U.S. IOOS and Ecosystem, Fisheries and Water Quality Observing

Ecosystems, fisheries, and water quality have been identified as priority issues for the RAs and their stakeholders, and the need for ecosystem-based management is common to all of the RAs. Physical and chemical coastal and ocean observations are necessary but not sufficient for resource assessment and management. U.S. IOOS supports ecosystem, fisheries and water quality observing through activities in the following areas:

Data standards:

- Reconciling community data and metadata standards for biological and ecological IOOS core variables

- Working with U.S. IOOS Regional Associations (RAs) on implementation of biological data and metadata standards and data access

Supporting development of a national observing capability:

- Providing resources (e.g. funding, expertise) to the RAs to enable support for a wide variety of ecosystem observation activities

- Supporting development of a U.S. Animal Telemetry Network

- Participating in workshops, symposiums and other meetings that improve overall coordination and understanding of ecosystems, fisheries, and water quality observing

The following table is intended as a high-level summary of RA activities (completed and ongoing) related to ecosytsems, fisheries, and water quality. The table is organized primarily according to the observing, data management and communcations (DMAC), and modeling subsystems.

Summary of U.S. IOOS Regional Association Activities in the area of Ecosystem, Fisheries and Water Quality Observing

Regional Association	Ecosystem, Fisheries & Water Quality Observing	Ecosystem , Fisheries, Water Quality Modeling	DMAC	NOAA/NMFS and Interagency Collaboration
AOOS	- Providing vessel charters, personnel time, data retrieval for OTN and POST acoustic monitoring efforts in Prince William Sound to identify tags on salmon, sharks, whales, and other organisms. -Ocean acidification monitoring -Marine animal tagging data acquisition - Support to Seward Line monitoring - Kachemak Bay CTD surveys	- Prince William Sound Demonstration Project – develop & run weather, hydrodynamic, wave, and ecosystem models	- Lead Spatial Tools for Arctic Mapping & Planning (STAMP) project. Developing decision support tools for potential commercial fisheries in the Arctic - AOOS Ocean Workspace in use by EVOS Long-term Monitoring Program and the Herring Research Program - AOOS Data Portal pages: Seabird Portal; PWS Herring Portal - Digitize and spatially enable several ADF&G data sets - Provide data management services to EVOS Long-term Monitoring Program & Herring Research Program	- Partnering with the ADF&G and NOAA to provide ocean and atmospheric conditions that influence the timing of the Yukon River Chinook salmon run. - Lead PI, Exxon Valdez Oil Spill Long-term Monitoring Program's 5yr project -
CaRA	-Bi-weekly sampling at, and annual refurbishing of, NOAA's Ocean Acidification Program MAPCO2 buoy at La Parguera -Continued implementation of water quality monitoring at Guanica Bay and La Parguera Marine Reserve and related remote sensing data product development for the region	Regional HYCOM-ROMS circulation model implementation (2km resolution) including nested subdomains (<500m res.). Model output will support Caribbean Fisheries Management Council (NOAA) fisheries reserve designation and management decision.		-See HYCOM ROMS -Circulation studies in support or PR Northeast Corridor Marine Reserve Management by NOAA's Coral Reef Conservation Program and CZMP

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CeNCOOS	-Maintain automated coastal shore stations for water quality; long term temperature trends in temperature, salinity, sea level, chlorophyll fluorescence, and ocean acidification; and HAB monitoring, forecasting, and mitigation - Laboratory analysis of water samples for HAB phytoplankton -Operate across-shore glider transects to monitor temperature, salinity, chlorophyll fluorescence, dissolved oxygen, currents and acoustic backscatter -Maintain and operate the HF radar surface current mapping network used to support search and rescue, marine operations, oil spill response, and ecosystem forecasting. - Supporting environmental impact studies for renewable energy platforms. -Leading U.S. IOOS Animal Telemetry Network Steering Team (Barbara Block) -Produce integrated surface current / sea surface temperature; and surface current / chlorophyll products	Run state-wide and West Coast-wide data assimilating oceanic, and CeNCOOS-wide atmospheric, circulation models to forecast currents, winds, other state variables, and eventually ecosystem parameters.	Working on creating surface current, wind, and sea surface temperature GIS layers for analyses and climatology.	-Provide regional oceanographic context for MPA monitoring – CeNCOOS supported the State of California's design of its MPAs and is supporting the assessment of them. - Working with NMFS to determine the effect of MPAs on fisheries and ecosystems. -Working with NMFS to predict amount of offshore chlorophyll entering into Humboldt Bay (informs aquaculture about oyster growth) -CeNCOOS Trinidad Bay data will be used to anchor the Trinidad Head PaCOOS line run by Dr. Eric Bjorkstedt (NMFS), who is located in HSU's Telonicher Marine Laboratory

