



# Central and Northern California Ocean Observing System (CeNCOOS)

## 2014-2019 Strategic Plan









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## **Vision Statement**

CeNCOOS will be a leader within U.S. IOOS®, and be recognized and relied upon regionally and nationally as a trusted source of data, information, and expertise to inform wise use of the ocean off central and northern California.

## **Mission Statement**

CeNCOOS is a collaborative that enables sustained and coordinated measurements, model nowcasts and forecasts, and integrated products to inform decisions about our regional ocean.

# Executive Summary

This plan details the overarching programmatic strategies for the Central and Northern California Ocean Observing System (CeNCOOS) for the 2014-2019 period. These strategies are meant to set medium-term goals for CeNCOOS that will guide the program's growth, meet national Integrated Ocean Observing System (U.S. IOOS®) requirements, and assist in the procurement of funds beyond those from the NOAA Regional Coastal Ocean Observing System (RCOOS) Grant.

The process for the creation of this plan began in the fall of 2012 with the initial draft of the CeNCOOS Framework for Decision Making ([FDM](#)) document (approved in 2013). Following the process for prioritization detailed in the FDM, the strategies in this plan were generated by the CeNCOOS Program Office and Governing Council in July 2013 and further honed through subsequent meetings. The products of this process are the following four strategies:

1. Continue long-term measurements of meteorological, and ocean physical, chemical, and biological parameters
2. Provide a publicly accessible data portal to integrate real-time and historic time-series measurements together with geospatial and other data
3. Develop, implement, and operate data-assimilating coupled ocean physical-biogeochemical ecosystem models
4. Utilize data to create products to inform policy and decision-making

Significant consideration was given during the prioritization process to the responsiveness of these strategies to pre-



Figure 1: Meteorological station in San Francisco Bay

existing federal, regional, and state priorities. Specifically, the strategies identified in this plan map to those of the U.S. IOOS program, the West Coast Governors Alliance on Ocean Health (WCGA), and the California Ocean Protection Council (OPC). Details on these connections are presented throughout the plan.

CeNCOOS is committed to maintaining its core capabilities (as detailed in the [FDM](#)):

- ◆ Scientific and technical expertise/leadership to identify and address ocean observing and modeling needs
- ◆ HF radar: ocean surface circulation measurements
- ◆ Shore stations: measuring water quality, hydrography, harmful algal blooms
- ◆ Numerical models
- ◆ Data/information products
- ◆ Ships/gliders/moorings: monitoring offshore subsurface variables for applications in climate, productivity, circulation, physical processes, and model assimilation
- ◆ Seafloor/habitat mapping – data delivery
- ◆ Data serving, including metadata and QC as appropriate

The strategies listed in this plan are meant to guide the program's growth, and provide further context for our core capabilities. The visions for these strategies over the next five years cannot be fully realized under current funding levels; to be successful, further sources of funding and strategic partnerships will need to be identified. It is a goal of this plan to assist in the efforts to attract that necessary funding.

CeNCOOS will evaluate its progress annually and revisit the strategies periodically to confirm that they continue to meet the vision of the Governing Council and Program Office.

We believe the five-year visions for these strategies to be both ambitious and feasible. If fully realized, the strategies detailed within the plan will allow CeNCOOS to become a leader within U.S. IOOS, and be recognized and relied upon as a trusted source of data, information, and expertise that contributes to the wise use of the ocean off central and northern California.



Figure 2: CeNCOOS data is heavily used by marine transportation



# Introduction

## Purpose of this document

The following plan details the overarching programmatic strategies for the Central and Northern California Ocean Observing System (CeNCOOS) for the 2014-2019 period. The strategies discussed later in this plan are not meant to replace or take precedence over the established “core capabilities” of the system (as discussed in section 7 of the [CeNCOOS Framework for Decision Making](#)). Rather, these strategies are meant to set medium-term goals for CeNCOOS that will guide the program’s growth, meet national Integrated Ocean Observing System (U.S. IOOS®) requirements, and assist in the procurement of funds beyond those from the NOAA Regional Coastal Ocean Observing System (RCOOS) Grant.

The process for the creation of this plan began in the fall of 2012 with the initial draft of the CeNCOOS Framework for Decision Making (FDM) document (approved in July 2013). Priorities and project funding decisions for the system are guided by sections 9 and 10 of the FDM (Appendix 1). The strategies discussed in this plan are a product of the prioritization process described in section 9, which was completed by the CeNCOOS Program Office and Governing Council in July 2013.

## Background on IOOS and CeNCOOS

CeNCOOS is one of 11 regional organizations under the U.S. IOOS, a national-regional partnership working to provide new tools

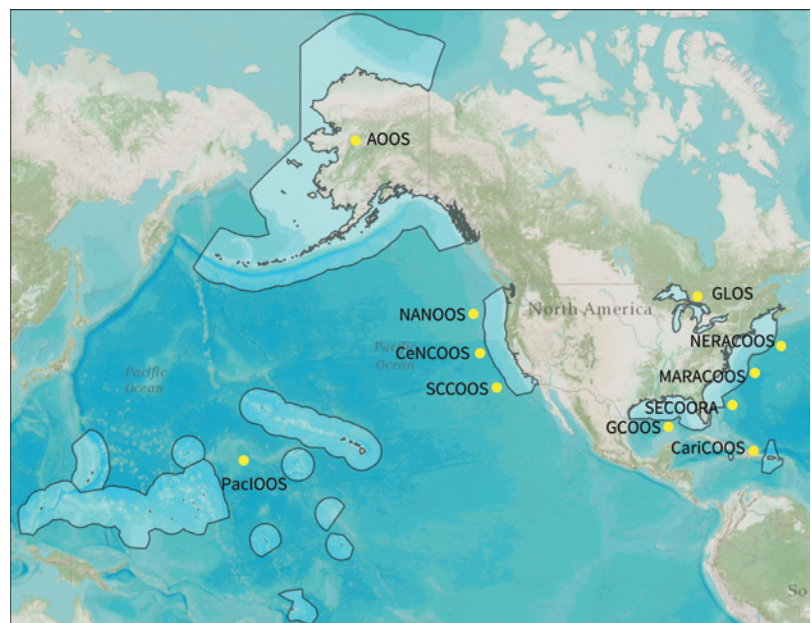


Figure 3: Map of IOOS Regional Associations

and forecasts to improve safety, enhance the economy, and protect our environment. Established by the 2009 Integrated Coastal and Ocean Observing System Act, IOOS coordinates the multi-agency, cooperative effort to routinely collect real-time data and manage historical information based on a continuously operating network of buoys, ships, satellites, underwater vehicles, and other platforms.

CeNCOOS was established in 2004 in response to a growing national priority to develop and maintain a network of observing systems designed to best meet both regional and national needs for understanding processes, predicting events, and developing response strategies in the maritime and coastal domains.

