Proteus Partners Meeting 2013

Houston, TX, USA


Knowledge and uncertainty in marine biodiversity science

Derek Tittensor

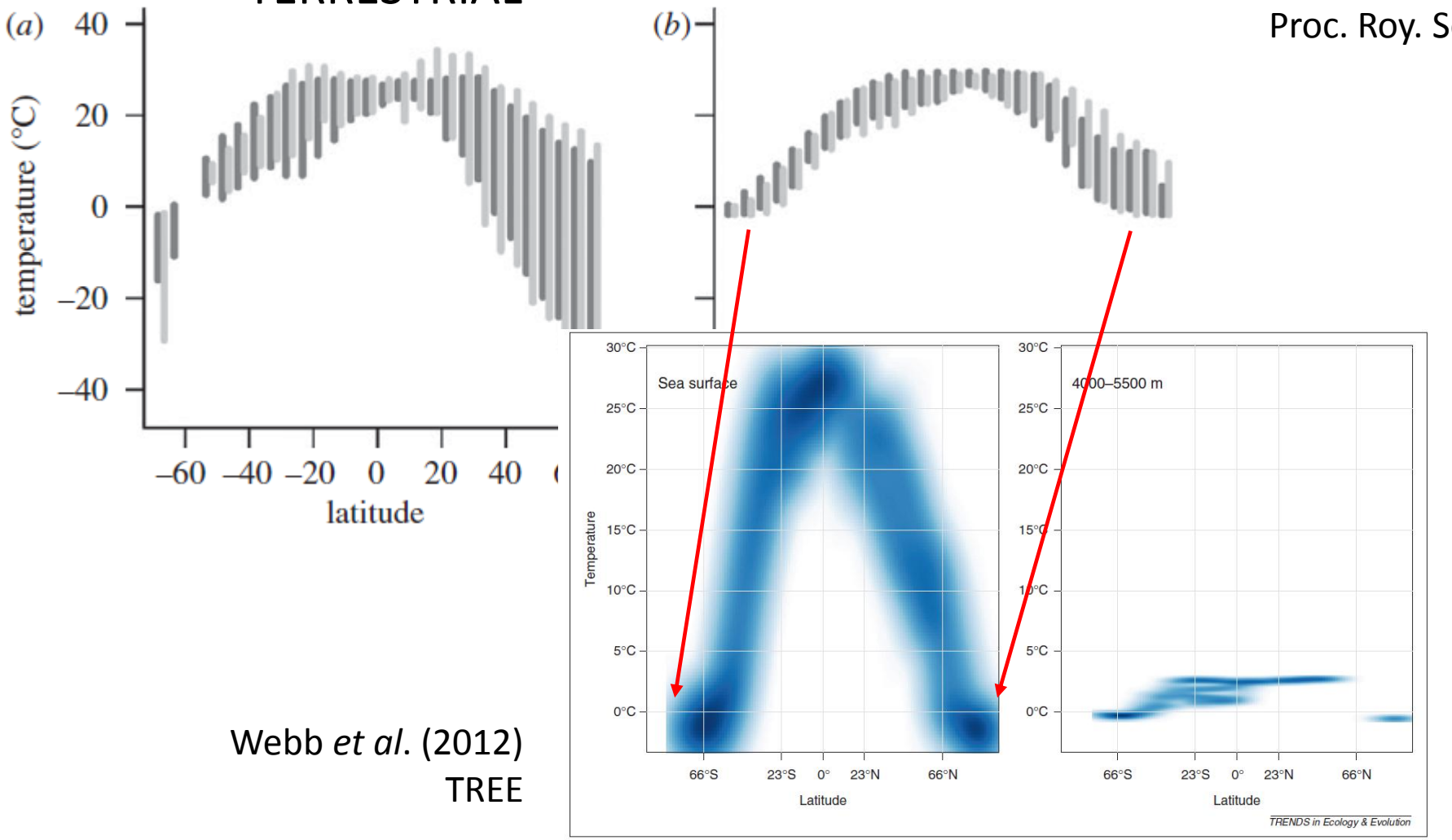
Marine & Terrestrial realms: differences in environment

Differences in thermal variability

TERRESTRIAL

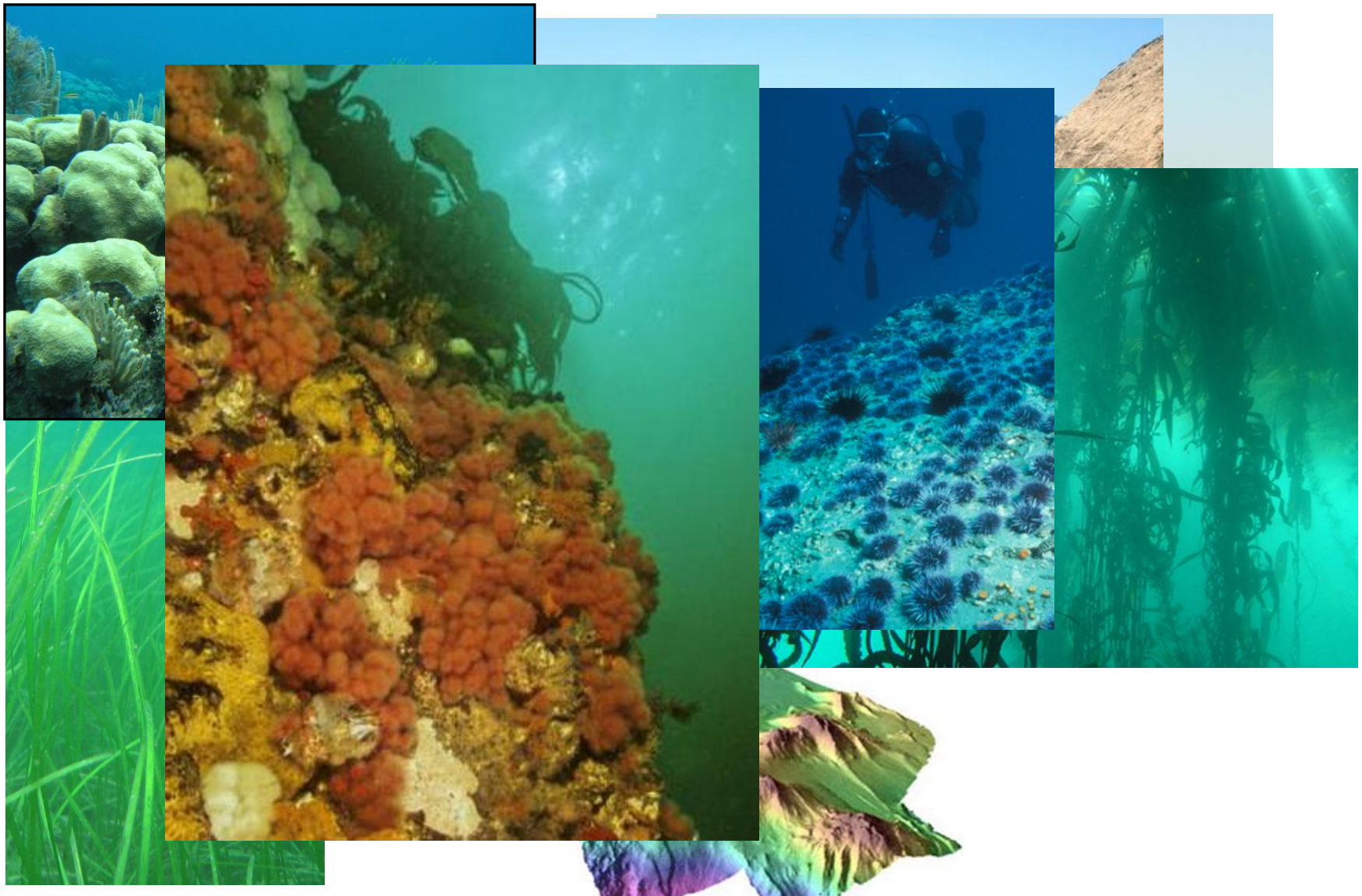
MARINE

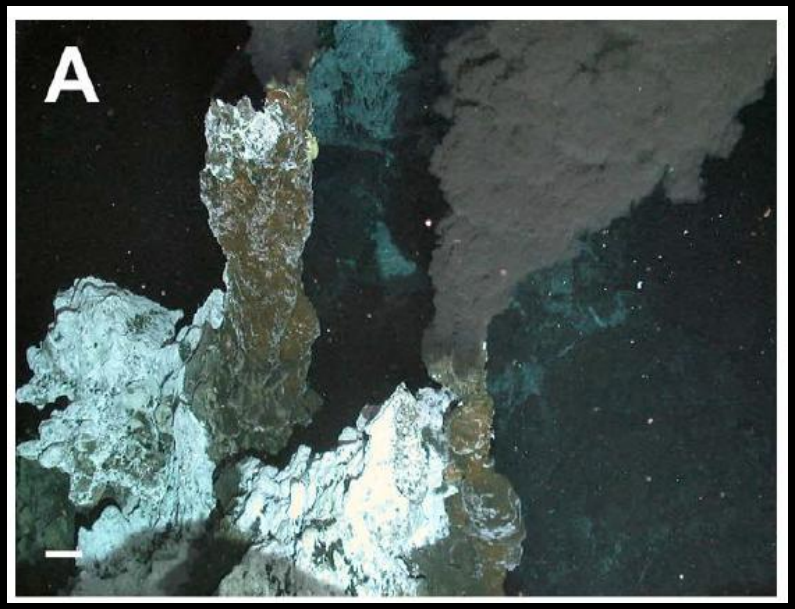
Sunday *et al*. (2011)
Proc. Roy. Soc. B



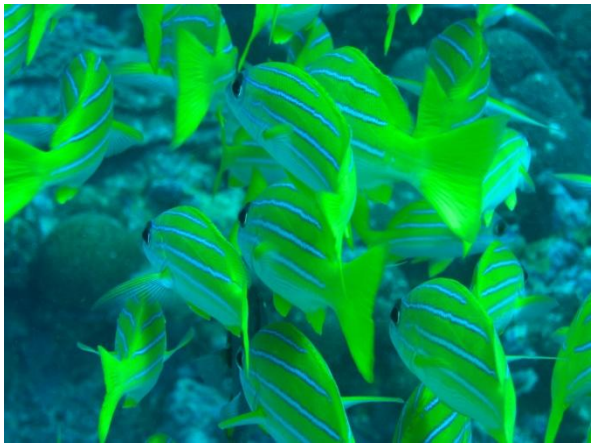
Webb *et al*. (2012)
TREE

Types of marine environment




A

Taxonomic imbalance

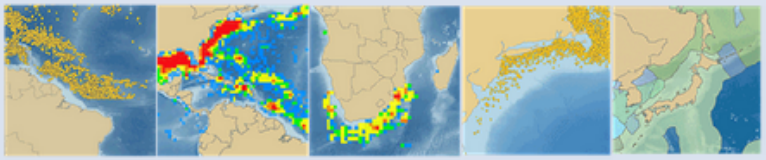


OBIS OCEAN BIOGEOGRAPHIC INFORMATION SYSTEM

Welcome to OBIS!

Last updated on Thu, 2011-01-13 09:49. Originally submitted by evberghe on 2010-05-25 15:58.

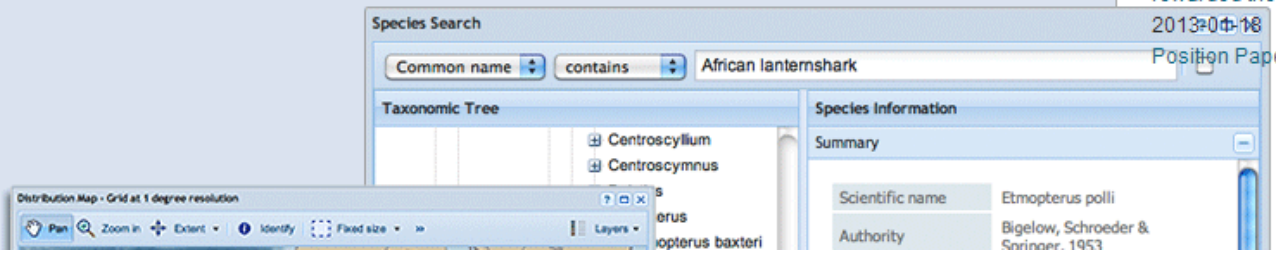
OBIS allows users to search marine species datasets from all of the world's oceans.



With our evolving OBIS database repository, users can identify biodiversity hotspots and large-scale ecological patterns, analyze dispersions of species over time and space, and plot species' locations with temperature, salinity, and depth.

To search the database, please select the "Search Data" option in the toolbar above.

If you want to see overview maps of OBIS content and derived information, select "Maps".



SEARCH OBIS WEB PAGES (FOR DATA GO TO SEARCH DATA)

Search

LATEST NEW DATA LOAD, 9 JANUARY 2013

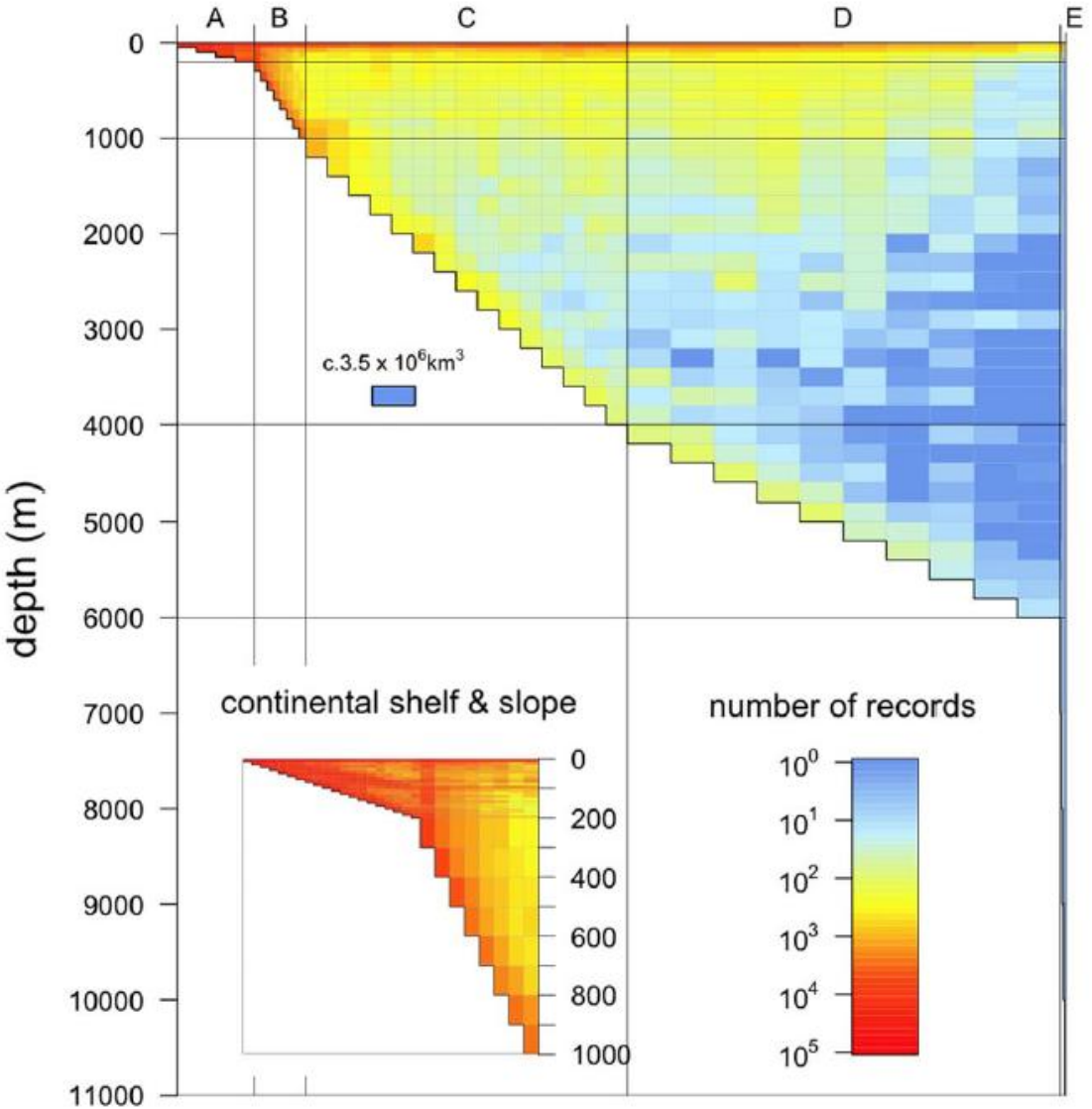
Follow us on Facebook, Twitter, Linkedin, Mendeley, SlideShare, Google Scholar and Google Books.

