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## Prediction of Marine Biodiversity to support society: thoughts on requirements



unesco

Intergovernmental  
Oceanographic  
Commission



2021-2030 United Nations Decade  
of Ocean Science  
for Sustainable Development

Life is at the core of everything we do



Multiple 'Essential Ocean Variables' are needed to monitor, model, and forecast:

- greenhouse gas fluxes,
- food production,
- water quality,
- renewable energy
- mining
- conservation and restoration planning
- research
- All other processes and ocean uses





# The Value of the Oceans: The Blue Economy

Organisation for Economic Co-operation and Development (OECD)

OECD 2016

The Ocean Economy in 2030

DOI:10.1787/9789264251724-en

## I. AN OVERVIEW OF THE OCEAN ECONOMY: ASSESSMENTS AND RECOMMENDATIONS – 23

Table 1.1. Established and emerging ocean-based industries

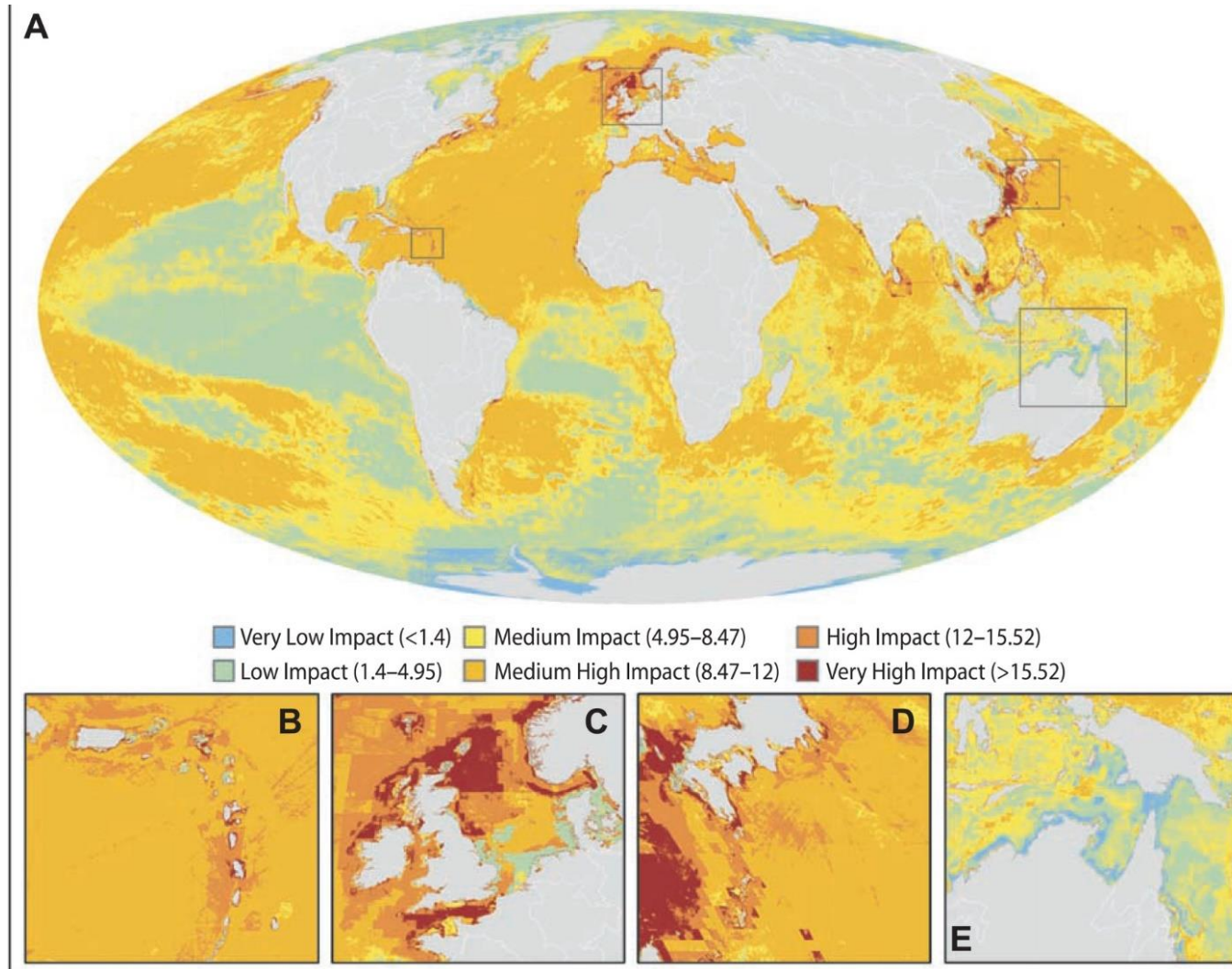
Established	Emerging
Capture fisheries	Marine aquaculture
Seafood processing	Deep- and ultra-deep water oil and gas
Shipping	Offshore wind energy
Ports	Ocean renewable energy
Shipbuilding and repair	Marine and seabed mining
Offshore oil and gas (shallow water)	Maritime safety and surveillance
Marine manufacturing and construction	Marine biotechnology
Maritime and coastal tourism	High-tech marine products and services
Marine business services	Others
Marine R&D and education	<b>+ Spiritual value and cultural heritage</b>
Dredging	

