

OCEAN  
HEALTH  
INDEX™  
+ = independent assessment

Assessments at any spatial scale:  
political and ecological

# Scaling Down the OHI Framework

Marine aspects are more or less important

Reference points ~ management objectives

Indirect measurements - estimate the status  
of various dimensions

# OHI+ Assessments

**scales smaller than global: countries, states, provinces,  
eco-regions**

At the scales **where decisions are made**

Relevant to local management

**BALANCE:** needs of people, economic  
development, natural resources

# Adapting the Ocean Health Index

Add or exclude goals

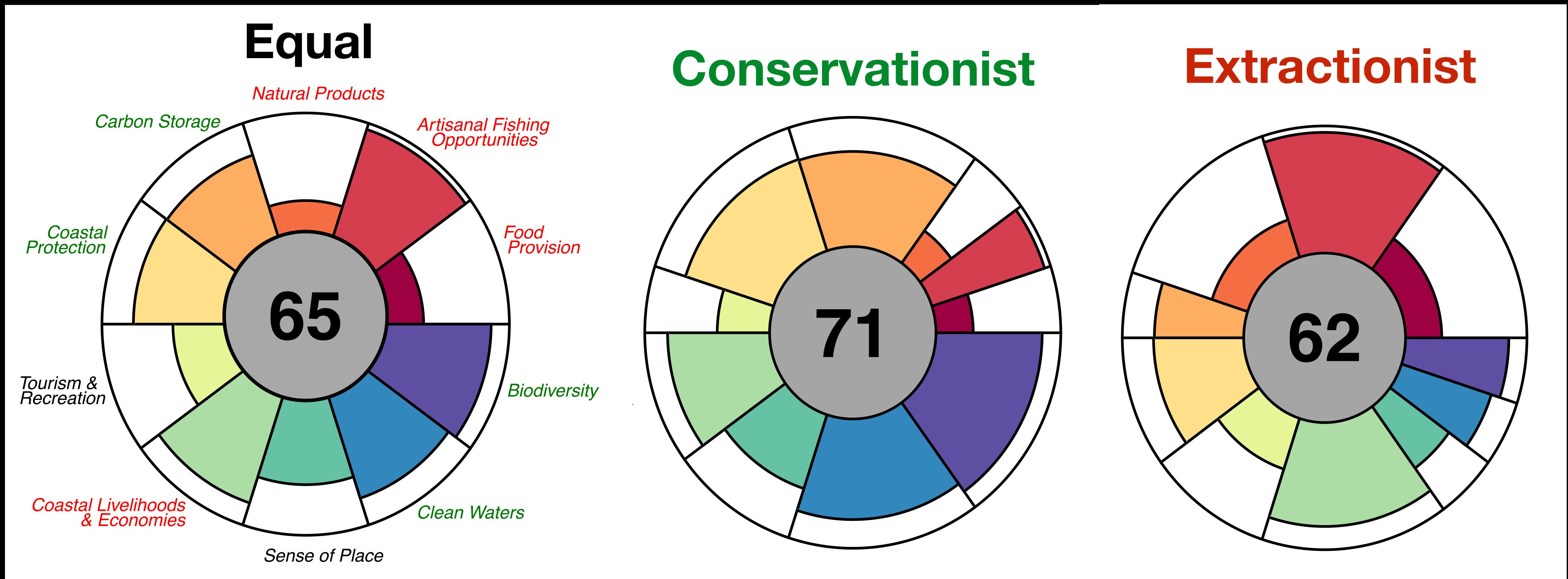
Locally relevant goal models

Stakeholder set reference points

# Weighing Goals

Goal	Global	Conservationist	Strongly Extractive
<b>Food Provision</b>	0.10	0.05	<b>0.18</b>
<b>Artisanal Opportunity</b>	0.10	0.05	<b>0.18</b>
<b>Natural Products</b>	0.10	0.05	<b>0.18</b>
<b>Carbon Storage</b>	0.10	<b>0.15</b>	0.03
<b>Coastal Protection</b>	0.10	<b>0.15</b>	0.09
<b>Coastal Livelihoods &amp; Economies</b>	0.10	<b>0.10</b>	<b>0.18</b>
<b>Tourism &amp; Recreation</b>	0.10	0.05	0.09
<b>Sense of Place</b>	0.10	<b>0.10</b>	0.03
<b>Clean Waters</b>	0.10	<b>0.15</b>	0.03
<b>Biodiversity</b>	0.10	<b>0.15</b>	0.03

# Weighing Goals



# Modifying Goal Models

Capture goal philosophies in a different way

## Reasons:

Management objectives

Data availability

Cultural priorities or preferences

# Example: Tourism & Recreation

Global 2012

International  
Arrivals

U.S. West Coast

2014

Participation rates in  
tourism activities

Brazil 2014

Employment in  
coastal tourism



# Potential applications

Comparison of productivity and performance  
across regions

Comparison of a region across time

# U.S.A West Coast Assessment



**Study Area: West Coast**

**Region: States**

# U.S West Coast assessment

Higher resolution **data** – 80% local data layers

**Management relevant** geographies

# U.S West Coast assessment

Local model **adaptation:**

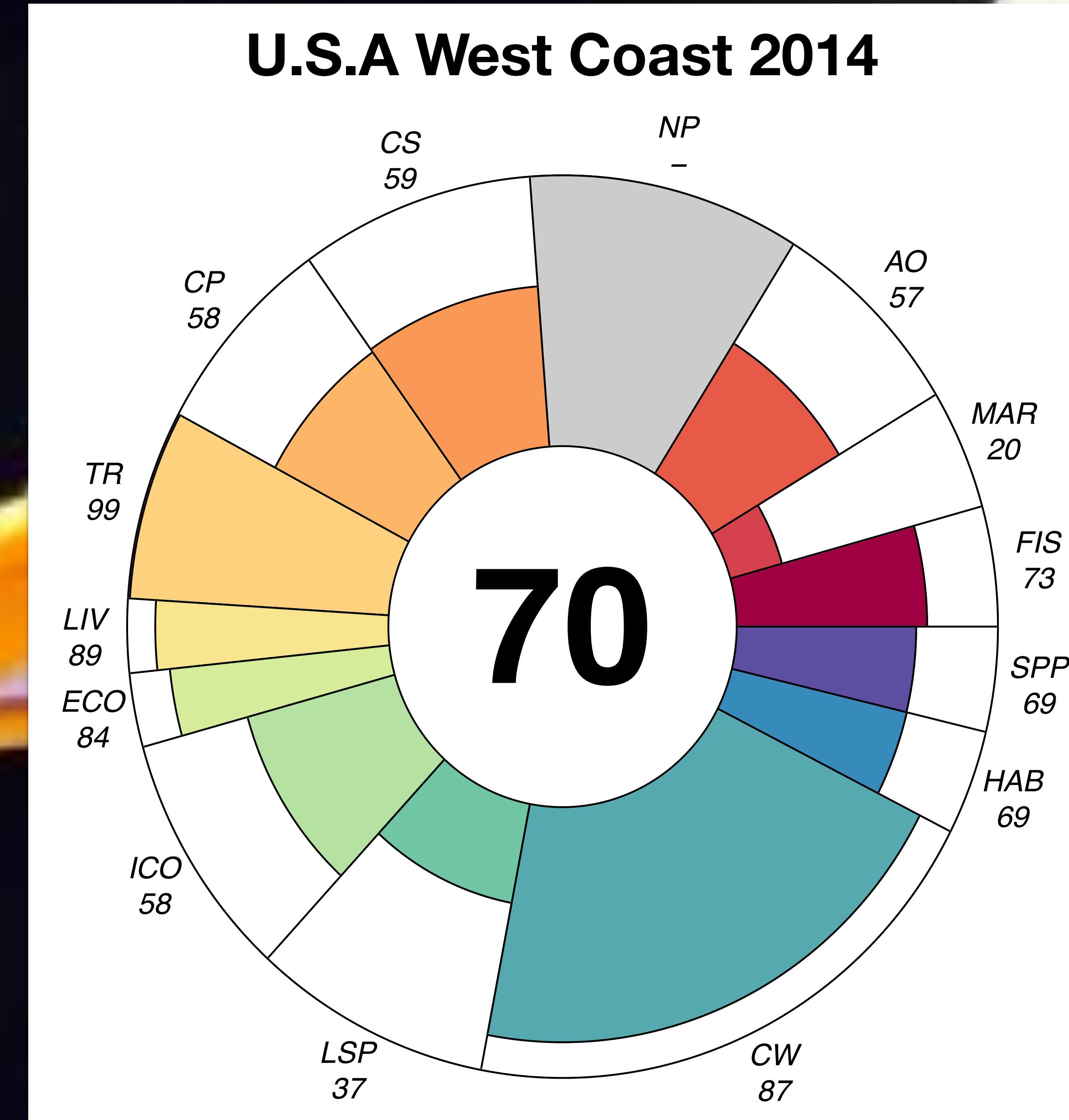
- a) wild-caught fisheries: formal stock assessments
- b) mariculture: potential sustainable productivity
- c) tourism & recreation: participation rates

