



Beyond the Horizon

The relevance of mapping to
conserving the ocean beyond
national boundaries

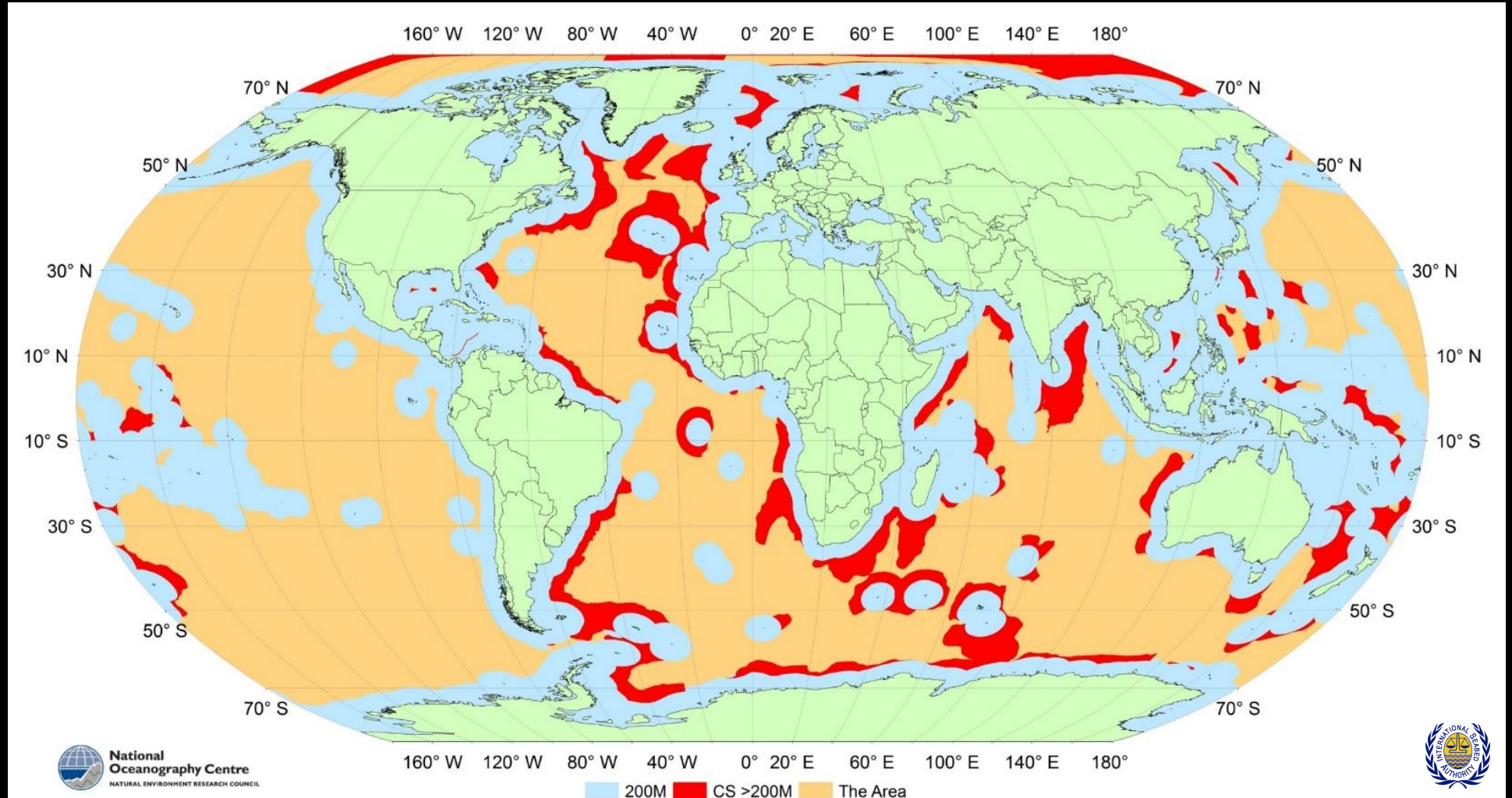
Kristina Maria Gjerde
Wycliffe Management, Sp zoo
IUCN Global Marine and Polar Programme
Middlebury Institute of International Studies at Monterey
Honorary Fellow, University of Edinburgh School of Geosciences

A Lawyer's map: International legal boundaries

Exclusive Economic Zones

Extended continental shelf

International seabed Area





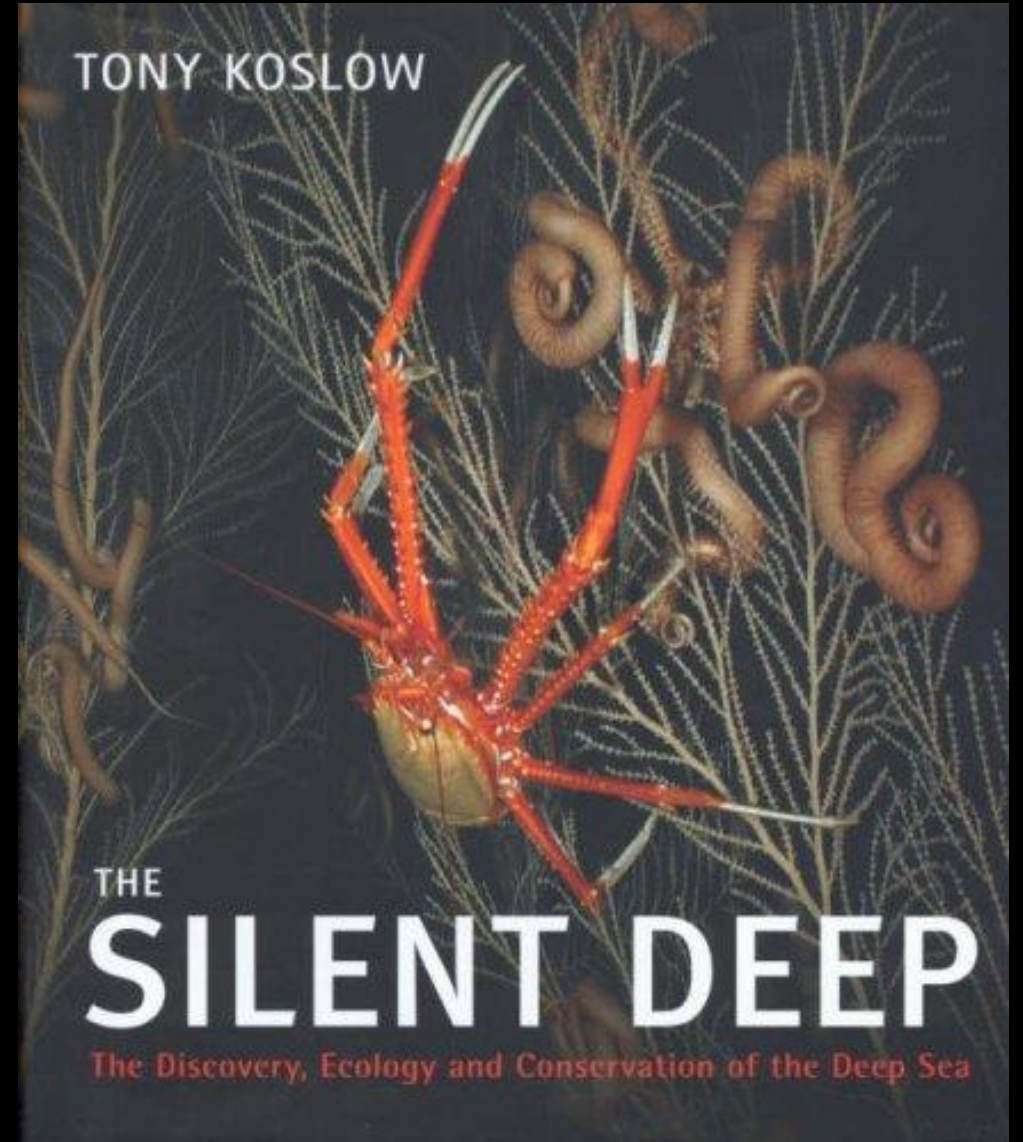
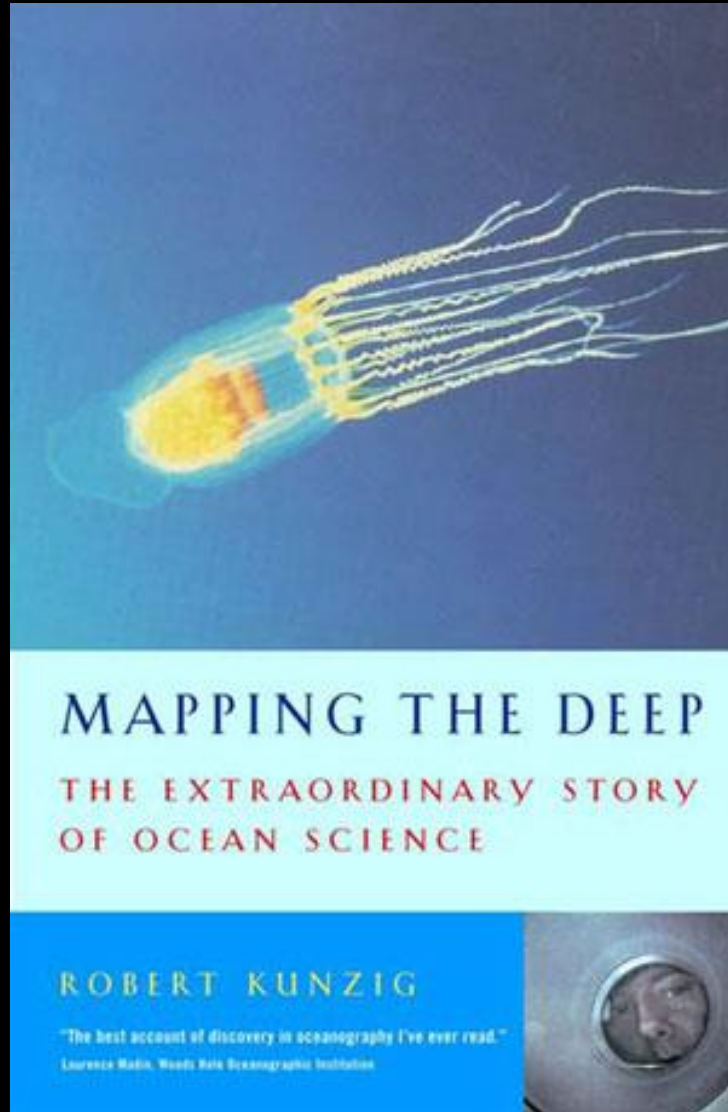


