# *Web-enabled Condition Reporting and Integrated Ecosystem Assessment*

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*IOOS*

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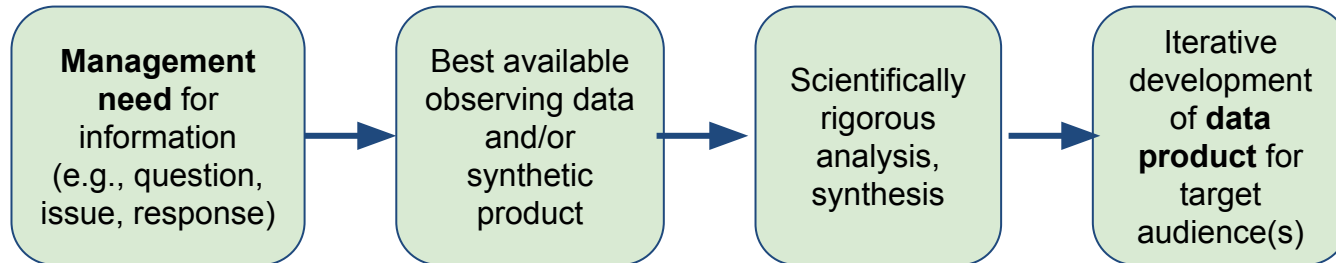*ONMS*

In collaboration with

# Co-Design is Key

*Start with the needs, identify the user, build and resource the team*

*Translation of data from observers and scientists to managers and the public is not automatic, it requires focus and resources*

**Co-design Team**
- managers (e.g., science, policy, resource protection, education)
- data-specific technical expert
- data product and web developer
- science translation, application, interpretation

**Process**

| **Management need** for information (e.g., question, issue, response) | → | Best available observing data and/or synthetic product | → | Scientifically rigorous analysis, synthesis | → | Iterative development of **data product** for target audience(s) |

# Needs

- Apply observation data to asssessment of management-relevant indicators at the scale of management

- Information updating at a frequency relevant to management and supported by data collection, management and analysis timelines

- Data summaries designed to meet the technical abilities of the audience

- Attractive interface that is easily accessible on digital platforms

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# Condition Reports: Periodic Assessment



- Assessment of sanctuary condition every 8-10 years

- Feeds critical information into management plan review

# Condition Reports: Periodic Assessment

- indicators selected for each condition report question

- apply available observation data to status and trend asssessment

- when possible, scale the analysis to the spatial scale most relevant to sanctuary assessment and management

## 15 Questions

- Human Dimensions
- Water Quality
- Habitat
- Living Resources
- Maritime Heritage Resources

| Good | Good/Fair | Fair | Fair/Poor | Poor | Mixed | Undetermined |
|------|-----------|------|-----------|------|-------|--------------|

▲ = Improving   ━ = Not Changing   ▼ = Worsening   ⬍ = Mixed

**?** = Undetermined   N/A = Not Applicable   NR = Not Rated

Confidence Scale:   Very High = ▮▮▮▮▮
High = ▮▮▮▮▯
Medium = ▮▮▮▯▯
Low = ▮▮▯▯▯
Very Low = ▮▯▯▯▯

Example: This symbol indicates the condition was rated "fair" with "medium confidence" and a "worsening" trend with a "very high confidence."

Confidence   Status   Trend Confidence
▮▮▮▯▯   **Fair**   ▼ ▮▮▮▮▮

# Condition reporting indicator portfolios as conceptual models



PELAGIC INDICATORS - Monterey Bay

# Which observation data fits the need?

CCIEA Ecological Integrity Indicator   Question 12: Foundation species   Question 15: Biodiversity

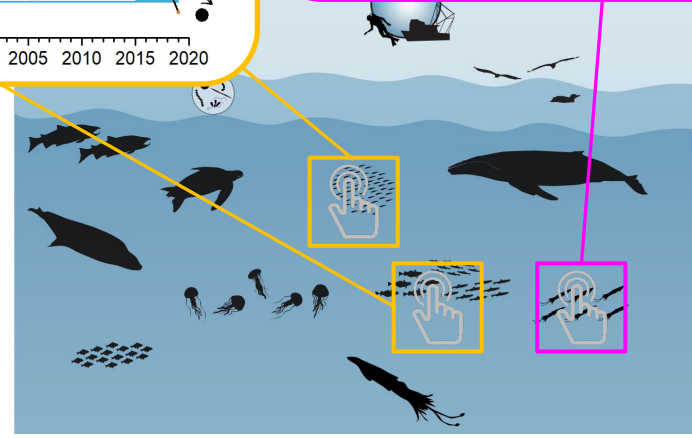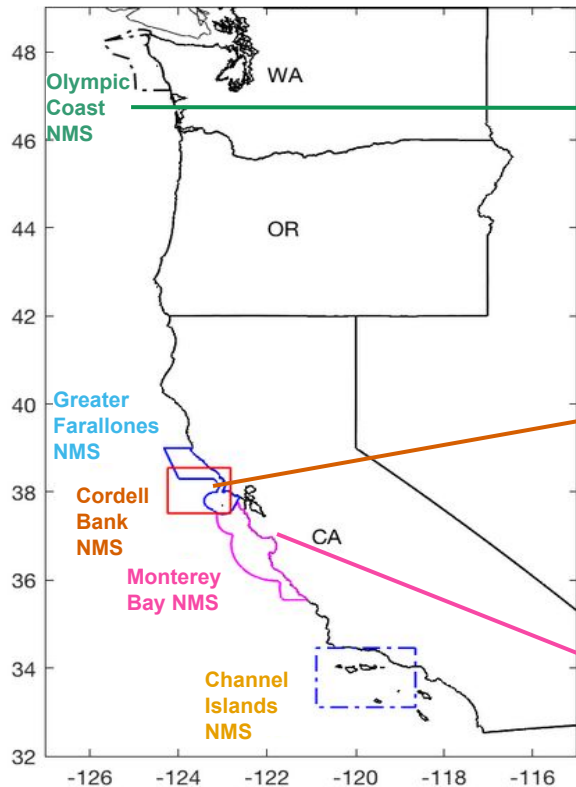# Downscaling CCIEA Regional Indicators to Sanctuary Scale



