

# Highlights of a Decade of Discovery Past & Future



Ron O'Dor

**Canadian Geographic June 2009**

# THE TRANSPARENT OCEANS PROJECT

After studying squid for two decades, Ron O'Dor had a revelation: whatever we have the power to change, we also have a responsibility to protect. Now he's leading a global effort to get a clear picture of the challenges facing marine life. Meet *Canadian Geographic's* Environmental Scientist of the Year.

BY JOHN DEMONT

**Census of Marine Life  
([www.coml.org](http://www.coml.org))**

# Why a Transparent Ocean? Tested Technology!





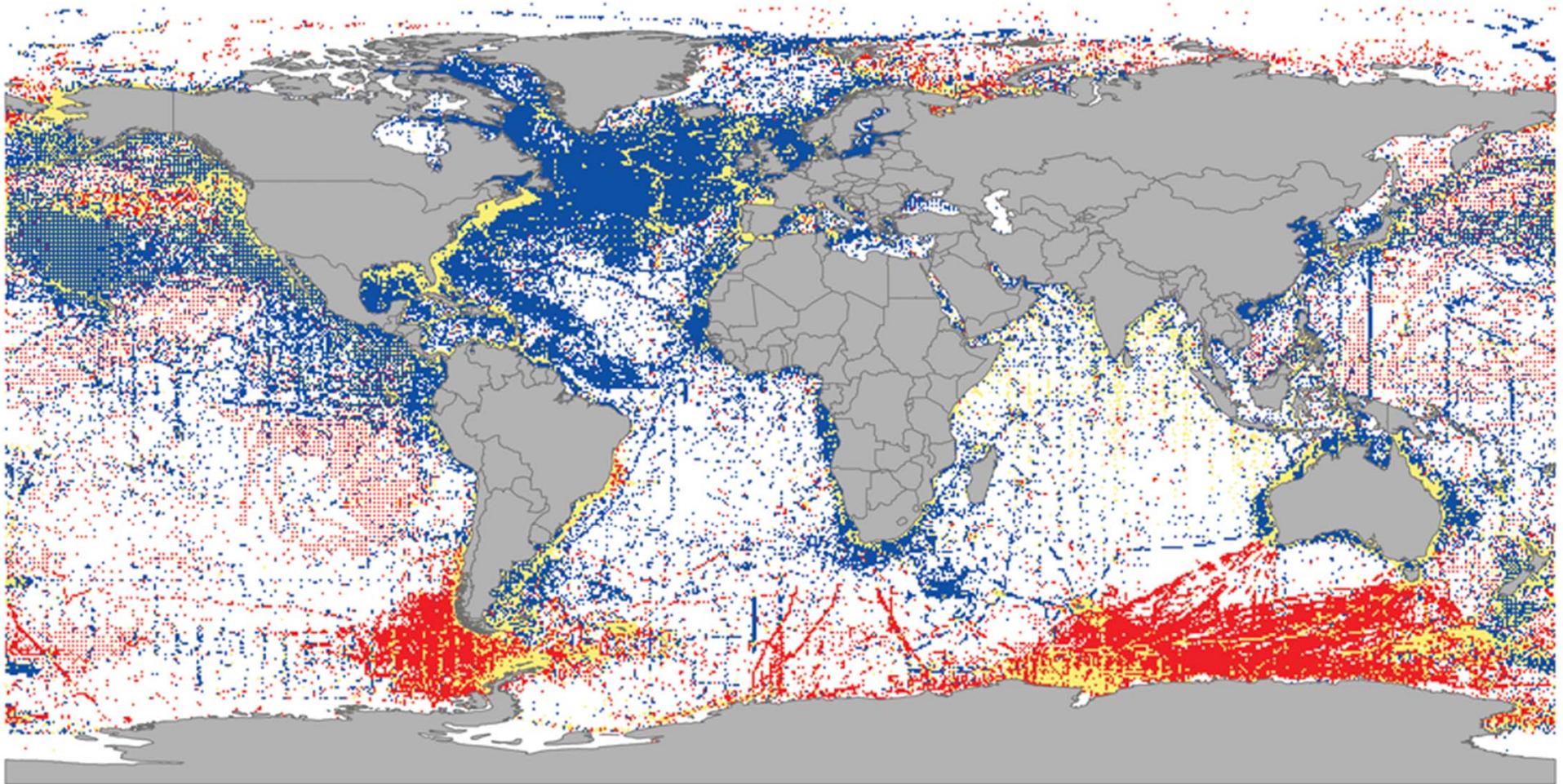
# Ocean Biogeographic Information System

30 Million Records 120,000 Species Half-degree Squares

Aggregated data

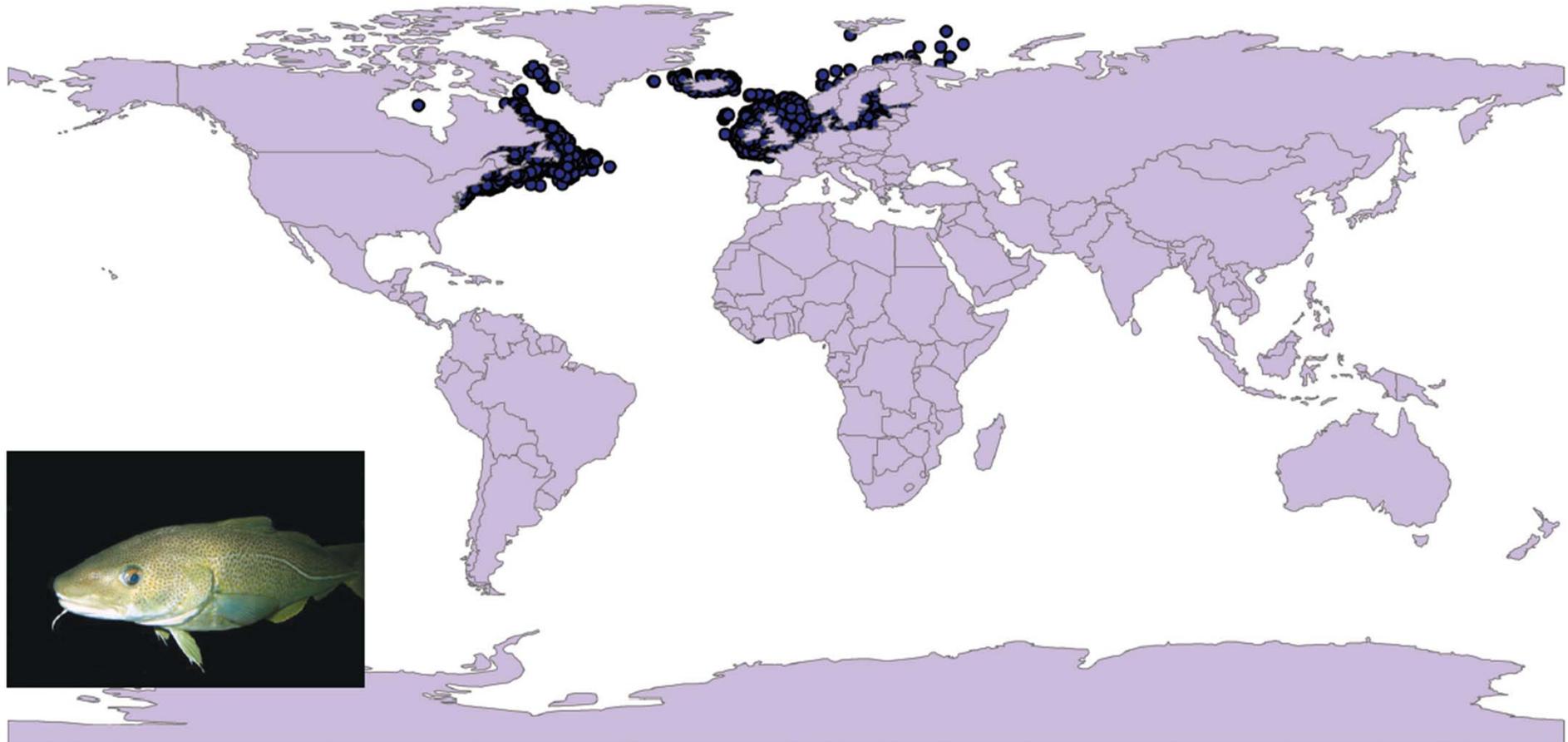
Only new data

Mixed data



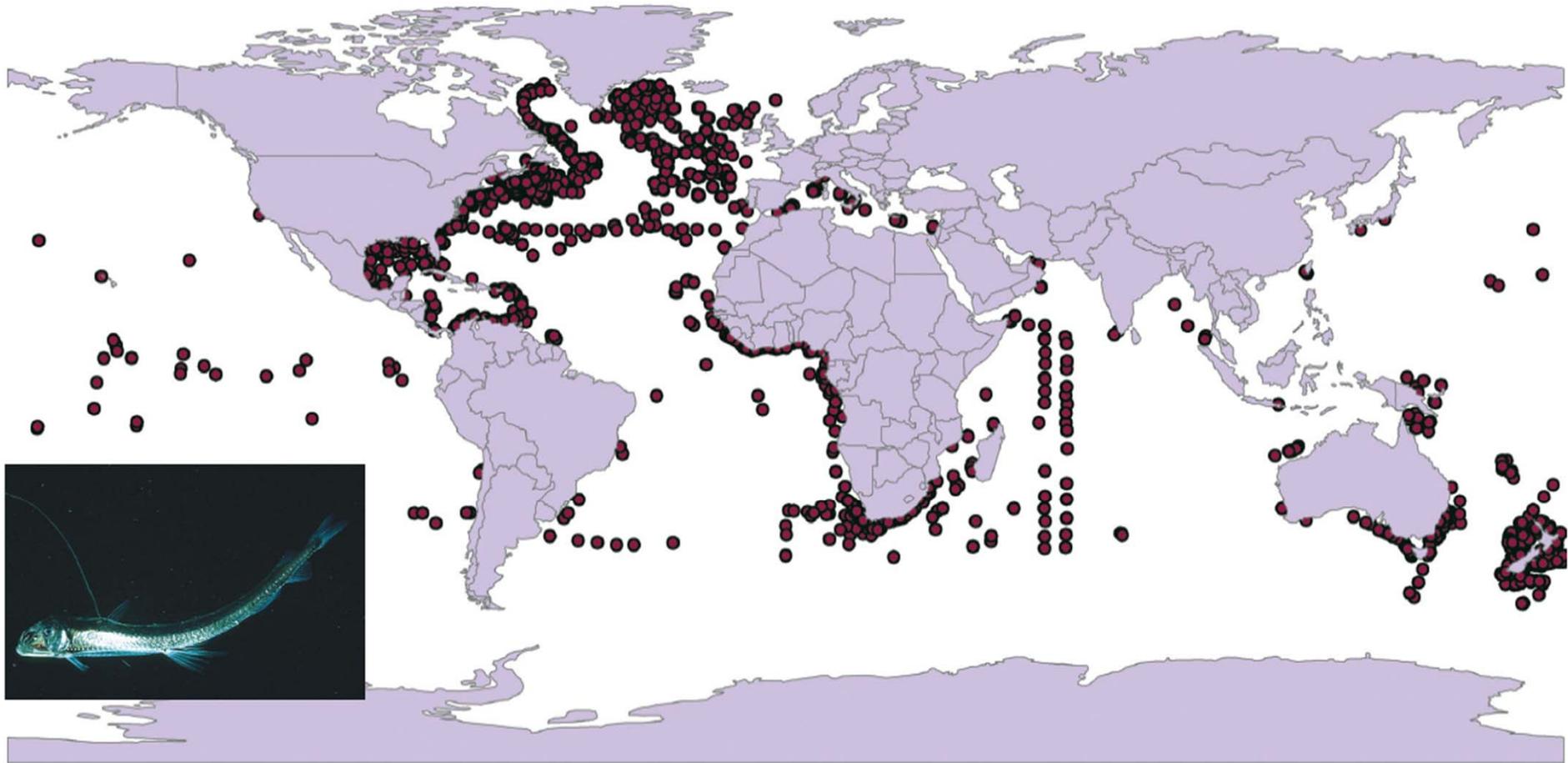
Adopted by The Intergovernmental Oceanographic Commission in Paris