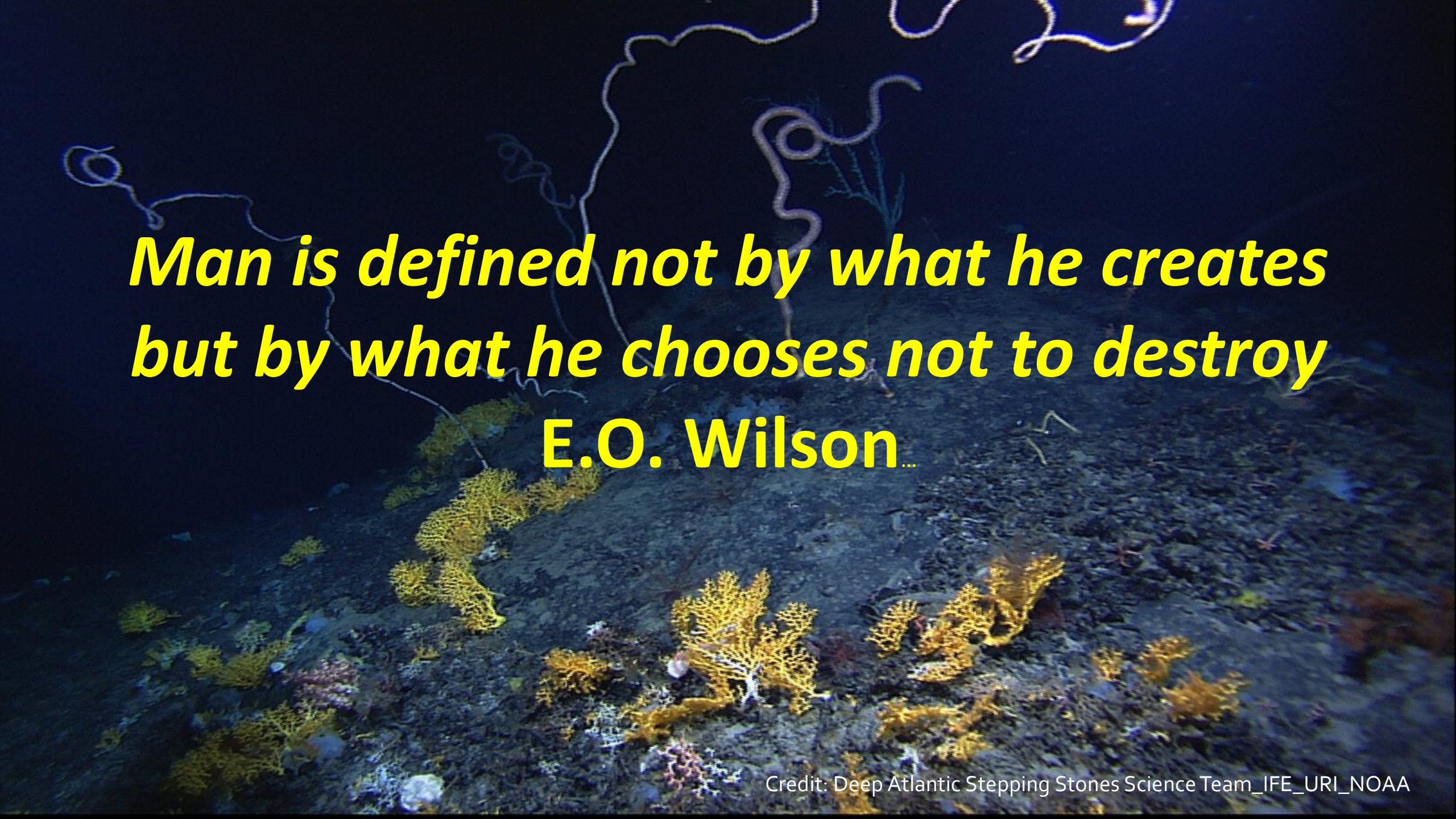
2001: Impacts of deep sea bottom trawling revealed by Norwegian scientists



Institute of Marine Research, Bergen

My journey to the deep



A deep-sea hydrothermal vent scene, likely a black smoker field. The seafloor is dark and covered with various hydrothermal structures, including tall, yellow and orange hydrothermal chimneys and smaller, more delicate structures. The water is dark, and the overall atmosphere is mysterious and otherworldly.

