Sea Grant–NCCOS California Aquaculture Siting and Development Workshop

San Diego, California
November 2, 2023

Sea Grant
CALIFORNIA

Sea Grant
UNIVERSITY OF
SOUTHERN CALIFORNIA

Sea Grant
MARYLAND

Sea Grant

NOAA
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

Design and layout: Jenna Clark, Maryland Sea Grant

Maryland Sea Grant College
University System of Maryland
5825 University Research Court, Suite 1350
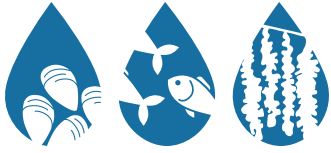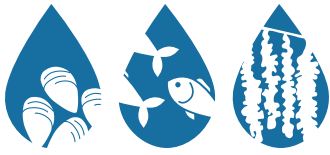College Park, Maryland 20740
T 301.405.7500
mdsg.umd.edu

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Workshop Background and Purpose

Welcome, and thank you for attending our Sea Grant–National Centers for Coastal Ocean Science (NCCOS) California Siting and Development Workshop. Our overarching priority today and throughout the project is to build capacity and collaboration among coastal-ocean groups for environmentally, economically, and socially equitable aquaculture development. We request that you review our workshop guidelines on page 8, which we rely on to create a safe and welcoming environment for all. We appreciate your participation in this effort.

Background

This workshop is part of a four-year project that connects 15 state Sea Grant programs, the National Sea Grant College Program (NSGCP), NCCOS, and other coastal-ocean groups engaged in aquaculture siting and sustainability. Funded primarily by a grant from the NSGCP, this collaboration has three goals: 1) Extend the reach of NCCOS aquaculture planning resources; 2) Conduct regional workshops to improve connections among scientists, extension specialists, and other coastal-ocean groups around the siting and development of ocean and coastal aquaculture; and 3) Inform broader Sea Grant–NCCOS marine planning efforts.

Purpose

The purpose of today's workshop is to advance understanding about tools and resources available for aquaculture siting and development in the California region. Through presentations and discussions, we will explore aquaculture siting tools, discuss topics related to aquaculture siting and development, and introduce ideas around collaboration for developing effective tools. We aim to identify ways we can collectively develop sustainable coastal and ocean aquaculture to meet US domestic seafood demand.

In this workshop, we plan to introduce the framework of "knowledge exchange," a component of "co-creation," when discussing aquaculture siting tools. Co-creation (also referred to as co-production, collaborative learning, participatory research, or collaborative modeling) can be defined as "iterative and collaborative processes involving diverse types of expertise, knowledge, and actors to produce context-specific knowledge" (Norström et al., 2020, p. 183)[1]. In the context of this workshop, knowledge exchange is a process that uses two-way communication and information transfer to build community among diverse interest groups who want to address complex social and environmental challenges around aquaculture siting and development. This approach is easily identified through its intent to empower all voices in the process. It can be characterized by frequent question asking.

Throughout the day, workshop participants will engage in discussion and apply the tenets of knowledge exchange and co-creation toward informing current and future aquaculture tools. We ask workshop participants to be open to fielding thought-provoking questions throughout the day. How might this tool be useful in your area? Could this tool be useful for a certain type of coastal-ocean user group? Does it prompt ideas of how you might expand who you work with? The questions intend to spur conversation so that we may listen and learn from each other.

Key outcomes for today's workshop are for participants to identify ways to make future aquaculture siting tools more accessible and applicable for broad audiences, and to contribute to conversations regarding aquaculture siting and development. This work will inform our future workshops with participants in the Pacific Northwest, the Pacific Islands, and the New England regions. Together, the outcomes from these workshops will provide recommendations on how to advance tool development, dissemination, and value to end users to move sustainable aquaculture production forward in the US.

Thank you for your support!

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1   Norström, A. V., Cvitanovic, C., Löf, M. F., West, S., Wyborn, C., Balvanera, P., et al. (2020). Principles for Knowledge Co-Production in Sustainability Research. Nat. Sustain. 9, 182–190. doi: 10.1038/s41893-019-0448-2

Workshop Agenda

Workshop Goal and Objectives

Goal

The primary goal of this project is to build capacity and collaboration among the National Oceanic and Atmospheric Administration (NOAA) Sea Grant network, NCCOS, and other coastal-ocean groups to advance environmentally, economically, and socially equitable aquaculture siting and development.

Objectives

- Present and explore existing aquaculture siting tools and data resources
- Introduce methods of knowledge exchange and co-creation in the context of aquaculture siting tools
- Build understanding among participants of the diverse perspectives, knowledge, and expertise present at the workshop
- Identify ways to improve and advance:
  - Utilization of co-creation in aquaculture siting tools
  - Existing and future aquaculture siting tools
  - Delivery of aquaculture siting tools to end users
  - Applicability of aquaculture siting tools for end users

Agenda

9:00 a.m.   Check-In

Light refreshments served

9:30 a.m.   **Welcome**

Fredrika Moser, *Maryland Sea Grant*
Chuck Weirich, *National Sea Grant Office*
Christopher Schillaci, *NCCOS*

9:35 a.m.   **Session 1: Introduction and Background**

Icebreaker Exercises

Fredrika Moser, *Maryland Sea Grant*

Workshop Overview and Intent

Annie Schatz, *Maryland Sea Grant*

Workshop and Project Evaluation

Cat Davis, *University of Maryland Center for Environmental Science, Appalachian Laboratory*

Principles of Knowledge Exchange and Co-Creation

Erin Satterthwaite, *California Sea Grant*

Aquaculture in California

Luke Gardner, *California Sea Grant*

10:20 a.m.   **Session 2: Aquaculture Perspectives**

Overview and Background

Annie Schatz, *Maryland Sea Grant*

Breakout Group Activity and Discussions

See 'Session 2' on page 5 for more information

10:50 a.m.   Break

11:00 a.m.   **Session 3: Aquaculture Siting Information and Tools**

Sea Grant and NCCOS Collaboration

Chuck Weirich, *National Sea Grant Office*

11:00 a.m. (cont.)	NOAA NCCOS Overview and the Coastal Aquaculture Planning Portal (CAPP)
	    Christopher Schillaci, NCCOS
	