## OBIS Map of Atlantic Cod, *Gadus morhua*



**Typical Distribution Range**

## OBIS Map of Many-light Viperfish, *Chauliodus sloani*



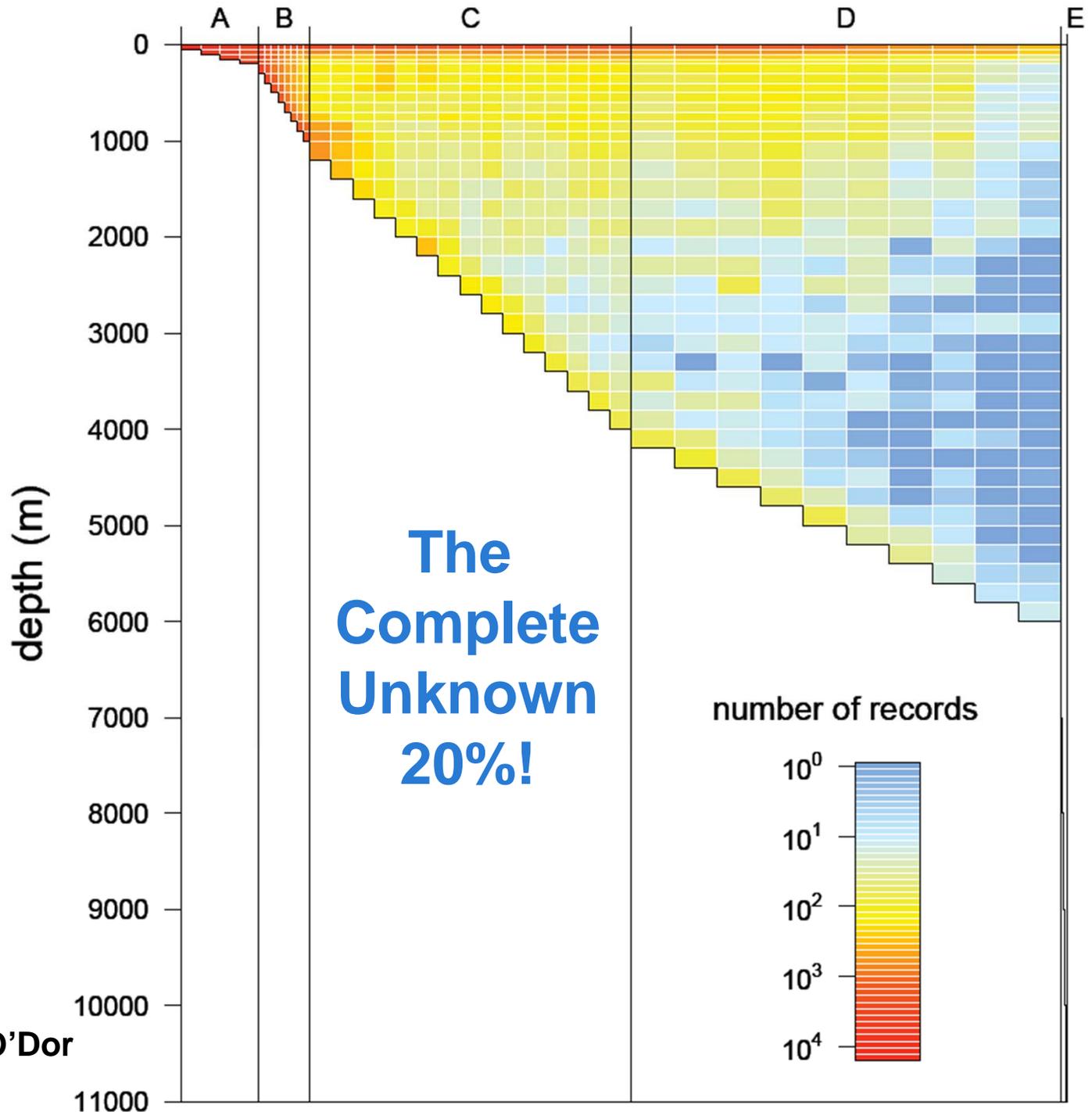
**Cosmopolitan Species Range**



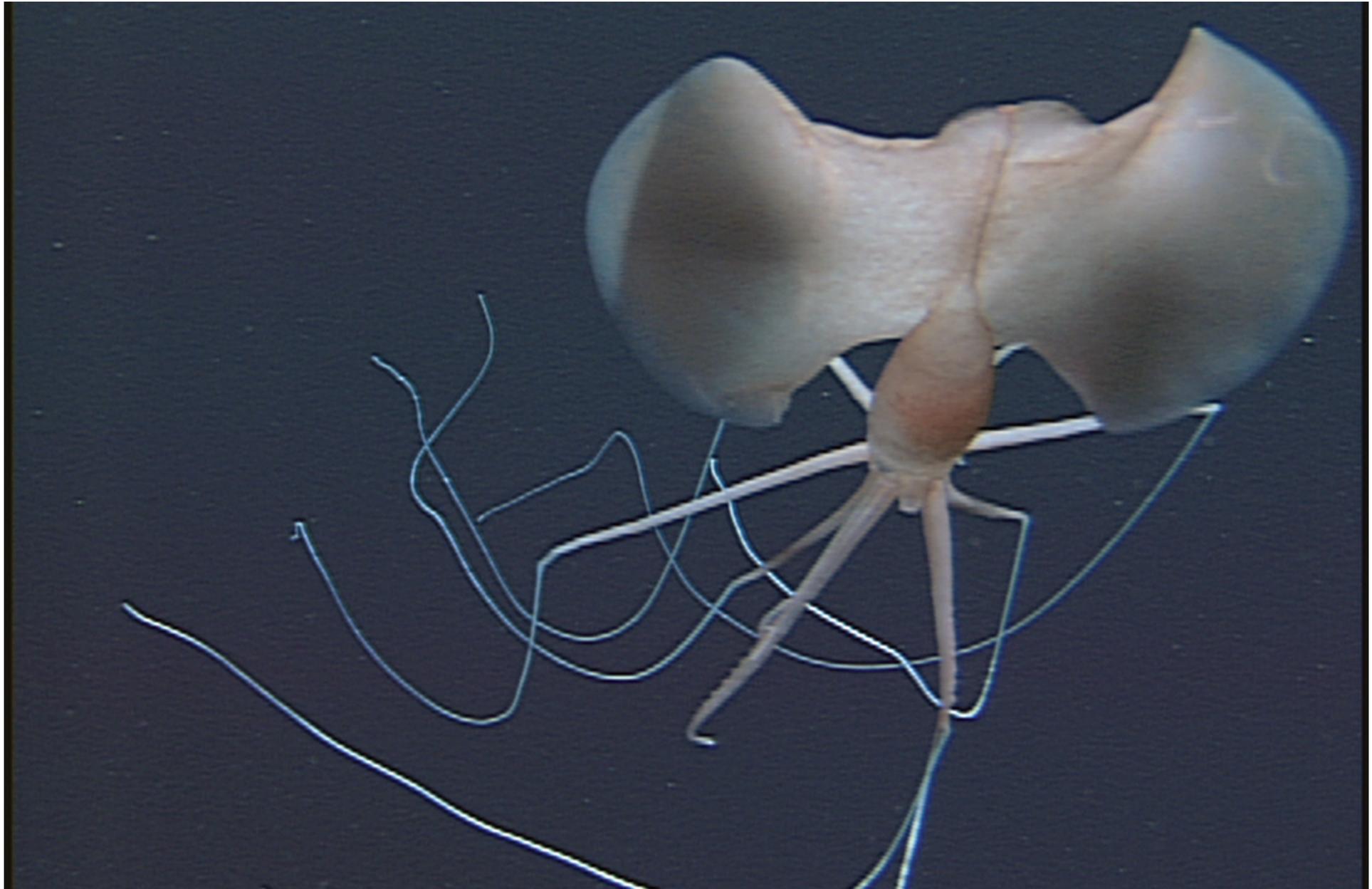
# 22,000,000 Records Relative to Depth

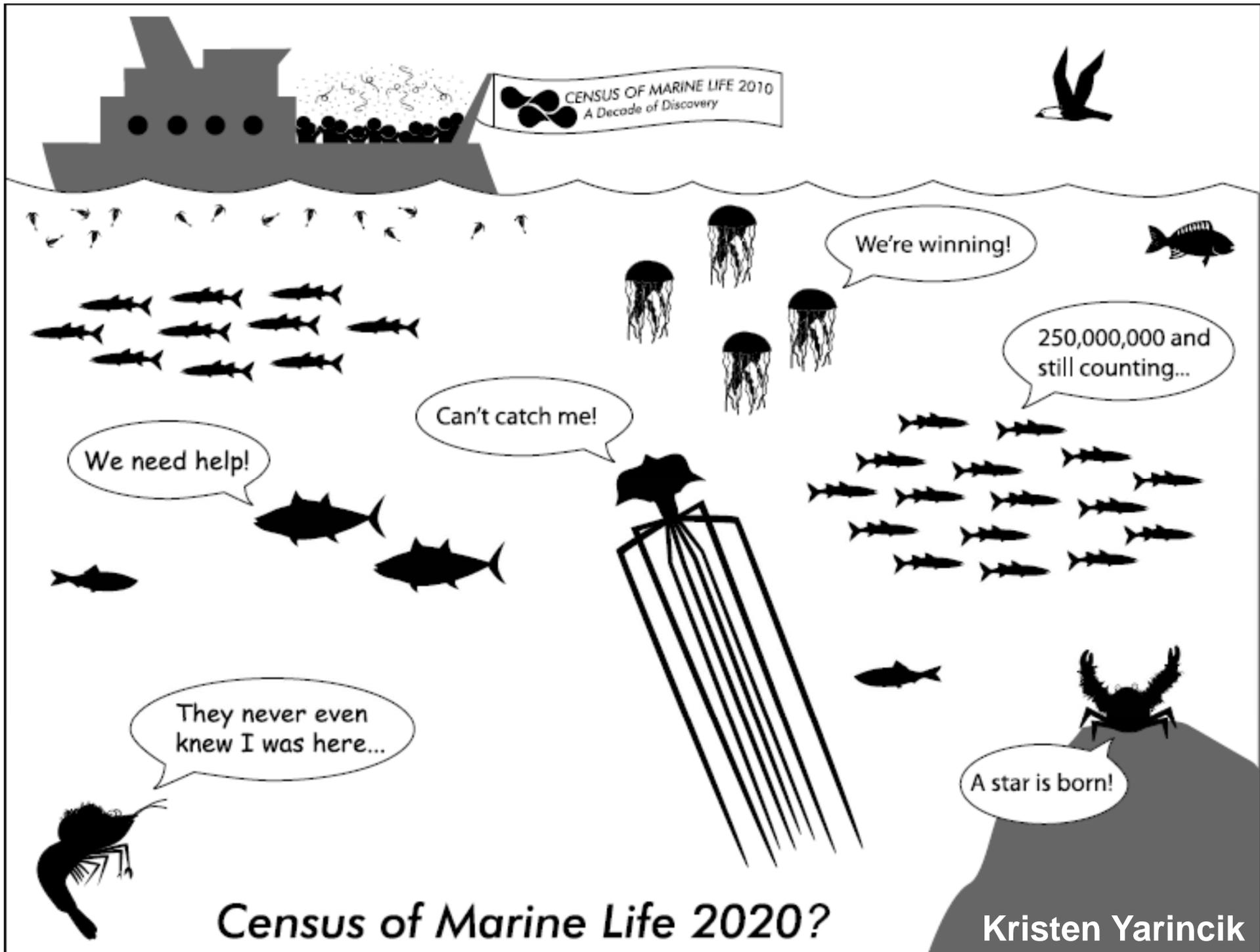
- A - 0-200m
  - B - 200-1000
  - C - 1000-4000
  - D - 4000-6000
  - E - >6000
- x axis ~ area