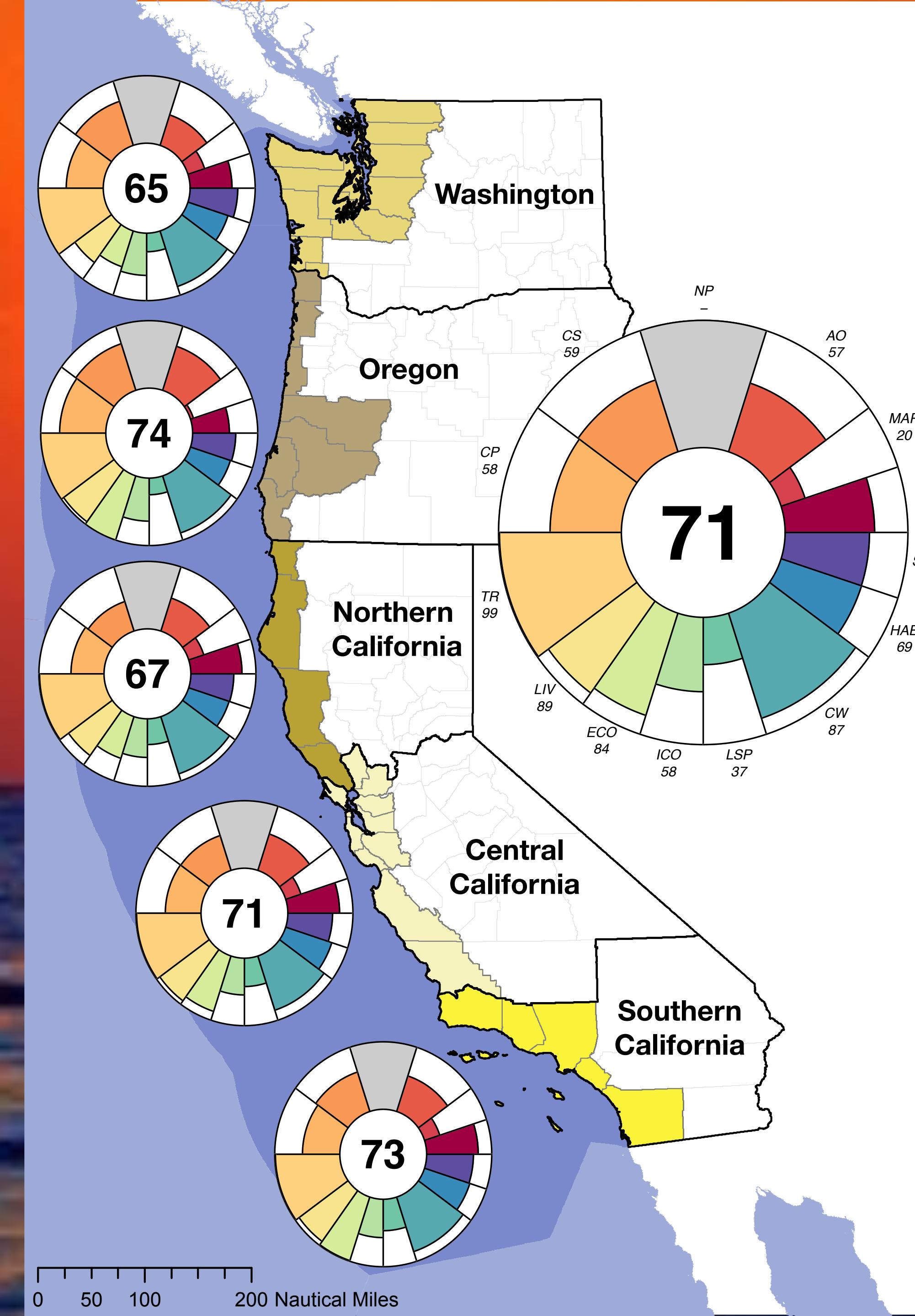
# U.S West Coast assessment

Reference points based on **U.S. west coast priorities:**

- a) mariculture: regional projections of economic and food security targets
- b) habitats: reconstruction of historic extents
- c) lasting special places: included 3-200nm

# U.S.A West Coast Assessment





# U.S.A West Coast Assessment

## Goal Weights

Food Provision	0.086
Artisanal Opportunity	0.075
Natural Products	0.102
Carbon Storage	0.087
Coastal Protection	0.073
Coastal Livelihoods & Economies	0.053
Tourism & Recreation	0.068
Sense of Place	0.177
Clean Waters	0.205
Biodiversity	0.075

# Analysis of management scenarios

Types and relative magnitudes of change

Responds to common management interventions

Consequences of management actions

# Example

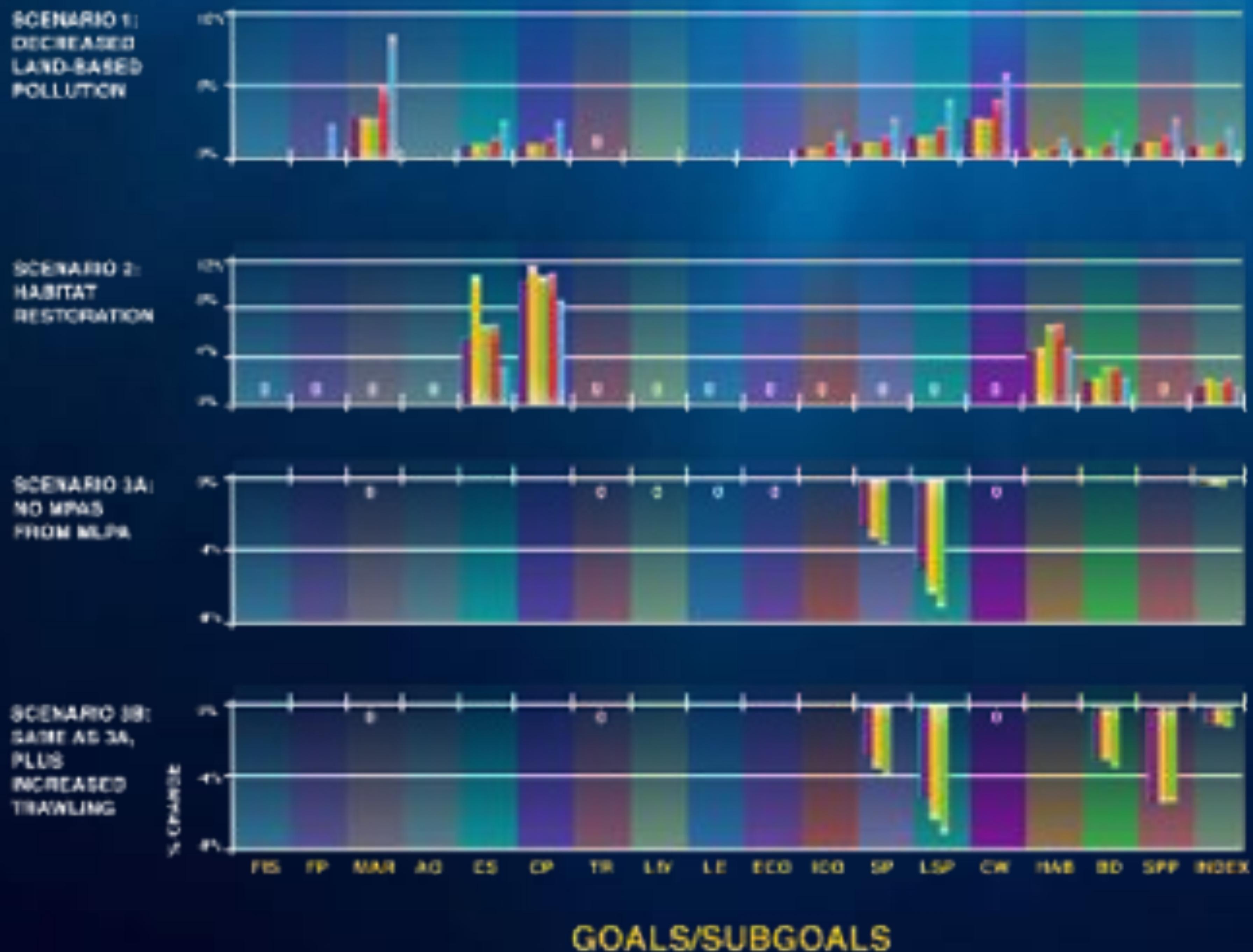
HOW WOULD SCORES CHANGE IF:

land-based pollution is decreased?

marine protected areas are removed?

trawling is increased?

# Management Scenarios



Northern California  
Central California  
Southern California  
Oregon  
Washington

advanced search

OPEN ACCESS PEER-REVIEWED

RESEARCH ARTICLE

# Assessing the Health of the U.S. West Coast with a Regional-Scale Application of the Ocean Health Index

Benjamin S. Halpern   Catherine Longo  Courtney Scarborough     Benjamin D. Best, Scott C. Doney, Steven K. Katona, Karen L. McLeod, Andrew A. Rosenberg, Jameal F. Samhouri

Published: June 18, 2014 • DOI: 10.1371/journal.pone.0098995

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## Abstract

[Introduction](#)[Methods](#)[Results](#)[Discussion](#)[Supporting Information](#)[Acknowledgments](#)[Author Contributions](#)[References](#)

## Abstract

Management of marine ecosystems increasingly demands comprehensive and quantitative assessments of ocean health, but lacks a tool to do so. We applied the recently developed Ocean Health Index to assess ocean health in the relatively data-rich US west coast region. The overall region scored 71 out of 100, with sub-regions scoring from 65 (Washington) to 74 (Oregon). Highest scoring goals included tourism and recreation (99) and clean waters (87), while the lowest scoring goals were sense of place (48) and artisanal fishing opportunities (57). Surprisingly, even in this well-studied area data limitations precluded robust assessments of past trends in overall ocean health. Nonetheless, retrospective calculation of current status showed that many goals have declined, by up to 20%. In contrast, near-term

# OHI Application in China Seas



- Launched in June, 2012
- Strong supports from SOA, using OHI to improve China Seas monitoring system