***Man is defined not by what he creates
but by what he chooses not to destroy***
E.O. Wilson..

HALF- EARTH

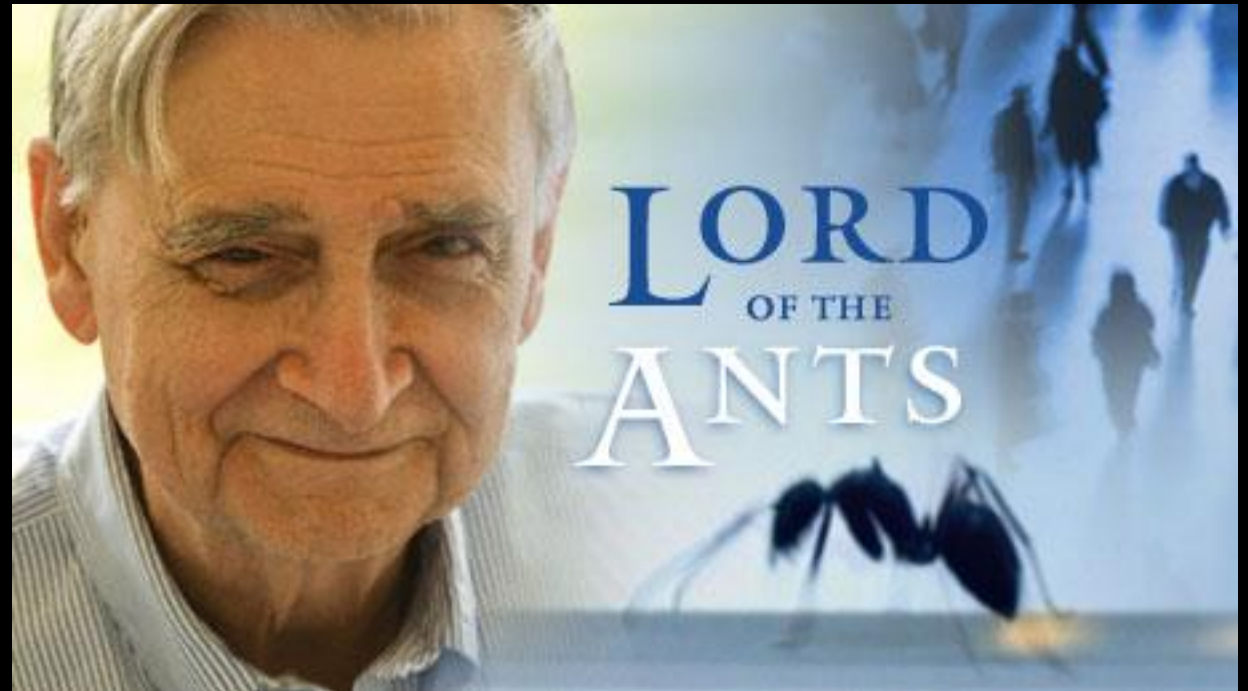


*Our Planet's
Fight for Life*

EDWARD O.
WILSON

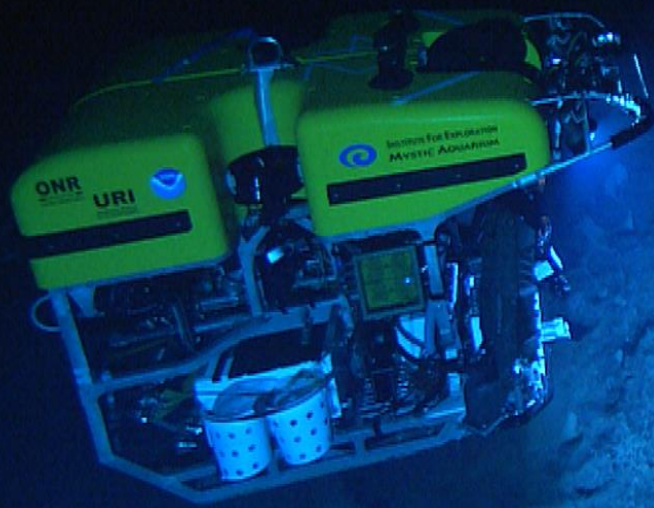
WINNER OF THE PULITZER PRIZE

“To save biodiversity, we need to set aside about half the earth’s surface as a natural reserve” — Edward O. Wilson



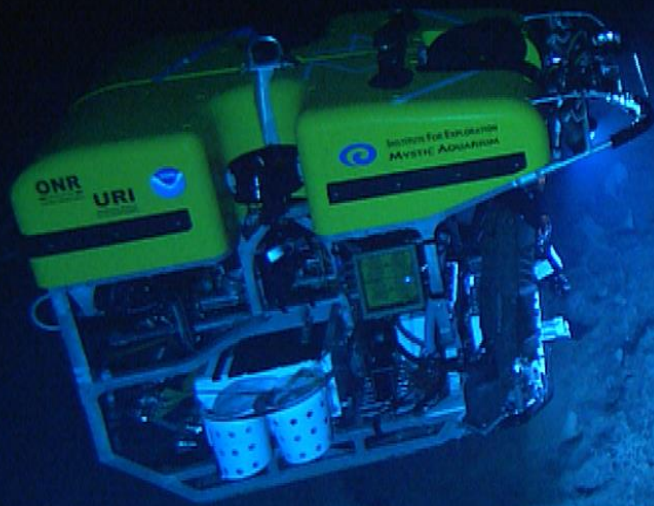
<http://www.pbs.org/wgbh/nova/nature/lord-ants.html>

Key takeaway message: mapping matters



Key takeaway message: mapping matters

- Provides context for biological observations
- Only way to appreciate patterns of marine life
- Key tool for designing networks of marine protected areas



Ocean Life

Diversity, Distribution, Abundance

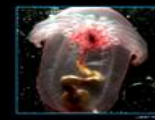
NATIONAL GEOGRAPHIC IN PARTNERSHIP WITH CENSUS OF MARINE LIFE



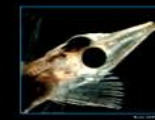
ARCTIC JELLYFISH
A new species of jellyfish was discovered in the Arctic Ocean in 2007. It is the first jellyfish species found in the Arctic region.



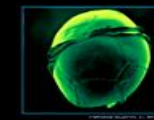
SQUID
Squid are highly intelligent and can change color to blend in with their surroundings. They are found in all parts of the world's oceans.



DEEP-OCEAN FISH
Deep-sea fish live in the dark, cold depths of the ocean. Many have unique adaptations for survival in this environment.



ICE FISH
Ice fish are found in the Southern Ocean. They have a unique adaptation: they lack hemoglobin, allowing them to survive in the cold water.



SEA SPIDER
Sea spiders are ancient marine arachnids. They have long, thin legs and are found in deep-sea environments.



PETALIA
Petalia is a genus of jellyfish. It is known for its unique, petal-like appearance and is found in the Pacific Ocean.

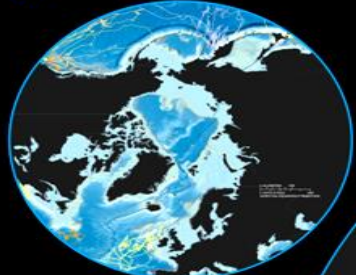


CRAB
Crabs are highly diverse and found in all parts of the world's oceans. They play a crucial role in the marine food web.

One Ocean

Long-distance Ocean Travels
The central map shows the complexity and richness of ocean life. It highlights the connectivity of the world's oceans and the long-distance travels of many species. This connectivity is essential for the health and resilience of the global marine ecosystem.

Discovery and Fascination
As we explore new frontiers of discovery and fascination, we uncover the hidden wonders of the deep. Our understanding of the diversity of life in the ocean is growing rapidly, revealing new species and ecosystems that challenge our previous assumptions about the world's oceans.



For millennia, the ocean has rekindled human imagination with the lure of treasure, mystery, and mystery. All hidden beneath a seemingly endless surface. Centuries of exploration have revealed wonders beneath the waves, but much more remains to be discovered. Frontiers of oceanography and marine biology remain only partially understood, including questions about the diversity, distribution, and abundance of the life that thrives in the ocean.

A collaboration of scientists working with unprecedented scope has provided a path to answer many of these questions. In the year 2000, the first Census of Marine Life began a 10-year effort to reveal the state of life in the ocean. Encompassing more than 200 countries, more than 80 countries, it employed divers, nets, and submersible vehicles, genetic identification, ocean electronics, and acoustic tagging, listening posts, and continuous video tapes. The Census spanned all ocean basins, from coasts down slopes, to the abyss, from the North Pole across seas to the shores of Antarctica. It systematically compiled information from new discoveries and historic archives and made it freely accessible. Census explorers found life wherever they looked—a riot of species.

The last decade has improved our understanding of the very small, the very large, and very remote creatures that call the ocean home. Marine life continues to bring forth surprises. In the Caribbean, explorers encountered a clam that thrived 200–300 million years ago, thought to have been extinct since the early Cambrian. In the Mediterranean, they found cold-water corals extending over 400 kilometers in waters 500 meters deep—one of the world's longest reefs. Near Chile, they found giant microbial mats covering an area of seabed the size of Greece. Long-term tracking revealed migratory pathways. Combining all this information has created a deeper understanding of new habitats and ecosystems, and of our impact on the world's oceans.

This map highlights discoveries of ocean life—its variety, extent, and habitat. It offers a glimpse into the discoveries of a decade's investigation into life in all ocean realms from microbes to whales.

Ocean Habitats
The ocean can be divided into distinct habitats, each with its own unique characteristics. These habitats are interconnected and support a vast array of marine life.

- CORAL REEF**
- CONTINENTAL SHELF**
- MID-OCEAN RIDGE**
- VENT**
- SEEP**
- SEAPOUNT**
- CONTINENTAL SHELVES**
- CONTINENTAL MARGINES**
- OPEN OCEAN**
- SEAMOUNTS**
- VENTS AND SEEPS**
- REVEAL PLAINS**
- ICE OCEANS**



Polar Regions
Polar regions are characterized by extreme cold and low biodiversity. However, recent discoveries have revealed unique and resilient life forms that thrive in these harsh environments.



PACIFIC BLUEFIN TUNA
The Pacific bluefin tuna is a highly migratory species that travels across the Pacific Ocean. It is a key species in the marine food web and is valued for its meat.

PACIFIC SEA TURTLES
Pacific sea turtles are found in the Pacific Ocean. They are highly migratory and play a crucial role in the marine ecosystem.

PACIFIC SEABIRDS
Pacific seabirds are found in the Pacific Ocean. They are highly migratory and play a crucial role in the marine ecosystem.

PACIFIC SHARKS
Pacific sharks are found in the Pacific Ocean. They are highly diverse and play a crucial role in the marine ecosystem.

PACIFIC FRINGED
Pacific fringed species are found in the Pacific Ocean. They are highly diverse and play a crucial role in the marine ecosystem.

ATLANTIC BLUEFIN TUNA
The Atlantic bluefin tuna is a highly migratory species that travels across the Atlantic Ocean. It is a key species in the marine food web and is valued for its meat.

ATLANTIC SEA TURTLES
Atlantic sea turtles are found in the Atlantic Ocean. They are highly migratory and play a crucial role in the marine ecosystem.

ATLANTIC SEABIRDS
Atlantic seabirds are found in the Atlantic Ocean. They are highly migratory and play a crucial role in the marine ecosystem.

SOUTHERN OCEAN
The Southern Ocean is a vast and diverse region. It is home to many unique and resilient life forms that thrive in its harsh environment.

