

OCEAN  
HEALTH  
INDEX™

Healthy Oceans. Healthy People.

# Framework and Methods

“How inappropriate to call this planet Earth,  
when it is evident it should be called Ocean”

- Arthur C. Clarke

The background image is an aerial photograph of a vibrant coral reef system in the ocean. The water is a deep blue, transitioning to bright turquoise over the reef. A small white boat is visible near the reef, providing a sense of scale to the vast, textured sea.

# Recognizing Ocean Values WORLDWIDE



\$21 trillion

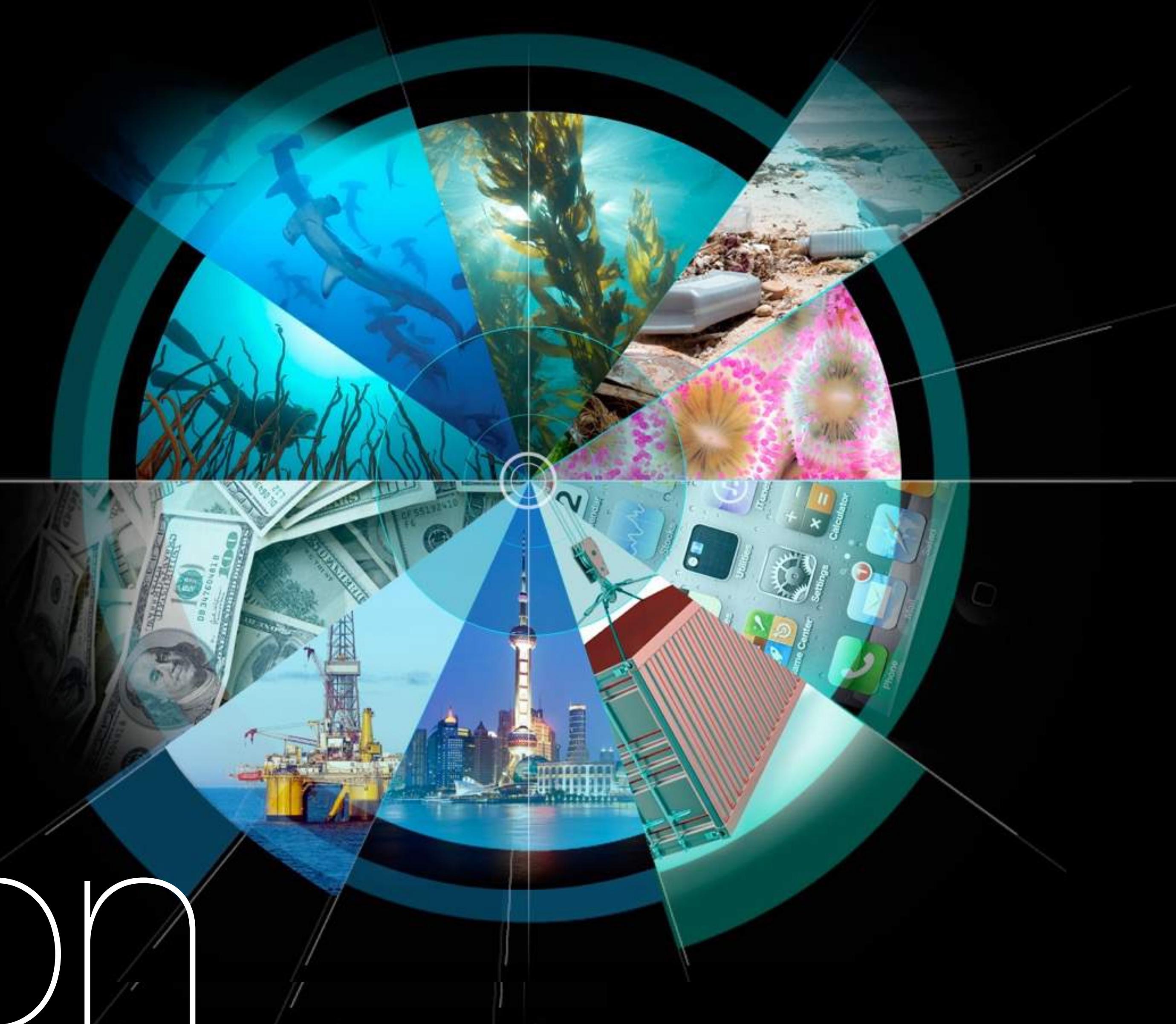
1 billion people



\$190 billion/year



500 million  
ocean related jobs



# OUTLINE

1. Need
2. Goals and Methods
3. Scale of assessments
4. Uses and benefits
5. Results of global assessment
6. Overcoming limitations with independent assessments



# WHY DO WE NEED AN OCEAN HEALTH INDEX?



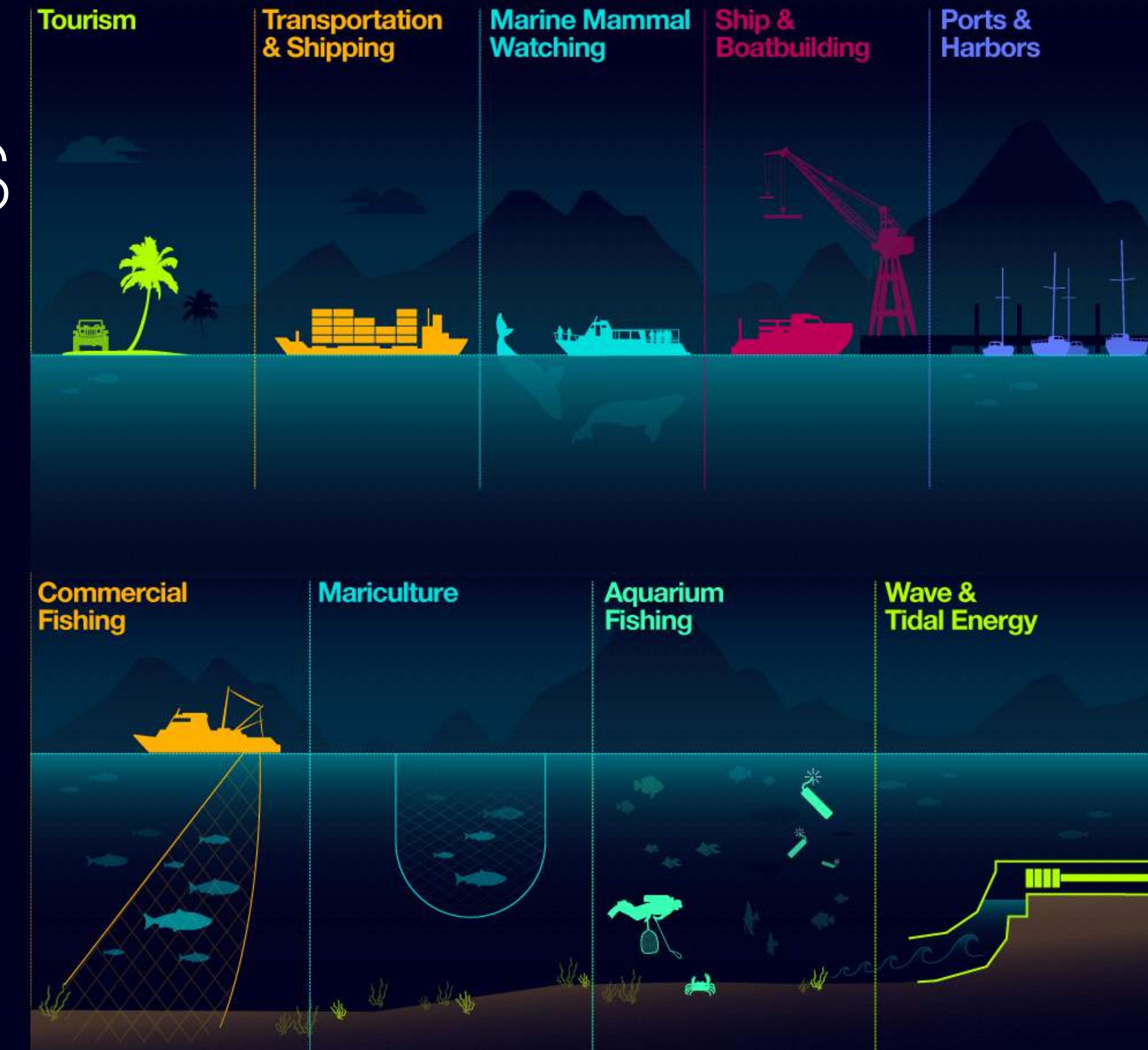
# OCEAN & COASTAL GOODS AND SERVICES



potential conflicts



need sustainable  
balance



Growing population



**90%**  
**of Fishing Jobs are Small-Scale**

Of the estimated 26-29 million total fishing jobs in developing countries, approximately 25-27 million are in the small-scale fisheries sector.

COASTS AND OCEANS ARE  
CHANGING IN  
unprecedented ways



# HOW DO YOU MEASURE OCEAN HEALTH?

## What is a healthy ocean?

One without human pressures?

A close-up, low-angle shot of a vast school of small, silvery fish swimming in a dark blue ocean. The fish are densely packed, creating a sense of movement. In the background, a rocky seabed is visible, covered with patches of vibrant orange and red coral reefs. Sunlight filters down from the surface, creating bright highlights on the fish and the coral. The overall scene is a rich, underwater ecosystem.

HUMAN BEINGS ARE PART OF MARINE  
ECOSYSTEMS  
**Everywhere in the world**

A photograph of a person standing on a beach at sunset. The sky is filled with dramatic, orange and yellow clouds. The person is silhouetted against the bright horizon, looking out at the ocean. The water is calm with gentle waves.