	Southern California, and Central and Northern California, Coastal Ocean Observing System (SCCOOS and CeNCOOS) Ocean Data: Introduction and Opportunities
	    Henry Ruhl, CeNCOOS

11:30 a.m.	**Session 4: Aquaculture Tool Discussion (Part 1)** Overview and Background *Annie Schatz, Maryland Sea Grant* Breakout Group Activity and Discussions *See 'Session 4' on page 5 for more information*
12:00 p.m.	Lunch
12:45 p.m.	**Session 5: AquaMapper and OceanReports Exercise** Presentation and Demostration *Christopher Schillaci, NCCOS* Breakout Group Activity and Discussions *See additional handout*
2:15 p.m.	Break
2:25 p.m.	**Session 6: Aquaculture Siting and Planning Tool-Use Panel** **Moderator:** *Amalia Almada, University of Southern California Sea Grant* **Panelists:** *Eliza Harrison, Ocean Rainforest* *Robert Smith, K&L Gates, LLP* *Paula Sylvia, Port of San Diego* *Diane Windham, NOAA Fisheries* *See 'Session 6' on page 6 for more information*
3:25 p.m.	**Session 7: Aquaculture Tool Discussion (Part 2)** Overview and Background *Annie Schatz, Maryland Sea Grant* Breakout Group Activity and Discussions *See 'Session 7' on page 6 for more information*
3:55 p.m.	**Session 8: Evaluation** *Cat Davis, University of Maryland Center for Environmental Science, Appalachian Laboratory*
4:00 p.m.	Workshop Concludes

Workshop Logistics

The workshop will be divided into eight sessions with several opportunities for discussion and tool exploration. Each table will have sticky notes, markers, and flip charts to capture brainstorming discussions. Additionally, each table/group will have a facilitator and notetaker to help guide, capture, and ensure equal contributions to the conversation.

If participants have additional questions for any of the workshop presenters, please feel free to reach out to the workshop organizing committee, and we can help connect you with the appropriate panelist to answer your question.

Session 1: Introduction and Background

The introduction session begins with introductory exercises to engage participants, followed by a quick overview of the workshop's purpose and evaluation. Then, there will be an introductory talk about knowledge exchange and co-creation to ensure everyone is clear on the concepts introduced for workshop discussions. Lastly, there will be an overview of the current landscape of aquaculture in California to familiarize participants with the basics of California regional aquaculture and aid later workshop discussions. There will be time for short Q&A sessions following the *Principles of Knowledge Exchange and Co-Creation* and *Aquaculture in California* presentations.

Session 2: Aquaculture Perspectives

Considerable aquaculture expertise is convened at this workshop, and it is vital all participants recognize the value of everyone and listen to the diverse perspectives in the room.

Session 2 will include an activity and subsequent discussions within small groups. Participants will take part in an activity to explain their connection to aquaculture, and their expertise, knowledge, and unique perspectives regarding aquaculture in California. As introduction, each participant will be asked to give a 30-second elevator pitch of their expertise and experience. Then each participant will be asked to select an image they think best represents their response to a the following prompts and give a brief explanation (2-3 minutes) as to why that specific image was chosen.

- Select an image that you think best represents your connection to, knowledge of, and expertise regarding aquaculture in California. Please explain why you chose this image.
- Select an image that you think best exemplifies what the term co-creation means to you and explain why.

Session 3: Aquaculture Siting Information and Tools

In this session, the National Sea Grant Office program manager and the NCCOS collaborators will give introductions followed by an overview of some of the information and tools available for aquaculture siting from NCCOS and the regional Integrated Ocean Observing System program, with time for Q&A.

Session 4: Aquaculture Tool Discussion (Part 1)

Before exploring current aquaculture siting tools, participants will discuss what their ideal aquaculture siting tool would be and why.

- What would be your ideal aquaculture or marine spatial planning tool? What do you want from that tool?
  - Environmental data? Economic data? Cultural landscape? Regulations and permitting information?
  - Is it for initial aquaculture site identification (i.e., strategic) or to begin developing an aquaculture site (i.e., tactical)?

Session 5: AquaMapper and OceanReports Exercise

Participants will use the National AquaMapper and OceanReports tools created by NCCOS. After a presentation by NCCOS on the history and uses of AquaMapper and OceanReports, participants will get to test out the tools by completing a group exercise, followed by a discussion of these questions:

- Would you use these tools for initial aquaculture site identification (i.e., strategic) or to begin aquaculture site development (i.e., tactical)?
- How could you improve or modify these tools?
- How would you like assistance with using these tools (e.g., accessing and using the tools on your own, collaborative use with tool developers, training from tool experts, site visits, 1:1 discussions)?
- Would you be interested in being involved with future tool development? How would you want to be engaged with (e.g., data collection, co-creation of tool, beta testing, focus groups, etc.)?

Session 6: Aquaculture Siting and Planning Tool-Use Panel

During this session, a panel of industry, local and federal government, and legal members will discuss the successes and challenges of their experiences using various siting and planning tools. Some topics that panelists will address are how the tools were beneficial to their work, how tool outputs were used in the farm permitting process, and next steps following tool use. There will be time for audience questions at the end.

- Moderator: Amalia Almada, *University of Southern California Sea Grant*
- Panelists:
  - Eliza Harrison, *Ocean Rainforest*
  - Robert Smith, *K&L Gates, LLP*
  - Paula Sylvia, *Port of San Diego*
  - Diane Windham, *NOAA Fisheries*

Session 7: Aquaculture Tool Discussion (Part 2)

In this session, participants will think about aquaculture tools within the context of sustainable aquaculture development, keeping in mind what was learned from the previous sessions. They will deliberate on what an ideal tool might look like and how co-creation could aid in the creation of such a tool.