2010:  
US\$ 1.5-2.5  
trillion

2030 Ocean  
economy:  
US\$ >3  
trillion

**Many/most of these industries and human well-being depend on marine life**

# Do we know: Impacts of human activities on marine life? Impacts on the future of industries?

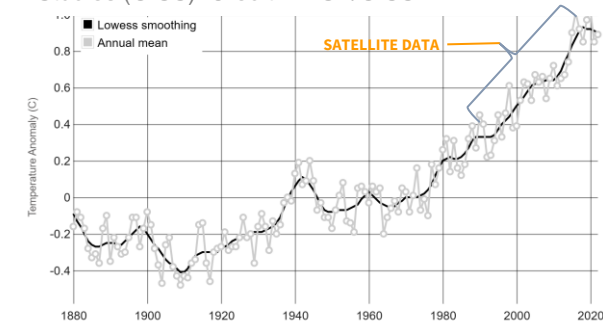


www.sciencemag.org **SCIENCE** VOL 319 15 FEBRUARY 2008

Ben Halpern et al. 2008

## GLOBAL LAND-OCEAN TEMPERATURE INDEX

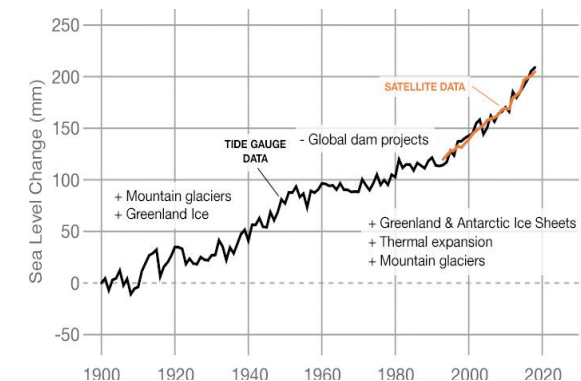
Data source: NASA's Goddard Institute for Space Studies (GISS). Credit: NASA/GISS



[Global Temperature | Vital Signs – Climate Change: Vital Signs of the Planet \(nasa.gov\)](#)

## SEA LEVEL / SATELLITE DATA: 1993-PRESENT

Credit: NASA's Goddard Space Flight Center



[Sea Level | Vital Signs – Climate Change: Vital Signs of the Planet \(nasa.gov\)](#)

# What are impacts from climate change?

# Drivers: Ocean Decade Challenges, CBD, national requirements

## 2024 OCEAN DECADE CONFERENCE

DELIVERING THE SCIENCE WE  
NEED FOR THE OCEAN WE  
WANT 10-12 APRIL 2024  
BARCELONA, SPAIN

As part of the Ocean Decade Week (8-12 April 2024)