RECENT NEWS

2013-06-07
8 June - Happy World Oceans day!
2013-05-23
Mike Flavell joins UNESCO-IOC as data manager for OBIS
2013-02-13
Report 2nd Session of the IODE Steering Group for OBIS
2013-01-31
John "Fred" Grassle, godfather of OBIS, was rewarded the Japan Prize
2013-01-18
Position Paper: OBIS and IPBES

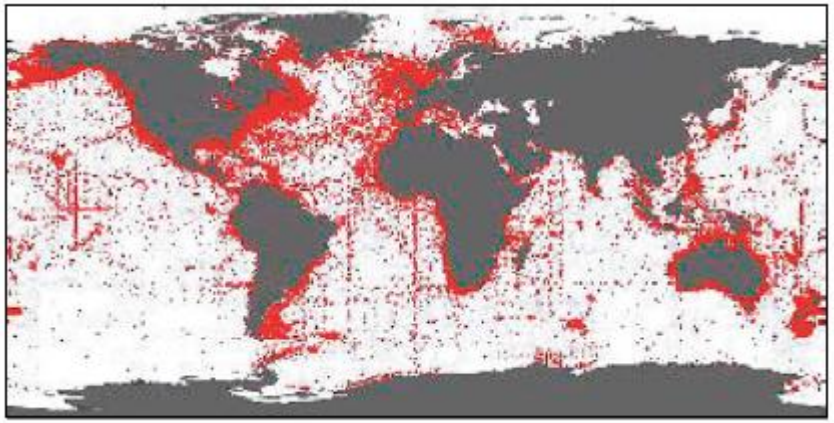
more

Limits to understanding



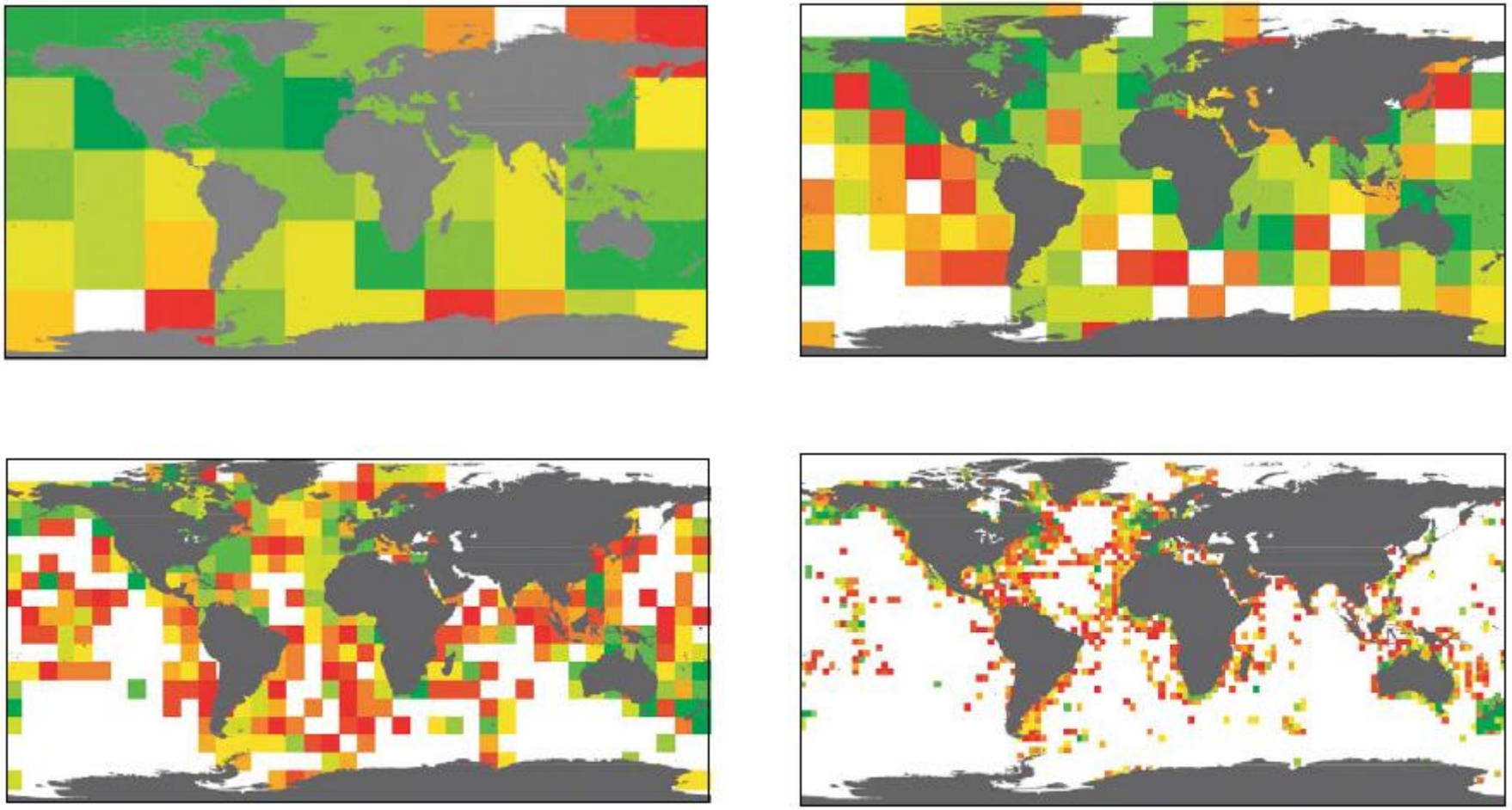
Webb *et al*. (2010)
PLoS One

The problem of scale



Mora *et al*. (2008)
Proc. Roy. Soc. B

The problem of scale



Mora *et al*. (2008)

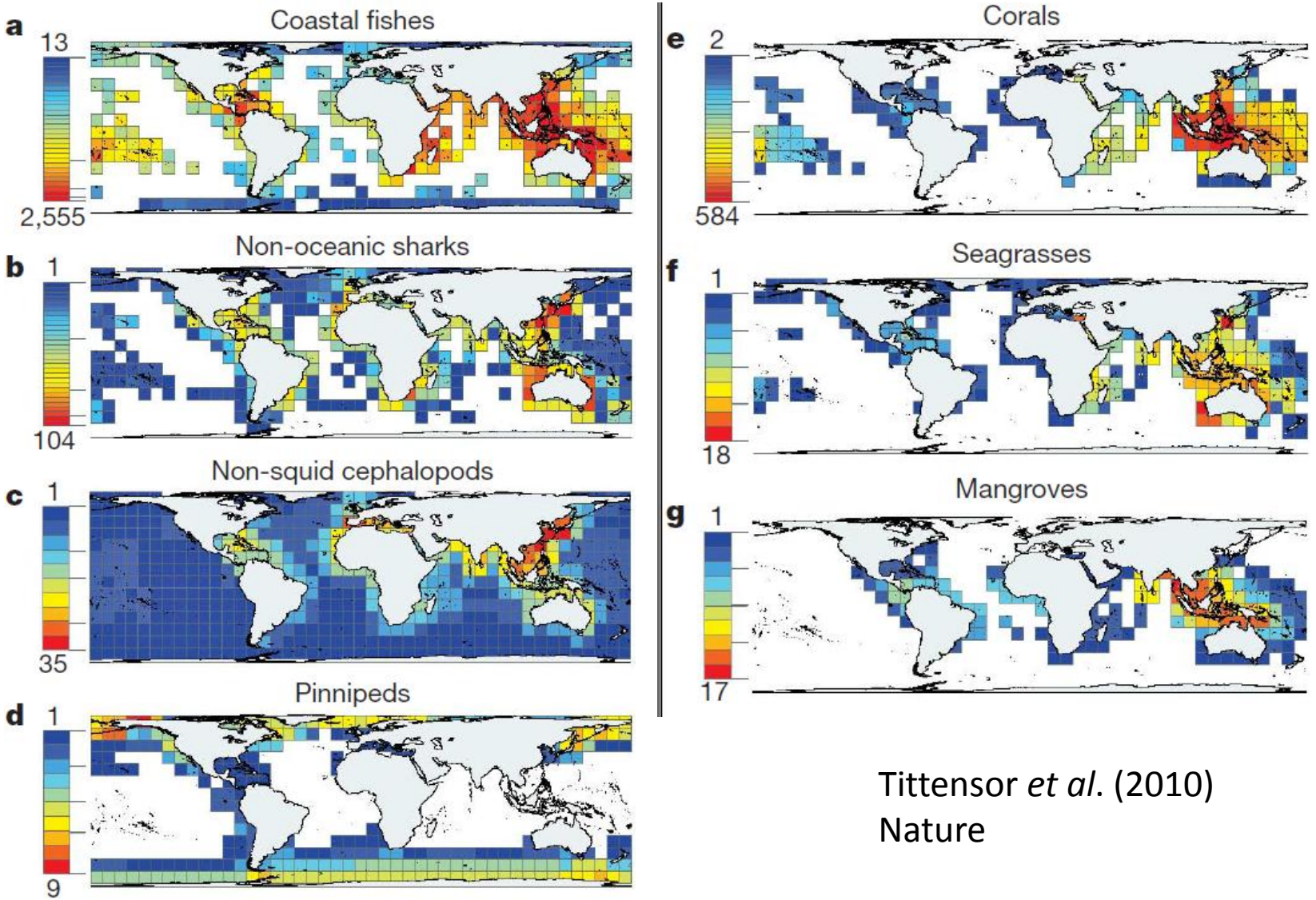
What is known about marine biodiversity?

- ~200,000 species described
- Predicted to be 25% of all species globally (~2.2 million out of 8.7 million)

Species	Ocean		
	Catalogued	Predicted	±SE
Eukaryotes			
Animalia	171,082	2,150,000	145,000
Chromista	4,859	7,400	9,640
Fungi	1,097	5,320	11,100
Plantae	8,600	16,600	9,130
Protozoa	8,118	36,400	6,690
Total	193,756	2,210,000	182,000