Webb, Vanden Berghe. O'Dor  
PLoS ONE



# New Family of Bigfin Squid, *Magnapinnidae*, 7 m long!

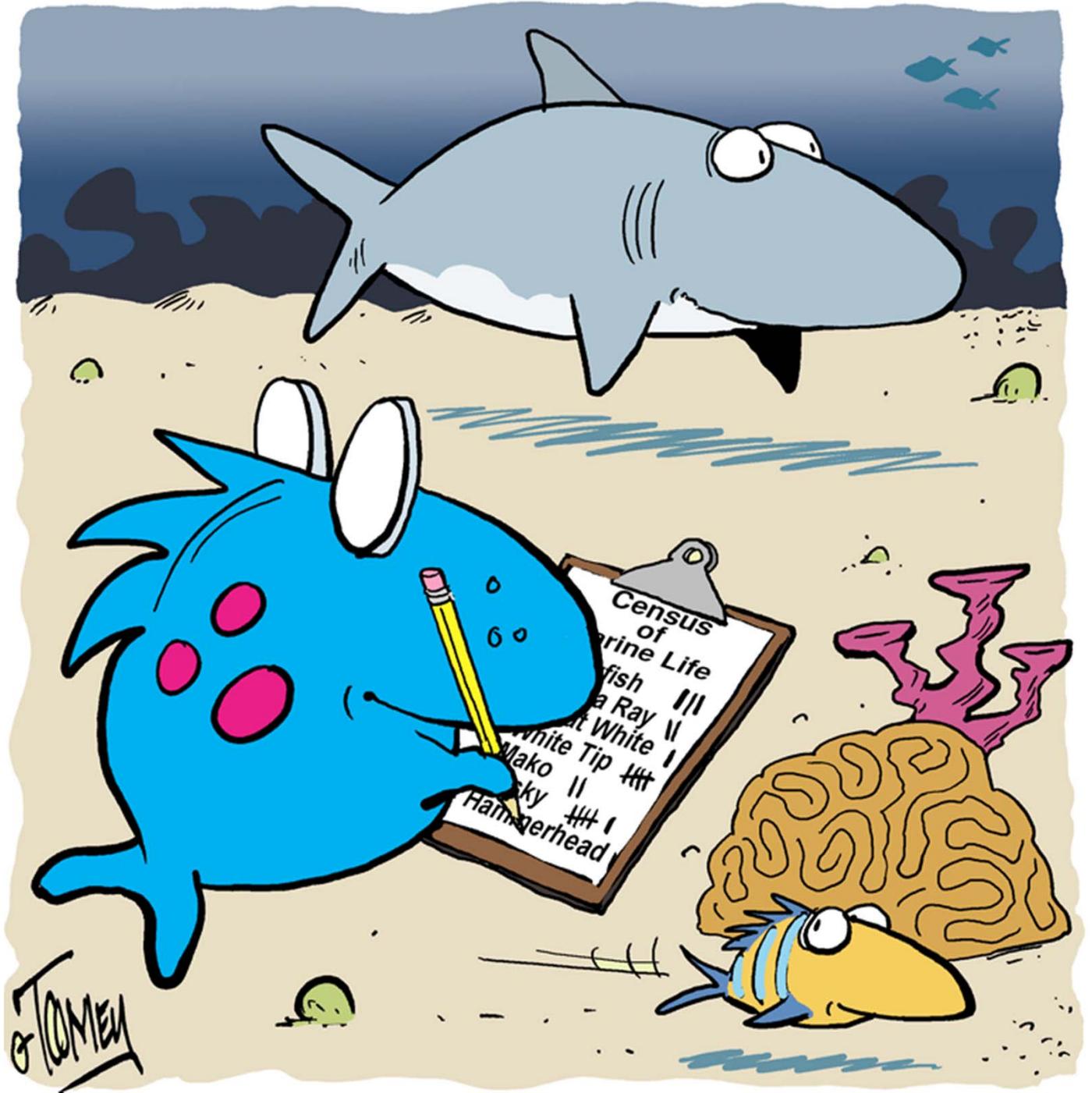




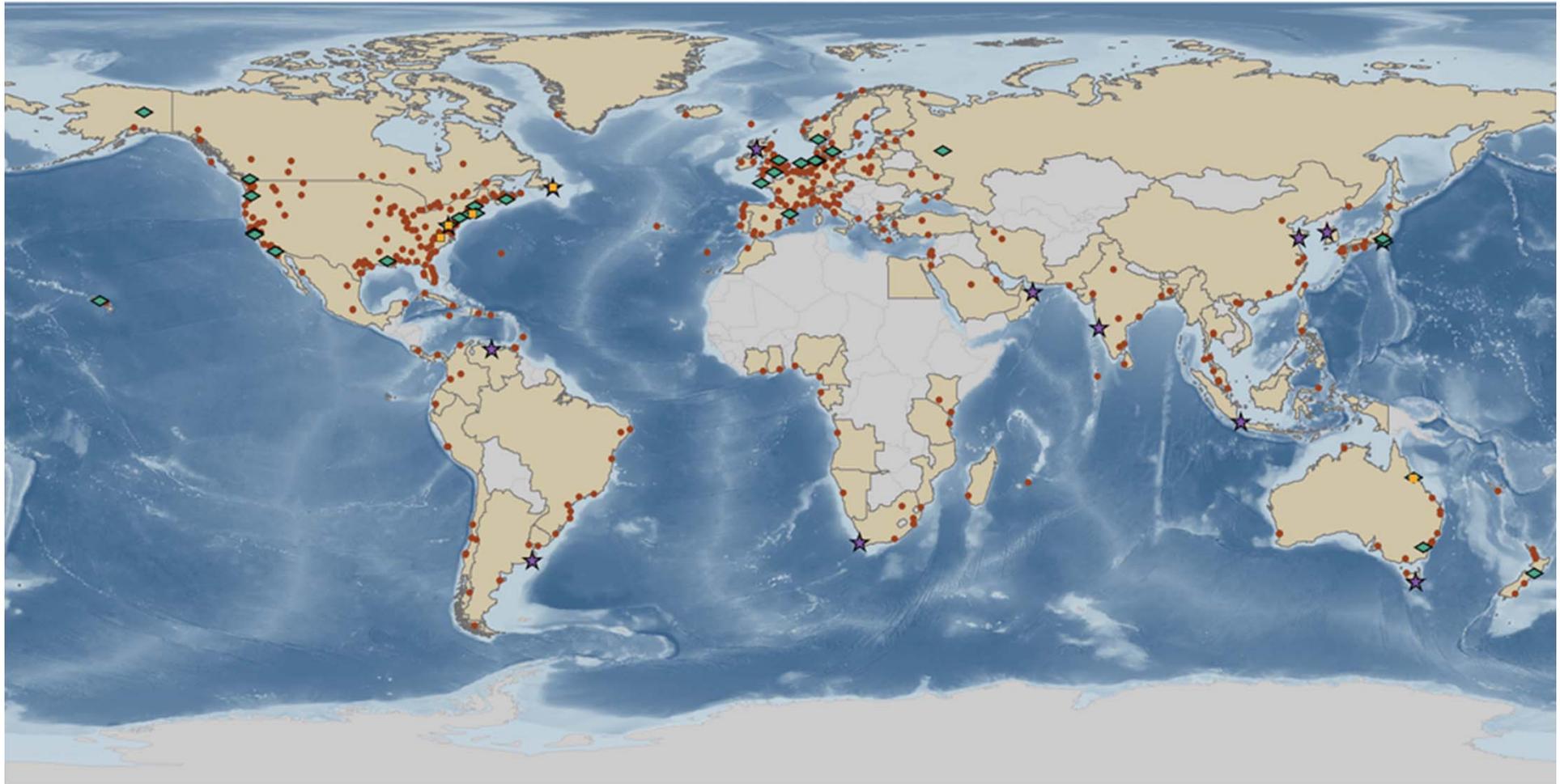
**Census of Marine Life 2020?**

**Kristen Yarincik**

# How Did It Work ?



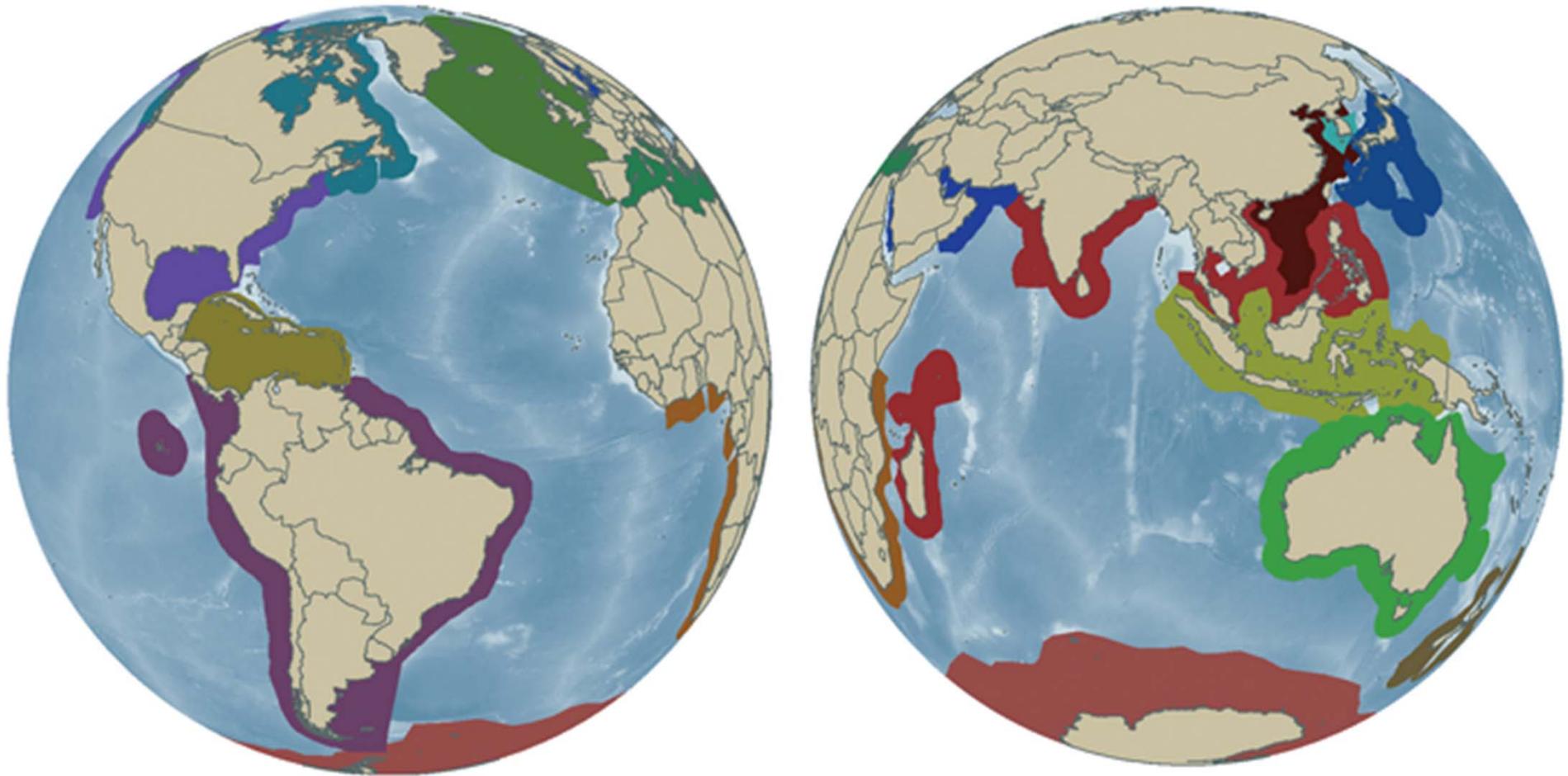
# Census of Marine Life Global Community



- Census global coordination
- ◆ Project headquarters
- ★ National or regional headquarters
- Participating institution
- Participating country

