New York City, 4 February 2011, MBL Board of Overseers

Planet Ocean

The Census of Marine Life: A Look at All Life in the Sea

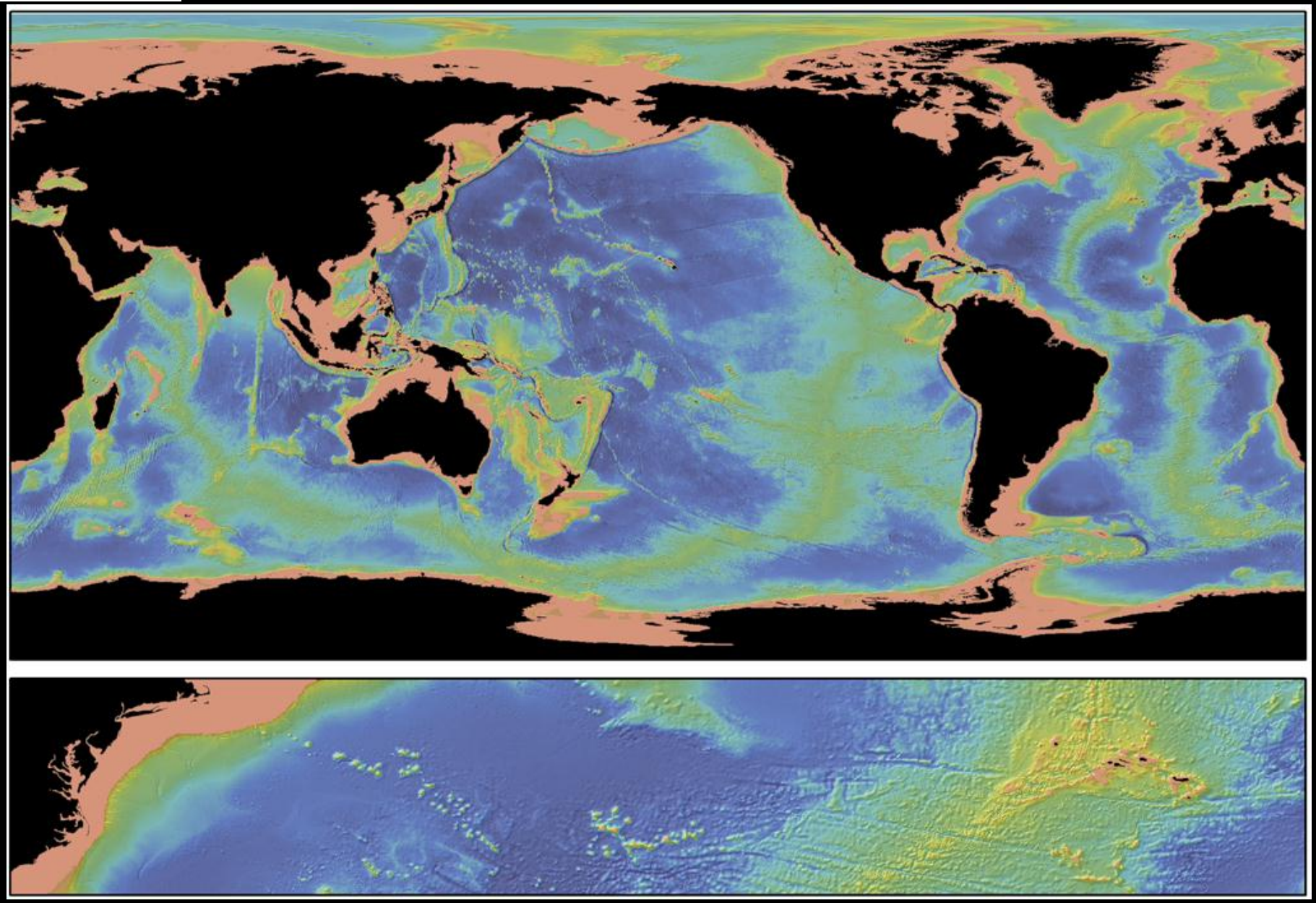
Jesse H. Ausubel

Alfred P. Sloan Foundation and The Rockefeller University

A DECADE OF DISCOVERY
CENSUS OF MARINE LIFE 2010

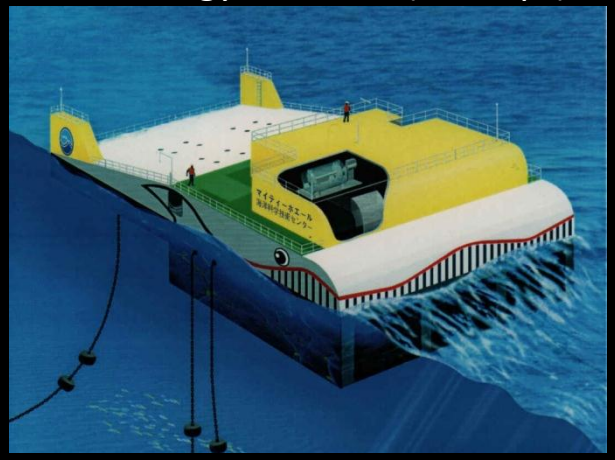
CENSUS OF MARINE LIFE

A reminder of features of Planet Ocean



Why a Census:
A more crowded ocean and yet an unexplored, unknown ocean

Wave energy machine (concept)



More uses, more users

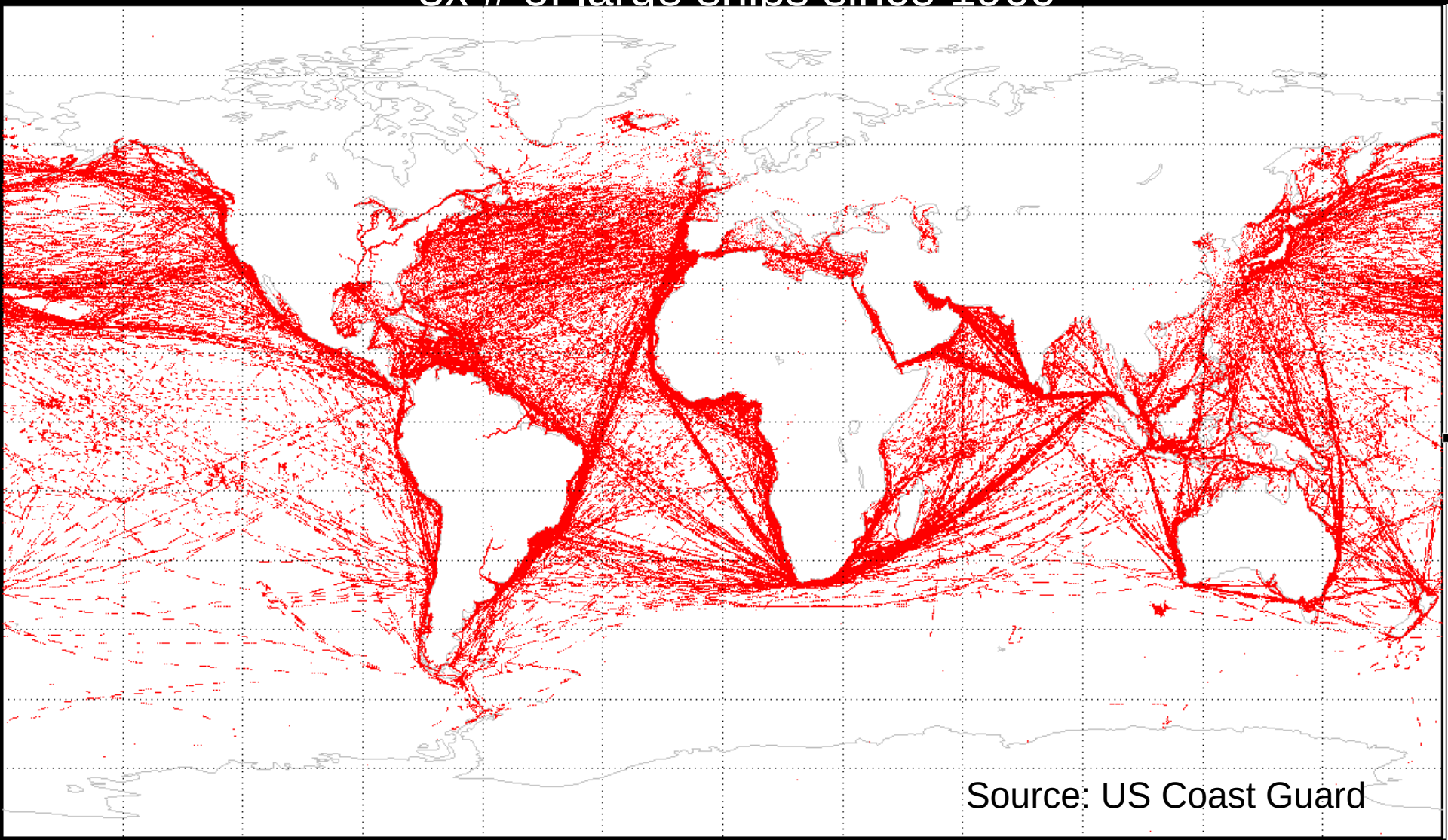
Drilling derricks

Crowding: Maritime Transport

Time lapse tracks of vessels > 300 gross tons, 2009

Busy highways but also areas with few vessels;