- After today's tool exploration and discussions, would you revise your ideal tool described earlier? Why or why not?
- How would you develop an ideal tool using a co-creation approach?
  - Is that approach different from the current methods for modifying an existing tool? Why or why not?
- Is there a stakeholder group that is not usually included in tool development that should be? Think back to *Session 2* and who you routinely work with. Who is missing?

Session 8: Evaluation

During this session, participants will complete a short evaluation developed by our external evaluator. This will help us to understand what you learned and to improve our workshop process.

Next Steps

In December, the workshop team will host a follow-up focus group session. This session is aimed at continuing the conversations from the workshop and building capacity and collaboration among coastal-ocean audiences for environmentally, economically, and socially equitable aquaculture development. If you are interested in participating in this focus group, please sign up here: bit.ly/Post_Workshop_Discussion.

After the focus group session, the team will synthesize the findings from our work in the region and create a summary paper to distribute to all participants and others interested in the findings. Additional information on that process and the materials will be listed on our website (mdsg.umd.edu/CaliforniaAquacultureWS).

Workshop Guidelines

Maryland Sea Grant (MDSG) is committed to providing safe and welcoming environments for all who participate in MDSG events. MDSG prohibits and will not tolerate any form of harassment, bullying, or discrimination. Together, through the following guidelines, we can ensure that this workshop supports free expression and exchange of ideas in environments that are positive and productive for all.

We value all perspectives. We encourage everyone to share. We are here to listen and understand. If you prefer not to answer, you can say "pass," or "pass for now."

Please note that disagreement is welcome for the purpose of understanding but not for convincing. Critique ideas, not individuals. Please actively listen to everyone. We ask that you avoid interrupting others when speaking. Please try to minimize distractions when possible.

During this workshop we will be developing a shared language. It is always OK to ask what a word or phrase means or to ask for further clarification, as we will be asking the same of you!

If you know that you need to leave the meeting early, please let the project team, facilitator, or notetaker know ahead of time so that we can allot your time first during our breakout sessions.

If you believe that you or someone else is being subjected to inappropriate conduct, or if you have any other concerns, please do not hesitate to contact MDSG event staff who can work with MDSG leadership to resolve the situation. If the project team determines that any behavior is inappropriate or violates the above guidelines, participants will be reminded of these ethics and/or asked to leave the meeting.

Appendix: Additional Materials

Project Overview and Personnel

Connecting Sea Grant, NCCOS, and Coastal Stakeholders to Improve Sustainable Aquaculture Siting and Development

The National Centers for Coastal Ocean Sciences (NCCOS) have developed tools and resources for aquaculture siting and development to begin addressing the complex needs of interested parties utilizing coastal-ocean spaces. The key to successful usage and continual development of NCCOS planning tools and resources is a science-based, community-led approach, which will ideally result in the identification of optimal locations for aquaculture development. Because many local groups overlap with aquaculture areas in coastal-ocean environments, it is important to deliberately connect and build capacity among users through conversations centered around aquaculture tools to improve sustainable aquaculture development.

Goal

The primary goal of this project is to build capacity and collaboration among the National Oceanic and Atmospheric Administration (NOAA) Sea Grant network, NCCOS, and other coastal-ocean groups to advance environmentally, economically, and socially equitable aquaculture siting and development.

Approach

Six regional workshops have and will take place: the Mid-Atlantic (Mid 2022); Gulf of Mexico (Early 2023); Southern California (Late 2023); Pacific Northwest (Mid 2024); Pacific Islands (Late 2024); and New England (Early 2025). The framework of co-creation and knowledge exchange will be introduced and help guide interactions with workshop participants to build a pathway for developing future aquaculture siting tools that are accessible and applicable to broad audiences. In addition, the workshops are designed to advance the reach of NCCOS aquaculture planning tools.

Workshop Objectives

To meet the goal and approach outlined above, each workshop has four objectives:

- Present and explore existing aquaculture siting tools and data resources
- Introduce methods of knowledge exchange and co-creation in the context of aquaculture siting tools
- Build understanding among participants of the diverse perspectives, knowledge, and expertise present at the workshop
- Identify ways to improve and advance:
  - Utilization of co-creation in aquaculture siting tools
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  - Delivery of aquaculture siting tools to end users
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Project PI

Fredrika Moser
Director, Maryland Sea Grant
(301) 405-7500
moser@mdsg.umd.edu

Project Co-PIs

Ginny Eckert, Director, Alaska Sea Grant
Sherry Larkin, Director, Florida Sea Grant
Beth Lenz, Assistant Director for Diversity and
Community Engagement, Hawai'i Sea Grant
Shauna Oh, Director, California Sea Grant

Project Collaborators

Jenna Clark, Senior Programs Manager,
Maryland Sea Grant
Hannah Cooper, Science Management and Policy Intern,
Maryland Sea Grant

National Aquaculture Coordinator

Annie Schatz
Aquaculture Projects Coordinator, Maryland Sea Grant
(301) 405-7500
kschatz@mdsg.umd.edu

Pamela Plotkin, Director, Texas Sea Grant
Cat Davis, Principal Agent, University of Maryland
Center for Environmental Science
Susan White, Director, North Carolina Sea Grant
Gayle Zydlewski, Director, Maine Sea Grant

Christopher Schillaci, NOAA NCCOS

For more information, please visit: mdsg.umd.edu/sustainable-aquaculture-siting

Coastal Aquaculture Planning Portal (CAPP)

A Toolbox for Sustainable Aquaculture Coastal Planning and Siting

The Coastal Aquaculture Planning Portal (CAPP) is a toolbox of coastal planning tools designed to assist managers, planners, and industry with sustainable aquaculture development. This toolbox was developed in partnership with Digital Coast, a product of the NOAA National Ocean Service Office for Coastal Management.