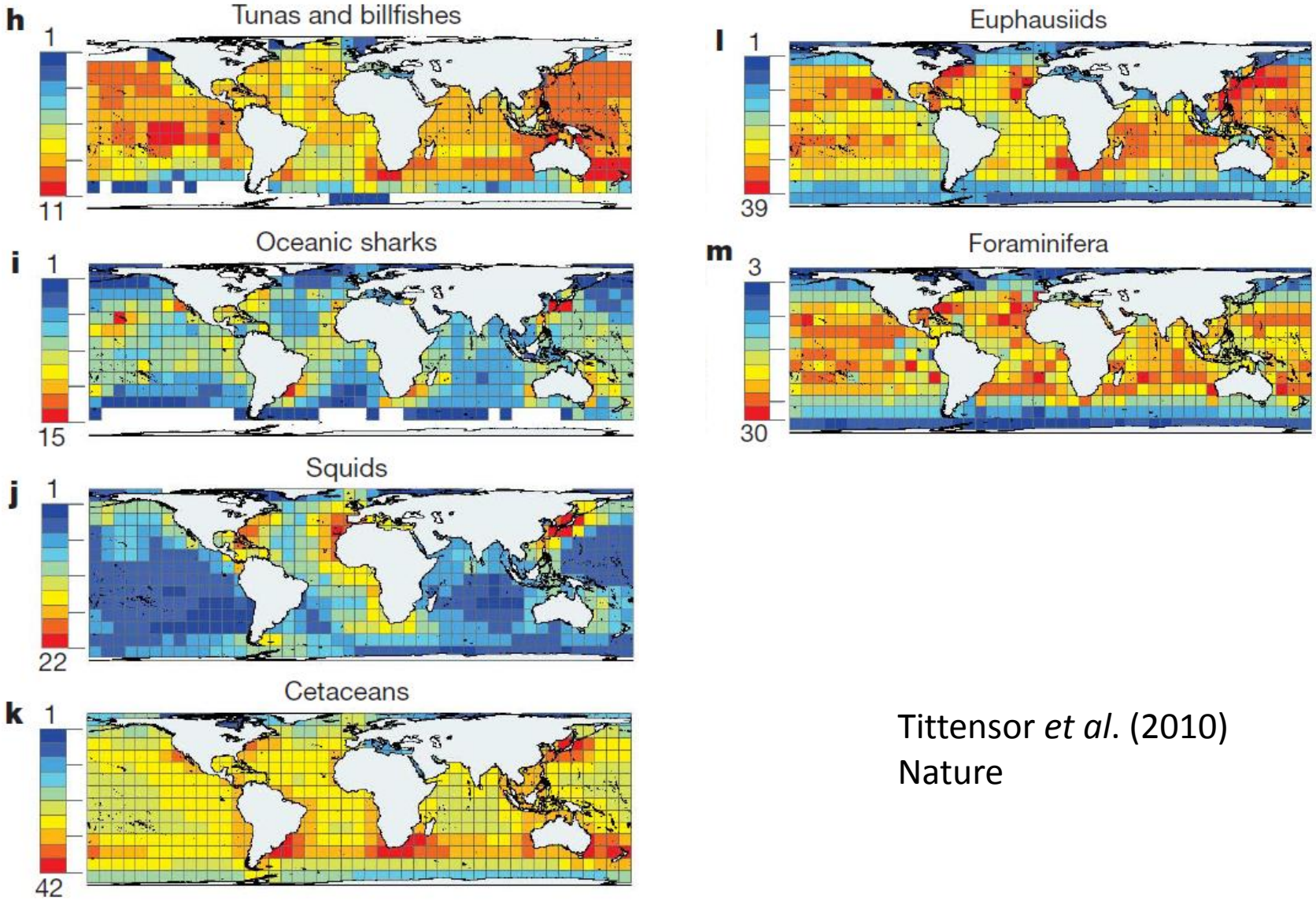
Mora *et al*. (2011)
PLoS Biology

Biodiversity of coastal species



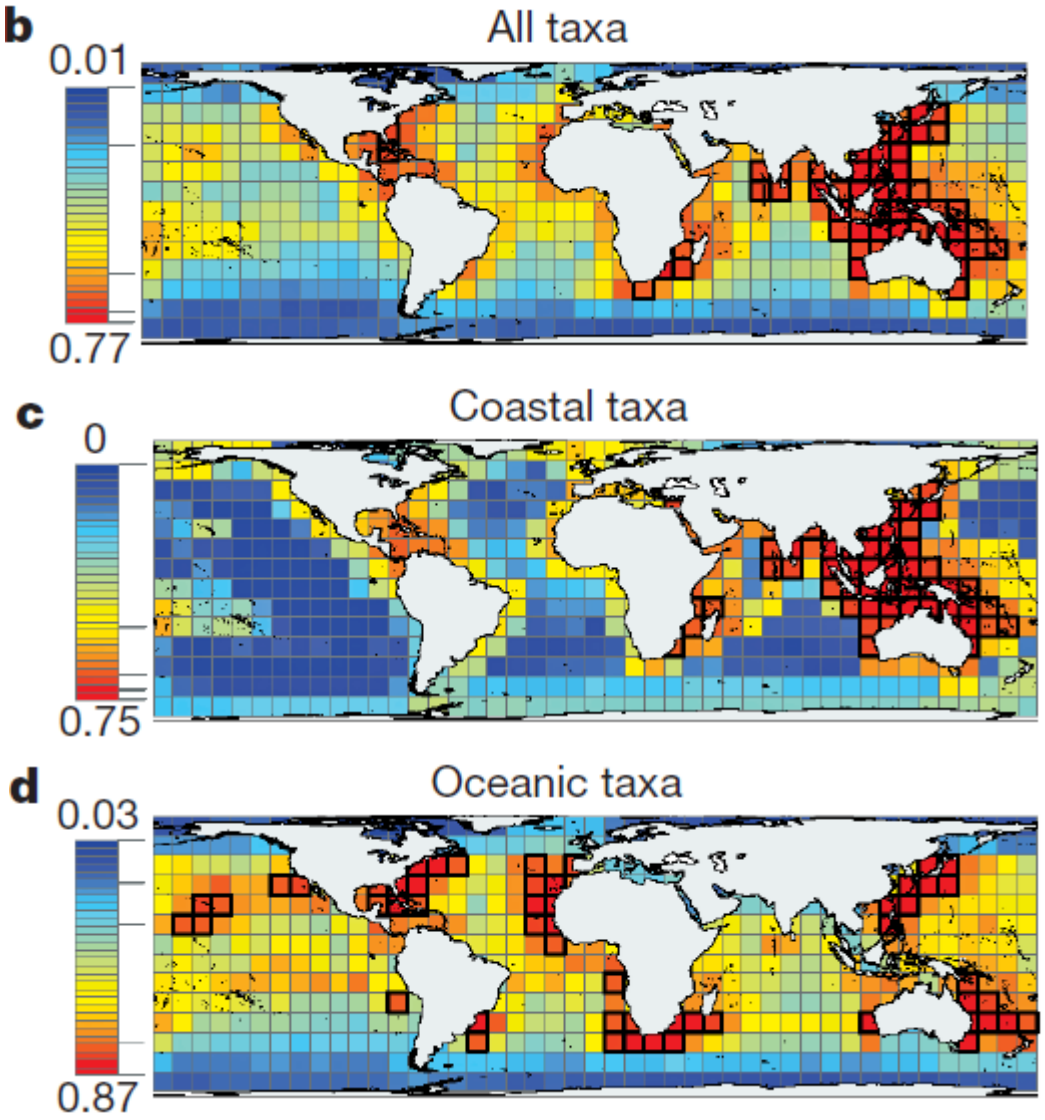
Tittensor *et al*. (2010) Nature

Biodiversity of oceanic species

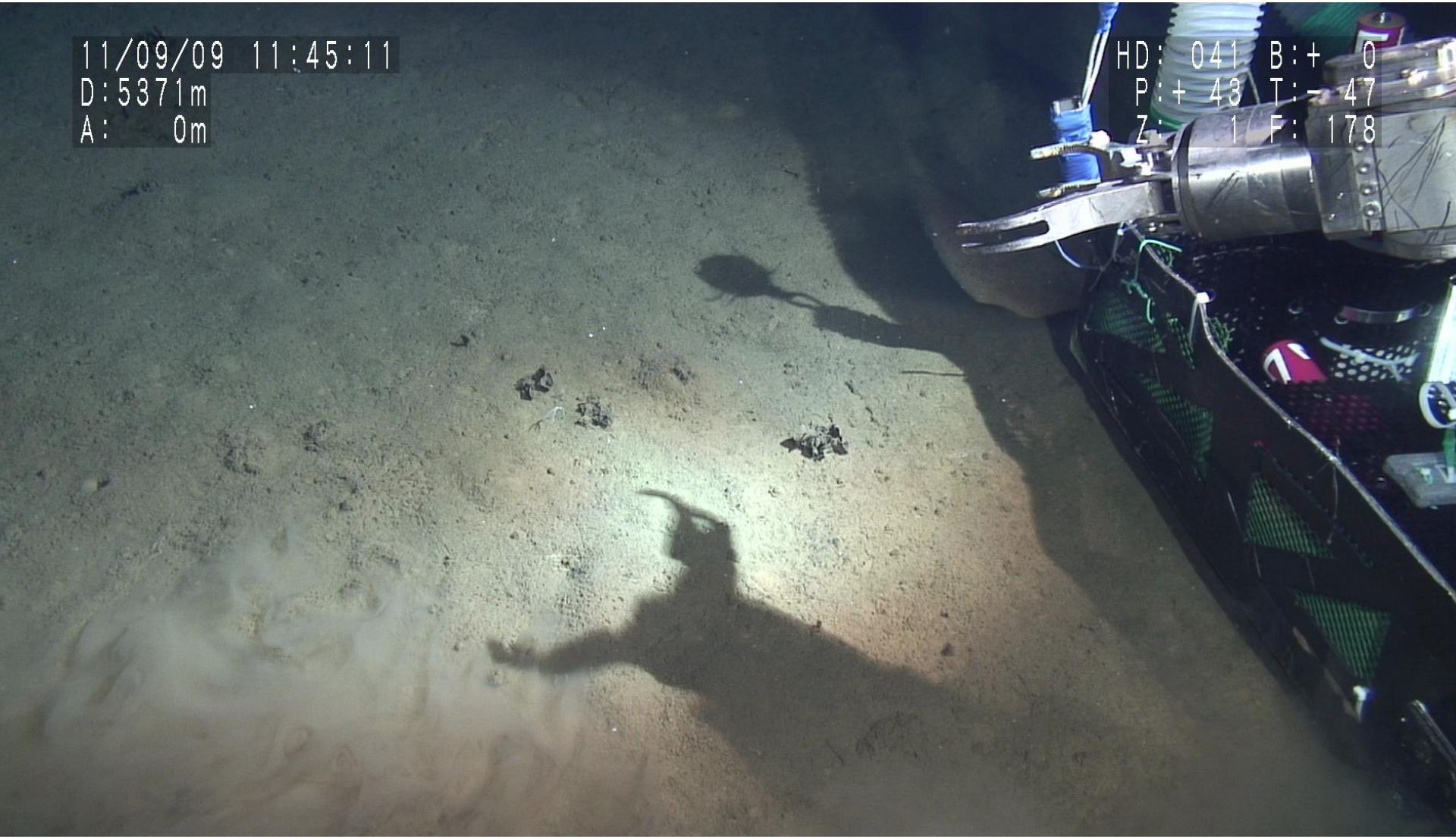


Tittensor *et al*. (2010)
Nature

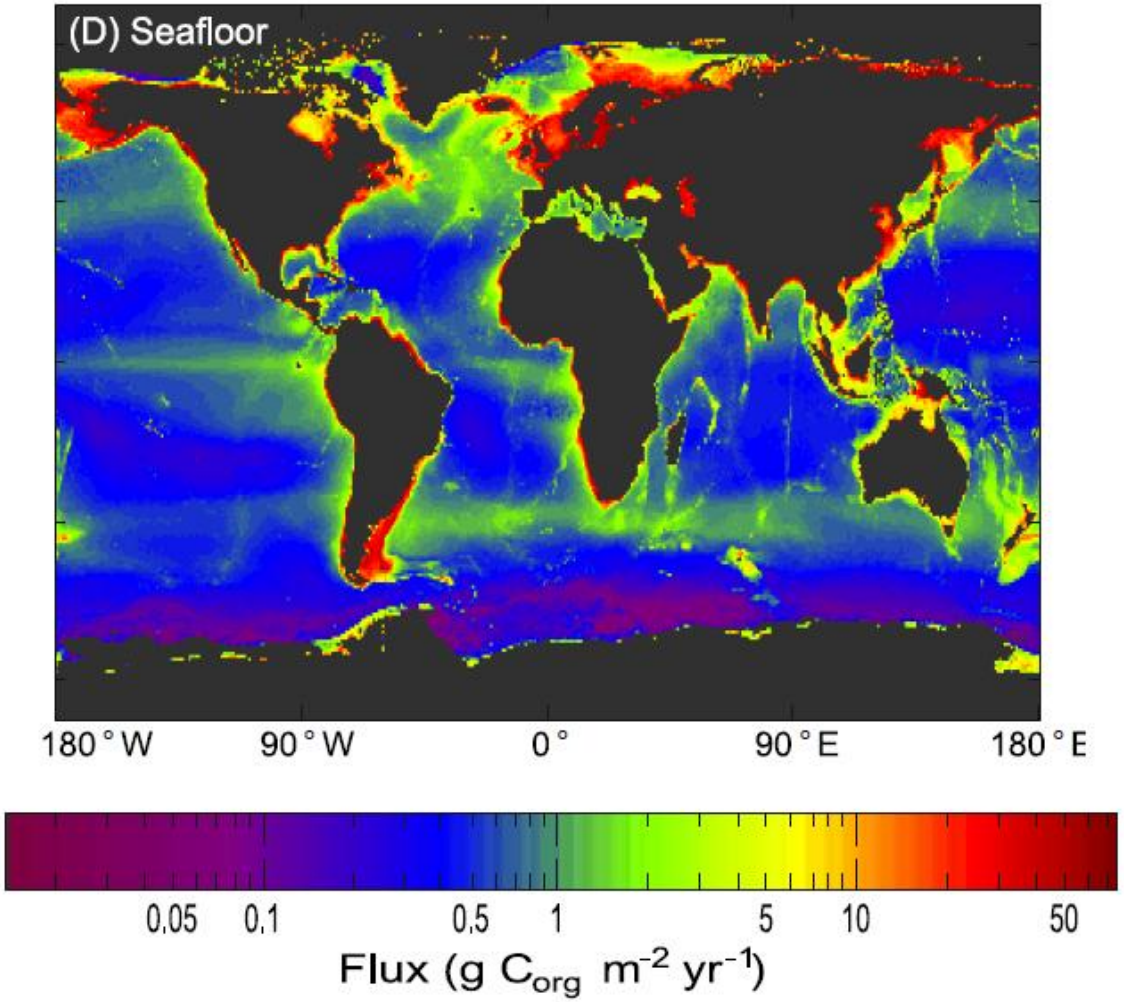
Overall marine biodiversity



Tittensor *et al*. (2010) Nature

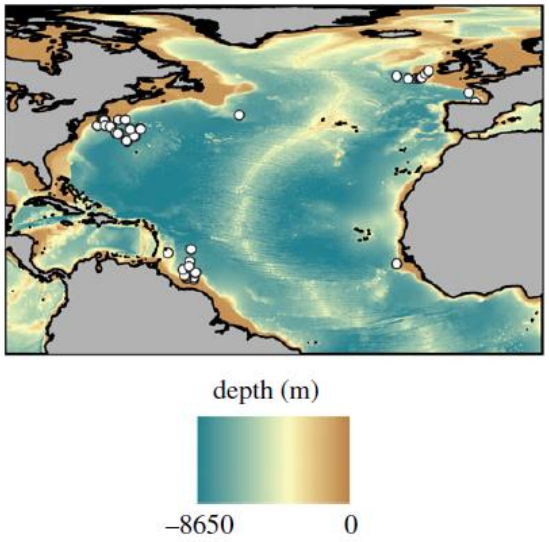

11/09/09 11:45:11
D:5371m
A: 0m
HD: 041 B:+ 0
P:+ 43 T:- 47
Z: 1 F: 178

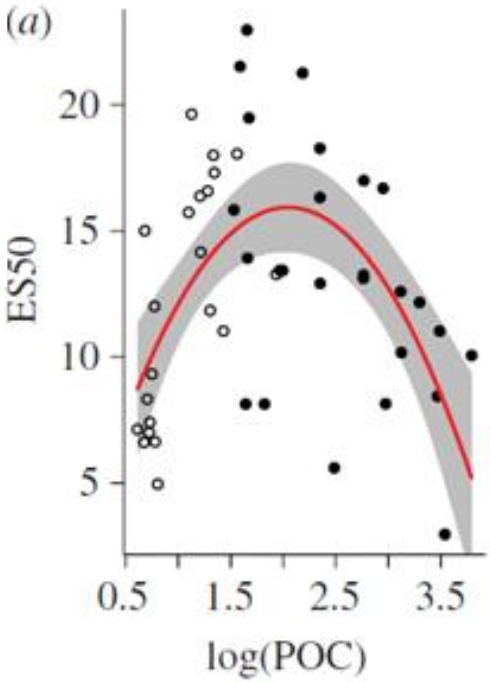
Low chemical energy (food)

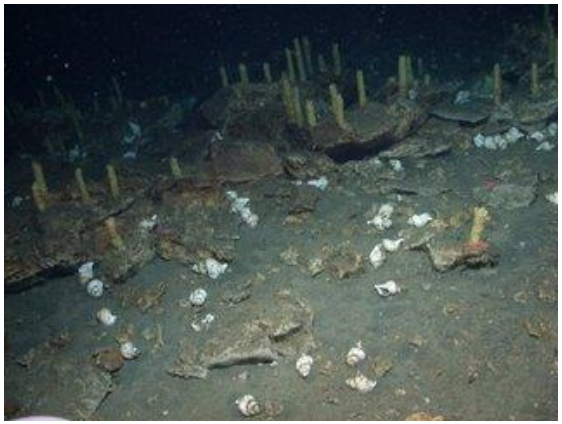


Lutz *et al*. (2007)
JGR

Deep sea diversity

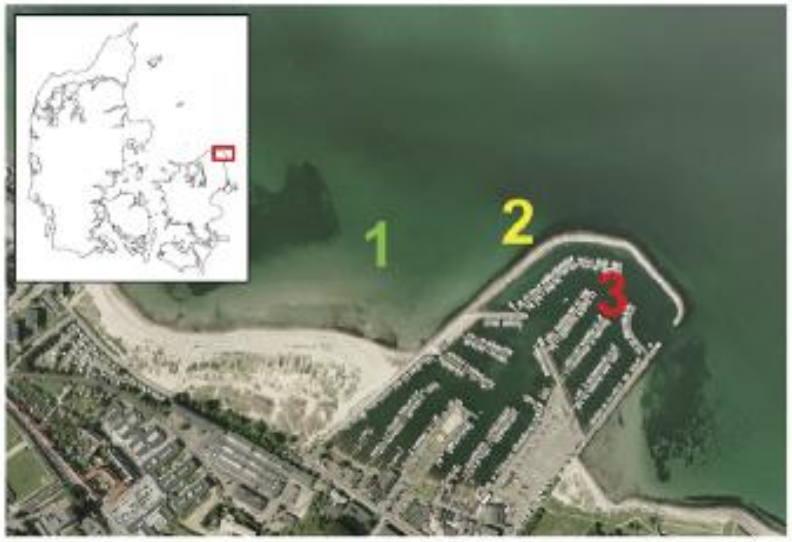




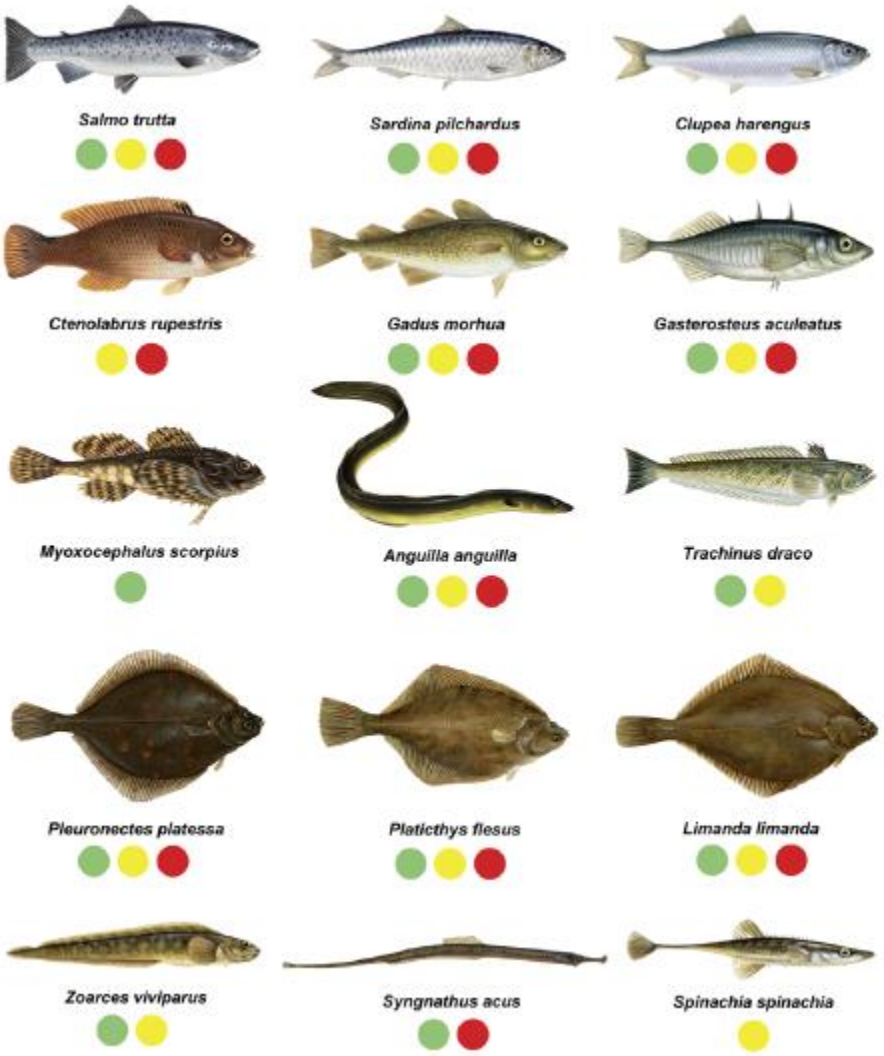


Tittensor *et al.* (2011)
Biology Letters

The future…



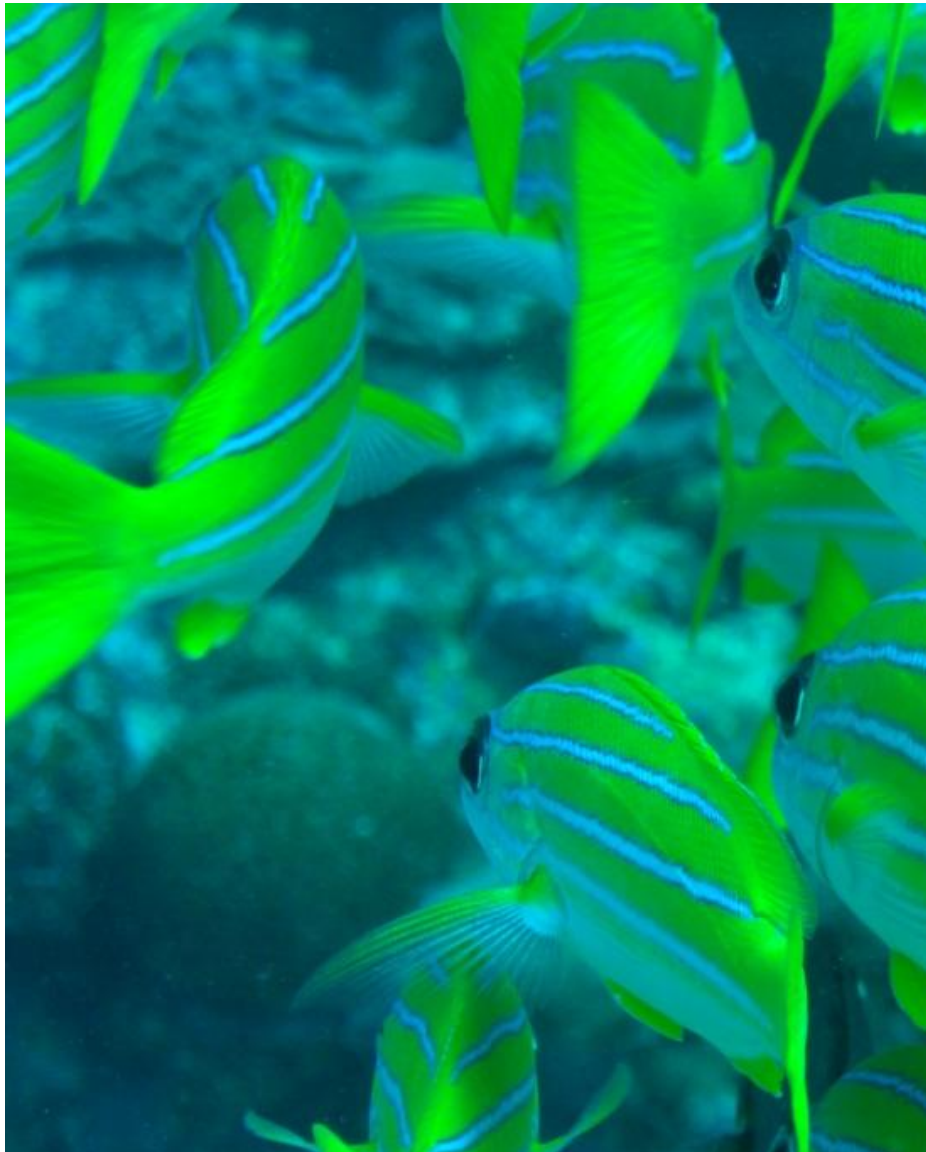
- Barcoding of DNA obtained from seawater samples…



Thomsen *et al*. (2012)
PLoS One

Marine biodiversity summary

- Knowledge very incomplete, particularly at fine scales
- Very expensive and challenging to sample
- Limited centralisation of data resources
- Taxonomic imbalance in knowledge



Proteus Partners Meeting 2013

Houston, TX, USA


Marine Critical Habitat Mapping and a Tool for Interpretation

Proteus Annual Meeting, Houston, 18th June 2013

Melissa Tolley

UNEP WCMC

Development of a mapping tool for marine biodiversity priorities

Proteus Annual Meeting, London, 14th June 2012

Jon Hutton

UNEP WCMC

Rationale…

Tools for application of IFC PS 6 are urgently needed for marine and coastal environments…

IFC International Finance Corporation

Performance Standard 6

Biodiversity Conservation and Sustainable Management of Living Natural Resources

January 1, 2012

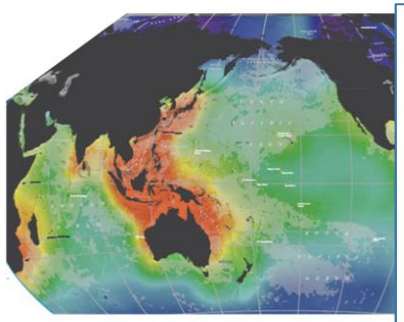
Introduction

1. Performance Standard 6 recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources are fundamental to sustainable development. The requirements set out in this Performance Standard have been guided by the Convention on Biological Diversity, which defines biodiversity as "the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species, and of ecosystems."

