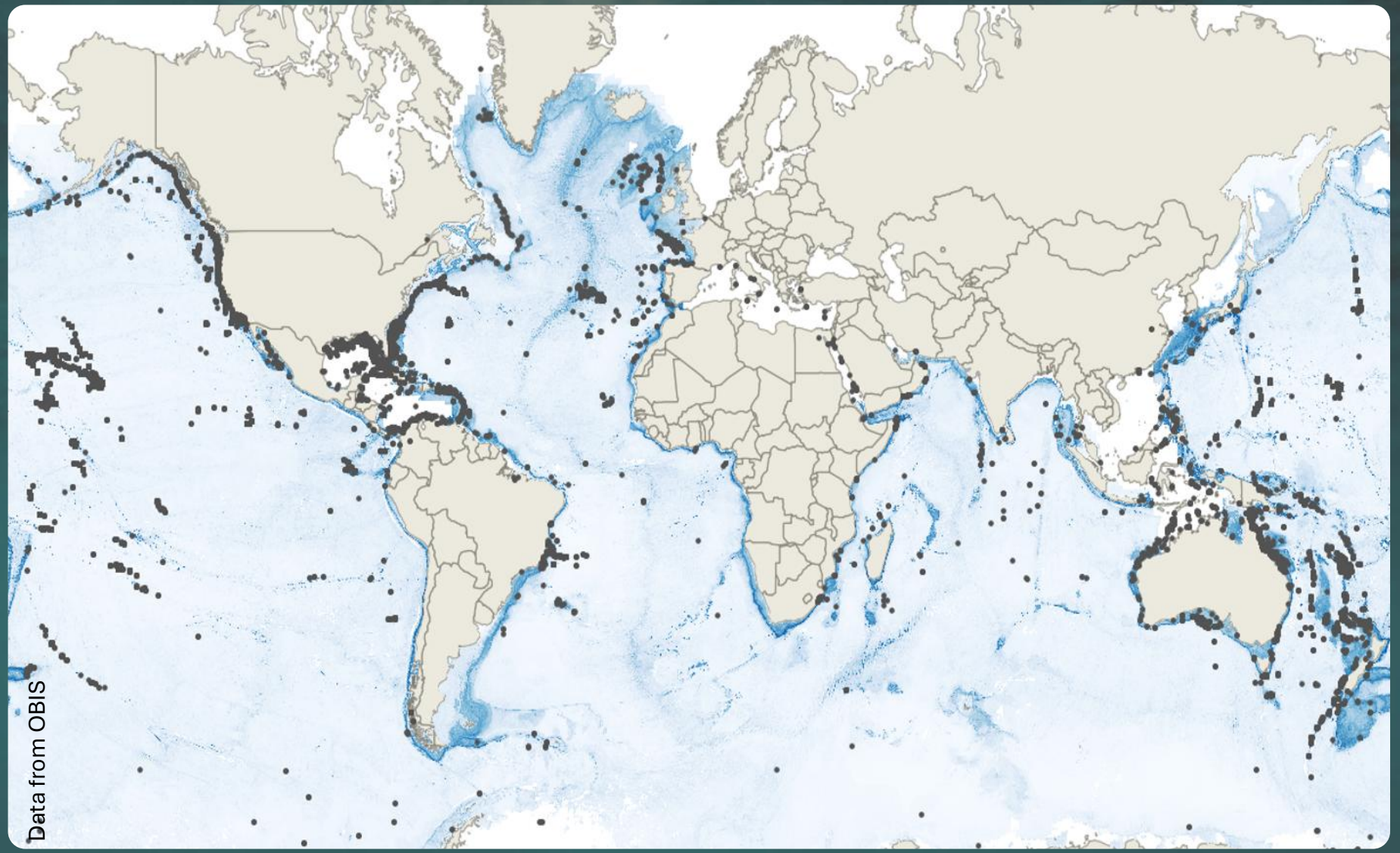
Current Situation

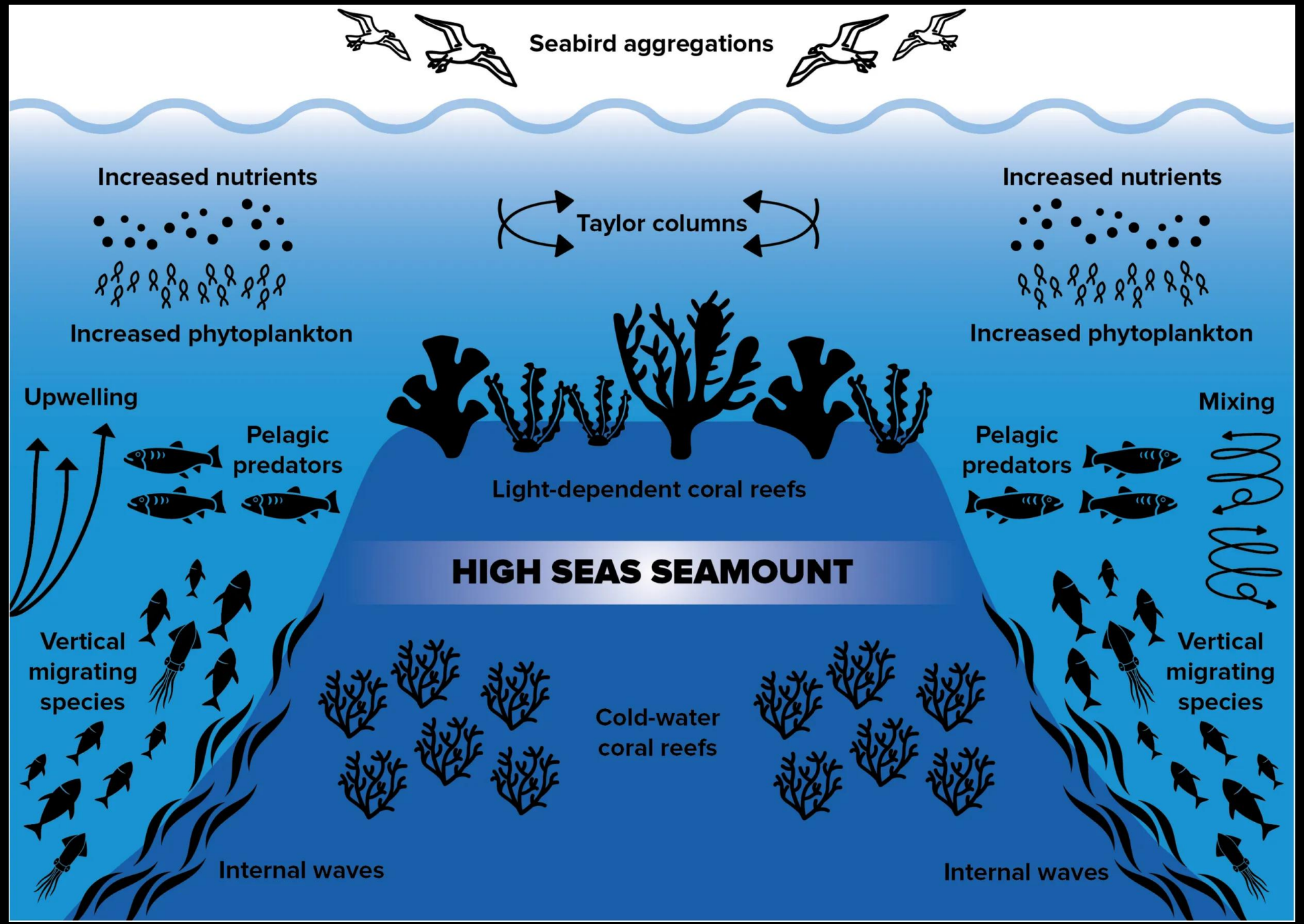




Current Situation

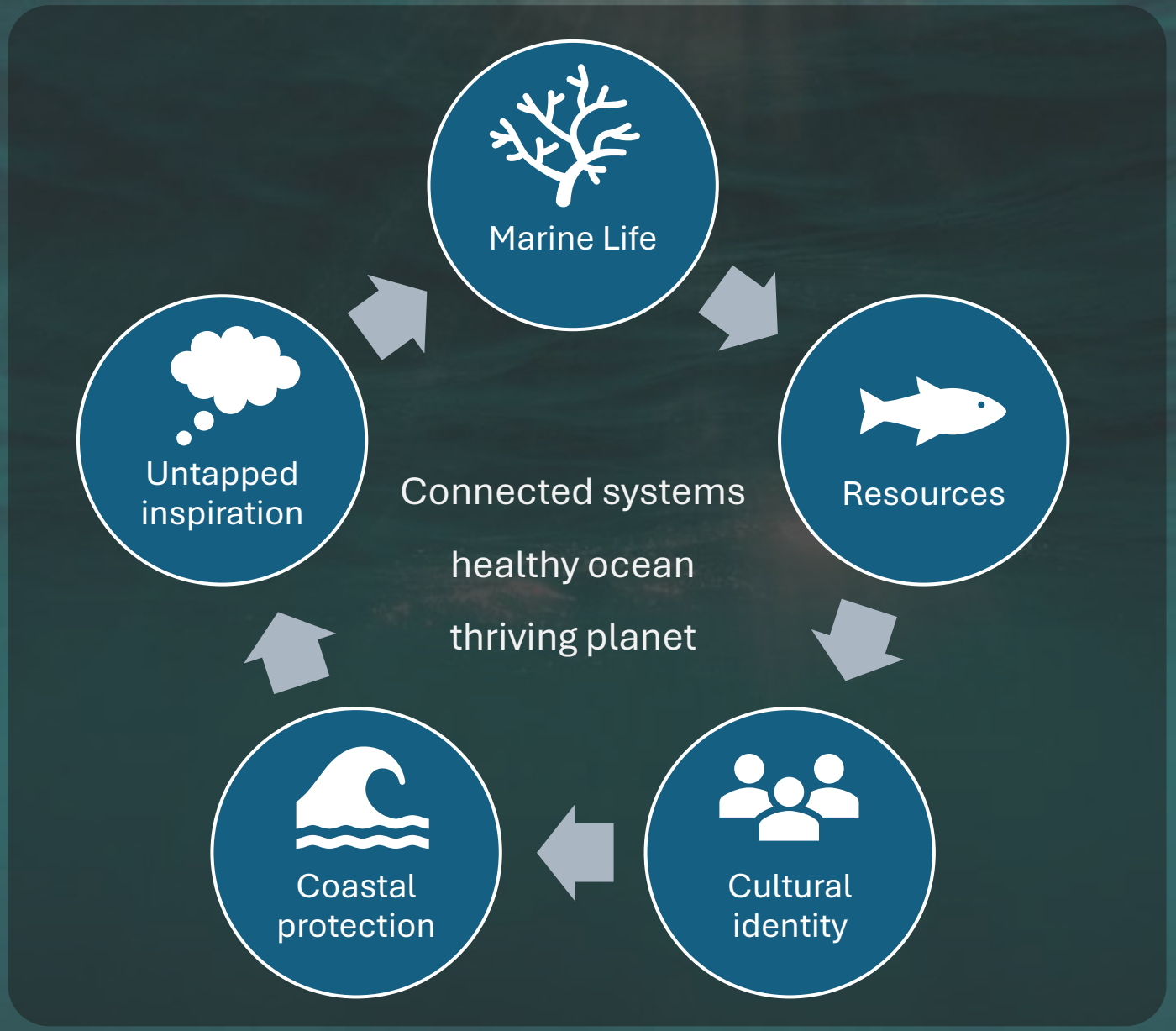






Wagner D, et al' (2020). Front. Mar. Sci. 7:567428

Deep reefs: A hidden infrastructure for a healthy ocean



Stressors

A changing world



Land use change



Coastal development



Resource extraction



Climate change-temperature



Physical pollution