Tool summary

In an effort to obtain global food security, many countries, including the United States, are turning toward the expansion of marine aquaculture. This effort requires a need for support in the decision-making and planning process for future site suitability and development of aquaculture infrastructure. The Coastal Aquaculture Siting and Sustainability (CASS) program—under NOAA/ National Ocean Service (NOS)/ National Centers for Coastal Ocean Science (NCCOS)—has developed a marine aquaculture toolbox composed of coastal aquaculture planning tools.

Tools for the Future…

Managers

Industry

Planners

…Tools for Planning

The Coastal Aquaculture Planning Portal (CAPP) is a consolidation of a wide range of existing tools and applications created to assist managers, planners, and industry in the development of sustainable aquaculture. Private universities, state and federal government agencies, and global organizations have developed these tools to provide the most accurate and up-to-date data and environmental analysis possible. These tools range from state-specific shellfish mappers to global geospatial ecology overviews. The portal is organized into four subcategories, each of which pertain to marine aquaculture and/or environmental interactions. The CAPP was developed in partnership with Digital Coast, a product of the NOAA/ NOS Office of Coastal Management, in efforts to support the growth and expansion of resilient and sustainable marine aquaculture within the United States and abroad.

coastalscience.noaa.gov/research/marine-spatial-ecology/coastal-aquaculture-planning-portal-capp/

For more information

Christopher Schillaci
NOAA National Ocean Service
National Centers for Coastal Ocean Science
Christopher.Schillaci@noaa.gov

A SUMMARY: CeNCOOS
Strategic Plan 2020-2025

Our Vision

A healthy and prosperous California coastal ocean powered by information solutions.

Our Mission

Translating data into action through the production, curation, and delivery of high-quality ocean information.
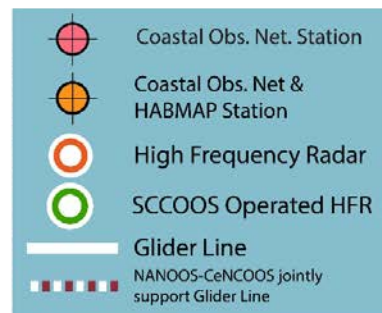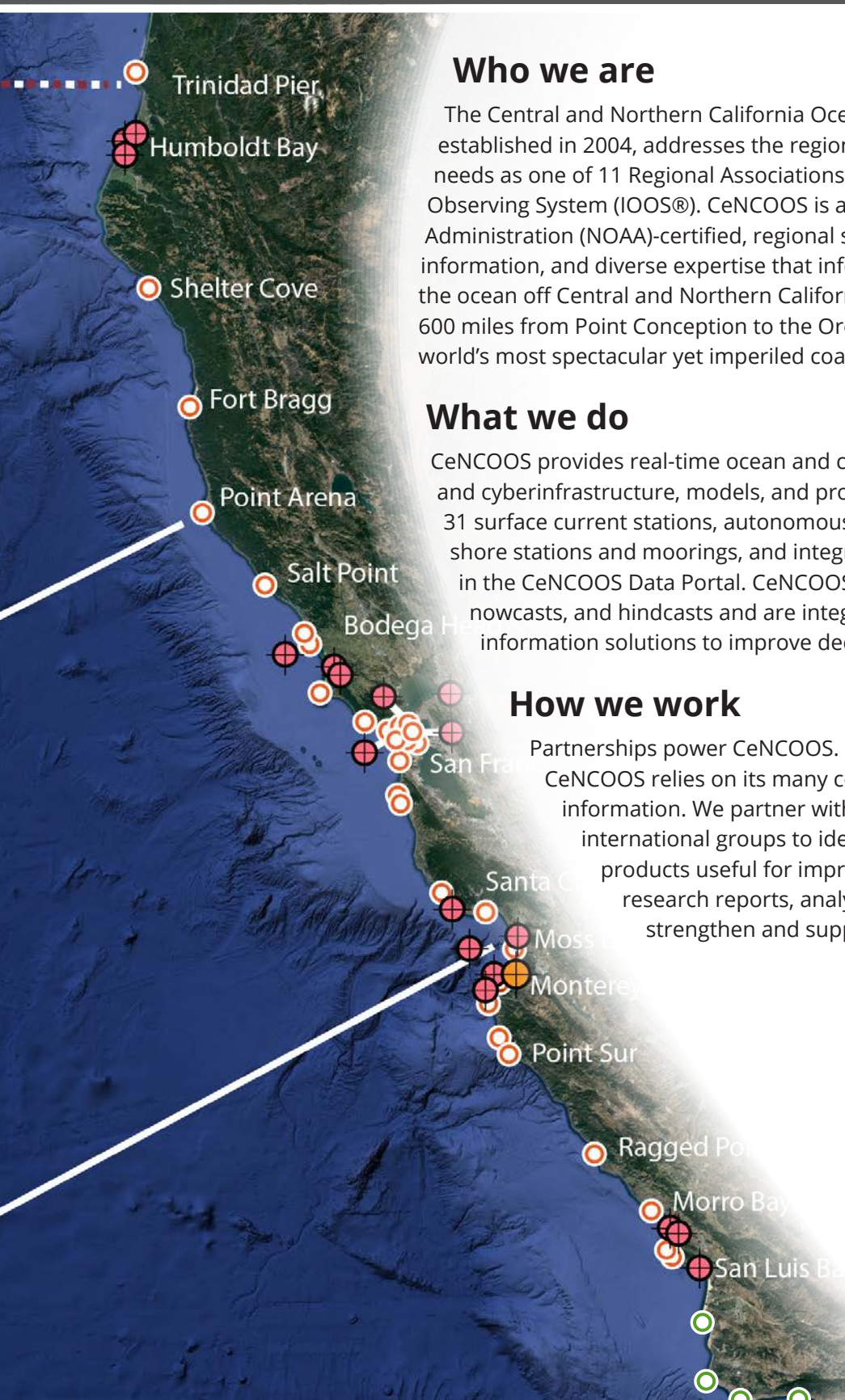
Who we are

The Central and Northern California Ocean Observing System (CeNCOOS), established in 2004, addresses the region's high-priority ocean information needs as one of 11 Regional Associations of the U.S. Integrated Ocean Observing System (IOOS®). CeNCOOS is a National Oceanic and Atmospheric Administration (NOAA)-certified, regional source for high-quality data, integrated information, and diverse expertise that informs wise and sustainable use of the ocean off Central and Northern California. The CeNCOOS region extends 600 miles from Point Conception to the Oregon border and covers some of the world's most spectacular yet imperiled coastline.