UNEP WCMC

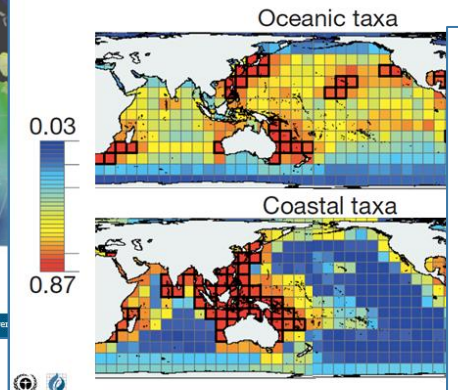
Mapping marine areas of high biodiversity 14 June 2012 19

Smoothing the data…



UNEP WCMC

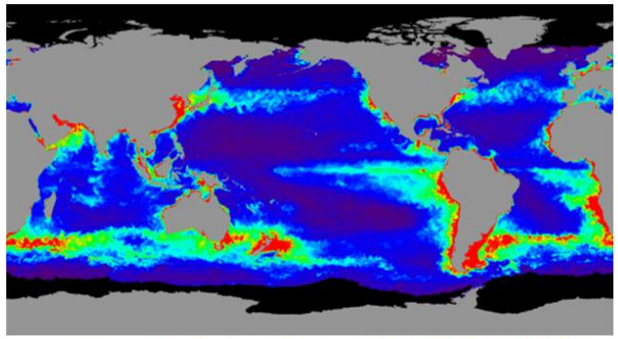
Mapping marine areas of high biodiver



UNEP WCMC

Mapping marine areas of high biodive

Productivity (1)



Vertically Generalized Production Model (VGPM) (*Behrenfeld and Falkowski, 1997a*)

UNEP WCMC

Mapping marine areas of high biodiversity 14 June 2012 28

Premise of Project

Better understanding of marine biodiversity and how the data currently available can be used to demonstrate biodiversity value

Phase 1: Mapping Critical Habitat

UNEP WCMC

UNEP-WCMC Marine and Coastal Data Layers

UNEP WCMC

Critical Habitat

Critical Habitats are areas with high biodiversity value, including:

1. Habitat of significant importance to Critically Endangered and/or Endangered species;
2. Habitat of significant importance to endemic and/or restricted-range species;
3. Habitat supporting globally significant concentrations of migratory species and/or congregatory species;
4. Highly threatened and/or unique ecosystems;
5. Areas associated with key evolutionary processes.

Critical Habitat

Additional criteria:

A. Other recognised high biodiversity values that might also support a Critical Habitat designation

B. Internationally and/or nationally recognised areas of high biodiversity value

Marine Biodiversity Data

Biodiversity:

- IUCN data
- Tittensor et al. 2010 data
- National Geographic interpolation data
- Aquamaps
- OBIS
- Predicted deep-sea coral habitat
- Turtle nesting sites data
- Tagging data
- Other data…

Governance / management / administrative division data:

- Marine Protected Areas
- Large Marine Ecosystems
- Ecologically or Biologically Significant Areas
- Marine Important Bird Areas
- Global 200 sites
- Other data…

Biodiversity proxies:

- NPP and chlorophyll data
- Biomass of the deep sea floor
- Predicted seamount locations
- Bottom complexity
- Biogeography of the ocean
- Biogeography of the deep sea
- Pelagic provinces of the world
- Longhurst Biogeographical Province
- Marine Ecoregions of the World
- Biogenic habitat data (coral, mangrove, seagrass, saltmarsh)
- Hydrothermal vents
- Other data…

Threat / human impact data:

- Human impact on marine ecosystems
- Ocean Health Index
- Fisheries intensity and value
- Other data…

UNEP WCMC

Alignment Categories

Known Critical Habitat

- Designations referenced in PS6
- Designations with aligned criteria and thresholds
- Habitats and biodiversity features aligned with criteria

Potential Critical Habitat

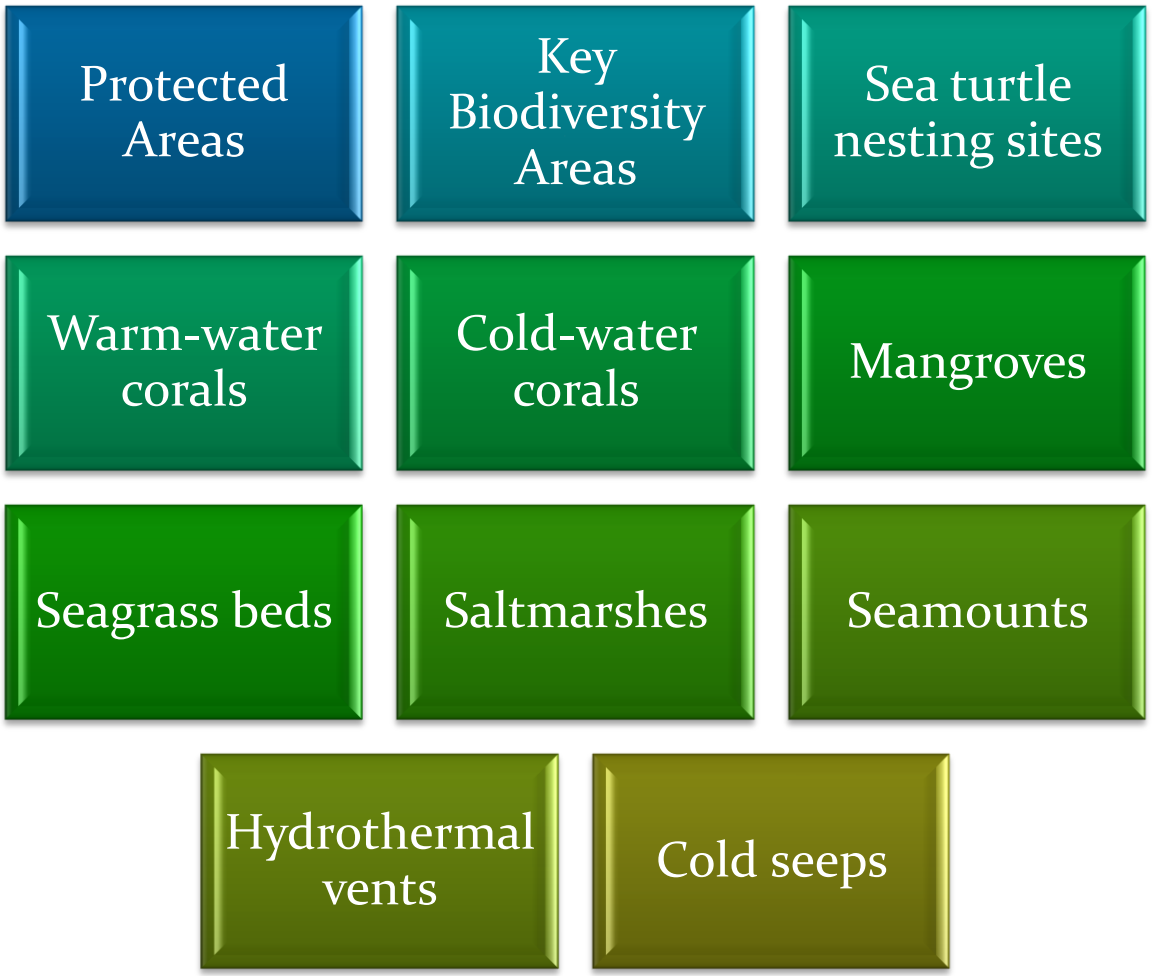
- Designations referenced in PS6
- Designations where there may be alignment but further investigation into biodiversity values needed
- Habitats and biodiversity features where there may be alignment but further investigation needed
- Modelled data for CH features

Data Deficient

- No global data available identifying Critical Habitat features

UNEP WCMC

Marine Biodiversity Features aligned with Critical Habitat



UNEP WCMC

Data Layers

Known Critical Habitat

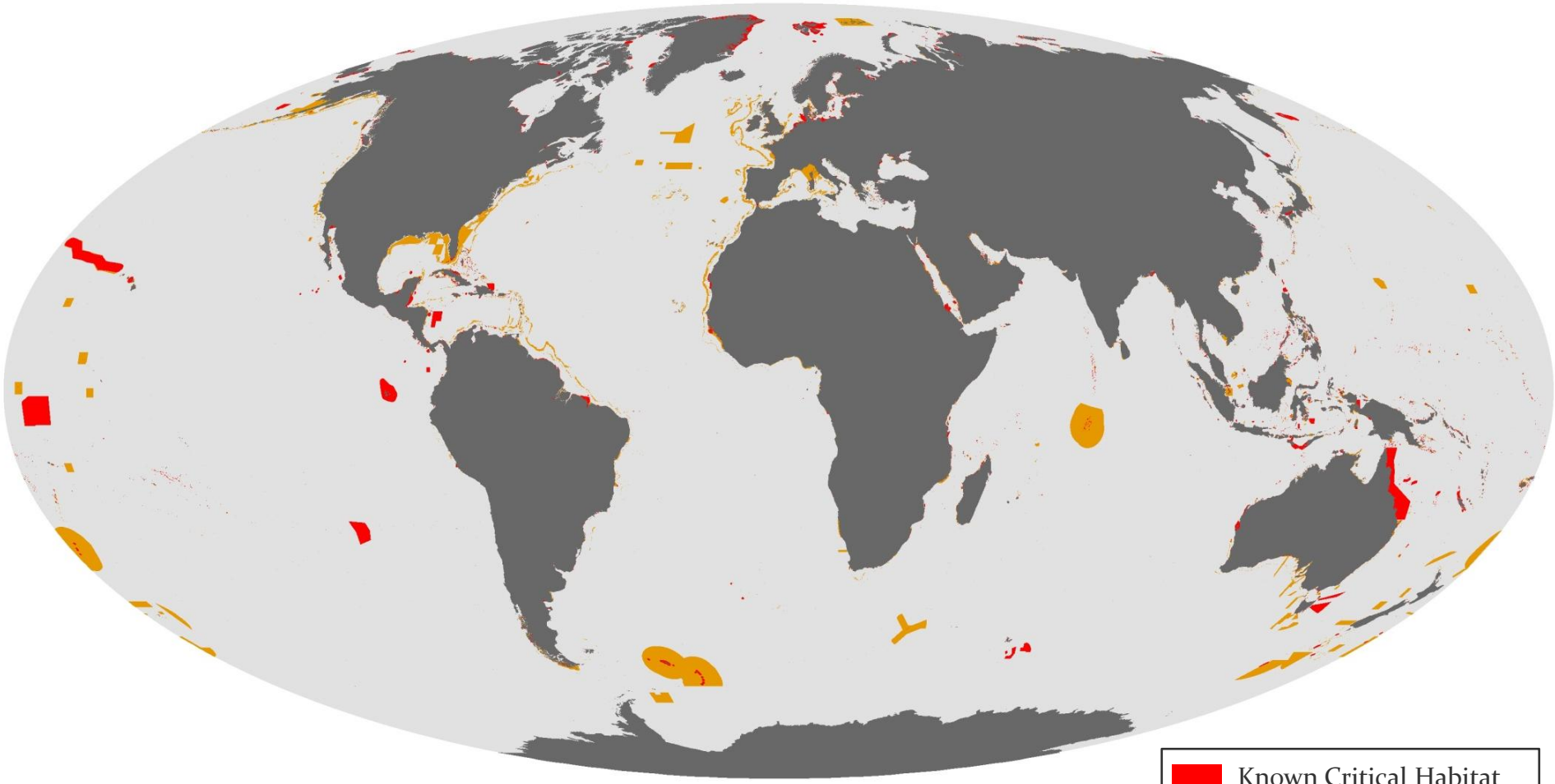
- Protected Areas
- Key Biodiversity Areas
- Sea turtle nesting sites
- Cold-water corals
- Warm-water corals
- Hydrothermal vents

Potential Critical Habitat

- Protected Areas
- Key Biodiversity Areas
- Sea turtle nesting sites
- Cold-water corals (predicted)
- Mangroves
- Seagrass beds
- Saltmarshes
- Seamounts
- Cold seeps

UNEP WCMC

Marine Critical Habitat



UNEP WCMC

Marine Critical Habitat

Known Critical Habitat

- Area: **4,500,000 km²**
- Percentage coverage: **1.3%**

Potential Critical Habitat

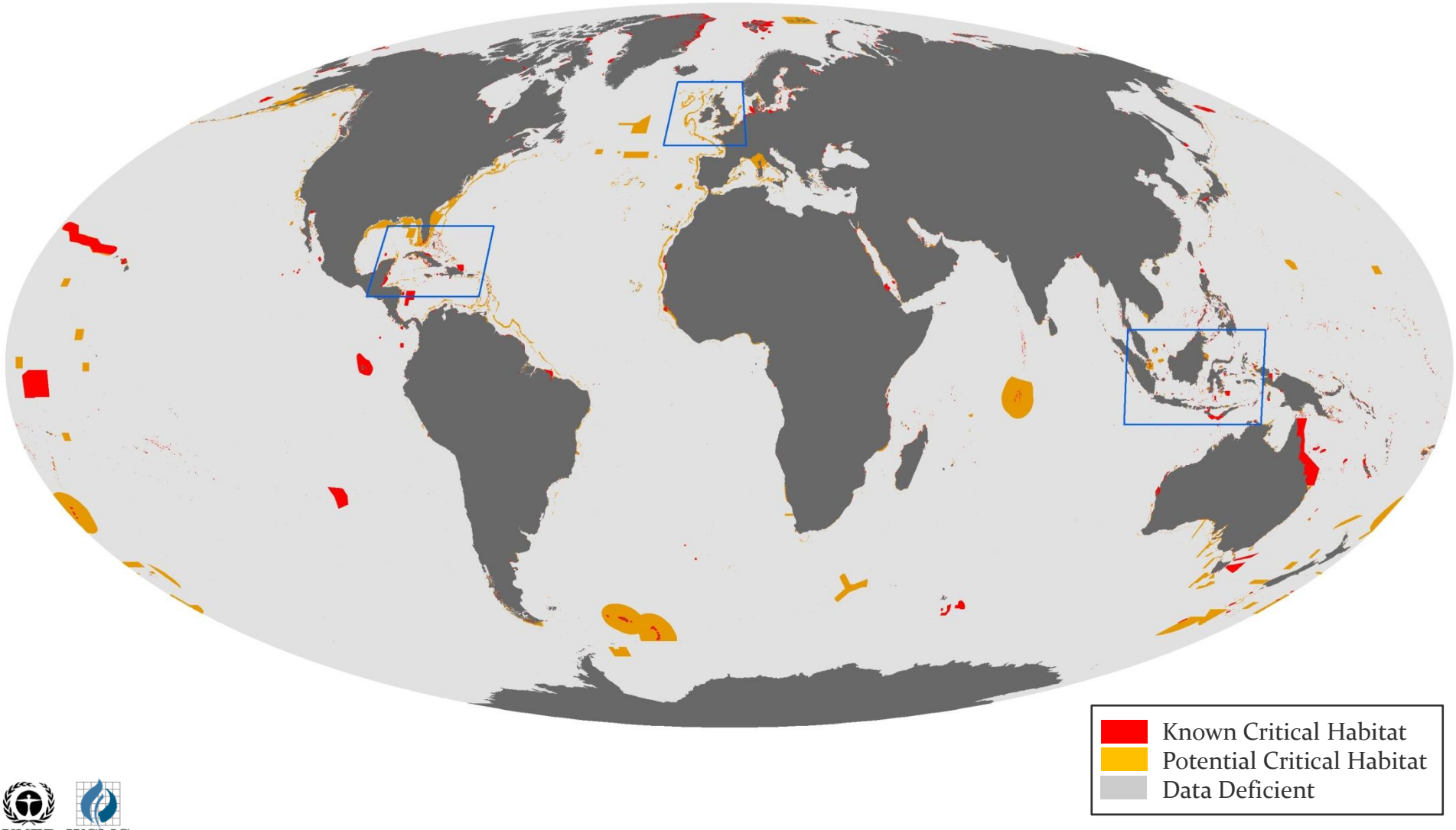
- Area: **7,600,000 km²**
- Percentage coverage: **2.1%**