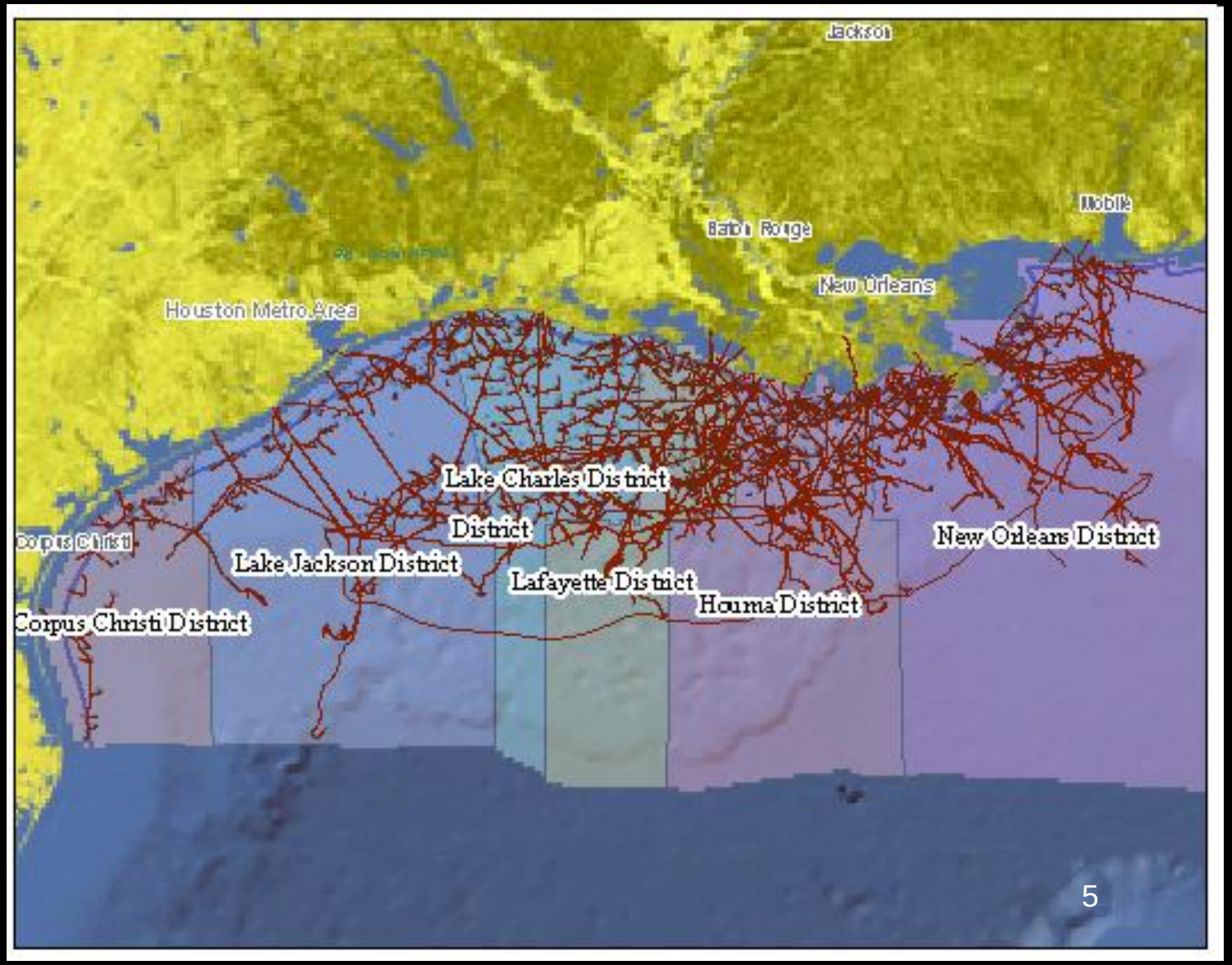
3x # of large ships since 1960



Source: US Coast Guard

Offshore oil & gas: Extensive, complex networks

Gulf of Mexico pipeline network



Source: NOIA

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How a Census? People and technology

Source: CoML NaGISA

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At work in Antarctic Waters

Source: CoML CAML

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Polar Sampling

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How: A concerto of technologies

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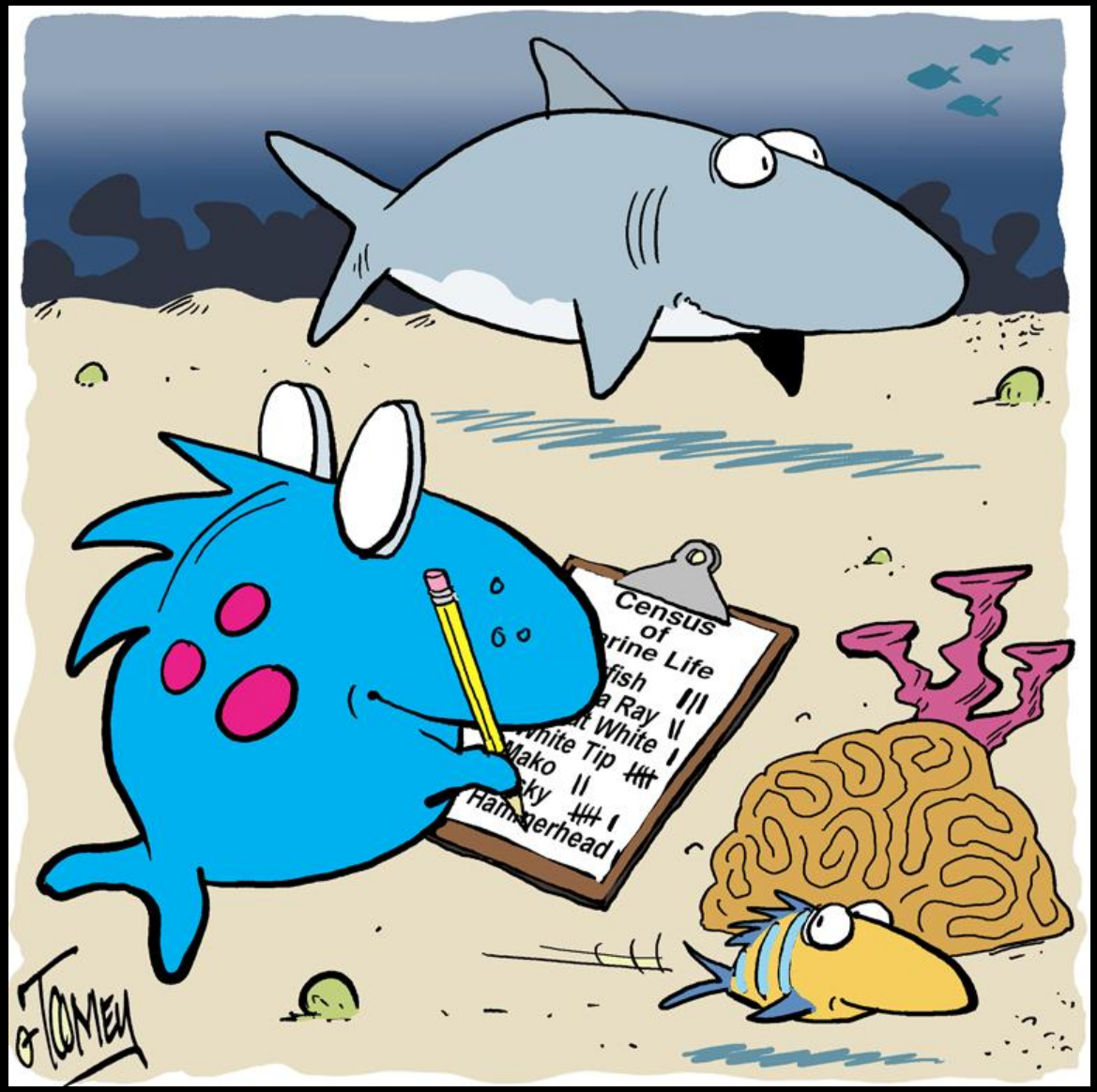
What? The Census surveyed

Diversity:
Kinds of life
Richer

Distribution:
Where they live & travel
More connected

Abundance:
How much of each kind
More altered



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Some newly discovered species: North Atlantic deep-sea octopod *Stauroteuthis syrtensis*

Source: CoML MAR-ECO

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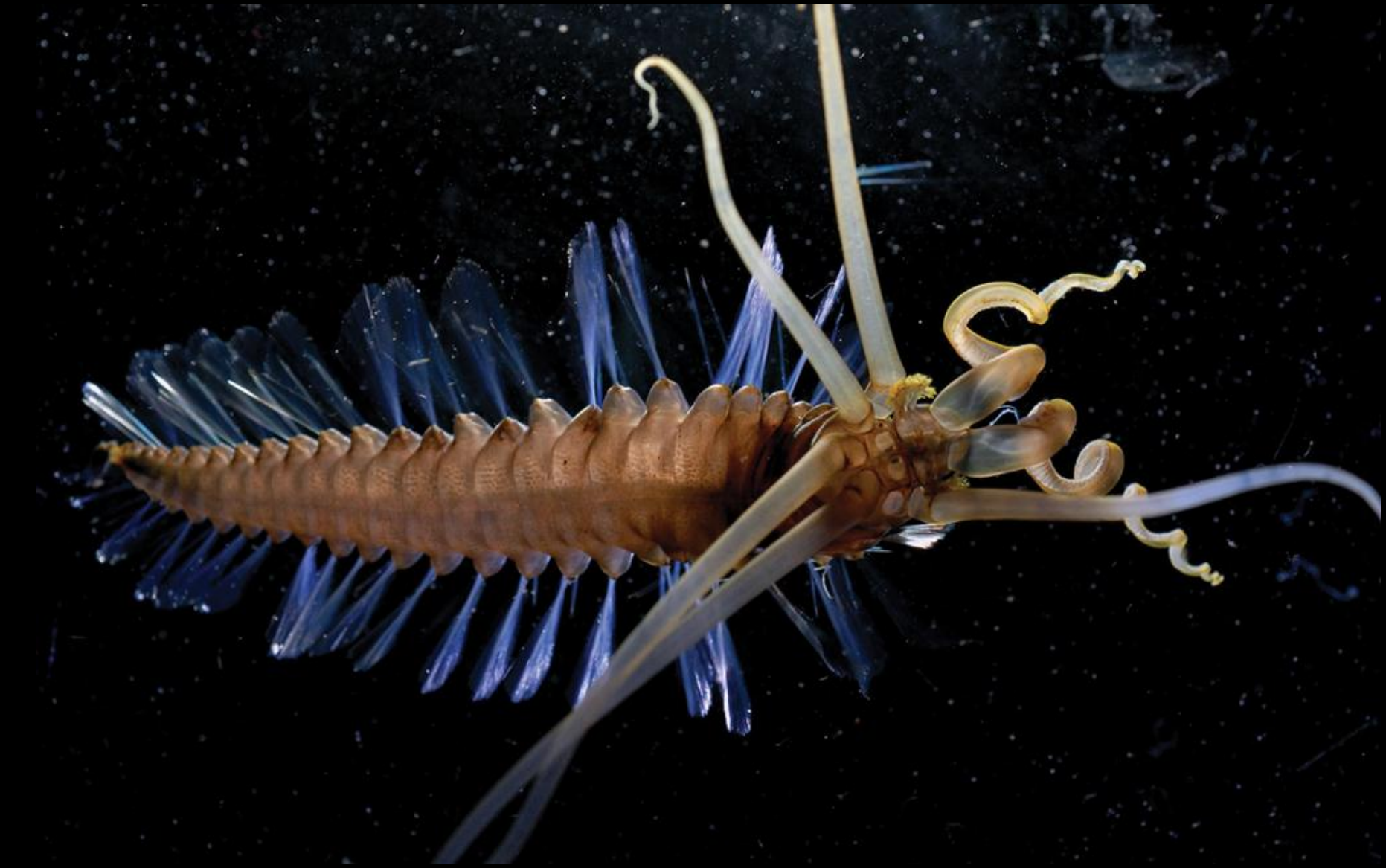
Celebes Sea, new “squidworm”