Policies aim to achieve  
healthy oceans

WITHOUT AN INTEGRATED TOOL TO  
MEASURE ITS HEALTH

need to **CHANGE** business as  
usual

1. Integrate various indicators
2. Evaluate cumulative pressures & resilience
3. Identify impacts of one sector over others

# nature

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**An index to assess the health and benefits of the global ocean**

published on 31.8.2012

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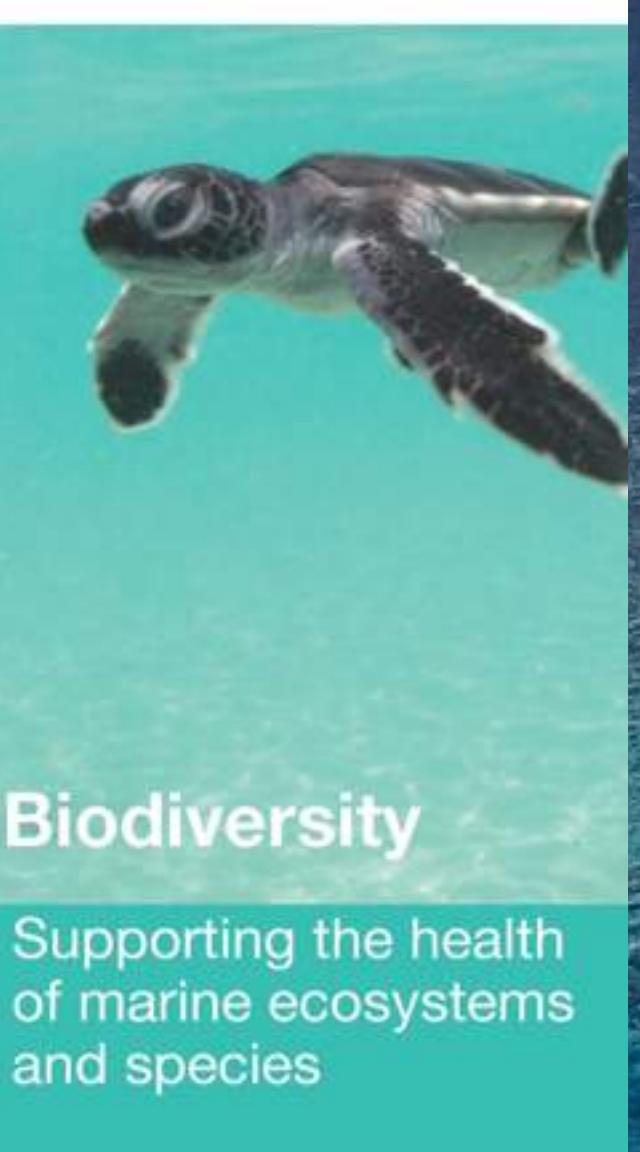
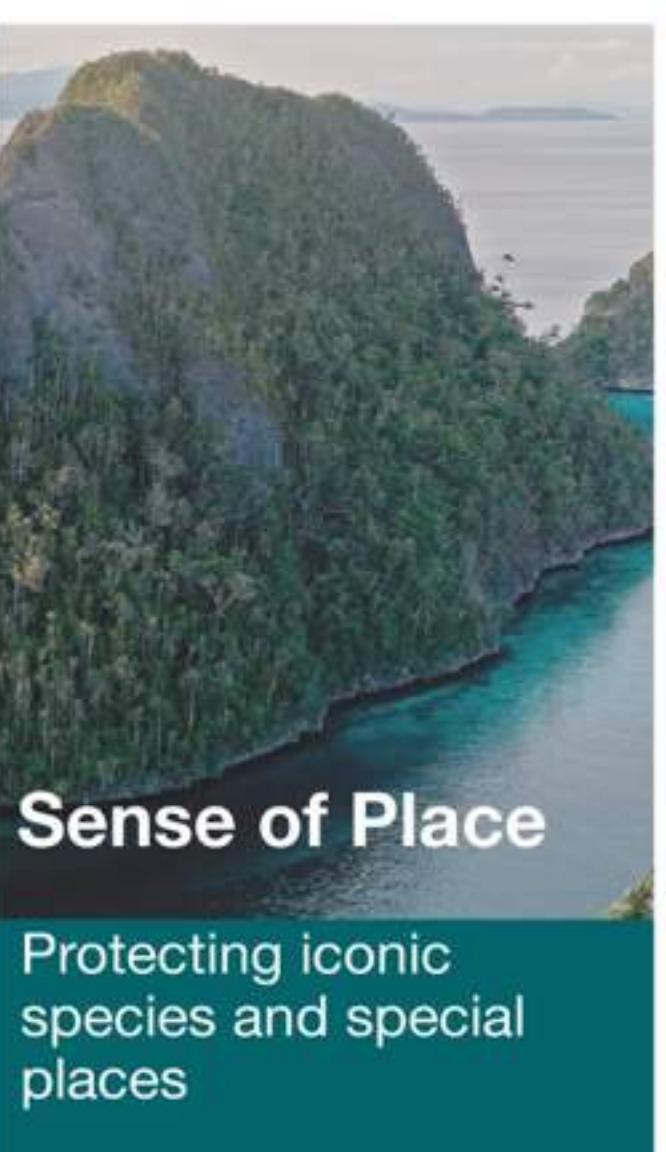
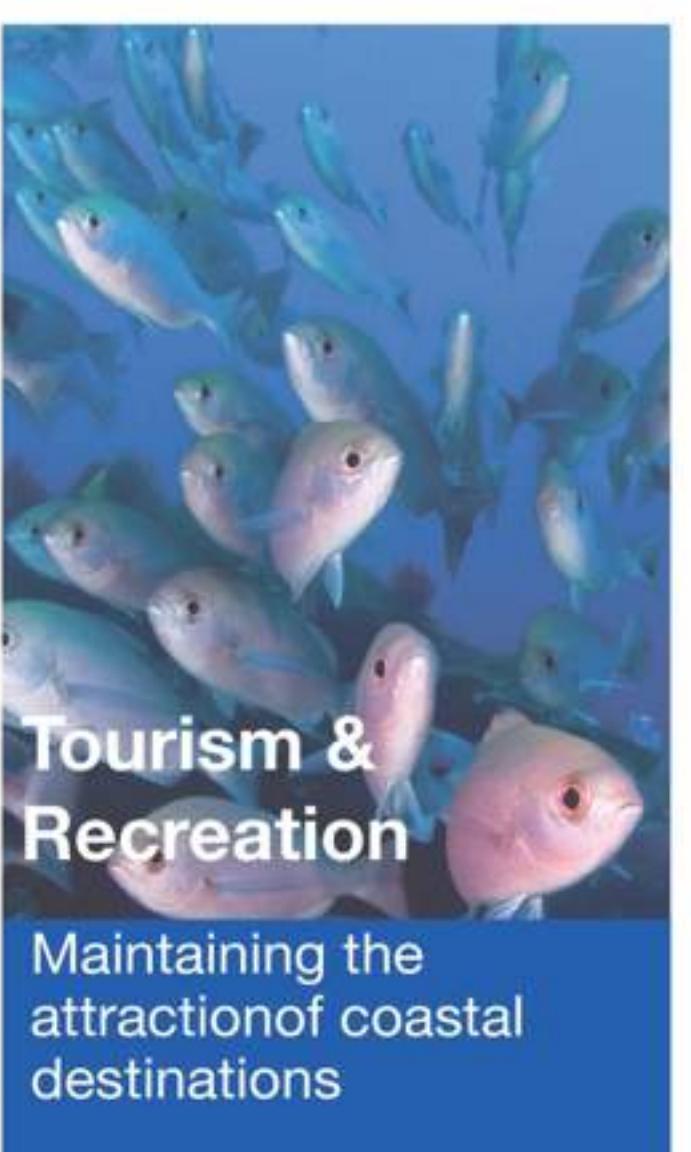
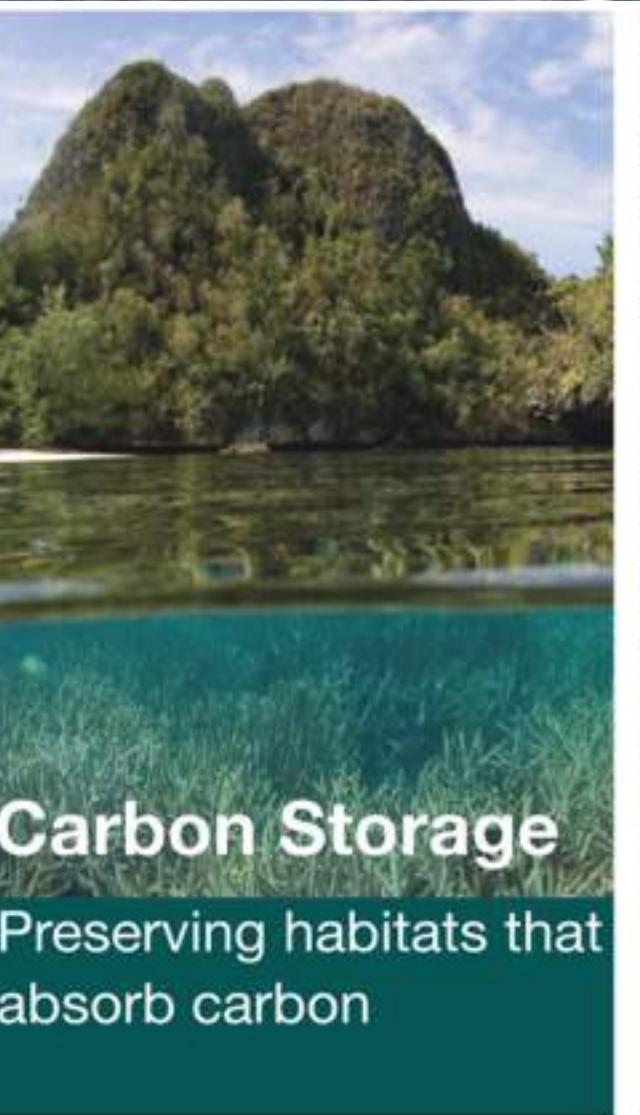
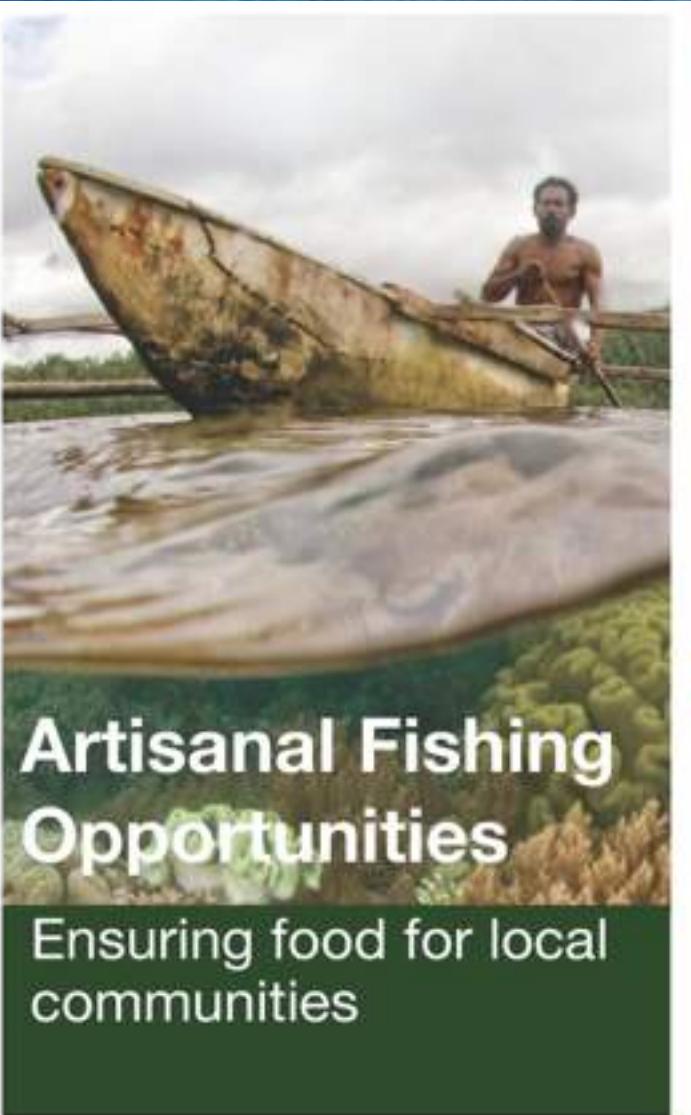
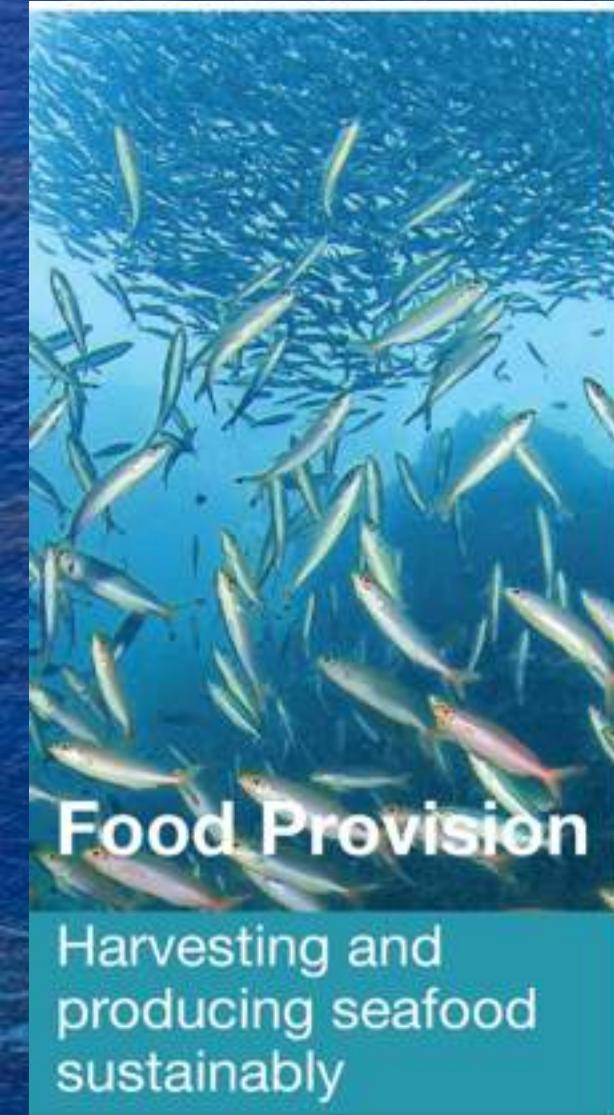
A photograph of four young children on a sandy beach. One child in the foreground is sitting on a rock, smiling at the camera. Behind him, three other children are playing soccer. One child is holding a soccer ball with "SPAIN" and "ITALY" visible on it. They are all wearing casual clothing like t-shirts and shorts. The ocean and sky are in the background.