Data Deficient

- Area: **343,200,000 km²**
- Percentage coverage: **96.6%**

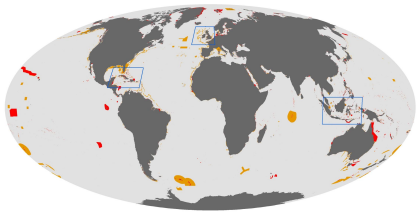
UNEP WCMC

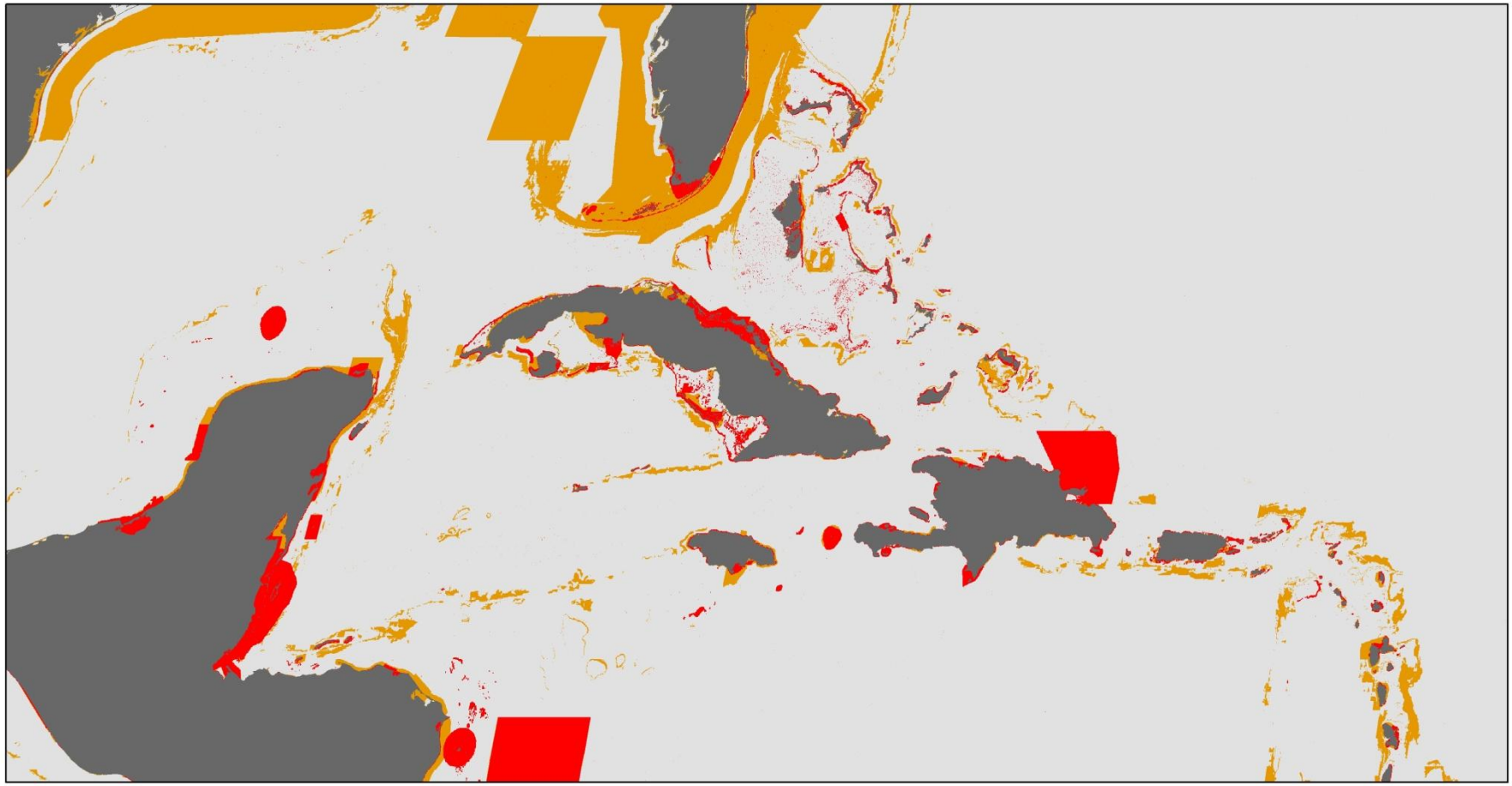
Marine Critical Habitat Examples



UNEP WCMC

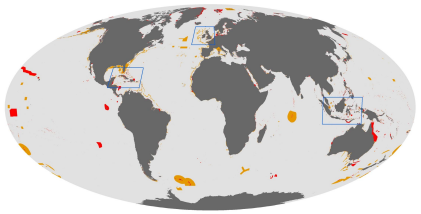
Caribbean

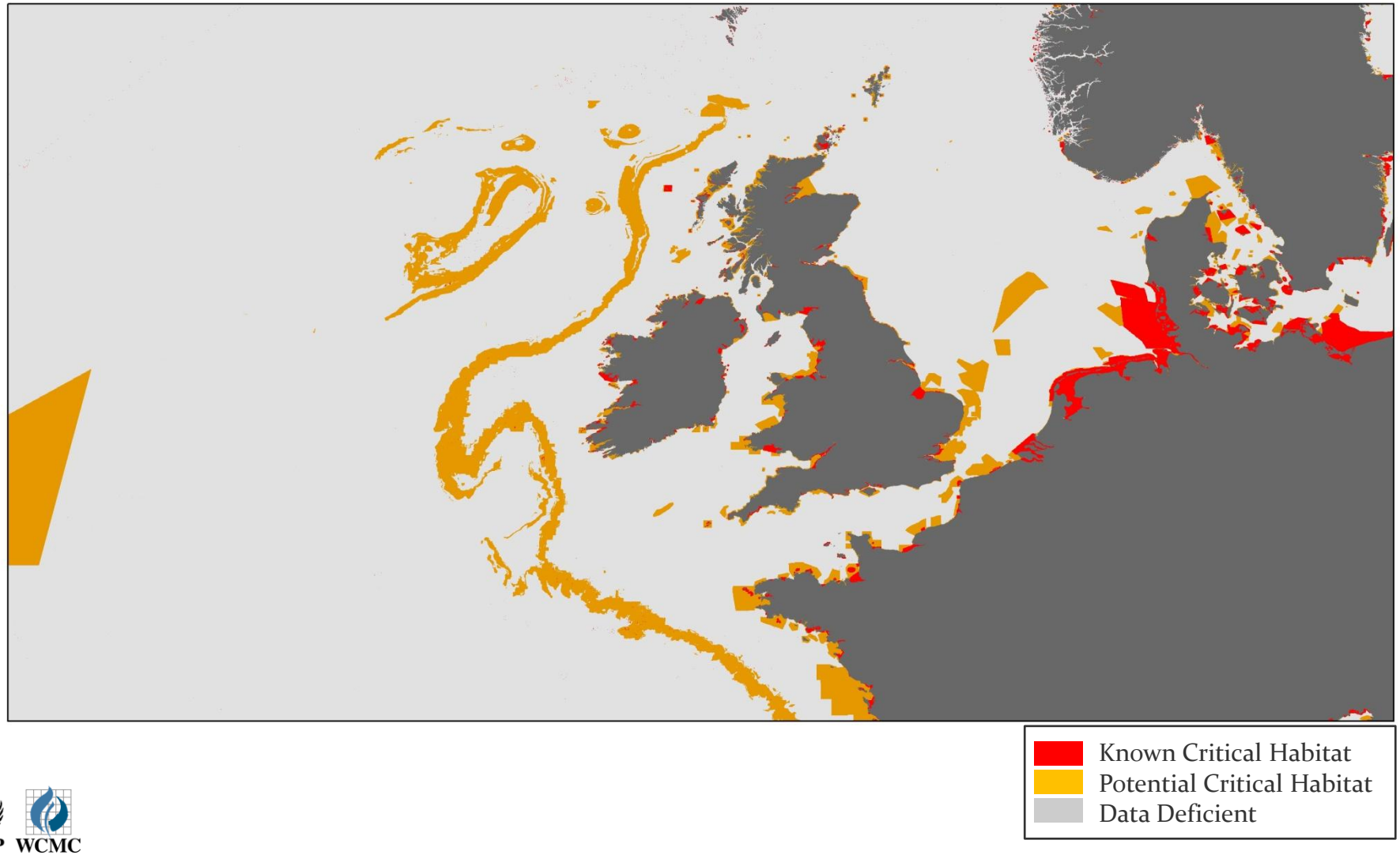




UNEP WCMC

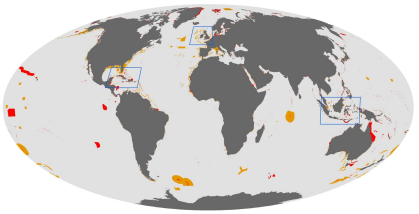
UK

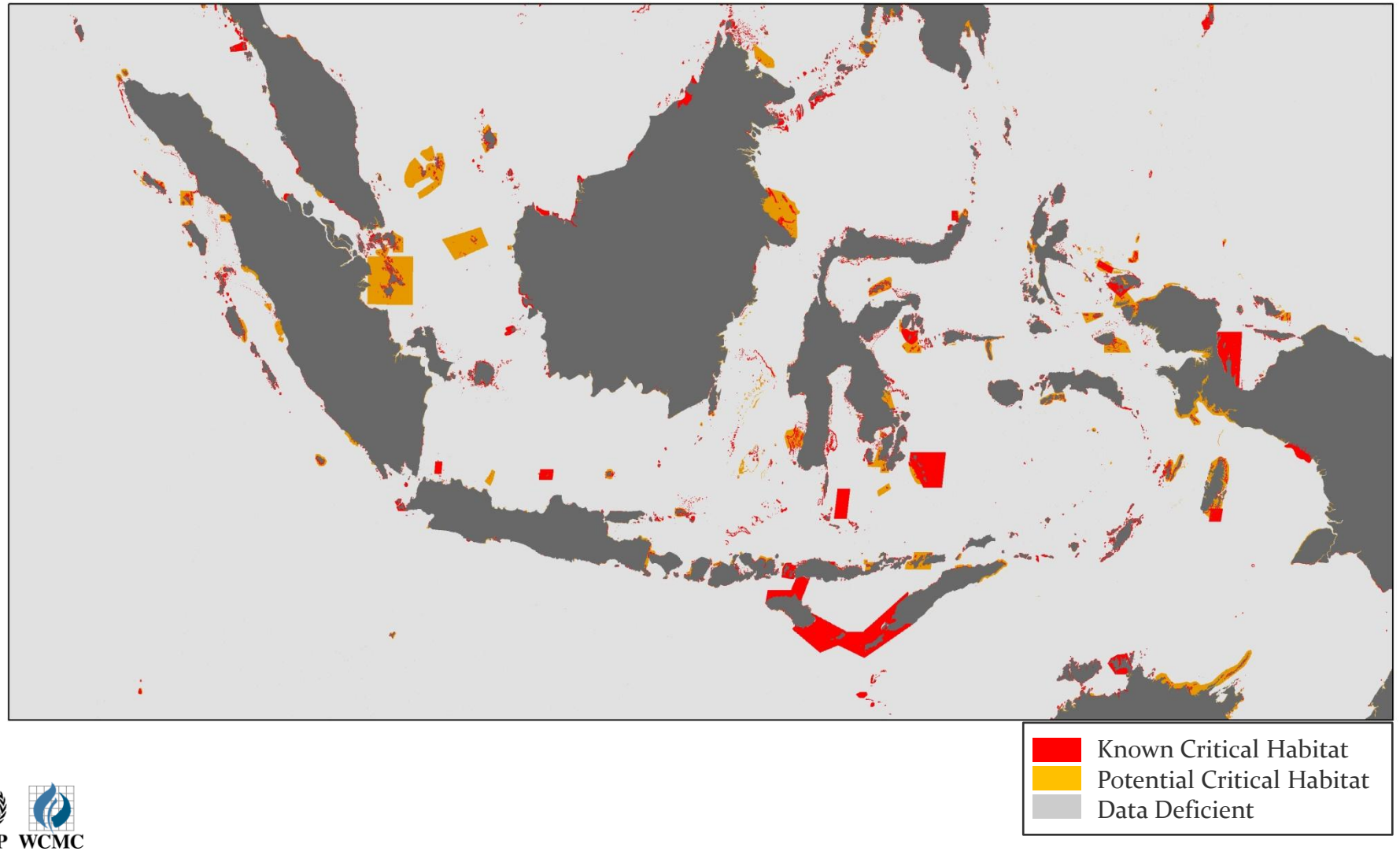



Known Critical Habitat
Potential Critical Habitat
Data Deficient

UNEP WCMC

Indonesia

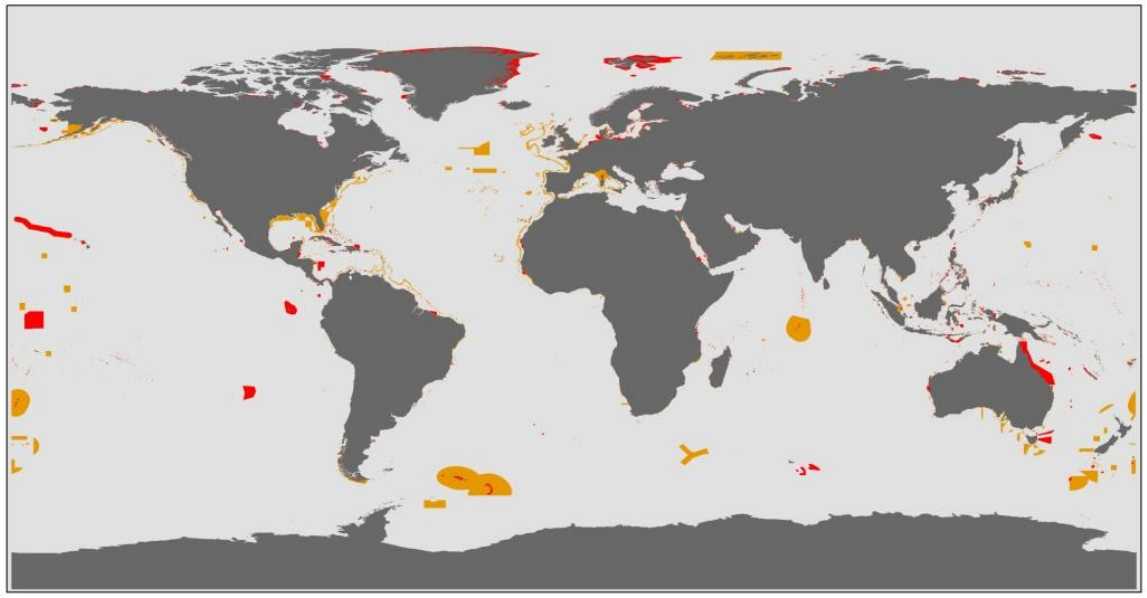




UNEP WCMC

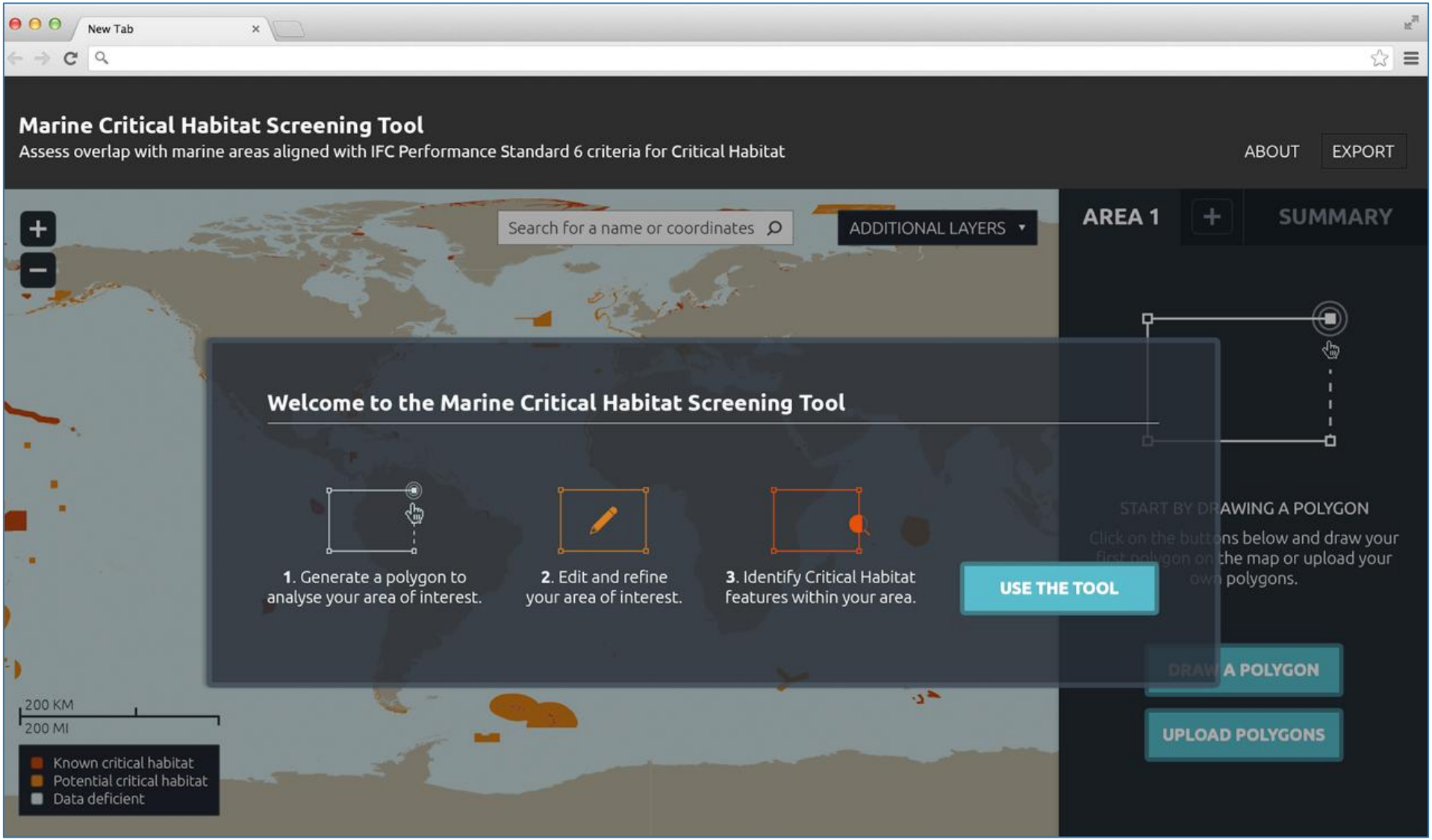
Marine Critical Habitat Screening Tool

Create a tool which allows users to query the presence of Critical Habitat* within a pre-defined area of interest