ANTARCTIC OCEAN
The Antarctic Ocean is a vast and diverse region. It is home to many unique and resilient life forms that thrive in its harsh environment.

www.coml.org
The first Census of Marine Life, completed in 2010, brought together 270 scientists from more than 80 countries to explore the diversity of life in the world's oceans. The results of this global effort are available at www.coml.org.



Discovered a wealth of biodiversity



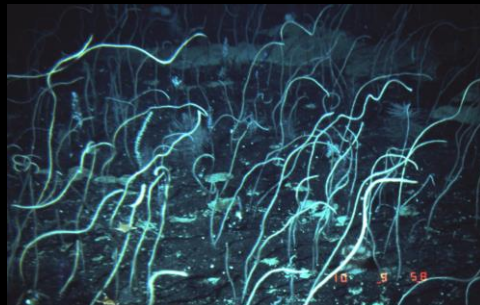
Hydrothermal Vents

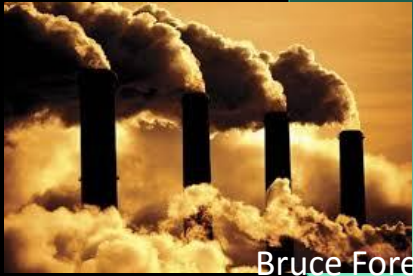


Slide credit Lisa Levin, AAAS, 2014



Seamounts and Canyons



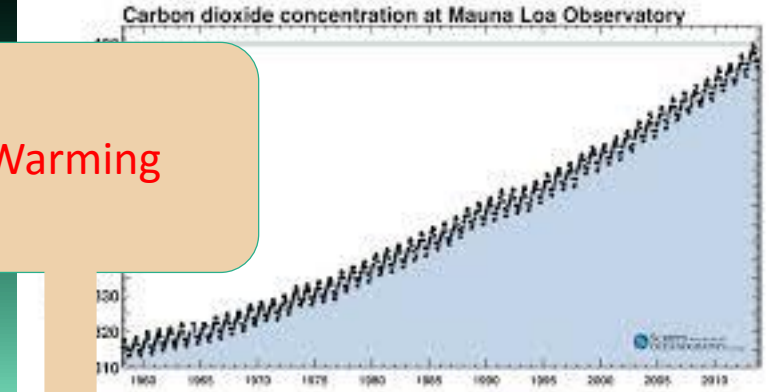


Bruce Forester

Atmosphere

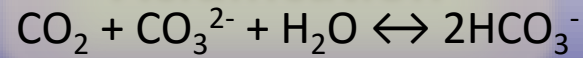
Increased CO₂

Warming



Ocean

Acidification



Warming

Ice cap melting

Stratification

Deoxygenation

Reduced O₂ solubility & ventilation
 Shoaling/Expansion of Midwater
 Oxygen (& pH) Minimum Zones

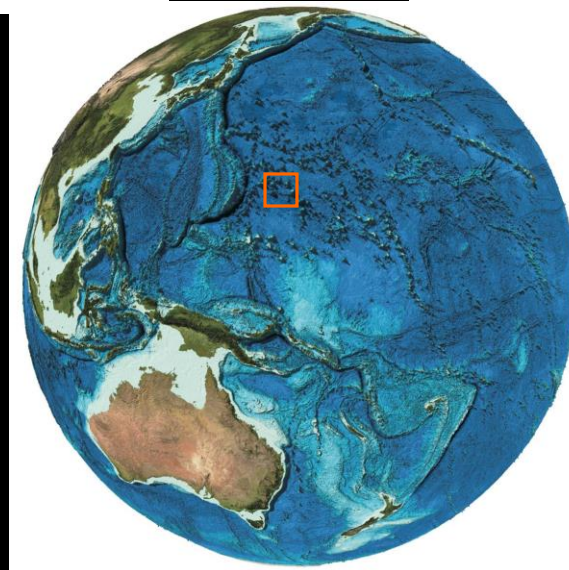
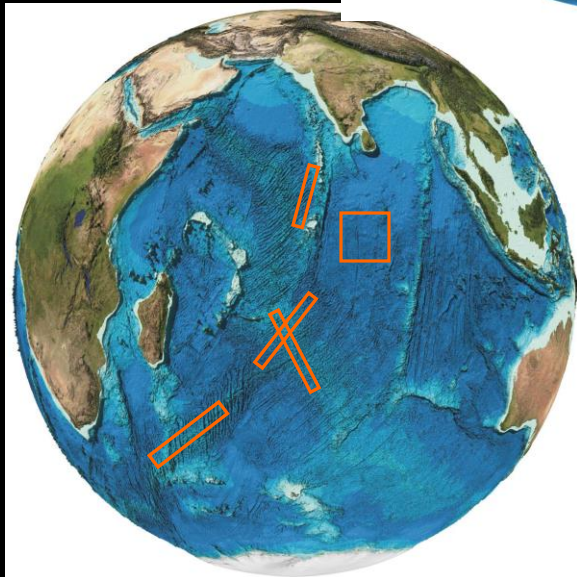
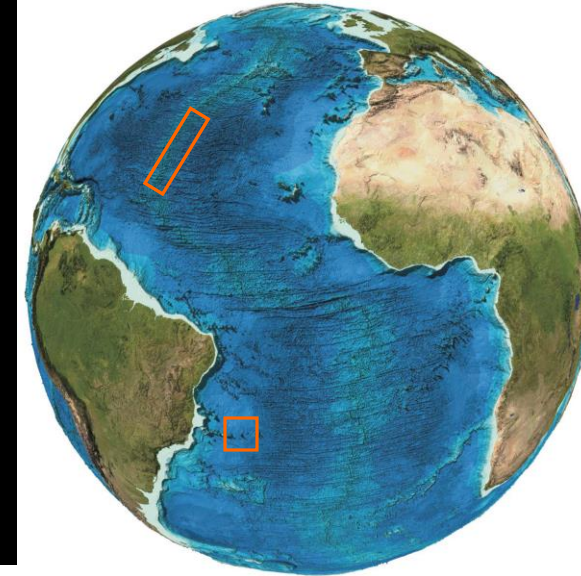
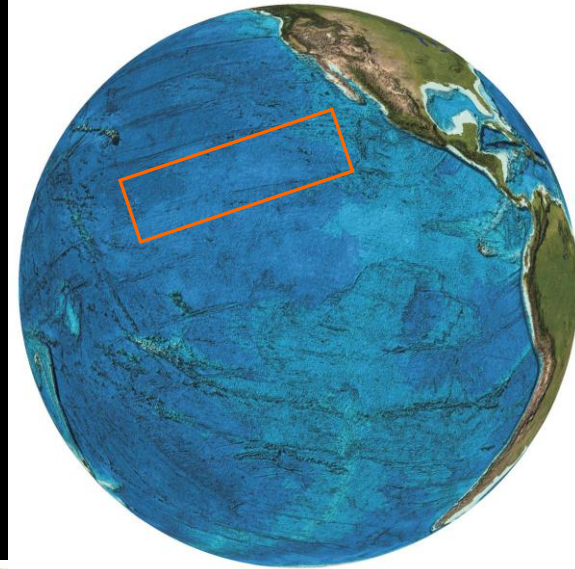
= Increasing threats to deep ocean

Current status of Deep Seabed Mining

- States and State enterprises
- Private sector



1,000,000 km² = area of 27 seabed exploration contracts beyond national boundaries