CeNCOOS is a consortium of member organizations with a coordinating central program office. Any organization or individual (not associated with a member organization) substantially engaged in the collection, delivery, or use of ocean observing data or information in the CeNCOOS region may become a member by signing a [Memorandum of Agreement](#) and abiding by the Bylaws. As of December 2013, CeNCOOS is comprised of 54 active signatory members and two affiliate members (Appendix 2). CeNCOOS has a 15-member Governing Council (Appendix 3) democratically elected by the signatory members with the goal of diverse representation as shown in the following table:

Category	# of Members
Research Organizations	2
Industry and For-profit Corporations	2
Federal Government	2
State, Regional, Local, or Tribal Agencies	2
Educators (any affiliation)	2
Non-profit organizations	2
At-Large (any affiliation)	3

Table 1: Governing Council target membership by category

## CeNCOOS and Industry

Far from being solely a research organization, CeNCOOS is a diverse consortium of member organizations. Among these members are representatives from the industry community. Below are just a few examples of CeNCOOS data and/or services being used by regional industry:

- ◆ CeNCOOS partners with Monterey Abalone Company to operate an automated shore station on the Monterey Wharf that is part of the regional observing network. The station's data are used by Monterey Abalone Company to track environmental conditions that could affect their crop's growth or harvest operations.
- ◆ Environmental consulting companies use CeNCOOS data to establish baseline conditions for environmental impact assessments of proposed desalination plants.
- ◆ CeNCOOS partners with Hog Island Oyster Company in Tomales Bay and mariculture operations in Humboldt Bay to monitor pH, dissolved oxygen, and primary productivity in their surrounding waters. The farmers use this information to track conditions potentially harmful to their oysters.



Figure 4: A Monterey Abalone Company cage beneath the Monterey Wharf

In general, CeNCOOS will be guided by the following principles when setting priorities and making decisions regarding activities in which to engage. It is anticipated that these principles will apply over the long-term, whereas priorities (derived from the process discussed in section 9 of the FDM, the results of which are detailed in later sections of this plan) may change over shorter time scales. CeNCOOS will strive to maintain a suite of activities and products that (as detailed in the FDM, section 5):

- ◆ Span the CeNCOOS geographic region
- ◆ Are inclusive across the IOOS themes (coastal hazards; marine operations; climate variability and change; and ecosystems, fisheries and water quality) and State priorities
- ◆ Include a diverse set of funded projects and recipients
- ◆ Support a stable, trained workforce to ensure continuity of core capabilities
- ◆ Leverage the intellectual capacity and resources within the CeNCOOS network to position CeNCOOS as a leader within IOOS
- ◆ Promote partnerships among stakeholders in the CeNCOOS region.

Overarching CeNCOOS responsibilities include responsive and adaptive strategic planning and coordination, as well as governance, management, and fundraising. CeNCOOS

essential activities are ocean observing and modeling, and data management and communications, as guided by identification of information needs through engagement with stakeholders. These needs cannot be met without the development and dissemination of information products, and research into new approaches, models, and sensors to optimize the system to meet those needs. Outreach to, and education of, users of CeNCOOS data and information are also important CeNCOOS activities.

CeNCOOS funds numerous principle investigators (PIs), presently at 15 institutions, who conduct most of the ocean observing and modeling work, and some of the data management and product development. This includes deployment and maintenance of measurement systems and platforms, implementation and operation of numerical models, sensor and model data management and visualization, and development and operation of the data portal. The CeNCOOS Program Office<sup>1</sup> manages the program, participates in fund raising, and runs daily operations including coordination among the CeNCOOS PIs and communications with the national IOOS office and local stakeholders. Program Office staff also develop products and operate the CeNCOOS website.

Funding permitting, CeNCOOS is committed to maintaining the following core capabilities, with the recognition that

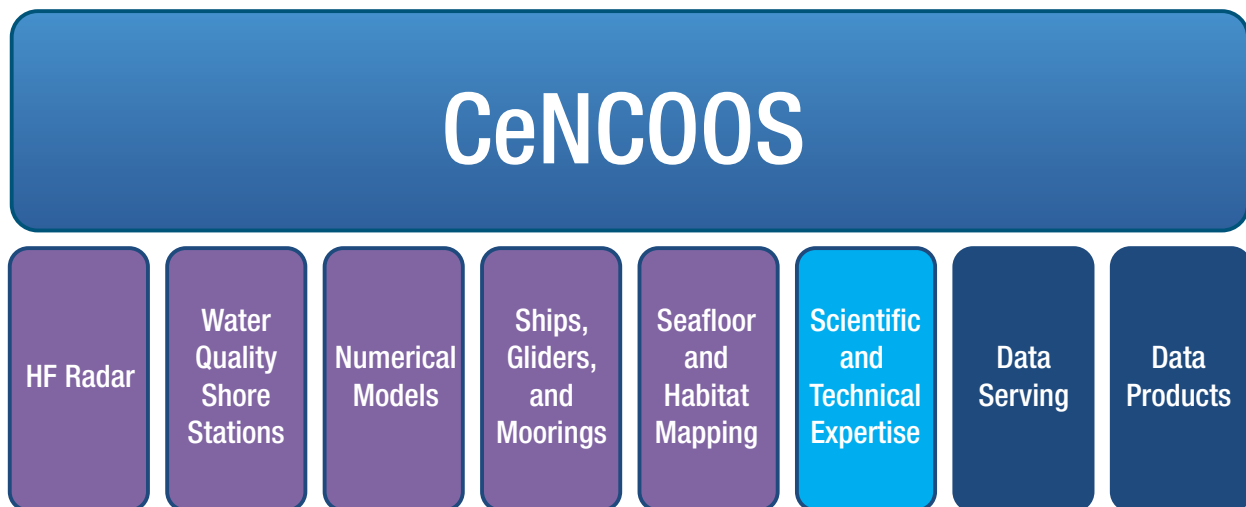


Figure 5: CeNCOOS Core Capabilities: Purple indicates instruments or observations we make, Cyan personnel we maintain, and Navy what we do with information collected.

<sup>1</sup> CeNCOOS Program Office staff currently consists of a Program Director, Program Manager, Information Manager, and Product Developer.



these may change as the program evolves (CeNCOOS FDM, section 7):

- ◆ Scientific and technical expertise/leadership to identify and address ocean observing and modeling needs
- ◆ HF radar: ocean surface circulation measurements
- ◆ Shore stations: measuring water quality, hydrography, harmful algal blooms
- ◆ Ships/gliders/moorings: monitoring offshore subsurface variables for applications in climate, productivity, circulation, physical processes, and model assimilation
- ◆ Numerical models
- ◆ Seafloor/habitat mapping – data delivery
- ◆ Data serving, including metadata and QC as appropriate
- ◆ Data/information products

