



Deep Ocean Observing Strategy

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Helen Pillar (UT Austin), DOOS Modeling/Observing WG Lead

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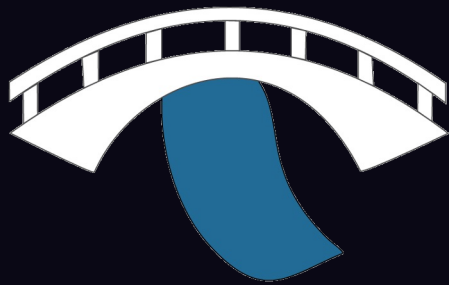
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Karen Stocks (SIO/UCSD), DOOS FAIR Data WG Lead

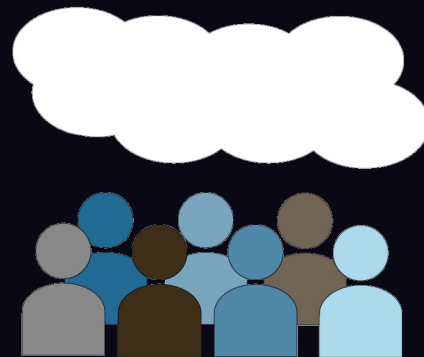
What is DOOS?



The Deep Ocean Observing Strategy (DOOS) is a community-driven, international initiative, strategically aligning the deep ocean observing community toward collective solution-based science.



Builds bridges across disciplines and communities



Facilitates discussions between people/groups tackling similar global deep-sea challenges



Promotes the development of future leaders and elevates diverse global voices

iDOOS Working Groups



Essential Ocean Variables

IOCCP
GOOS
BioEco
OOPC
GCOS • GOOS • WCRP
Ocean Observations Physics and Climate panel

Accessible Ocean Technology

The Global Ocean Observing System
GOOS
Synchro
OCEAN DISCOVERY LEAGUE

Assessing Observational Gaps for Understanding Climate Change

DOSI
DEEP-OCEAN STEWARDSHIP INITIATIVE
ipcc

Habitat Mapping for Place-Based Management

esri
THE SCIENCE OF WHERE
CHALLENGER
150
A DECADE TO STUDY DEEP-SEA LIFE

Science to Policy

DOSI
DEEP-OCEAN STEWARDSHIP INITIATIVE
2021-2030 United Nations Decade of Ocean Science for Sustainable Development

Integrating Modeling and Observing

US CLIVAR
ECCO

SeaFAIRers

ESIP
OBIS
OCEAN BIODIVERSITY INFORMATION SYSTEM

GOOS Essential Ocean Variables (EOVs)

- **Physics & Climate (OOPC):**


- Ocean Bottom Pressure - adopted as EOVS
- Turbulence - adopted as Pilot EOVS
- Geothermal Heat Flux - Under development

- **Biogeochemistry (BGC):**

- Methane - integrated EOVS "non CO2 GHG"
- Seafloor Oxygen Uptake - merge w/ Oxygen EOVS
- Seafloor Labile Organic Matter - merge w/ Particulate Matter EOVS


- **Biology & Ecosystems (BioEco):**

- Invertebrate abundance and distribution - Perspective paper published; adopted as Pilot EOVS
- Hard coral cover and composition - add deep context to existing EOVS
- Sponge cover and composition - under discussion