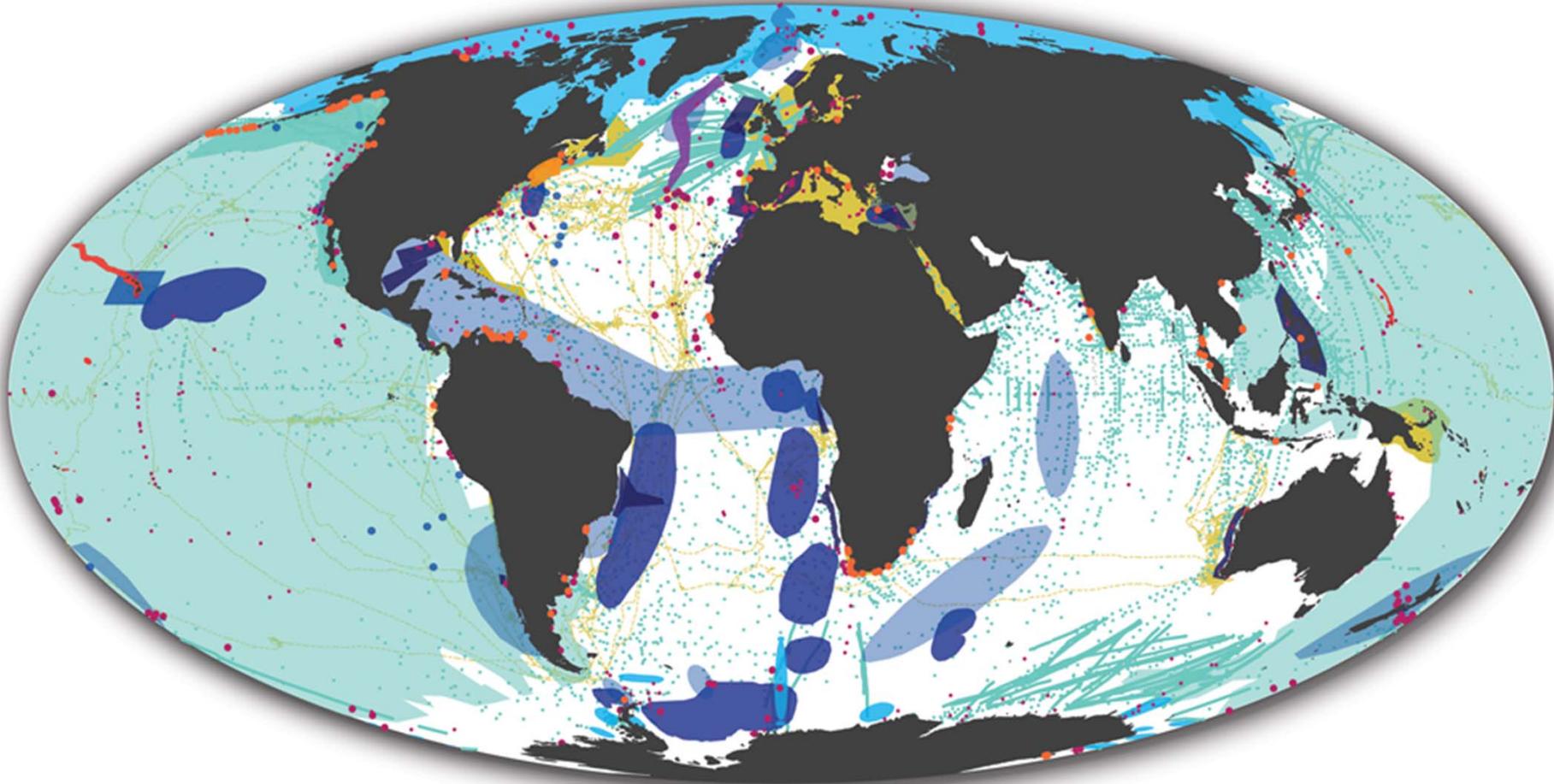
# 14 National/Regional Committees

## Published Diversity Summaries in 25 Coastal Regions



(2010) PLoS ONE 5(8): e12110. doi:10.1371/journal.pone.0012110

# 17 Projects in Space & Time



## Coastal

- Regional Ecosystems (GoMA)
- Near Shore (NaGISA)
- Coral Reefs (CReefs)

## Polar

- Arctic Ocean (ArcOD)
- Antarctic Ocean (CAML)

## Pelagic

- Top Predators (TOPP)
- Continental Shelves (POST)
- Zooplankton (CMarZ)

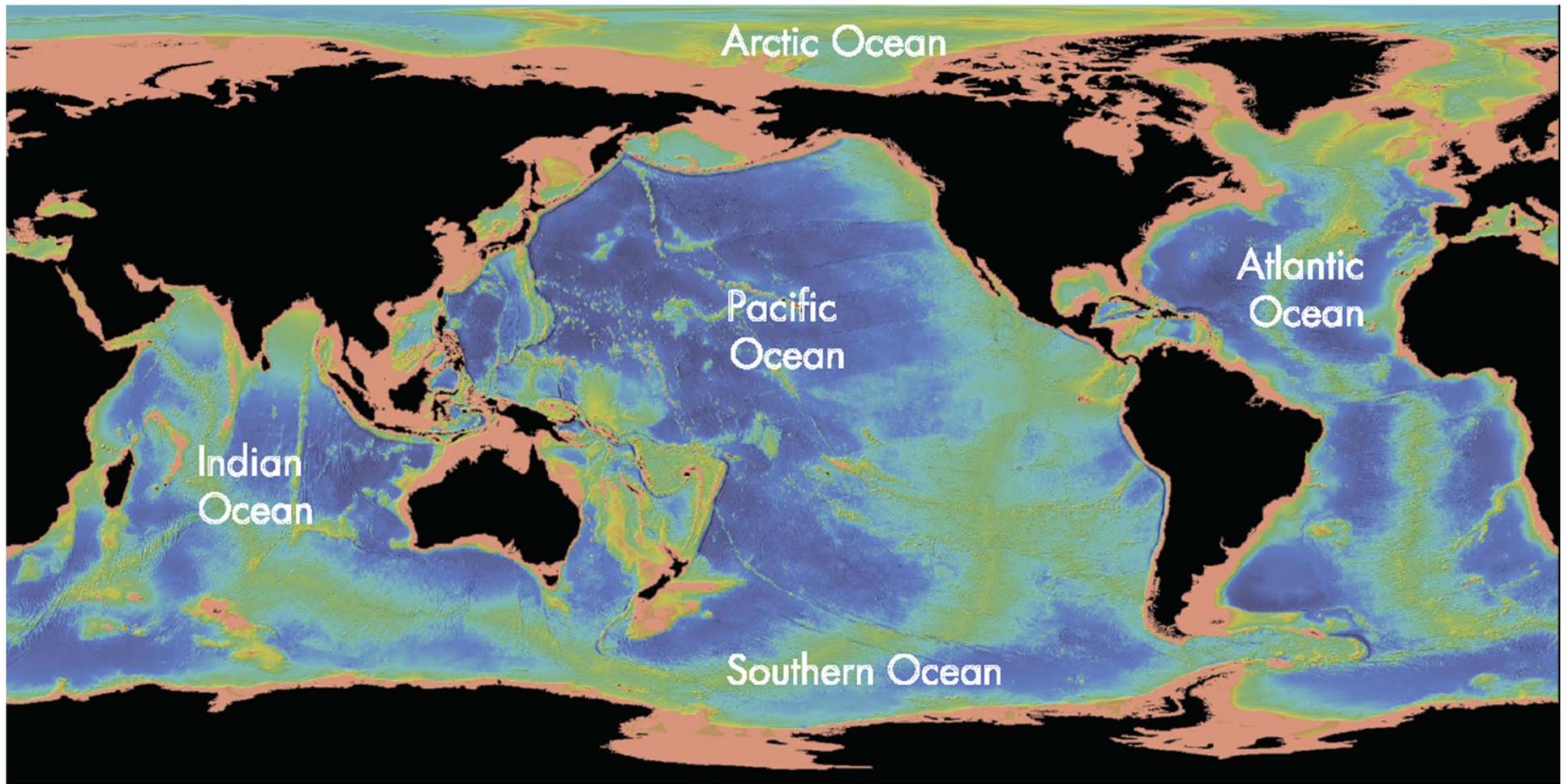
## Deep Sea

- Vents and Seeps (ChEss)
- Abyssal Plains (CeDAMar)
- Seamounts (CenSeam)
- Continental Margins (COMARGE)
- Mid-Ocean Ridges (MAR-ECO)

## Global Information and Analysis

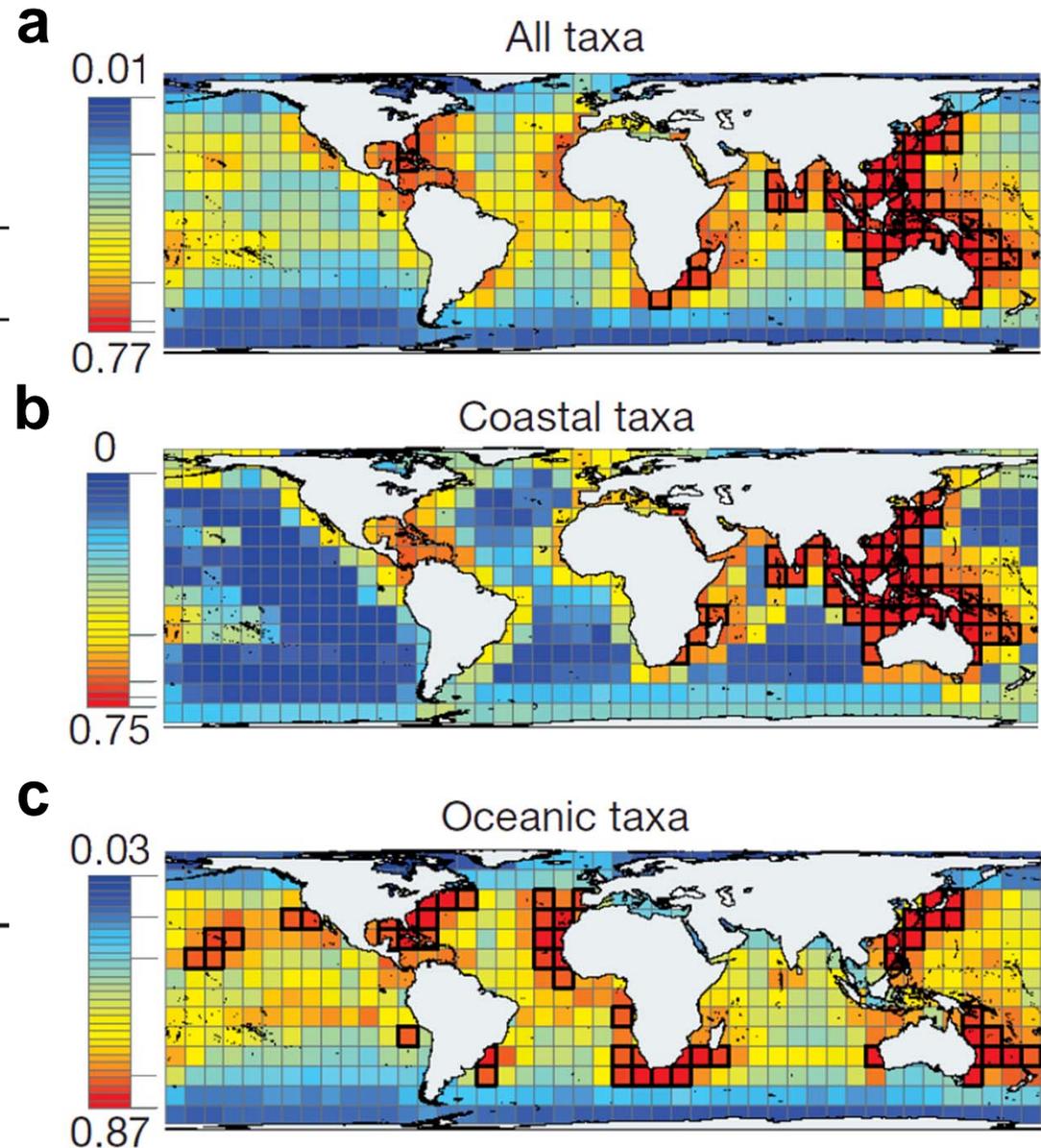
- Oceans Future (FMAP)
- Information Systems (OBIS)
- Microbes (ICoMM)
- Oceans Past (HMAP)