What we do

CeNCOOS provides real-time ocean and coastal observations, data management and cyberinfrastructure, models, and products that present information from 31 surface current stations, autonomous underwater gliders, more than 15 shore stations and moorings, and integration with >250 other data layers in the CeNCOOS Data Portal. CeNCOOS observations support forecasts, nowcasts, and hindcasts and are integrated into tailored, user-driven information solutions to improve decision-making.

How we work

Partnerships power CeNCOOS. From observations to user applications, CeNCOOS relies on its many contributors to meet the demand for information. We partner with state, regional, national, tribal and international groups to identify, develop, and deliver information products useful for improving ocean stewardship—including research reports, analytics, and educational materials that strengthen and support all levels of ocean policy formation.

Trinidad Pier
Humboldt Bay
Shelter Cove
Fort Bragg
Point Arena
Salt Point
Bodega Head
San Fran
Santa C
Moss
Monterey
Point Sur
Ragged Po
Morro Bay
San Luis Ba

Legend:
- Coastal Obs. Net. Station
- Coastal Obs. Net & HABMAP Station
- High Frequency Radar
- SCCOOS Operated HFR
- Glider Line
- NANOOS-CeNCOOS jointly support Glider Line

A SUMMARY: CeNCOOS Strategic Plan 2020-2025

Societal Focus Areas

Predicting Weather and Climate Variability and Change

CeNCOOS observing systems provide sustained observations to understand and detect trends and changes in ocean weather and climate.

Healthy Ecosystems and Water Quality

CeNCOOS supports dynamic ecosystem management by integrating diverse types of information to document impacts of many marine stressors including harmful algal blooms, ocean acidification, overfishing, pollution, habitat destruction, and global-scale environmental change.

Preparedness and Risk Reduction for Coastal Communities

CeNCOOS data and products support readiness and resilience to climate change and coastal hazards such as sea level rise, flooding, and erosion by providing federal, state and municipal programs with state-of-the-art data, tools, training and expertise.
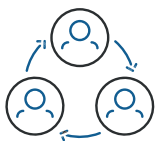
## Safe and Efficient Transportation and Commerce

Supported by surface current High Frequency Radar (HFR) observations, CeNCOOS provides surface current and trajectory maps, models, and information products for emergency response to oil spills, search and rescue, and more.
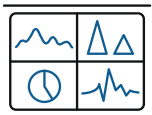
Strategies (2020-25)

★ **Strategy 1:** Engage marine stakeholders to drive the creation of integrated information products that are valuable for decision-making.
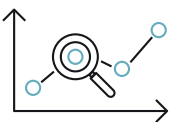
★ **Strategy 2:** Observe coastal and ocean physical, biogeochemical, biological, and ecosystem variables to meet regional stakeholder needs.

★ **Strategy 3:** Streamline access to information, including through a publicly accessible Data Portal.

★ **Strategy 4:** Provide access to improved ocean models and other tools to scale information from individual observations and to make data relevant for policy and management.

Evolving Our Systems and Filling the Gaps

HIGH FREQUENCY RADAR (SURFACE CURRENTS) — Our HFR network is a backbone system for maritime safety.

Aging infrastructure requires recapitalization and hardening the network for system resilience.

GLIDERS — CeNCOOS operates a fleet of ocean-going autonomous gliders to provide near real-time observations of climate change and variability.

Additional resources are needed to expand ocean acidification, nutrient and plankton observing on gliders.

MOORINGS & SHORE STATIONS — The CeNCOOS Coastal Observing Network integrates automated shore stations, coastal moorings, and ship stations.

Coastal observing enhancements include the addition of ocean acidification, harmful algal bloom (HAB) and eDNA monitoring.

MODELING — We support high-resolution meteorological forecasts, high-resolution nowcasts and forecasts of changing conditions.

Next generation models include high-resolution, local-scale, biogeochemical and biological forecast models.

BIOLOGY & ECOSYSTEMS — CeNCOOS incorporates novel observing techniques to track changes in marine biodiversity, species abundance and distribution, and ecosystem function.

Integration of emerging tools such as imaging, passive acoustic monitoring, animal tagging and genomics (e.g. eDNA) will increase our understanding and ability to manage changing ecosystems.
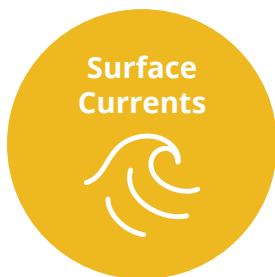
DATA MANAGEMENT & PRODUCT DEVELOPMENT — We provide information solutions to support decision making for eleven federal agencies and seven state agencies.

The maturation of observing technologies, machine-readable metadata standards and data processing are all streamlining the production of timely ecosystem-level information solutions.

Visit our CeNCOOS Data Portal for information access (data.cencoos.org)

- Surface Currents
- Marine Heatwaves
- Harmful Algal Blooms
- Shellfish Aquaculture
- What do you need to know?