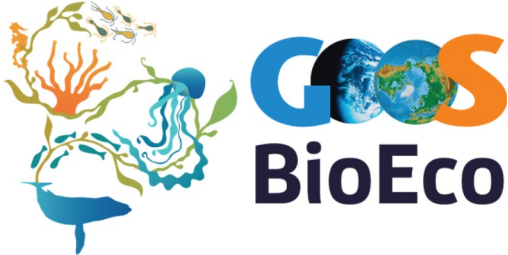
The Global Ocean Observing System

GOOS Expert Panels




INTERNATIONAL OCEAN CARBON COORDINATION PROJECT
IOCCP

Biogeochemistry



GOOS BioEco

Biology/Ecosystem



GCOS • GOOS • WCRP

OOPC

Physics

Ocean Observations Physics and Climate panel

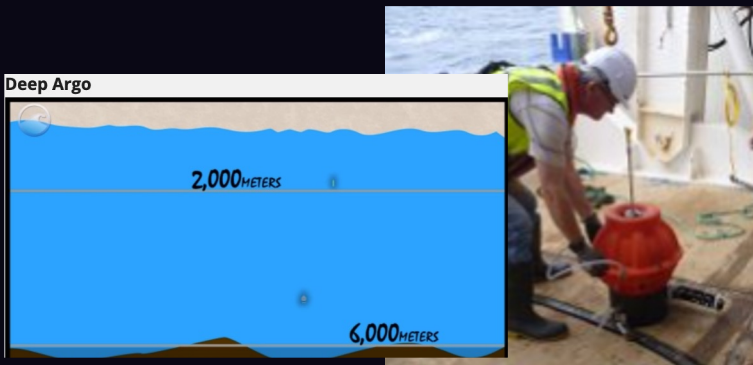
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Integrating Modeling and Observing

Bringing together observational oceanographers and modelers across physical, biogeochemical, and ecological communities...

to assess our understanding of pathways connecting the surface to the seafloor...

and to develop recommendations for improved detection and attribution of change in the global deep ocean system.



Pathways Connecting Climate Changes to the Deep Ocean Workshop

Tracing physical, biogeochemical, and ecological signals from surface to deep sea

A joint US CLIVAR/OCB workshop
April 23-25, 2024, in Lewes, DE and virtual

Bringing together observational oceanographers and modelers across physical, biogeochemical, and ecological communities to assess our understanding of pathways connecting the surface to the seafloor and to develop recommendations for improved detection and attribution of change in the global deep ocean system.

Scientific Organizing Committee

Xinfeng Liang, University of Delaware	Isabela La Bras, Woods Hole Oceanographic Institution
Monique Messié, Monterey Bay Aquarium Research Institute	Helen Pillar, University of Texas at Austin
Leslie Smith, Deep Ocean Observing Strategy	Cristina Schultz, Northeastern University
Zachary Erickson, NOAA PMEL	Charlie Stock, NOAA GFDL
Patrick Heimbach, University of Texas at Austin	

OCB
Deep Carbon & Biogeochemistry

US CLIVAR

NASA

NOAA

NSF

DOOS

Scan or click

Accessible Ocean Technology (AOT)

Bringing together AOT Community

- Leading network coordination to synergize efforts across AOT stakeholders (users, tech providers, governmental programs, funders)
- Emphasis on the **global** community
- Co-Creating an online community hub to connect accessible providers and users.

A Lens towards Sustainability

- Producing a roadmap, timeline, and communication points to pave a sustainable path for accessible tech into the Blue Economy.



13 March 2024 | Oceanology International, London, UK

2021 United Nations Decade of Ocean Science for Sustainable Development

EOOS Technology Forum 2024

CATCHING THE MOMENTUM IN OCEAN OBSERVING TECHNOLOGY: OPTIMISING VALUE AND DATA PROVISION

Partners: EuroGOOS, JERICO3a, Ifremer, OGS, National Institute of Oceanography, SMHI, iDOOS, The Global Ocean Observing System, NOAA, GEORGE, MTS (Marine Technology Society), Opportunity runs deep.

Technologies in Sustainable Ocean Observations

World Trade Center, Room 9+10, Barcelona
9 April 2024 | 12:00 - 14:00 CET

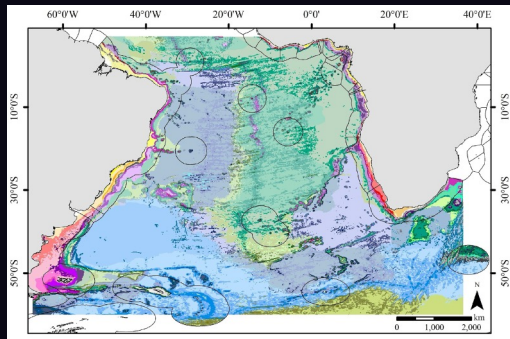
Partners: SMHI, JERICO3a, iDOOS, Ifremer



