ANNUAL SUPPLEMENTAL TO THE MARACOOS SEMI-ANNUAL REPORT: 2
6/1/2011 – 11/30/2012
NOAA Award Number NA11NOS0120038 (June 2011 – May 2016)

1) PRODUCTS AND SERVICES

a) Regional Products:

New advances in regional products include:

i) MyMARACOOS Fishing Web Portal

The MyMARACOOS product is described on page 3 of this document under Data Management.

ii) Habitat Models for Regional Fisheries Management

MARACOOS took advantage of the IOOS collaborative culture to form an interdisciplinary workgroup of habitat scientists, oceanographers, fishery managers, social scientists, and fishermen from academia, government and industry to develop ecologically informed habitat models that could be applied to regional fisheries management (Figure 1). We held workshops to combine scientists' and fishermen's knowledge into a single model of butterfish habitat made using National Marine Fisheries Service (NOAA/NMFS) surveys of organisms and hydrography, and satellite and high-frequency radar measurements of ocean properties and processes provided by MARACOOS.

We intend to continue to work with fishermen within the context of the IOOS collaborative culture. Integrating their practical ecological knowledge with academic knowledge of the sea should result the rapid development of accurate seascape models. These models will first be considered hypotheses that can be adaptively tested within ocean observing systems. Once vetted in this way they can be easily operationalized as tools for the space and time management of human activities in dynamic ocean ecosystems.

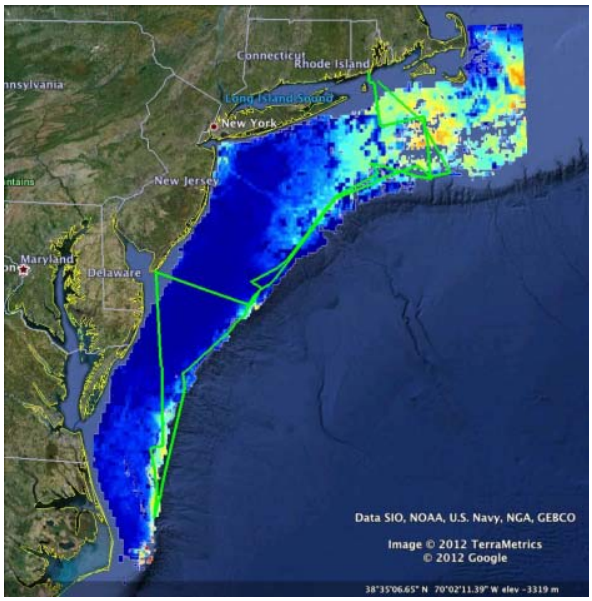

Figure 1. Butterfish habitat preference predicted by the model during our 8-day evaluation. Warmer colors indicate areas of preferred habitat. The vessel track is green.

iii) Water Quality Monitoring of Nearshore Coastal Waters

The New Jersey Department of Environmental Protection (NJDEP) and the U. S. Environmental Protection Agency (EPA) – Region II has prioritized monitoring the coastal waters off New Jersey in their long-term strategic plans as an essential component of the decision-making process. Of particular interest are the spatial and temporal characteristics of dissolved oxygen (DO) (Figure 2). In response to this need, we have put together a program to augment existing MARACOOS monitoring with targeted deployments of glider Autonomous Underwater Vehicles (AUVs) equipped with sensors to map coastal hydrography and dissolved oxygen conditions in near-real time along the New Jersey inner-shelf. MARACOOS provided critical facilities and technical expertise to accelerate the adoption of the shelf-wide glider missions to near-shore missions with a specific focus on water quality monitoring. EPA Region II and NJDEP identified the need and provided the necessary resources to support these coastal missions. Throughout the project there is consistent communication to both adapt the glider mission given the near-real time data and coordinate a response if needed. It is only through partnerships initiated and maintained through IOOS that these applications can be identified and implemented. As we look forward to the next 10 years we identify this clear need of partnership as required for the effective development of coastal applications

and the availability of these data for informed federal and state environmental resource management, enabled by an operational regional component of IOOS.

iv) SST Product

RU-COOL has developed a state-of-the-science declouded, coldest pixel composite satellite SST product which is currently being ingested into real-time atmospheric simulations with the Rutgers University version of the Weather Research and Forecasting (RU-WRF). By using a coldest pixel composite (something that has never been done before) the very high resolution (1-km grid spacing) SST product resolves coastal upwelling and cold wakes from storms like Hurricanes Irene and Sandy. These oceanic phenomena have a great influence on the near-surface boundary layer of the atmosphere and the resulting offshore wind resource, which is currently being assessed via RU-WRF simulations for the New Jersey Board of Public Utilities. Figure 3 in the December annual report highlights this product.