# People are most aware of coasts and shelves, but 10x more deep ocean has many unique habitats



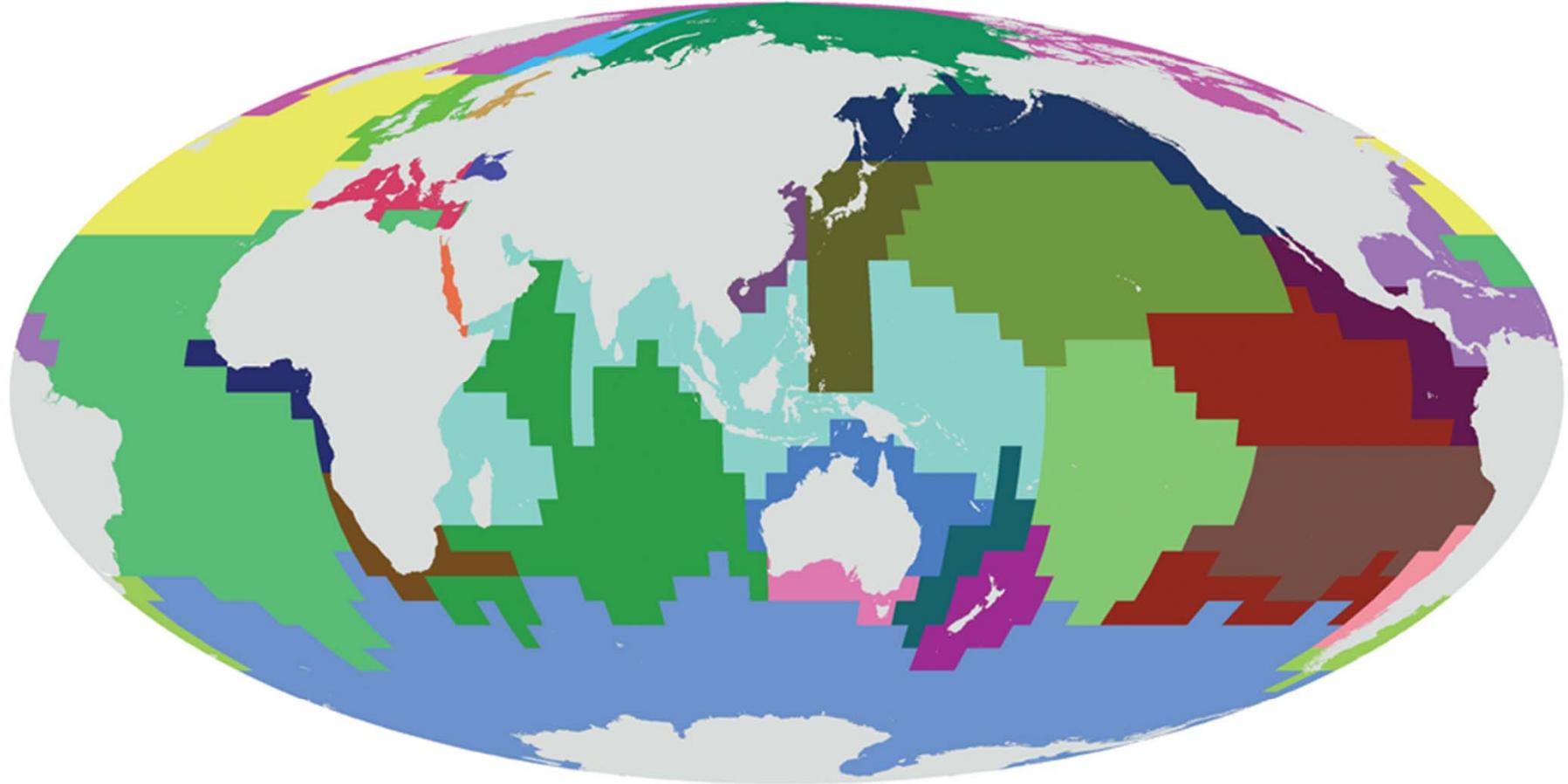
# Biodiversity Hotspots

Species group	Species richness	Per cent of known
<b>Primarily coastal species</b>		
Coastal fishes	9,713	79
Non-oceanic sharks	480	100
Non-squid cephalopods	122	25
Pinnipeds	36	100
Corals	794	95
Seagrasses	60	100
Mangroves	32	60
<b>Primarily oceanic species</b>		
Tunas and billfishes	12	63
Oceanic sharks	27	100
Squids	85	25
Cetaceans	81	96
Euphausiids	86	100
Foraminifera	39	88



Tittensor et al. Nature 2010

# 30 marine biomes with distinctive fauna & flora



*Mark J. Costello*

# Biodiversity by Phylum



**19% Crustacea**  
(including crabs, lobsters, shrimp, and barnacles)



**17% Mollusca**  
(including squid, octopuses, clams, snails, and slugs)



**12% Pisces**  
(fish, including sharks)



**10% Protists**  
(unicellular microorganisms)



**10% algae and plant-like organisms**



**7% Annelida**  
(segmented worms)



**5% Cnidaria**  
(including sea anemones, corals, and jellyfish)



**3% Platyhelminthes**  
(including flatworms)



**3% Echinodermata**  
(sea stars, sea urchins, sea cucumbers)



**3% Porifera**  
(including sponges)



**2% Bryozoa**  
(mat or "moss animals")



**1% Tunicata**  
(including sea squirts)

# Biodiversity by Code

## DNA Barcodes Accelerate Identification and Detection of New Species



Tube anemone



Pelagic snail

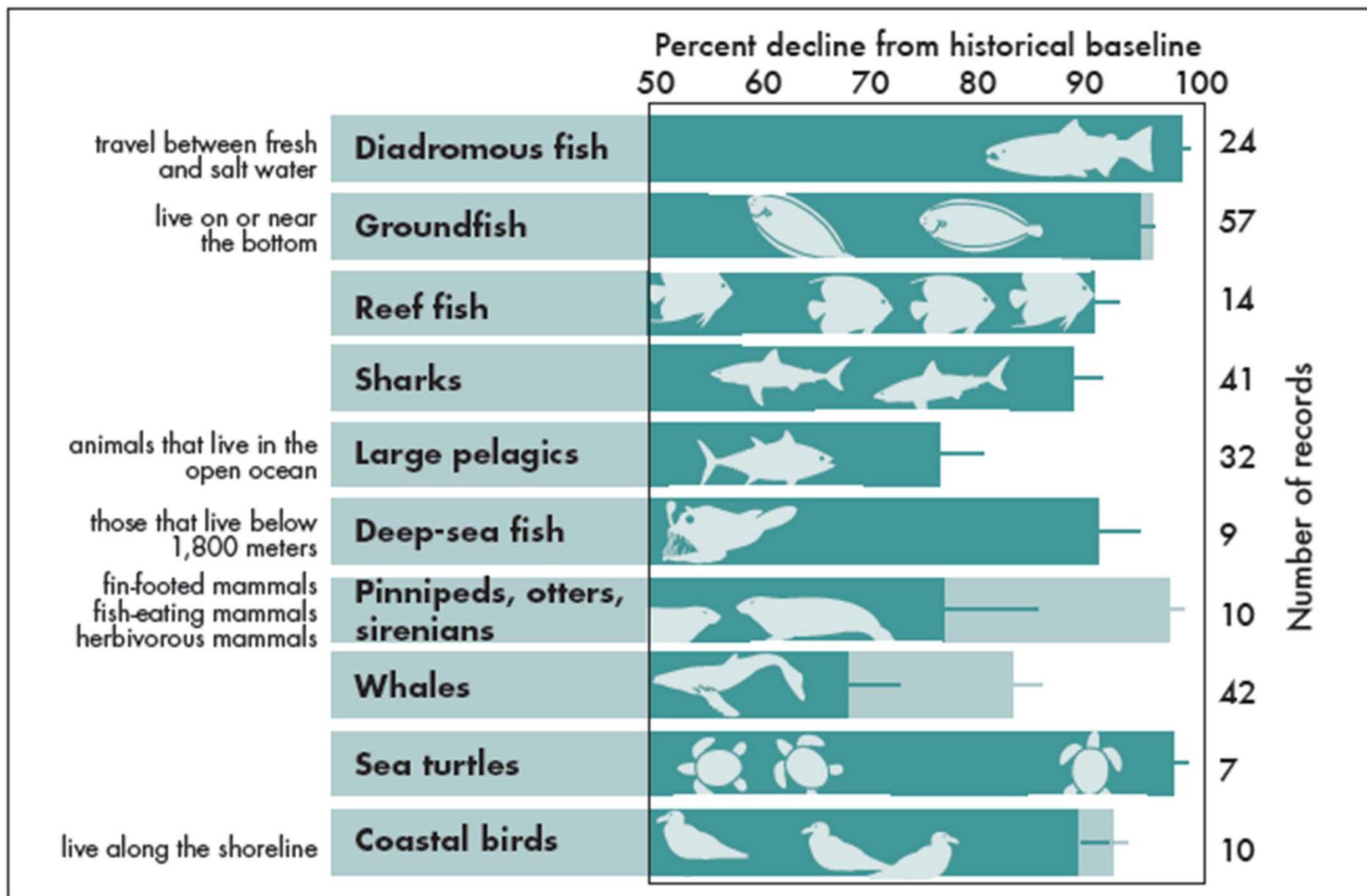


Ambereye shrimp



Arctic Sea star

# Whither The Ocean Predators?



# Census 2020

Census 2010 has provided a Biodiversity Baseline

Climate WILL change, we cannot stop it!

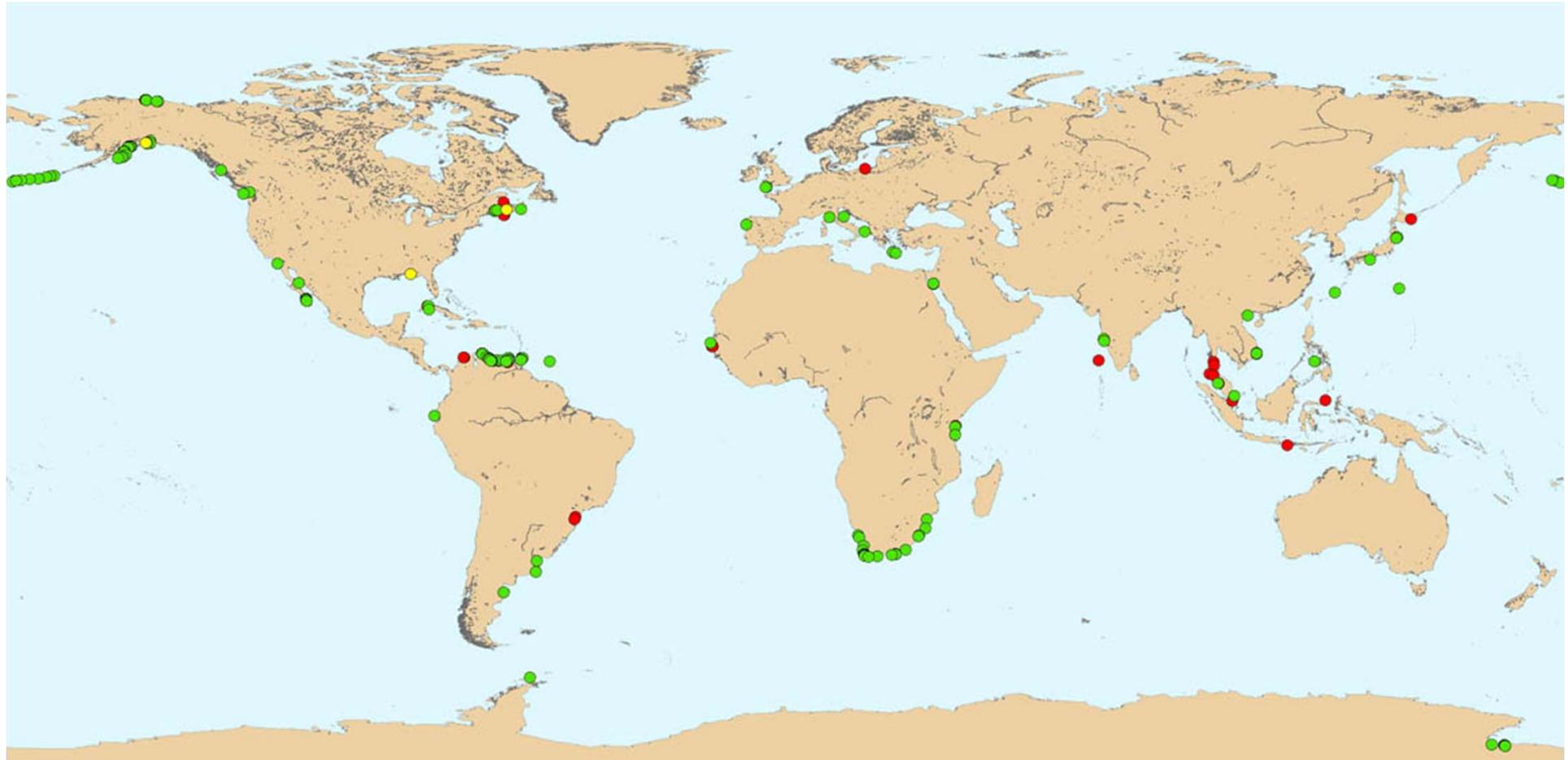
What can we save?

Optimizing:

MPAs, Food Security, Ecosystem Services

How much will it cost?