Habitat Mapping for Place-Based Mgmt



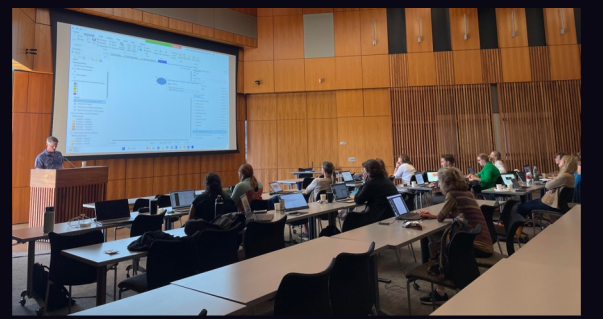
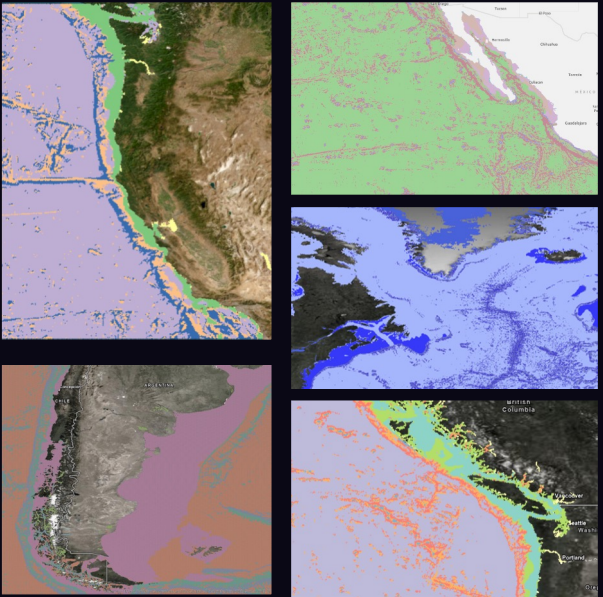
GOAL: gridded regional habitat characterization maps for use across applications - MPAs, Sanctuaries and offshore wind.



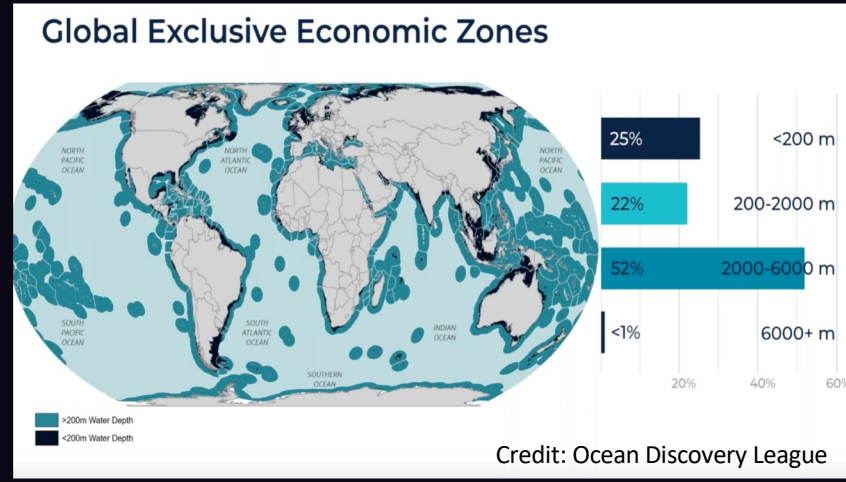
Benthic Habitat Classifications

A primer from the Deep Ocean Observing Strategy Habitat Mapping for Place-Based Management Working Group