Trawl Bottom Contact Indicators
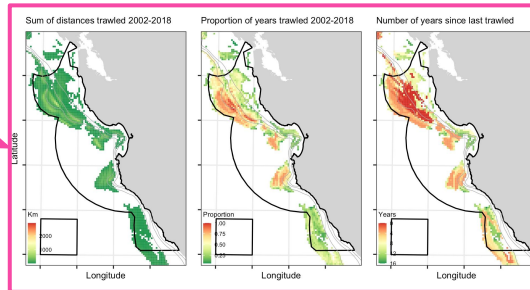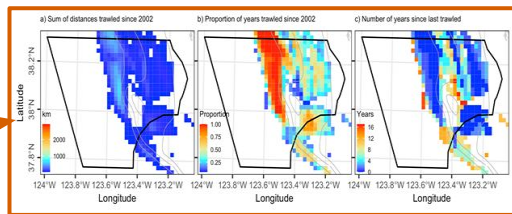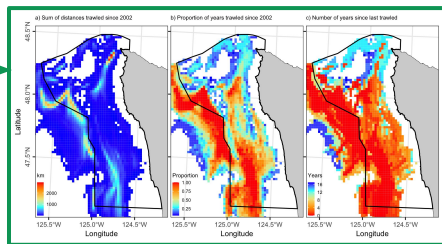
Groundfish Species and Assemblage Indicators

# SanctSound

**Olympic Coast**
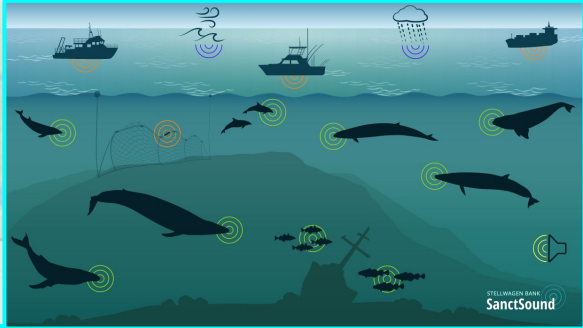
**West Coast Region**

Monterey Bay

**Channel Islands**

**Stellwagen Bank**

**Eastern Region**

**Gray's Reef**

**Florida Keys**

Papahānaumokuākea

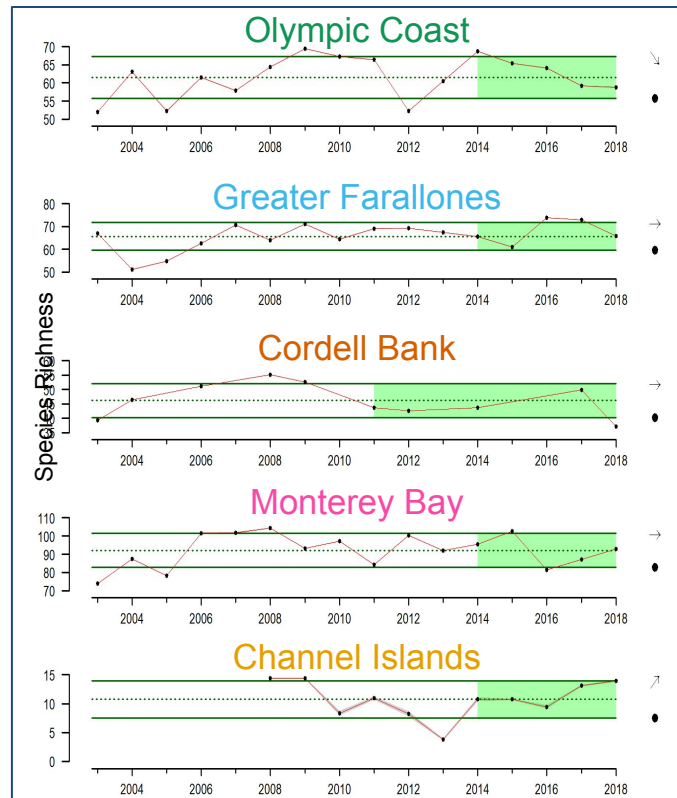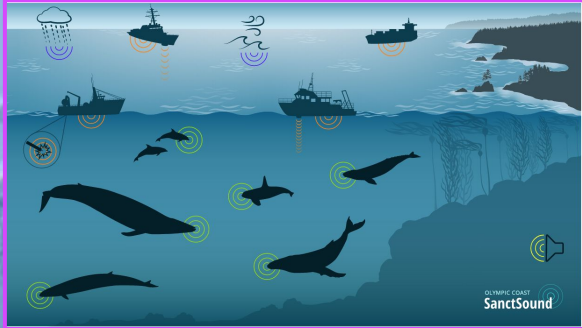**Pacific Island Region**

Hawaiian Islands Humpback Whale
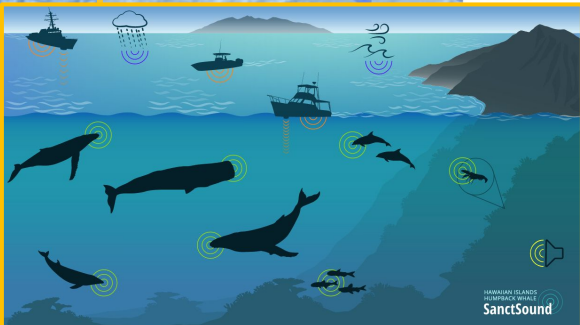
# Needs

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# Web-enabled Condition Reporting (WebCR)
## Goal = improve availability and timeliness of information for sanctuary management