a **HEALTHY OCEAN**  
sustainably delivers a range of  
benefits to people both now and  
in the future

# What is the Ocean Health Index?

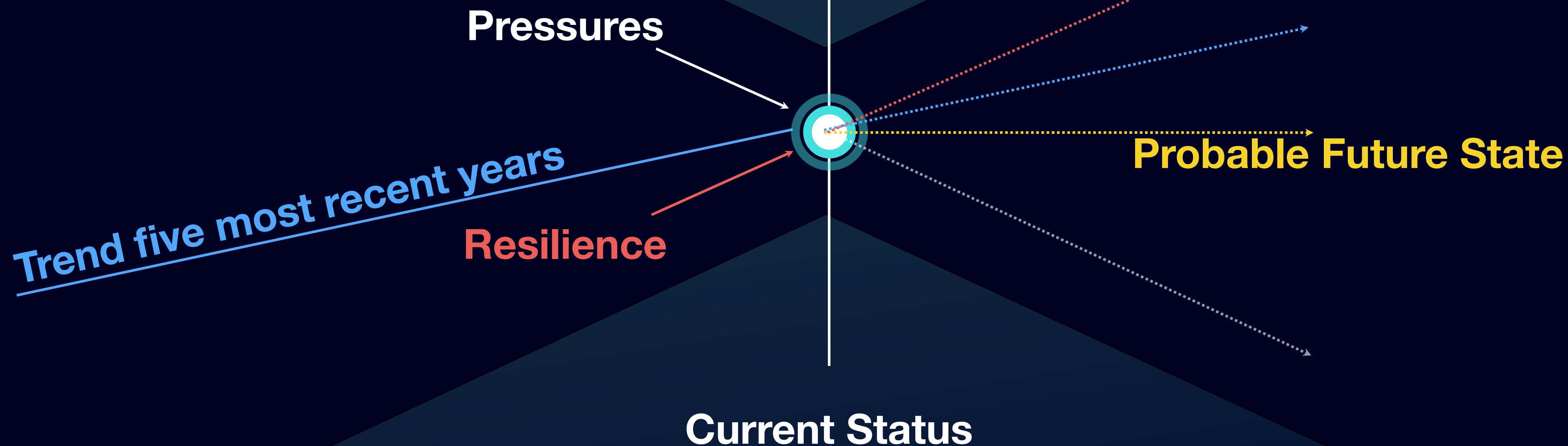
- a quantitative, repeatable, transparent and comprehensive tool
- that measures & tracks sustainable ocean use
- with a common language to inform decision making

# Ten Human Goals: an Ocean Dashboard

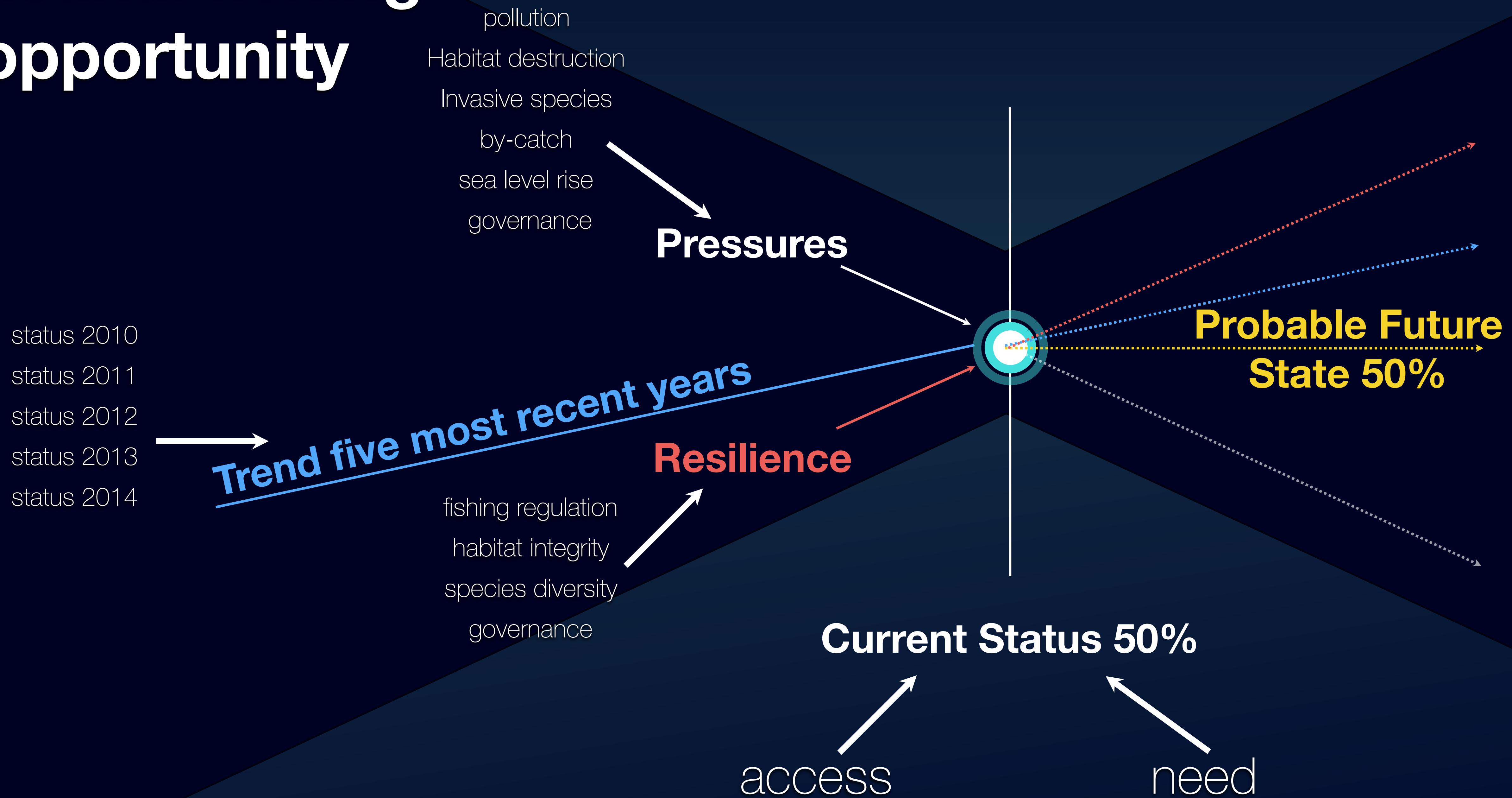


$$\sum_{i=1}^N \alpha_i I_i = I$$

The Ocean Health Index  $I$  is the weighted sum of individual goal indices  $I_i$ :



# Artisanal fishing opportunity



# Calculations for Each Goal

Present  
Reference

$$\frac{X_i}{X_{i,R}} = x_i =$$

CURRENT  
STATUS 50

Trend  $T$

Pressures  $p_i$

Resilience  $r_i$

+

$$I_i = \frac{x_i + \hat{x}_{i,F}}{2}$$

PROBABLE  
FUTURE  
STATE 50

$$(1+\delta)^{-1} [1 + \beta T_i + (1 - \beta)(r_i - p_i)] x_i = \hat{x}_{i,F}$$

# Current Status

## EXAMPLES OF INDICATORS USED TO CALCULATE GOAL STATUS

<b>Food Provision</b>	<b>Artisanal Fishing</b>	<b>Natural Products</b>	<b>Carbon Storage</b>	<b>Coastal Protection</b>
Catch volume by species	Quality of artisanal fishing management	Tons harvest of non food products	Extent of coastal habitats	Extent of habitats 1km
Biomass/biomass of MSY	GDPpcPPP	Value of harvest by product	Relative weight of carbon storage by habitat	Condition of habitats 1km
Tons of Mariculture per species	Artisanal fishing need	Sustainability of the harvest		Ocean acidification
Mariculture sustainability				Ultra violet incidence
Coastal population				Sea level rise

# Current Status

## EXAMPLES OF INDICATORS USED TO CALCULATE GOAL STATUS

Economies & Livelihoods	Tourism & Recreation	Cultural Identity	Clean Waters	Biodiversity
Sector revenues	Proportional employment in tourism	Conservation status of iconic species	Chemical pollution	Conservation status of species
Employment and wages in the sectors	Tourism sustainability	Proportion of marine and coastal protected areas	Pathogens	Conservation status of habitats
Unemployment				
Coastal GDP				
Marine sector evenness			Nutrient pollution	
			Trash	

# Pressures

## EXAMPLES OF INDICATORS USED TO CALCULATE GOAL PRESSURES

Ecological Pressures						Social Pressures
Pollution	Habitat destruction	Species Pollution	Fishing Pressures	Climate Change	Social factors	
Chemical	Habitat destruction	Invasive species	Commercial bycatch (high & low)	Sea surface temperature	Governance indicators	
Pathogens						
Nutrients	Subtidal hard and soft bottom habitats	Genetic escapes	Artisanal bycatch (high & low)	Ocean acidification		
Trash	Intertidal habitats					
		Selective harvesting		Ultraviolet incidence		
				Sea level rise		