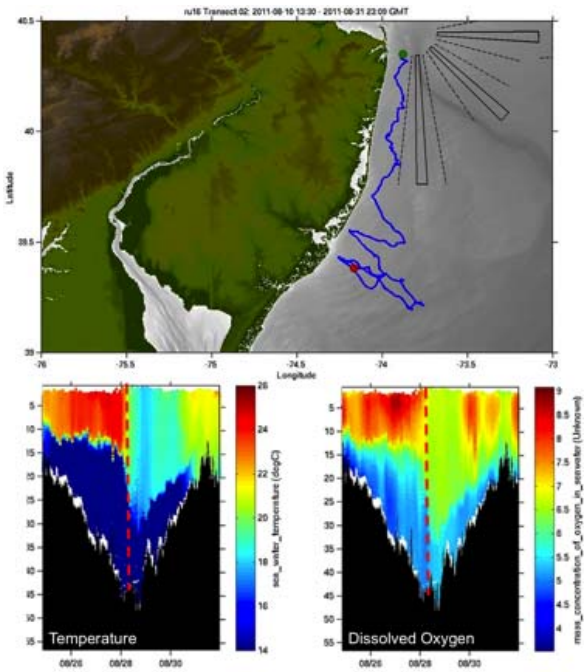

Figure 2: Glider path during August 2011. The temperature (C) (lower left) and dissolved oxygen concentration (mg/L) (lower right) collected during Hurricane Irene along the cross-shelf line at the southern end of the path. The timing of the storm is shown as a red dashed line in each cross-section.

b) National Products:

All of the MARACOOS regional products mentioned above can be augmented for use at the national level.

The butterfish habitat model is based on incorporating information from HF-RADAR surface convergence, SSTs, bottom sediment maps, organism samples and bottom bathymetry maps. The butterfish bycatch assessment is specific to the Mid-Atlantic, however, the tools used to perform the assessment are generally available throughout a large portion of the coastal United States and could therefore be transitioned towards developing models for other species in other regions.

The coastal water quality map products are simply based on availability of gliders, the required glider payload instruments, HF-RADAR, SSTs and ocean color satellite data. The limiting factors for most regions currently are glider availability and HF-Radar coverage. As we move into the future, the availability of these technologies throughout the CONUS area should make this type of product available on a national level.

Finally, the SST coldest pixel product can be implemented by all regions immediately. The focus for this product in the Mid-Atlantic region has been coastal upwelling and storm mixing, which can be applied through out the coastal U.S. MARACOOS is working with NCEP to discuss implentation of such a product for storm forecasting.

2) DATA MANAGEMENT

The MARACOOS DMAC efforts have been divided into the following categories:

a) Supporting the IOOS Program Office Regional DMAC efforts
b) Maintaining and hardening the data server infrastructure for MARACOOS data
c) Maintaining the MARACOOS Asset Map (http://assets.maracoos.org/)
d) Building the My MARACOOS Portal (http://mymaracoos.org/) for thematic applications with a primary focus on the fishermen portal
e) Mobile web site development http://mymaracoos.org/m
f) Progress towards a standards-based foundation for DMAC capabilities

a) IOOS Program Office Regional DMAC efforts

The MARACOOS DMAC team is playing a leading role with the IOOS architects in supporting the RA DMAC developments with specific support for ncSOS and the latest SOS schema and implementations. The web-based client developed by MARACOOS for the asset map is also being adopted by other regions.

b) Maintaining and hardening the data server infrastructure for MARACOOS data

The DMAC team continues to work on maturing the asset map and adding data sources. The data management approach underlying the Asset Map includes:

- Where possible, the data is served and integrated using open, interoperable data standards recommended by IOOS
- Where possible, the data providers manage, host and serve their particular data and the Asset Map integrates data "on the fly" from this distributed network of data servers
- The Asset Map provides preview capabilities so users can see recent, present, and future conditions (from models) in a single map and view time series data at discrete points. Scientists or other "power users" are provided actual links to the data servers so they can download data for further analysis with tools such as Matlab and ArcGIS.
- The system takes advantage of a combination of OpenSource technologies and standards
- The system leverages the power of the federal data centers to access data using open standards
- The system is extensible to add new data sources from other data providers

The uptime for observations and model data in the MARACOOS Data Center has been >98% and the auto-monitoring system provides feedback on most of the data feeds. We continue to explore ways to add redundancy in the system. Applied Science Associates (ASA) aggregates some of the MARACOOS data on redundant servers and also uses Amazon Cloud servers, primarily for Satellite data. The DMAC team has plans for additional consolidation and redundancy in 2013.

c) Maintaining the MARACOOS Asset Map

The Asset Map continues to be a robust entry point to access MARACOOS (and its partners) data sources, including models, gliders/drifters, buoys, satellite, and HF-Radar.

The MARACOOS asset map and data system has focused on providing 2D or surface layer data. We are currently developing access services and client tools to allow analysis of 3D data. To the right (Figure 3) is an example of a 3D slice of a FVCOM model using web services to access NetCDF/DAP servers.

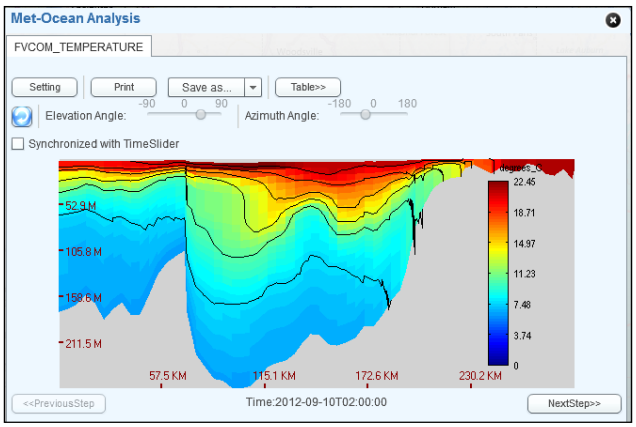

Figure 3. 3D subsurface cross

d) MyMARACOOS

The Asset Map represents a "science-based" view of data and is not well suited for all users. Through outreach efforts of the MARACOOS team with a specific focus on the needs of fishermen – the DMAC and Outreach teams are building new portals under the domain MyMARACOOS.org. The portal is designed to provide easy access to key data sets such as Metocean data, bottom temperature, and fishing data sets such as by-catch data and fishing tracks (Figure 4).

Progress on the MyMARACOOS Fishermen Ocean Portal has been made through the involvement of leading fishermen from the following fleets in development and beta testing of the site:

- Southern New England squid-butterfish
- Southern New England-Mid-Atlantic sea herring and mackerel fishermen
- Southern New England-Mid-Atlantic monkfish fishermen
- Southern New England-Mid-Atlantic lobster fishermen
- Southern New England-Mid-Atlantic sea scallop fishermen

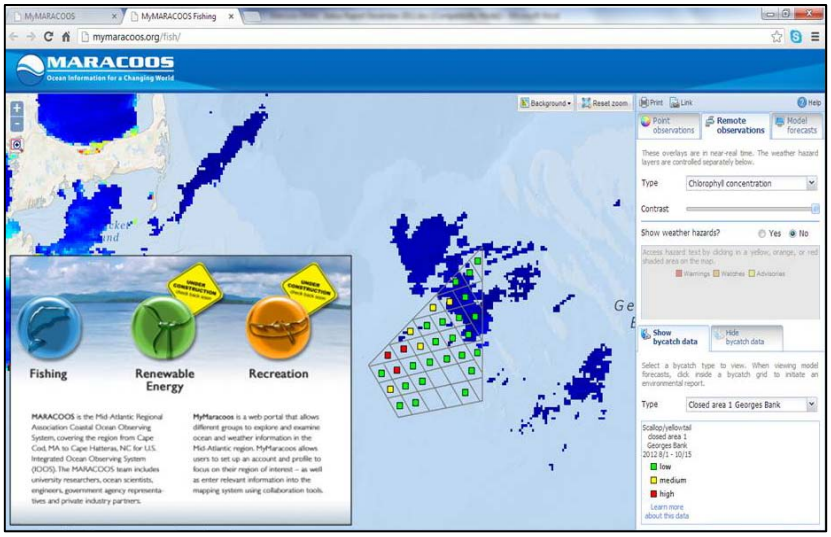

Figure 4. MyMARACOOS interface.