# Challenge 2: Protect and restore ecosystems and biodiversity

Understand the effects of multiple stressors on ocean ecosystems, and develop solutions to monitor, protect, manage and restore ecosystems and their biodiversity under changing environmental, social and climate conditions

**April 10, Session 1, 16:30 h**



2021 United Nations Decade  
2030 of Ocean Science  
for Sustainable Development



**We need  
indicators to answer:**

**What lives where?**

**How is it doing?**

**How will it do in the future?**



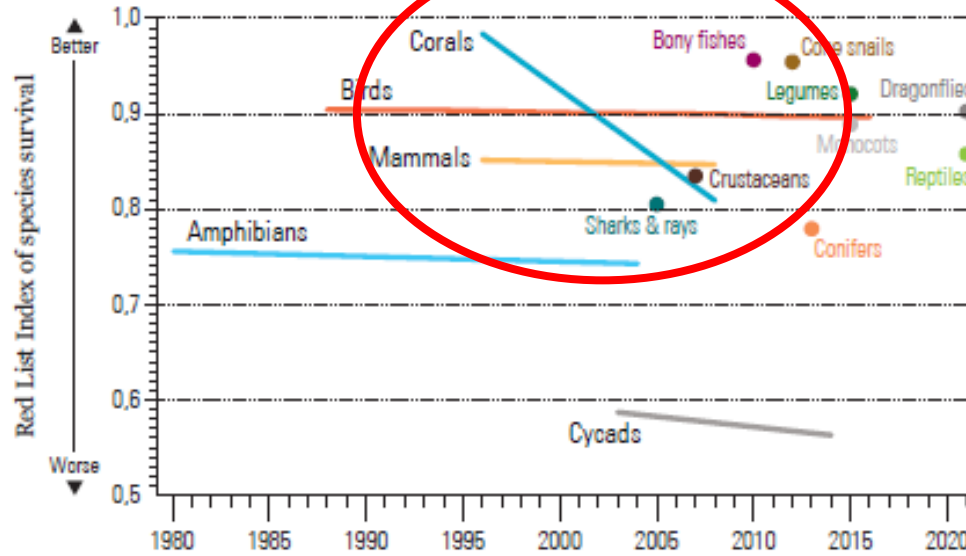


Figure 7: The Red List Index (RLI)

# Living Planet Index

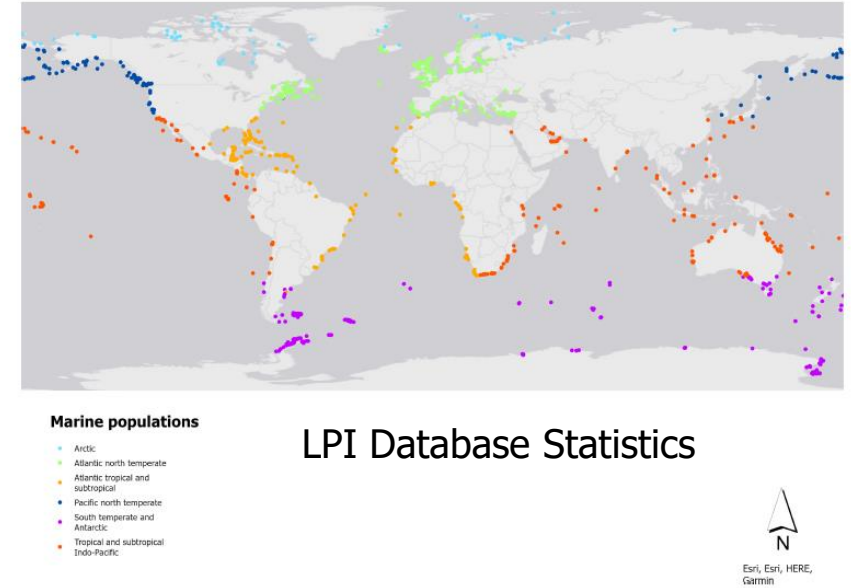
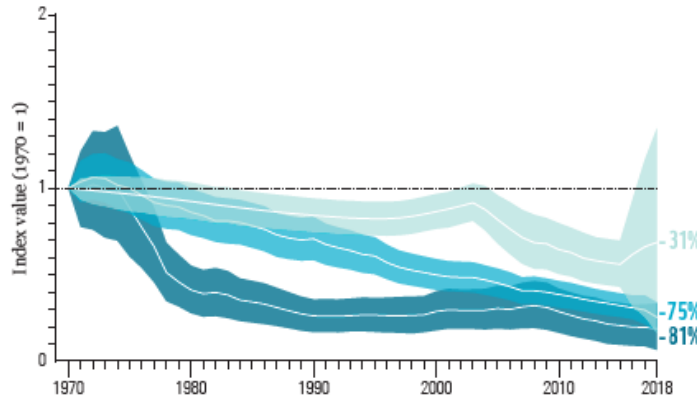