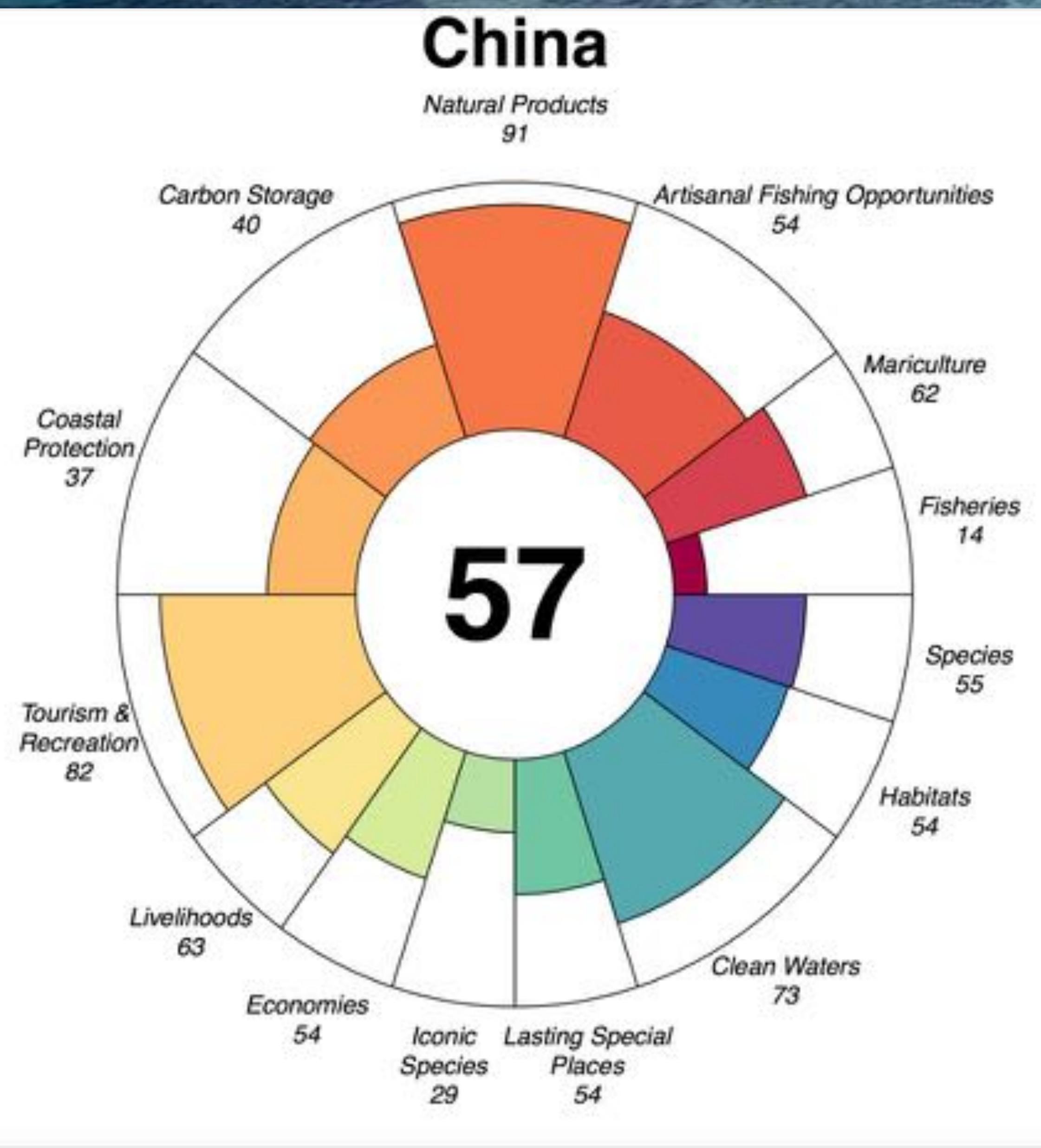
## Main partners

- SOA
- Marine Environmental Monitoring Center of China
- South China Sea (SCS) Branch, SOA
- East China Sea (ECS) Branch, SOA
- North China Sea (NCS) Branch, SOA
- The First Institute of Oceanography, SOA
- The Third Institute of Oceanography, SOA