Source: CoML CMarZ

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Sea cucumber *Enypniastes* caught at 2,750 meters on the continental margin in the Celebes Sea between Indonesia and the Philippines

Source: CoML CMarZ

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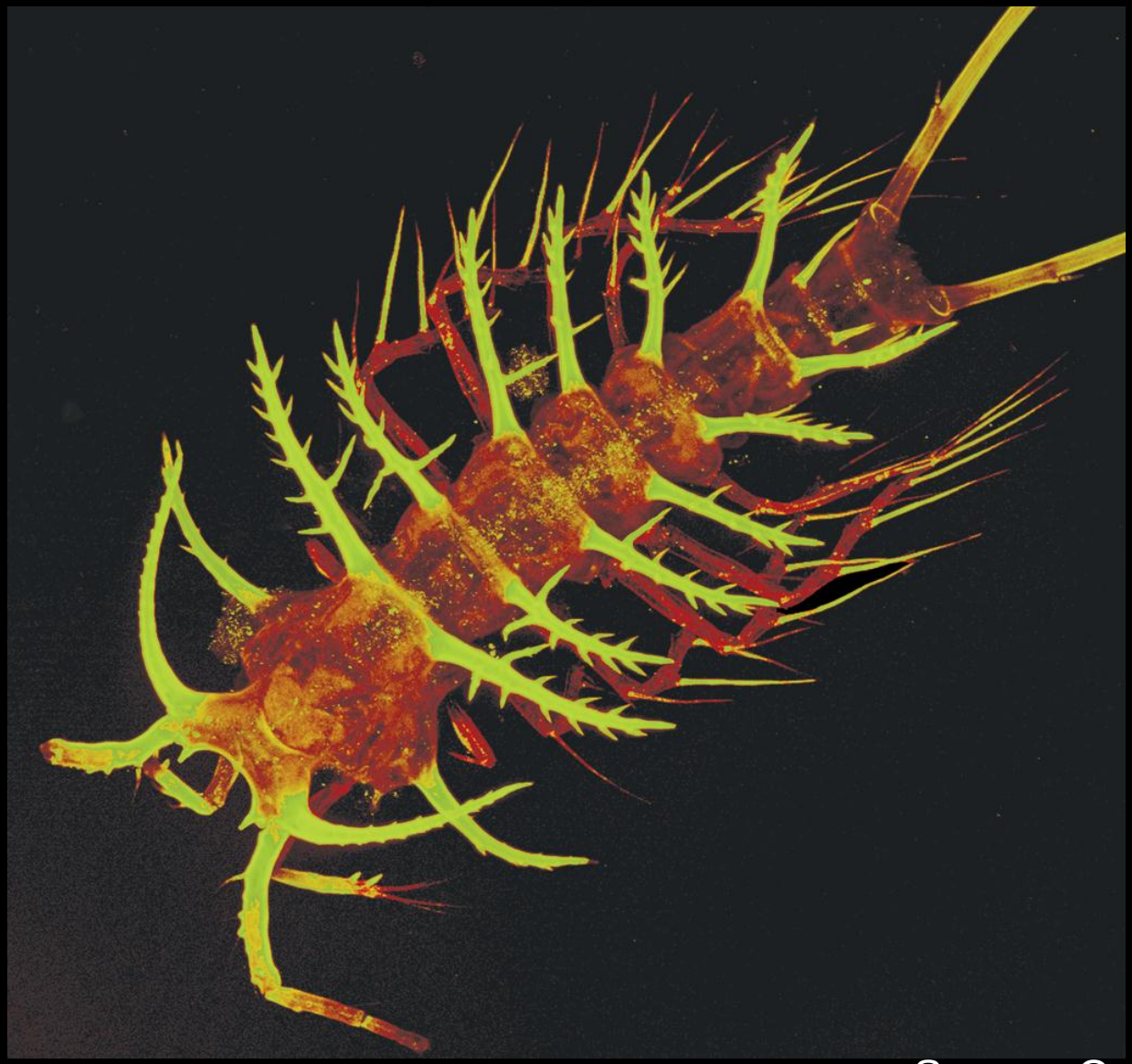
Abyssal plains, S. Atlantic copepod *Ceratonotus steiningeri*



Source: CoML CEDAMAR

Source: Pedro Martínez Arbizu – CeDAMar

Diversity never imagined

Angola Basin: > 800 different copepods, most new to science

Southern Ocean: > 700 different isopods, > 500 new to science

Source: Pedro Martínez Arbizu – CeDAMar

Astounding discoveries, richness

A group of
carnivorous sponges
abundant & species rich in the deep sea

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An anaerobic animal, found in deep Mediterranean, the phylum Loricifera, *Nanaloricus cinzia*

No mitochondria

Survivors from an ancient anoxic ecological niche?

Source: Danovaro et al., 2010

Links to other information sources such as Encyclopedia of Life; 100,000 marine species have EOL pages

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Encyclopedia of Life

login | create an account

SHOWING: ALL INFORMATION

FIND

Names Tags Full-text

Dinochelus ausubeli

Ausubel's Mighty Claws Lobster

Taxon recognized by EOLspecies

IUCN RED LIST STATUS: NOT EVALUATED

SHOWING: SCIENTIFIC NAMES

IMAGES | COMMENTS

IMAGES (1)

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SUPPLIER: EOL Rapid Response Team

AUTHOR: Tin-Yam Chan, National Taiwan Ocean University, Keelung

ORIGINAL: View image source

Dinochelus ausubeli, holotype

CLASSIFICATION: What's this?

Species 2000 & ITIS Catalogue of Life: Annua

Animalia +
Arthropoda +
Malacostraca +
Decapoda +
Nephropoidea +
Nephropidae +

Name not in Species 2000 & ITIS Catalogue of Life: Annual Checklist 2010 . Select an alternate hierarchy from the list above

Archaea +
Bacteria +
Chromista +
Fungi +
Plantae +
Protozoa +
Viruses +

Diversity: 250,000 species known, named; 750,000 more to discover?? + microbes!!

Source: CoML Creefs

Why so many yet to know?

- The rare, the small
- Hard to sample, immensity, 3-d complexity, hard to reach
- Few experts – Many taxonomic groups poorly known