Chemical pollution



Invasive species



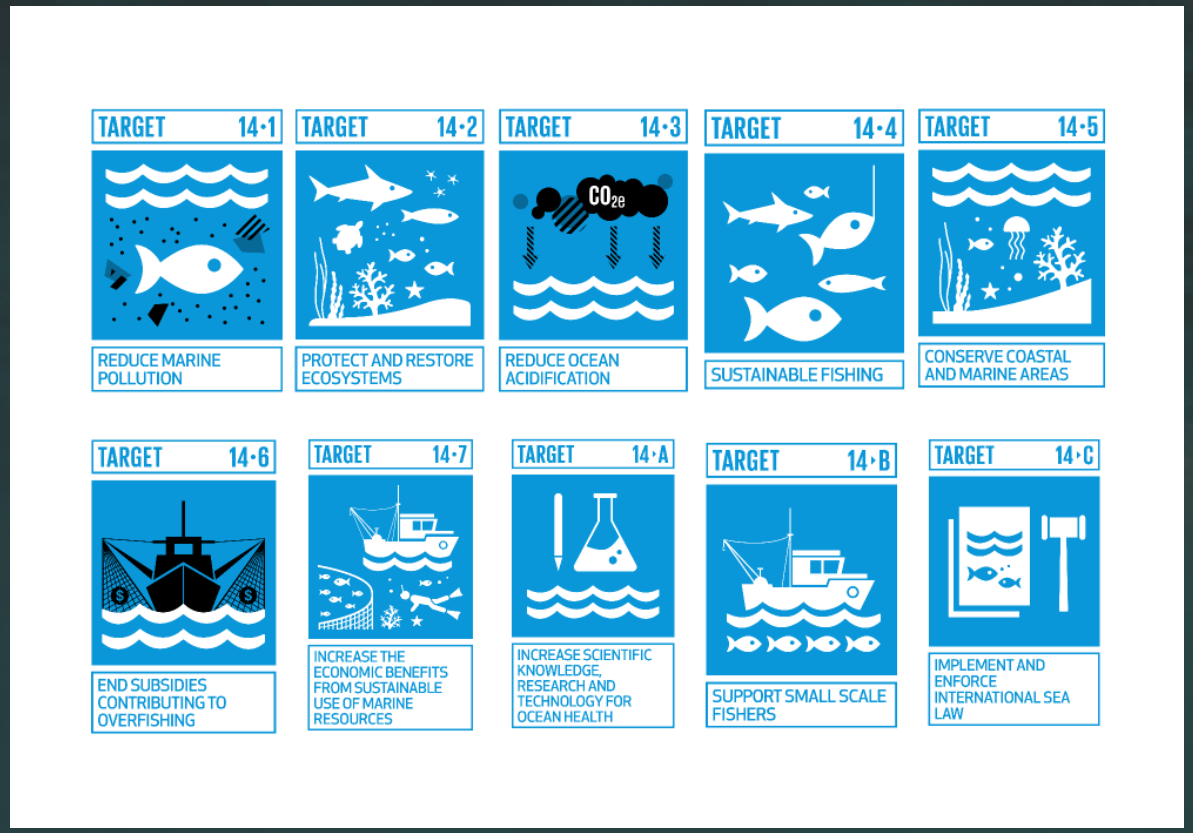
Climate change-CO_2 and pH

Why now? Global Biodiversity Framework

Nature Positive

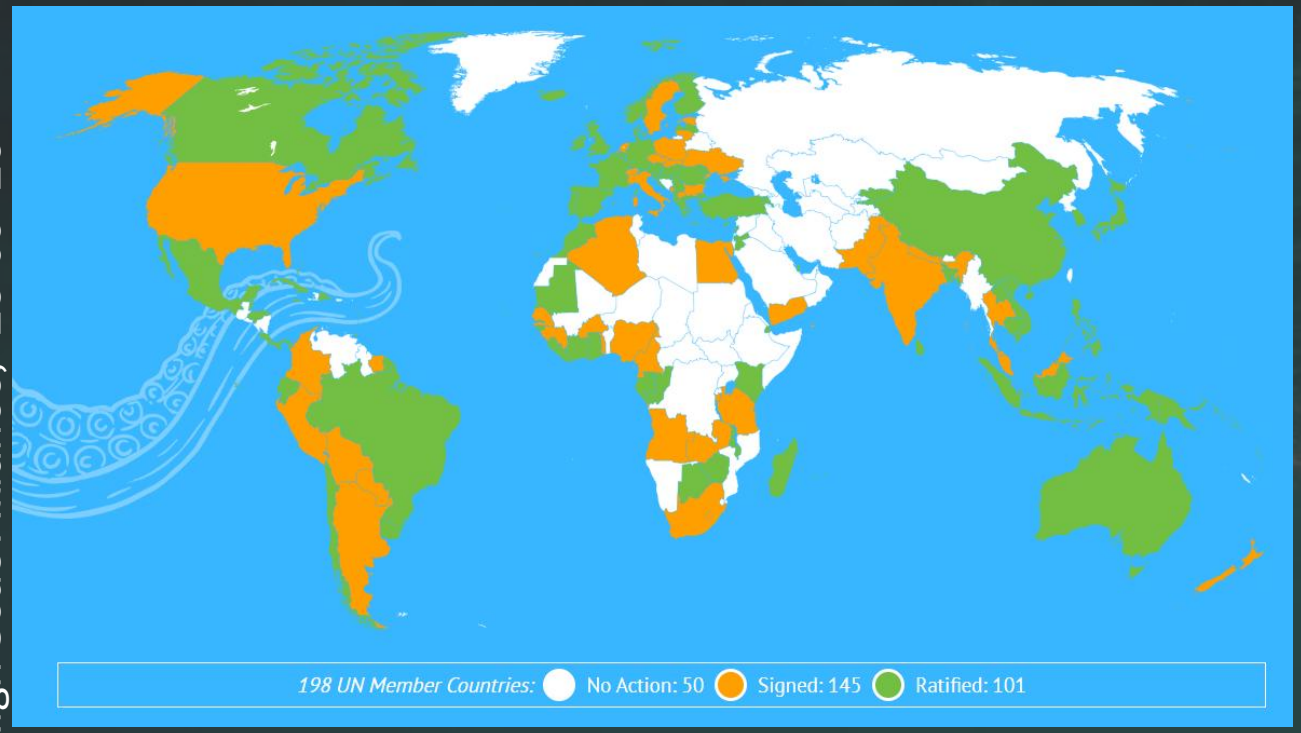


Why now? Sustainable Development Goals



UN

Why now? BBNJ



High Seas Alliance,- 28-09 -26



Why now? Ocean Decade

1. Understand and beat marine pollution
2. Protect and restore ecosystems and biodiversity
3. Sustainably nourish the global population
4. Develop a sustainable, resilient and equitable ocean economy
5. Unlock ocean-based solutions to climate change
6. Increase community resilience to ocean and coastal risks
7. Sustainably expand the Global Ocean Observing System
8. Create a digital representation of the ocean
9. Skills, knowledge, technology and participation for all
10. Restore humanity's relationship with the ocean