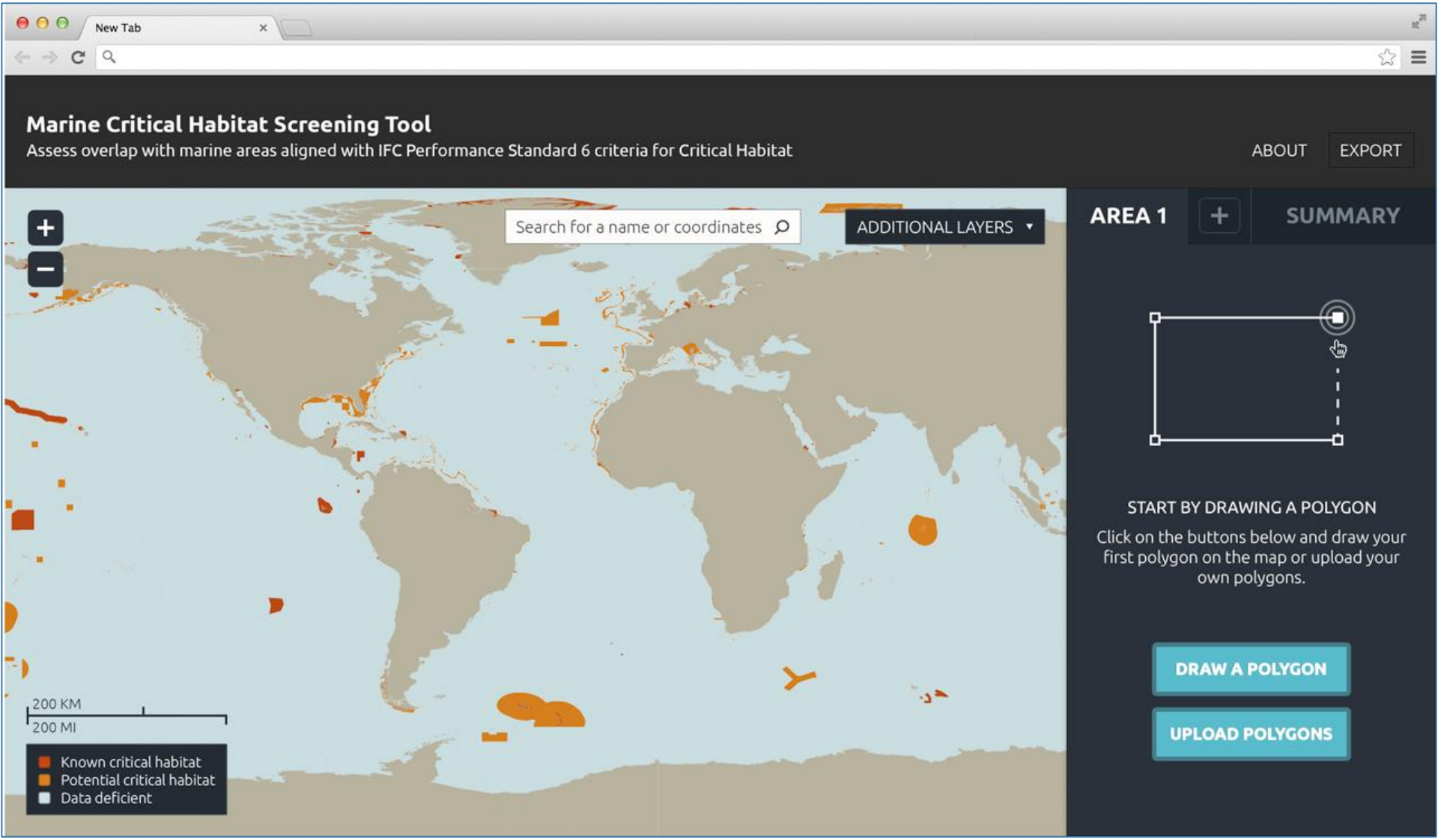
UNEP WCMC

Marine Critical Habitat Screening Tool

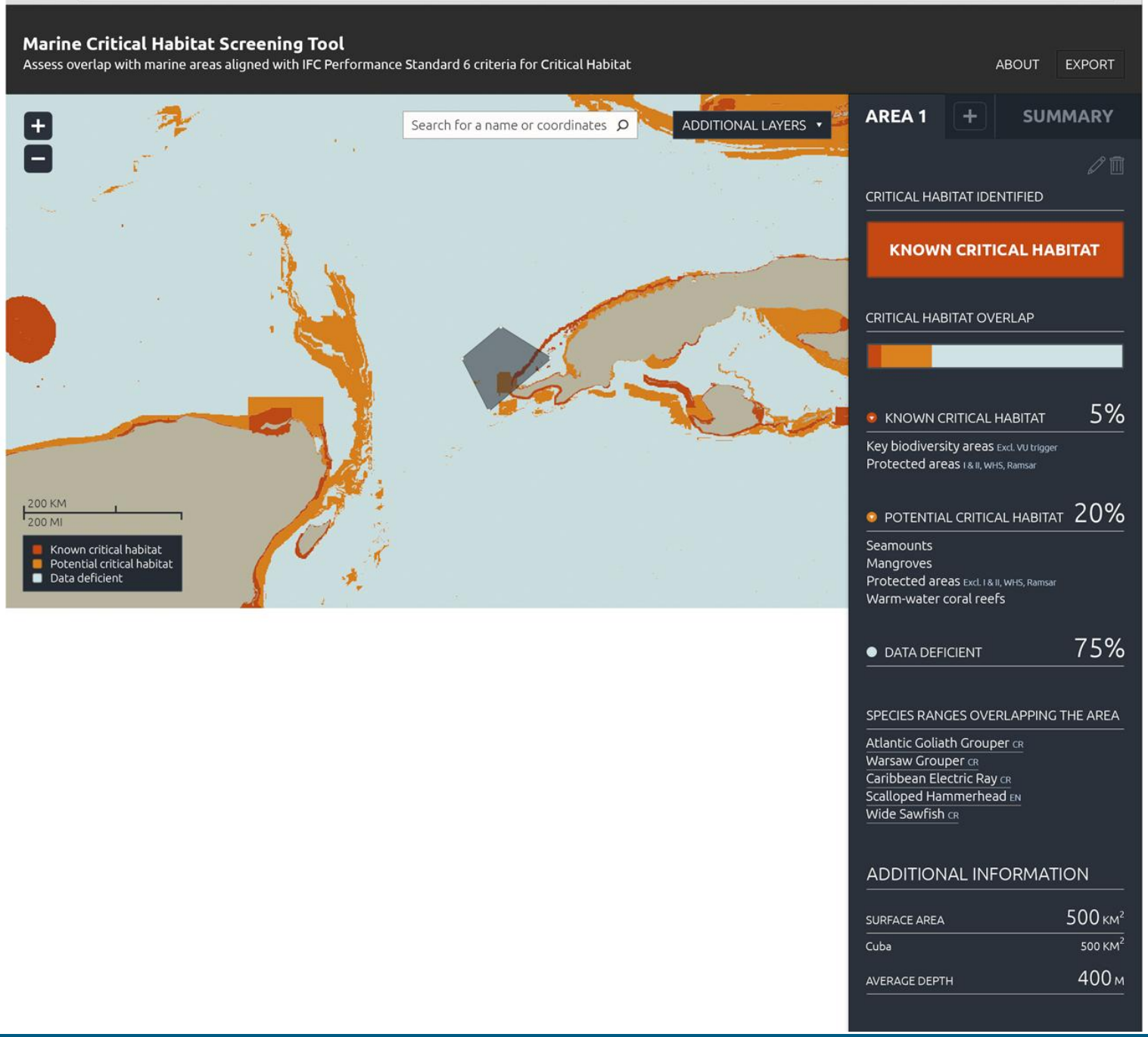


UNEP WCMC

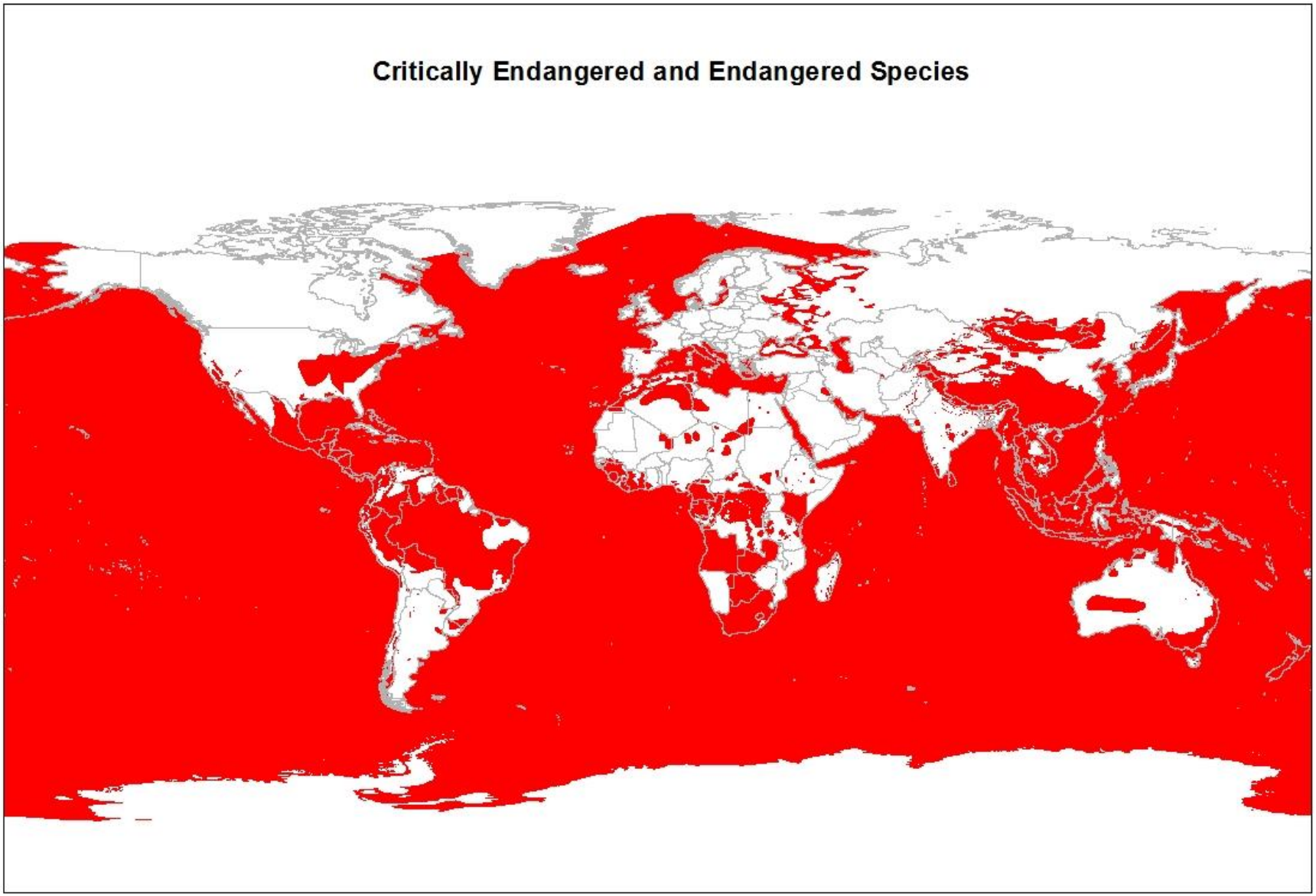
Marine Critical Habitat Screening Tool



UNEP WCMC

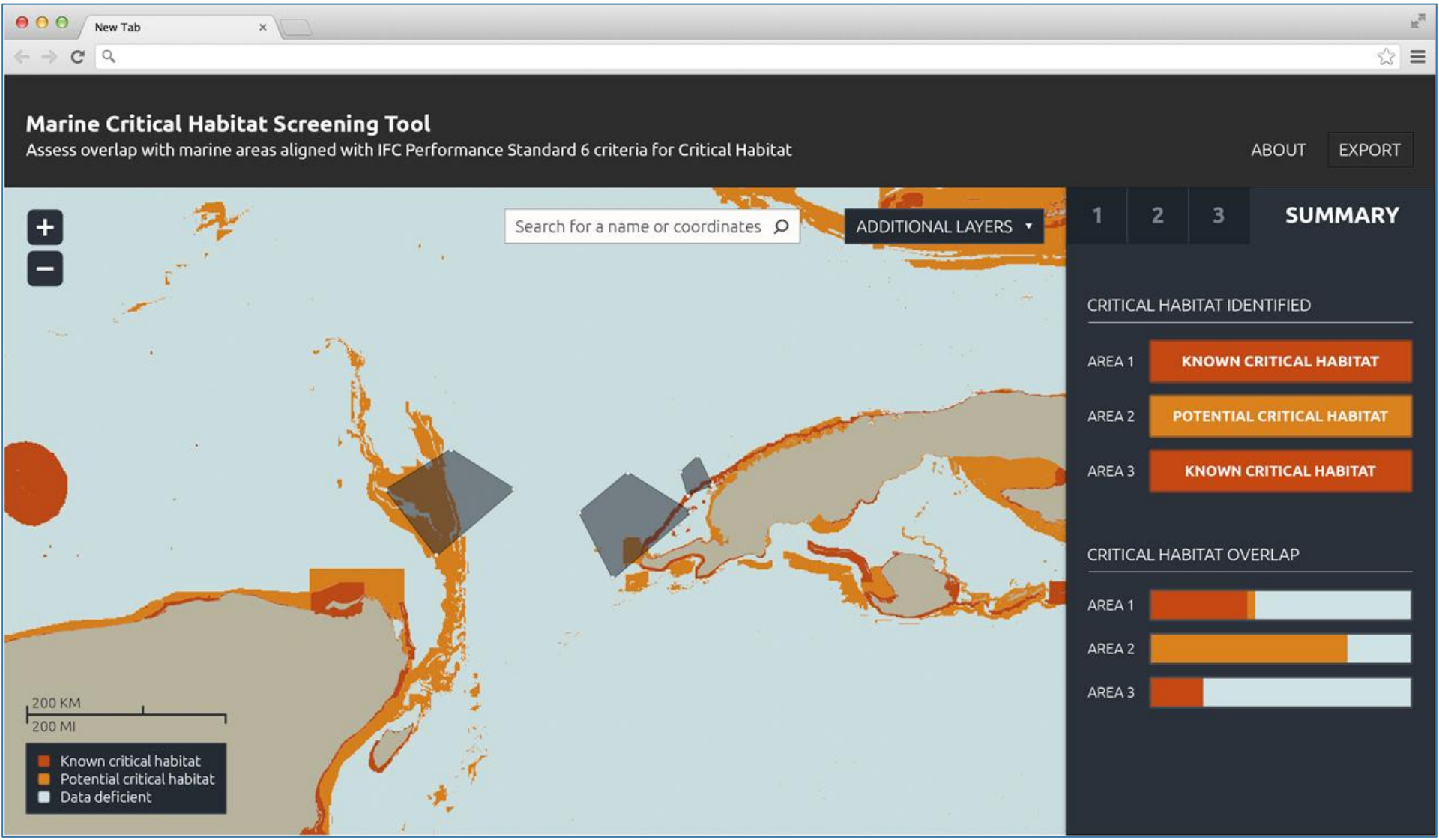

Marine Critical Habitat Screening Tool
Assess overlap with marine areas aligned with IFC Performance Standard 6 criteria for Critical Habitat
ABOUT
EXPORT
Search for a name or coordinates
ADDITIONAL LAYERS
200 KM
200 MI
Known critical habitat
Potential critical habitat
Data deficient
AREA 1
SUMMARY
CRITICAL HABITAT IDENTIFIED
KNOWN CRITICAL HABITAT
CRITICAL HABITAT OVERLAP
KNOWN CRITICAL HABITAT 5%
Key biodiversity areas Excl. VU trigger
Protected areas I & II, WHS, Ramsar
POTENTIAL CRITICAL HABITAT 20%
Seamounts
Mangroves
Protected areas Excl. I & II, WHS, Ramsar
Warm-water coral reefs
DATA DEFICIENT 75%
SPECIES RANGES OVERLAPPING THE AREA
Atlantic Goliath Grouper CR
Warsaw Grouper CR
Caribbean Electric Ray CR
Scalloped Hammerhead EN
Wide Sawfish CR
ADDITIONAL INFORMATION
SURFACE AREA 500 KM²
Cuba 500 KM²
AVERAGE DEPTH 400 M