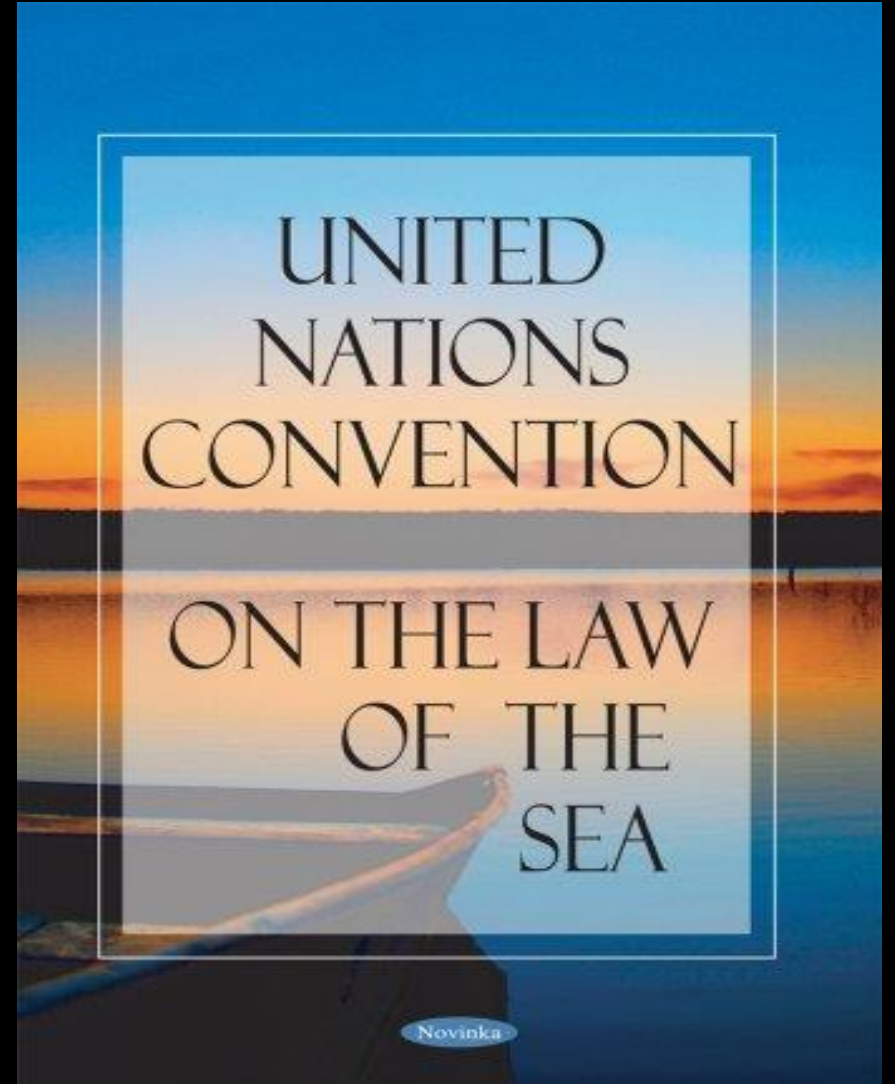
**19 of the total of 27
exploration claims
for deep-sea
minerals approved
by the ISA have been
granted since 1 Jan
2011**

Existing legal regime

United Nations Convention on the Law of the Sea UNCLOS, 1982

Supplemented by:

- 1) 1994 Agreement relating to
Implementation of Part XI of UNCLOS
(mining)



A new concept for the deep seabed: Common Heritage of Mankind

“Race to be the first to possess ocean floor resources should give way to an international authority to oversee development of this shared resource.”

Arvid Pardo, Ambassador of Malta,
November 1967



Amb. Arvid Pardo,

<http://legal.un.org/avl/ha/uncls/uncls.html>

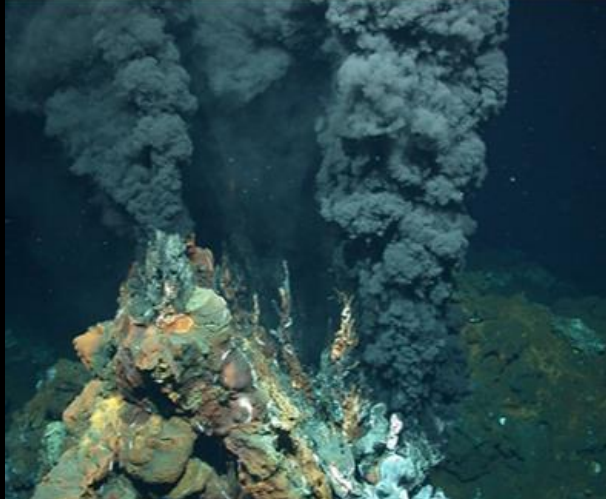
A new concept for the deep sea: Common Heritage of Mankind

“The seabed and ocean floor, and the
subsoil thereof, beyond the limits of
national jurisdiction (the Area),
as well as its resources
“are the common heritage of
mankind”

**UN General Assembly resolution 2749
(XXV) of 17 December 1970**



Amb. Arvid Pardo,
<http://legal.un.org/avl/ha/uncls/uncls.html>



**“The Area and its resources are the
Common Heritage of Mankind”**

No sovereignty

Rights vested in humankind

Benefit of “mankind”

Sharing of economic benefits

UNCLOS Art. 145: Necessary measures shall be takento ensure effective protection for the marine environment from harmful effects



© Lily Simonson

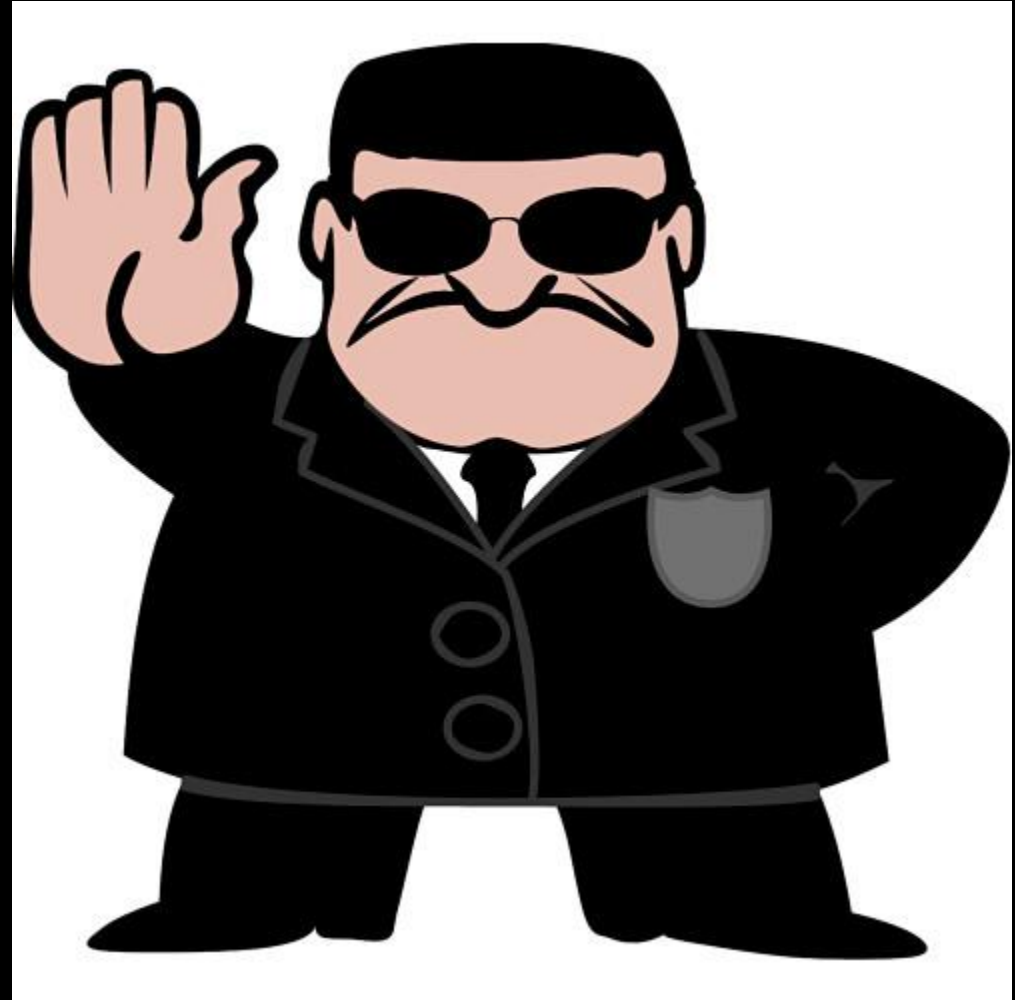
UNCLOS Art. 143:

Marine scientific research shall be carried out
“for the benefit of mankind as a whole”