Learn more about our strategies at cencoos.org

IOOS Integrated Ocean Observing System

CENTRAL & NORTHERN CALIFORNIA OCEAN OBSERVING SYSTEM

U.S. INTEGRATED OCEAN CERTIFIED REGIONAL ASSOCIATION OBSERVING SYSTEM
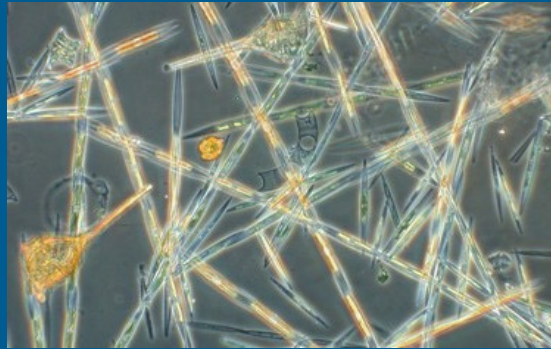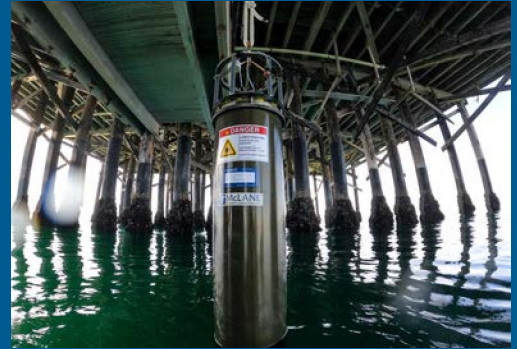
HARFMUL ALGAL BLOOMS

SCCOOS and CeNCOOS operate and sustain Harmful Algal Bloom (HAB) and phytoplankton community monitoring in support of a National HAB Observing Network

California sea lion displaying symptoms of domoic acid toxicosis and being rescued by CIMWI volunteers in August 2022.

Pseudo-nitzschia, a diatom known to produce domoic acid, a potent neurotoxin that is harmful to marine mammals, seabirds, and humans.
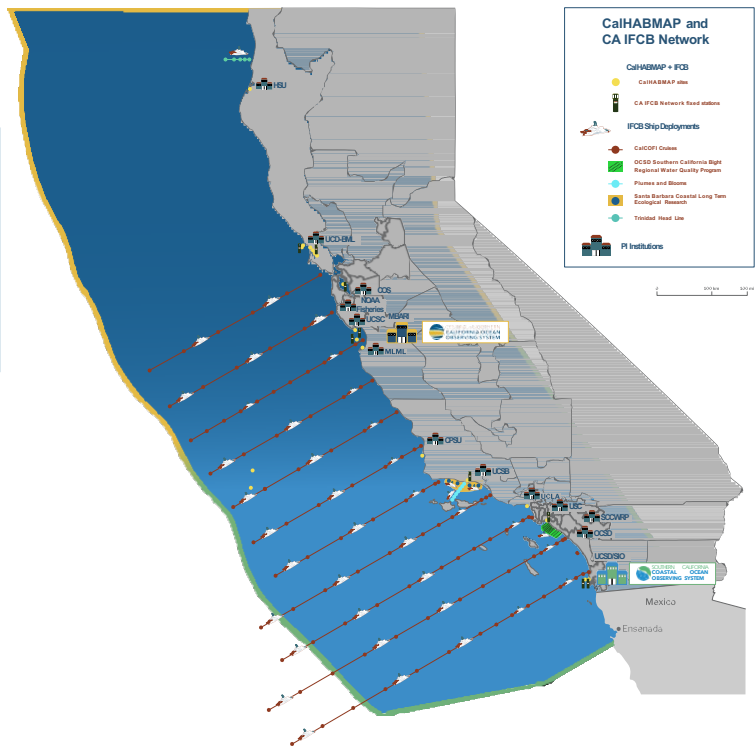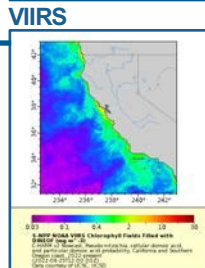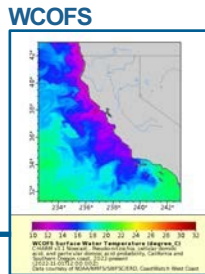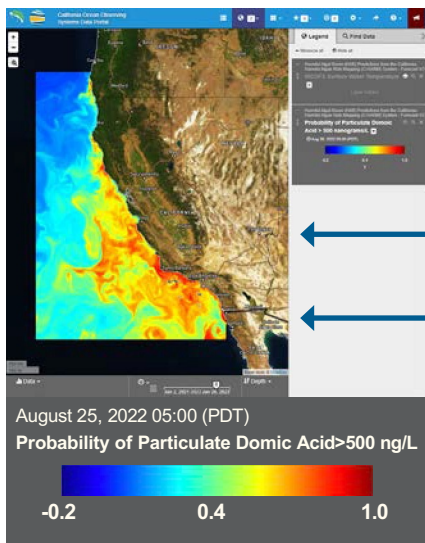

The Imaging FlowCytobot (IFCB) at Newport Beach Pier takes *in situ* photos of plankton and applies machine-learning algorithms to identify species in real time.

California Harmful Algal Bloom Monitoring Alert Program and the California Imaging FlowCytobot Network

C-HARM
California Harmful Algae Risk Mapping System

August 25, 2022 05:00 (PDT)
Probability of Particulate Domic Acid>500 ng/L

-0.2   0.4   1.0

WCOFS

VIIRS

CA HAB Bulletin

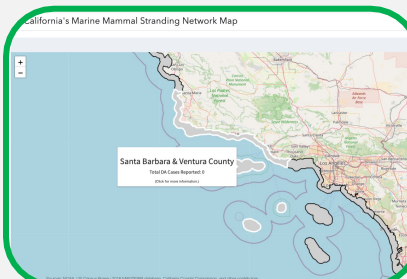Monthly Highlights

C-HARM

HABMAP

IFCB

CDPH

Strandings

The CA HAB Bulletin is a monthly hindcast to give resource managers and the public a quick overview of the recent toxic algal blooms in coastal California from models and aggregate data sets. Subscribe to the CA HAB Bulletin at sccoos.org/california-hab-bulletin/

11 Suspect Domoic Acid strandings in August 2023

California Ocean Observing Systems

Science-based and Stakeholder-driven

Visit: data.caloos.org

CeNCOOS & SCCOOS by the Numbers:

California Surface Current Mapping Network
62 HF Radars

California Underwater Glider Network
6 Glider Lines

California Coastal Observing Network
21 Shore Stations

10 Moorings and Buoys

California Coastal Flood Network
6 Beaches

Animal Telemetry Network
13 Tagged Northern Elephant Seals

42 Tagged White Sharks

Marine Mammal, Seabird, and Sea Turtle Observations
● CalCOFI Cruises
● ACCESS Cruises

6 Predictive Models

18 Funded Partner Institutions and
44 Principal Investigators

Since 2004, SCCOOS and CeNCOOS have been providing California with sustained long-term, high-quality observations, reliable data, and supporting stakeholder-driven products and tools. We employ a variety of *in situ* and remote sensing technologies to measure physical, chemical, and biological parameters as well as support ocean prediction models in the California Current Ecosystem and stakeholder driven products and tools.