UNEP WCMC



UNEP WCMC

Marine Critical Habitat Screening Tool



UNEP WCMC


Feedback

Thank you

Melissa Tolley

Head of Business and Biodiversity

UNEP WCMC

melissa.tolley@unep-wcmc.org

Proteus Partners Meeting 2013

Houston, TX, USA


Proteus

The CBD EBSA Process

Daniel C. Dunn & Patrick N. Halpin

Marine Geospatial Ecology Lab

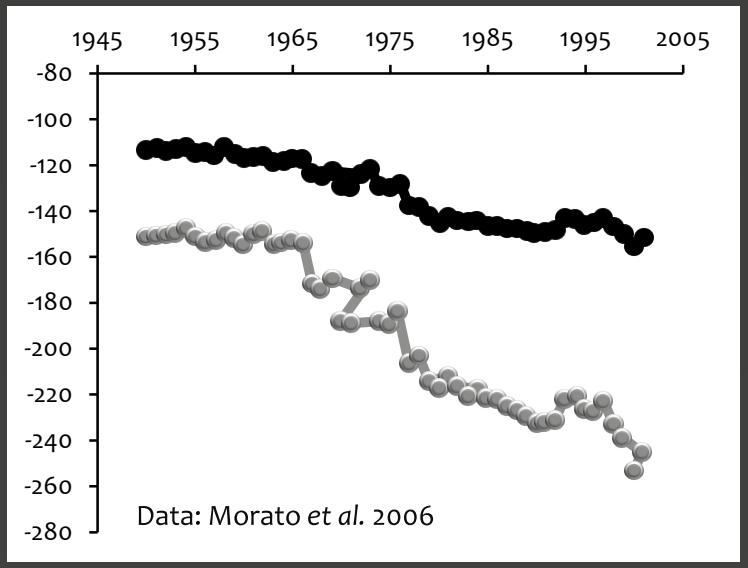
Duke University Marine Lab

Beaufort, NC 28557

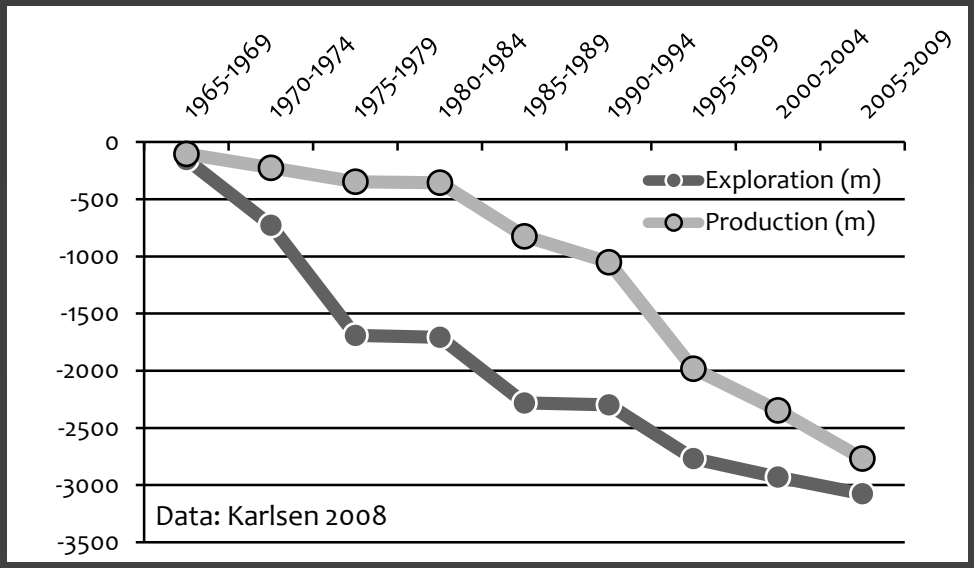
Daniel.dunn@duke.edu

Increasing & Deeper Use of the Ocean

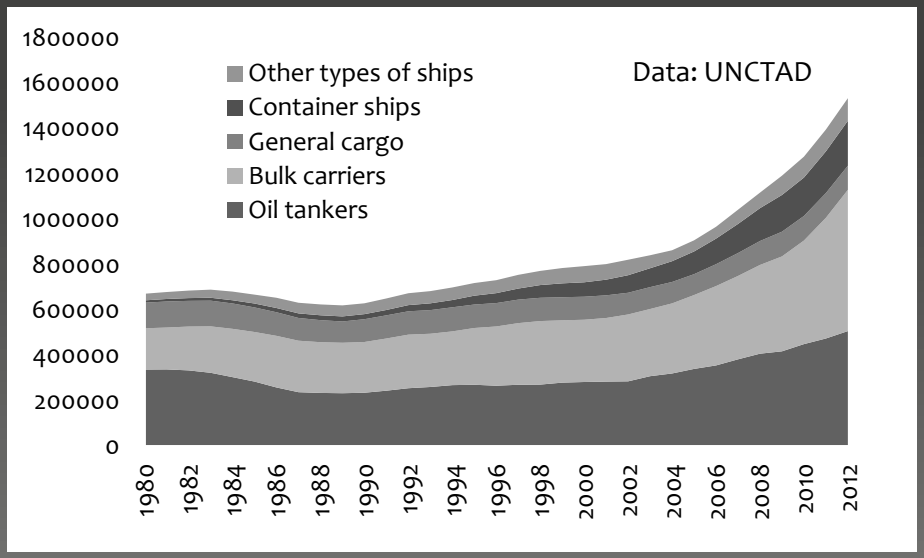
Depth of Fishing



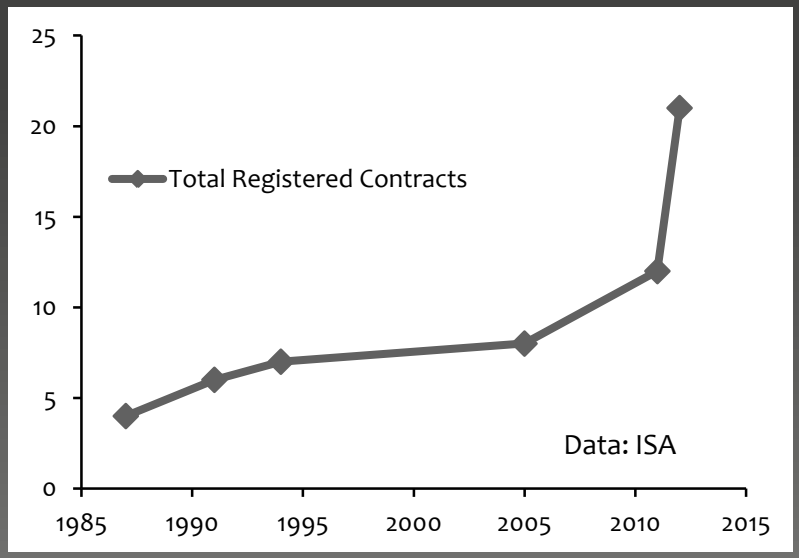
Depth of Oil Exploration/Production



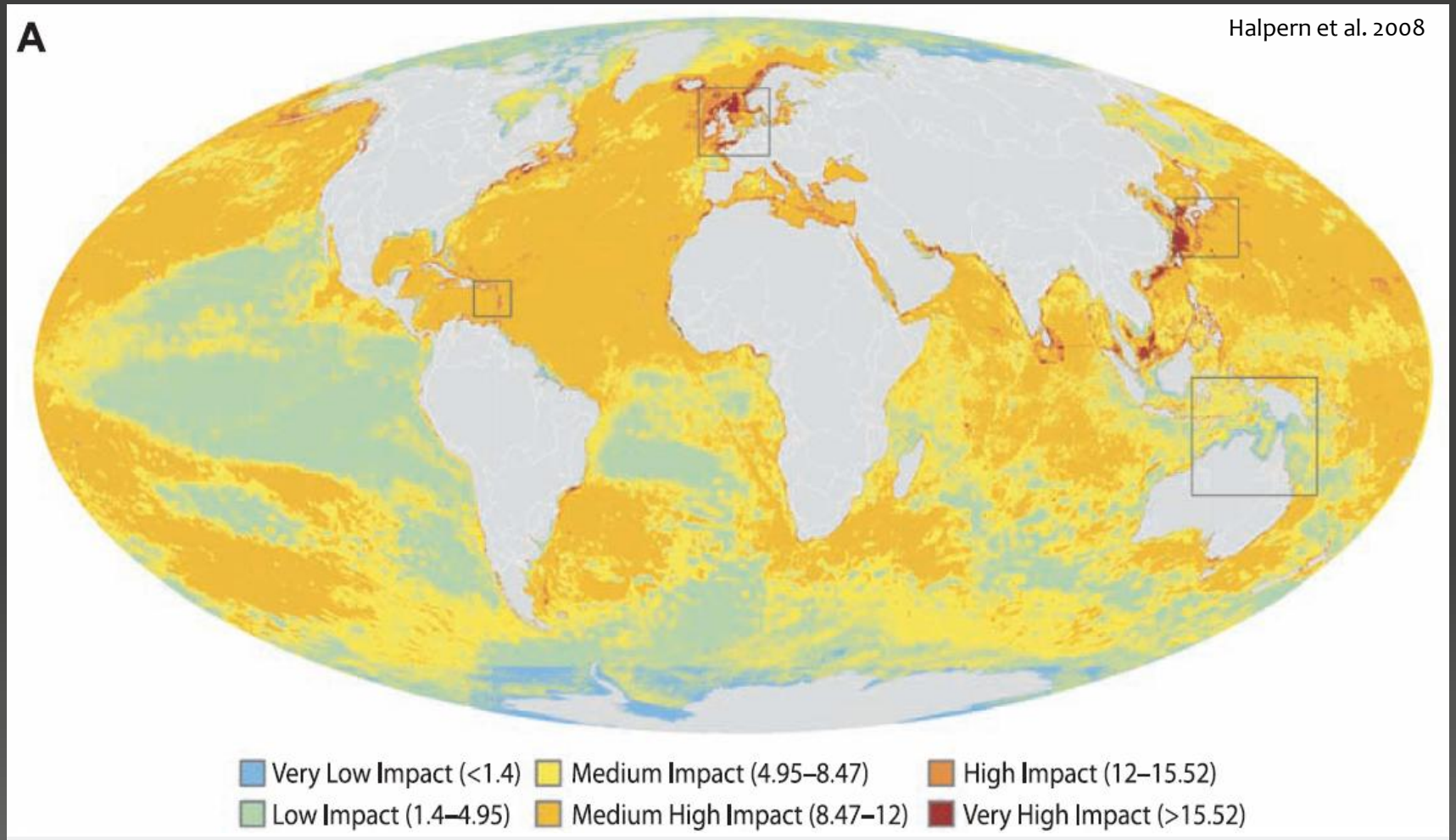
Shipping Capacity



Deep Sea Mining Contracts

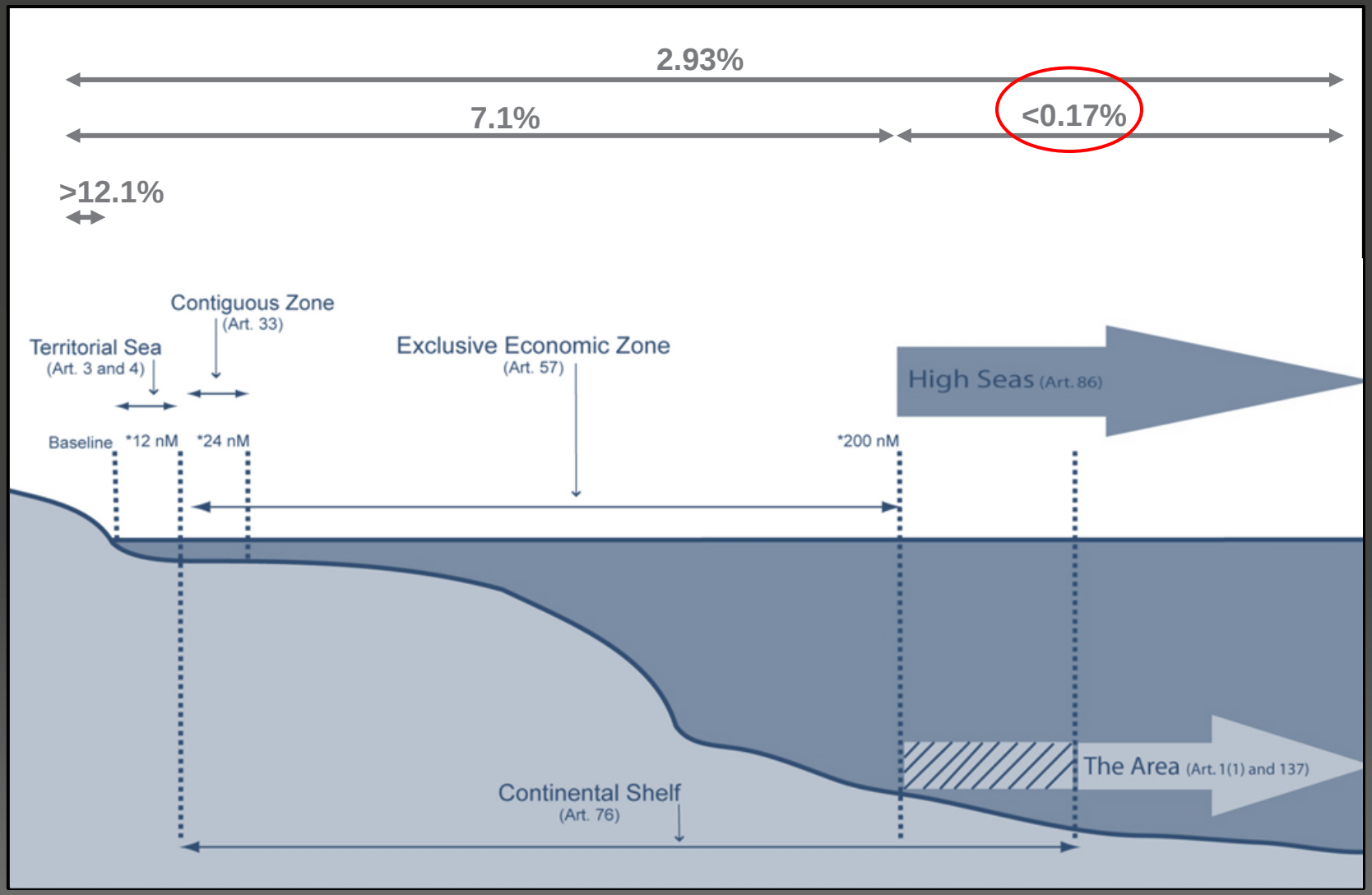


Cumulative Impacts

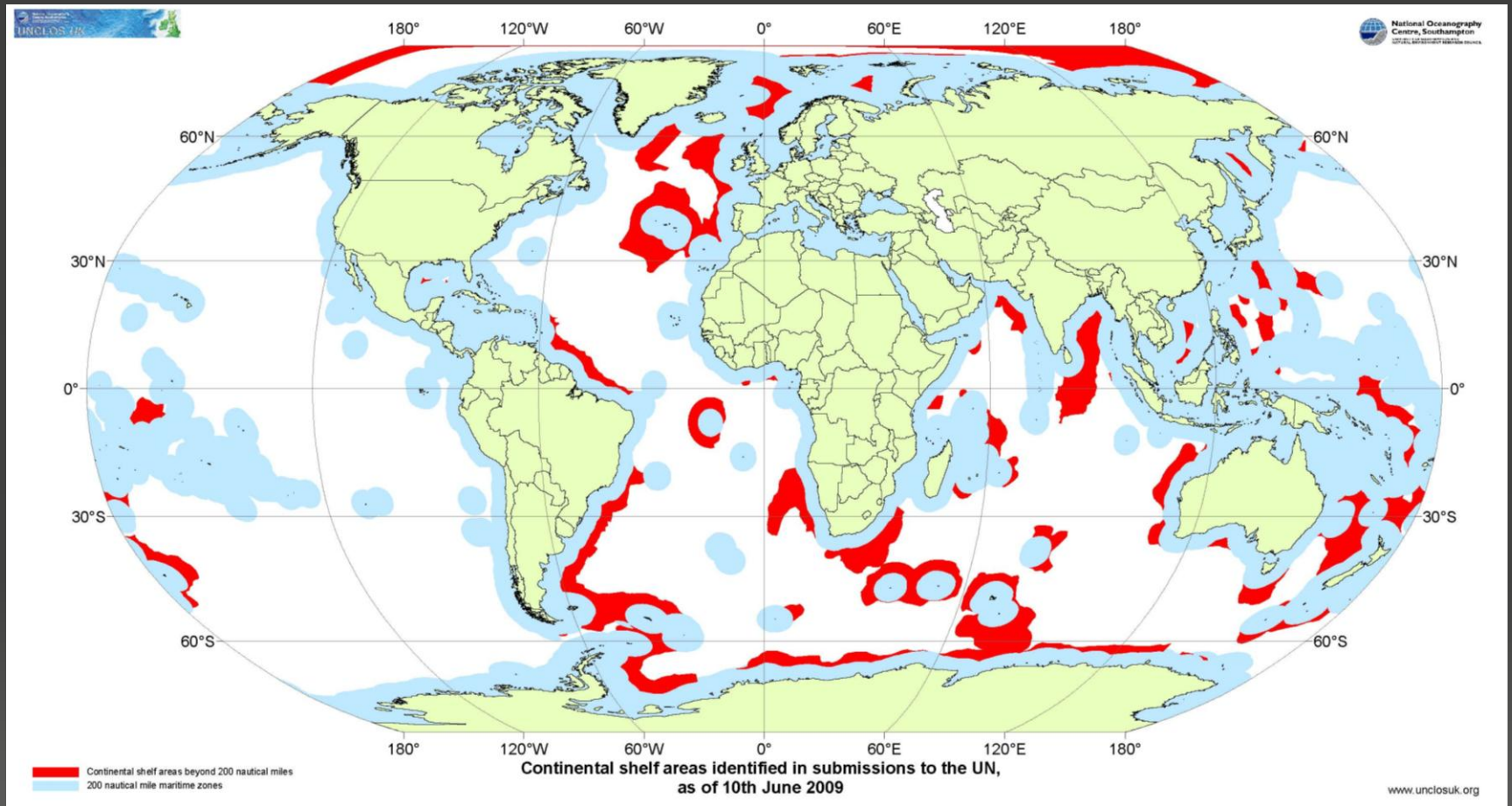


- **Pressures:** Intensifying human uses; Climate change; Ocean acidification + + +

Progress toward MPA targets



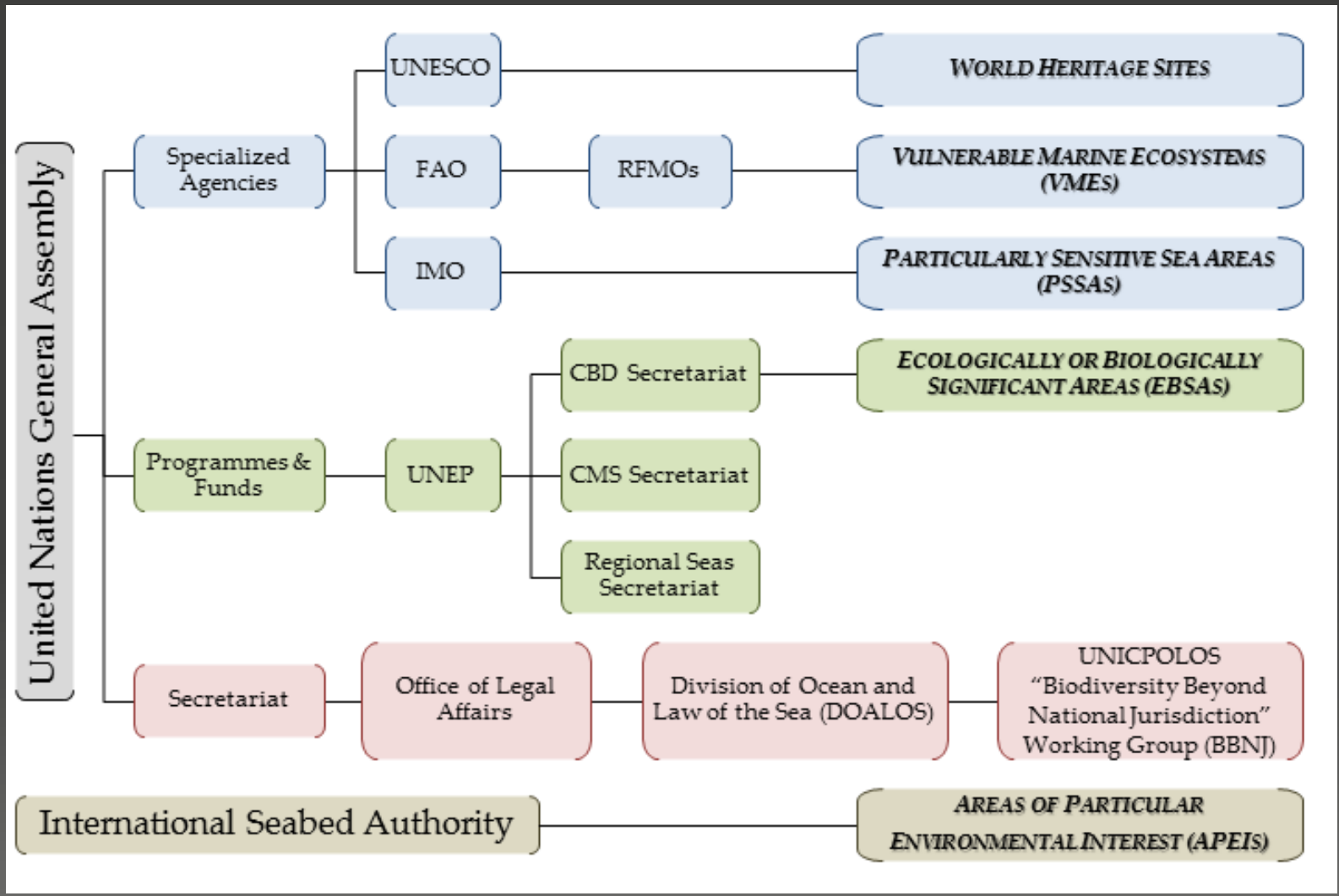
Areas Beyond National Jurisdiction



Credit: National Oceanography Centre, Southampton

- **Facts:** 64% = high seas; 95% of the habitable volume of the planet

UN Biodiversity Criteria Suites

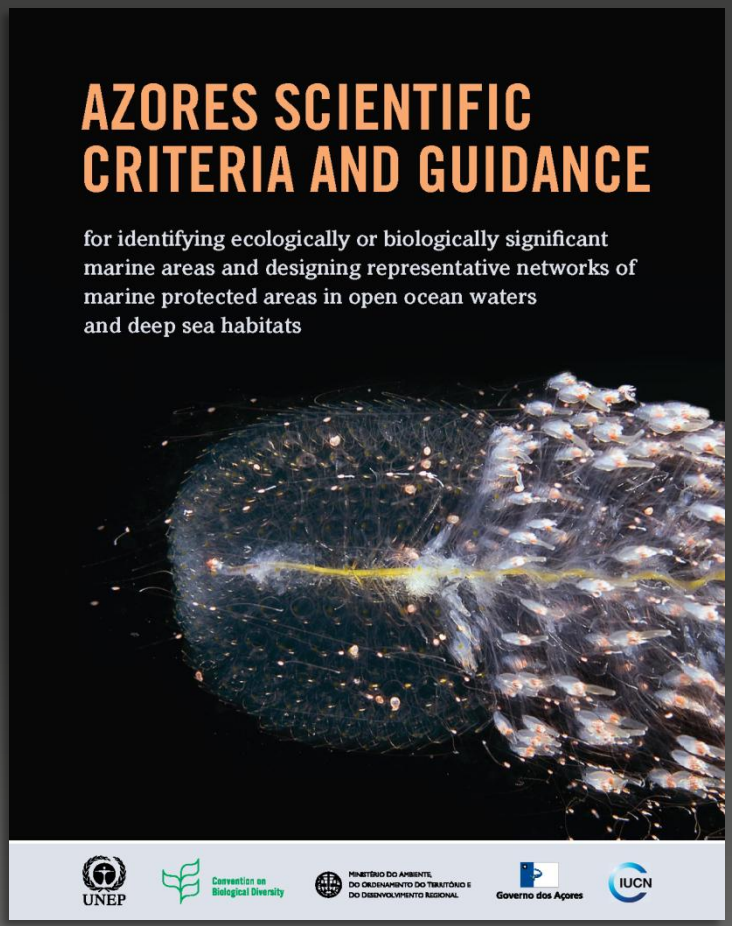


What are EBSAs?