2021 2030 United Nations Decade of Ocean Science for Sustainable Development

THE NIPPON FOUNDATION-NEKTON OCEAN CENSUS

CHALLENGER 150 A DECADE TO STUDY DEEP-SEA LIFE

The challenge

- Historically
  - Expensive technology
  - Specialist platforms
  - Limited access





- Leading to
  - Underexplored depths
  - Patchy and biased data
  - Limited opportunity and knowledge





Summary of deep reefs

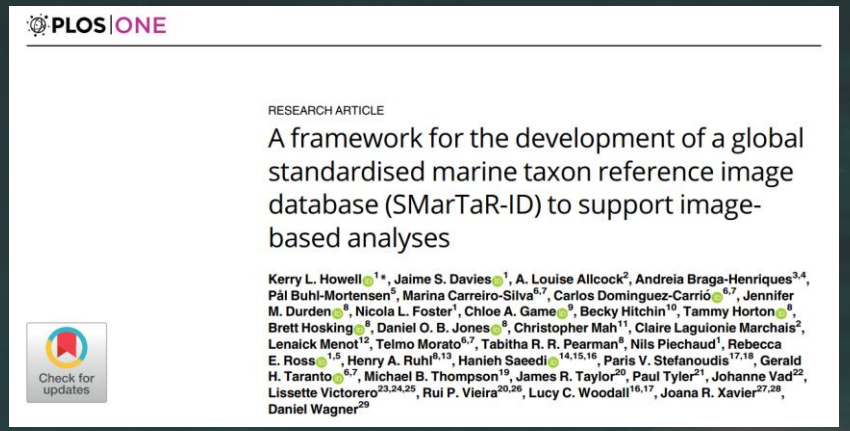
- Unique
- Extensive
- Important

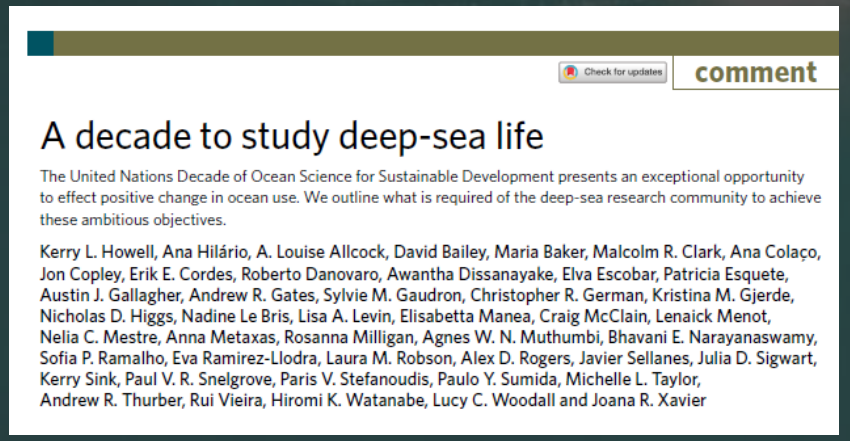
- But unknown



Metrics and standardisation







Meeting the Demand: Aligning Marine Biodiversity Data Supply with Policy Needs

Authors:

Chris McOwen[a], Grace Chandler[a], A. Caroline Faessler[a], Rhian Bland[a], Valeriia Vakhitova[a], Charlotte Lamb[a], Ella L. Howes[a], Lucy C. Woodall[d], Verity Nye[b], Oliver Steeds[b], Alex D. Rogers[c], Philip Erm[a]

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Phone: +44 (0) 7341 775236

Knowledge really makes a difference



The knowledge and opportunity gap is limiting both conservation and human opportunity

Co-defining the solutions

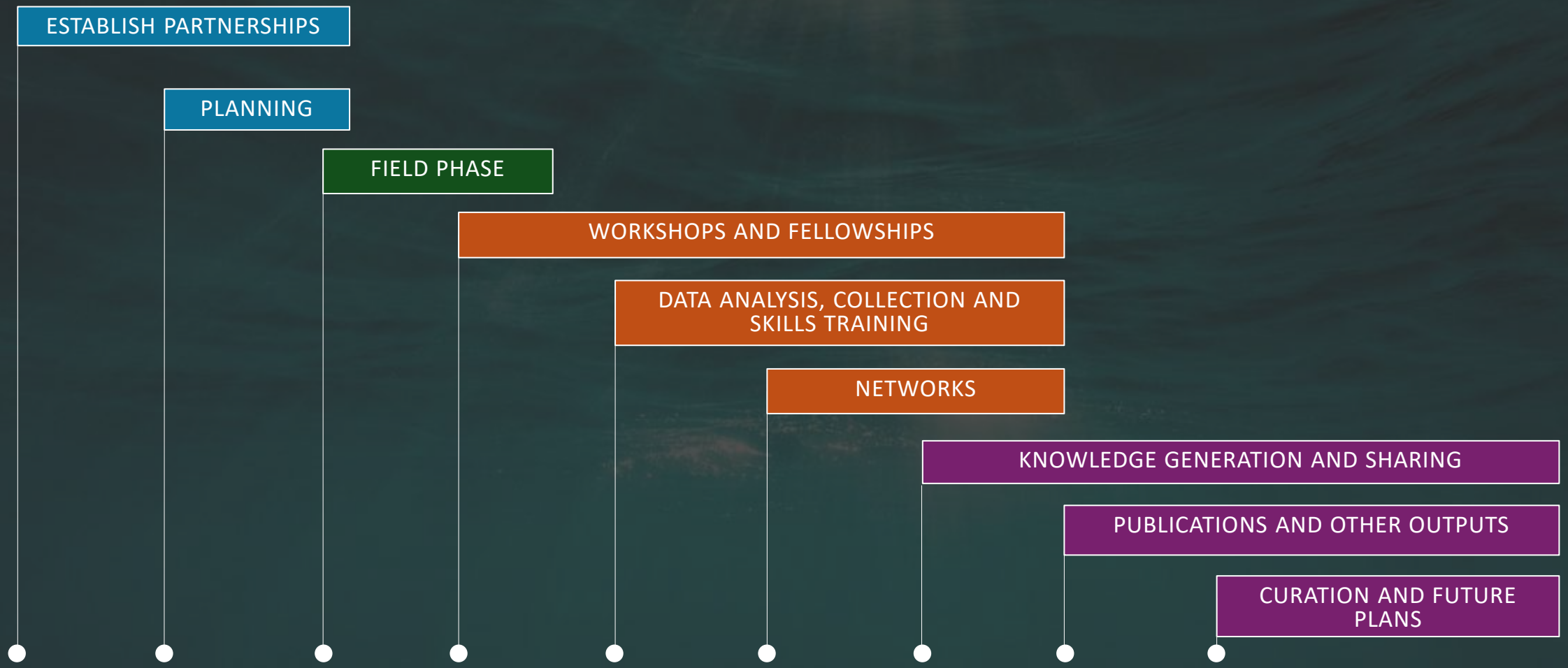
IMPACT → OUTPUTS → ACTIVITIES → TEAM → QUESTIONS