# Resilience

## EXAMPLES OF INDICATORS USED TO CALCULATE GOAL RESILIENCE

Ecological Resilience		Social Resilience
Regulatory	Ecological Integrity	Social Integrity
Invasive Species	Species Diversity	Global Competitiveness Index
CITES Signatories	Habitat Diversity	Sector Evenness
Fishing Regulations		Global Governance Indicators
Habitat Protection		
Biodiversity Protection		
Good Governance		
Sustainable Tourism Measures		
Clean Water Measures		

# Reference Points: optimal status

**S**pecific

**M**easurable

**A**mbitious

**R**ealistic

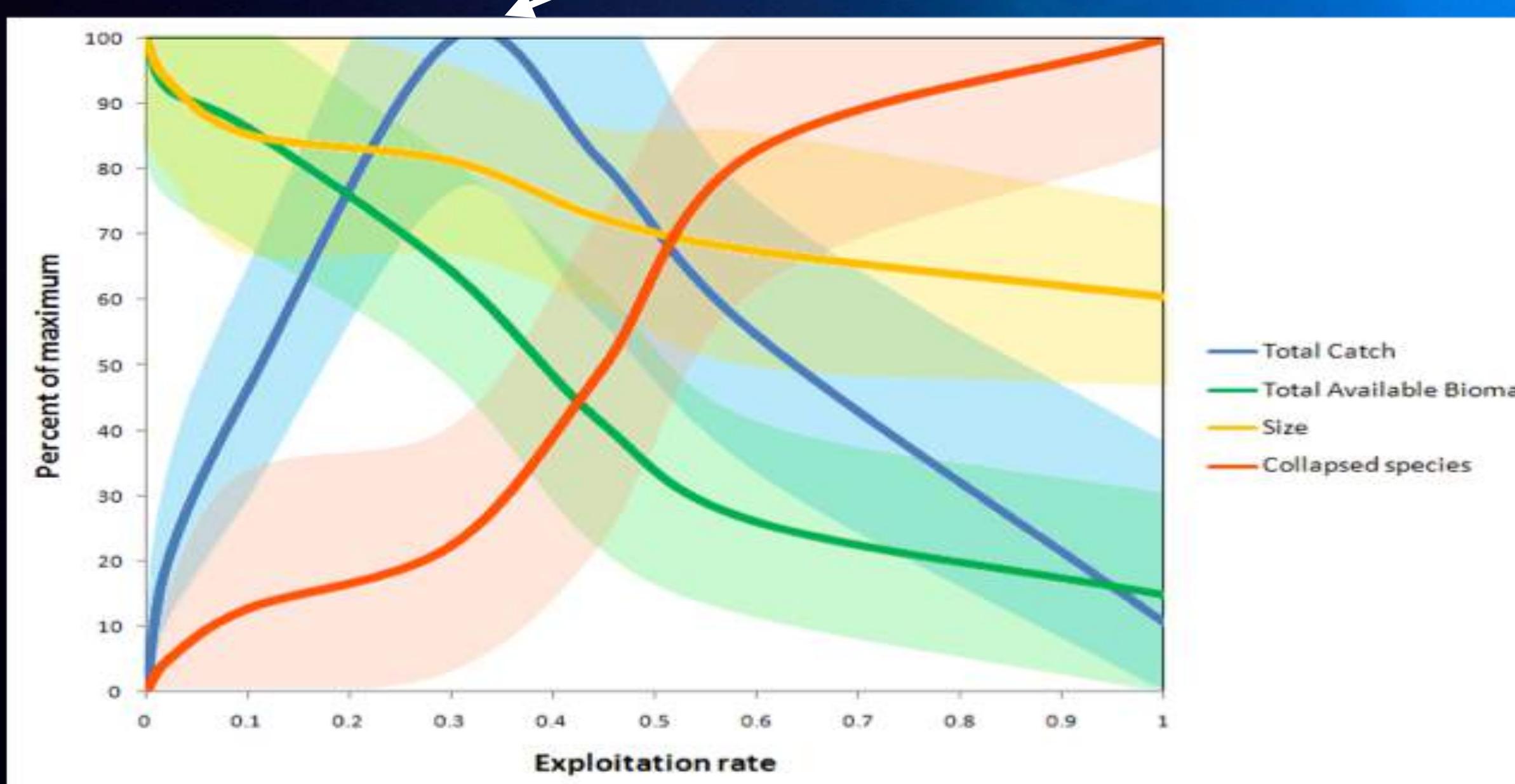
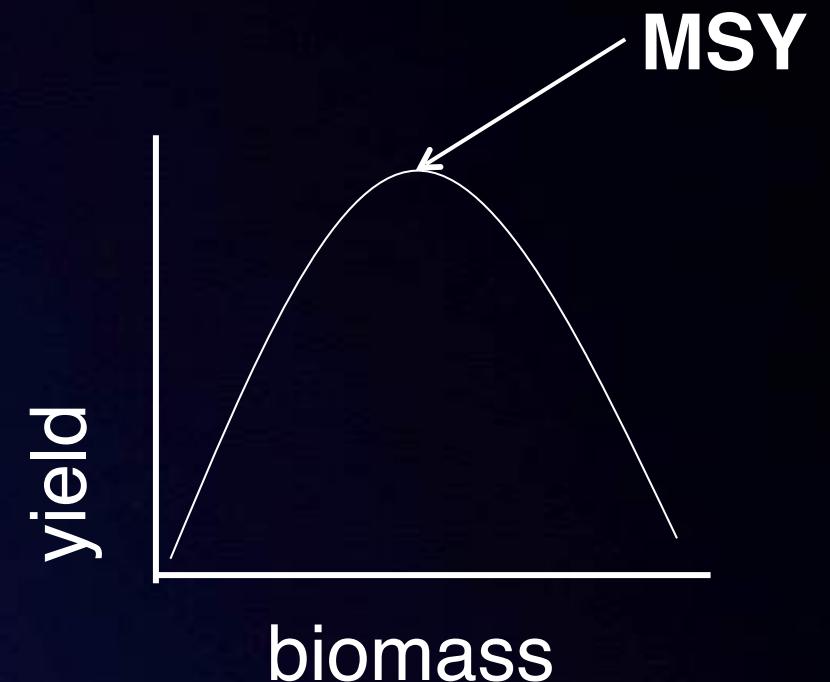
**T**ime bound

**A**rticulate management  
guides

selection of appropriate  
indicators for assessing  
the status of the goal

# Types of Reference Points

## 1. Functional Relationships (preferred method)



Wild Caught  
Fisheries



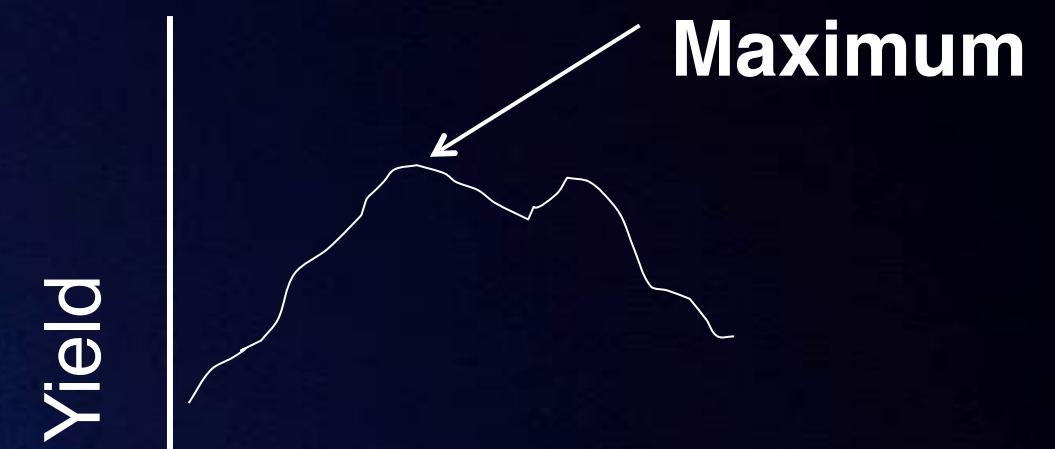
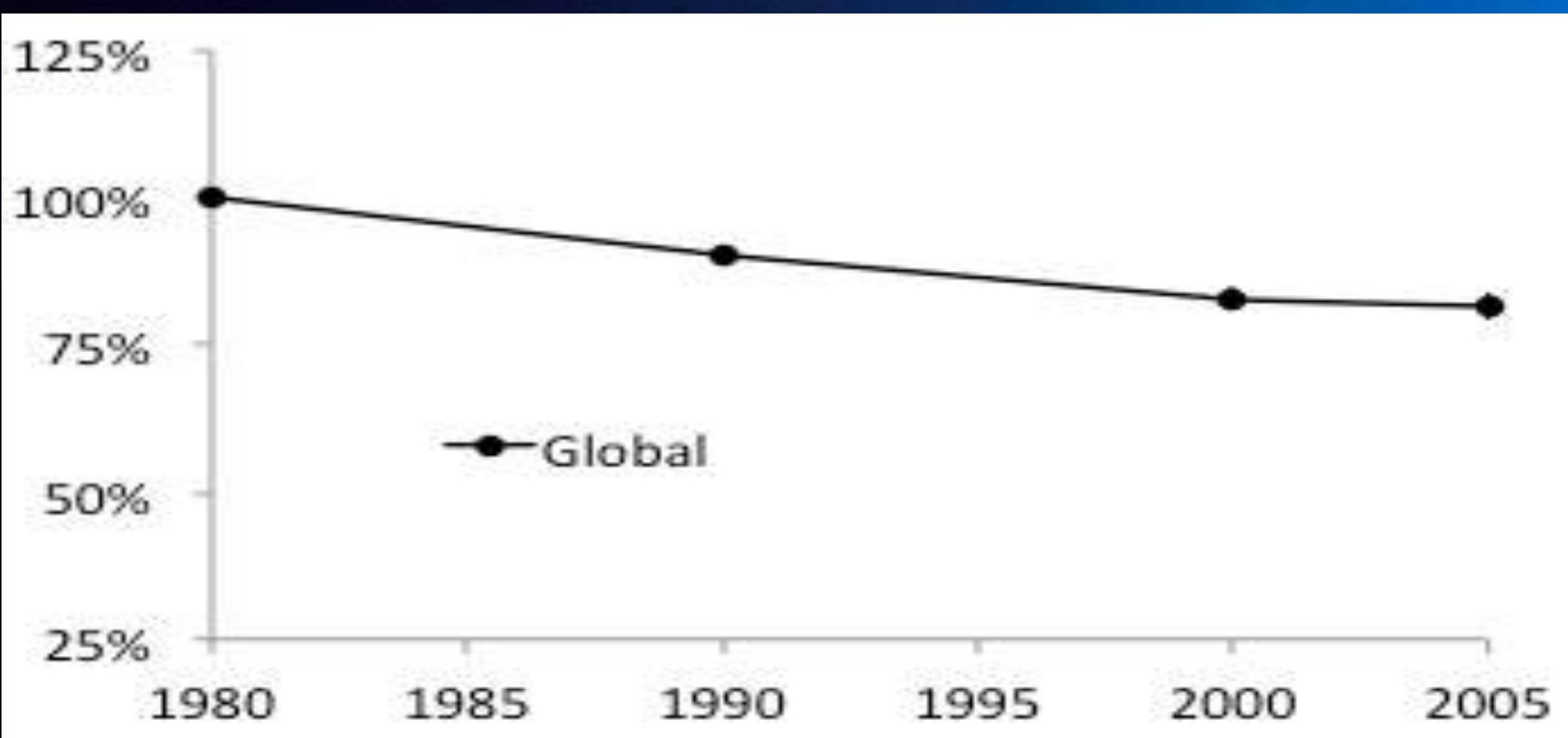
Artisanal  
Fishing