Figure 8 Map of terrestrial & freshwater (top), and marine populations (bottom) in the Living Planet Database. Only populations monitored in a specific location are plotted on the map.

## Sharks

Key

- Oceanic sharks LPI Small < 250 cm
- Credible intervals
- Oceanic sharks LPI Medium 250 - 500 cm
- Credible intervals
- Oceanic sharks LPI Large > 500 cm
- Credible intervals



## Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES):

-Marine species affected by:

- Climate change
- Fishing pressure
- Land-derived pollution

IPBES (2019): Summary for policymakers of the global assessment report... IPBES secretariat, Bonn, Germany.

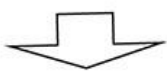
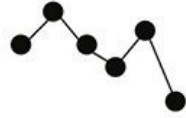
### Identify biodiversity components

Habitat-forming species, species of conservation concern, biological threats



### Develop metrics

E.g., occurrence, abundance, distribution, and diversity

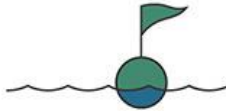


### Create biodiversity indicators

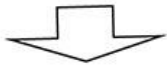
By applying metrics to components



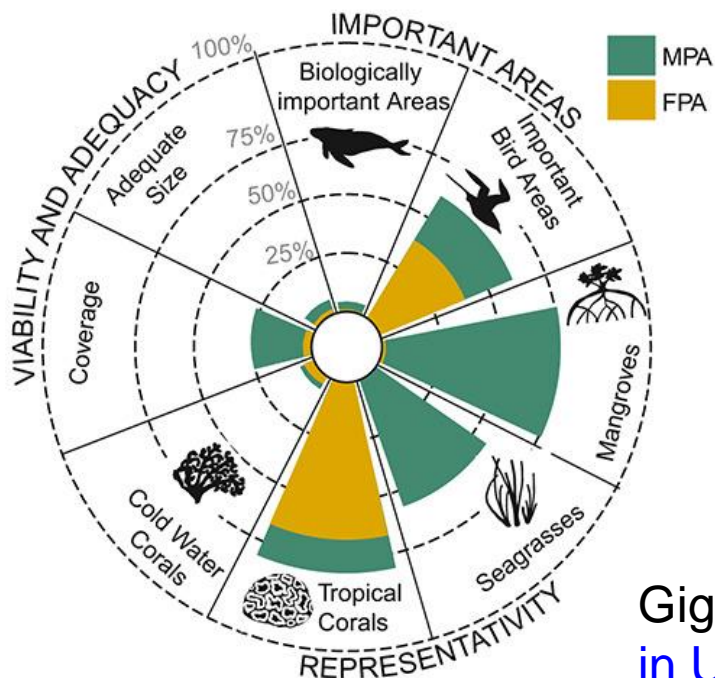
### Assemble spatial protection data



### Assemble spatial indicator data



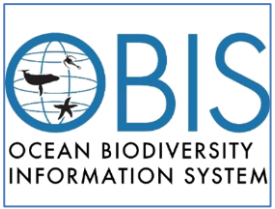
### Assess criteria of effective protection network



# Biodiversity and ecosystem assessments

- May be based on
  - Occurrences
  - Species distributions
  - Abundance
  - Production or some other trait
  - Environment measurements
- This information is incomplete