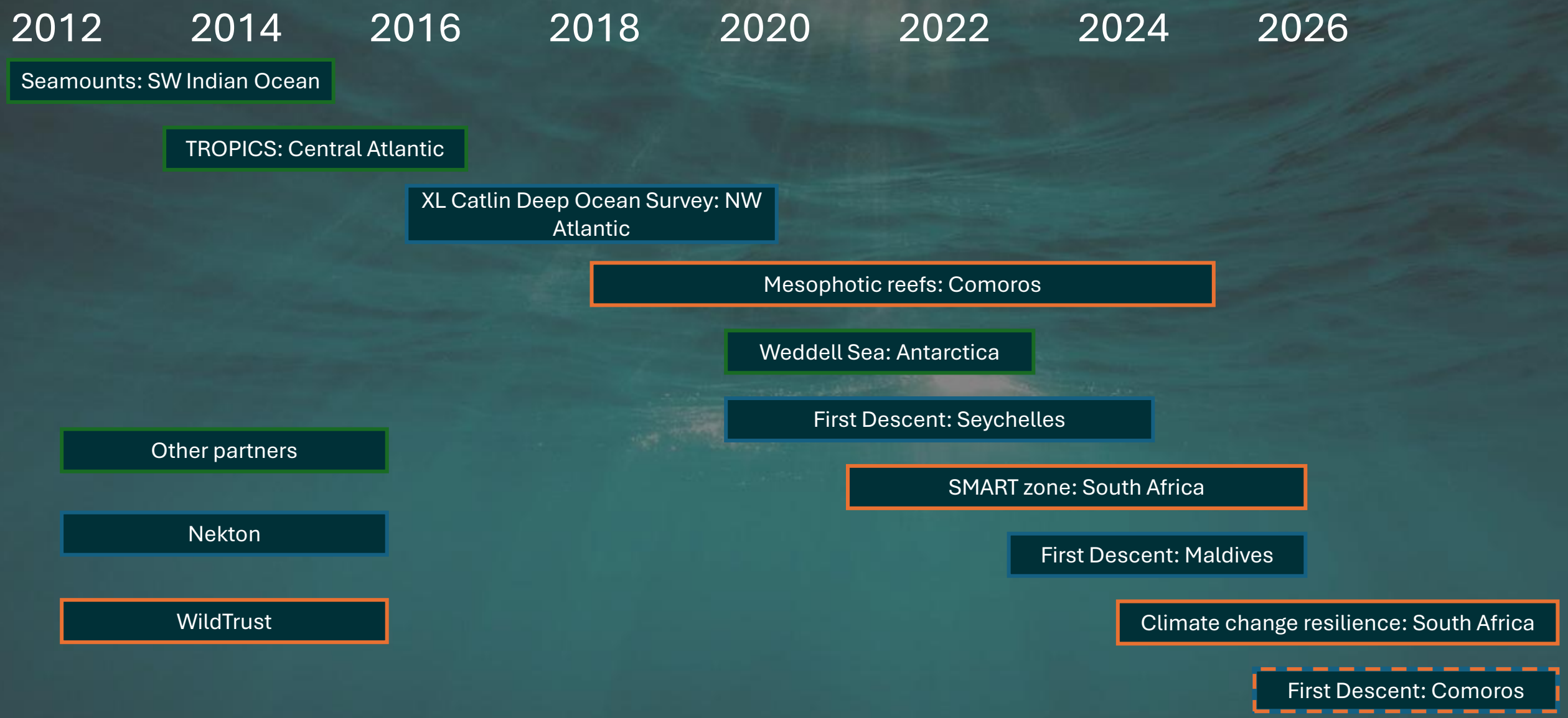

ESTABLISH PARTNERSHIPS
PLANNING
FIELD PHASE
WORKSHOPS AND FELLOWSHIPS
DATA ANALYSIS, COLLECTION AND SKILLS TRAINING
NETWORKS
KNOWLEDGE GENERATION AND SHARING
PUBLICATIONS AND OTHER OUTPUTS
CURATION AND FUTURE PLANS

Indian Ocean

- Least explored ocean
- Least protected ocean
- Highly reliant coastal population
- Highly diversity ocean life