Natural  
Products

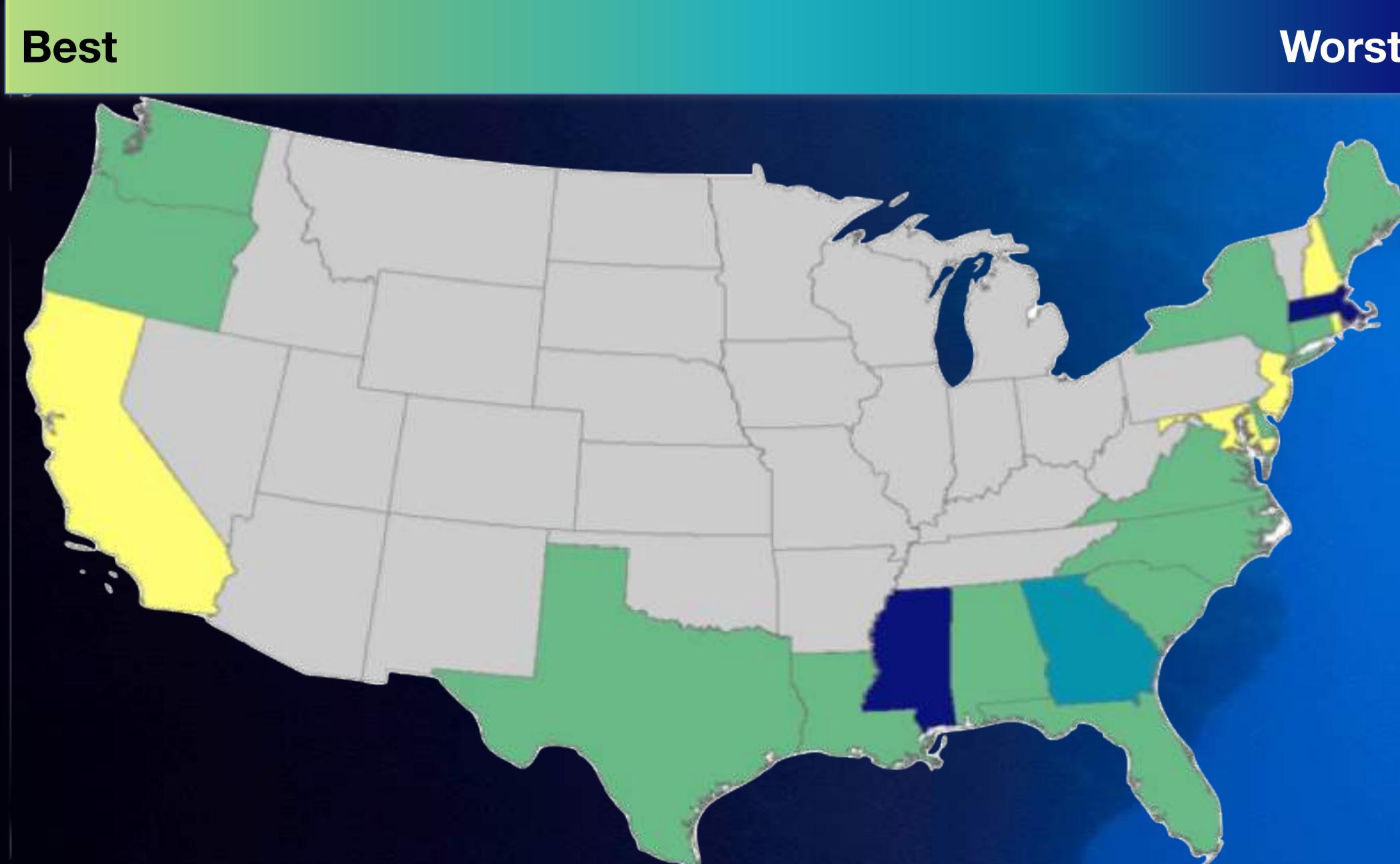
# Types of Reference Points

## 2. Temporal comparisons



# Types of Reference Points

## 3. Spatial Comparison



Livelihoods



Turism & Recreation



Mariculture

# Types of Reference Points

4. Known/established target



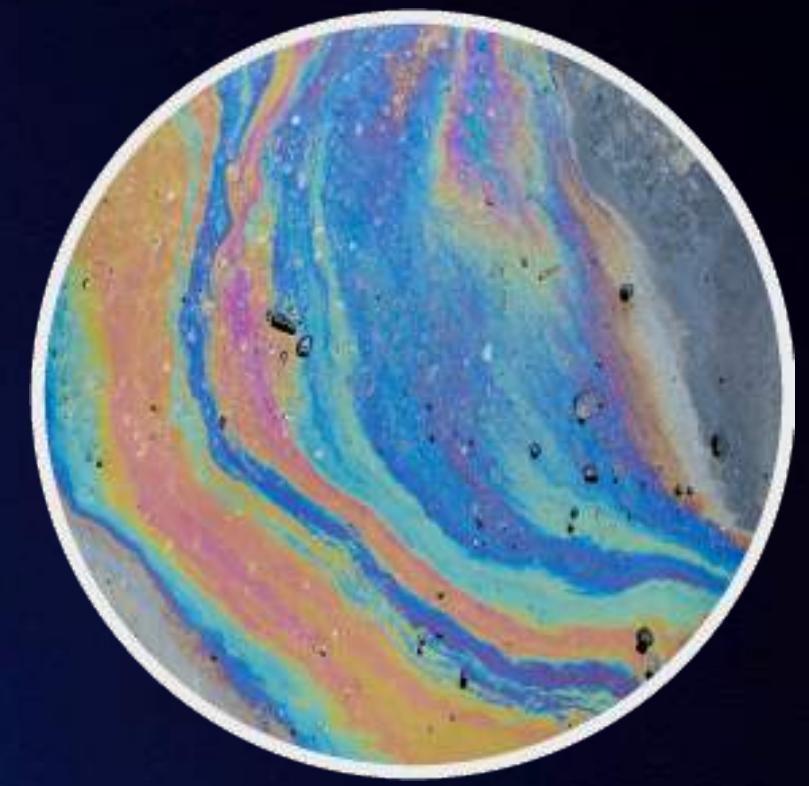
Convention on  
Biological Diversity



Sense of place:  
Lasting Special Places



Sense of Place:  
Iconic Species



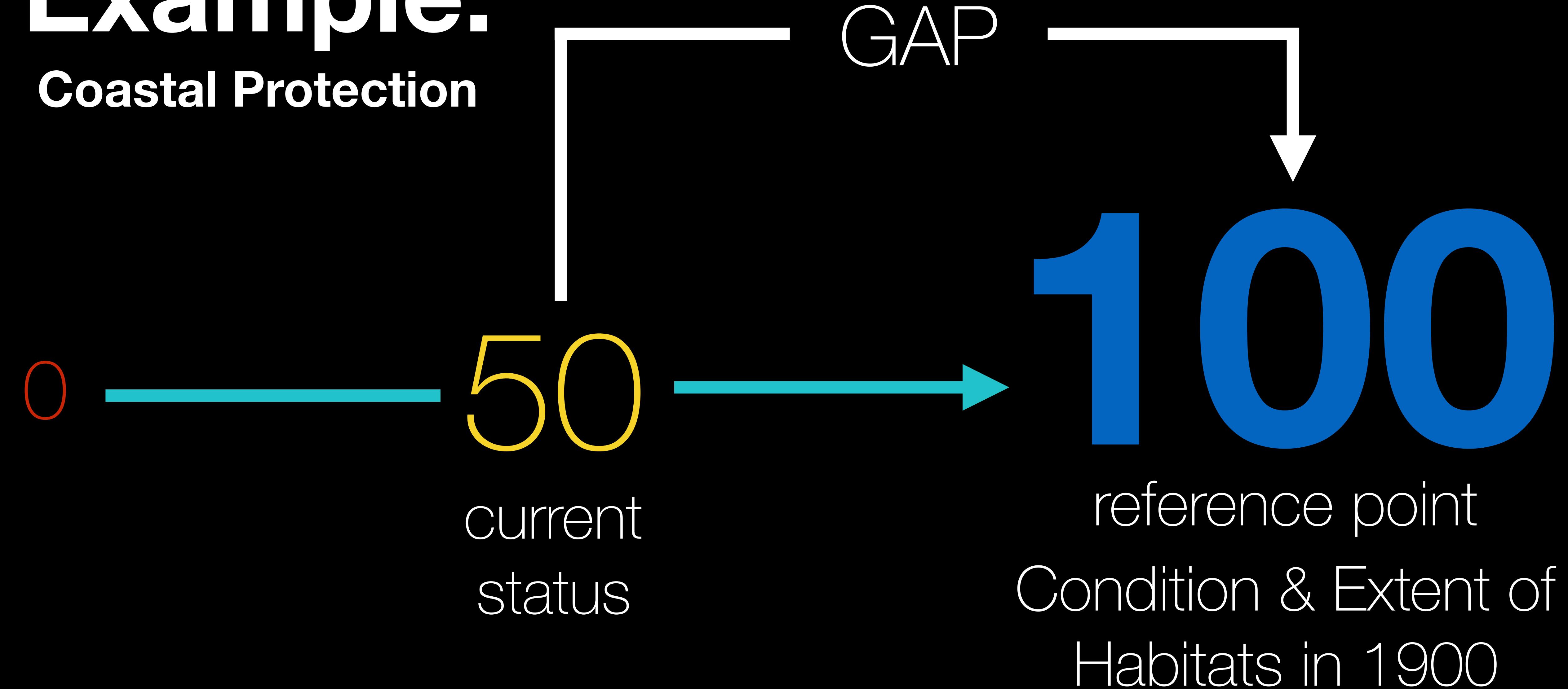
Clean Waters



Biodiversity:  
Species

# Example:

## Coastal Protection



# Components of Goal Scores

## Present Status

50%

Goal's present value compared to a goal-specific reference point

## Likely Future Status

50%

2/3

**Trend**  
average percentage change in Status shown by the most recent five years of data

2/3

1/3

Pressure	Resilience
ecological and social factors that negatively affect status	sum of ecological and social factors that positively affect status and reduce pressures

FLEXIBLE &  
SCALEABLE  
approach

global  
assessments

vs.