Photo courtesy David Billet

UNCLOS Art. 153:
ISA shall exercise
control necessary to
secure compliance



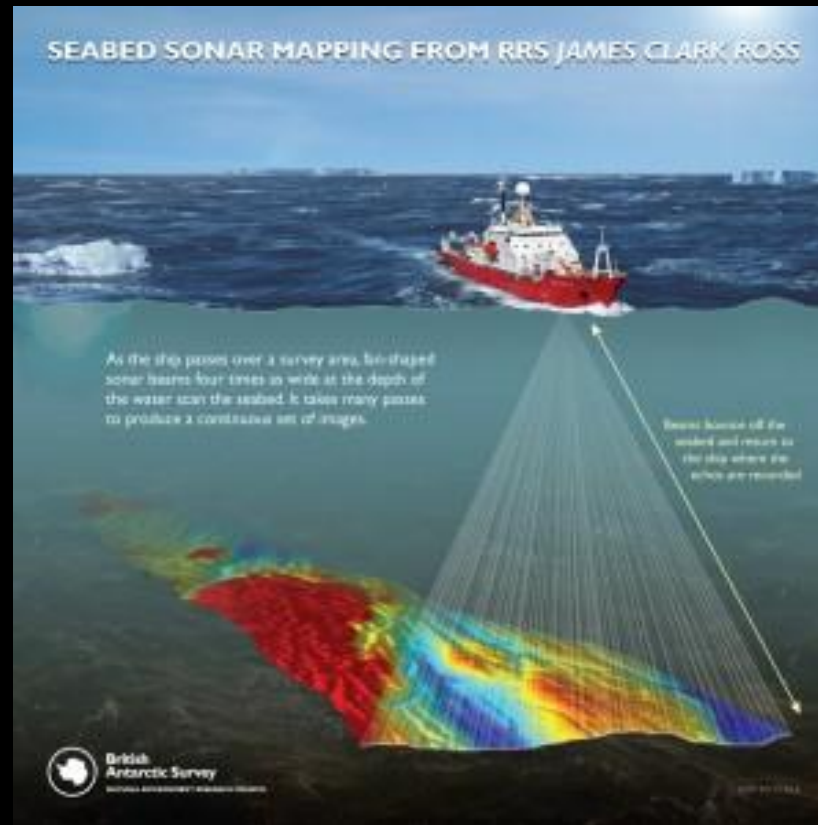
Technology - The enabler

Satellite guided GPS



en.wikipedia.org

Mapping Tools



Slide credit Lisa Levin, AAAS, 2014

New Cables and gear to reach deep



Nature.com

New mining tools



deepseanews.com



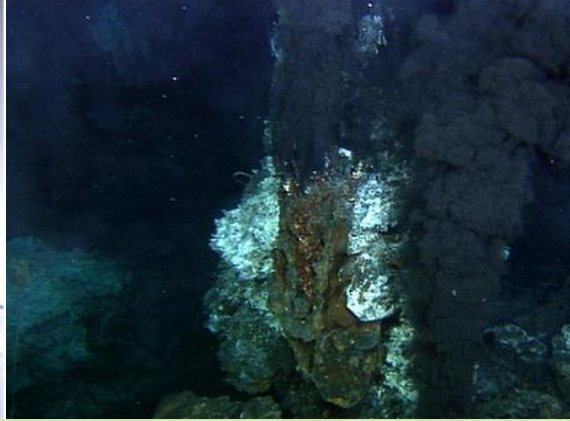
Offshoreenergytoday.com

The Mining Code

Annex III to UNCLOS (Conditions of exploration and exploitation)



*Polymetallic nodules
(2000)*



*Polymetallic sulphides
(2010)*



*Cobalt-rich crusts
(2012)*

ISA Regulations on Prospecting and Exploration

Exploitation Regulations under development

Role of States: National rules and regulations to be “no less effective than international rules and regulations”



1. Due diligence
2. Precautionary approach
3. Best environmental practices
4. Environmental impact assessments

**Seabed Disputes Chamber of the International Tribunal for the Law of the Sea
Advisory Opinion on “Responsibilities and Obligations of States Sponsoring Persons and
Entities with Respect to Activities in the Area” (Feb. 1, 2011)**

Gathering baseline data requires good seafloor maps

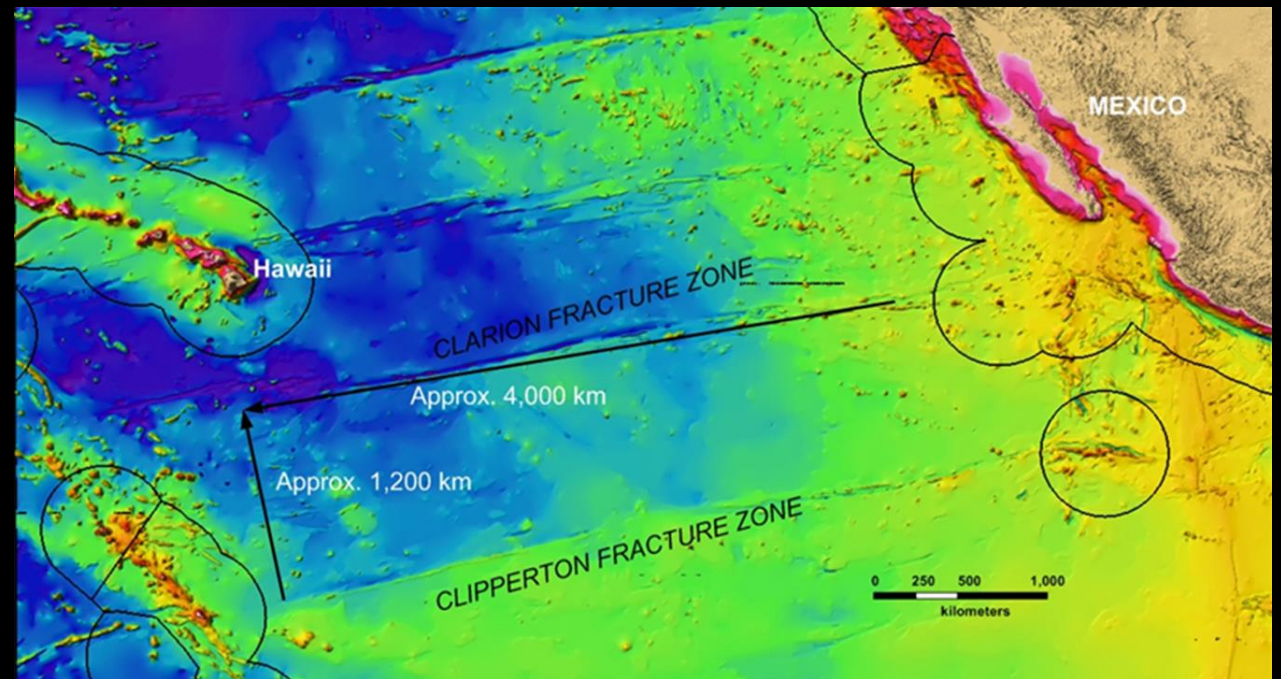
15. Data to be addressed should include:

...

(e) For biological communities, using high-resolution bathymetric maps to plan the biological sampling strategy, taking into account variability in the environment:

(i) Gather data on biological communities, taking samples of fauna representative of variability of habitats, bottom topography, depth, seabed and sediment characteristics, abundance and mineral resource being targeted;

....



Recommendations for the guidance of contractors for the assessment of the possible environmental impacts arising from exploration for marine minerals in the Area ISBA/19/LTC/8

Clarion Clipperton Zone Environmental Management Plan

(2012) (ISBA/17/LTC/7)