Timelines of projects



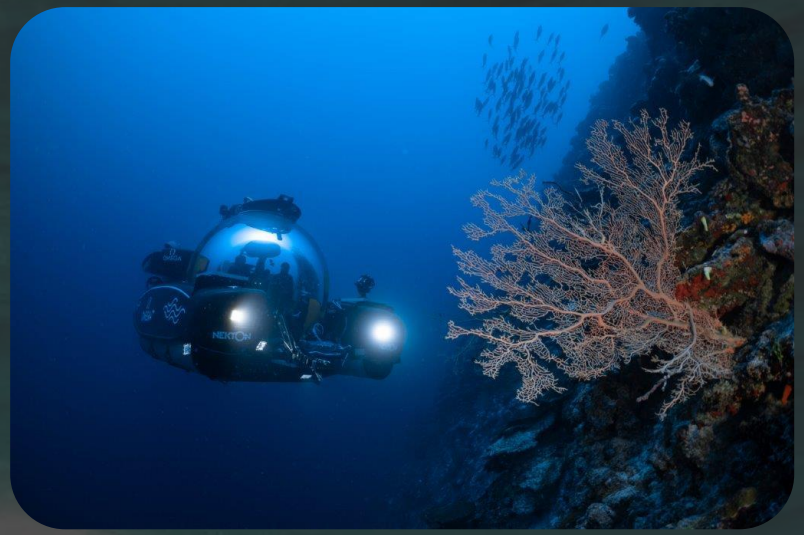
Example of some equipment types

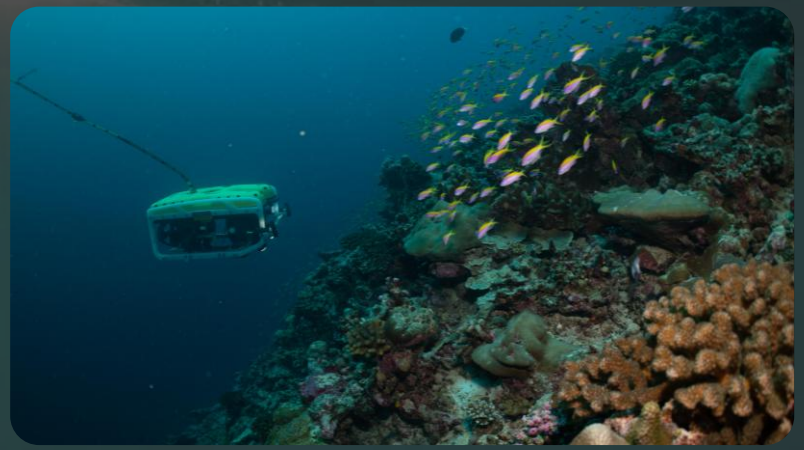


Seychelles: First Descent, 2019



Seychelles: First Descent, 2019





Maldives: First Descent, 2022

Comoros

STRENGTHENING OCEAN PROTECTION IN COMOROS



WildTrust

CRITICAL ECOSYSTEM PARTNERSHIP FUND

WILDTRUST

CORDIO

AIPEC

CNDRS

IRD Institut de Recherche pour le Développement FRANCE

Parcs Nationaux des Comores

NRF National Research Foundation | SAIAB South African Institute for Aquatic Biodiversity

UNIVERSITE des Comores

NEKTON

Comoros

STRENGTHENING OCEAN PROTECTION IN COMOROS

- Situation:
  - No data from below 20 m
- Contribution:
  - Peer-reviewed papers
  - Cultural event
  - Governmental interest
- Situation now:
  - Project to programme
  - Further funding
  - New expedition



Seychelles



Seychelles: First Descent, 2019

Seychelles

- Situation:
  - Commitment to protect >30% waters
- Contribution:
  - Peer reviewed papers
  - Fellowships/ grants
  - Training workshops
  - Co-developed way of working
  - Coral collection facility support
- Situation now:
  - Two deep sea expeditions
  - Seychellois expertise in deep sea science



Biodiversity Data Journal 9: e65970
doi: 10.3897/BDJ.9.e65970

open access

Taxonomic Paper

Reef benthos of Seychelles - A field guide

Nico Fassbender[‡], Paris V Stefanoudis[§,‡], Zoleka Nontlantla Filander[|], Gilberte Gendron[¶], Christopher L Mah[#], Lydiane Mattio[¤,«], Jeanne A Mortimer[»,ˆ,ˇ], Carlos J Moura[¦], Toufiek Samaai[|,ª,²,ʳ], Kaveh Samimi-Namin[¢], Daniel Wagner[ℓ], Rowana Walton[ⁱ], Lucy C Woodall[‡,§]

‡ Nekton Foundation, Oxford, United Kingdom
§ Department of Zoology, University of Oxford, Oxford, United Kingdom
| Department of Forestry, Fisheries and Environment, Branch Oceans and Coasts, Cape Town, South Africa
¶ Sustainable Ocean Seychelles, Victoria, Seychelles
# Smithsonian Institution National Museum of Natural History, Washington, United States of America
¤ University of Cape Town, Rondebosch, Cape Town, South Africa
« blue[c]weed, Brest, France
» Island Conservation Society (ICS), Point Larue, Mahé, Seychelles
ˆ Seychelles' Conservation & Climate Adaptation Trust (SeyCCAT), Victoria, Mahé, Seychelles
ˇ Department of Biology, University of Florida, Gainesville, Florida, United States of America
¦ OKEANOS / DOP, University of the Azores, Horta, Portugal
² iZiko Museums of South Africa, Cape Town, South Africa
ʳ University of the Western Cape, Bellville, Cape Town, South Africa
¢ Naturalis Biodiversity Center, Leiden, Netherlands
ℓ Conservation International, Arlington, United States of America
ⁱ James Michel Blue Economy Research Institute, University of Seychelles, Anse Royale, Mahé, Seychelles