OHI+  
independent  
assessments





# Global Goal Status Models and Reference Points

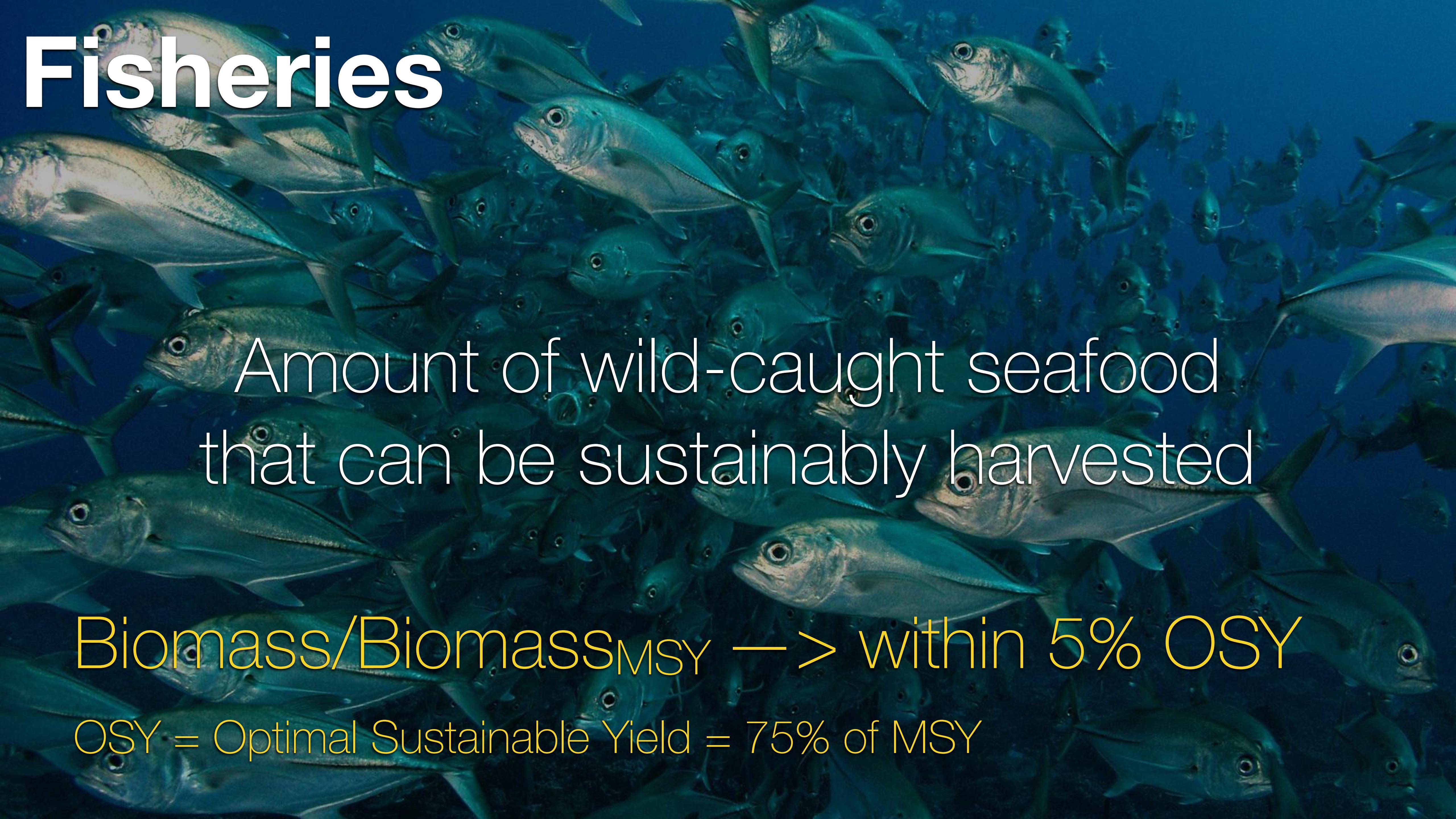
# Food Provision

Measures the amount of seafood sustainably harvested & produced

**WILD-CAUGHT  
FISHERIES**

**MARICULTURE**

# Fisheries

A dense school of fish, likely tuna, swimming in a dark blue ocean. The fish are silvery-blue with dark stripes and are packed closely together, filling most of the frame.

Amount of wild-caught seafood  
that can be sustainably harvested

Biomass/Biomass<sub>MSY</sub> → within 5% OSY

OSY = Optimal Sustainable Yield = 75% of MSY

# Fisheries

$B/B_{MSY} \Rightarrow r \& K$

$$X_{FIS} = \prod_{i=1}^n SS_i^{\frac{C_j}{\sum C_i}}$$

values aggregated using geometric mean

## Status Model Equation

$r$  = rate of population increase

$K$  = carrying capacity

$B_{MSY}$  = mean time series B

Catch = FAO data report commercial fishing landings (proxy for catch) by fishing country  
—>0.5° resolution, distribution of taxa

$X_{FIS}$  = Status for each reporting region  $i$

SS = stock status scores

$i$  = individual taxon &  $n$  = total # of taxa

$C$  = relative contribution to overall catch

# Mariculture

Annual harvested yields from  
marine & brackish waters

Harvested tonnes per coastal inhabitant

# Artisanal Fishing Opportunity



The ability to access fish for food - small & local scales



All demand for artisanal fishing is allowed and/or achieved and done in a sustainable manner

# Natural Products



Harvest of non-food natural products

35% of the peak maximum value ever achieved

# Carbon Storage

A photograph showing an underwater perspective looking towards a dense forest of mangrove trees. The water is clear, and the intricate root systems of the mangroves are visible, extending from the sandy bottom up into the water. The surface of the water is calm, and the sky above is overcast.

Extent and condition of coastal habitats  
store & sequester atmospheric CO<sub>2</sub>