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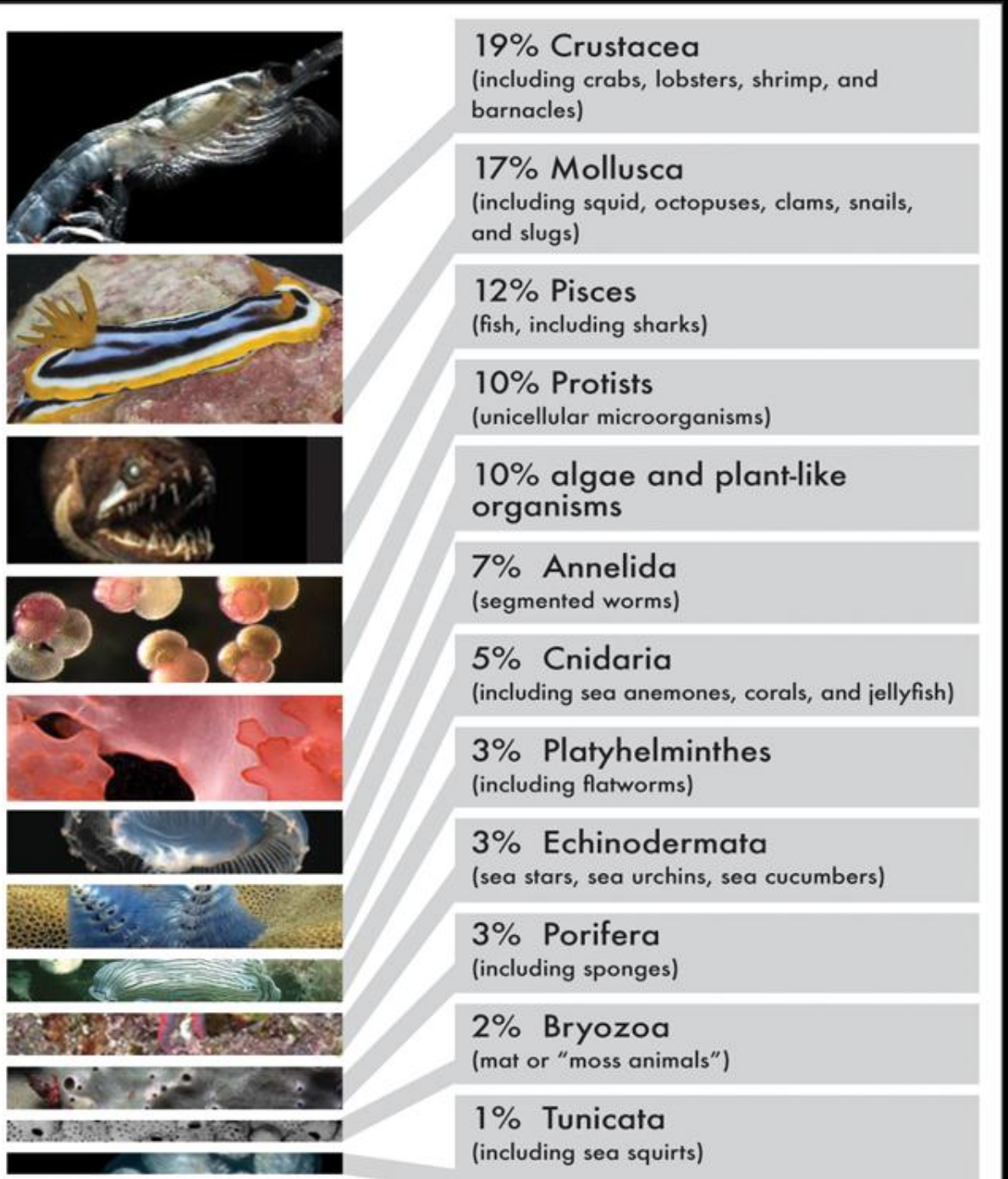
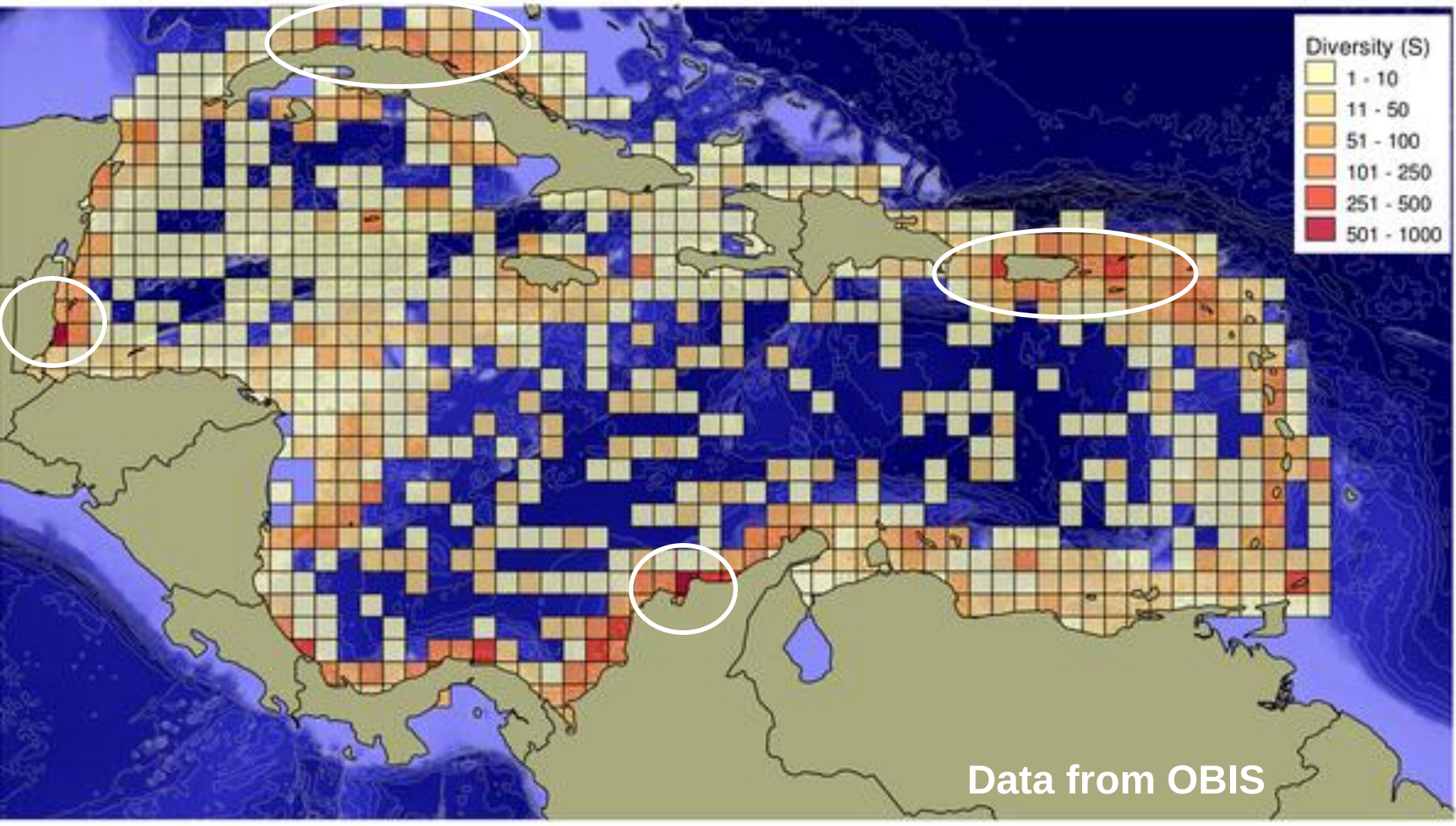
Average known diversity in 25 regions

~10,000 known species in average region



Source: Costello, Miloslavich, et al., 2010.

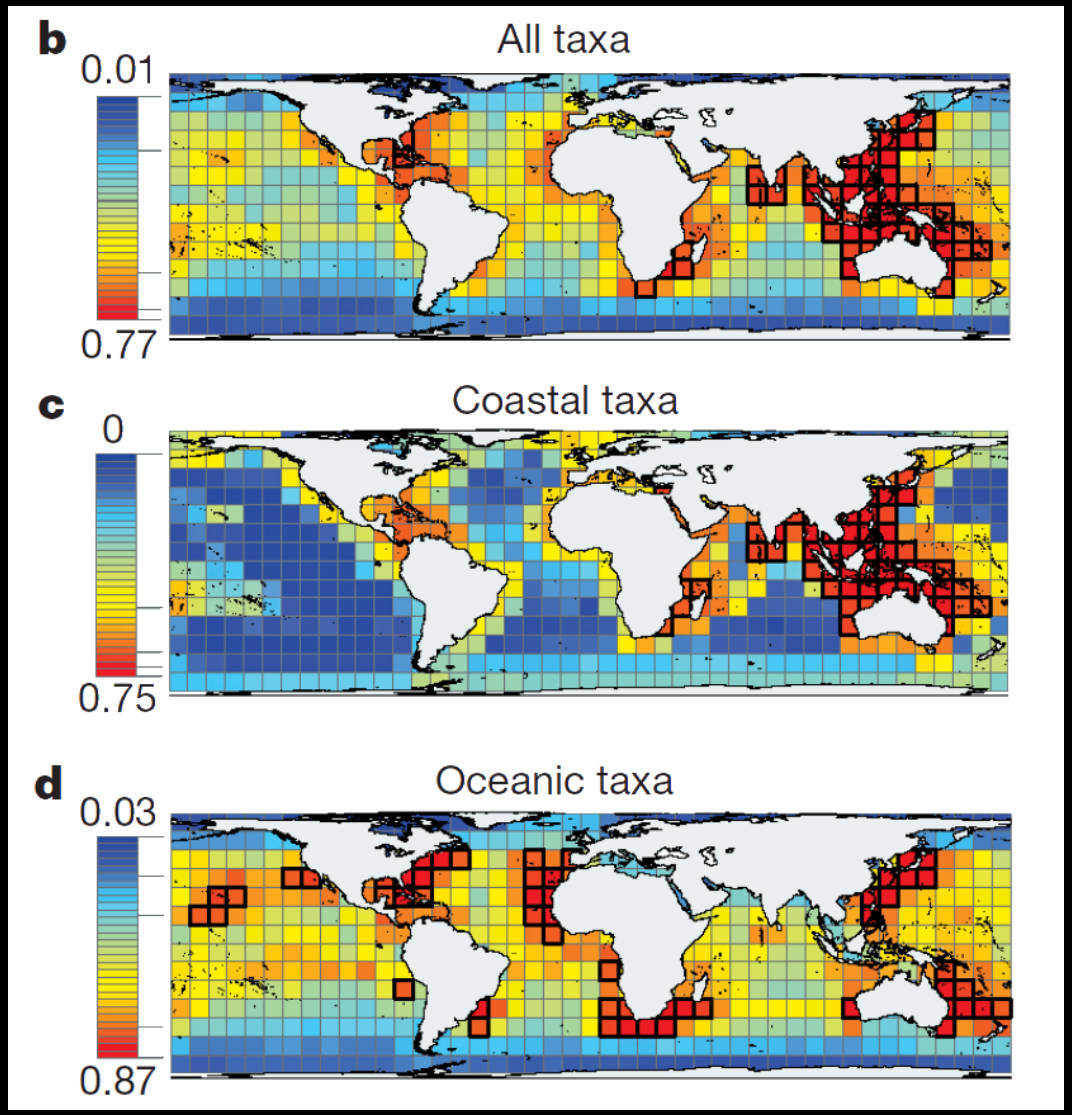
Identification of hot spots – Caribbean example



60,368 records of 5601 species

Source: CoML Caribe

Global hot spots of species diversity



Source: Tittensor et al. (2010). Nature 466: 1098-1101

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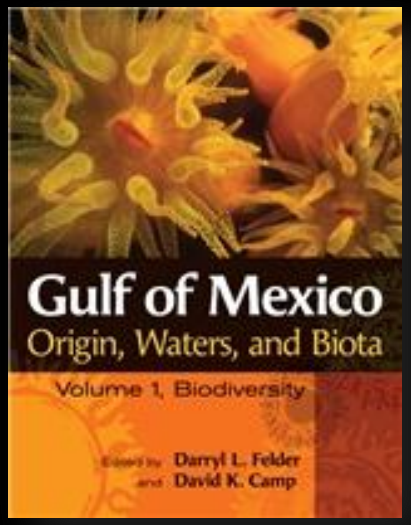
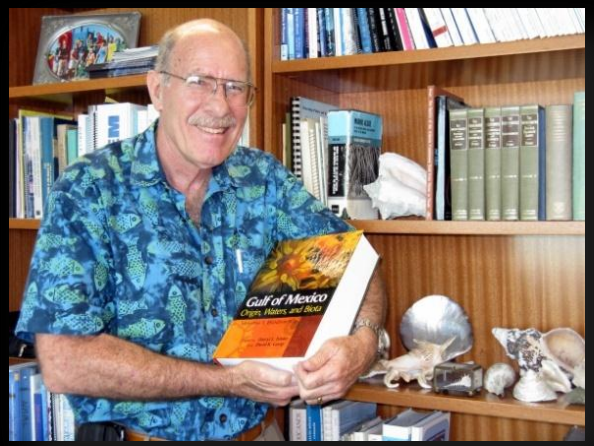
Distribution: Some species, like the manylight viperfish, *Chauliodus sloani*, spread through many oceans

Source: CoML OBIS

Distribution: What lives in e.g., the Gulf of Mexico



- Comprehensive pre-spill (2010) baseline
- 15,419 species
- Compiled by 140 experts from 80 institutions in US, Cuba, Mexico…
- Data available online



Team leader Wes Tunnell prepared expert report for spill claims administrator Feinberg