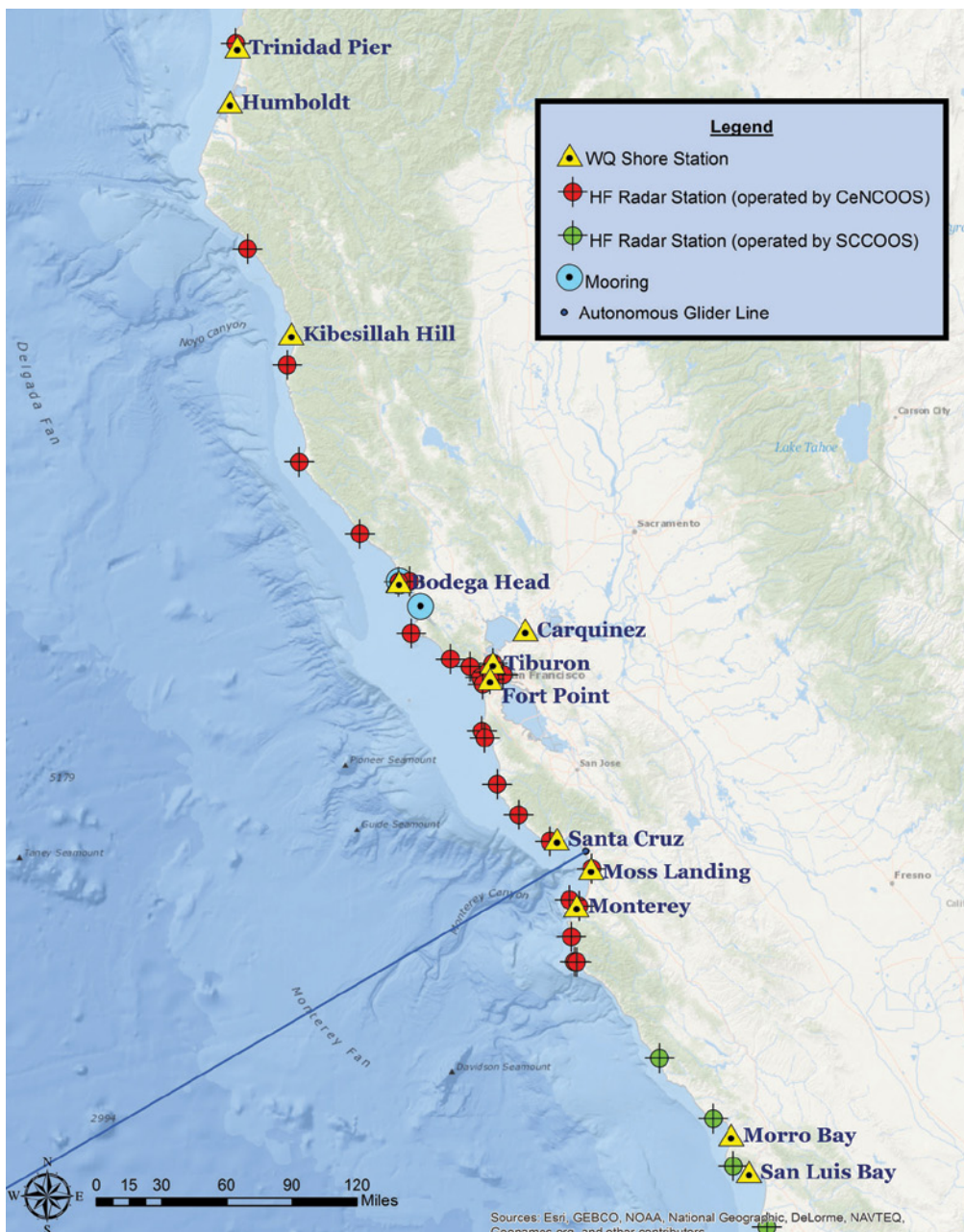


Figure 6: Map of CeNCOOS Assets; does not include Federal and other organizations' assets whose data CeNCOOS serves

# Priorities

## CeNCOOS Priorities

Through the process described in section 9 of the FDM document and discussed in the Introduction of this plan, the CeNCOOS Governing Council and Program Office identified four overarching priorities:

1. Long-term measurements of meteorological, and ocean physical, chemical, and biological parameters
2. A publicly accessible data portal to integrate real-time and historic long-term time-series measurements together with geospatial and other data
3. Data-assimilating coupled ocean physical-biogeochemical ecosystem models
4. Data products that inform policy and decision-making

The strategies generated from these priorities and their implications on the future of CeNCOOS are discussed in the following section. As a consortium that brings together academia, research institutions, private industry, non-governmental organizations, and government bodies, CeNCOOS is acutely aware of the priorities of other organizations and how they relate to the ocean observing system. It is with this thought in mind that we briefly touch on the Federal, West Coast, and State priorities that were considered in the development of this plan. Within each of the strategies discussed later in this document, the relation of said strategy to the planning work at these other levels will be discussed (also summarized in Table 1)

## Federal Priorities

The U.S. IOOS strategic plan, revised in 2009, identifies seven overarching goals:

1. *Improve access to high-quality, integrated data*
2. *Enhance data products and decision-support tools*
3. *Support NOAA and regional ocean observation capability*
4. *Establish a functional management structure that addresses all aspects of NOAA IOOS*
5. *Develop and implement cohesive NOAA IOOS Program planning*
6. *Maximize societal and economic benefits of IOOS through targeted research, education, and training*
7. *Coordinate communications and act as an information broker to facilitate NOAA's distributed implementation of IOOS*



U.S. IOOS is organized around four themes (descriptions of the themes quoted from [ioos.noaa.gov](http://ioos.noaa.gov)):

**1. Marine Operations**

*Safe and efficient shipping and boating; offshore energy; support to search and rescue.*

**2. Coastal Hazards**

*Providing hazard and disaster information where and when it is needed; promoting risk-wise behavior.*

**3. Climate Variability and Change**

*Status and trends of essential variables; supporting coastal communities.*

**4. Ecosystems, Fisheries and Water Quality**

*Harmful algal blooms, hypoxia; protecting drinking water; ocean acidification, beach and near shore water quality; ecosystem based management.*

CeNCOOS participates in national joint planning and execution efforts between the regional observing systems and the U.S. IOOS office. Collaboration with the other regions is facilitated by the IOOS Association, a non-profit organization that fosters frequent communication among the regions to highlight lessons learned, identify common issues, and strengthen the inter-regional relationships necessary for building a national network.

**West Coast Priorities**

In 2006, the Governors of California, Oregon, and Washington created the West Coast Governor’s Alliance on Ocean Health (WCGA). The agreement launched a new, proactive regional collaboration to protect and manage the ocean and coastal resources along the West Coast of the United States.

Based on feedback from their Action Coordination Teams (ACTs) and current ocean health priorities within the region, the WCGA narrowed its focus to [four priority areas](#) for 2013 and 2014. These ACTs will receive active guidance and financial support from the WCGA:

1. Marine debris
2. Adaptation to climate change

**CeNCOOS & Resource Management**

Among CeNCOOS’s priorities identified in 2013 is the development of data products that inform policy makers and resource managers. CeNCOOS is dedicated to the support of sound, science-based decision making. Below are just a few examples of resource management applications of our data:

- ◆ CeNCOOS data were used to aid in the design of [California’s Network of Marine Protected Areas](#) and our observations are currently used to assist in monitoring the effectiveness of the MPAs.
- ◆ CeNCOOS data are regularly used to support the guidelines developed by the [California State Water Resources Board](#) as they relate to water quality and the coastal zone.
- ◆ Harmful algal bloom (HAB) monitoring and prediction work supported by CeNCOOS is used by the California Department of Public Health to create public health notices and recreational invertebrate collection warnings. These notices aid in protecting coastal communities from paralytic shellfish poisoning and other HAB-related toxins that pose a risk to human and ecosystem health.