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GCOOS	- Support regional real-time observation systems, including the High-Frequency Radar network, Water Level Monitoring Network, Harmful Algal Bloom Integrated Observing System, and Hypoxia Monitoring System - Develop an Integrated Water Quality Data Network for rivers to ocean with focus on state waters and local communities to leverage untapped observational resources for the GCOOS data stream	- Maintain and enhance a Model Resource Center to provide formatted data to modelers for HAB monitoring and shelf hypoxia forecasts, including non-federal data sets from buoys maintained by GCOOS partners at TAMU, TAMU-CC, LSU, LUMCON, USM, DISL, FSU, USF, SCCF, and Mote, and to provide access to regional and local model outputs from GCOOS partners. - Develop an Ecosystem Nutrient Model Pilot project	- IOOS Biological Data Project - SW Florida Integrated Water Quality Pilot Data Network: integrating the data from the mouths of rivers through the estuaries into the coastal and deep ocean - Develop capability to integrate animal telemetry data into the GCOOS data streams - Develop capability to integrate biological, HAB, and other relevant data from gliders into the GCOOS data streams - Develop capability to integrate beach quality data into the GCOOS data streams - Maintain capability to integrate phytoplankton imaging data into the GCOOS data streams in support of HAB monitoring	- Work with GOMA: Water Quality, Nutrient Reduction, and Ecosystem Integration and Assessment Priority Issue Teams - Lead development of HAB Integrated Observing System plan - Work with the NOAA NCCOS CSCOR & NCDDC on the NGOMEX Hypoxia Program activities to plan the Hypoxia Monitoring Implementation Plan - Work with the NOAA GoM Regional Collaboration Team on ecosystem and living marine resources issues - Work with the UNIDO-GEF Mexico-U.S. GoM Large Marine Ecosystem Project (NOAA SEFSC is a co-chair) on Gulf-wide HABs and ecosystem issues - Work with the Gulf of Mexico Research Initiative to integrate data sets dealing with restoration of the Gulf of Mexico environment

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GLOS	- Tributary Monitoring Project - Expand, enhance, and coordinate the Great Lakes network of monitoring and observing systems to provide a comprehensive assessment of the Great Lakes ecosystem for use in monitoring Beneficial Use Impairments in high priority Areas of Concern - Developed a MODIS specific algorithm to locate and map the extent of HABs; mapped using MODIS satellite data as input estimates of optical water properties for Lake Michigan - Supporting monitoring activities that provide oxygen levels, water temperature, and wave heights to the Cleveland Division of Water. This information acts as a warning system to allow the utility to avoid drawing in hypoxic waters or enabling it to treat affected water appropriately.	-Facilitate development of the Ecosystem Forecasting Modeling Framework pilot for Lake Michigan - The Model Inventory allows users to search for models, applications, people, and organizations. Reviews of modeling and assessment tools are provided and some direct access to models.	- Make the Huron to Erie Connecting Waterways Forecasting System available online - The Great Lakes Testbed: a bi-national effort establishing protocols for integrating measurements of chemical, physical, and biological parameters on both sides of the border in the Great Lakes Basin - Develop a decision support and data management system that addresses GLRI goals and high priority user needs including those of municipal water systems managers (intake and sewage), beach managers, and others	- Partnered with the Great Lakes Fishery Commission to launch the Great Lakes Acoustic Telemetry Observing System (GLATOS) tool to answer fisheries management and ecology questions in the Great Lakes