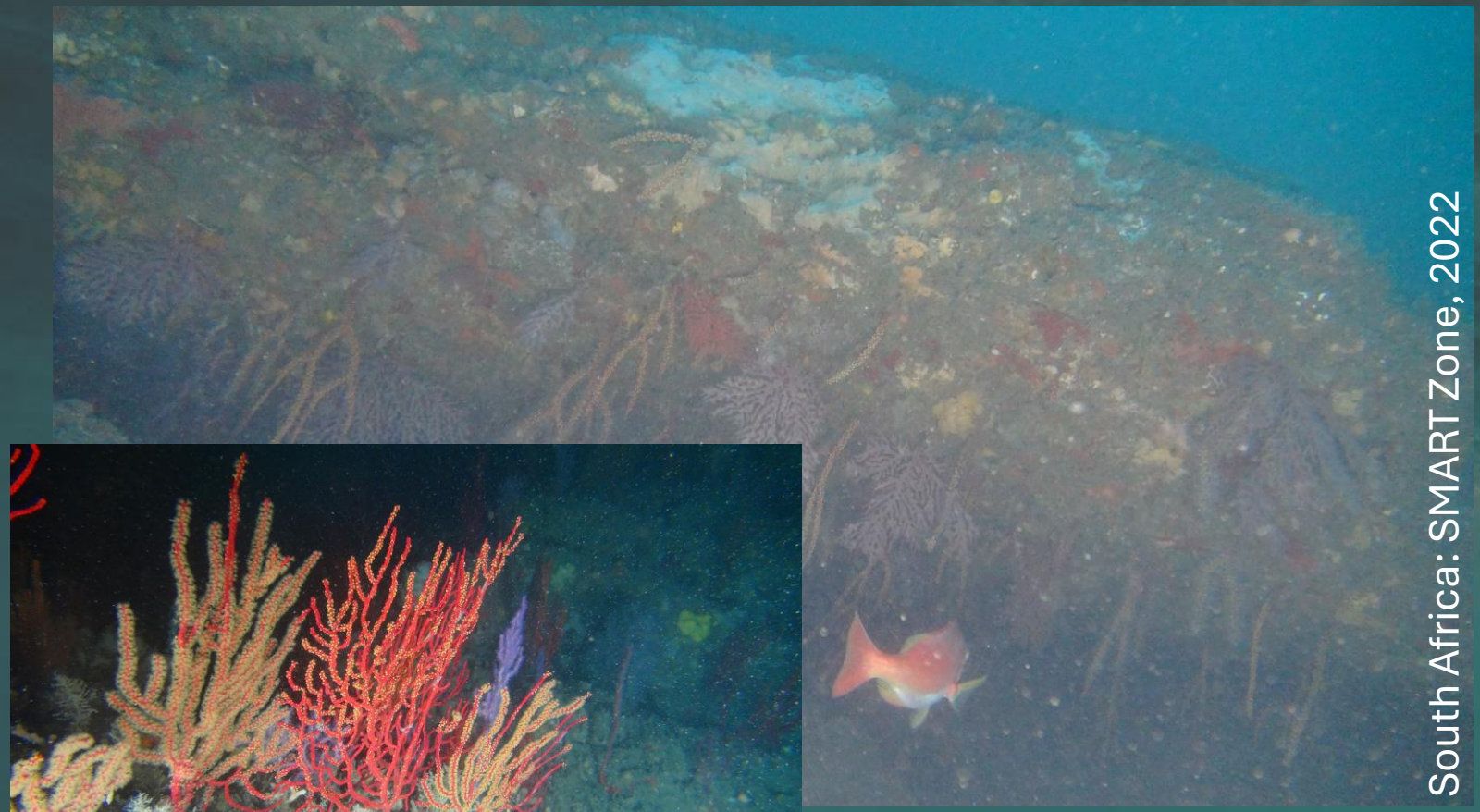
Corresponding author: Nico Fassbender (nico@nektonmission.org)

Academic editor: Danwei Huang

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Citation: Fassbender N, Stefanoudis PV, Filander ZN, Gendron G, Mah CL, Mattio L, Mortimer JA, Moura CJ, Samaai T, Samimi-Namin K, Wagner D, Walton R, Woodall LC (2021) Reef benthos of Seychelles - A field guide. Biodiversity Data Journal 9: e65970. https://doi.org/10.3897/BDJ.9.e65970

South Africa



South Africa: SMART Zone, 2022

South Africa

- Situation:
  - Knowledge of mesophotic reefs but not extensive condition of Wild Coast reefs
- Contribution:
  - Peer reviewed papers
  - Input into marine management plans
  - Training UG and MSc students
  - Created reef impact metric
- Situation now:
  - Further funding secured for new location
  - SA team presenting at IMCC26



Maldives







Maldives

- Situation
  - A wealth of knowledge from shallow reefs
- Contribution
  - Peer-reviewed papers
  - Training fellowships
  - Benthic ID guide
  - Live lessons for 11,500 school children
- Situation now
  - Purchasing ROV for the country



Diversity and Distributions

WILEY

Diversity and Distributions

RESEARCH ARTICLE OPEN ACCESS

Remoteness Is Not a Silver Bullet for Mediating Local Human Stressors on Tropical Benthic Communities

Paris V. Stefanoudis[1,2,3] | Farah Amjad[1] | Nina M. de Villiers[1] | Mariyam Shidha Afzal[4] | Fathimath Hana Amir[5,6] | Shaha Hashim[7,8,9] | Ryan Palmer[10] | Nuria Rico Seijo[1] | Mohamed Shimal[5] | Denise Swanborn[11] | Sheena Talma[3,12] | Mohamed Ahusan[5] | Lucy C. Woodall[1,9]

[1]Nekton Foundation, Oxford, UK | [2]Oxford University Museum of Natural History, University of Oxford, Oxford, UK | [3]The Biodiversity Consultancy, Cambridge, UK | [4]University of the Ryukyus, Okinawa, Japan | [5]Maldives Marine Research Institute, Male, Maldives | [6]Bangor University, Bangor, UK | [7]Blue Marine Foundation, London, UK | [8]Maldives Resilient Reefs, Male, Maldives | [9]University of Exeter, Exeter, UK | [10]South African Institute for Aquatic Biodiversity, Makhanda, South Africa | [11]Minderoo-UWA Deep-Sea Research Centre, The University of Western Australia, Perth, Australia | [12]Department of Biology, University of Oxford, Oxford, UK

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Editor: Aibin Zhan

Funding: This research has been funded by the Nekton Foundation.

Keywords: coral reefs | deep reefs | deep sea | Indian Ocean | Maldives | mesophotic coral ecosystems

ABSTRACT

Aim: Tropical coral reefs are at the forefront of the current triple planetary crisis of climate change, pollution, and biodiversity loss. While geographic remoteness is considered to shield reefs from local human pressures, and potentially aid in combating adverse climate change impacts, recent evidence from shallow reefs (0–30 m) to support this hypothesis has been inconclusive. We use a holistic approach focusing on the whole shallow reef community and expanding to mesophotic coral ecosystems (MCEs; 30–150 m) and deep-sea corals (250–500 m) to test the effect of vertical (depth) remoteness.

Location: Five coral atolls in the Maldives, central Indian Ocean, including depths from 0 to 500 m.

Method: Firstly, we obtained benthic community characteristics (abundance, richness, community evenness) by annotating 4200 images from 105 stereo video-based transect surveys. Subsequently, we collected data on human activities and proxies thereof that could impact benthic communities, as well as other geographic and topographic parameters due to their role in shaping benthic communities. Using modelling approaches (random forests), we then combined the above datasets to assess the importance and influence of human pressure and other variables on benthic community characteristics.