Figure 7: An algal bloom in California waters

## CeNCOOS and Coastal Safety

The economic stability and culture of California largely depends on a healthy and safe coastline. CeNCOOS has made significant contributions in this area; just a few examples are provided below:

- ◆ CeNCOOS observations and modeling were integral in the assessment and tracking of oil plumes resulting from the 2007 Cosco Busan oil spill in the San Francisco Bay.
- ◆ Surface current observations and predictions are regularly used by U.S. Coast Guard search and rescue operations.
- ◆ CeNCOOS wind, wave, and current observations and predictions are used by both commercial and recreational ocean vessels to evaluate ocean conditions.



Figure 8: U.S. Coast Guard search and rescue team

3. *Building a regional data framework (now called West Coast Ocean Data Portal)*
4. *Ocean acidification (discussed [here](#))*

The three West Coast ocean observing systems ([NANOOS](#), [SCCOOS](#), and [CeNCOOS](#)) have signed a MOU with the WCGA affirming their commitment to jointly plan California Current Large Marine Ecosystem (CCLME) observations and share information that will mutually benefit each sub-region and the larger CCLME.

### California State Priorities

Established under the California Ocean Protection Act of 2004, the California Ocean Protection Council (OPC) is tasked with coordinating activities of ocean-related state agencies. Specifically, they are asked to improve the effectiveness of state efforts to protect ocean resources within existing fiscal limitations, to establish policies to coordinate the collection and sharing of scientific data related to coastal and ocean resources, and to identify and recommend changes in law and policy.

In 2012, the OPC completed a five-year [strategic plan](#) (which can be found at [www.opc.ca.gov](http://www.opc.ca.gov)). As part of that plan, five focal areas were identified:

1. *Science-based decision-making*
2. *Climate change*
3. *Sustainable fisheries and marine ecosystems*
4. *Coastal and ocean impacts from land-based sources*
5. *Existing and emerging ocean uses*

Additionally, OPC made reference to [14 key issues](#) that need to be addressed to be successful in the above areas:

- Issue 1:** Improving the use and sharing of scientific and geospatial information
- Issue 2:** Identifying high priority management information needs
- Issue 3:** Developing strategies – and building institutional capacity – to incorporate scientific information into management decisions



**Issue 4:** Impacts to coastal communities by storms, erosion, and sea-level rise

**Issue 5:** Ecosystem impacts of the changing climate

**Issue 6:** Supporting sustainable fisheries management

**Issue 7:** Sustainable seafood

**Issue 8:** Leveraging investments and realizing benefits of the state’s marine protected areas

**Issue 9:** Downstream impacts

**Issue 10:** Marine debris

**Issue 11:** Sediment management

**Issue 12:** Desalination

**Issue 13:** Marine renewable energy

**Issue 14:** Offshore aquaculture

As California is the only state with more than one regional ocean observing system, it is imperative that CeNCOOS and its southern California counterpart SCCOOS, work closely together in meeting State needs.

Federal, Regional or State Priority		Strategy 1: <i>Long-term measurements</i>	Strategy 2: <i>CeNCOOS data portal</i>	Strategy 3: <i>Data-assimilating ecosystem models</i>	Strategy 4: <i>Products to inform policy &amp; decision makers</i>
IOOS Themes	Marine Operations	◆	◆	◆	◆
	Coastal Hazards	◆	◆		◆
	Climate Variability and Change	◆	◆	◆	◆
	Ecosystems, Fisheries, & WQ	◆	◆	◆	◆
WCGA Priorities	Marine Debris	◆	◆	◆	◆
	Adaptation to Climate Change	◆	◆	◆	◆
	West Coast Ocean Data Portal		◆		◆
	Ocean Acidification	◆	◆	◆	◆
CA OPC Focus Areas	Science-based Decision-making	◆	◆	◆	◆
	Climate Change	◆	◆	◆	◆
	Sustainable Fisheries & Ecosystems	◆	◆	◆	◆
	Impacts from Land-based Sources	◆	◆		◆
	Existing & Emerging Ocean Uses	◆	◆	◆	◆

Table 2: Matrix displaying the relationships among CeNCOOS strategies and Federal, Regional, and State priorities

# CeNCOOS Strategies

The following strategies were identified through the priority setting process defined in Section 9 of the FDM. These strategies do not supercede one another, rather they are intended to be complementary in a manner that allows the system to grow into our vision for it. Figure 9 depicts the interaction of these priorities with each other and CeNCOOS's core capabilities.

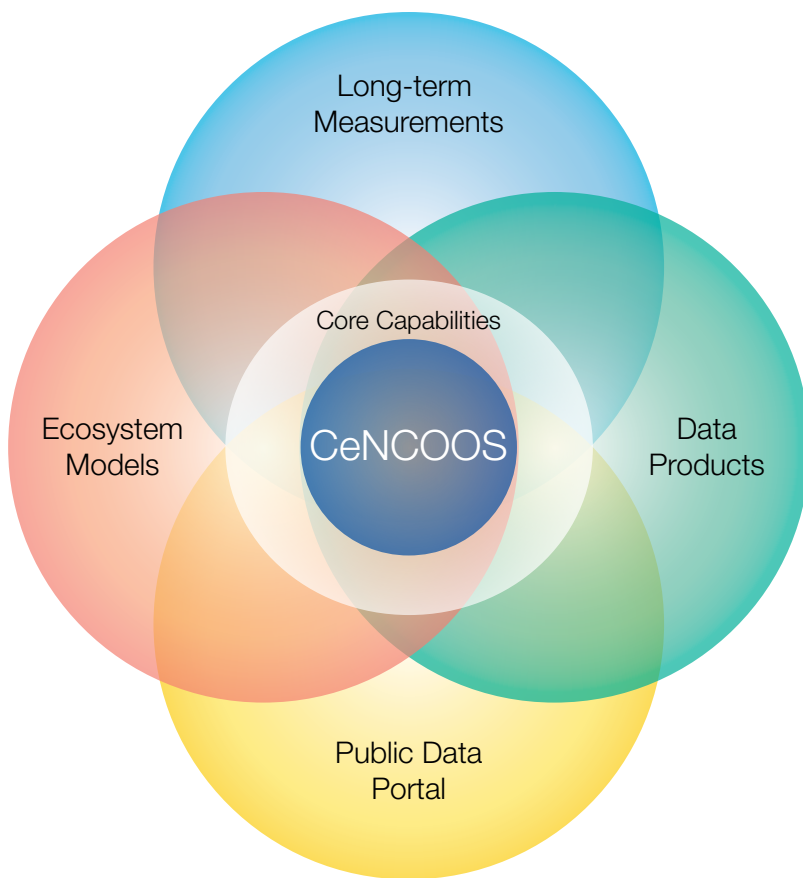


Figure 9: The intersection of the CeNCOOS strategies with each other and the system's core capabilities

**Strategy 1:** *Continue long-term measurements of meteorological, and ocean physical, chemical, and biological parameters.*

Long-term measurements and data sets are vital to identifying anomalies and assessing environmental change over time. For a variety of reasons, most research and academic institutions are unable to maintain these measurements and/or host the resulting data sets. CeNCOOS is uniquely suited to fill this role, and has done so since its inception. CeNCOOS data sets are utilized by industry, government, researchers, students, and others to conduct essential and cutting edge science that has far reaching policy and resource management implications, and also for making decisions that require near-real-time information. Long-term sustained measurements are also integral to developing and running predictive models (specifically, those discussed in Strategy 3).