Static, infrequent report

Interactive, routinely updated web-enabled tool

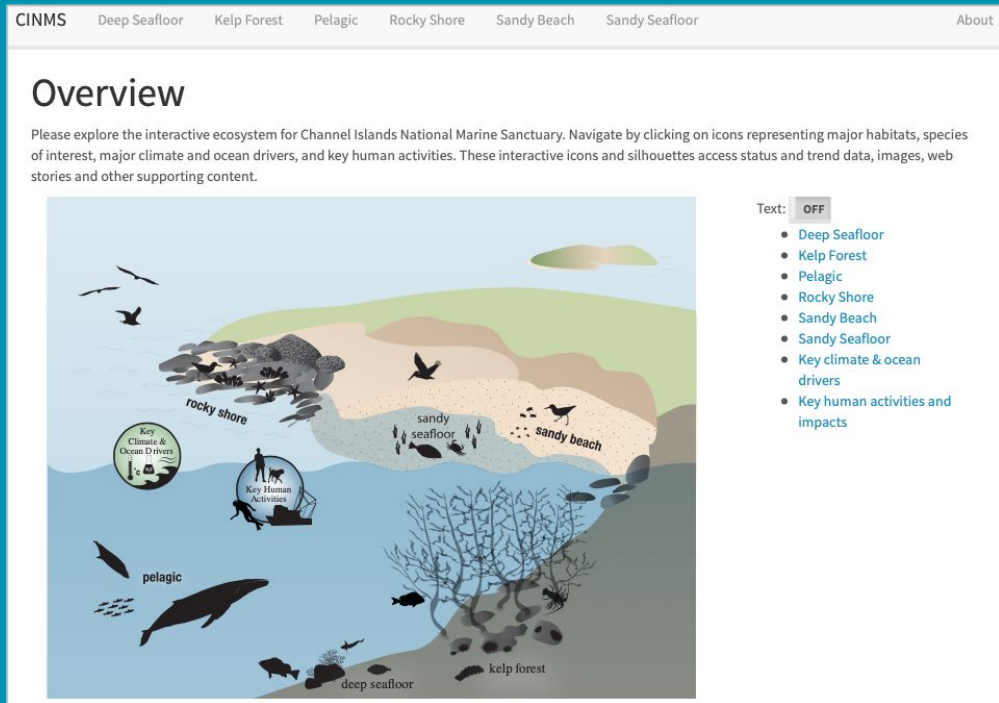Office of National Marine Sanctuaries
National Oceanic and Atmospheric Administration
CHANNEL ISLANDS NATIONAL MARINE SANCTUARY

CONDITION REPORT 2016

CHANNEL ISLANDS

CINMS  Deep Seafloor  Kelp Forest  Pelagic  Rocky Shore  Sandy Beach  Sandy Seafloor  About

## Overview

Please explore the interactive ecosystem for Channel Islands National Marine Sanctuary. Navigate by clicking on icons representing major habitats, species of interest, major climate and ocean drivers, and key human activities. These interactive icons and silhouettes access status and trend data, images, web stories and other supporting content.
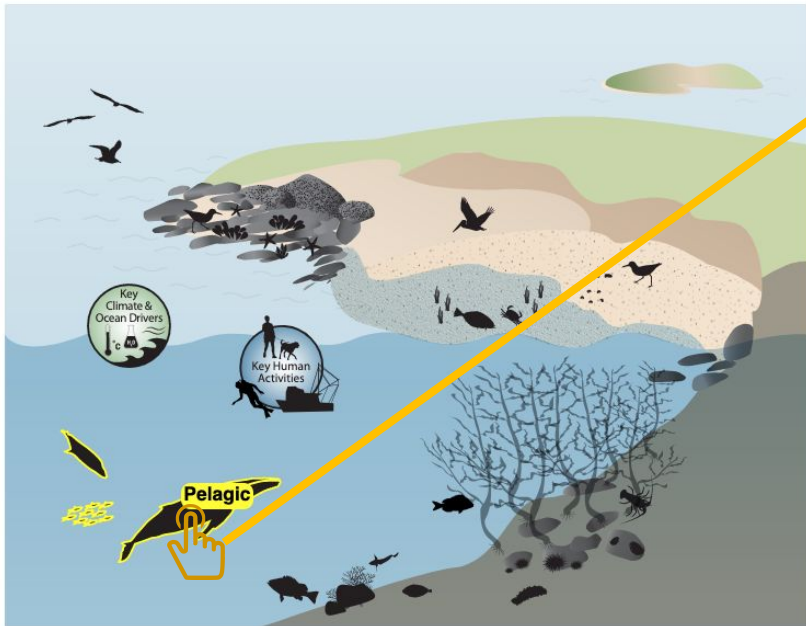
Text: OFF