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MARACOOS	-Utilize HFR network to monitor river plumes for water quality impacts on recreational beaches. -Repeat coastal glider missioned focused on dissolved oxygen monitoring for the New Jersey Department of Environmental Protection and Environmental Protection Agency Region II -Provide HFR data in western Long Island Sound to complement buoy mounted ADCPs to support the development of improved understanding of the effect of the transport of nutrients from the East River to the Sound.	-Butterfish model to avoid by-catch in the Loligo squid fishery -Dynamic preferred habitat nowcast for butterfish and loligo squid with input from real-time satellite, HF radar data. -Providing 3-D environmental information to fisheries resource managers, commercial and recreational fishers. -Provide HFR data in LIS and Block Island Sound to evaluate wave and current forecasting for ecosystem mapping in Long Island Sound.	-Developing a fisherman's web portal with data layers from our region asset map that is specific to the needs identified by the industry.	-Working with NMFS to develop observatory based habitat models and ecosystem indicators for critical species distributed throughout the Mid-Atlantic Bight -Funding from NMFS S&T for butterfish modeling work -Working on a process to get industry data collected by the NMFS/NEFSC to inform MARACOOS products -Working with CT and NY Sea Grant to provide temperature and current data to Sea Grant sponsored researchers.

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NANOOS	-Partner with NERRS to provide real-time water quality data to shellfish growers - Coordinate with POST to improve telemetry observations -Support NOAA's Ocean Acidification Program by providing observational data from the La Push, WA mooring. - Sustain existing buoys and gliders in the PNW coastal ocean, in coordination with national programs. Maintain these essential assets providing regional observations, with focus on hypoxia, HABs, ocean acidification, climate change detection and modeling input. -Maintain observation capabilities in PNW estuaries, in coordination with local and regional programs to aid sustainable resource management, water quality assessment and sub-regional climate change evaluation. -Collection and providing data and information of fluorescence, salinity, density, water temperature, transmissivity, and oxygen. -Participating in the Animal Telemetry Network Steering Committee. Providing water quality data for Shellfish growers. -Maintain and operate the HF radar surface current mapping network used to support search and rescue, marine operations, oil spill response, and ecosystem forecasting for the Oregon Coast. -Providing information and data products oriented towards commercial and recreational albacore tuna fishing communities.	-Collaborate with the modeling community to assist in facilitating the assimilation of HF data into regional circulation models to support analysis and modeling of HAB transport. -Provide model output for products on web, e.g., Tuna Plots for ocean fishers, circulation forecasts for tracking HABs.	-Animal tagging data management	

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NERACOOS	-Support monitoring of surface and bottom boundary layer acidification. -Support URI and Subchem to develop a regional nutrient monitoring capacity and to enhance existing buoys in Narragansett Bay so the data can be delivered in real-time -Support buoys in LIS for hypoxia and water quality -Support buoy that is monitoring water quality in Great Bay, NH -NERACOOS data provides information for NH DES nutrient criteria effort to protect eelgrass habitat in Great Bay, NH -NERACOOS and observations and modeling support regional HAB research, monitoring and forecasting -Supports satellite detection and water sampling for *Alexandrium* in the Bay of Fundy -Support for Environmental Sampling Processor deployment -Supports nutrient monitoring in the Northeast Channel, part Atlantic Zone Monitoring Program (AZMP). -Working to develop an Integrated Regional Sentinel Monitoring Program -Developed regional data portal to provide access to regional observations in support of ecosystems, fisheries, and water quality. -Proposal submitted to EPA LISS for water quality monitoring enhancements to support the hypoxia management in Long Island Sound.	-Facilitate development of an ecosystems forecast model to aid in understanding acidification and fisheries. -Data from NERACOOS buoys are assimilated into regional ocean forecast system (NECOFS) and utilized for assessing model accuracy. -By supporting the NECOFS, UMASSD is able to run other models like FVCOM/UG-RCA to provide an assessment of the water quality condition in Mass Bay and NPZD-based ecosystem model for 1995-2010 for the Gulf of Maine, also allowing for UMASSD to create 20 year hindcast in support of ecosystem based modeling. -Hypoxia monitoring and modeling in Long Island Sound for NY and CT waste load allocations.	-Right whale detection data management -- sightings posted on NERACOOS website in partnership with Cornell and used with maritime transportation to avoid ship strikes-State and regional programs use historical and real-time data from NERACOOS in management of environmental agencies and lobster, shrimp, and other fisheries. -Developing a regional data management framework to facilitate integration of data in support of ecosystems, fisheries, and water quality.	-Support for the Northeast Channel buoy, initially set up with gomoos and nmfs. -NEFSC provides ship time for buoy operations -Support OA mooring and data analysis in collaboration with PMEL -Providing support for OA in Stellwagen Bank with bottom boundary layer acidification observatory. -NERACOOS buoys are used to house acoustic fish sensors for the NMFS and bat detection sensors for DOE. -Developing exhibit to highlight right whale research in NOAA SBNMS -Collaboration and participation with NEP and NERRS in the region -Participation in Northeast Indicators Community of Practice -Participates in the Working Group on the Northwest Atlantic Regional Sea (WGNARS) -Collaboration with agencies through regional partnerships like NROC and NART on initiatives such as the Regional Planning Initiative