Federal agencies cover some aspects of long-term measurements that are not collected by the academic or private sectors, however there are a number of important parameters that would not be collected without a regional ocean observing system. CeNCOOS is exceptionally positioned to fill the void in this area due to its organizational structure, funding sources, and institutional capacity.

### Current work:

Since establishment, CeNCOOS has supported the measurement of meteorological (wind, air temperature, etc.), ocean physical (temperature, salinity, currents, etc.), chemical (dissolved oxygen, pH, etc.), and biological (chlorophyll fluorescence, harmful algal blooms, etc.) parameters. For each of these parameters, data are maintained and made available through our data portal, other web services, and information products such as visualizations. Some products are custom tailored and

made available through specific inquiry. CeNCOOS strives to stay current on evolving technology, methods, and quality control procedures for collecting and serving this information in the most accurate manner possible.

### Our Vision for 2019:

Over the next five years, CeNCOOS intends to maintain these measurements, add to our list of parameters measured where appropriate, and upgrade/augment our infrastructure and methods with evolving technology. Additionally, CeNCOOS plans to continually adapt the way we serve these data to meet the needs of our stakeholders (detailed further in Strategies 2 and 4).



Figure 10: A Liquid Robotics Wave Glider; a future platform for CeNCOOS observations

## Strategy 1: Relation to Federal, West Coast, and California Priorities

### Federal

- ◆ Benefits all of the IOOS themes and closely relates to “[Climate Variability and Change](#)” and “[Ecosystems, Fisheries and Water Quality](#)”
- ◆ Supports Goals 1 and 3 of the IOOS Strategic Plan (see page 8 of this document)

### West Coast

- ◆ Supports [WCGA priorities](#) of “Adaptation to Climate Change”, “Marine Debris”, and “[Ocean Acidification](#)”

### California

- ◆ Supports all [OPC focus areas](#)
- ◆ Supports work on Issues 5, 6, 8, 9, 12, 14 as outlined in [OPC’s strategic plan](#)

**Strategy 2: *Provide a publicly accessible data portal to integrate real-time and historic time-series measurements together with geospatial and other data.***

As part of IOOS, CeNCOOS is required to make the data it collects available to the public and to make sure that these data meet specific standards and protocols. We do this in a variety of ways, but one comprehensive way our data is made available to the public is through an online interactive data portal. This portal integrates many different types of data, not just from CeNCOOS-supported assets but also from assets operated by other agencies and organizations. The data portal allows a wide audience to discover and explore multiple ocean data sets in the region. The integration of different data types, such as models and observations, makes the data portal more than a discovery mechanism but also a tool for simultaneously viewing and comparing data. CeNCOOS has operated an online data portal since 2011. While many other organizations in the region also operate portals, each specific to their organization’s mission and focus areas, CeNCOOS is in the unique position of having the mandate and the technical capability to serve a wide variety of ocean related data sets including real-time data from continuously monitoring sensors, model nowcasts and forecasts, satellite data, and bathymetry. CeNCOOS is the only entity in the region that meets U.S. IOOS requirements for data service.

**Current work:**

CeNCOOS operates an online interactive data portal that displays near real-time and some historical data from fixed position in-situ ocean observing platforms, remotely sensed data from satellites and land-based HF radars, and model output. For many assets, a user can also download data via the portal.

**Our Vision for 2019:**

Over the next five years, CeNCOOS plans to significantly enhance the capabilities of the data portal, and to share these developments with other regional ocean

observing systems. Data from mobile platforms will be added, and more historical data from currently operating platforms will be ingested. More data QC procedures will be implemented for a wider variety of parameters. We will continue to seek out other data sources to integrate into the portal. By 2019, data from all long-term continuing ocean observing programs in the region, whether gridded, point source, or from mobile platforms will be explorable through the portal and accessible via web services. The portal will be configured to serve the needs of both the traditional desktop user as well as the expanding portable device user community, enabling it to be the leading source of integrated ocean data in the region. To support

**Strategy 2: Relation to Federal, West Coast, and California Priorities**

**Federal**

- ◆ Supports work in all four of the IOOS themes
- ◆ Supports Goals 1 and 2 of the IOOS Strategic Plan (see page 8 of this document)

**West Coast**

- ◆ Serves data relating to all WCGA priorities
- ◆ CeNCOOS contributes to the development of the West Coast Ocean Data Portal (WCODP) by providing advice based on years of experience with data portals.
- ◆ Data available through the CeNCOOS portal will also be available to the WCODP. Data services and metadata implemented for our portal will support integration into other portals such as the WCODP.

**California**

- ◆ Relates to all of [OPC focus areas](#) and issues
- ◆ Particularly supports [OPC Issue 1](#) as outlined in their Strategic Plan.



interoperability with other regional, state, and national data portals the framework supporting the CeNCOOS data portal will also enable CeNCOOS data sets to be accessed and displayed in these other portals as well.

### *Strategy 3: Develop, implement, and operate data-assimilating coupled ocean physical-biogeochemical ecosystem models.*

The development and operation of comprehensive data-assimilating coupled ocean physical-biogeochemical ecosystem models has the potential to dramatically improve our assessment of ecosystem health and provide critical information for resource management decisions. The physical circulation models are also an important component in addressing marine operations needs, including for navigation and search and rescue. These models will allow for the better interpretation of observations, interpolation of observations in space/time, and the ability to put observations in the context of other variables. More importantly, these models allow for predictions of physical and ecosystem conditions, including those related to climate change.

Inherently, these models require expertise in a variety of fields and a capability to link ocean observations with modeling efforts. CeNCOOS is exceptionally suited to lead the regional work in this area and has the potential to set the national standard. As a consortium of academic, research, government, and private entities, CeNCOOS creates a wide umbrella for the necessary groups to further develop these models. Several CeNCOOS members and PIs, and their research partners, have been developing models in this vein over many years. It is our aim to support the continuation of this work, foster its expansion, and transition operational models and/or their outputs to our system.