- Deep Seafloor
- Kelp Forest
- Pelagic
- Rocky Shore
- Sandy Beach
- Sandy Seafloor
- Key climate & ocean drivers
- Key human activities and impacts

rocky shore

Key Climate & Ocean Drivers

Key Human Activities

sandy seafloor

sandy beach

pelagic

deep seafloor
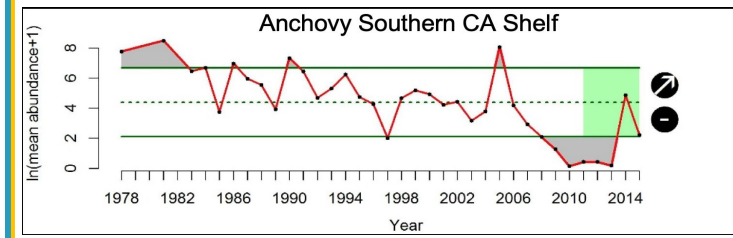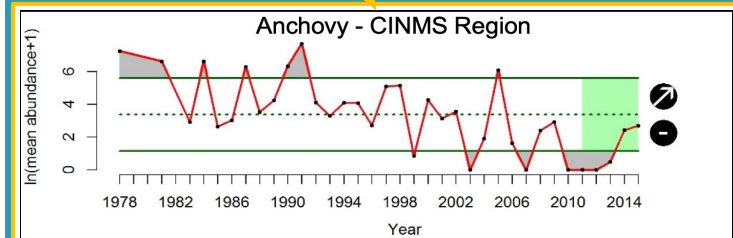
kelp forest

Time frame: Management plan review

Time frame: on-going condition tracking

# Web-enabled Condition Reporting (WebCR)
## Step 1: access to information in Condition Report
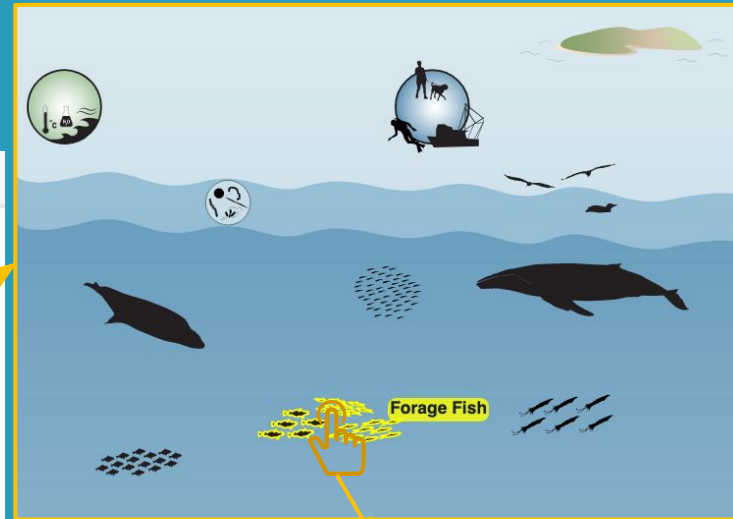
# Web-enabled Condition Reporting (WebCR)
## Step 2: Transition to on-going tracking
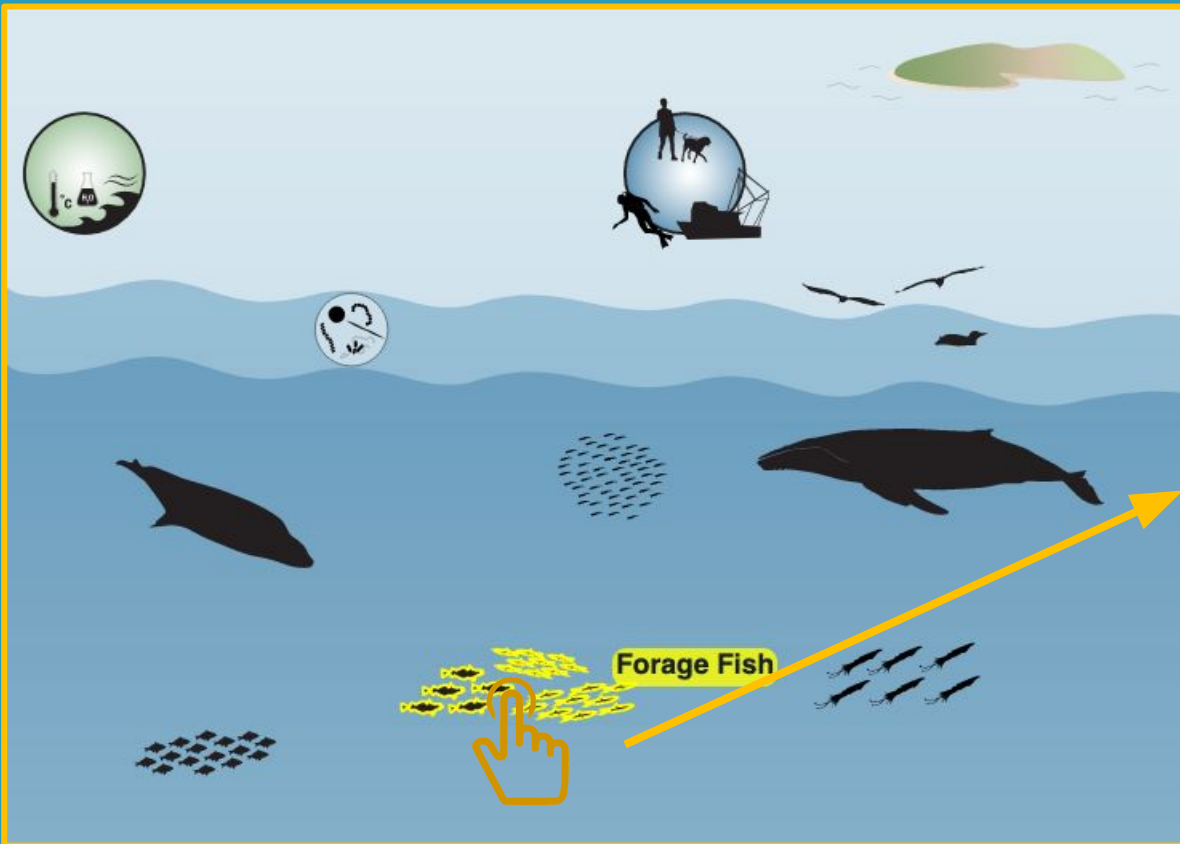