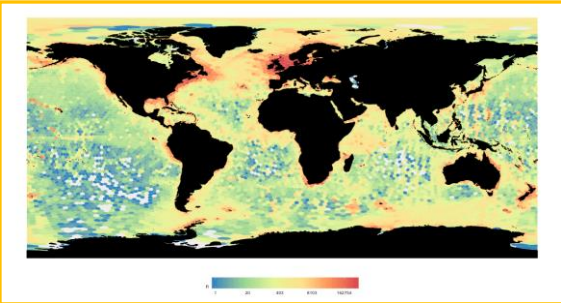
Gignoux-Wolfsohn et al. (2024) [New framework reveals gaps in US ocean biodiversity protection](#). *OneEarth*



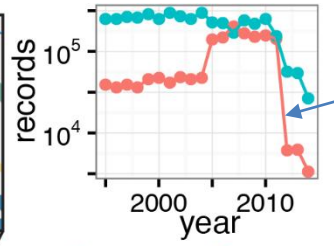
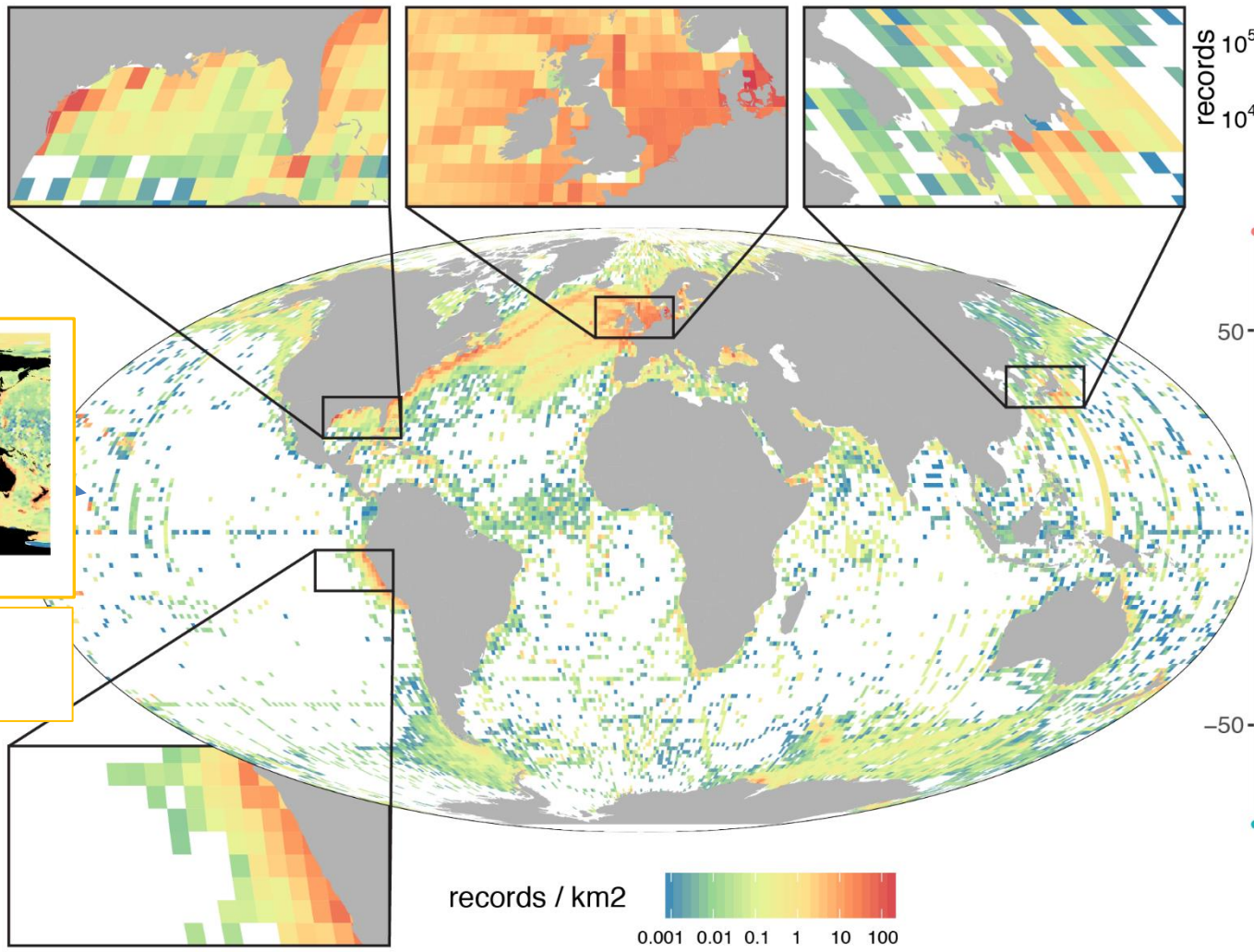
# The reality: in situ surface ocean records of biodiversity in over 100 years