# Timeline of Activities and Achievements 2013-2015

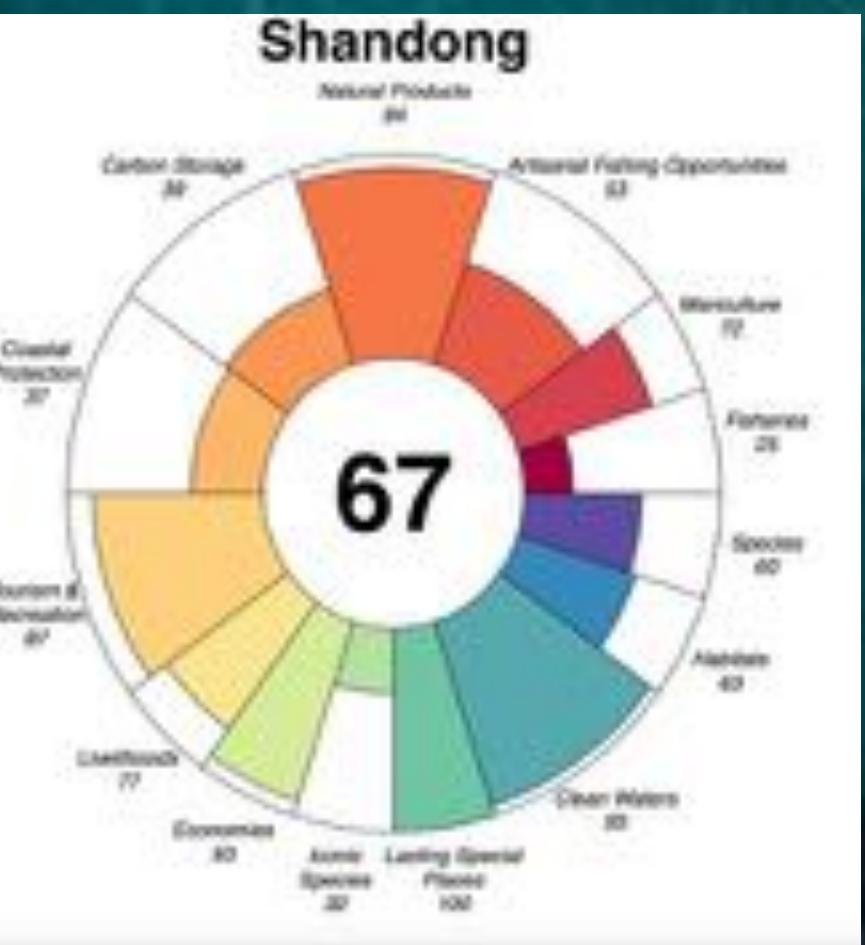
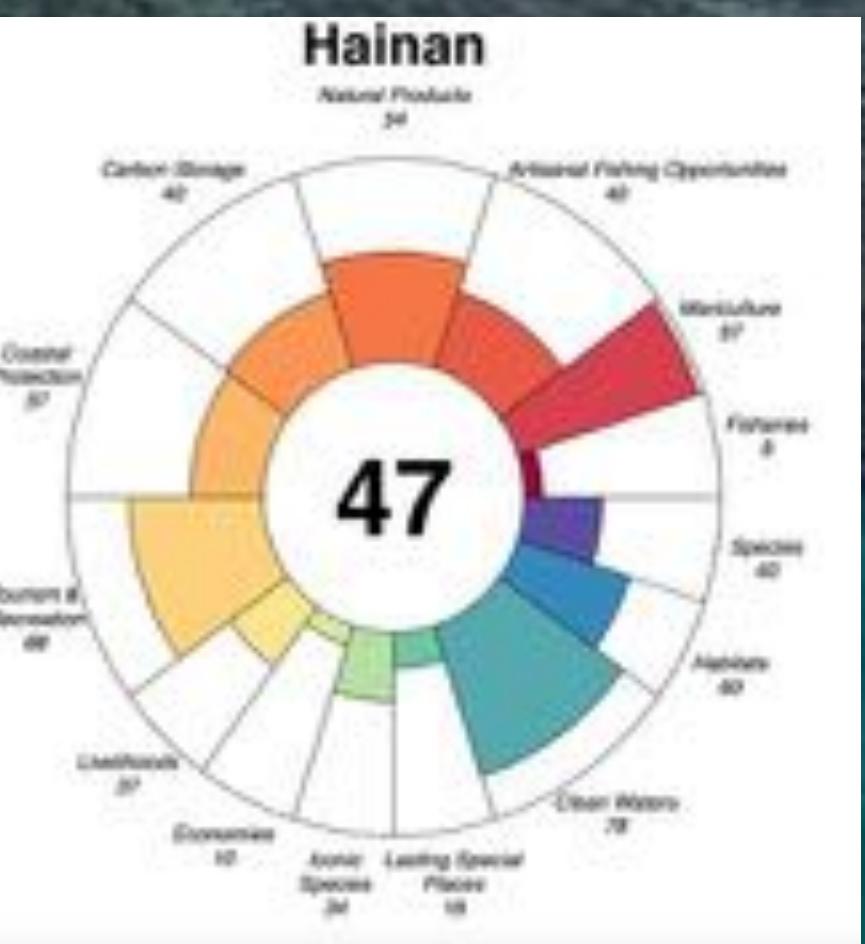
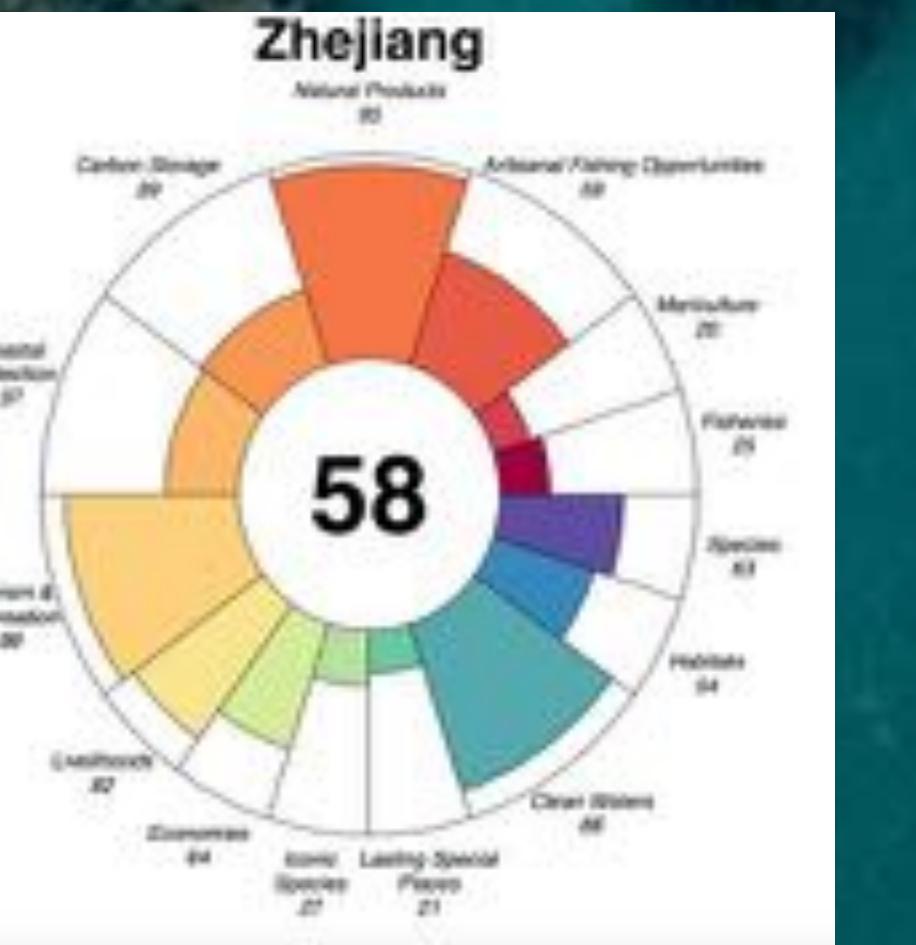
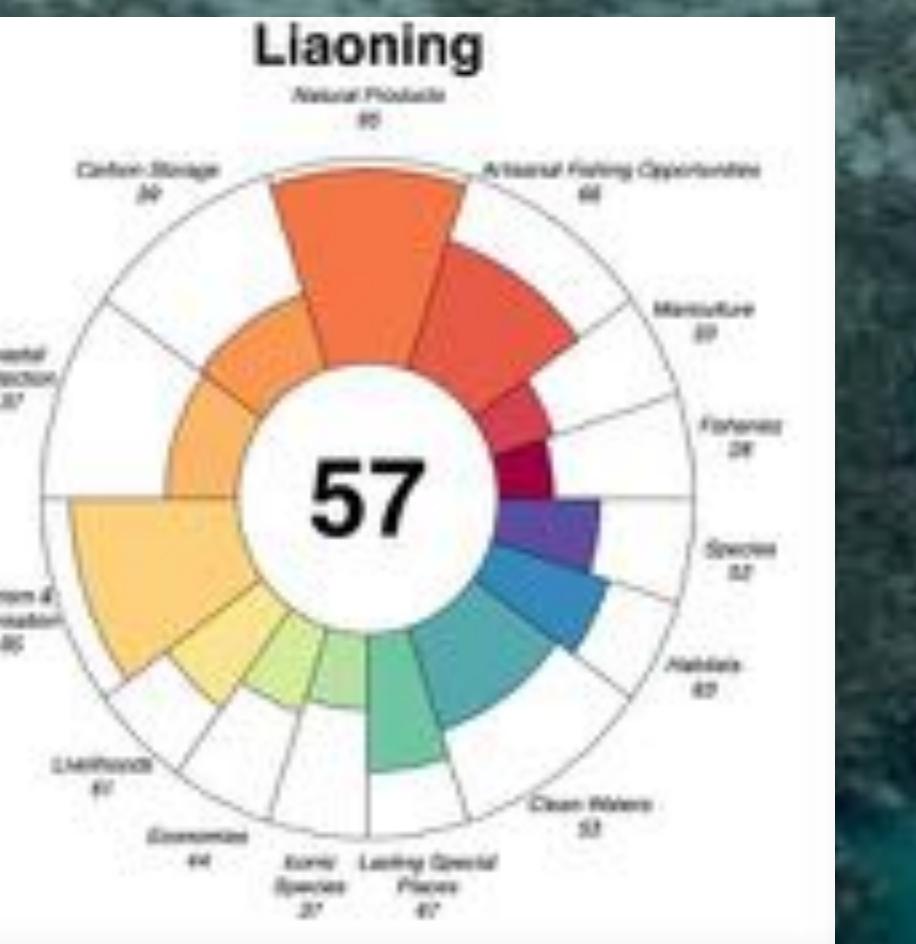
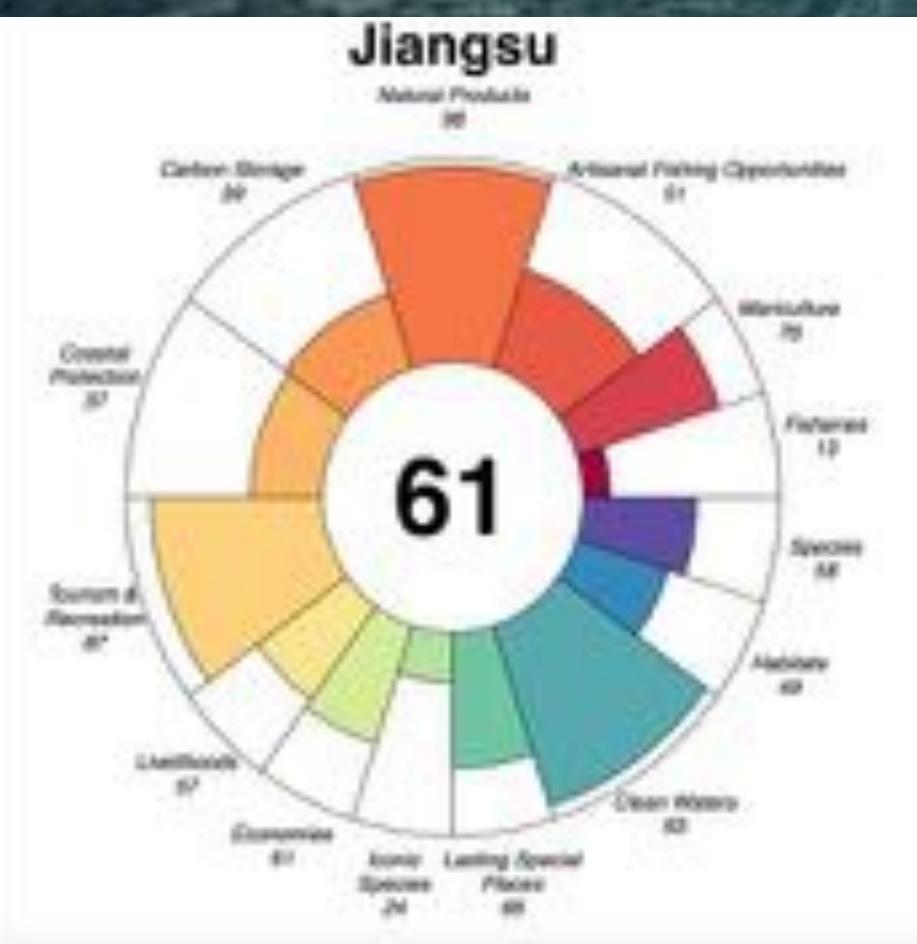
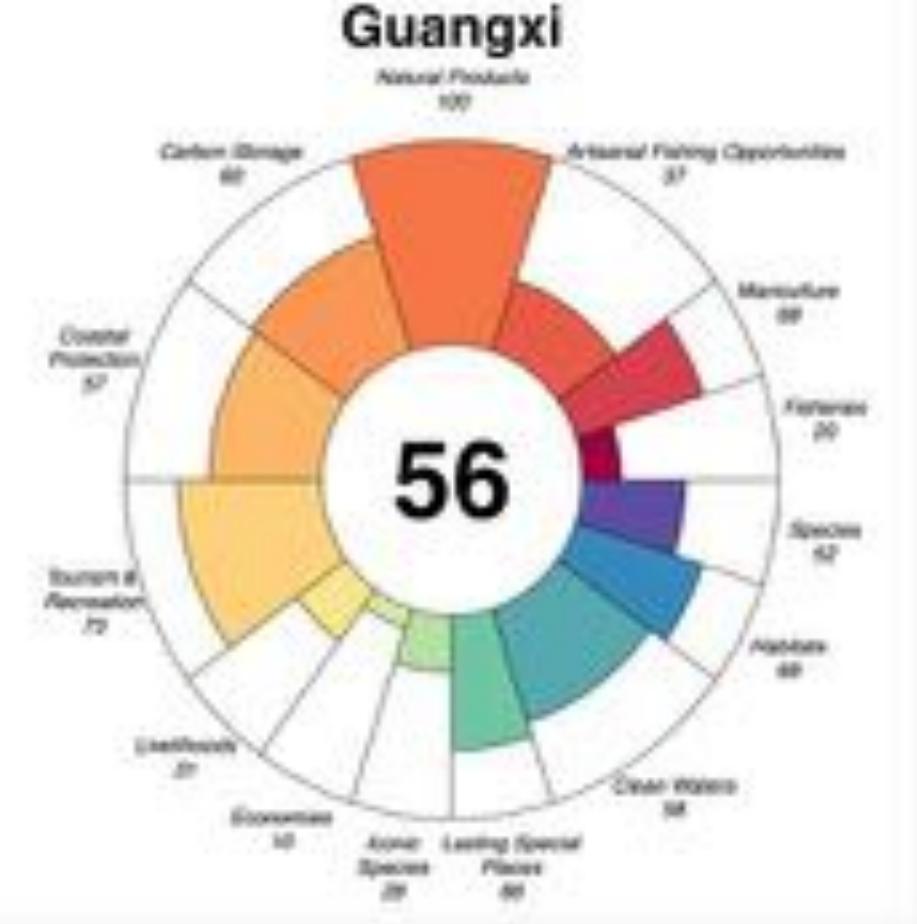
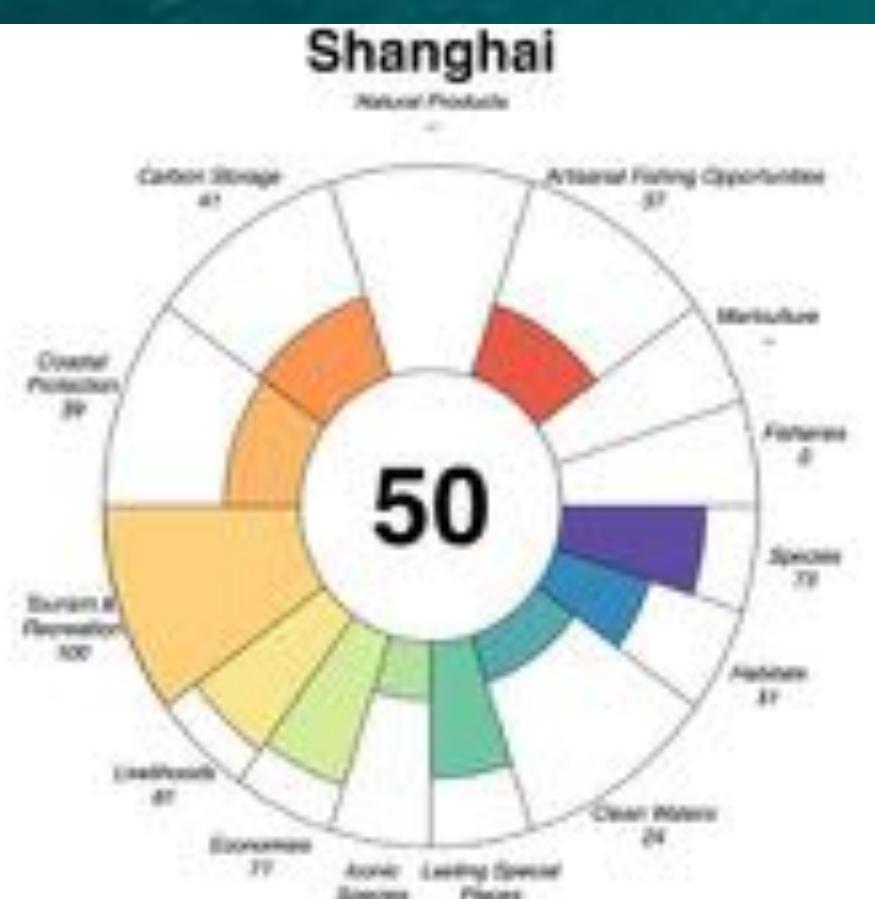
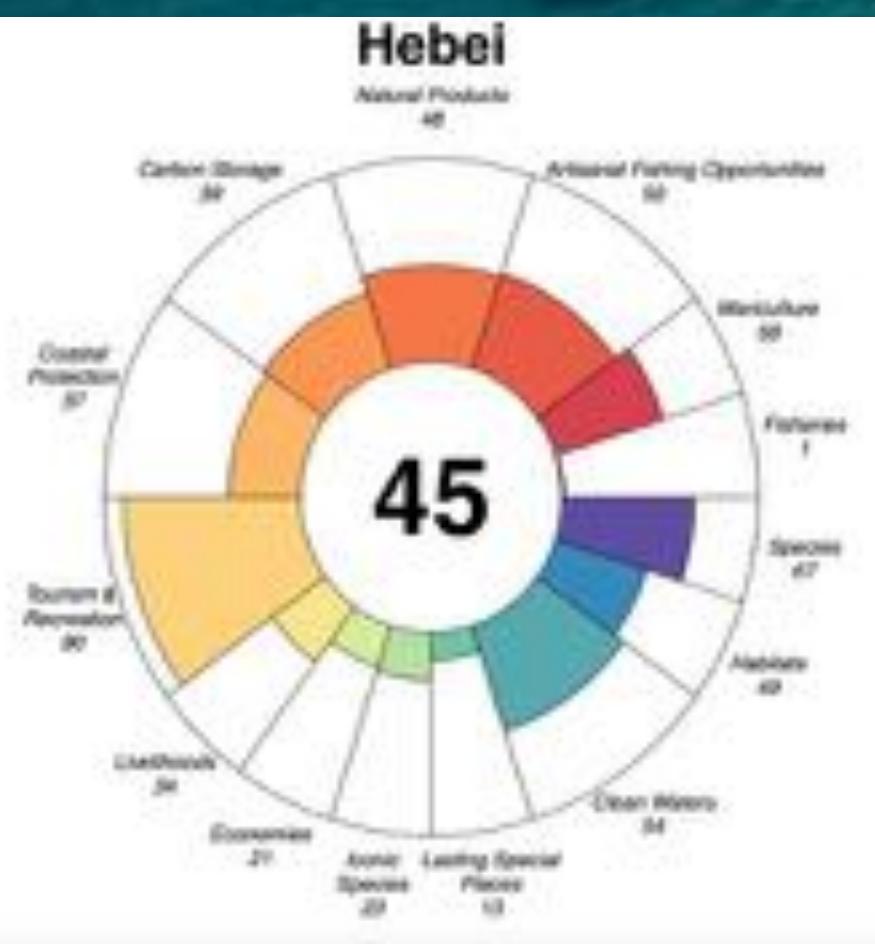