March 27, 2024



McQuaid et al., 2023

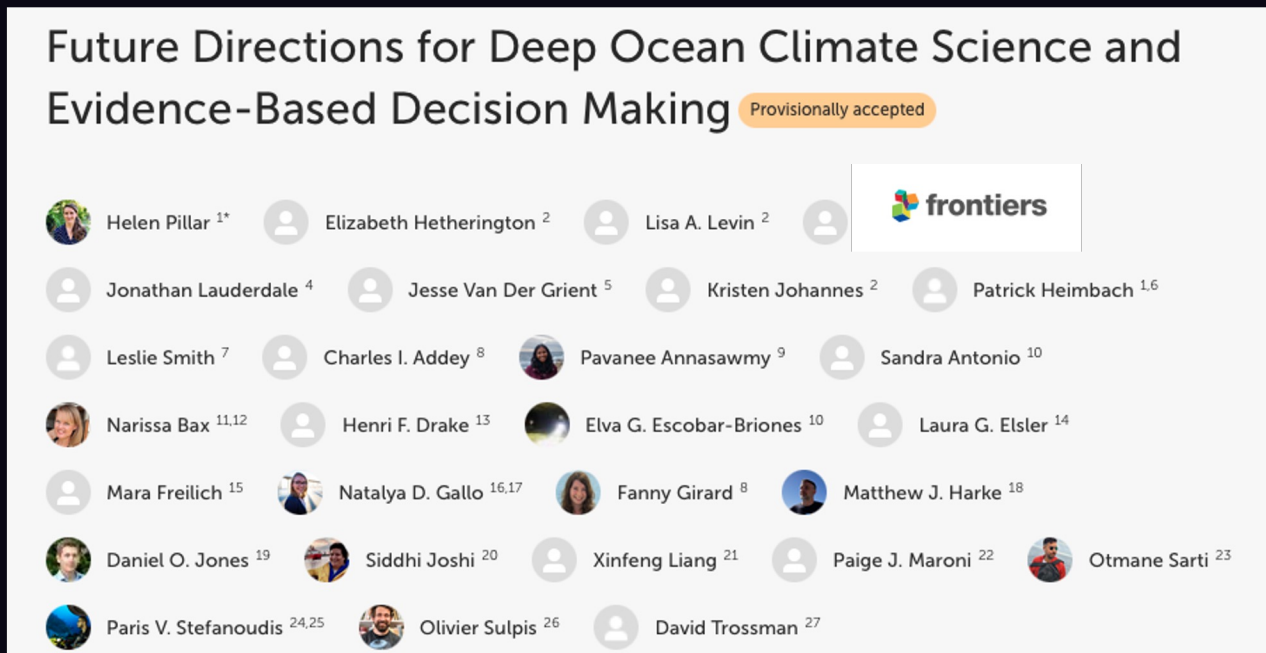


ICES *Journal of Marine Science*, 2022, 8, 1-5
 DOI: 10.1093/icesjms/ksac145
 Food for Thought

ICES
 CIEM
 International Council for the Exploration of the Sea
 Commission for the Eastern Pacific Ocean
 Commission for the North Atlantic

Building on a human-centred, iterative, and agile co-design strategy to facilitate the availability of deep ocean data
 Diana E. LaScala-Gruenewald¹, Natalie H. N. Low¹, James P. Barry¹, Jennifer A. Brown^{2,3}, Chad King³, Francisco P. Chavez¹ and Henry A. Ruhi^{1,*}

Knowledge Gap Analysis (*Pillar et al. 2024*)

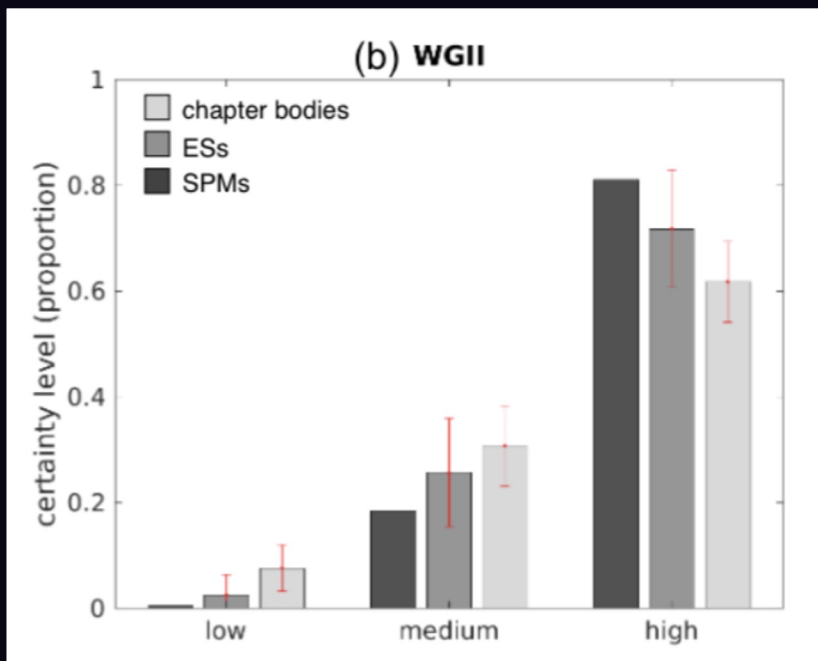


Aims: Collate major deep ocean knowledge gaps across the IPCC AR6 to

1. identify key research priorities for improving confidence in AR7
2. encourage better representation of deep ocean risks in reporting

IPCC Uncertainty Language Challenges

Report focus is on *medium* → *very high confidence* statements & this skewness increases towards widely-read SPMs



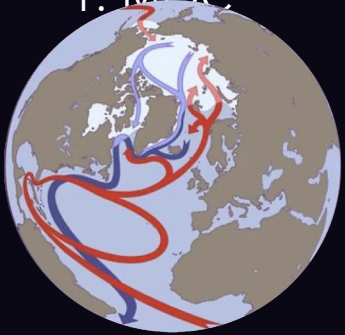
Deep Ocean Ramifications?