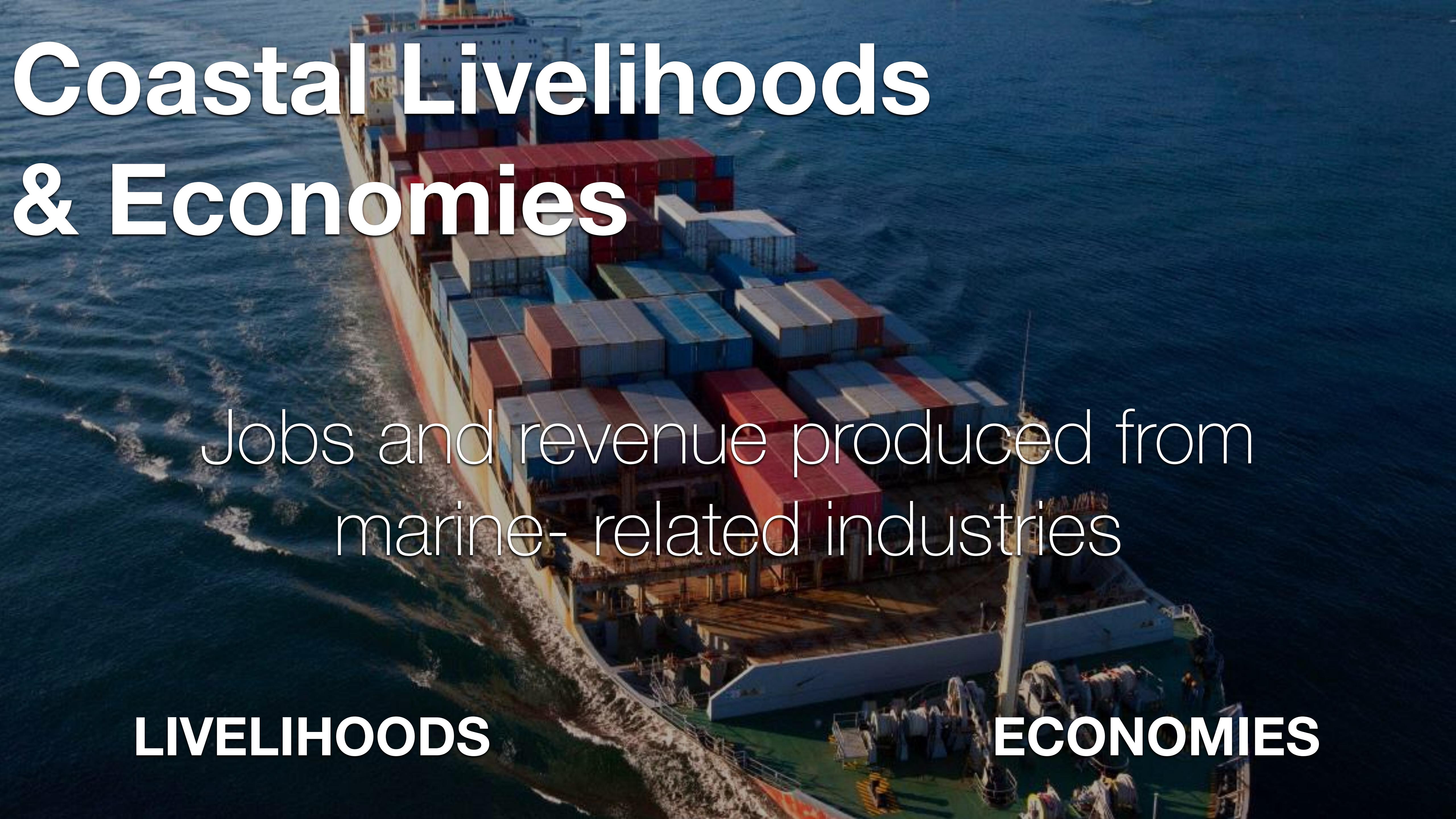
Condition in the early 1980s

# Coastal Protection

Extent and condition of coastal  
habitats against flooding and erosion

Condition in the early 1980s

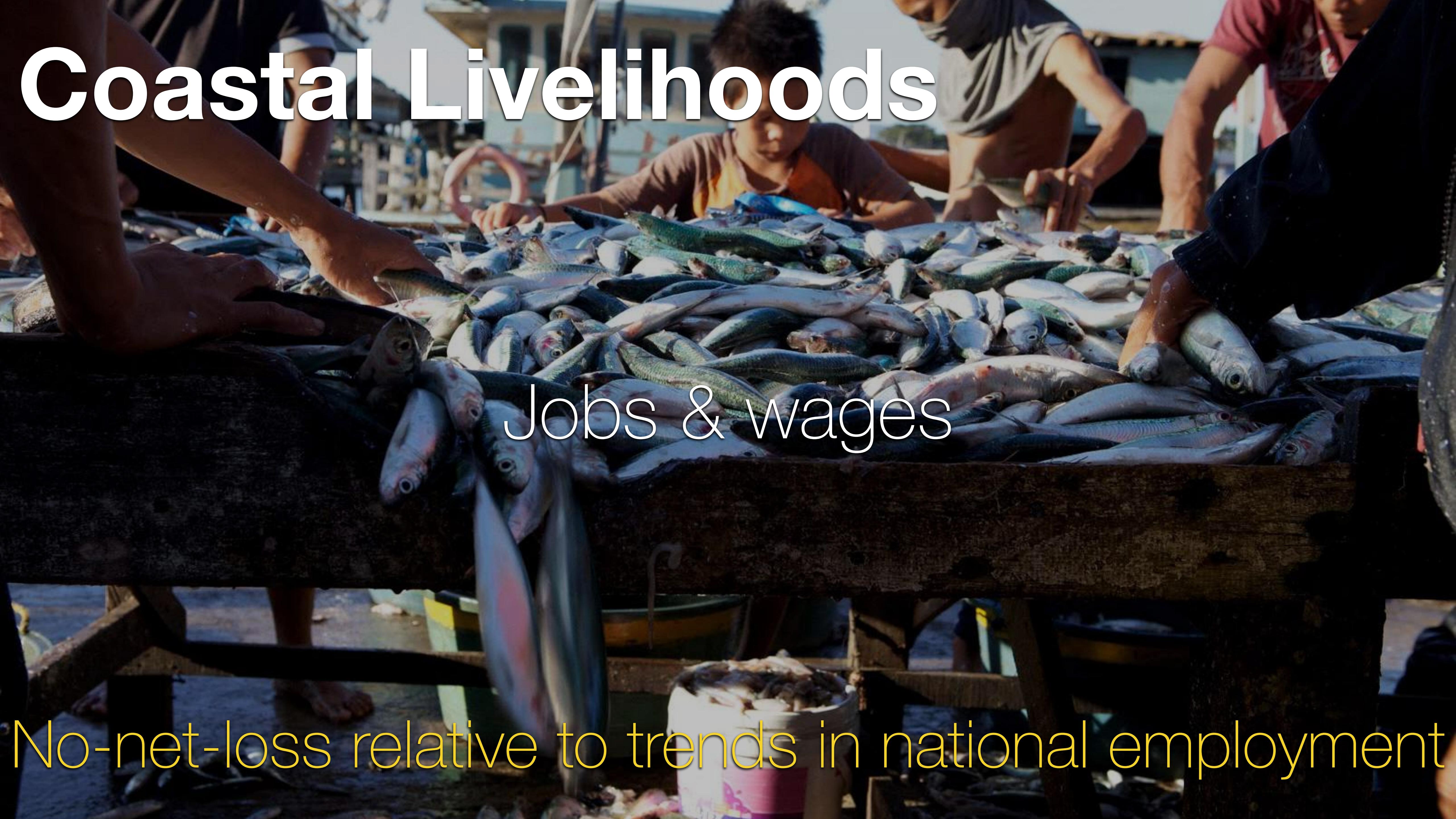
# Coastal Livelihoods & Economies

An aerial photograph of a massive cargo ship sailing across a dark blue ocean. The ship's deck is filled with numerous shipping containers stacked in organized rows. The side of the ship is white with some orange and yellow markings. The wake of the ship is visible in the water behind it.

Jobs and revenue produced from  
marine-related industries

LIVELIHOODS

ECONOMIES



# Coastal Livelihoods

Jobs & wages

No-net-loss relative to trends in national employment



# Coastal Economies

## Eight Sectors

1. Commercial fishing
2. Mariculture
3. Tourism and recreation
4. Shipping and transportation
5. Whale watching
6. Ports and harbors
7. Ship and boat building
8. Renewable energy production (wind and wave)

# Coastal Economies



Revenue produced from  
marine-related industries

No net loss marine-related revenue & keep  
pace with GPD growth

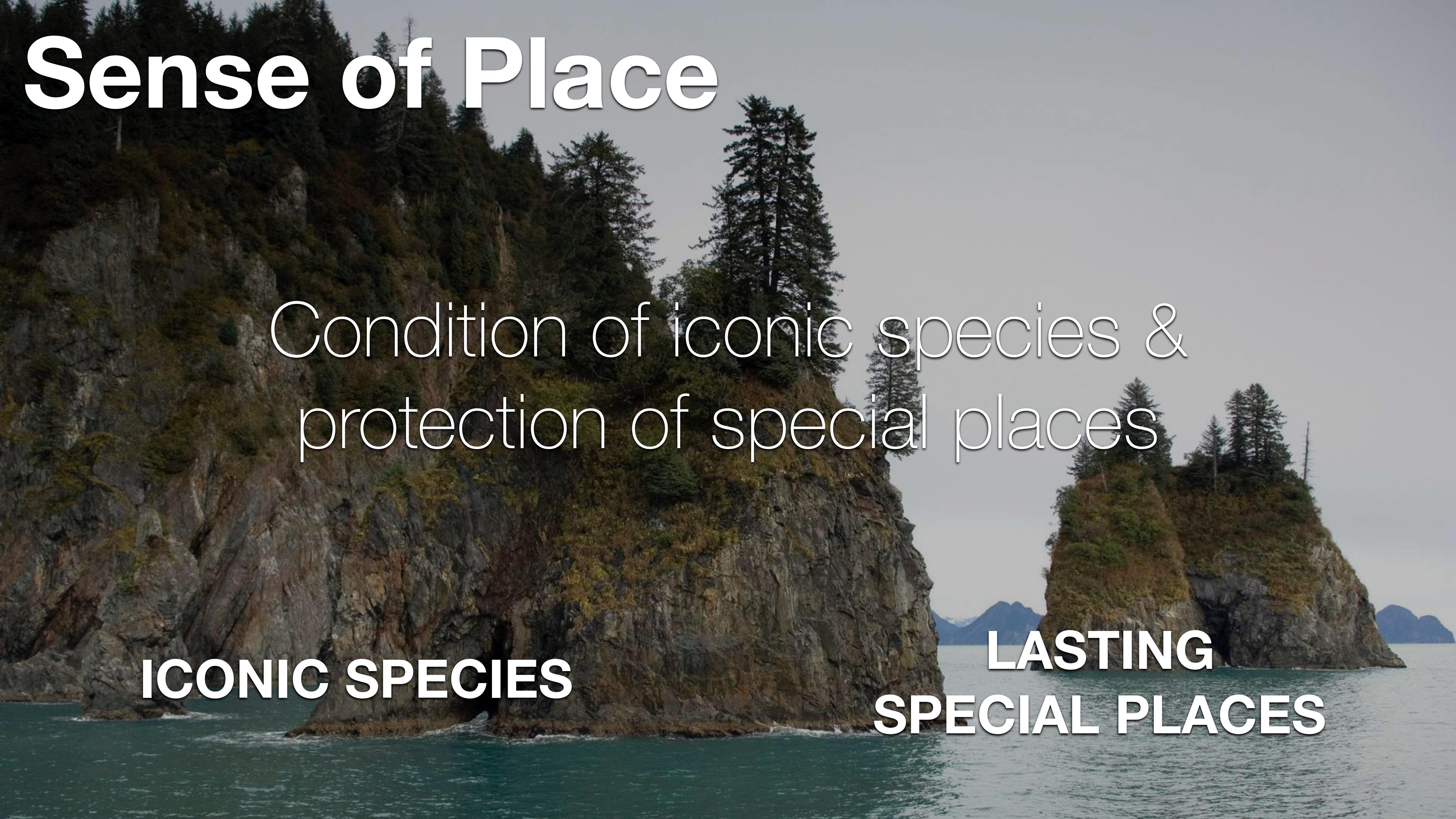
# Tourism & Recreation

A vibrant underwater photograph showing a large, colorful coral reef in the foreground. A scuba diver in a blue tank and fins is swimming towards the right side of the frame. Sunlight filters down from the surface, illuminating the coral and small fish swimming around it.

Capture experience in visiting coastal & marine areas and attractions

Proportion of the labor force engaged in the sector  
90% percentile — 9.5% of total labor force

# Sense of Place

A large, rugged rock formation covered in green vegetation, standing in a body of water under a cloudy sky.

Condition of iconic species &  
protection of special places

**ICONIC SPECIES**

**LASTING  
SPECIAL PLACES**

# Iconic Species

A close-up, underwater photograph of a sea turtle, likely a green turtle, swimming gracefully. The turtle's head is turned slightly to the left, showing its eye and the patterned scales on its forehead. Its body is angled towards the right, with its long, flared tail visible. The background is a deep blue ocean, and the lighting creates a soft glow around the turtle's form.

Unique importance is recognized  
through traditional activities

Relevant marine species categorized “least concern”

# Lasting Special Places



Geographic locations that  
are valuable to people

Protecting 30% of coastal waters to 3 nautical  
miles & 30% 1km inland of shoreline

# Clean Waters

Measures the degree to  
which waters are polluted

Zero pollution

# Biodiversity

Success in maintaining the richness and variety of marine life

SPECIES

HABITATS

# Species

Average IUCN conservation  
status of marine species

Species categorized at very low levels of extinction  
risk, or “least concern”

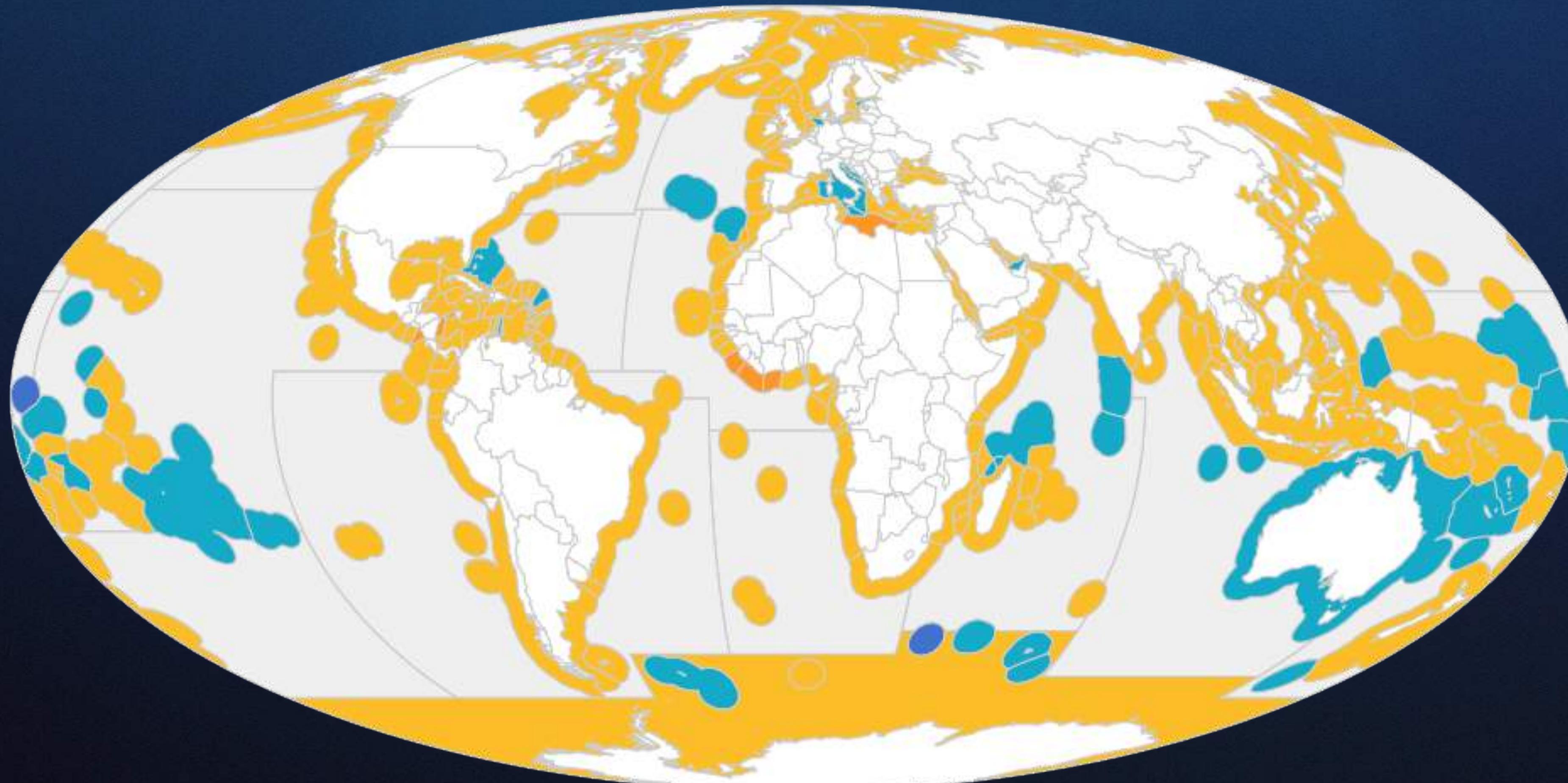
# Habitats

mangroves, coral reefs, seagrass beds,  
salt marshes, sea ice, and subtidal soft-  
bottom habitats