CENTRAL & NORTHERN CALIFORNIA OCEAN OBSERVING SYSTEM

Data, information and expertise to promote ocean health and grow the Blue Economy.

CeNCOOS Strategies 2020 - 2025

☐ **Strategy 1.** Observe coastal and ocean physical, biogeochemical, biological and ecosystem variables. [Observations]

☐ **Strategy 2.** Streamline access to information including through a publicly accessible Portal. [DMAC]

☐ **Strategy 3.** Provide access to improved ocean models and other tools to provide information relevant for policy and management decision-making. [Models & Analysis]

☐ **Strategy 4.** Engage marine stakeholders to create integrated and valuable information products to inform decision-making and policy. [Products & Outreach]
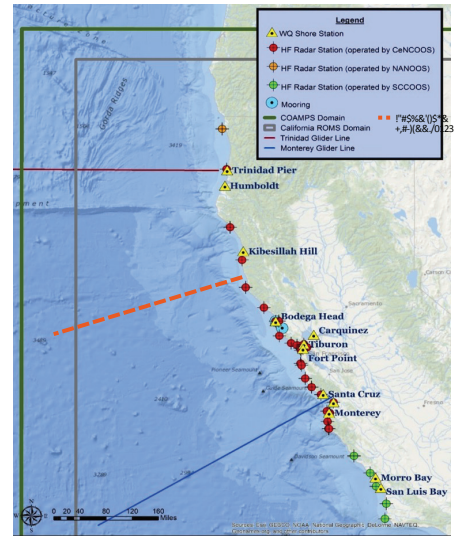
Marine Operations, Transportation, and Event Response

CeNCOOS' array of physical ocean observations, data delivery services, models and curated data products informs statewide search and rescue missions, oil spill and water pollution tracking, natural resource management, port and harbor operations, recreational boating activities, and more. CeNCOOS operates a network of 26 High Frequency Radars providing economical and accurate sensors to map ocean surface currents to assess large-scale physical and biological change in the coastal ocean.

PROTECT

Helping to grow the Blue Economy.

OPTIMIZE

Tailoring ocean data to the needs of central and northern California.

EXPAND

Supporting wise use and stewardship of coastal and ocean resources.

PRIORITIZE

Integrating and serving data, information and expertise.

Henry Ruhl, Director
hruhl@mbari.org
(831) 775-2126

cencoos.org

Alex Harper, Program Manager
aharper@mbari.org
(831) 775-1987

CENTRAL & NORTHERN CALIFORNIA OCEAN OBSERVING SYSTEM

Climate Change & Variability

CeNCOOS Technologies Improve Preparedness

Emerging technologies collect real-time measurements in the ocean that are needed for weather and climate prediction. CeNCOOS gliders are underwater robots that relay information about deep ocean temperatures to the public. Buoys and mooring measure temperature and other essential oceanographic information at fixed depths and over long timescales. Emerging technologies are revolutionizing ocean observing by being

Data from gliders, buoys, and ships can be assimilated into forecasts for California farmers and families. Output from model forecasts improve preparedness for all of Central and Northern California. CeNCOOS provides easy access to high quality, reliable ocean information through the CeNCOOS Data Portal (data.cencoos.org).

Harmful Algal Blooms, Acidification & Hypoxia

CeNCOOS partners with academic researchers and industry members to deliver site-specific, real-time, actionable information (data, indicators, and forecasts) to sustain and aid industry operations and expansion by providing timely and accessible information.
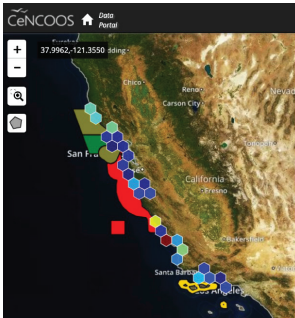
Increasing Safety and Security of Food Supply

Fisheries and aquaculture industries face several challenges from episodic events such as Harmful Algal Blooms (HABs) to longer term change from ocean warming, acidification (OA) and hypoxia. California is especially susceptible to OA through the a combination of the accumulation of carbon dioxide from the atmosphere and the upwelling of naturally lower pH waters from the deep ocean. CeNCOOS works closely with aquaculture and fishing communities to provide information to support operations.

Integrating Biological & Ecosystem Observations
Ocean Health Indicators for California Managers

Marine resource managers are increasingly reliant on fit-for-purpose updates on changing ecological conditions that incorporate near real-time data. Automated ecosystem indicator products can target specific or multiple management requirements by providing timely information on living resources in the CCLME.
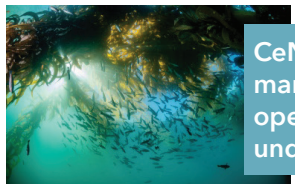
CeNCOOS is building consensus and regional strengthening coordination among marine researchers and observing practitioners to develop and implement an operational biological ecosystem monitoring program to promote improved understanding and management of our most valuable marine ecosystems.

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hruhl@mbari.org
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National AquaMapper

Helps industry and coastal managers find the right space for offshore aquaculture opportunities.