The deep ocean is understudied
→ characterized by large uncertainty
→ largely left out from SPMs
→ underrepresented in policy & critical research needs overlooked

Pillar et al., Frontiers in Climate, in press.

Highlighted Knowledge Gaps (*Pillar et al. 2024*)

1. MOC



3. Primary Production



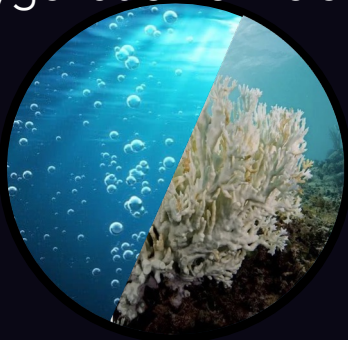
5. Ocean Ecosystems



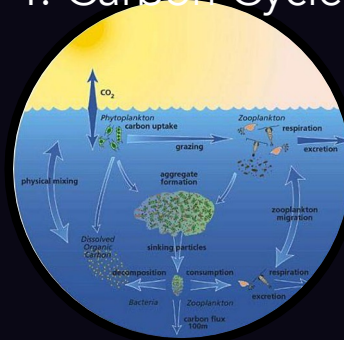
7. mCDR



2. Deoxygenation & Acidification



4. Carbon Cycle



6. Fisheries



NB These are the known unknowns!

UN Ocean Decade Events

DEEPENING THE DECADE

Deep Ocean Actions for a Sustainable Ocean

April 12th, 13:15 - 14:45
CCIB, Southern Ocean Room (133+134)

Featuring expert panels on:

- Deep ocean health, wealth, and the role of biodiversity
- Progressing deep ocean observing for the next generation



2022: COP 27, Sharm el-Sheikh, Egypt

2022: PICES Sustainability of Marine Ecosystems, Busan, Korea

2023: UNFCCC Ocean and Climate Change Dialogue, Bonn, Germany

2023: COP 28, Dubai, UAE

2023: Informal Consultative Process at the UN General Assembly New York, (New Maritime Technologies: Challenges and Opportunities)

2025: Ocean Visions, Atlanta, GA

2023: DOOS Collective Solution Accelerator, SIO/UCSD

2024: UN Ocean Decade Conference, Barcelona, Spain

2025: ...

Deepening the Decade (Hetherington et al. 2024)

COBRA
CRUSTAL OCEAN BIOSPHERE
RESEARCH ACCELERATOR

COBRA
COASTAL OCEAN BIOMONITORING
AND RESEARCH ACCELERATOR

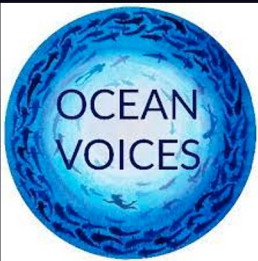


OCEAN VISIONS

Digital Deep

DO
DEEP-OCEAN STEWARDSHIP INITIATIVE

 **unesco**



JETZON
SMART Cables for Ocean Observing



ASLO
Association for the Sciences of
Limnology and Oceanography

Bulletin
LIMNOLOGY AND OCEANOGRAPHY

Article

Deepening the Decade: Collaborative Action for Advancing Deep-Ocean Science and Policy in the United Nations Decade of Ocean Science for Sustainable Development

Elizabeth D. Hetherington ✉, Clarissa Anderson, Liliana Bastian, Naomi Boon, Nan-Chin Chu,
Ceci Rodriguez Cruz, Hayley Drennon, Andrew Gates, Brandon Gertz, Kelly D. Goodwin, Svenja Halfter,
Kerry Howell, Ella Howes, Vanessa Lopes, Tina Martin, Terrence McConnell, Pei-Yuan Qian,
Sarah Seabrook, Leslie Smith, Glen Snyder, Karen I. Stocks, Rosalynn Sylvan, Dawn Wright, Lisa A. Levin ✉
... See fewer authors ^