Source: Tunnell et al., GoMex project

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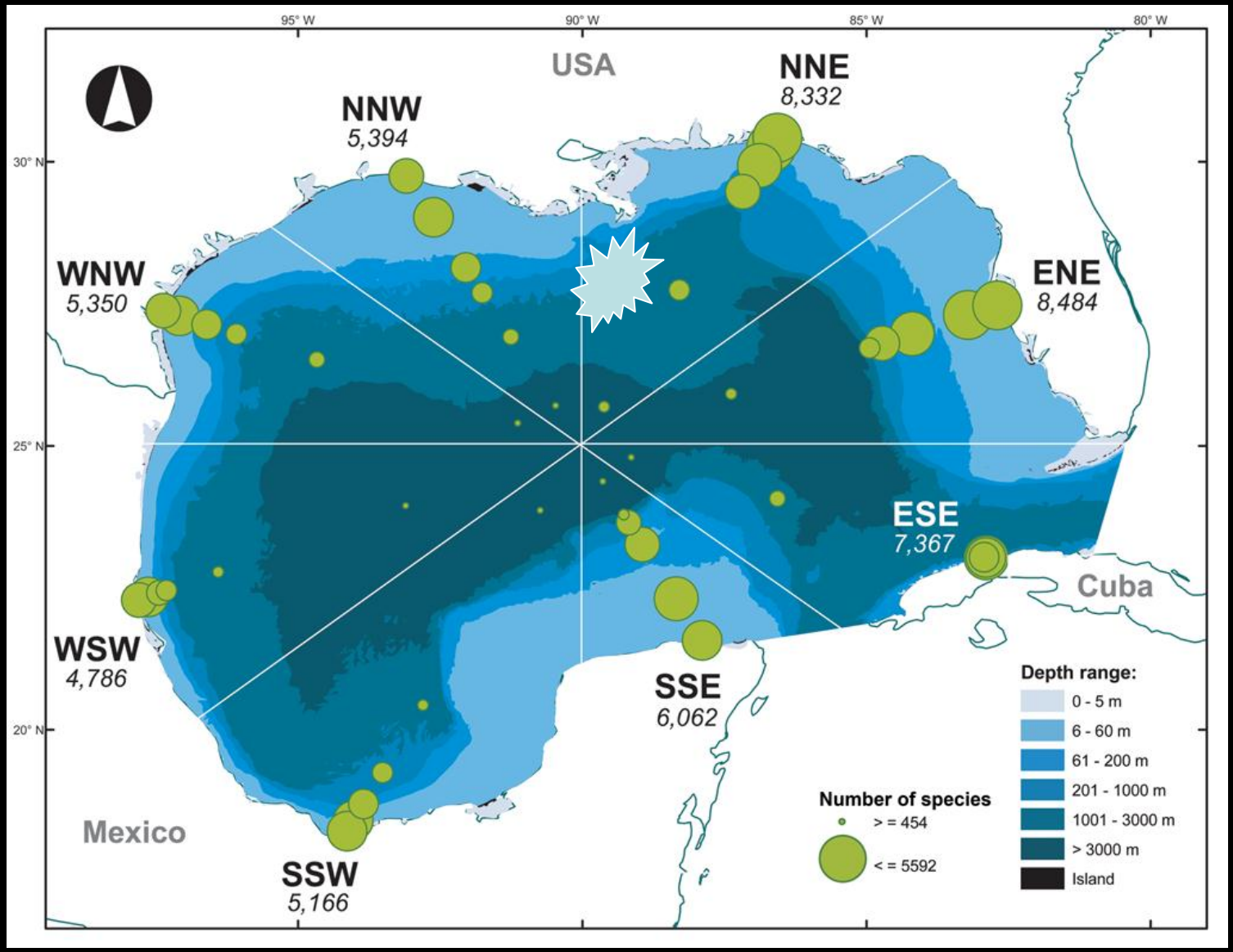
8,332 species have been recorded in the NNE region near the Deepwater Horizon spill

Source: Harte Institute GoMex project



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Distribution: The journeys
Trans-ocean travelers: Bluefin tuna, *Thunnus thynnus*

Source: CoML TOPP

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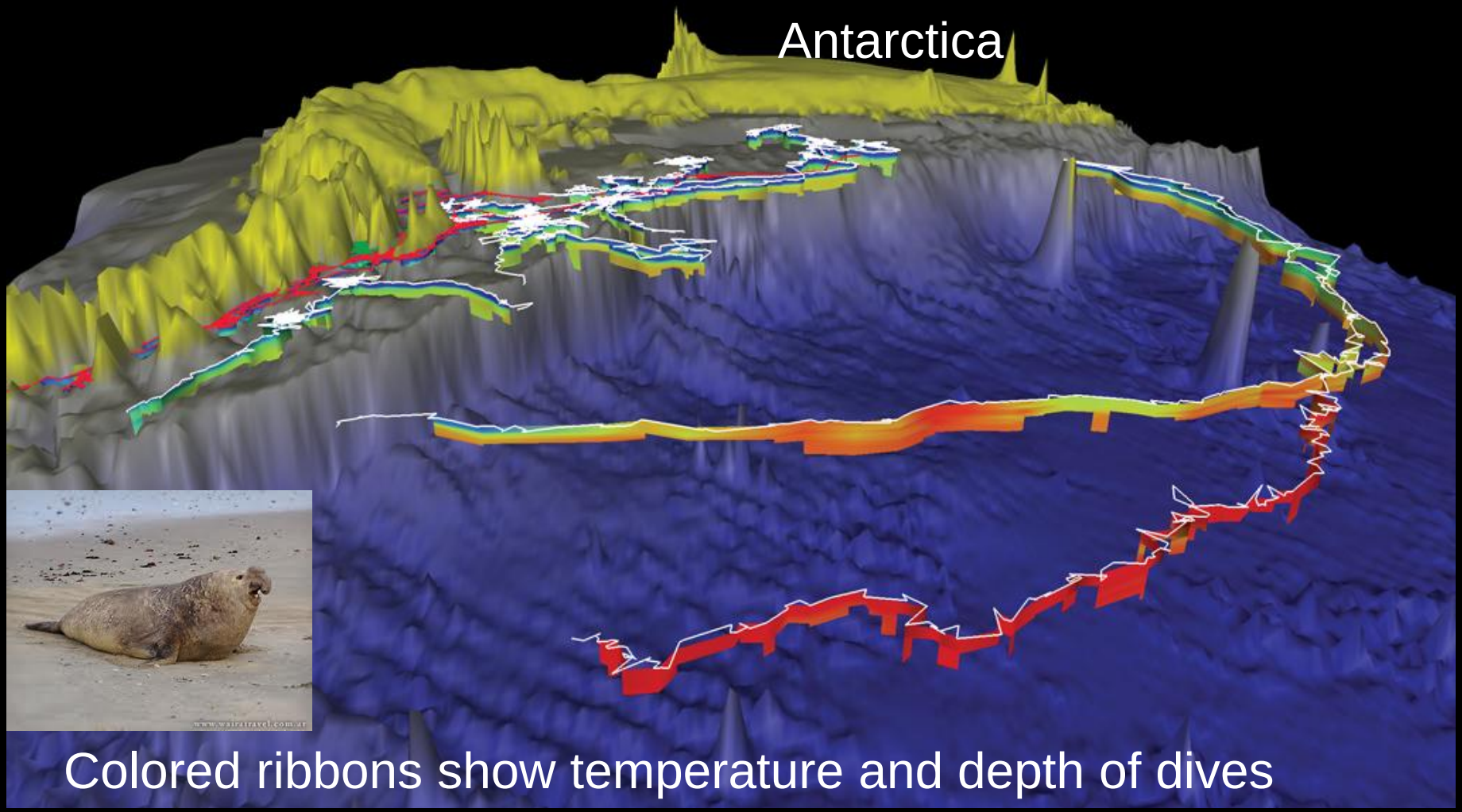
Two elephant seals, *Mirounga leonina,* explore seamounts down to 2,300 meters, connecting deep & surface; crabeater seals make tracks close to shore



Colored ribbons show temperature and depth of dives

Source: CoML TOPP/SEaOS

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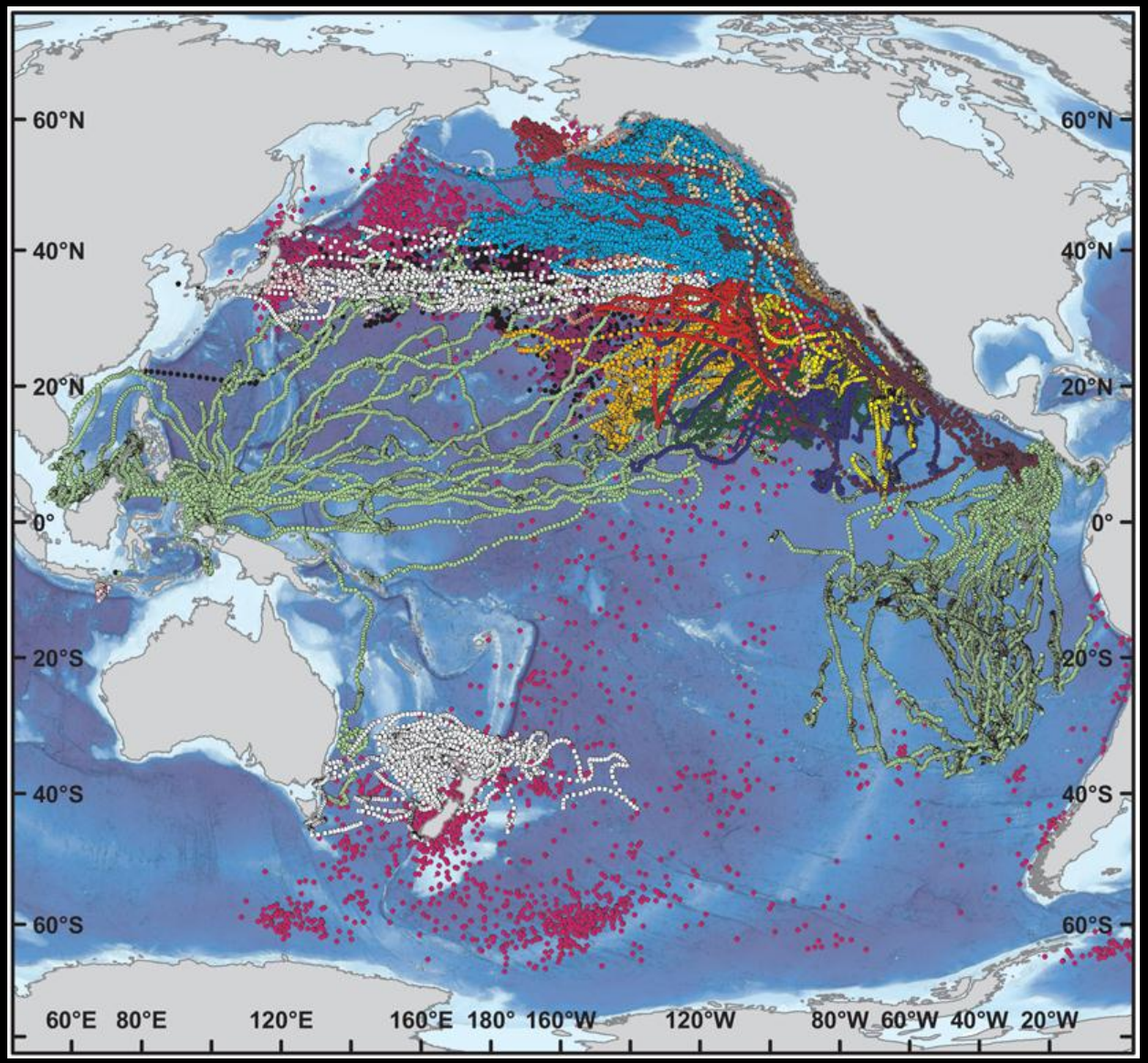
Summary distributions of top predators: connectivity
Blue Highways and neighborhoods of the Pacific