#### **Current work:**

CeNCOOS assisted in the development, and currently supports the operation of, several Regional Ocean Modeling Systems (ROMS). Two ROMS implementations including central and northern California are currently



Figure 11: Spray Glider being prepped for deployment

## Strategy 3: Relation to Federal, West Coast, and California Priorities

### Federal

- ◆ Supports the IOOS themes of “[Ecosystems, Fisheries and Water Quality](#)”, “[Marine Operations](#)”, and “[Climate Variability and Change](#)”
- ◆ Supports Goal 2 of the IOOS Strategic Plan (see page 8 of this document)

### West Coast

- ◆ Supports the [WCGA priorities](#) of “Adaptation to Climate Change,” “Marine Debris,” and “[Ocean Acidification](#)”

### California

- ◆ Contributes to [OPC focus areas](#) of “Science Based Decision-making”, “Climate change”, “Sustainable Fisheries and Marine Ecosystems,” and “Existing and Emerging Ocean Uses”
- ◆ Supports work on Issues 5, 6, 10, 11, 12, 13, and 14 as outlined in [OPC’s strategic plan](#)

being served: the [West Coast ROMS](#) which extends from Canada to Mexico at a resolution of 10 km, and the [California ROMS](#) which spans from just north of the CA-Oregon border south to Mexico, and has a resolution of 3 km. Both models provide information on sea surface height, water temperature, salinity, and currents. Additional support for further development and validation of these models, and coordination with a national operational modeling center, is now being provided through the successful competition for inclusion in the Coastal and Ocean Modeling Testbed program, an IOOS-supported program to accelerate the transition of advances from the coastal ocean modeling research community to improved operational ocean products and services.

CeNCOOS also supports and serves outputs from a 4-km resolution California implementation of the Navy's [COAMPS@ mesoscale atmospheric model](#).

CeNCOOS is assisting in the development and operational implementation of an empirical forecast model that takes advantage of CA ROMS currents together with satellite remote sensing data to predict harmful algal blooms (HABs).



Figure 12: A high frequency radar antenna

### Our Vision for 2019:

By 2019, we envision CeNCOOS becoming the leader within IOOS in the development, implementation, and operation of data-assimilating ocean physical-biogeochemical ecosystem models. Over these five years, CeNCOOS will have assisted in the fostering of the partnerships necessary to further develop these coupled models. Data served by CeNCOOS will be assimilated into models and CeNCOOS will routinely be serving nowcasts and forecasts for an expanded set of variables (e.g. dissolved oxygen and chlorophyll). We also expect that the output from these models will directly inform a variety of research, management, and operational applications.

### Strategy 4: Utilize data to create products to inform policy and decision-making.

Data serving and the development of data products are core CeNCOOS capabilities, and the collection (observing) and creation (modeling) of data are main foci of the system, as detailed in strategies 1 and 3. However, the aspiration of those efforts, as described in our vision statement, is to “inform the wise use of the ocean off central and northern California”. The creation and distribution of derived data products, in collaboration with a publicly accessible data portal, is how CeNCOOS will achieve that vision.

As an IOOS Regional Association, CeNCOOS is in a unique position to engage with stakeholders of all types to assess their ocean information needs, prioritize those needs, and to develop and serve products to meet those needs. CeNCOOS products support user decisions as diverse as deciding whether and where to go surfing or kayaking, to the geographical distribution of marine protected areas. Users span the gamut from federal agencies, such as National Marine Sanctuaries, to recreational boaters.

### Current work:

CeNCOOS has developed and continues to support a number of products derived from observations and models that inform policy and decision making. Some examples of these products include:



- ◆ [AIS tracking](#) of ships in the region's three National Marine Sanctuaries
- ◆ [Particle tracking](#) using CA ROMS
- ◆ [Wind page](#) continuously comparing observed and COAMPS-modeled winds
- ◆ [Overlay of HF radar-derived surface currents](#) with satellite-measured sea surface temperature and chlorophyll

CeNCOOS participates in national product development efforts and is working with the WCGA and Sea Grant to develop products specifically aimed at ocean acidification and marine debris.

### Vision for 2019:

Through this strategy, we intend to focus resources on those products that inform sound and evidence-based policy and decision-making. This will involve both the evolution of current products and the creation of new products. CeNCOOS seeks to further partnerships and work collaboratively with stakeholders to meet their informational needs to determine product development priorities.

Over the next five years additions will be made to our suite of data products to address a wide array of issues and management and operational decisions. Following are examples of areas for which we have specific targets:

1. We plan to significantly increase our work in developing regional climatology products. We want to develop climatologies based on the long-term data sets that CeNCOOS has collected to date. To serve stakeholder needs, we also intend to provide this information in GIS-friendly formats to enable use of inherently time variable ocean data together with more static geospatial information.
2. We plan to expand the number of specialized data portals that focus on the needs of specific user groups or geographic areas. These portals would serve relevant data in a manner that most directly relates to the needs of the user/area. Current examples of this type of product are the webpages for Humboldt Bay oyster growers and the [San Francisco Bay Conditions](#) page.

## Strategy 4: Relation to Federal, West Coast, and California Priorities

### Federal

- ◆ Supports work in all four IOOS themes
- ◆ Supports Goals 1 and 2 of the IOOS Strategic Plan (see page 8 of this document)

### West Coast

- ◆ Relates to all of the [WCGA priorities](#)
- ◆ Many products we currently serve and plan to develop will feed into the WCGA priority of “building a regional data framework”

### California

- ◆ Relates to all [OPC focus areas and issues](#)
- ◆ Particularly supports their focus area of “Science-based decision making” and Issue 1 as outlined in their [strategic plan](#).



Figure 13: Plankton monitoring on California's North Coast

## Funding

Currently, CeNCOOS is funded almost exclusively by a five-year Regional Coastal Ocean Observing System (RCOOS) Grant administered by the National Oceanic Partnership Program (NOPP). This award, which commenced in June 2011, covers both the administration and implementation of CeNCOOS. The original proposal included a \$4 million per year request. However, the grant is subject to Congressional budget fluctuations, and has been funded at approximately 50% of the original request each year. It is expected that the remaining years of the grant will not see a significant increase in award funding. U.S. IOOS will begin work on the next RCOOS Federal Funding Opportunity in 2014.

CeNCOOS has received intermittent funding (aside from the RCOOS grant) through other parts of NOAA, and will continue to seek out these oppor-

tunities. In 2013-14, CeNCOOS participated in a NASA-funded effort to operationalize a predictive harmful algal bloom model. In addition, CeNCOOS has received two small grants to assist with the application of ocean observation data to environmental management and impact analyses.

With the incomplete funding of the RCOOS grant and the comparatively low amount of external funding, CeNCOOS has been operating at a level lower than its desired capacity. At current funding, little more than the maintenance of core capabilities is possible. Within the timeline this strategic plan covers, we expect to actively seek out other sources (be they federal, state, or private foundation) to fund the new endeavors necessary to implement the four strategies above and to replace aging/obsolete infrastructure.