# Quantitative Global Coastal Baseline For Future Standardized Monitoring



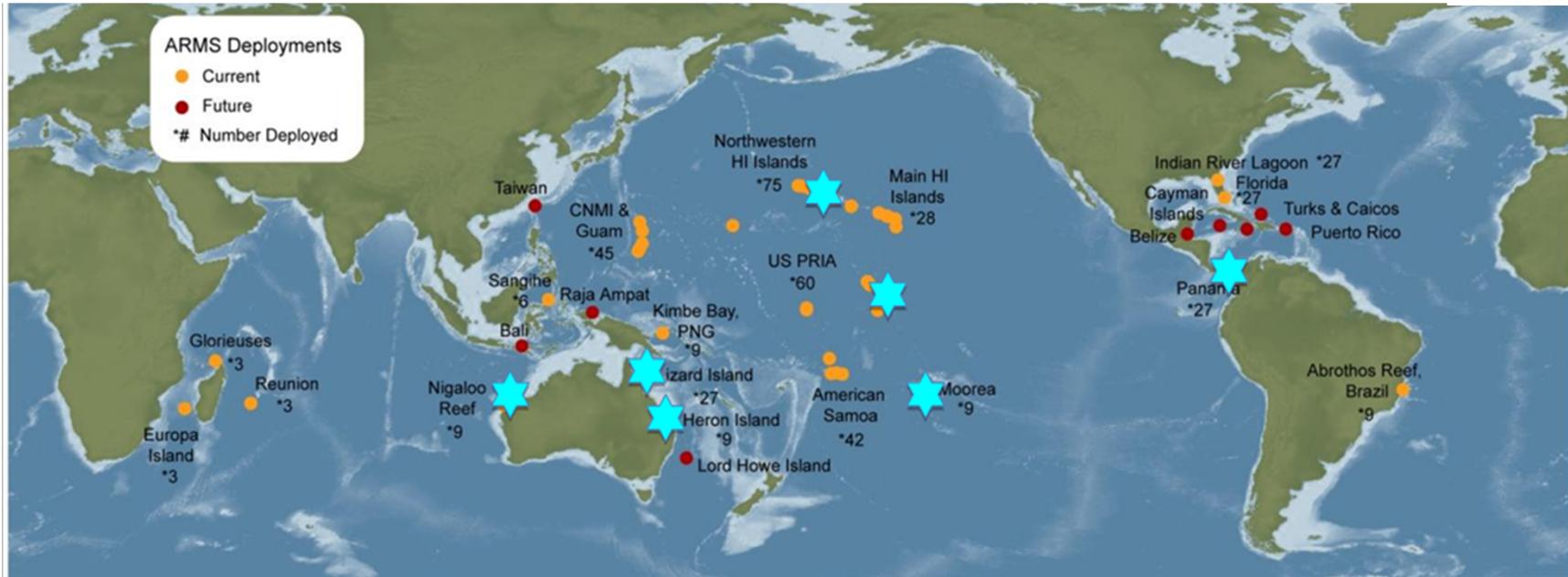
● Rocky macroalgal sites  
N=182

● Seagrass sites  
N=71

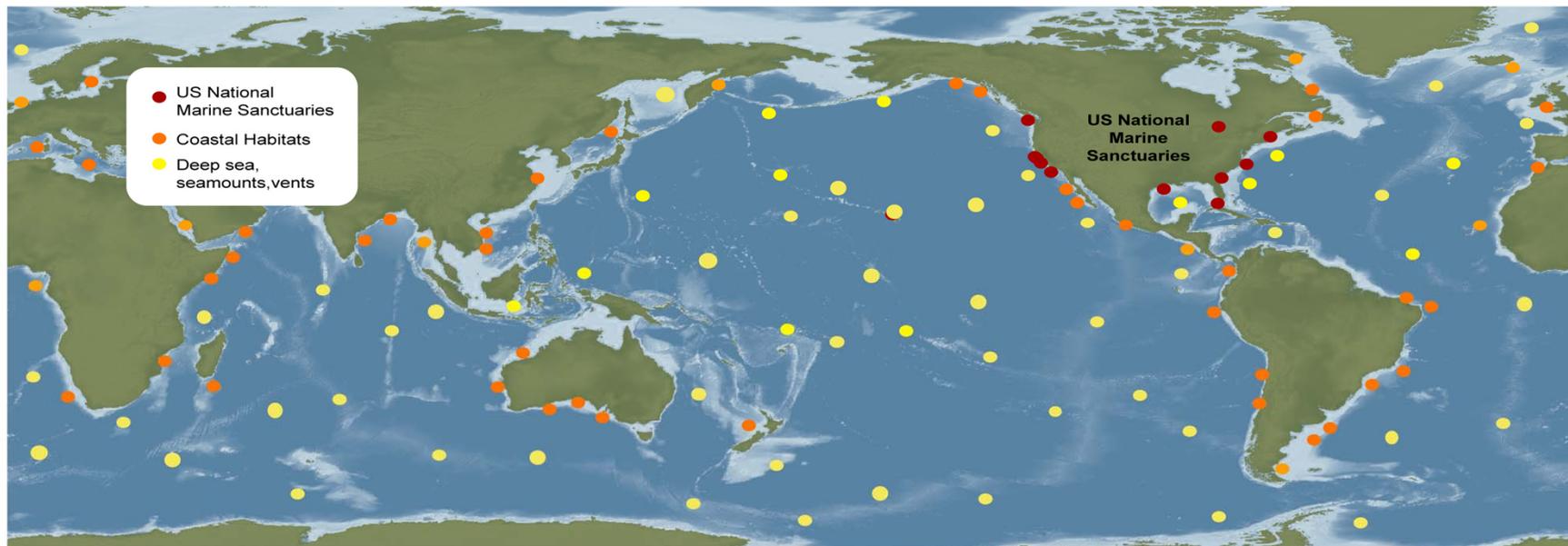
● Other habitats  
N=3

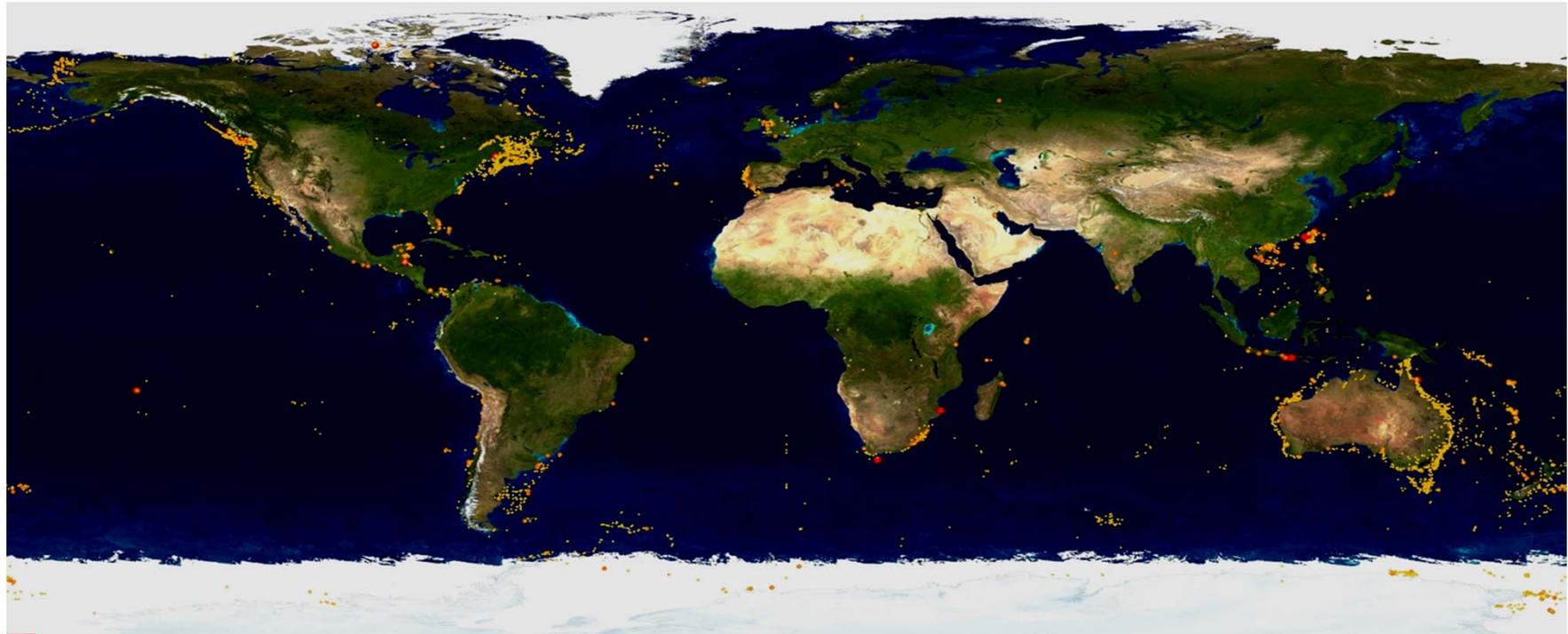
**Data in OBIS: 54,782 records for 2,779 taxa (23 Jul 2010)**

# Autonomous Reef Monitoring Structures



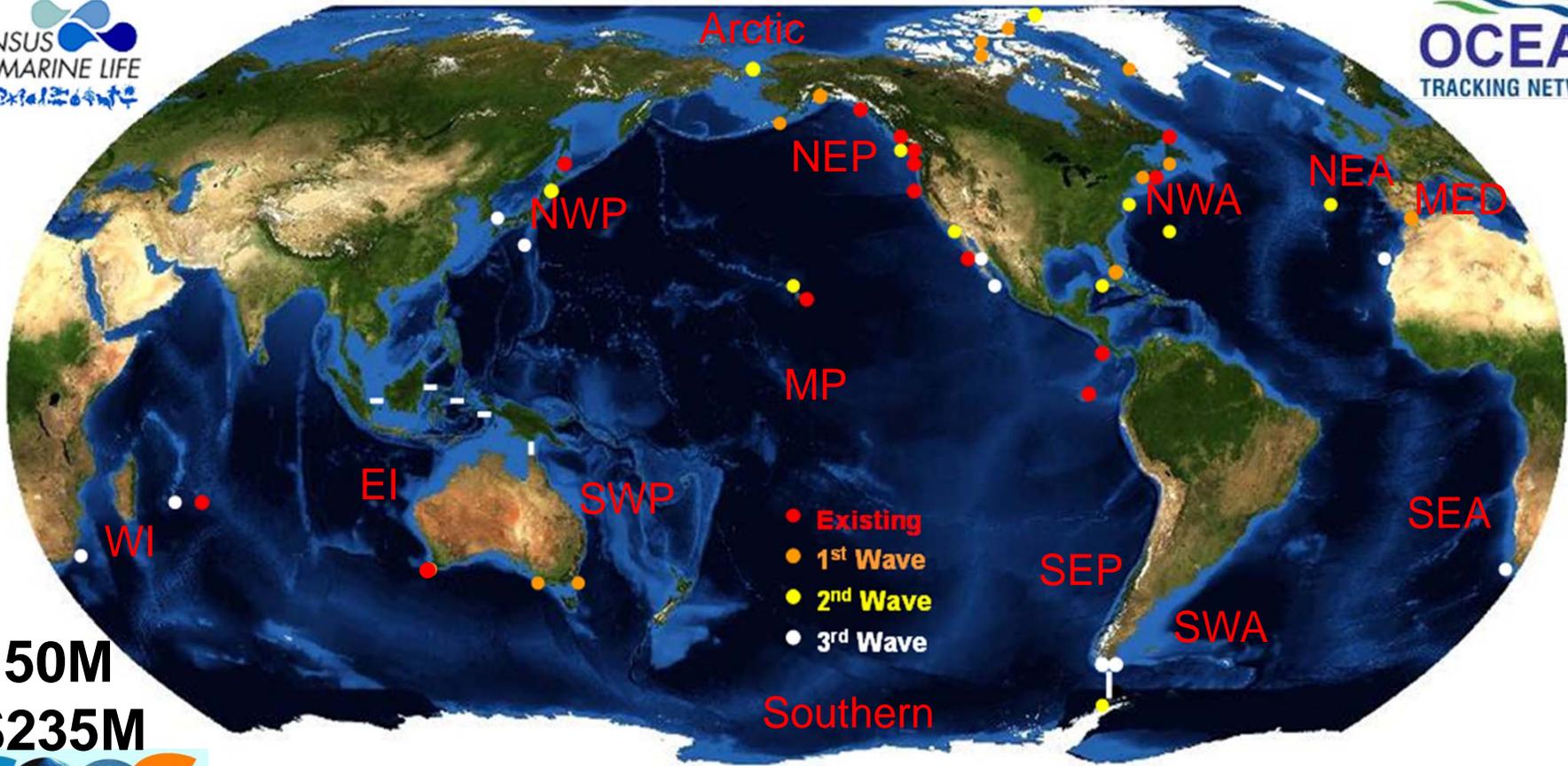
Sites where ARMS and/or *Pocillopora* heads analyzed - 600 deployed