Proteus

- "Ecologically or Biologically Significant Areas"
- Areas described to meet a set of biodiversity criteria promulgated by the Convention on Biological Diversity
- They carry NO direct management implication, thus they are not MPAs
- However, they can aid in the conservation and sustainable use of biodiversity in marine areas

CBD EBSA Criteria



Annex I: Site Criteria

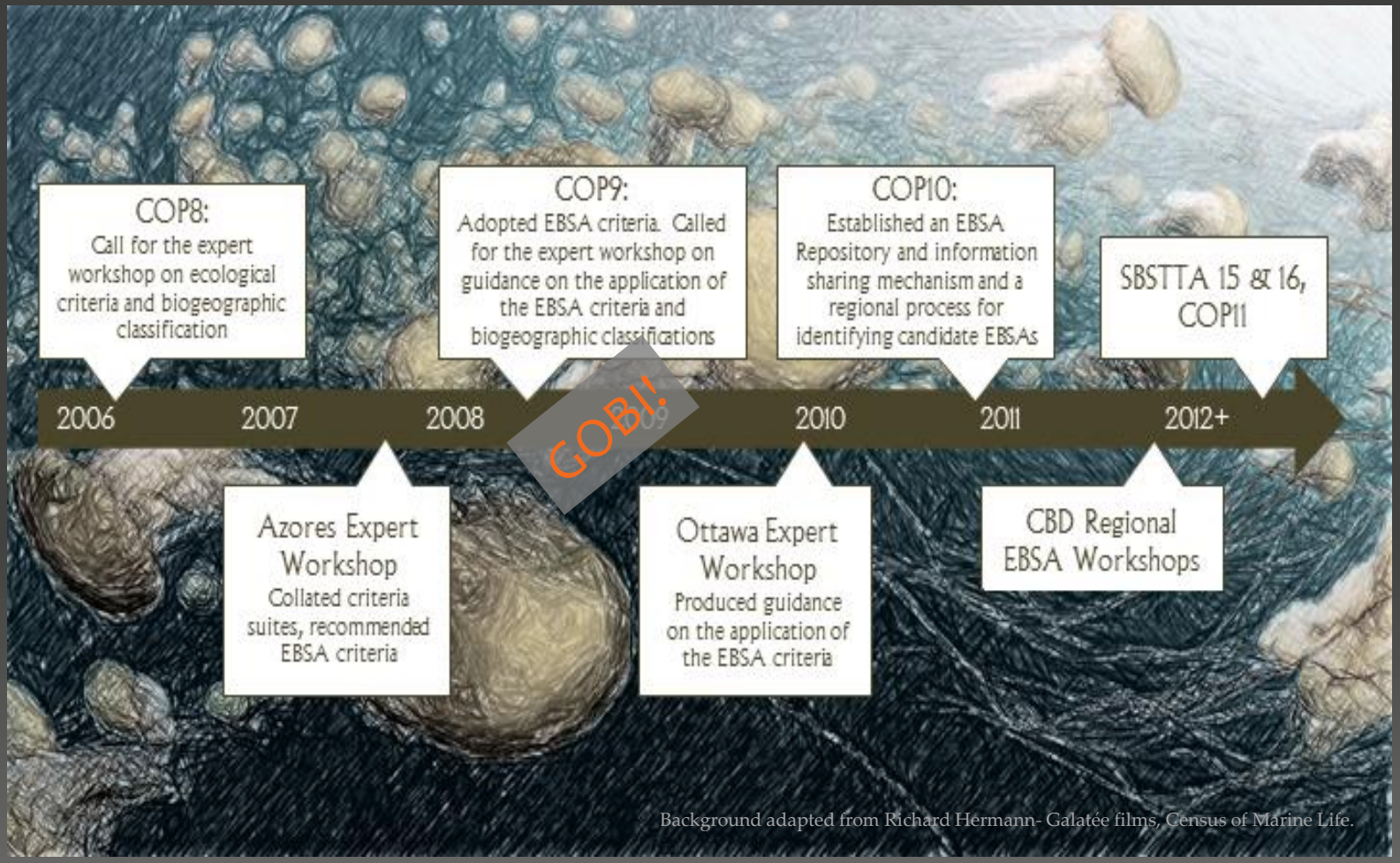
1. Uniqueness or rarity
2. Special importance for life history of species
3. Importance for threatened, endangered or declining species and/or habitats
4. Vulnerability, fragility, sensitivity, slow recovery
5. Biological productivity
6. Biological diversity
7. Naturalness

For more info on criteria suites: Dearden & Topelko 2005, Gilman et al. 2011

Areas that may meet EBSA Criteria

- *Static Bathymetric Habitats*
  - **Continental shelf-breaks**
  - **Seamounts**
  - **Submarine Canyons**
  - **Areas of high slope**
  - **Areas of high rugosity?**
  - **Areas of terrestrial nutrient input**
    - Wind driven dust
    - River plumes
- *Defined by species observation:*
  - **Areas of high pelagic biodiversity**
  - **Core-use areas**
  - **Foraging grounds**
  - **Spawning grounds**
  - **Migratory routes**
- *Persistent Hydrographic Habitats & Ephemeral Habitats*
  - **Coastal upwelling**
  - **Fronts & Frontal systems**
  - **Currents**
  - **Eddies & Eddy fields**
  - **Retention areas**
  - **Divergence/Convergence zones**
  - **Oceanic gyres**
  - **Areas of Oxygen Minimum Zone Shoaling**
  - **Thermocline Shoaling**
  - **Other areas of high productivity (not feature specific)**

Have criteria. Will apply.

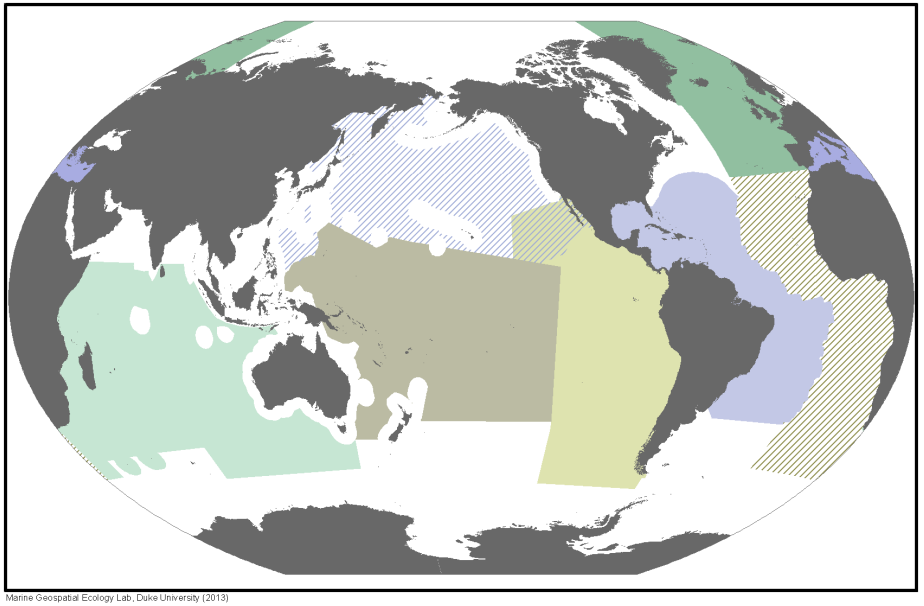


CBD COP 10 EBSA Decisions (2010)

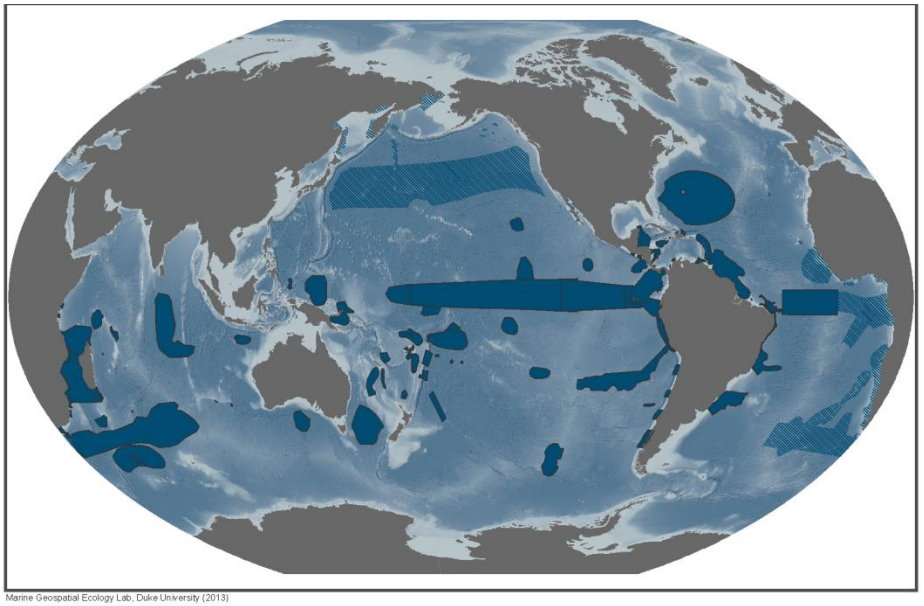
- Consider the use of the scientific guidance on the **identification of marine areas beyond national jurisdiction**
- **Facilitate availability and inter-operability** of the best available marine and coastal biodiversity data sets and information across global, regional and national scales
- Organise a series of regional workshops to facilitate the description of EBSAs
- Establish an EBSA repository & information sharing mechanism

EBSA Regional Workshops

Draft Results



Marine Geospatial Ecology Lab, Duke University (2013)



Marine Geospatial Ecology Lab, Duke University (2013)

EBSAs and the management of anthropogenic stressors

The CBD has no management authority…

… so how do you expect the identification of EBSAs to have any impact on the management of anthropogenic stressors?

Criteria Crosswalk

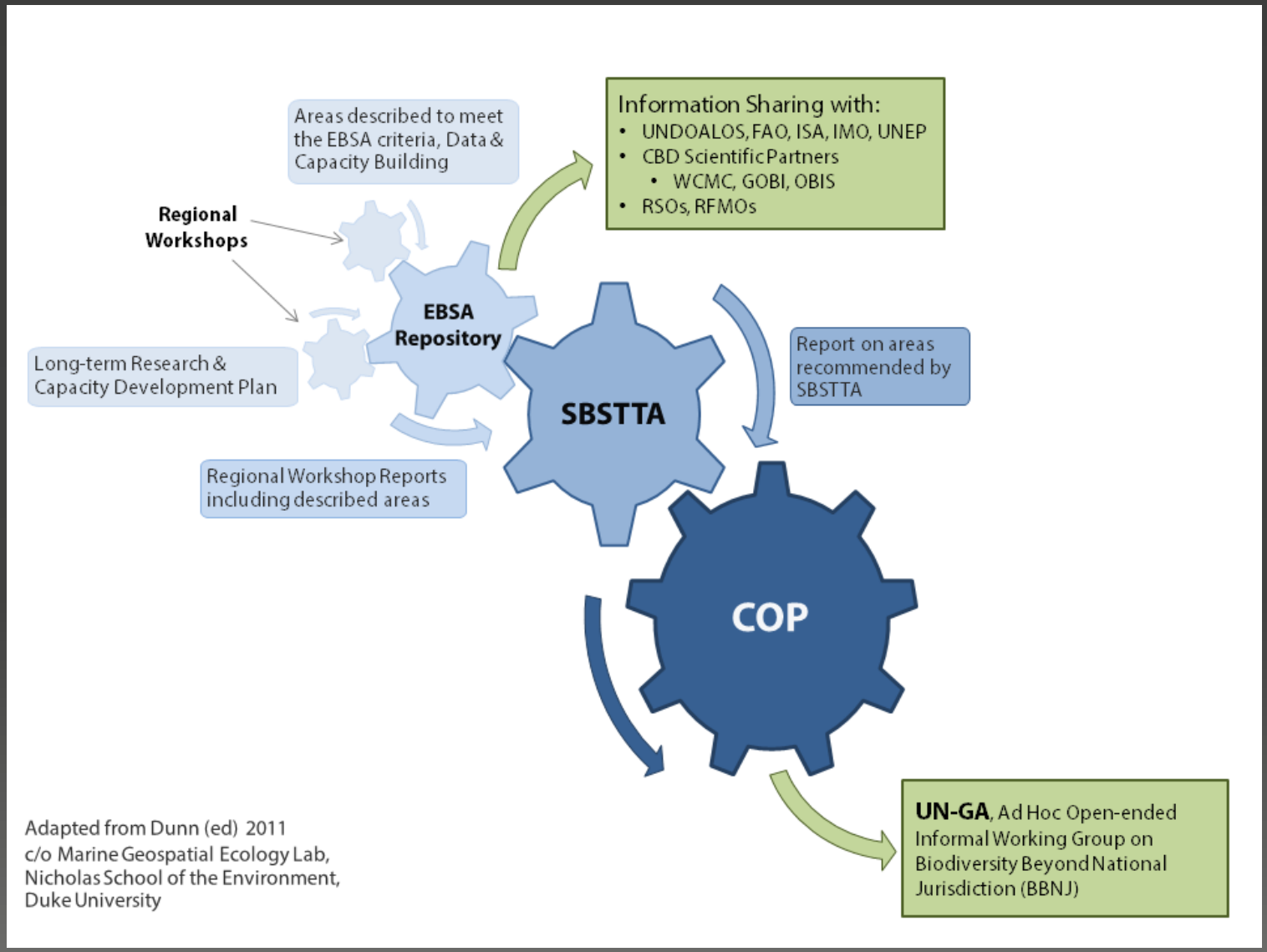
Proteus

Organization	CBD	FAO	IMO	UNESCO	Birdlife	IUCN	RAMSAR
Site Criteria	**EBSAs**	**VMEs**	**PSSAs**	**WHSs**	**IBAs**	**KBAs**	**RAMSAR**
Uniqueness or rarity							
Special importance for life history stages of species							
Importance to threatened or endangered species							
Vulnerability, fragility, sensitivity, or slow recovery							
Productivity							
Biodiversity							
Naturalness							
Structure							
Historical Geomorphological Importance							

IFC Critical Habitat Crosswalk

	Uniqueness or rarity	Special importance for life history stages of species	Importance to threatened or endangered species	Vulnerability, fragility, sensitivity, or slow recovery	Productivity	Biodiversity	Naturalness	Structure	Historical Geomorphological Importance
Habitats of significant importance to Critically Endangered and/or Endangered species		✓	✓						
Habitats of significant importance to endemic and/or restricted-range species		✓	✓						
Habitats supporting globally significant concentrations of migratory species and/or congregatory species		✓	✓						
Highly threatened and/or unique ecosystems	✓			✓					
Areas associated with key evolutionary processes						✓		✓	
Internationally and/or nationally recognized areas of high biodiversity value						✓			

The EBSA Process



CBD COP 11 EBSA Decisions (2012)

Proteus

- *Welcomes* the scientific and technical evaluation of information contained in the reports of the regional workshops..
- … *emphasized* that the identification of EBSAs and the selection of conservation and management measures is a matter for States and competent intergovernmental organizations
- *requests* that the regional EBSA workshop reports be included in the EBSA repository, and be submitted to the UNGA, the BBNJ working group and the Regular Process, as well as UN specialized agencies

Take Home Messages

Proteus

- There are a variety of ongoing intergovernmental initiatives attempting to identify areas of importance to biodiversity
- There is significant overlap in the criteria used by the different initiatives
- EBSAs can inform other processes that have management implications
- The UNGA is the forum contemplating how to implement conservation of biodiversity beyond national jurisdiction

Thanks!

daniel.dunn@duke.edu

The CBD EBSA Process

Daniel C. Dunn & Patrick N. Halpin

Marine Geospatial Ecology Lab

Duke University Marine Lab

Beaufort, NC 28557

Daniel.dunn@duke.edu

Proteus Partners Meeting 2013

Houston, TX, USA