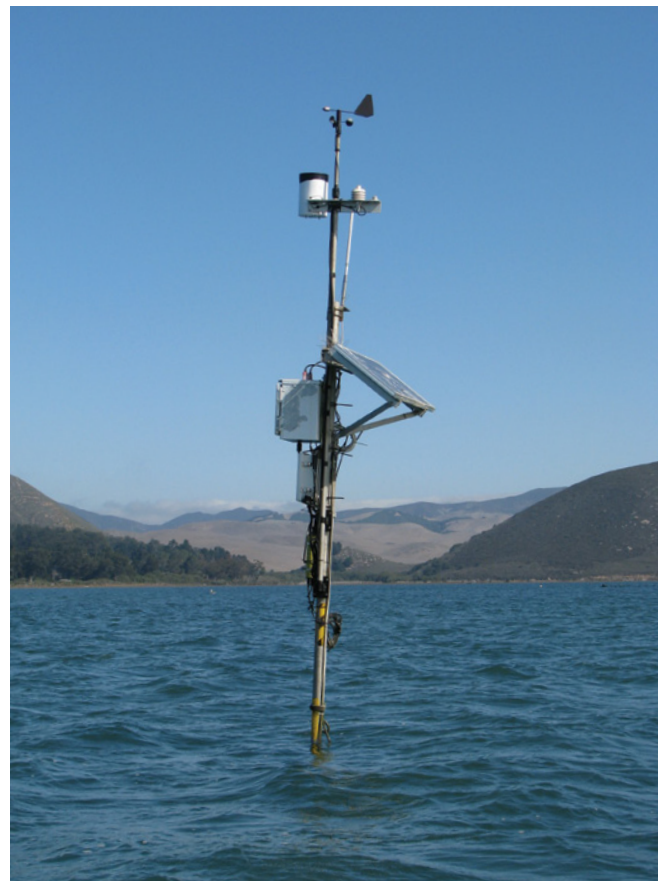


# Conclusion

This Strategic Plan is the product of a prioritization process conducted by the CeNCOOS Program Office and Governing Council. The plan will be used to communicate programmatic growth and direction goals to current and potential members, Pls, stakeholders, and funders. CeNCOOS will evaluate its progress annually and revisit its strategies periodically to confirm that they continue to meet the vision of the Governing Council and Program Office.

CeNCOOS's primary goal is to maintain the core capabilities outlined in section 7 of the FDM (and in Figure 5, page 6). The strategies listed in this plan do not take precedence over those capabilities, rather they are meant to set medium-term goals for CeNCOOS that will guide the program's growth. The visions for these strategies over the next five years cannot be fully realized under current funding levels; to be successful, further sources of funding and strategic partnerships will need to be identified. It is a goal of this plan to assist in the efforts to attract this necessary funding.

We believe the five-year visions laid out in this plan to be both ambitious and feasible. If fully realized, the strategies detailed above will allow CeNCOOS to become a leader within U.S. IOOS, and be recognized and relied upon as a trusted source of data, information, and expertise that contributes to the wise use of the ocean off central and northern California.



*Figure 14: Meteorological and water quality monitoring station in Morro Bay*

# Appendices



## Appendix 1

### Sections 9 & 10 of the Framework for Decision Making Document:

#### 9. Priority-Setting Considerations (approved by Governing Council on Jan. 14, 2013)

Core capabilities listed in Section 7 will be considered high priorities unless otherwise stated. The intent of these considerations is to give additional guidance to the Council when setting strategic programmatic priorities. After the initial priority-setting exercise using the process outlined in this document, CeNCOOS will re-evaluate its priorities on a periodic basis dovetailing with the IOOS funding cycle, which is anticipated to be every five years from 2016 onwards. The CeNCOOS strategic plan will be updated in concert with the re-evaluation of priorities.

The process of establishing the CeNCOOS priorities, which may be refined annually based on funding availability, will take into consideration the following factors.

As an example, currently we might express high priorities for CeNCOOS as:

- ◆ IOOS Themes and State priorities: climate variability and change; and ecosystems, fisheries and water quality
- ◆ Issues: HABs, ocean acidification
- ◆ Geography: San Francisco Bay, Monterey Bay, continental shelf
- ◆ Technology: HF radar, automated shore stations, ocean circulation models
- ◆ Variables: surface currents, water quality variables
- ◆ End-users: state agencies, shellfish growers

Again, as an example, in the future priorities might change to emphasize the nearshore zone or biological variables.

**Table 2: A Matrix of Priority-Setting Considerations**

Responsiveness to Established Federal, State, or Regional Priorities (i.e. priorities set by bodies other than CeNCOOS GC, such as WCGA)	<ul style="list-style-type: none"><li>◆ IOOS requirements, or national or state priorities: applies to issues, technology, variables</li><li>◆ Regional priorities (including those of neighboring RAs): applies to issues, geography, variables, end users</li></ul>
Reinforcement of Unique or Partner Role of CeNCOOS	<ul style="list-style-type: none"><li>◆ Is CeNCOOS uniquely suited, within the region, to undertake this activity? To what extent are other organizations or consortia already addressing this need or issue?</li><li>◆ Availability of personnel and expertise within CeNCOOS region to make significant progress in this area</li><li>◆ Does CeNCOOS stand to be a national leader in this area?</li></ul>
Legacy and Sustainability Considerations	<ul style="list-style-type: none"><li>◆ Was it included in the current IOOS proposal?</li><li>◆ What has CeNCOOS done in the past?</li></ul>
Time	<ul style="list-style-type: none"><li>◆ Time scale to make an impact in this area</li></ul>
Cost and Funding	<ul style="list-style-type: none"><li>◆ Potential to leverage existing funds or attract future funds</li></ul>

**10. Criteria for project selection** (approved by Governing Council on Jan. 14, 2013)

While Section 9 outlines considerations which will be used to set annual priorities for the CeNCOOS program as a whole, the following table of criteria will be used on an ongoing basis to help determine whether specific activities should be pursued. These criteria will be reviewed and updated in concert with re-evaluation of the CeNCOOS priorities and strategic plan.

Table 3: A Matrix of Projection Selection Criteria <sup>2</sup>	
Primary Criteria	Responsiveness to Established CeNCOOS Priorities <ul style="list-style-type: none"> <li>◆ How does it map to the CeNCOOS strategic plan and priorities?</li> <li>◆ Does it align with a CeNCOOS core capability?</li> </ul>
	Reinforcement of Unique or Partner Role of CeNCOOS <ul style="list-style-type: none"> <li>◆ Is CeNCOOS uniquely suited to undertaking this activity or project? To what extent are other organizations or consortia already addressing this need or question?</li> <li>◆ Does it demonstrate the integrated and interoperable nature of CeNCOOS?</li> <li>◆ Does the activity promote partnering within the CeNCOOS region?</li> </ul>
	Impact of Project <ul style="list-style-type: none"> <li>◆ Is there an identified end user or a clear articulation of the end-to-end use of the proposed product or activity?</li> <li>◆ Number or category of people impacted by the decisions the data, product, or activity inform</li> <li>◆ Significant biological resources impacted by the decisions the data, product, or activity inform</li> <li>◆ Economic impact of the data, product, or activity</li> <li>◆ Does it fill an identified gap?</li> <li>◆ Local vs regional impact</li> <li>◆ Real-time vs delayed mode vs historical data</li> </ul>
	Likelihood of success <ul style="list-style-type: none"> <li>◆ Is this project likely to meet its goals, as agreed upon by the proposer and CeNCOOS management, with the funding provided by CeNCOOS and other sources?</li> </ul>
Other Criteria	Legacy and Sustainability Considerations <ul style="list-style-type: none"> <li>◆ Was it included in current proposal to IOOS?</li> <li>◆ What has CeNCOOS done in the past? Is this activity worth continuing into the future? What will be the impact if we drop a currently funded activity?</li> <li>◆ Does the project ensure CeNCOOS longevity and a succession path by developing internal expertise?</li> <li>◆ Lifetime of the activity or project – potential to sustain it over time, or transition it to another organization; vs. shorter-term activities</li> <li>◆ Will the project help sustain the CeNCOOS workforce?</li> </ul>
	Time Scale for Project <ul style="list-style-type: none"> <li>◆ Time scale to spin up the activity or product</li> </ul>
	Cost and Funding <ul style="list-style-type: none"> <li>◆ What's the cost to CeNCOOS of the activity?</li> <li>◆ Is targeted funding available for this specific activity?</li> <li>◆ Potential to leverage existing funds or attract future funds</li> <li>◆ Has the PI been able to attract other funding based on CeNCOOS funding or a CeNCOOS letter of support – and if so can they keep going without base CeNCOOS funding?</li> </ul>