Bluefin tuna

Leatherback turtles

White shark

Source:
CoML TOPP Project



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Abundance: A story of alteration

Recreational fishing, Key West, Florida, 1958

Source: CoML HMAP

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Abundance:
Recreational fishing, Key West, 2007

Source: CoML HMAP

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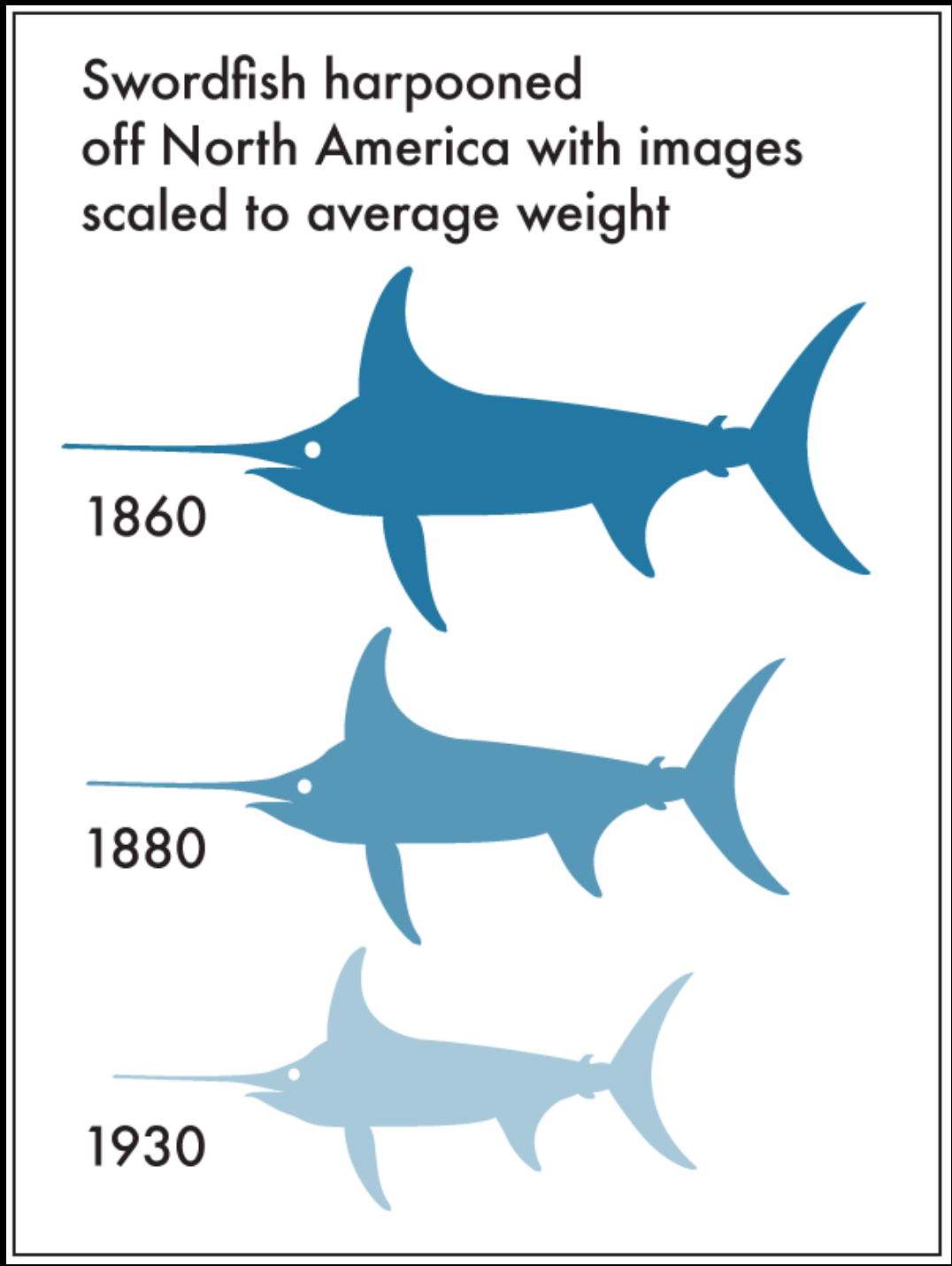
Abundance: Decline of large animals

alteration

Source: CoML HMAP, MacKenzie et al.



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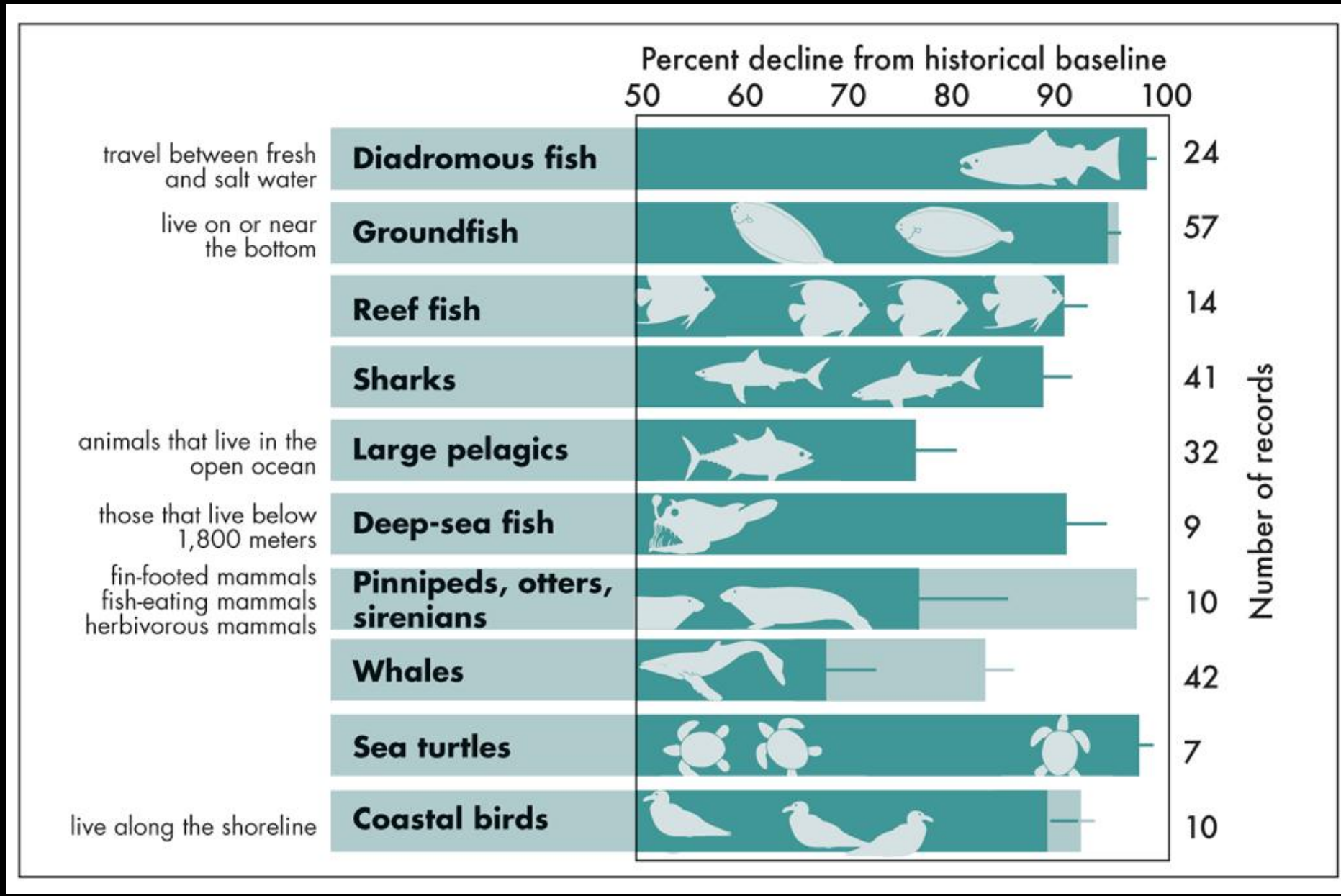
Abundance/Alteration: 90% drops of 10 groups

Source: CoML FMAP, Lotze et al.