Results: We report that shallow reef benthic communities—both their abundance and richness—were higher on geographically remote reefs, and these communities were also more even. No such pattern was observed for MCE evenness, while richness was actually lower on remote reefs. Notably, MCE abundance and all deep-sea models had low explanatory power, suggesting that factors other than human pressures, such as depth and topography, are driving community patterns at our study sites, highlighting the need for holistic, multi-faceted approaches to coral reef conservation and management.

Comoros

RENFORCEMENT DE LA PROTECTION DES OCÉANS AUX COMORES







Comoros: First Descent, 2025

UNIVERSITE des Comores

NEKTON

WILDOCEANS

A programme of the WILDNESS

NRF National Research Foundation

SAIAB South African Institute for Aquatic Biodiversity

THE NIPPON FOUNDATION-NEKTON OCEAN CENSUS

Parcs Nationaux des Comores

Centre National de Documentation et de Recherche Scientifique CNDRS

CORDIO

NELSON MANDELA UNIVERSITY

Comoros

RENFORCEMENT DE LA PROTECTION DES OCÉANS AUX COMORES

- Situation
  - Commitment to protect 30 x 30
- Contribution
  - Systematic conservation planning documents
  - Equipment and mentoring
  - Biodiversity data from Raya bank
  - Benthic and Fish field ID guides
- Situation now
  - 1st marine PhD student
  - International stage plenaries for Ministers
  - Funding for Systematic Conservation Plan

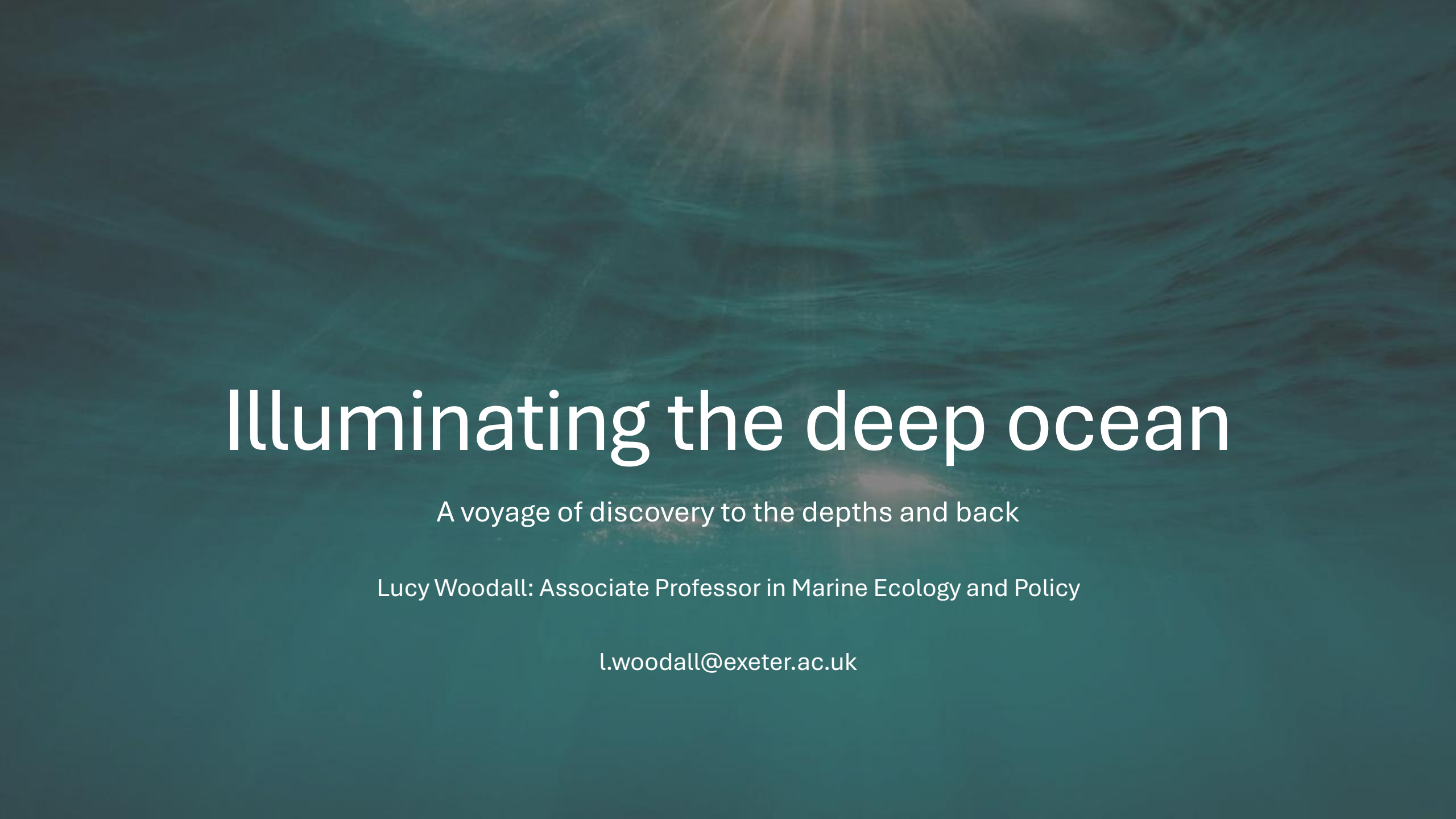


Comoros: First Descent, 2025

Where are we with the challenge?

- Access
  - Ocean access is important: grants submitted for equipment development and Yachts for Science (Nekton programme)
- Use
  - Ensure deep reef knowledge is presented in a useable way for decision makers by working with partners and decision-makers from the start
- Literacy
  - Work with decision makers to understand their comprehension and concern about the ocean within their portfolios to conduct gap analysis
- Promotion
  - Lift the blue blanket on the deep reefs through cultural connections, e.g. Ocean Rising (Nekton Programme)


What questions
do you have?



Illuminating the deep ocean

A voyage of discovery to the depths and back

Lucy Woodall: Associate Professor in Marine Ecology and Policy

l.woodall@exeter.ac.uk