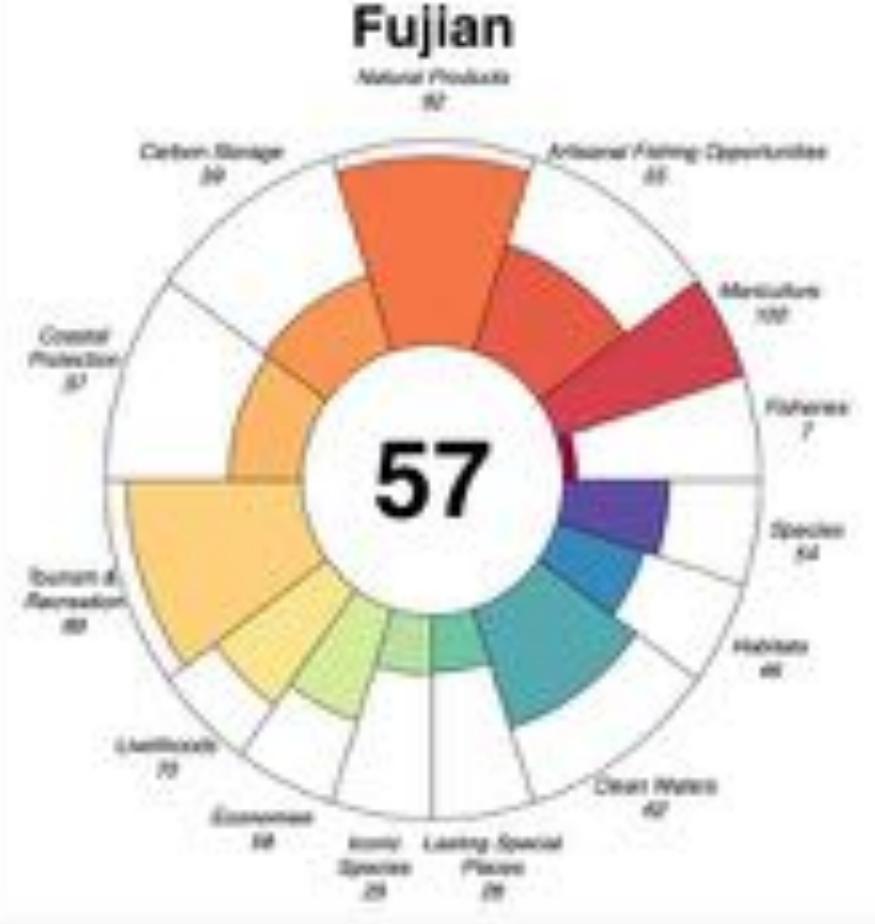
- 2013-2014: two trainings for SOA staff at University of California, Santa Barbara
- 2014-2015: nine working group meetings in China , CI-China & SOA
- April 2015: China model developed and National data collected
- August 2015: China regional scores calculated
- Oct-Dec 2015: two workshops – launch OHI China results, and discuss how to improve the regional study