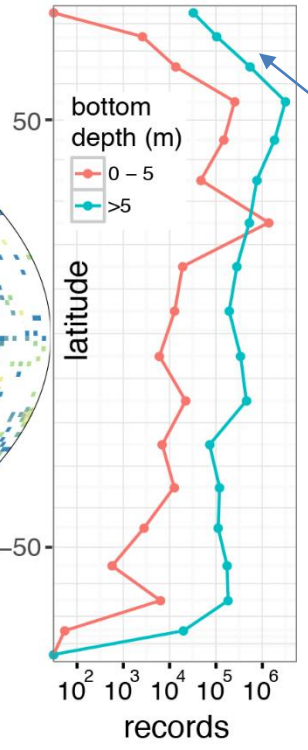
Standardized marine life databases



OBIS: >77 million records (water column to benthos)



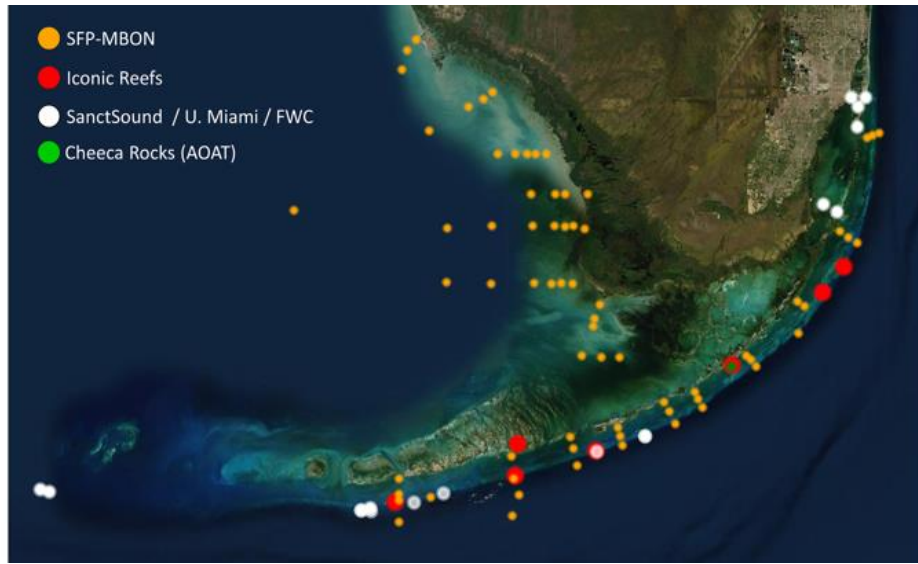
Records drop off in last few years



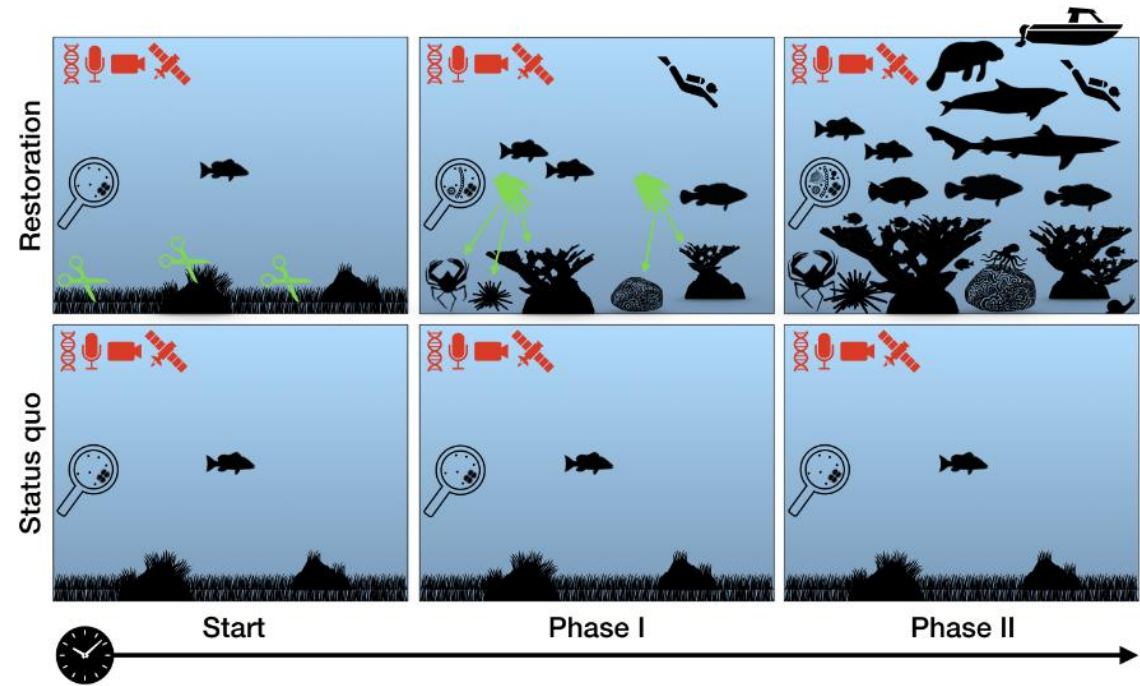
Records drop off in high latitudes

We need better coverage and baselines to evaluate changing diversity, abundances, ranges, and connectivity