The National AquaMapper is a web-mapping application designed to assist managers in identifying suitable areas for aquaculture development in U.S. federal waters. The application provides high resolution maps to improve the coordination and transparency of permits and siting, which in turn reduce planning costs on industry and regulatory agencies and allow for more investment opportunities in domestic seafood production.
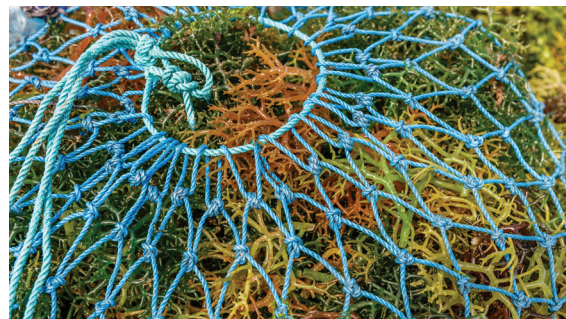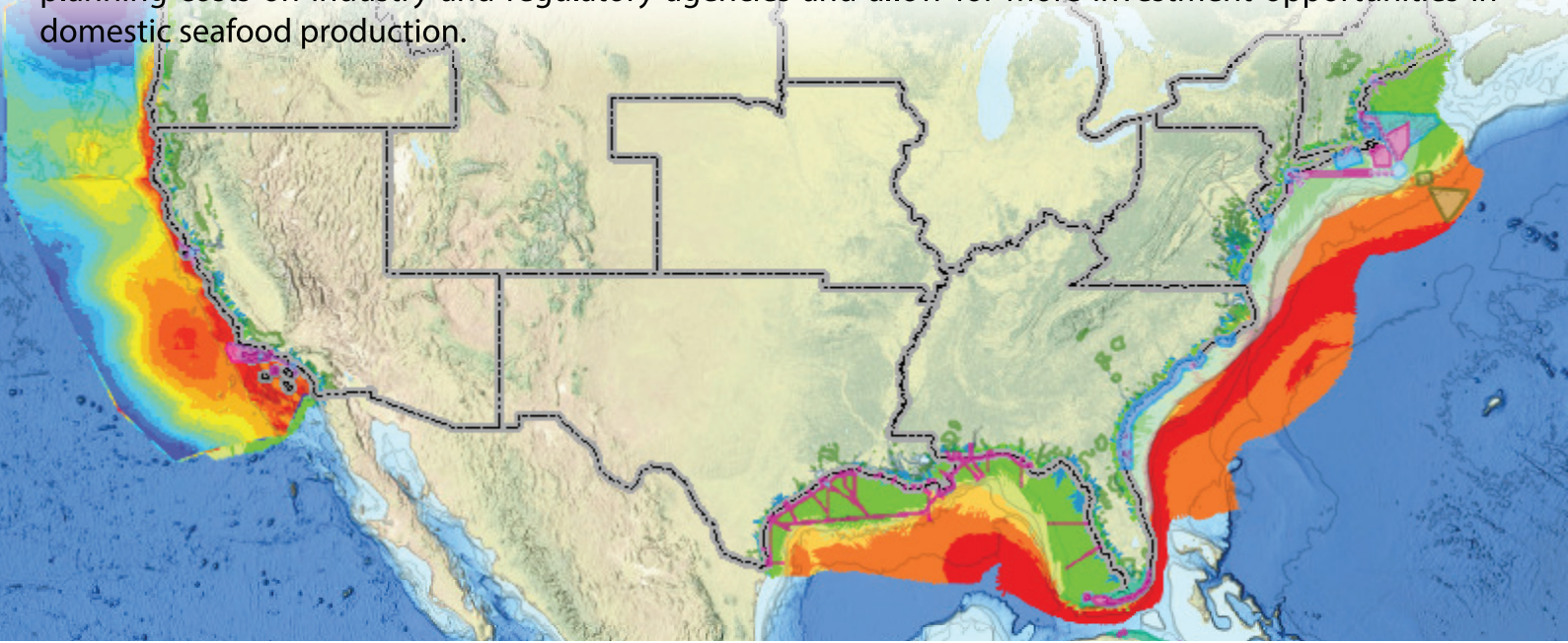
Minimize user conflicts with:

Military

Navigation

Industry

Oceanographic
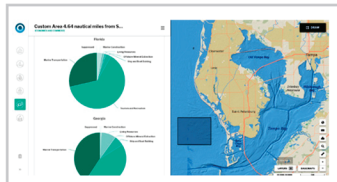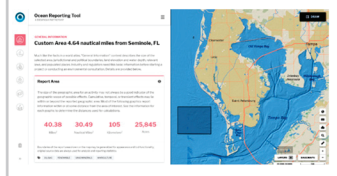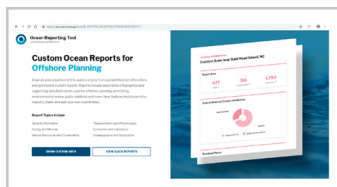
Natural & Cultural Resources

A trusted one-stop tool for custom automated spatial analyses for authoritative ocean data to streamline permitting, decrease costs, and increase transparency for all ocean industries

OceanReports

Explore Your Ocean with OceanReports

OceanReports Quickfacts

• Over 100 data sets including energy and minerals, natural resources, transportation and infrastructure, oceanographic and biophysical conditions, and the local ocean economy

• Provides custom automated geospatial analyses for exploring the entire U.S. ocean

• Made for all ocean industries including energy, shipping and transportation, aquaculture, fisheries, and seabed mining

• Users include ocean industries, permitting agencies, consultants, marine planners, physical scientists, policy analysts, and the general public

• The only tool that generates comprehensive spatial reports for the entire U.S. ocean

This tool was developed by NOAA, the Bureau of Ocean Energy Management, the Department of Energy, and Esri.

For questions contact: James.Morris@noaa.gov, Dave.Stein@noaa.gov, and Christine.Taylor@boem.gov

SCAN ME

NOAA National Ocean Service
National Centers for Coastal Ocean Science
Office of Coastal Management
http://coastalscience.noaa.gov