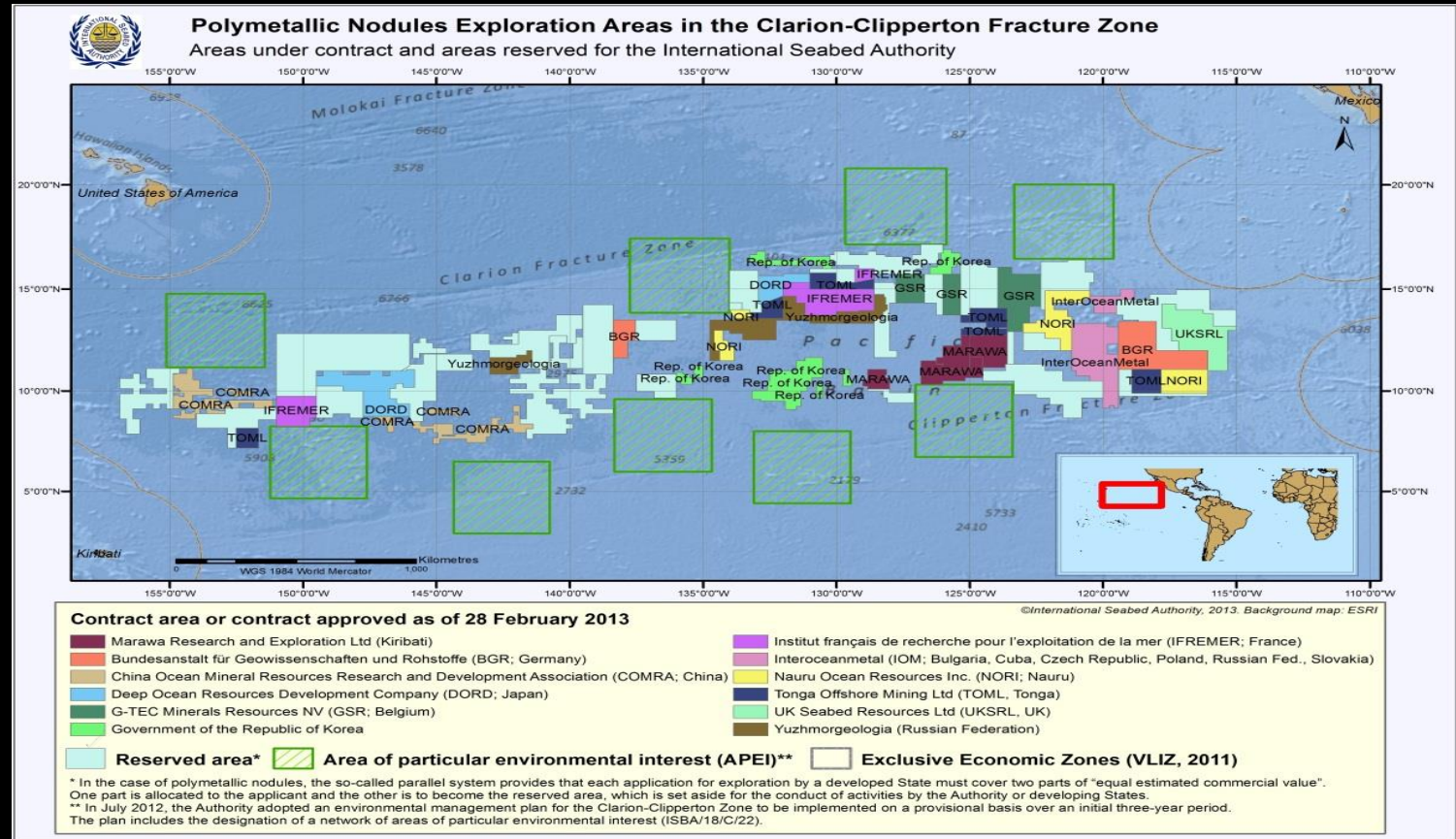
©Ifremer



Ifremer

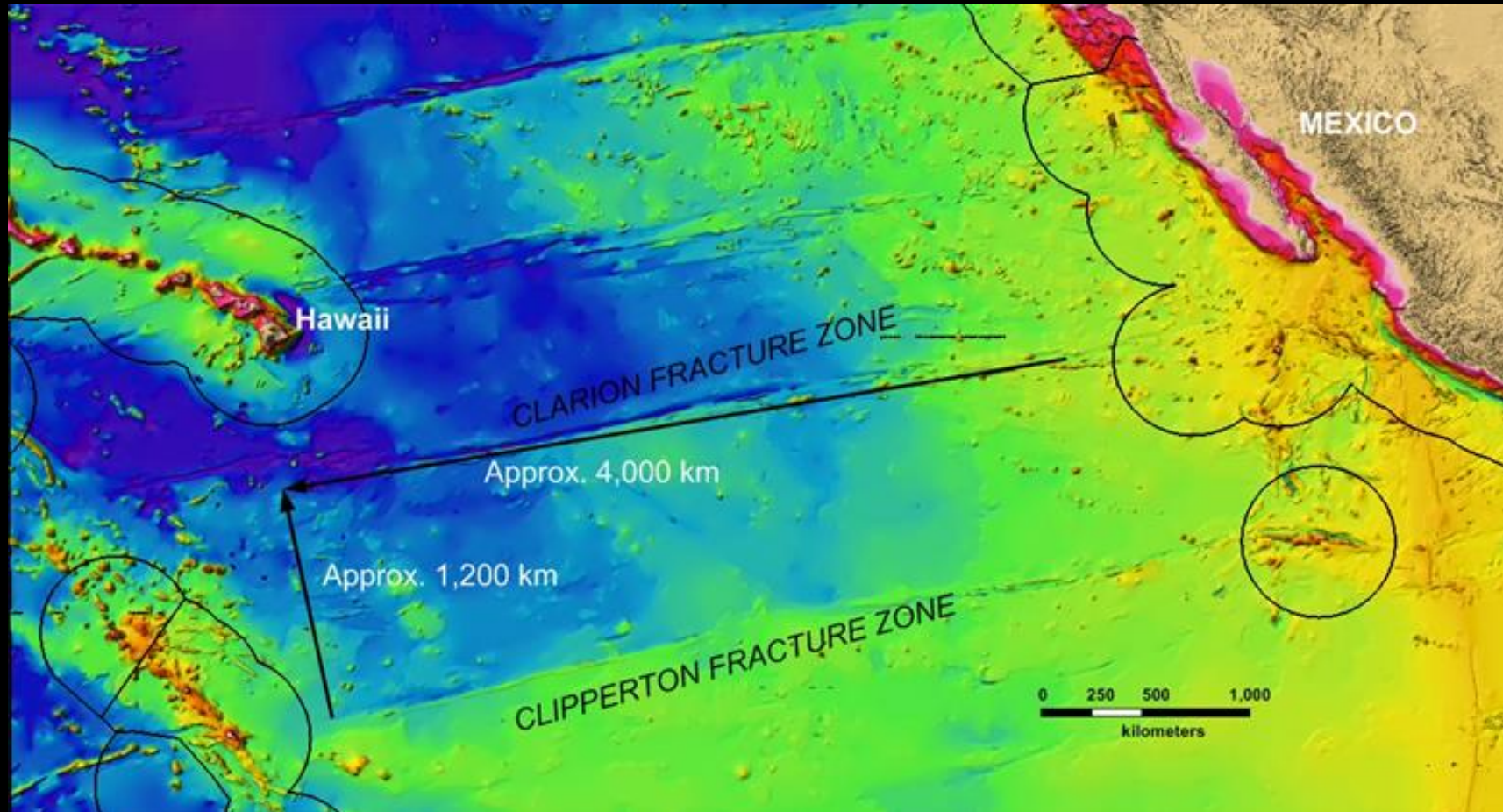


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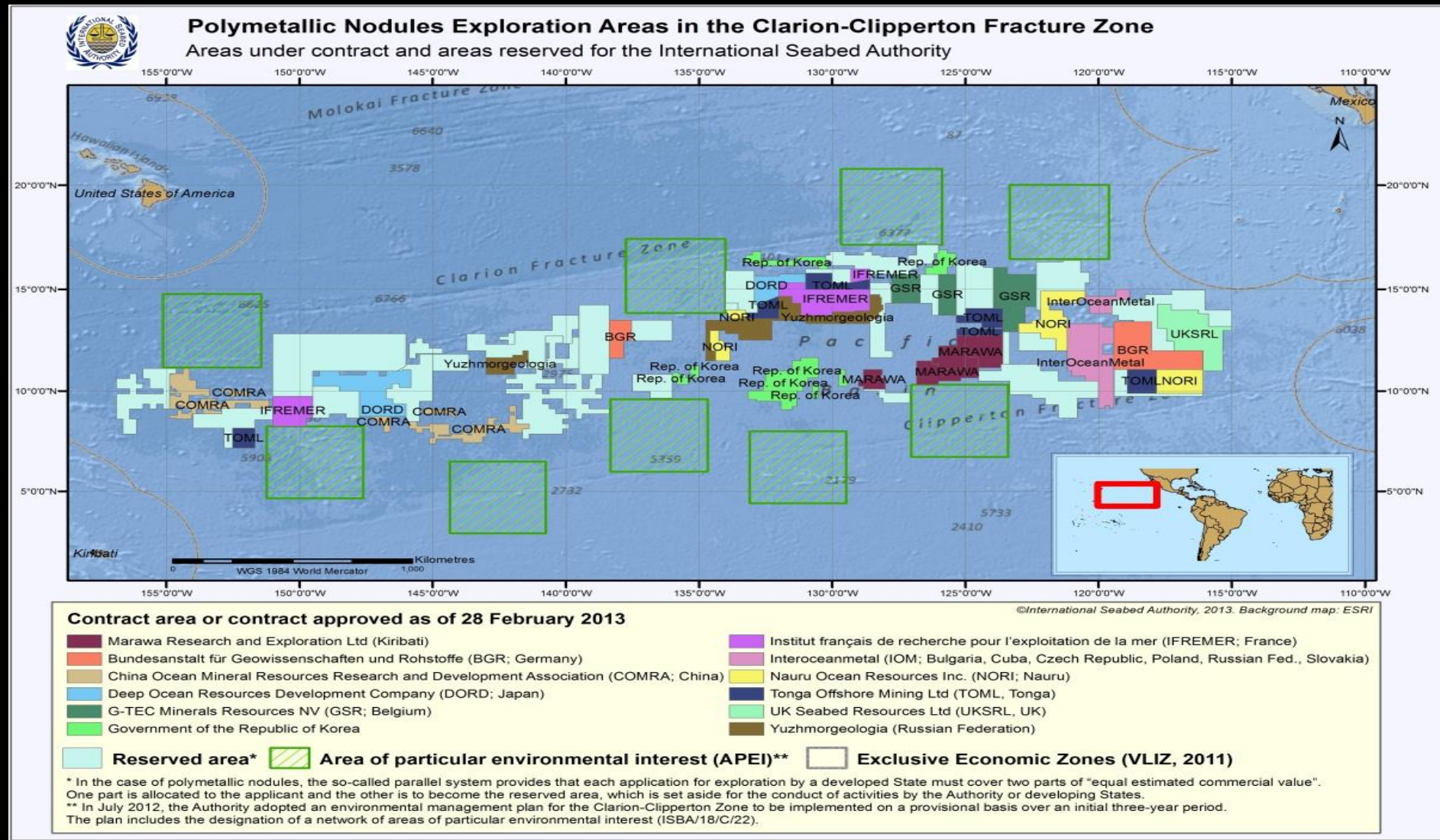