**\$20M**

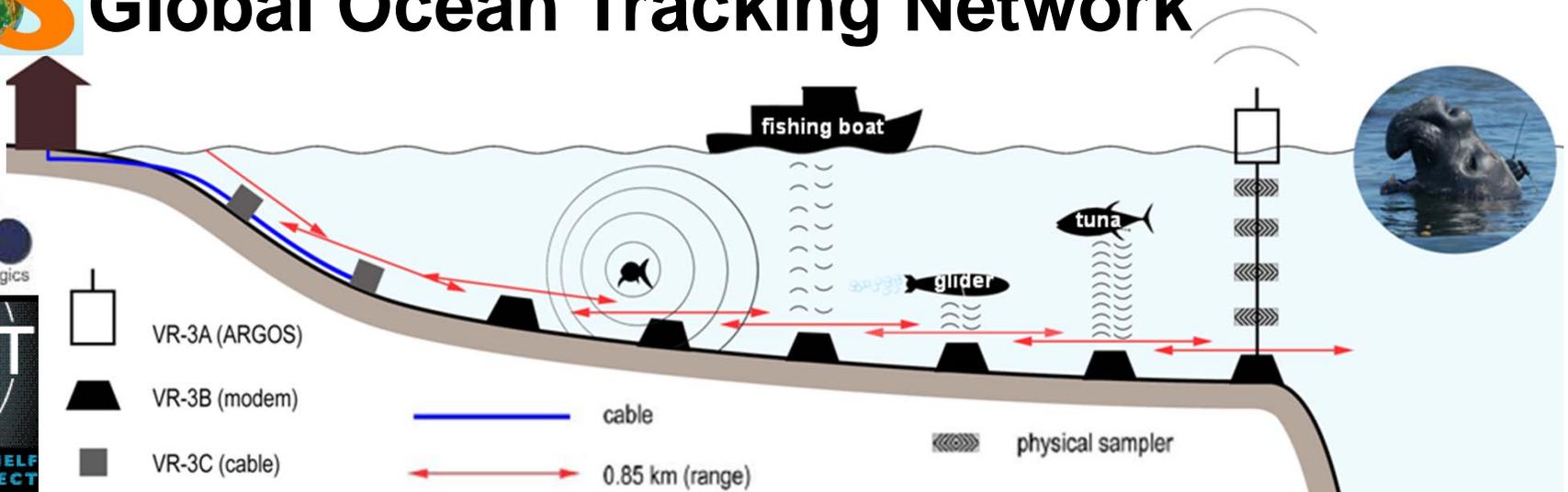
The Mobile Barcoding Laboratory.



\$150M  
+\$235M



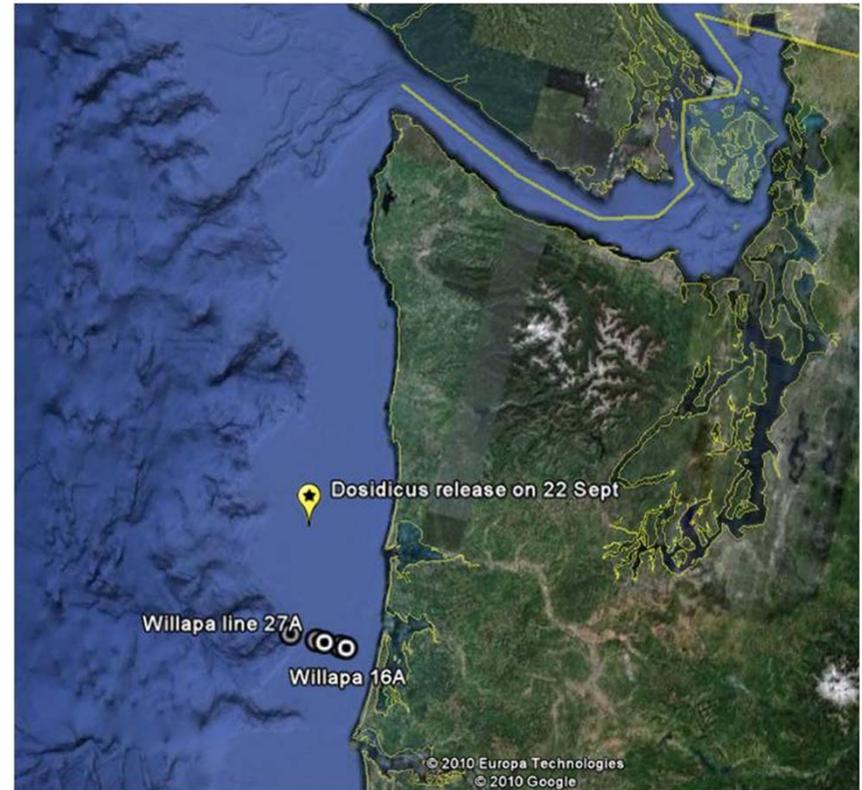
# Global Ocean Tracking Network



# POST Continental shelves play a key role in the life histories of most marine species



Humboldt squid, a deep water sub-tropical species, may threaten fisheries as it extends its range north.



# MAR-ECO's Silent Vessels



Norway - *G. O. Sars*

100-fold sensitivity, shrimp 3 km down!



UK - *James Cook*

US - *Henry B. Bigelow*

10,000 m wire

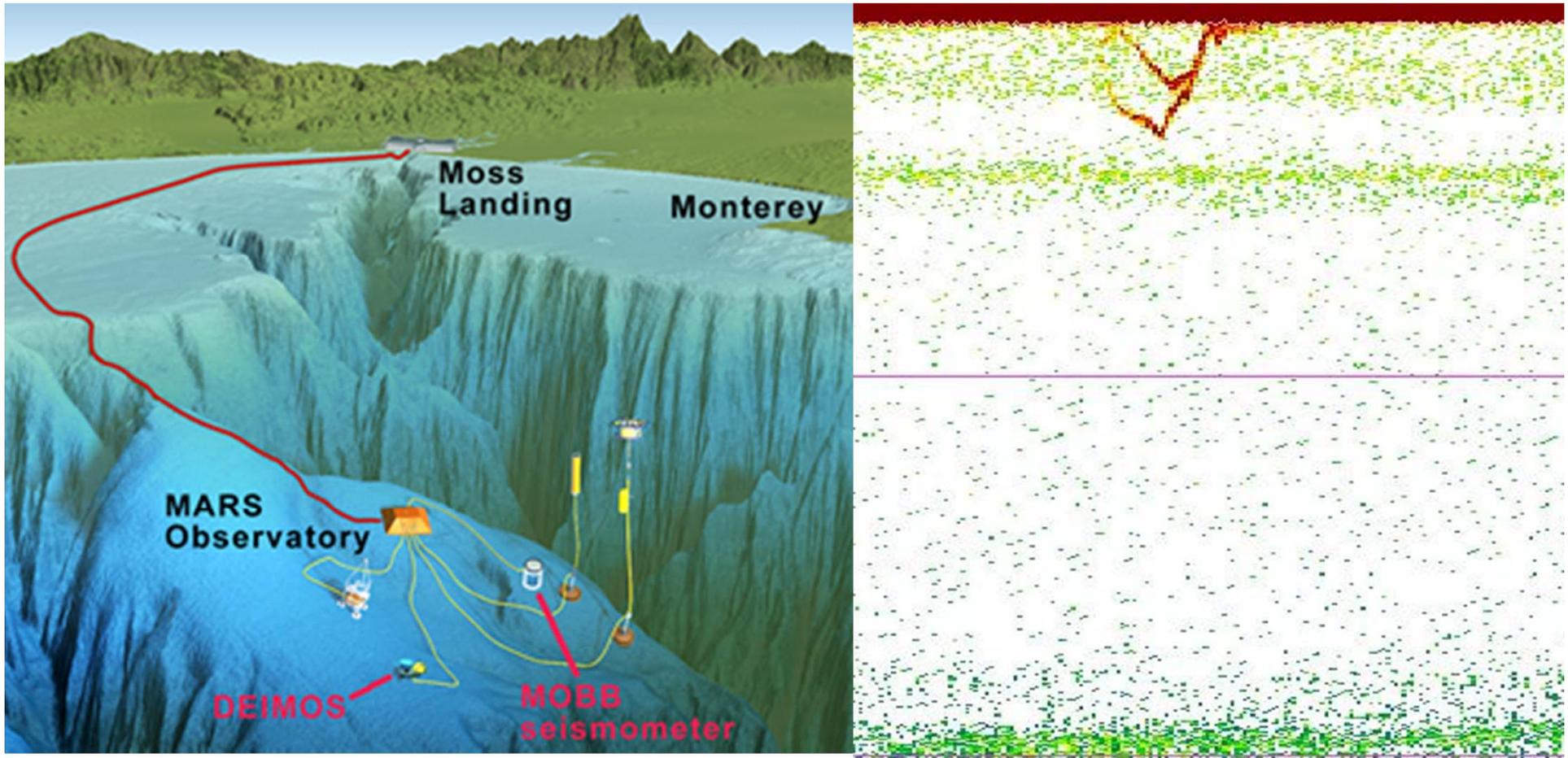


IOC – “*Patricio Bernal*”

For the  
Southern Hemisphere  
?

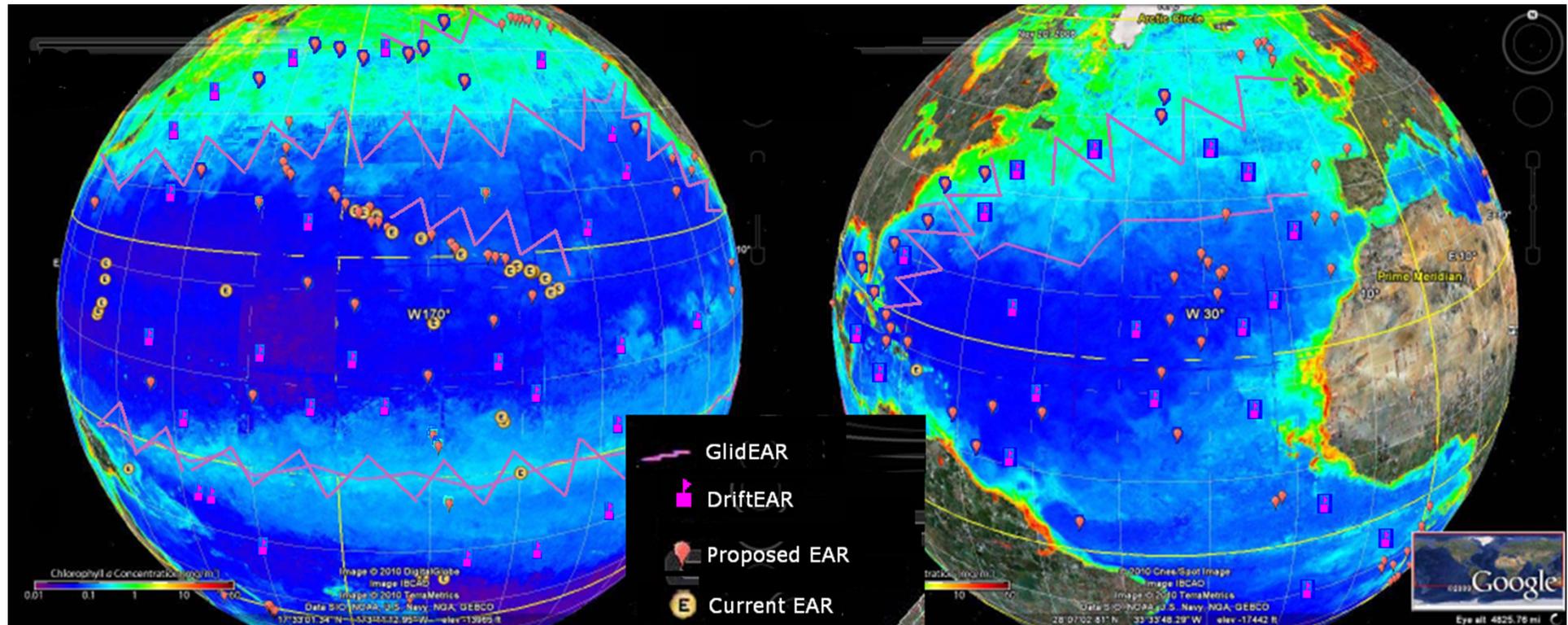
**\$192M**

# Adding Active Acoustics to the MARS Observatory



John K. Horne, Richard B. Kreisberg, David H. Barbee  
[www.acoustics.washington.edu/DEIMOS](http://www.acoustics.washington.edu/DEIMOS))