Areas or conditions equal or exceed what they  
were in the early 1980s

# 110 Global Data Sets

## 221 EEZ – Countries & Territories



Puntuación

0

25

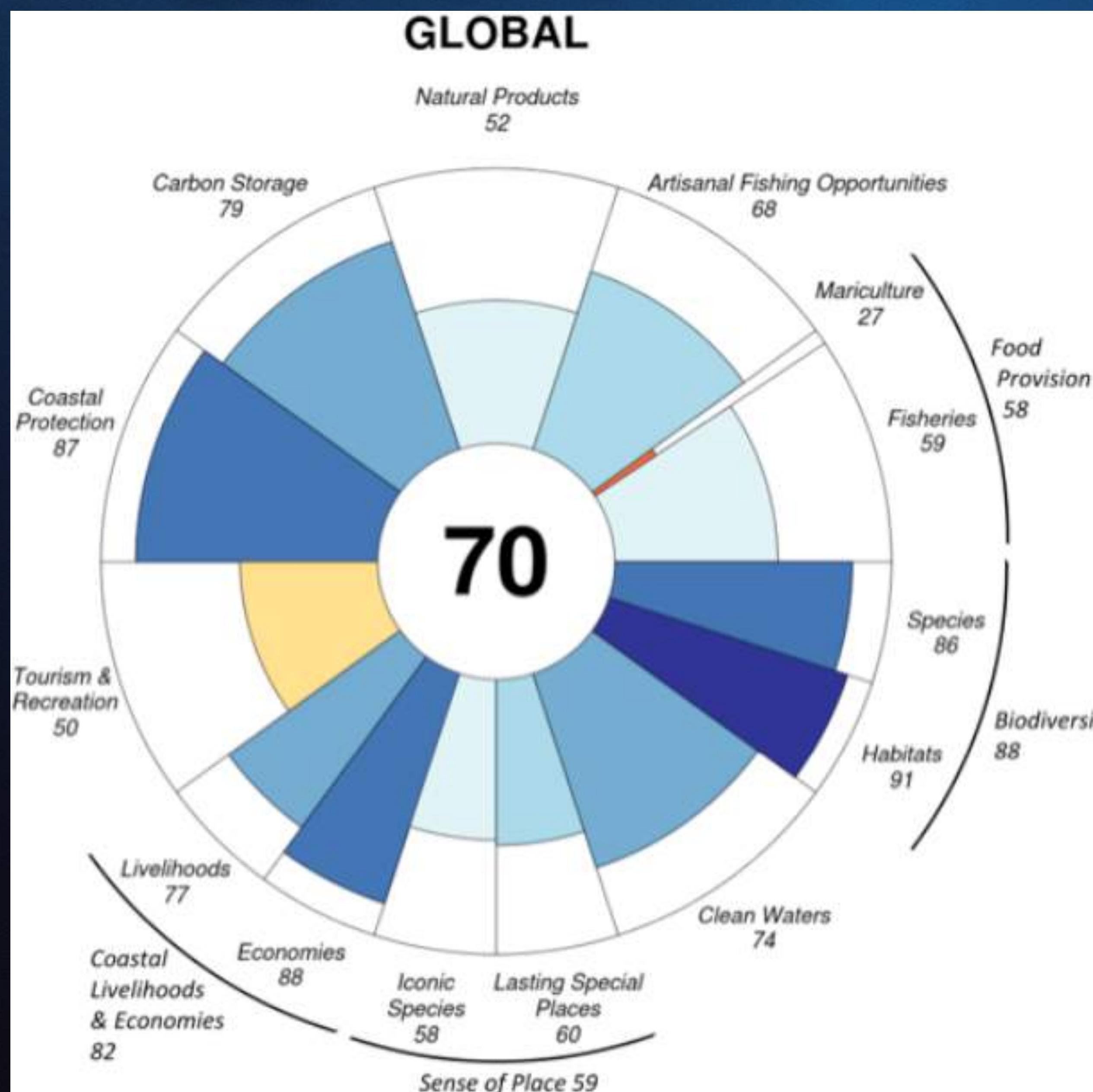
50

75

90

100

# 2015 Global Assessments



## Highest scoring areas:

Prince Edward Islands **92**  
Howland Island and Baker Island **90**  
Macquarie Island, Heard and McDonald Islands **87**  
Phoenix Group, Northern Saint-Martin **86**  
New Caledonia (pop. 269,000) **85**

## Lowest scoring areas:

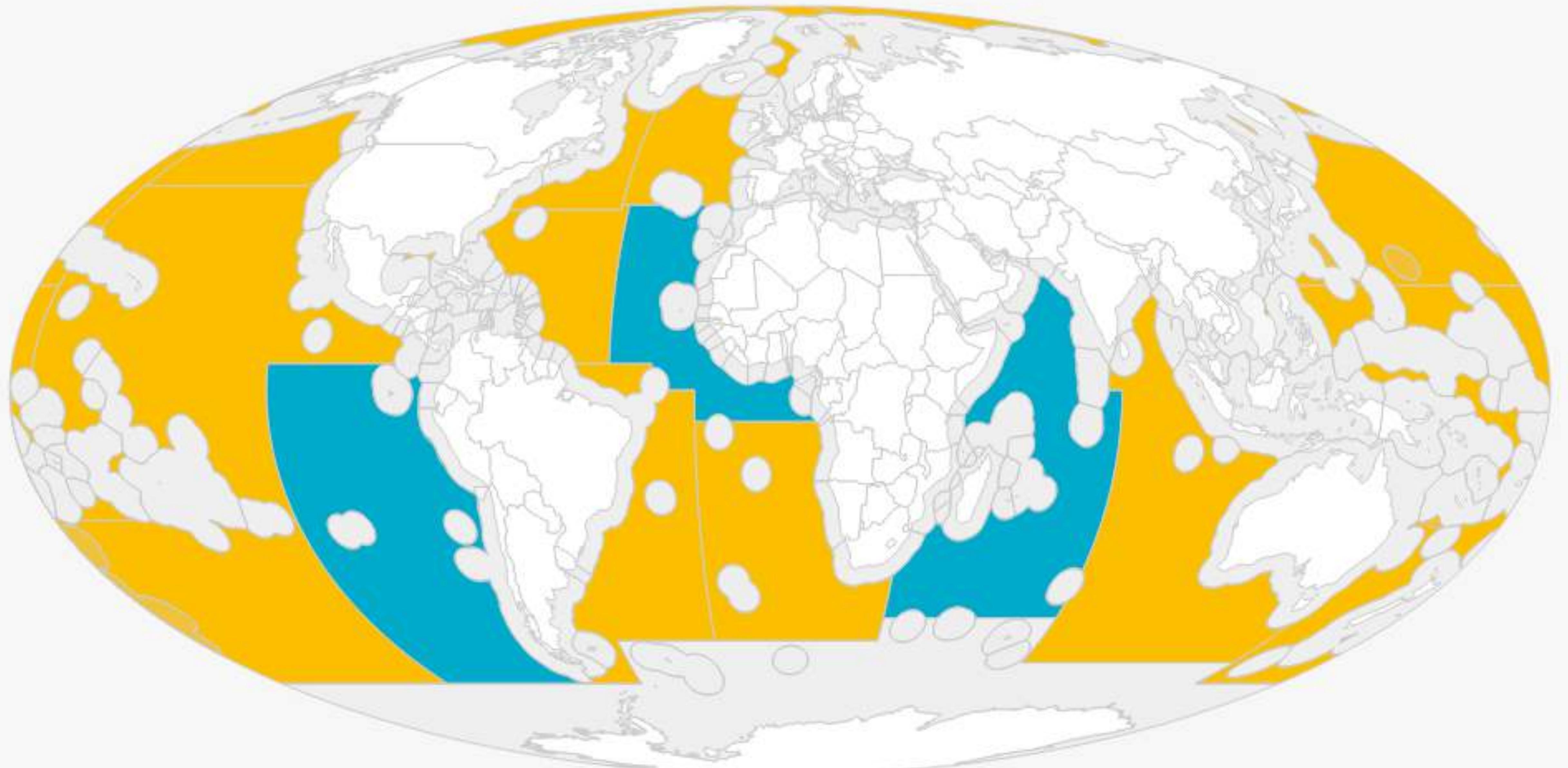
North Korea, Lebanon **50**  
Liberia, Nicaragua **48**  
Sierra Leone, Ivory Coast, DRC **47**  
Dominica **46**  
Libya **43**

# High Seas Assessment

Based on 15 FAO subdivisions

Only three components assessed:

1. Food provision: fisheries
2. Sense of place: iconic species
3. Biodiversity: species



Score



NO DATA

Lowest: 53 Pacific Northwest  
Highest: 79 Western Indian Ocean

## LIMITATIONS & CHALLENGES OF GLOBAL STUDY



- Data must be uniformly available from all countries
- Better data from individual countries can't be used
- Results are coarser than country-level data might provide
- Can't see local-scale phenomena

# Strengths

Uniform methods &  
common language

Comparisons

Synergy with Multilateral  
Environmental Agreements

# Limitations

Global data quality

Low local precision

Low policy relevance  
at local scales

# Endorsements & Adoptions



**United Nations World Ocean Assessment**  
Regular Process for Global Reporting and Assessment of the State of the Marine Environment Including Socioeconomic Aspects

Member login





A composite image. The top half shows a man with a beard and dark skin, wearing white shorts, sitting in a long, narrow, traditional wooden boat. He is holding a long wooden oar. The boat is on a wide river with greenish-brown water. In the background, there are green hills under a cloudy sky. The bottom half of the image is a close-up view of a coral reef. The corals are various shades of green, brown, and yellow, forming complex, textured structures.

thank You!  
Questions?