Slide courtesy David Bjllet

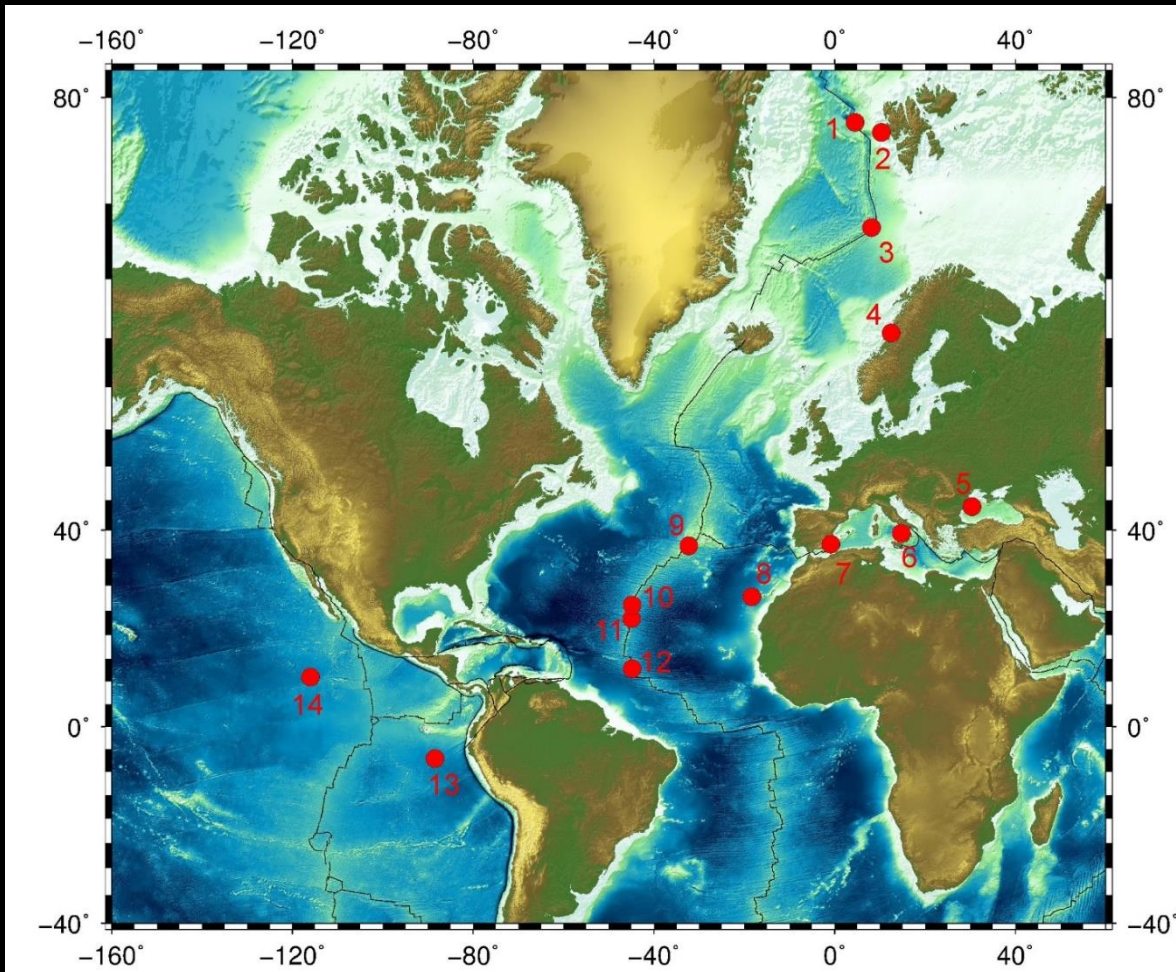
Goals: ... Maintain **regional biodiversity, ecosystem structure and ecosystem function** across the Clarion-Clipperton Zone



CCZ EMP : Nine “Areas of Particular Environmental Interest”



To enable the **preservation of representative and unique** marine ecosystems



Project Objectives

1. To identify the scale of possible impacts, and their duration;
2. To develop workable solutions and best practice codes;
3. To develop cost-effective technologies for monitoring impacts and recovery;
4. To work with policy makers to enshrine best practice in international and national regulations

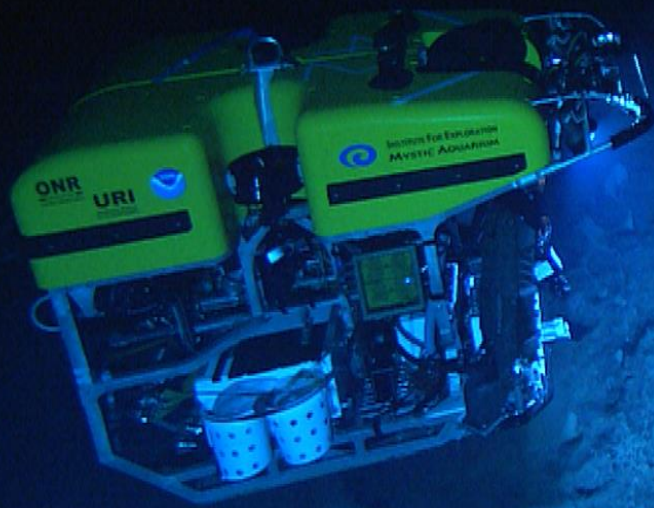


JC120 UK MIDAS Cruise Clarion-Clipperton Zone

15 APRIL TO 19 MAY 2015 - MANZANILLO TO MANZANILLO, MEXICO
Contact Daniel Jones@NOC for further info



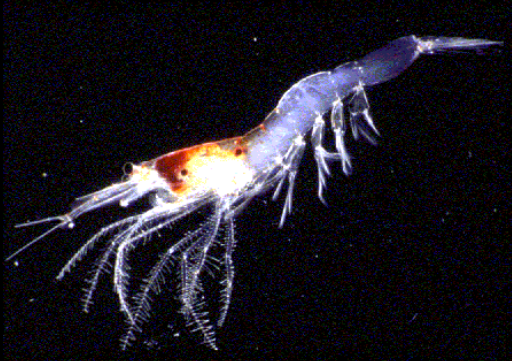
Key takeaway message: mapping matters: but is only the first step



Connectivity questions



The water column above



New decade of exploration!

- Mapping the Deep
- Studying Life in a Changing Ocean
- Grounding management and conservation in science
 - ISA seabed mining regulations
 - New UN Agreement on conservation and sustainable use of marine biodiversity beyond national jurisdiction



A deep-sea hydrothermal vent scene. The background is dark blue/black. In the foreground, there is a dark, rocky seafloor covered with various hydrothermal vent organisms. Prominent are several bright yellow, branching coral-like structures. Interspersed among these are white, worm-like structures, likely giant tube worms. The lighting is focused on the seafloor, creating a dramatic contrast with the dark water above.

For the benefit of present and future generations...

Credit: Deep Atlantic Stepping Stones Science Team_IFE_URI_NOAA

A deep-sea hydrothermal vent scene featuring a dark, rocky seafloor with several bright yellow-orange hydrothermal vents. In the background, there are large, white, wavy structures resembling chimneys or mineral deposits. The overall lighting is dim, with the primary light source being the vents themselves.

Thank you for your attention!

MIDAS is funded by the European Union's Framework 7 Programme under the theme "*Sustainable management of Europe's deep sea and sub-seafloor resources*", Grant Agreement 603418.

Credit: Deep Atlantic Stepping Stones Science Team_IFE_URI_NOAA

Additional resources

- Vanreusel, A., Hiliario, A., Ribeiro, P.A., Menot, L. & Arbizu Martinez, P. (2016). “Threatened by mining, polymetallic nodules are required to preserve abyssal epifauna,” Scientific Reports 6, doi:10.1038/srep26808. [Open access online](#).
- L. M. Wedding, A. M. Friedlander, J. N. Kittinger, L. Watling, S. D. Gaines, M. Bennett, S. M. Hardy and C. R. Smith (2013), From principles to practice: a spatial approach to systematic conservation planning in the deep sea, Proc. R. Soc. B 2013 280, 20131684,
- Jaeckel, A, Ardron, J.A., Gjerde, K.M. (2016), “Sharing benefits of the common heritage of mankind – is the deep seabed mining regime ready?” Marine Policy, Volume 70, August 2016, Pages 198–204 (free download through 3 August 2016) <http://authors.elsevier.com/a/1TChJ,714MRO-8>
- Wedding, L.M., Reiter, S.M., Smith, C.R., Gjerde, K.M., Kittinger, J.N., Friedlander, A.M., Gaines, S.D., Clark, M.R., Thurnherr, A., Hardy, S.M., Crowder, L.B. (2015). “Managing mining of the deep seabed” 349 SCIENCE 144-145
- MIDAS (Managing Impacts of Deep Sea Resources Exploitation) project: <http://www.eu-midas.net>
- Deep Ocean Stewardship Initiative: <http://dosi-project.org/> (new members welcome!)