# Ecological Acoustic Recorders (EARs)

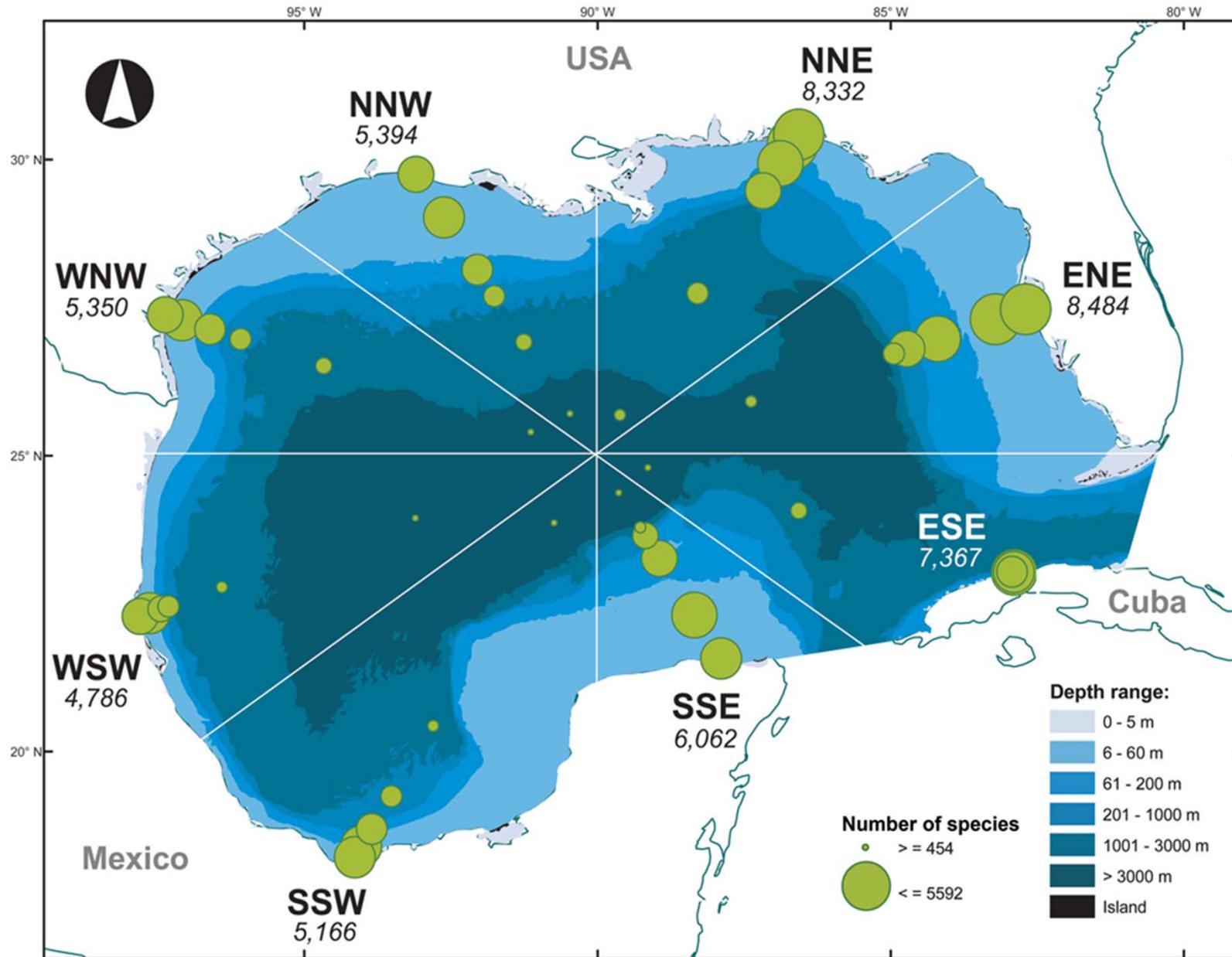


## Ecological Acoustic Observation Network (EAON)

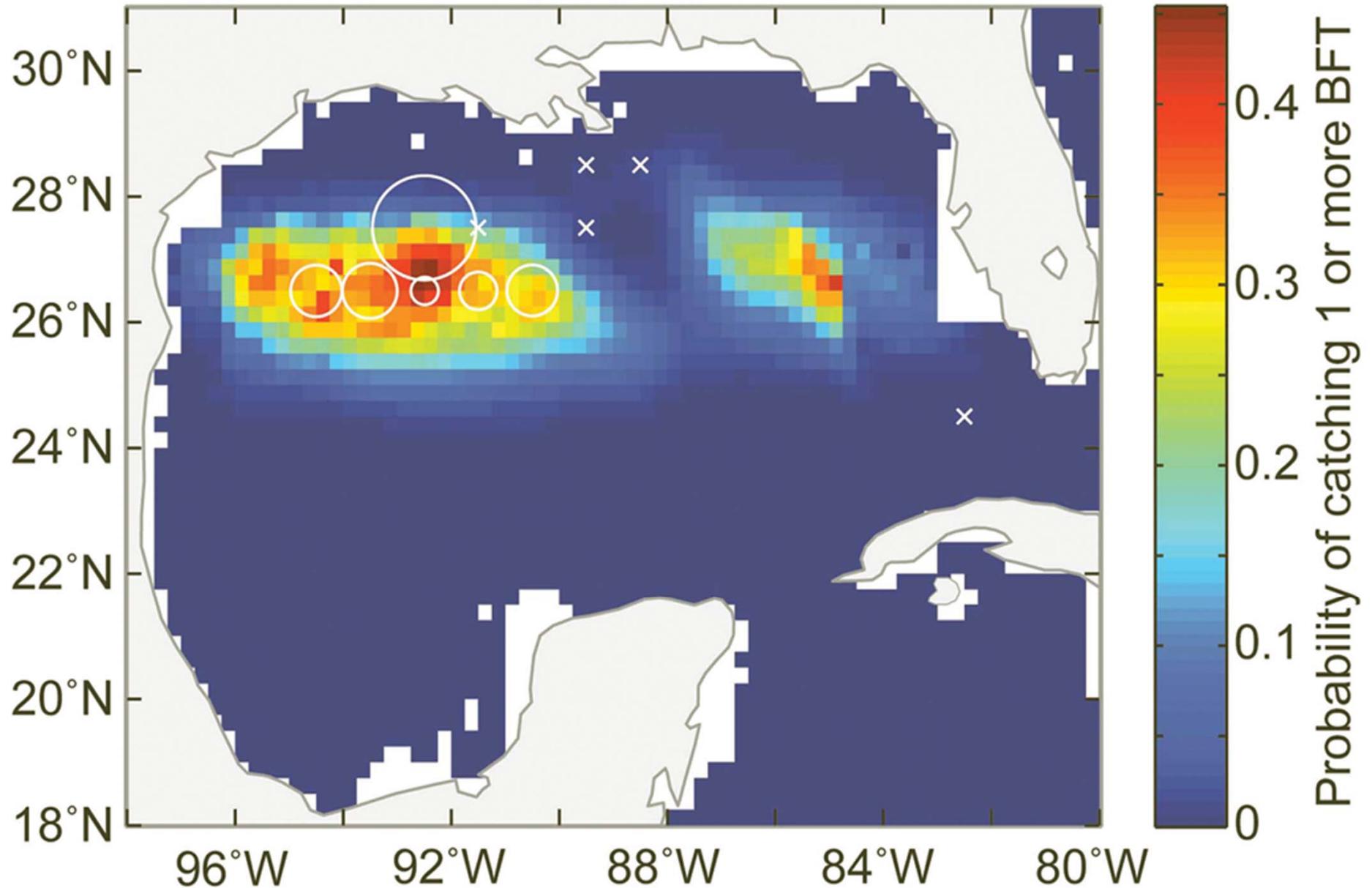
Passive acoustic monitoring of  
marine mammals, fish & invertebrates

Fixed or dynamic  
EARs for NaGISA?

# What Good Is An Ocean Census?



# How Did Bluefin Tuna React?



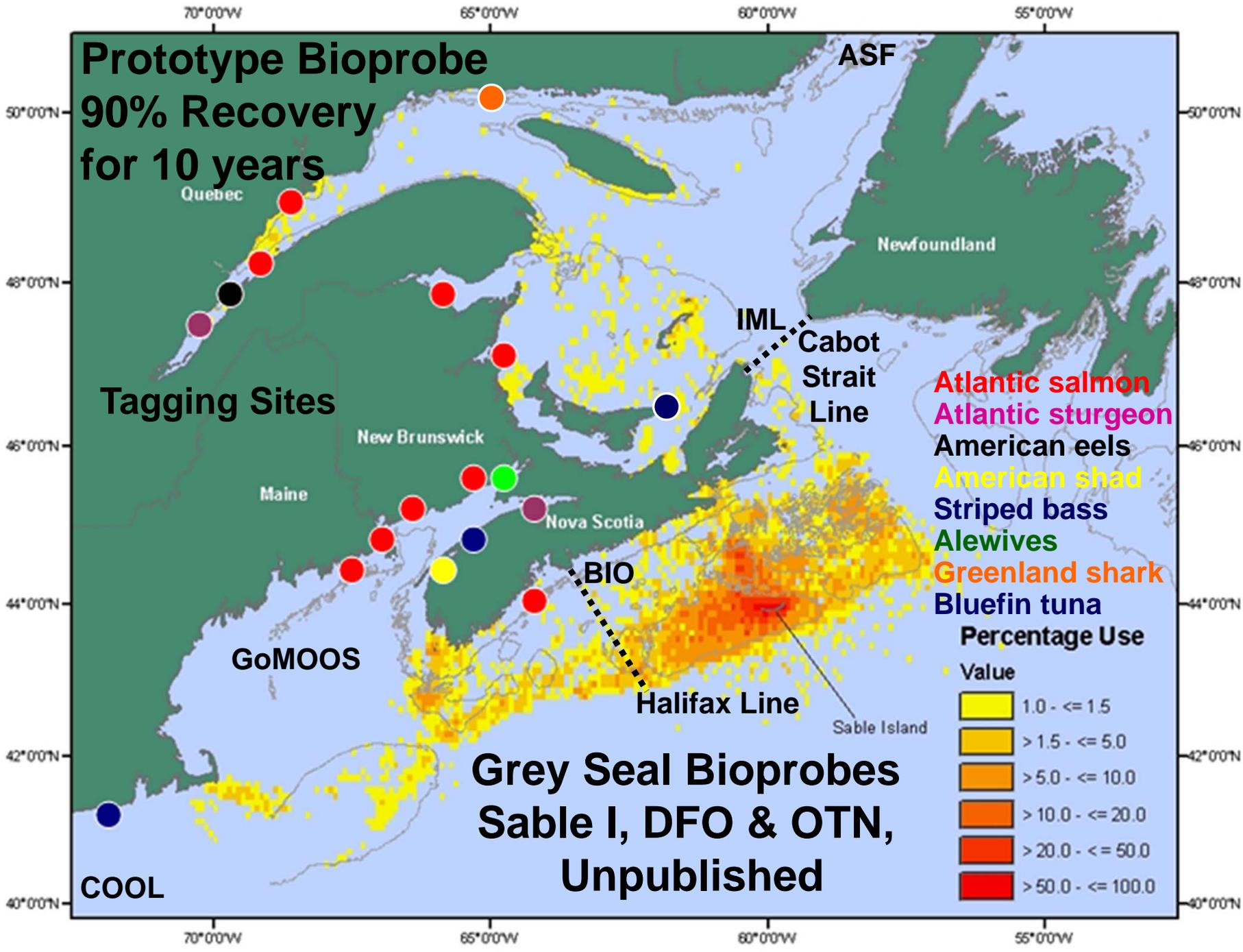
# Double-tagged bluefin tuna Gulf of St. Lawrence, Canada

Satellite  
1 year



Acoustic  
10 years





**One of 15 grey seal Bioprobes released  
Sable Island, October 2009, DFO Canada  
Satellite and 100% duty cycle Business Card Tag**



**Listens**

**Transmits**