### Forage Fish

Forage fish, also called prey fish or bait fish, are small fish which are important food for larger predators including larger fish, seabirds, sea lions and whales. Forage fish, such as anchovies, sardines, feed near the base of the food chain on plankton.
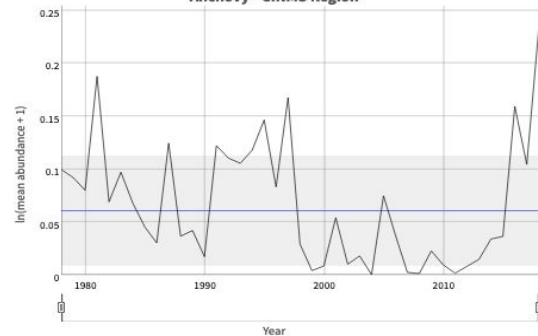
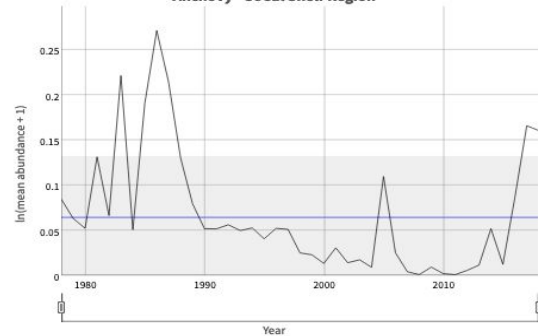| Map of Regions | Anchovies | Hake | Myctophids | Rockfish | Sanddab | Sardines |

**CINMS Region**

📋 CalCOFI Monitoring Program          🗄 CalCOFI data

**Anchovy - CINMS Region**

ln(mean abundance + 1)

Year

**Anchovy - SoCal Shelf Region**

ln(mean abundance + 1)

Year

A figure showing the relative abundance of northern anchovy (*Engraulis mordax*) collected during the spring around the Southern California Shelf from 1978 to 2018. The bar at the bottom of the figure can be used to zoom in to specific dates, using the small slider buttons on either edge of the bar. The blue horizontal line indicates the mean value for the time series. The horizontal gray bar shows one standard deviation above and below the mean. Data source: CalCOFI; Figure credit: A. Thompson/NOAA; Ben Best/EcoQuants.
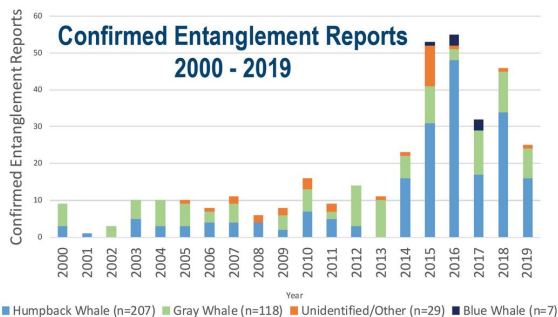
▶ Click for Details

# Flexible design

* different data sets are currently available in different formats

* data set can transition from static to interactive to auto-updating if interest and resources are available

Florida Keys Web-enabled Ecosystem Tracking Tool

https://noaa-iea.github.io/fk-esr-info/infographic.html

**TRACKING ECOSYSTEMS AND HUMAN CONNECTIONS IN THE FLORIDA KEYS**

**Florida Keys National Marine Sanctuary Ecosystem Tracking Tool**

This interactive graphic allows you to find data used to track the changing conditions of natural resources and levels of human use in the Florida Keys. Called "indicators," you can hover over each icon, or click the indicator from the menu on the right to learn more about it and see the data. This is a product of the Florida Keys NOAA Integrated Ecosystem Assessment program.
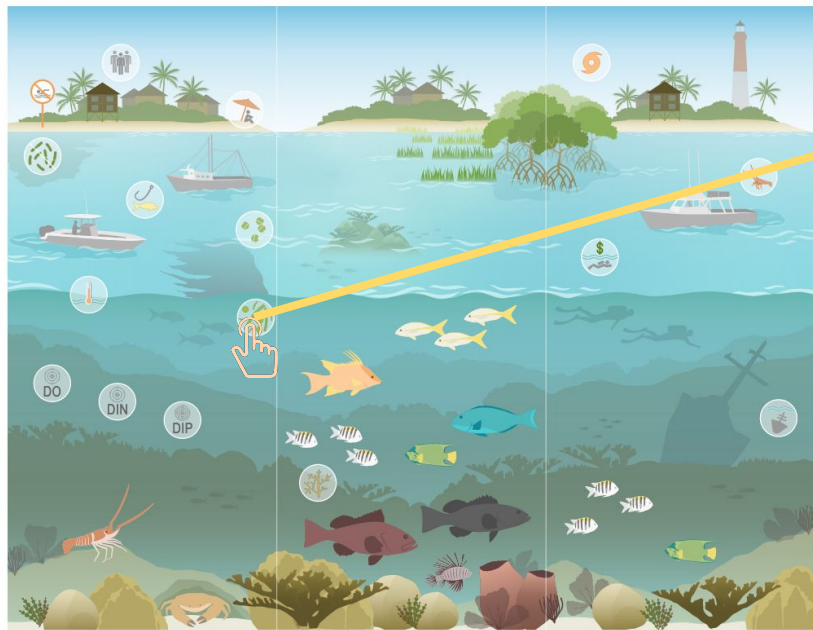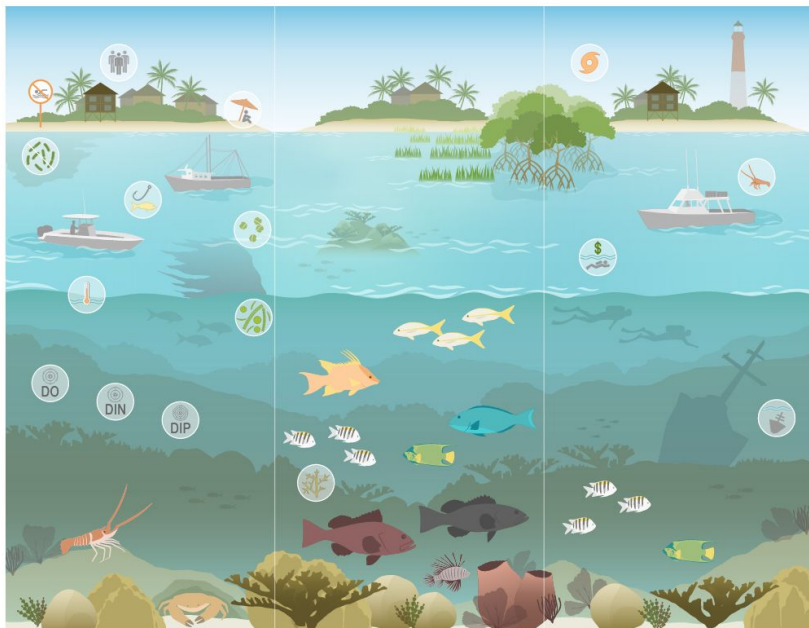