@CI保护国际基金会  
weibo.com/u/2033075556

# 海洋健康指数 中国适用性研究报告 (初稿)

Preliminary Assessment Report: Ocean Health Index for China





CHINA

Data layers  
Geological features

MAP REGIONS LAYERS GEOLS SCORES

Geology Geographical

CITY

1. Economic activity

Industry

2. Economic largest cities in year

2000

3. Economic dimensions

2000

LEGEND: The colored areas represent the weighted average of all given scores.  
Score: This dimension is an average of the scores from all three cities.

DIMENSIONS

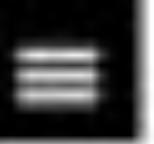
Industry: 100.00	0.00
Score: 99.00	0.00
Score: 95.00	0.00
Score: 85.00	0.00



# Golfo de Guayaquil 2015



Select Language 1  
Presented by OHIQ Business



APP REGIONS LAYERS GOALS SCORES

Branch Selection: publishedRegions2015

Date Comparison

8. Choose variable type:

Output Score

9. Choose target index or goal:

GI Index

10. Choose dimension:

Score

8 Index: The overall index represents the weighted average of all your scores.

Score: This dimension is an average of the current status and likely future.

Index = 0.000

count: 100 total: 0  
min: 58.62  
mean: 63.14  
max: 86.7



# Gulf of Guayaquil 2015

85.4% data layers from local sources

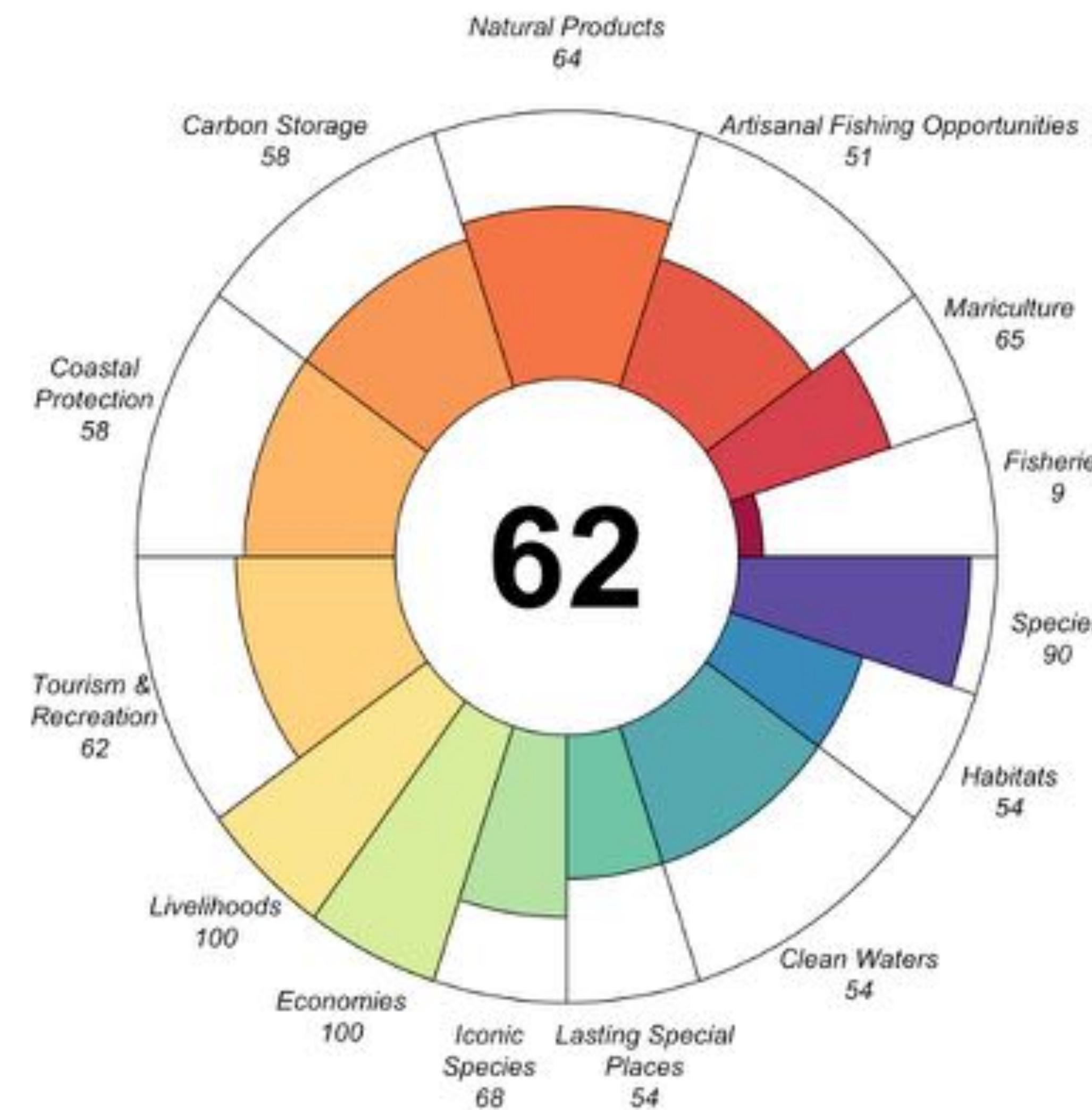
96 indicators total: 52 status, 25 pressures,  
19 resilience