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Ocean
Decade
Africa
Roadmap



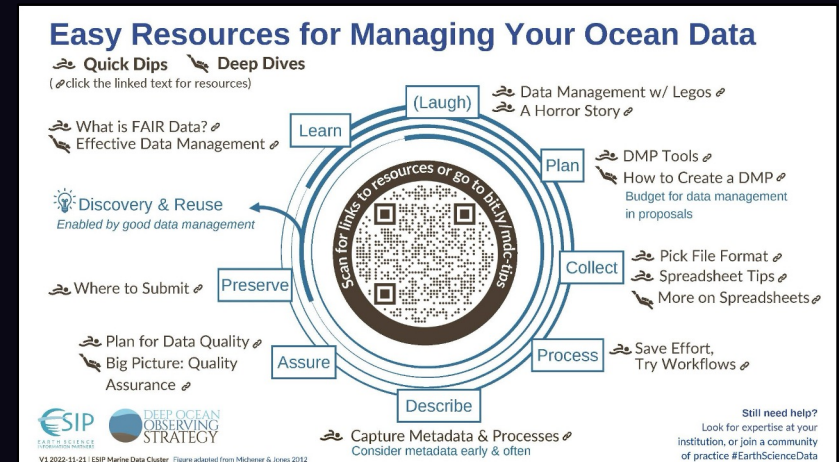
OBOON
OCEAN BIOMOLECULAR
OBSERVING NETWORK

THE NIPPON FOUNDATION-GEBCO

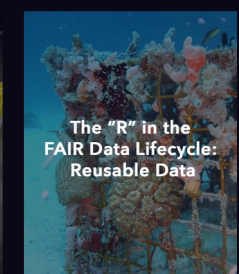
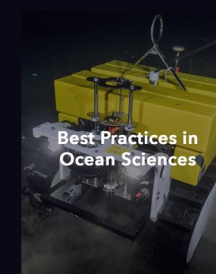
SEABED
2030

Supporting FAIR-er data - SeaFAIRers

- Collaborations with ODIS Ocean InfoHub Decade Programme
- DeCODER project - implement schema.org in deep sea data repositories = increased findability
- Decade FAIR Data Cohesive Asks related to Decade-endorsed deep-ocean Actions
 - Provide Actions with FAIR/CARE data training by 2025.
 - Obtain endorsement and commitment of FAIR and CARE data from 100% of Actions by 2028.
 - Provide Actions with OBIS training or resources by 2026.



<https://www.deepoceanobserving.org/pages/tips-for-managing-your-ocean-data>



DOERs data training by Stace! doi: [10.1575/1912/67631](https://doi.org/10.1575/1912/67631)

Deep Ocean Early-career Researchers



The science we need for the ocean we want...
requires a sustained & innovative workforce

DOERs



The Deep Sea, the Climate, and the Next Generation

Wednesday, November 9, 2022
4:30pm-5:30pm GMT+2 (10:30am EST)
Climate Education Hub, Blue Zone COP27
Watch online: earthday.org/climateeducationhub/



Dr. Sarah Seabrook
National Institute of Water and Atmospheric Research, New Zealand



Dr. Narissa Box
South Atlantic Environmental Research Institute, Falkland Islands



Dr. Iso Elegbede
CEESP/IGER/IUCN, Switzerland
Lagos State University, Nigeria



Olivia S. Pereira
Scripps Institution of Oceanography, USA

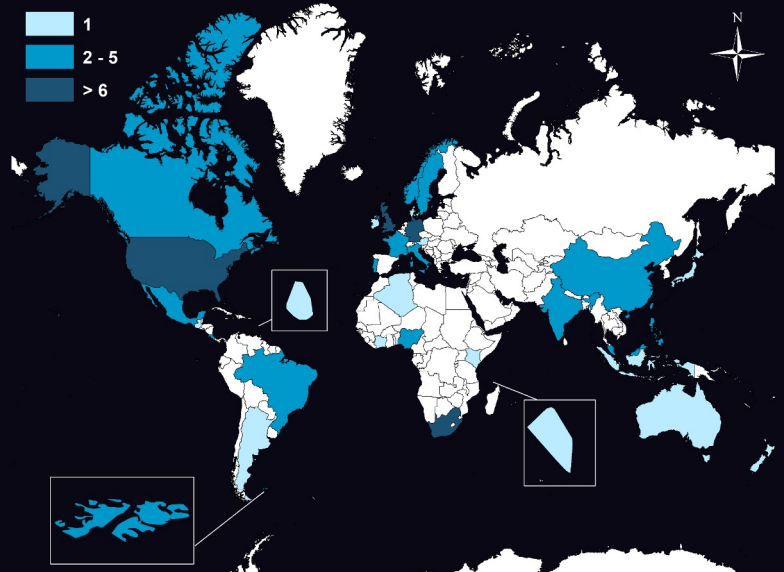


Michelle Gursieb
Scripps Institution of Oceanography, USA



Dr. Lisa A. Levin
(moderator)
Scripps Institution of Oceanography, USA

Photo: ROV Sulistiana/Schmidt Ocean Institute (K210726/Pt Levin)