# Example



Florida Keys National Marine Sanctuary  
NOAA Iconic Reefs (red circles)



**Restoration Goal: increase biodiversity, health, resiliency, boating, diving, and other reef uses**

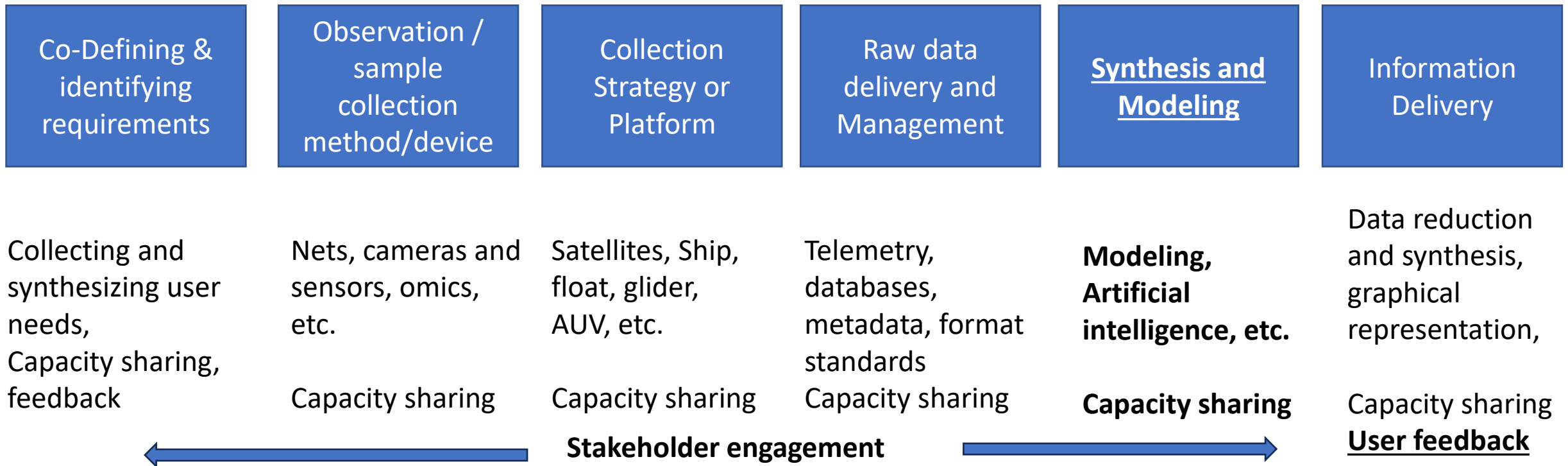
Monitoring: eDNA, acoustic, BRUVS, satellite seascapes (red)