Modified 5 reference points w/ priorities

Context specific models for 4 goals

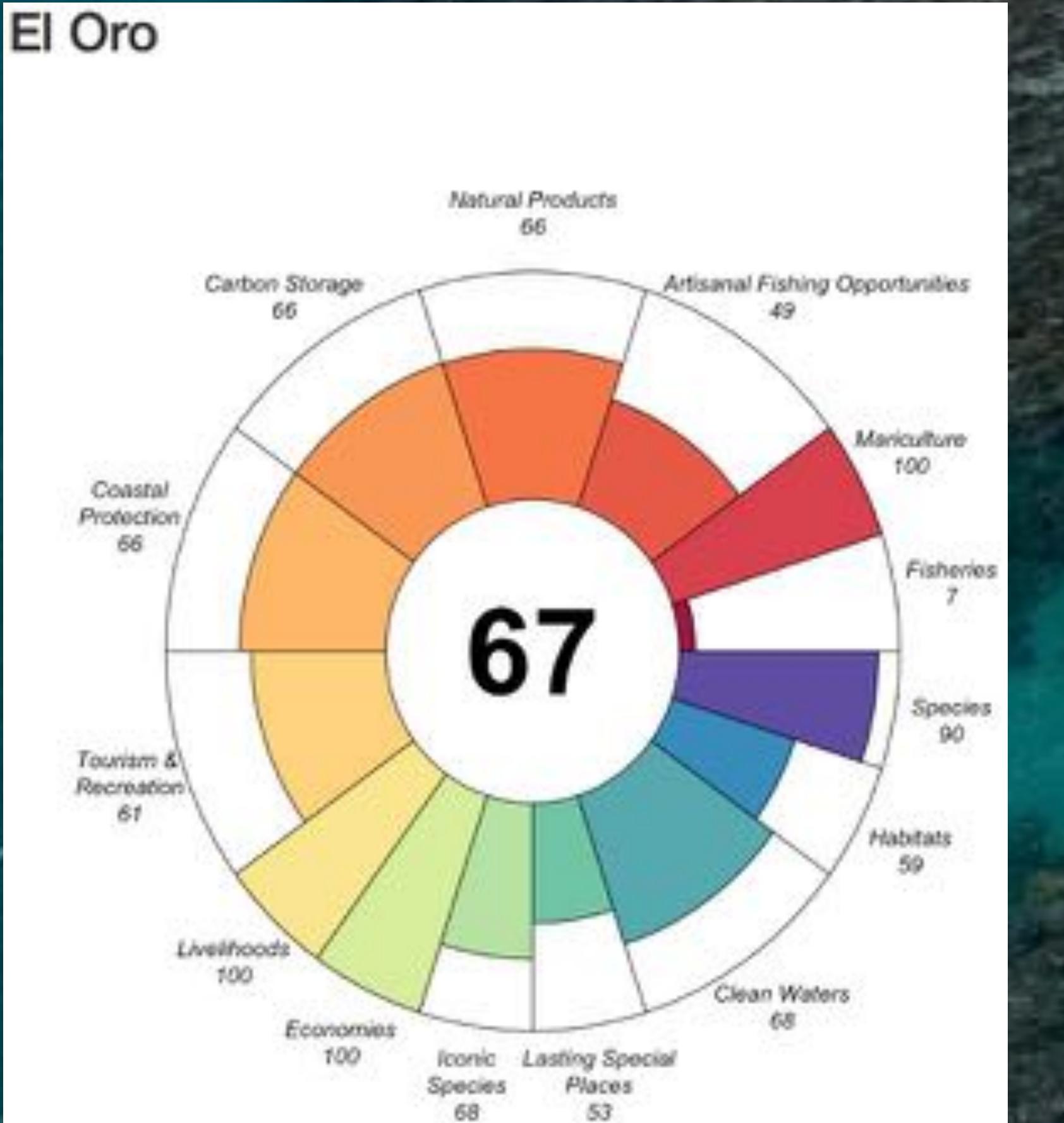
# Gulf of Guayaquil 2015

## Golfo de Guayaquil

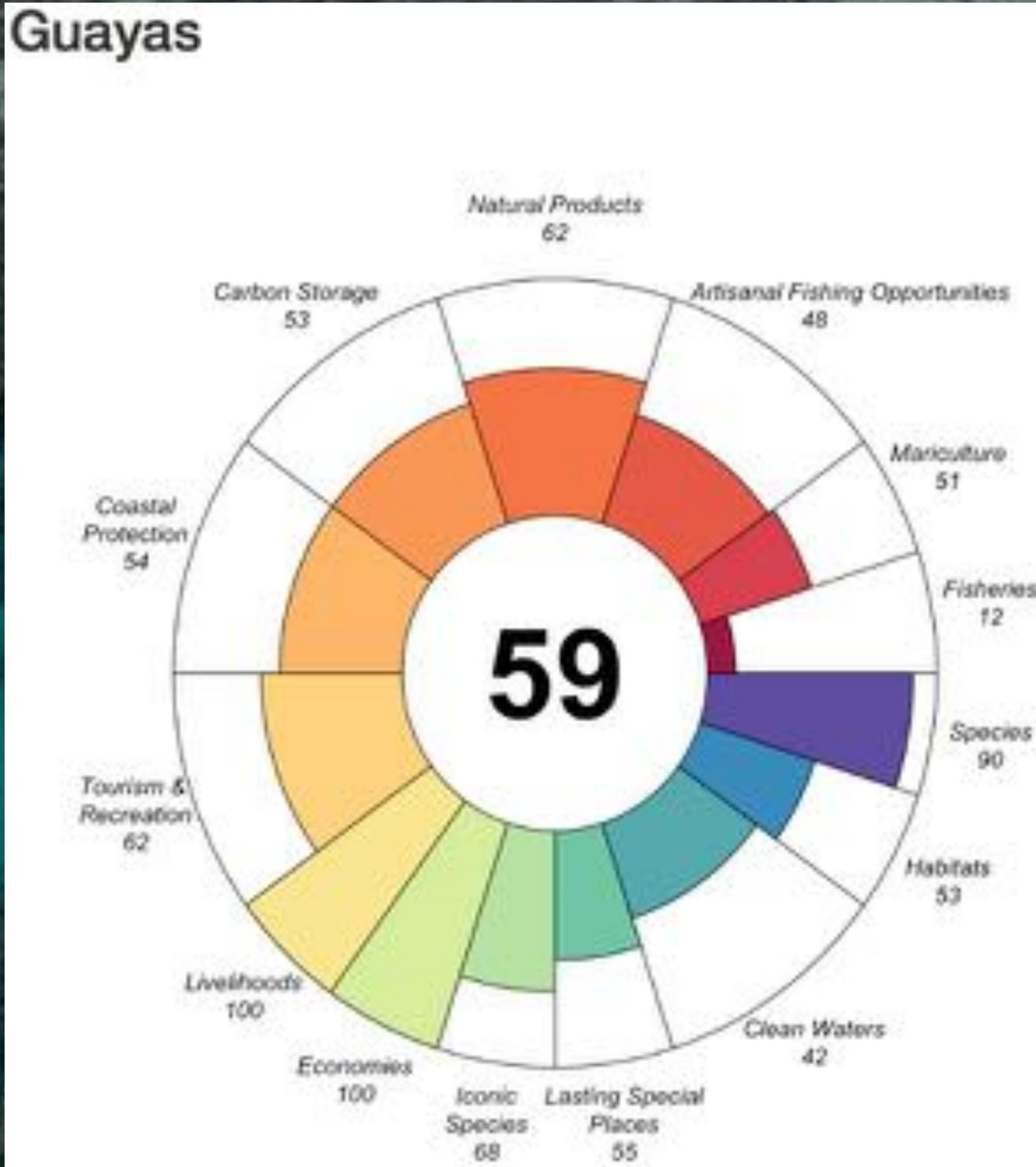


# Gulf of Guayaquil 2015

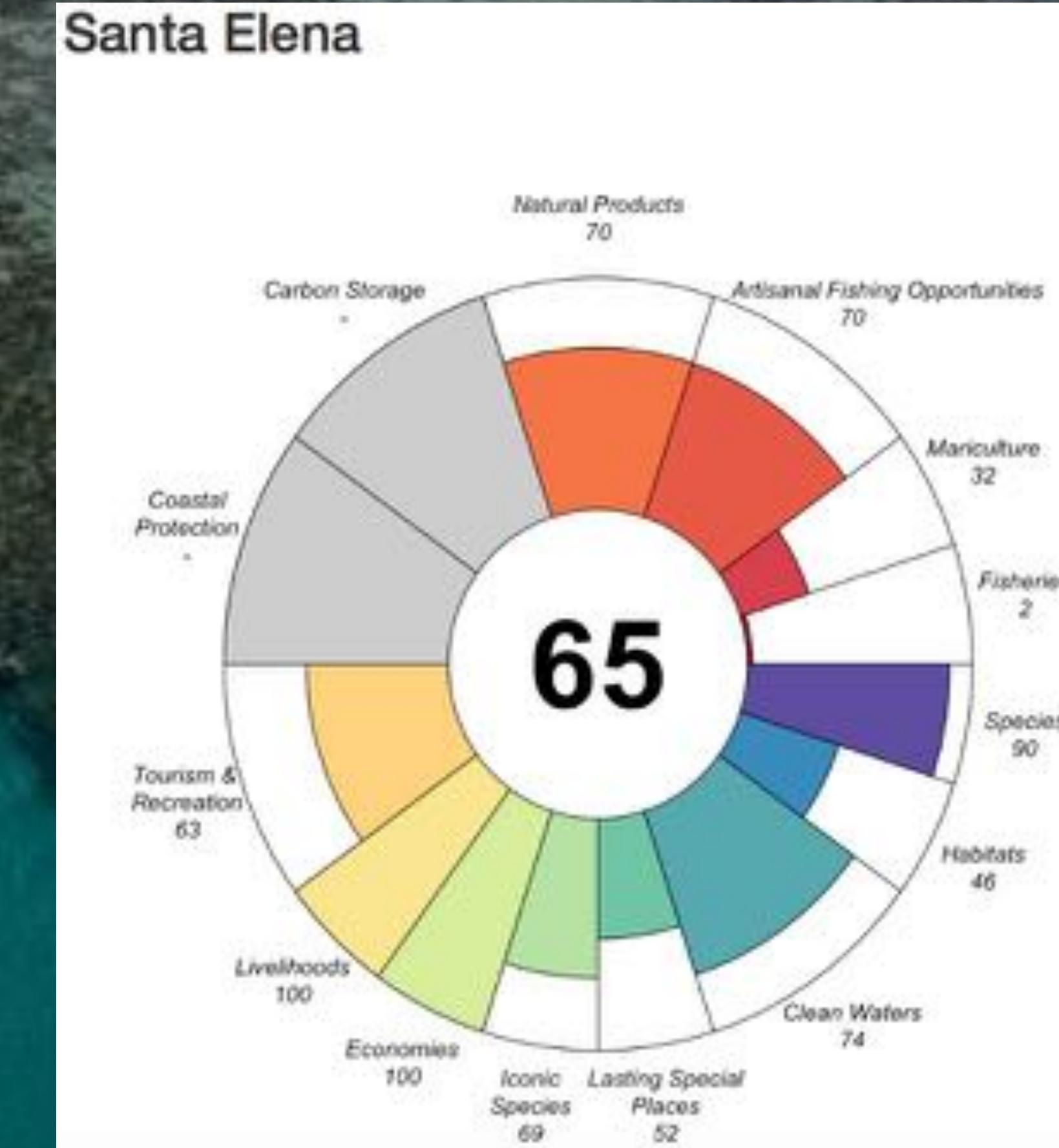
El Oro



Guayas



Santa Elena



# Gulf of Guayaquil 2015

**Team of 12:** 8 analysts, 1 coordinator, 1 R programmer, 1 GIS specialist, 1 statistician

1 year planning/engagement + 9 months of technical work

Leadership of the SETEMAR \$2mill/2yr



# What else?

## Sub-regional case studies

1. Xiamen case study (independent assessment by Xiamen university)
2. Wenzhou case study:
  - in data collection process
  - Led by East China Sea
  - will contribute to Wenzhou 13th five-year plan

# Adaptive Management Tool

Establish **targets** and evaluate the effectiveness of interventions

Assess management **tradeoffs** and identify a win-win balance

**Efficient use** of funds

# OHI+ Benefits

Identify local data & knowledge gaps

Assess positive feedbacks of management actions

Identify management priorities: Geographic and thematic

# Other Potential Applications

Governance support

Strategic environmental assessments

Resource allocation

Tracking performance

Risk mitigation and Return on Investment

Support Blue Economy

# Stakeholder Forum

include local **values & perspectives**

discuss **place & responsibility**

collaboratively establish **management  
targets**

# OHI+ Toolbox

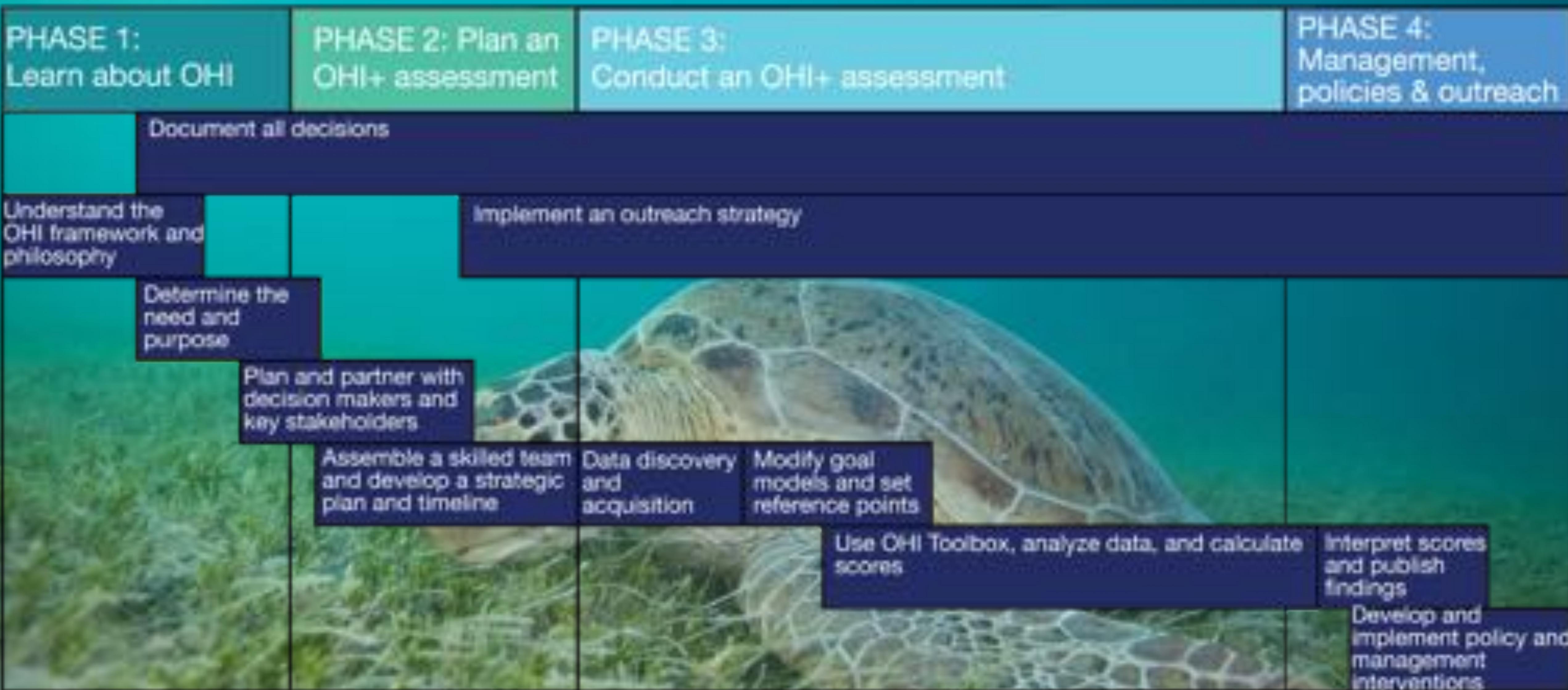
OHI+ Toolbox: Software and virtual data  
repositories

Technical guides and manuals

Virtual Capacity Building Portal (Dec 2015)

[ohi-science.org](http://ohi-science.org)

# Planning an OHI+ Assessment





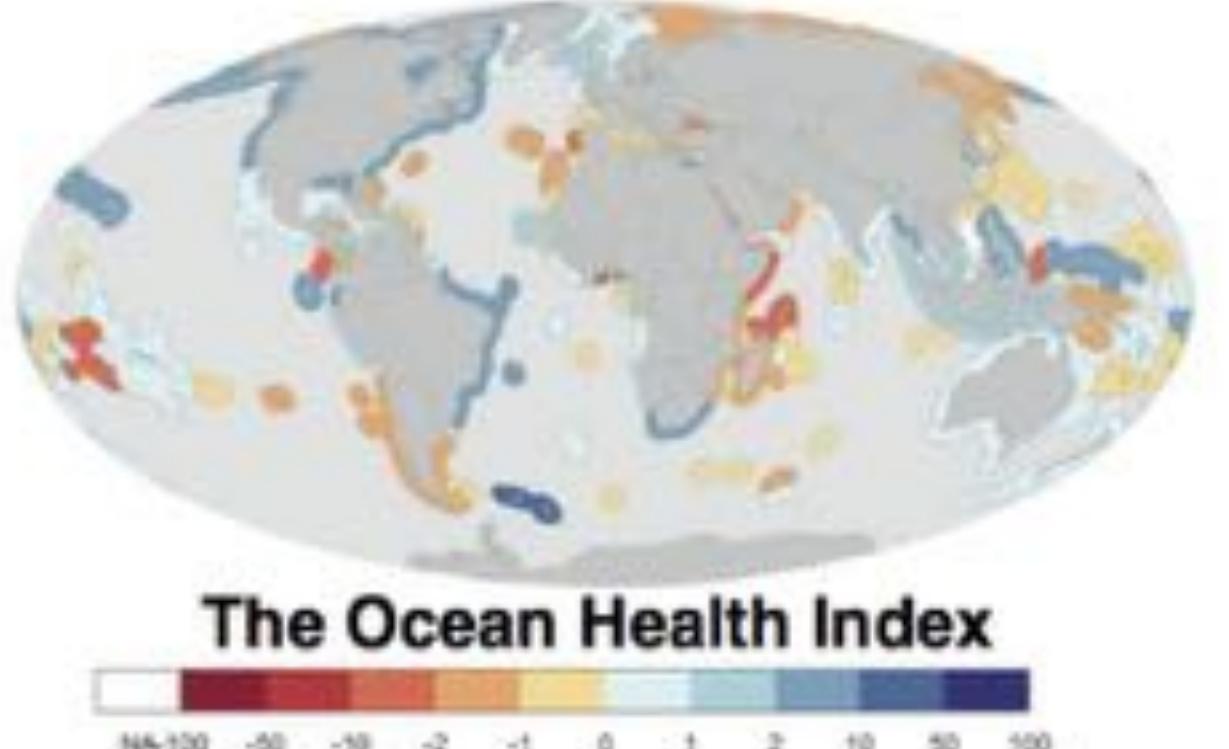
# Where We Work



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

Benjamin S. Halpern<sup>1,2</sup>, Catherine Longo<sup>3</sup>, Darren Hardy<sup>1</sup>, Karen L. McLeod<sup>1</sup>, Jameal F. Sambour<sup>4</sup>, Steven K. Katona<sup>5</sup>, Kristin Kleisner<sup>6</sup>, Sarah E. Lester<sup>7,8</sup>, Jennifer O'Leary<sup>9</sup>, Marla Ranelletti<sup>9</sup>, Andrew A. Rosenberg<sup>2</sup>, Courtney Scarborough<sup>1</sup>, Elizabeth R. Selig<sup>1</sup>, Benjamin D. Best<sup>9</sup>, Daniel R. Brumbaugh<sup>10</sup>, F. Stuart Chapin<sup>11</sup>, Larry B. Crowder<sup>12</sup>, Kendra L. Daly<sup>13</sup>, Scott C. Doney<sup>14</sup>, Cristiane Elfes<sup>15,16</sup>, Michael J. Fogarty<sup>17</sup>, Steven D. Gaines<sup>8</sup>, Kelsey I. Jacobsen<sup>8</sup>, Leah Bunce Karrer<sup>2</sup>, Heather M. Leslie<sup>18</sup>, Elizabeth Neeley<sup>19</sup>, Daniel Pauly<sup>6</sup>, Stephen Polasky<sup>20</sup>, Bud Ris<sup>21</sup>, Kevin St Martin<sup>22</sup>, Gregory S. Stone<sup>5</sup>, U. Rashid Sumaila<sup>6</sup> & Dirk Zeller<sup>6</sup>