2021
2030 United Nations Decade
of Ocean Science
for Sustainable Development



ECOP
Early Career
Ocean Professionals



ECOP
Early Career
Ocean Professionals

Website coming soon!

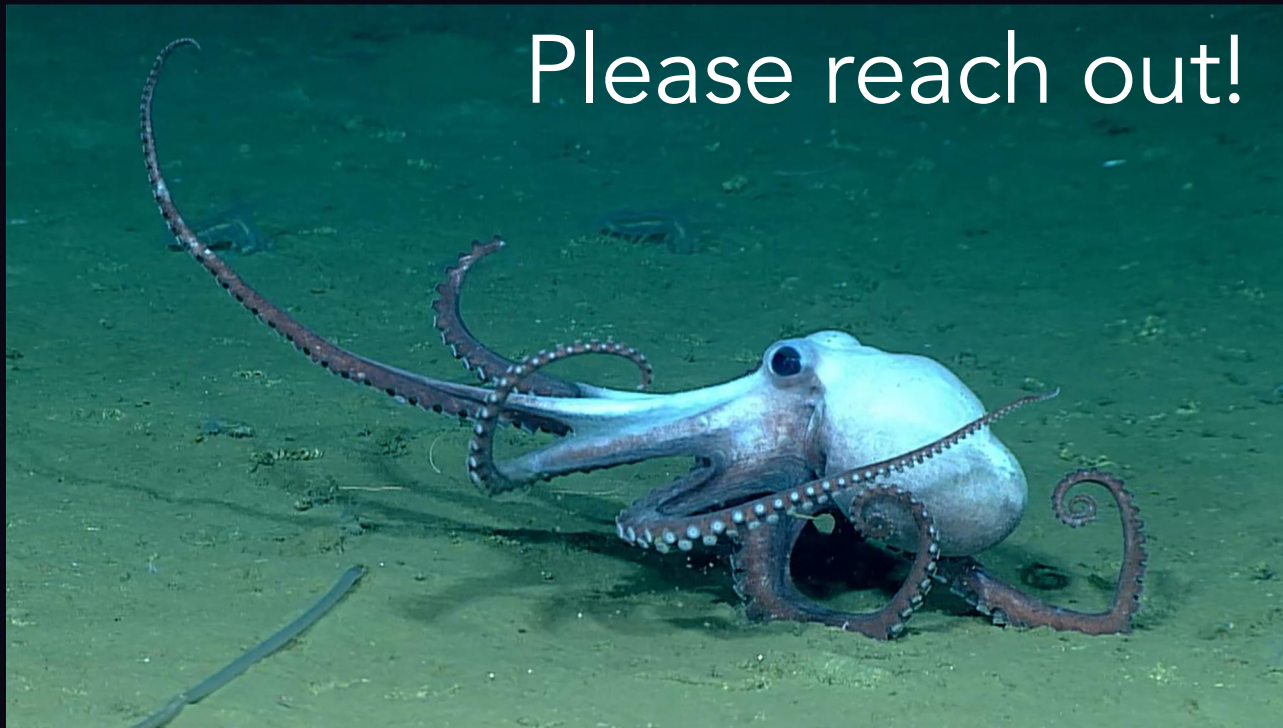
Contact ehetheri@ucsd.edu if
you're interested in joining the
Deep ECOP Task Team

What should the deep ECOP task team work on?

1. Outreach-education & ocean literacy
2. Networking & professional development/workshops
3. Capacity building & Skill sharing
4. Central coordination of ECR programs/activities (i.e., avoiding duplication)
5. Engaging in deep ocean science policy & advocating for ECR representation at high level meetings
6. Publishing opinion pieces or desk-based studies

Hoping to serve as a connection point between early career folks and Decade actions.

 Thank you!



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www.deepoceanobserving.org

Image courtesy of NOAA Ocean Exploration, 2023 Shakedown + EXPRESS West Coast Exploration.