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PacIOOS	-Hawaii Tuna Tracking Project -Expanded and now maintaining a tracking array and network of automated acoustic receivers (e.g., tracking of sharks in Palau) -Supplying real-time observations of biological, chemical, and physical water parameters to improve the understanding of ocean acidification, more effectively protect healthy coastal marine ecosystems, and enhance the response to marine events that impact human health. - Operations and maintenance of CO_2 buoys, water quality sensors, wave gliders, and HF radars. - Partnering with NOAA to provide select tracks of information on monk seals in the Hawaiian Islands. - Contributing a suite of sensors to a new coral observing station added in Lao Lao Bay, Saipan in the Northern Mariana Islands in support of the Coral Reef Early Warning System (CREWS).	Operations of ocean circulation model.	-Animal tagging data management -IOOS Biological Data Project	-IOOS Biological Data Project pilot with Pacific Islands Fisheries Science Center to integrate reef fish data, including abundance, from multiple partners

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SCCOOS	-Provide monitoring, tracking, and prediction tools for harmful algal blooms, outfall and stormwater plumes, and surfzone contaminants. -Maintain and operate the HF radar surface current mapping network used to support search and rescue, marine operations, oil spill response, and ecosystem forecasting. -Deploy and maintain oxygen and carbon dioxide (O2/pCO2) sensors to Automated Shore Stations to initiate ocean acidification Monitoring. -Operate glider operations for monitoring harmful algal blooms (HABs) and coastal discharge plumes in San Pedro Bay and Santa Barbara Channel.	-Climate scale reanalysis of ocean state to provide a physical context and products for ecosystems and fisheries analysis.		Connectivity reanalysis with high-resolution (1 km) ocean circulation model output and direct observations of surface currents from HF radar for use in oil spill risk analysis and marine protected areas monitoring.

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SECOORA		-SABGOM nowcast/forecast model of ocean circulation for the entire Gulf of Mexico and South Atlantic Bight -East Coast of Florida (ECF) domain model is now running in Nowcast/Forecast (3 days forecast) mode. -Provide SC DHEC a decision support tool for beach/shellfish water quality advisories	-IOOS Biological Data Project -Added Everglades Monitoring Network Marine Monitoring Network data to SECOORA DMAC system -SECOORA DMCC participation on Eye on Earth system demo project -SECOORA Biological and Habitat GIS Web Site: providing biological data to researchers who want to link biological data with oceanographic data. The specific data sets that were requested to create this prototype were habitats and species distribution models.	- Develop data products derived from satellite and in situ observations for fisheries stock assessment (ROFFS, University of Miami CIMAS, and SAFMC)

Assumptions:

- All RAs are providing physical and chemical data that is or can be used to support fisheries and ecosystem management, such as providing oceanographic information (currents, temperature, salinity, etc.) to parameterize ecosystem models. This includes water quality data, dissolved oxygen, nutrients, etc.

Acronyms:

- OTN – Ocean Tracking Network (Canadian funded project)
- POST – Pacific Ocean Shelf Tracking network (now under OTN)