Sanctuary Waters and Human Activities Indicators

Living Resources and Habitat Indicators

Maritime Heritage and Ecosystem Services Indicators

Infographic Credits
Data is updated on various timelines based on the schedules of each monitoring program.

⤢ FULL SCREEN

**HABITAT** ⌄

**HUMAN CONNECTIONS** ⌄

**LIVING RESOURCES**

**MARITIME HERITAGE** ⌄
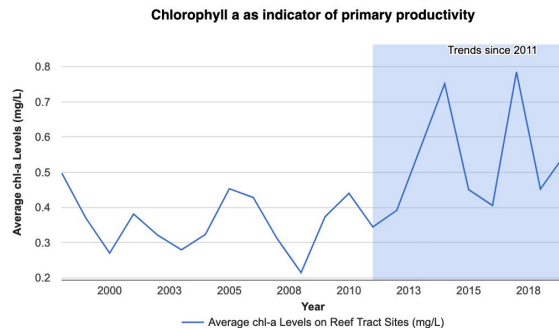
**SANCTUARY WATERS** ⌃

- Beach closures due to presence of fecal indicator
- Chlorophyll a as indicator of primary productivity
- Dissolved inorganic nitrogen
- Dissolved inorganic phosphorus
- Dissolved oxygen
- Red tide current status
- Sea Surface Temperature (SST)

# Florida Keys Web-enabled Ecosystem Tracking Tool

**CORAL DISEASE**

The below interactive visualization tools represent changes due to the spread of the stony coral tissue loss disease in the Florida Keys. The site, Cheeca Rocks, in the Middle Keys, is monitored regularly and changes are documented via high resolution photo mosaics. Click the gray circle to show the pre-disease spread reef in March 2018, the reef during the disease spread in June 2018, and post disease event in July 2019.
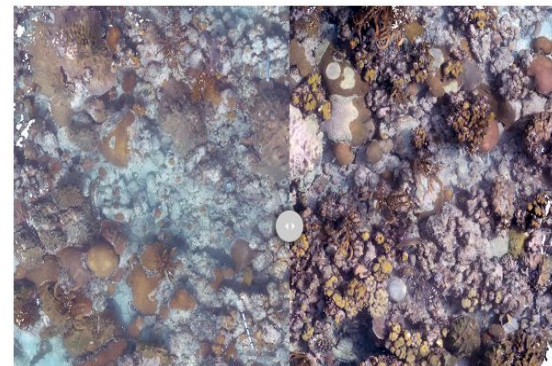


https://noaa-iea.github.io/fk-esr-info/living-resources.html

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# Audience matters…

**Knowledge producers**                                            **Knowledge users**

| Technical experts | Researchers | Advisory councils, working groups | Decision makers, engaged public, educators |
|---|---|---|---|
| Data archives and services | Data portals | Curated Data Views, Shiny apps | WebCRs, interactive ESRs |

*Least*                                                                    *Most*

Level of **Interpretation**

Level of **Technical expertise**

*Most*                                                                      *Least*

# Sanctuary Audience

- Resource management & policy makers
  - Federal, state, agencies, tribal management
  - Advisory council working groups
  - NGOs, etc.

- Science
  - State, federal, academic, tribal researchers
  - Regional research partners

- Education/Outreach
  - ONMS education team and partners
  - Teachers and students
  - Engaged public

# Shellfish closures

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*Harmful algae species and biotoxins in shellfish are naturally present on the Olympic Coast, but increasingly they pose potential risks to the health of humans and other vertebrates that may consume contaminated shellfish. Shellfish in Washington that are harvested for human consumption are tested regularly to detect toxins like domoic acid, and in 2015-2016 high domoic acid levels in Dungeness crabs and razor clams prompted a devastating fishery closure that had negative consequences for coastal treaty tribes and adjacent coastal communities. Additional shellfish harvest closures have occurred more recently as well. Please consult official sources for updated information about shellfish safety.*

PLEASE NOTE: for real-time information about shellfish harvesting in Washington, please visit the Washington Department of Health shellfish safety information map