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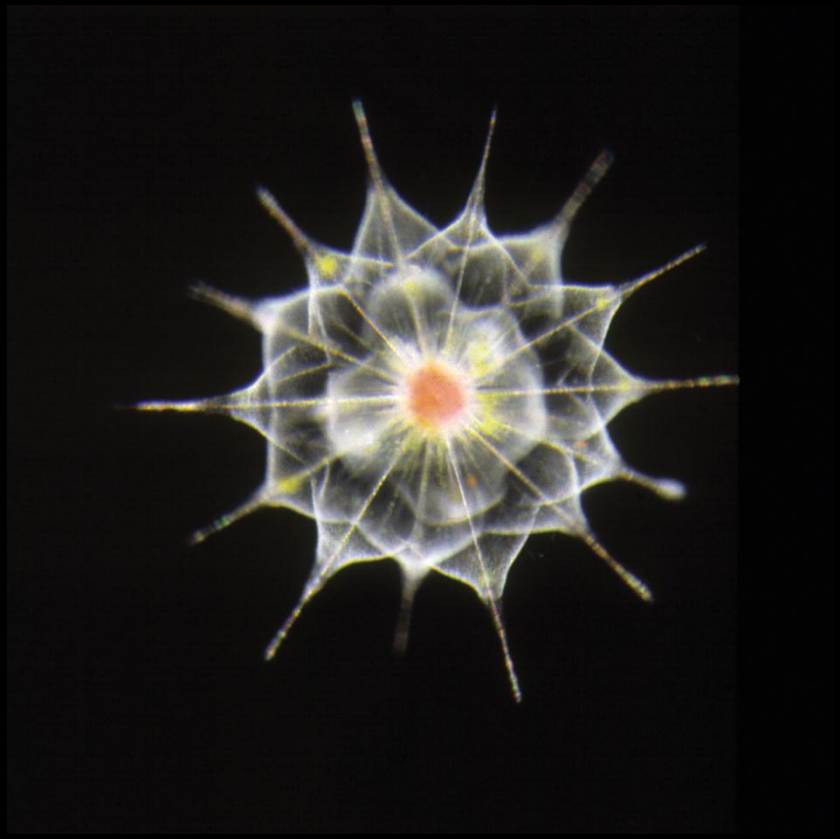
Abundance: the Hidden Majority, marine microbes Acantharian, captured off Bermuda

Connectedness:
Ubiquity of many microbes connects the oceans



Source: CoML ICOMM

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Abundance: Filamentous bacteria, *Thioploca*, wove mat size of Greece off Chile

Source: CoML Gallardo

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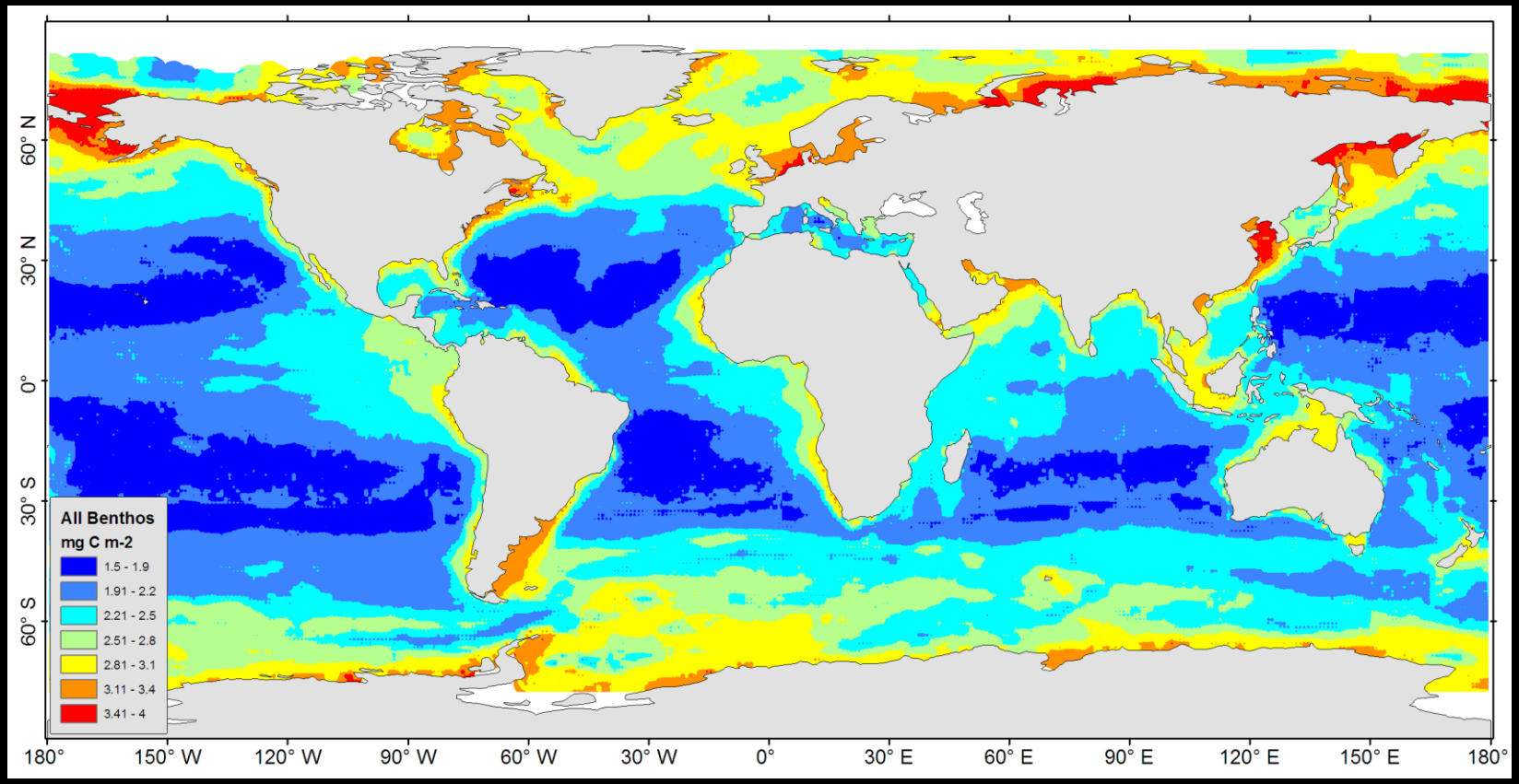
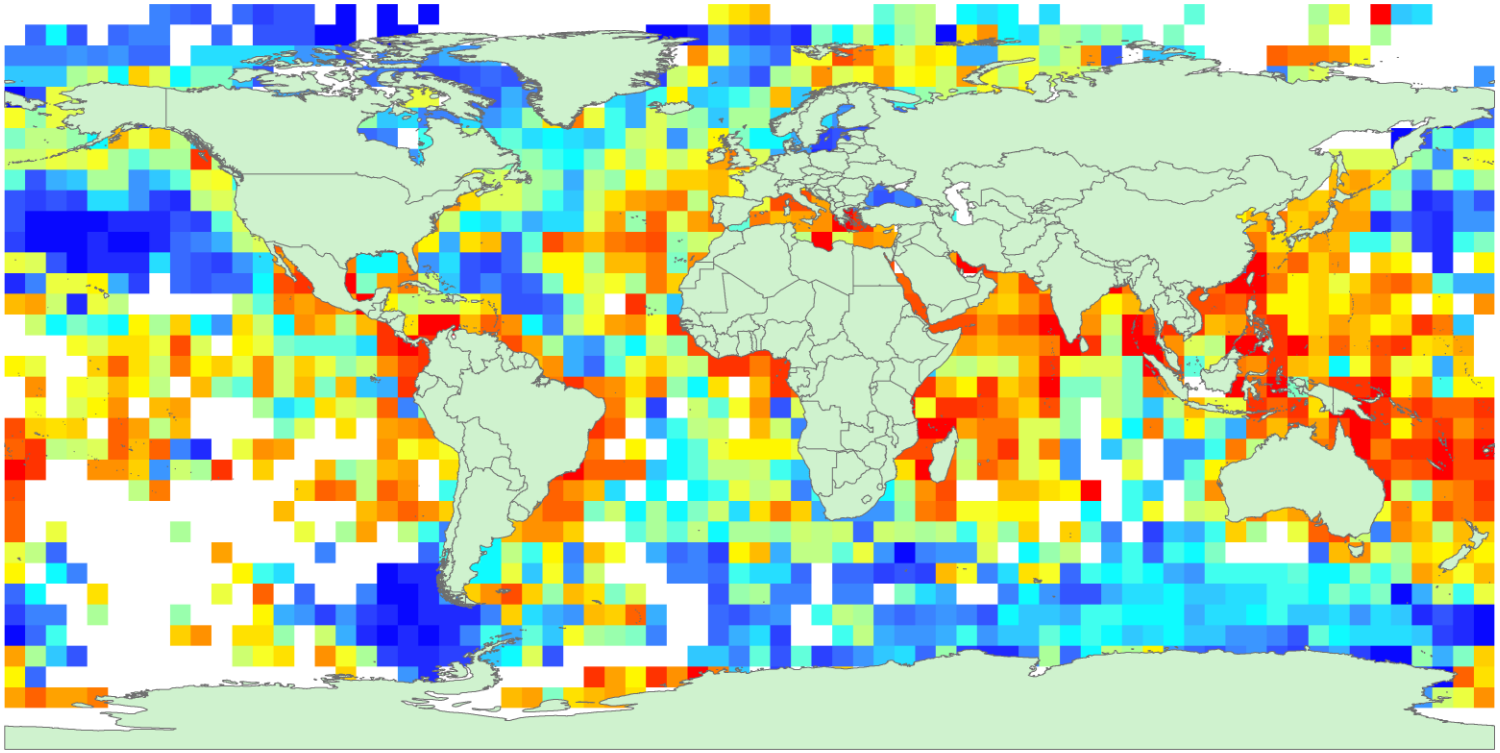
Abundance: Seafloor biomass high in temperate, polar regions



Source: Wei et al., 2010

The Unknown Ocean from above: many gaps
White squares lack data to estimate diversity