<sup>2</sup> Within the “primary” and “other” categories, sequence of criteria is based on a logical progression from broad to specific considerations, and is not intended to imply any prioritization or relative weighting of considerations



## Appendix 2

### CeNCOOS Active Signatory Members (as of April 2014)

- ◆ Alliance for Coastal Technologies (ACT)
- ◆ Axiom Consulting and Design
- ◆ California Coastal Commission
- ◆ California Coastal Conservancy
- ◆ California Coastkeeper
- ◆ California Cooperative Oceanic Fisheries Investigations (CalCOFI)
- ◆ California Department of Fish and Wildlife
- ◆ California Maritime Academy
- ◆ California Ocean Science Trust
- ◆ California Polytechnic State University (CalPoly)
- ◆ California State University East Bay (CSUEB)
- ◆ California State University Monterey Bay (CSUMB)
- ◆ California State University, Moss Landing Marine Laboratories (MLML)
- ◆ Central Coast Long-term Environmental Assessment Network (CCLEAN)
- ◆ Central Coast Waterboard
- ◆ Coast Seafoods, Inc.
- ◆ CODAR Ocean Sensors
- ◆ Cordell Bank National Marine Sanctuary (CBNMS)
- ◆ CSU Council on Ocean Affairs Science and Tech (COAST)
- ◆ DeepWater Desal, LLC
- ◆ Elkhorn Slough National Estuarine Research Reserve (ESNERR)
- ◆ Farallon Institute for Advanced Ecosystem Research
- ◆ Humboldt Bay Harbor, Recreation and Conservation District
- ◆ Humboldt State University (HSU)
- ◆ Liquid Robotics
- ◆ Marine Science and Engineering Institute
- ◆ Matthew Binder
- ◆ Monterey Abalone Company
- ◆ Monterey Bay Aquarium (MBA)
- ◆ Monterey Bay Aquarium Research Institute (MBARI)
- ◆ Monterey Bay National Marine Sanctuary
- ◆ Monterey Peninsula College, Marine Advanced Technology Education (MPC/MATE)
- ◆ National Marine Fisheries Service, Southwest Fisheries Science Center (NMFS/SWFSC)
- ◆ Natural Resources Defense Council (NRDC)
- ◆ Naval Postgraduate School (NPS)
- ◆ NOAA Environmental Research Division (NOAA ERD)
- ◆ Pacific Coast Federation of Fishermen's Association (PCFFA)
- ◆ Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO)
- ◆ Point Reyes Bird Observatory (PRBO)
- ◆ Point Reyes National Seashore
- ◆ Reef Check California
- ◆ San Francisco Bar Pilots
- ◆ San Francisco Bay National Estuarine Research Reserve (SFNERR)
- ◆ San Francisco Estuary Institute (SFEI)
- ◆ San Francisco Exploratorium
- ◆ San Francisco State University, Romberg Tiburon Center (SFSU/RTC)
- ◆ Santa Cruz County Environmental Health Services (SC County EHS)
- ◆ Science Applications International Corporation (SAIC)
- ◆ SOLITON Ocean Services, Inc.
- ◆ Sonoma State University
- ◆ Tagging of Pacific Pelagics (TOPP)
- ◆ University of California, Davis (UCD)
- ◆ University of California, Santa Cruz (UCSC)
- ◆ Vancouver Aquarium Pacific Ocean Shelf Tracking (POST) Program

## Appendix 3

## CeNCOOS Governing Council March 2013/14

**Erika McPhee-Shaw – Chair**  
Associate Professor  
Moss Landing Marine Laboratories

**Pat Coulston – Past-Chair**  
Marine Resource Assessment Program Manager (Retired)  
California Department of Fish and Wildlife

**Francisco Chavez – Executive Committee**  
Senior Scientist  
Monterey Bay Aquarium Research Institute

**Raphael Kudela – Chair-elect**  
Professor - Ocean Sciences and IMS  
UC Santa Cruz

**John Largier**  
Professor  
UC Davis/Bodega Marine Lab

**Skyli McAfee**  
Executive Director  
California Ocean Science Trust

**Dan Costa**  
Professor of Biology  
Tagging of Pacific Predators (TOPP)

**Karina Nielsen**  
Professor  
Sonoma State University

**Kyle VanderLugt**  
Director of Program Development  
Liquid Robotics, Inc.

**Steven Bograd**  
Supervisory Research Oceanographer  
Southwest Fisheries Science Center, Env. Research Division

**Dean Wendt**  
Interim Dean of Research  
Biological Sciences Department  
CCMS Cal Poly State University

**Mary Miller**  
Project Director, Public Understanding of Science  
San Francisco Exploratorium

**Greg Dale**  
Southwest Operations Manager  
Coast Seafoods, Inc.

**Krista Kamer**  
Director  
CSU Council on Ocean Affairs, Science, and Technology

**Eric Bjorkstedt**  
Research Fish Biologist  
NOAA/NMFS Southwest Fisheries Science Center  
Fisheries Ecology Division

## CeNCOOS Governing Council March 2014/15

**Raphael Kudela – Chair**  
Professor - Ocean Sciences and IMS  
UC Santa Cruz

**Francisco Chavez – Executive Committee**  
Senior Scientist  
Monterey Bay Aquarium Research Institute

**John Largier – Executive Committee**  
Professor  
UC Davis/Bodega Marine Lab

**Skyli McAfee – Executive Committee**  
Executive Director  
California Ocean Science Trust

**Karina Nielsen**  
Professor  
Sonoma State University (now at San Francisco State University)

**Laura Rogers-Bennett**  
Senior Environmental Scientist  
California Department of Fish and Wildlife  
Bodega Marine Laboratory

**Alexander Parker**  
Assistant Professor, Oceanography  
The California Maritime Academy

**Kyle VanderLugt (left Council in 2014)**  
Director of Program Development  
Liquid Robotics, Inc.

**Dean Wendt**  
Interim Dean of Research  
Biological Sciences Department  
CCMS Cal Poly State University

**Mary Miller**  
Project Director, Public Understanding of Science  
San Francisco Exploratorium

**Greg Dale**  
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