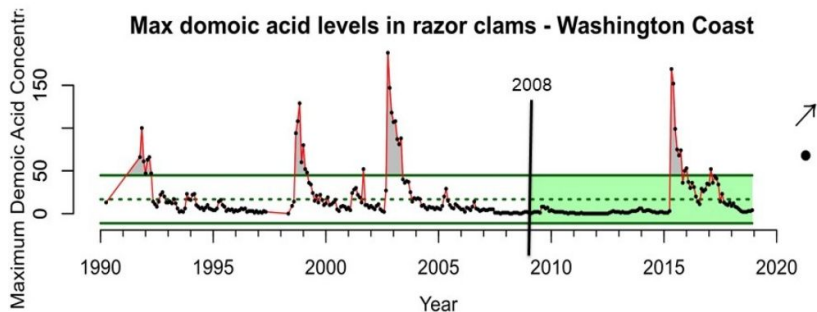| Trends - Biotoxin closures | Trends - Domoic Acid, all beaches (CCIEA) | Trends - Kalaloch Domoic Acid Levels |
|---|---|---|

Trends - Mocrocks Domoic Acid Levels (CCIEA)     Trends - Mocrocks Domoic Acid Levels (WDFW)
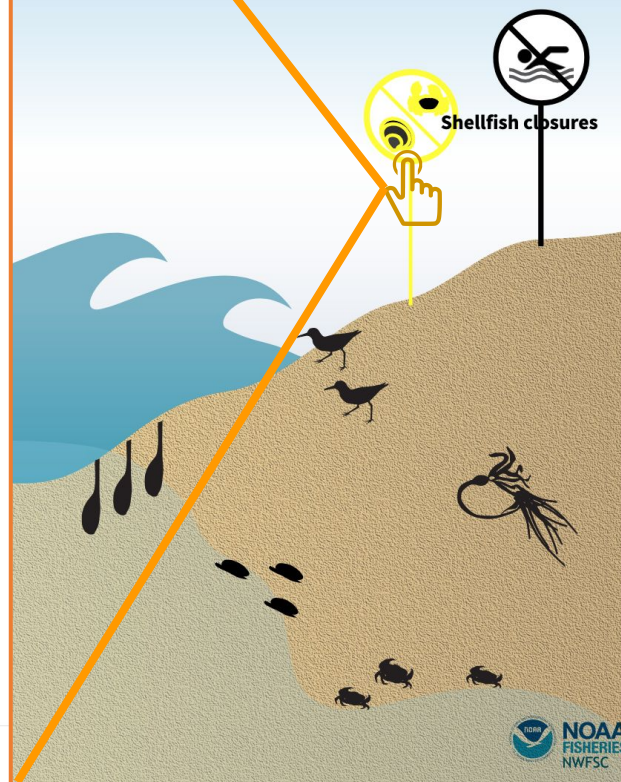
| Safe Shellfish Harvest Map | CCIEA Ecological Integrity Indicators |
|---|---|



Maximum Domoic Acid in Razor Clams for Washington Coast 1991-2018, CCIEA

Close

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Olympic Coast

Shellfish closures

# California Current 2022 Ecosystem Status Report Infographic

https://www.integratedecosystemassessment.noaa.gov/regions/california-current/california-current-2022-ecosystem-status-report-infographic

## 2021-22 CCIEA Ecosystem Status Report Highlights

**NOAA FISHERIES**

### Favorable Physical Conditions Over Much of the Shelf and Slope

- Above-average upwelling season, coolest shelf conditions since 2013
- Good nutrient supply to the base of the food web
- La Niña conditions, Negative Pacific Decadal Oscillation (PDO)

### Unfavorable Conditions and Risk Factors

**Marine Heatwave**
7th largest marine heatwave on record since 1982, largely remained offshore US EEZ

**Terrestrial Disturbances**
Early snowmelt, drought, warm streams

**Record heat, extreme & widespread wildfires**

**Hypoxia**
Widespread near-bottom hypoxia off OR/WA May–October

**Fishery Landings & Revenue**
Landings continued to decline in 2021 for several target groups (though revenue improved for many)

### Positive Ecological Responses

- Lipid-rich northern copepods highly abundant off Oregon
- Favorable conditions for juvenile salmon off Washington and Oregon
- Further south, continued very high abundances of anchovies in surveys and in predator diets
- Positive trends in productivity and growth rates of upper level predators

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Text in image: **On**

**Salmon Returns** ×

### Salmon Returns

#### RECENT OCEAN CONDITION INDICATORS TREND

good | fair | poor

| ECOSYSTEM INDICATORS | | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CLIMATE & ATMOSPHERIC | PDO (SUM; Dec-Mar) | | | | | | | | | | |
| | PDO (SUM; May-Sep) | | | | | | | | | | |
| | ONI (AVG; Jan-Jun) | | | | | | | | | | |
| LOCAL PHYSICAL | SST NDBC Buoys (°C; May-Sep) | | | | | | | | | | |
| | Upper 20 m T (°C; Nov-Mar) | | | | | | | | | | |
| | Upper 20 m T (°C; May-Sep) | | | | | | | | | | |
| | Deep Temp (°C; May-Sep) | | | | | | | | | | |
| | Deep Salinity (May-Sept) | | | | | | | | | | |
| LOCAL BIOLOGICAL | Copepod richness | | | | | | | | | | |
| | N copepod biomass | | | | | | | | | | |
| | S copepod biomass | | | | | | | | | | |
| | Biological transition | | | | | | | | | | |
| | Nearshore Ichthyoplankton | | | | | | | | | | |
| | Nearshore & offshore Ichthyoplankton | | | | | | | | | | |
| | Chinook salmon juvenile catch | | | | | | | | | | |
| | Coho salmon juvenile catch | | | | | | | | | | |