Restoration (top row) and control sites (bottom row)





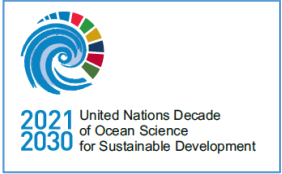
# Requirements for information flow



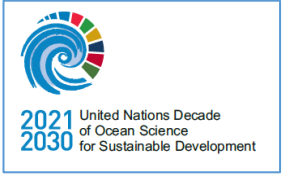
At present: Steps not coordinated, no convention on standards, no coordination on capacity for observing, data management, modeling, user not really in the loop



# Requirements for biodiversity modeling



- Data, information
  - Biology, ecosystems
  - Environmental
  - Socio-economic
- Process parameterization
- Model initiation
- Ingestion/assimilation
- Model validation
- Catalog of models for different purposes



# Perhaps most Important Requirements

**Partnerships, collaboration, networking**

**Recognition that marine life is at center of many stakeholder needs**

**Convergence / convention on minimum sets of standards:**

- Data interoperability
- Data formatting
- Model input and output requirements
- Model result publication / (e.g., guide for value-added industry)

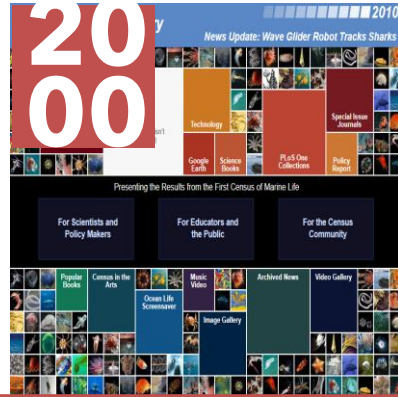
# We have the networks – let's use them



**GOOS**

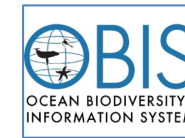


IOC, WMO, UNEP, ISC  
Deliver information essential for sustainable development, safety, wellbeing and prosperity



**CoML**

A DECADE OF DISCOVERY  
2,700 scientists, 80+ nations  
540 expeditions  
US\$ 650 million (AP Sloan Fn)  
6,000+ potential new species  
47 million distribution records



**MBON**



GEO BON, NOAA/IOOS, NASA, BOEM, NOPP  
To standardize and integrate data to understand marine biodiversity and ecosystem functions



**ML2030**

**Partnership:** MBON, GOOS/IOOS, OBIS, WCMC, others. **Vision:** Transform observation and forecasting of marine life for the benefit of all people

**OBON, OARS, SMARTNET, DOOS, GOOS, OASIS, OceanPredict, ForeSea, SUPREME, ECOPS, Challenger150, Maritime Acoustic Environment**





# Conversation topics:

- Propose UN Ocean Decade ‘Actions’ on biodiversity and ecosystem modeling
- Promote support for Actions (at present, National processes are disconnected from Ocean Decade Actions)

# Thank You!



**MBON**  
Marine Biodiversity  
Observation Network

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#MarineLife2030

Websites: <https://marinelife2030.org>

<http://marinebon.org>