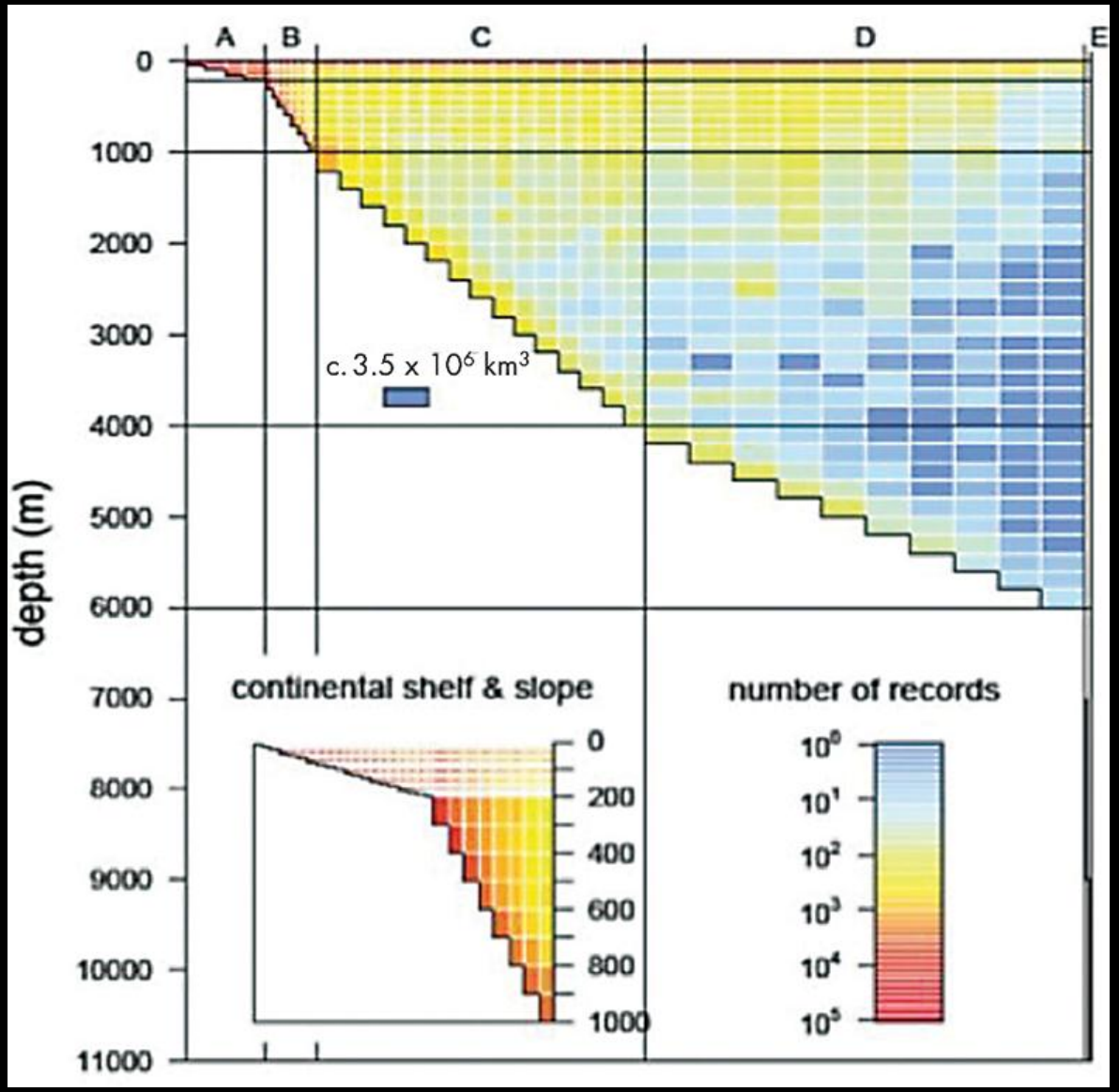
Red = high diversity, blue low

Source: CoML OBIS Vanden Berghe

The Unknown Ocean: A slice
Red = many records, dark blue none

The vast midwaters, Earth's largest habitat by volume, mostly unexplored

Source:
CoML OBIS
Webb, O'Dor
Vanden Berghe



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Public Engagement: The iconic species of CoML, yeti crab, *Kiwa hirsuta*, discovered in S. Pacific

Source: CoML CHeSS

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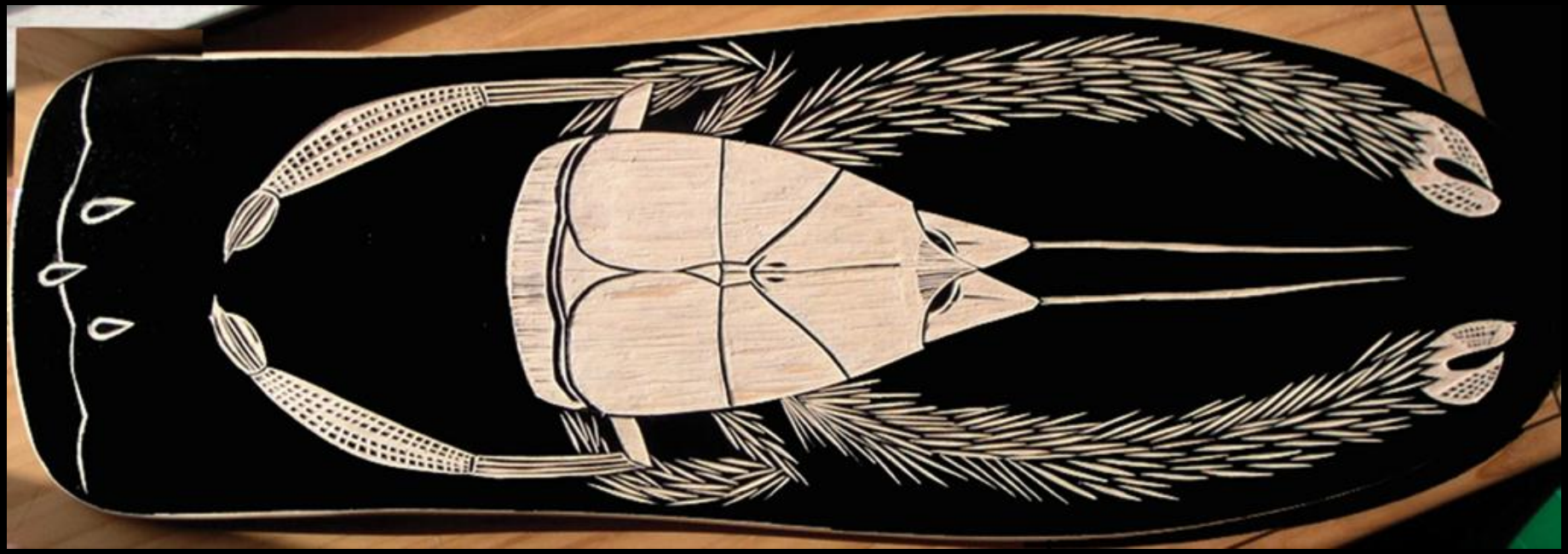
Yeti crab enters popular culture
….on a skate board



Yeti crab enters world of painter Lily Simonson

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Galatee Films observes humpback whale off British Columbia

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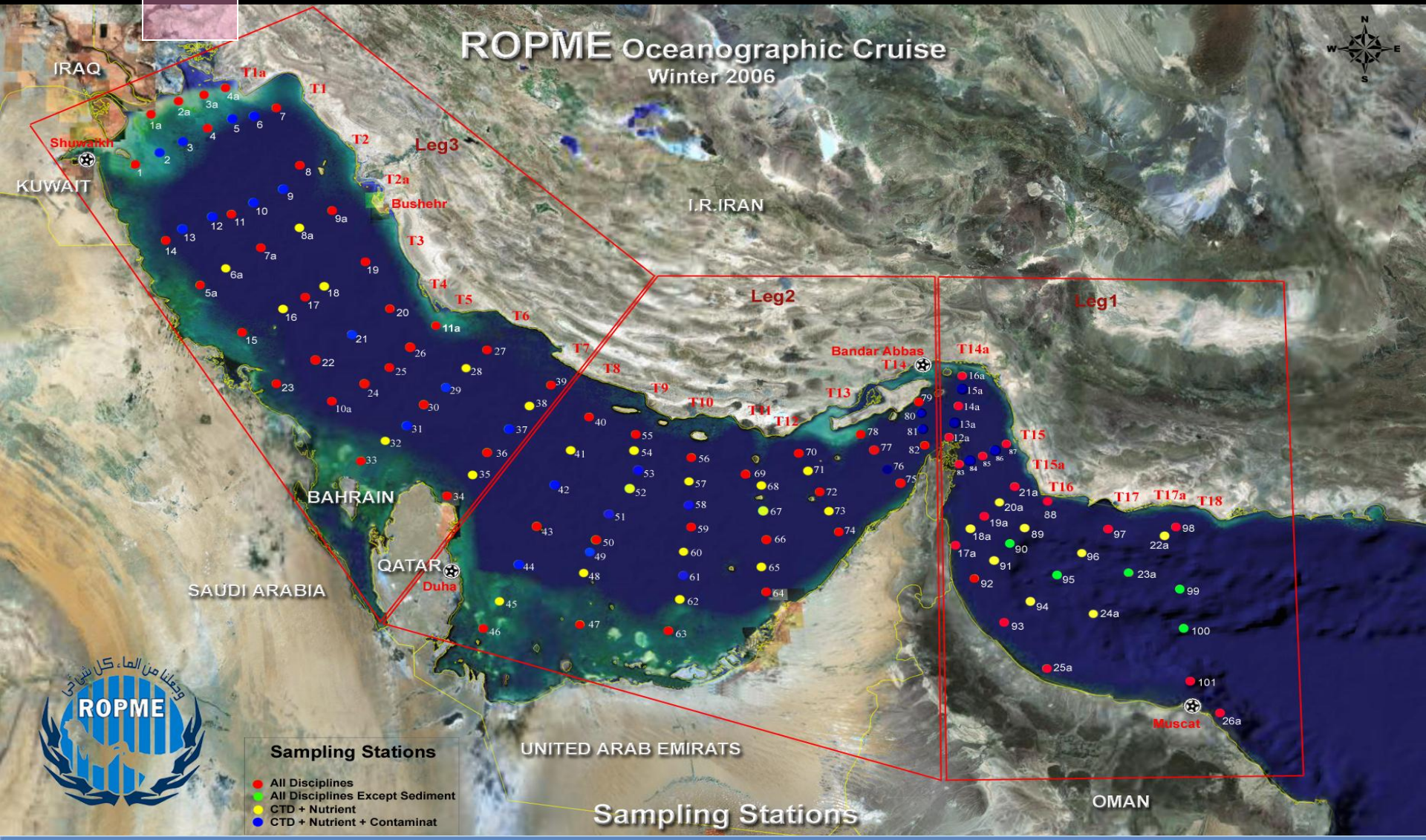
A bridge between people
Participants, CoML workshop
Sultan Qabus University, Muscat , Oct 2007

We worked in rough neighborhoods: Plankton Persian Gulf



A Decade of Discovery 2010

Source: CoML Arabian Sea team

Census Summary 2000-2010

>2,700 scientists

>80 countries

>540 field expeditions

~US$650 million

>1,200 new species +
5000 await description

>100,000 EOL pages for
marine species

~35,000 marine species
with DNA barcodes

2,600 publications,
books, maps, videos,
films, paintings,
sculptures, songs…

New protected areas…

Marine Life is:

- Richer
- More connected
- More altered
- Unknown,
  Unexplored

Voted favorite animal: Blob fish

Source: K. Parkingson

Found south of Tasmania

Thank you! www.coml.org