"Stoplight" table of conditions for smolt years 2012-2021 for coho salmon originating in coastal Oregon and Chinook salmon from the Columbia Basin. Green = "good," yellow = "intermediate," and red = "poor," relative to the full time series (1998-present). Chinook salmon from smolt year 2020 and coho salmon from smolt year 2021 (columns outlined in blue) represent the dominant age classes likely to return to their respective spawning rivers in 2022. In 2021, this suite of ecosystem indicators was the most favorable for northern California Current salmon productivity in the last decade and the second most favorable of the

Close

- Seabirds Yaquina Head

**Human Communities**
- Fishery Landings All (Coastwide)
- Fishery Landings California
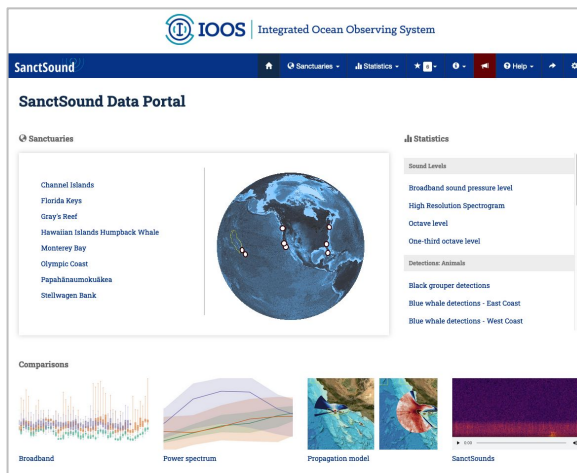- Fishery Landings Oregon
- Fishery Landings Washington

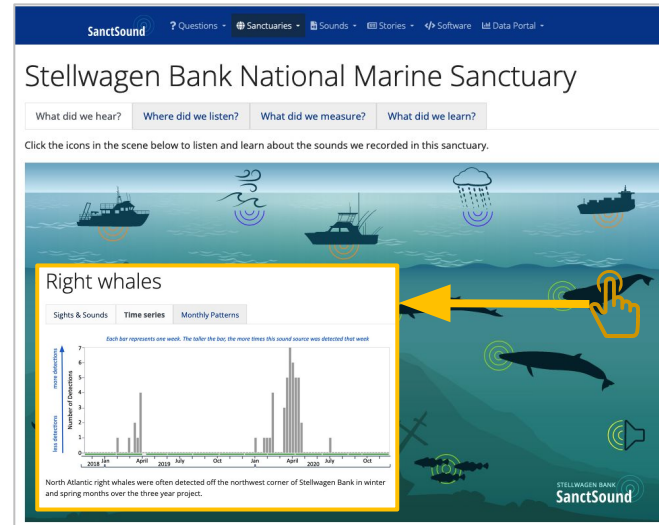# Continuum of Products to Match Target Audience

## NCEI Raw Data Archive
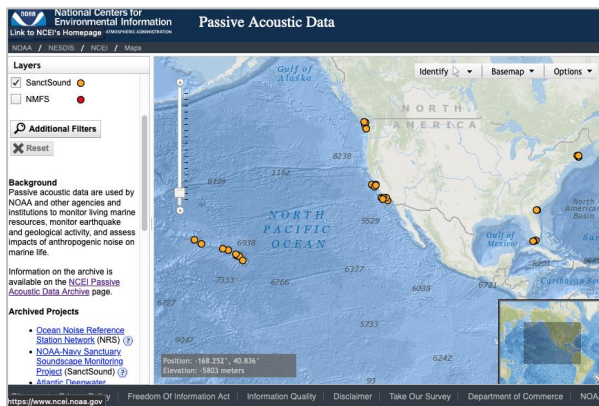


& extracted standard measurements via ERDDAP

## SanctSound Data portal



## SanctSound Web portal



Level of **Interpretation**
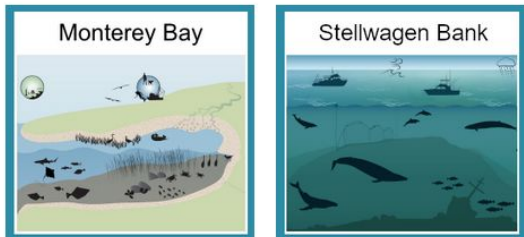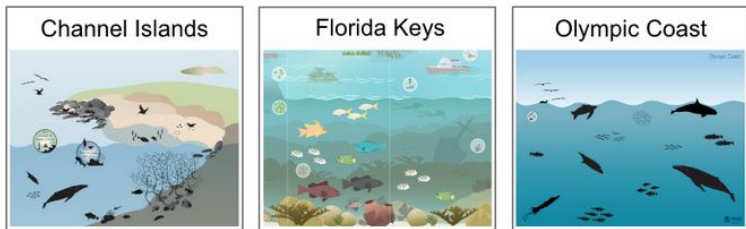
Level of **Technical expertise**

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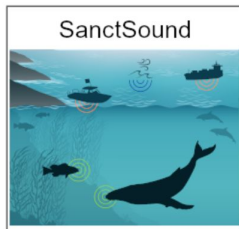- Attractive interface that is easily accessible on digital platforms

**Sanctuary Watch**

- *centralized location for tools used in Sanctuary management*

- *tools that connect to system-wide needs and priorities*

- *Public access to synthesized information used in decision-making*

# Product Landscape

- There are many tools, dashboards, portals, etc.

- Determine how new products and tools relate to existing websites, data portals, dashboards, etc.

- Sanctuary Watch

  - increase transparency of what information is supporting management and highlight the value of those data collection efforts

  - faciliate discovery of supportive content to increase interpretation and related products/tools to dive deeper

# *Questions? Comments?*

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**Kathy Broughton**
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