Additional menus have been added that incorporate bycatch data overlays from some of these fisheries (all will be incorporated as access to the federal data becomes possible) enabling fishermen to create a pre-trip bycatch report that will serve to guide decision making about where and when to fish. A goal for the future is to build real-time, forecast and hindcast functionality into the bycatch grids so that users can analyze ocean conditions on a fine scale in a particular location that, for example, may have been identified as a bycatch "hotspot" in the past and should be entered with caution in future fishing trips.

In addition, data streams on the following parameters have been added (or are scheduled to be added) to the drop down menu: frontal zone locations, moon phase and bathymetry.

The next stage of the development is to allow users to log in and customize their view so the system can be configured to meet their specific needs. We are also exploring methods to allow users to enter information into the system, for example, weather or species sitings from vessels.

e) Moblie Website Development

Another key development component is the development of MyMARACOOS.org/m, a mobile-enabled site compliant for iPhones, iPads, and Androids (Figure 5). This allows users to view specific data sets on the mobile device in map display format as well as time series graphs.

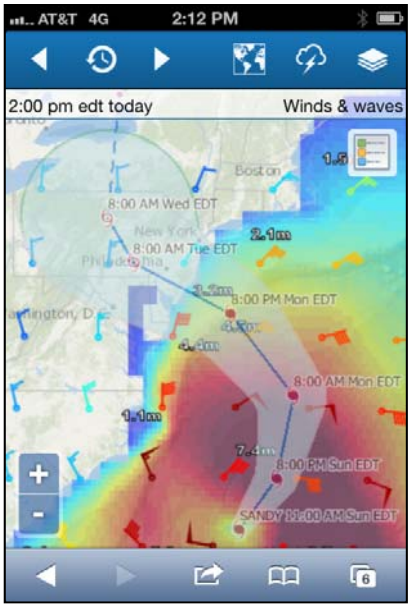

Figure 5. MyMARACOOS mobile application.

f) Progress towards a standards-based foundation for DMAC capabilities

MARACOOS has demonstrated progress towards:

- open data sharing;
  MARACOOS data is available in numerous formats/services. The Asset Map demonstrates access to data via WMS (via Dap), SOS, and KML. The modeling and satellite teams have all converged on NetCDF as a storage format with availability via TDS/DAP.
- provision of data to WMO GTS;
  MARACOOS does not provide data independently to the GTS, any data provided to NDBC will be provided to the GTS
- implementation of a service-oriented architecture;
  The design of the DMAC system is a set of distributed servers and

services – with a focus on DAP, SOS, and WMS. We are working on a new catalog system to store the service end points

- use of common vocabularies and identifiers;
  MARACOOS is a hybrid of centralized data and distributed data providers. The centralized data is managed for compliance with standards and vocabularies, but this has not been applied to all distributed data providers.
- improved use of metadata conventions; and
  The primary focus on metadata has been the implementation of metadata information in the global attributes of the NetCDF storage containers. Broader metadata compliance needs to be implemented for the distributed providers.
- data storage and archiving.
  MARACOOS are working with NODC for archive of satellite data. Glider data will go to NODC when the formats are finalized.

MARACOOS has on-going program-level participation in:

- data management planning and coordination; and
  MARACOOS DMAC staff are active participants in the RA DMAC meetings and calls.
- IOOS maturity levels and certification standards.
  MARACOOS are playing a leadership role in the development of the SOS reference implementation.

3) OBSERVING ASSETS

A list of all observing assets is attached to this supplemental report as it is too cumbersome to include in the five pages the supplemental is limited to. Descriptions of the asset, status, locations, data type collected and owner are included. The attachment is called “Non-Federal-IOOS_Observing-Assets-2012-12-19”. Currently ocean acidification is only measured on a limited basis by occasional instrument deployments by the MARACOOS team. There are no long duration measurement platforms in place.