Nature, 2012



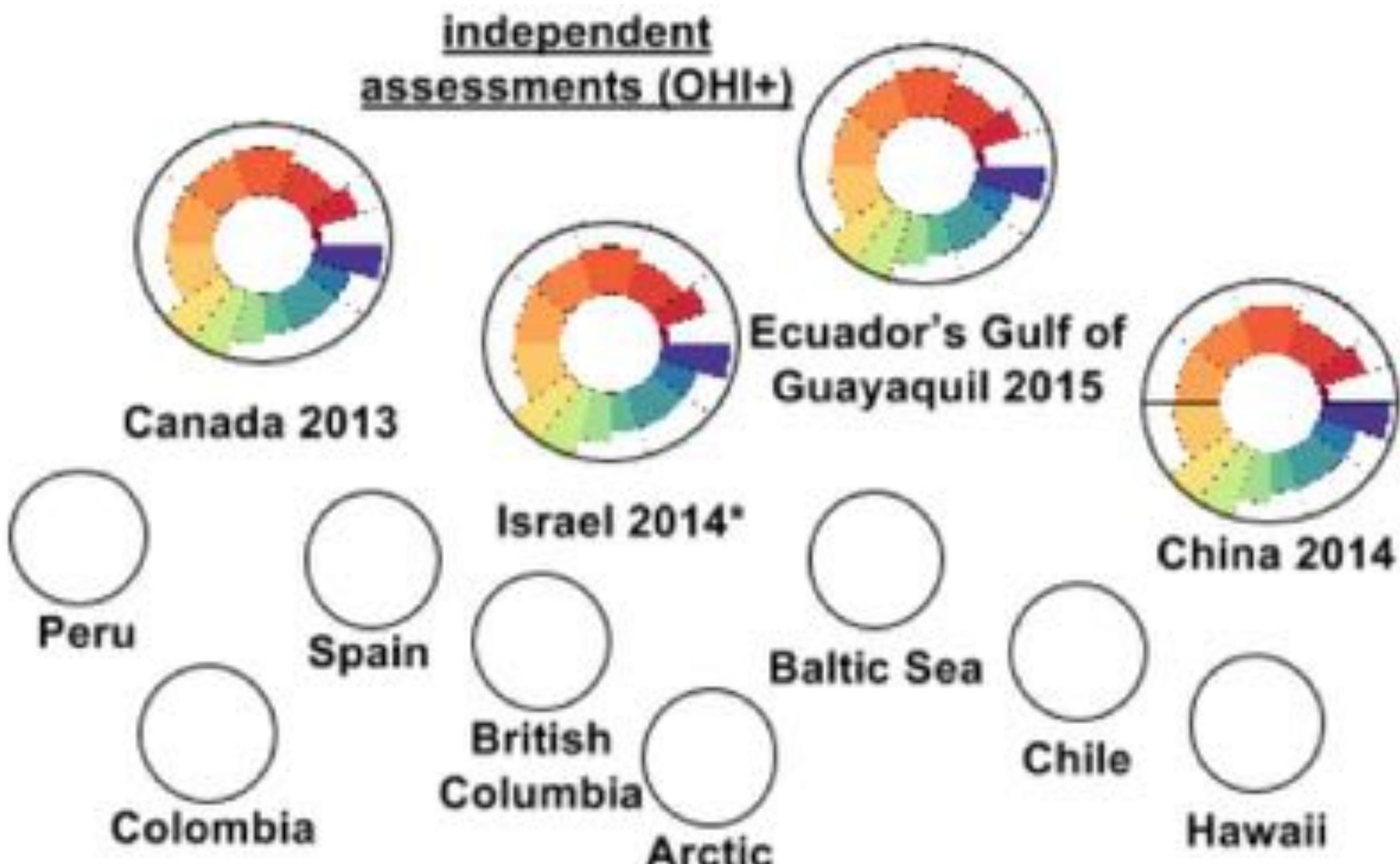
global 2012\*, 2013\*, 2014, 2015



OHI team:  
NCEAS & CI



\*published



Toolbox and resources to enable independent assessments (OHI+)

open-source software

visualization tools

training program

# Conclusion

**Global:**  
Global data  
National scores  
Comparisons between countries

**10 Goals**  
**Two Scales**



**OHI+:**

National & local data/indicators  
Scores by political boundaries  
Comparisons between regions

+

Integrate indicators  
Country specific goal models

+

Improve decision-making  
Effective use of public funds  
Local impact & adaptive

# A Framework

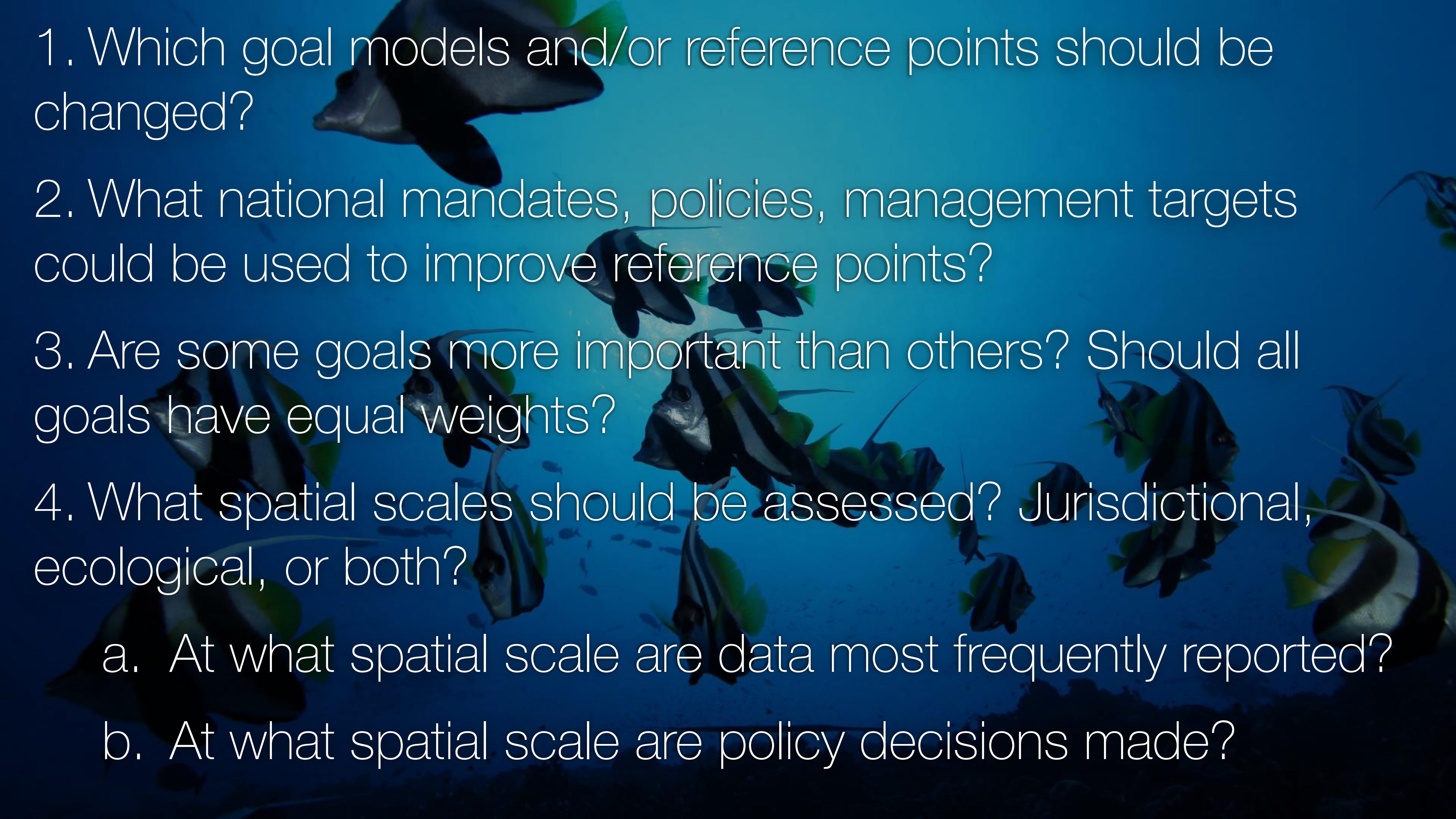
- For science- & data-based discussions on policy and management priorities;
- To objectively balance competing uses and weigh tradeoffs; and
- To sustainably maximize the ecological and economic productivity of the ocean.

A composite image. The top half shows a man with a beard and dark skin, wearing a white cloth around his waist, 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 shows a close-up view of a coral reef. The corals are in various shades of green, brown, and tan, forming intricate, brain-like structures. The water is clear, allowing a good view of the reef's details.

thank You!  
Questions?

# GROUP ACTIVITY:

- Get back with your groups
- Discuss and answer the following questions (30 minutes)
- Each group presents back (15 minutes)

- 
- A dark blue background image showing a large school of fish, likely tangs or surgeonfish, swimming in the ocean. They are silhouetted against a lighter blue background.
1. Which goal models and/or reference points should be changed?
  2. What national mandates, policies, management targets could be used to improve reference points?
  3. Are some goals more important than others? Should all goals have equal weights?
  4. What spatial scales should be assessed? Jurisdictional, ecological, or both?
    - a. At what spatial scale are data most frequently reported?
    - b. At what spatial scale are policy decisions made?