SANCTUARY MBON

Updates from the Florida Keys and Monterey Bay Projects

February 2016

DMAC UPDATE

The DMAC team is revising the data management plan under the leadership of Dave Anderson at CeNCOOS. The Florida and Monterey Bay teams are working on enrollment of historical data sets for ingestion in close collaboration with Philip Goldstein with OBIS-USA. Axiom continues to make progress on data ingestion of Florida and California biological data sets and ingested a large number of Florida Keys National Marine Sanctuary (FKNMS) ecological data GIS layers and several time series data sets.

Eighteen years (1995-2012) of the Reef Visual Census (RVC) data have been transformed from their original forms into the standards-based forms used by OBIS-USA, such as Darwin Core and the Marine Bio-Geography (MGB) common terms definitions. Guidance for this effort was derived from the "MBG 2.1 Enrollment Journal Florida Marine Sanctuaries Fish 2004 Draft 20140521" produced by Philip Goldstein. The transformed data and metadata were written into NetCDF files and installed in an ERDDAP server making them available through the network via human or URL-based interfaces.

Axiom and a team of Monterey Bay and Florida scientists are working on the development of a generalized biodiversity indices tool. Axiom is working with the RVC data set to prepare it for real-time biodiversity indices calculations. Software engineers have started to incorporate biodiversity indices calculations into backend server side analytical code. The prototype biodiversity indices tool is expected to be available for use with the AXIOM tool in early March. Axiom (along with IOOS and OBIS staff) met with Barbara Block and team at Hopkins Marine station and discussed best paths forward to accessing ATN data relevant to MBON.

The RVC data is available through a GCOOS ERDDAP server. The ERDDAP interface allows users to filter the data, produce maps, and deliver data and metadata in many different formats. Click here: The "Make a Graph" page allows users to plot selected data and export the plots. You can enter constraints by hand or generate the plot directly from here.

Another impressive dataset, the Historical NOAA CTD data for the Florida Keys (30 raw CTD data sets collected from the *R/V Walton Smith* from 2006-2015) have been incorporated into the MBON data management system. Data collected include temperature, salinity, beam attenuation, beam transmission, dissolved oxygen, surface and *in situ* irradiance (PAR). Underway systems collect near-surface temperature, salinity, meteorological and navigation data. Some cruises include current meter data. In the coming month, we will have products from these three-dimensional time series datasets mapped. Additional water quality data will be ingested from http://data.gcoos.org/nutrients/ and other sources to visualize and analyze with the Axiom workspace.

A DMAC X-MBON team has been formed with participants from Alaska, Florida, Monterey Bay, Santa Barbara and the Smithsonian MarineGEO Tennenbaum.

Welcome

to the first MBON Project Update. In addition to the team updates, this issue focuses on Florida projects. The next issue will focus on California.

NEW MBON TEAM MEMBER: NOAA SEFSC

Kathryn Shulzitski, Ph.D., Cooperative Institute for Marine and Atmospheric Studies, University of Miami, was hired in the fall of 2015 to work on the MBON project with John Lamkin (NOAA SEFSC). Shulzitski's expertise is in the study of processes affecting growth and survival during the early life history stages of fishes.

She is analyzing data sources of value for marine biodiversity research. The Reef Visual Census dataset was chosen because its standardized survey methods provide robust data on fish density and distribution in coral reef habitats throughout the FKNMS. Analysis will begin immediately and figures for a manuscript addressing the temporal and spatial patterns in biodiversity in the FKNMS will be produced.

Florida Fish and Wildlife Research Institute (FWRI/FWC) Update

For the phytoplankton analyses, the FWRI/FWC and University of South Florida research teams made a joint decision to conduct microscopy analysis of phytoplankton diversity on a limited number of samples (~10 per year). As written in the proposal, remote sensing and/or discrete chlorophyll data and/or eDNA determinations of phytoplankton biodiversity will be used to target specific samples of interest as this data is made available.

The eDNA method validation is still being conducted but is nearly complete; once it is complete, processing of phytoplankton eDNA time series samples by FWC can begin. Protocols from MBARI for 18S phytoplankton sequencing and for accessing the data server were provided and reviewed so that Steven Bruzek (FWC) can obtain/compile necessary reagents and equipment for Next Generation Sequencing (NGS) phytoplankton analyses.

A NGS library prep and bioinformatics training at MBARI is scheduled for 2/10-2/12/16, and will include participants from USF, Stanford, MBARI, and FWC. Bruzek is in the process of getting trained in the preparation of zooplankton NGS libraries in collaboration with members of the USF Genomics Core, which methodologically is quite similar to the preps that will be used for phytoplankton libraries.

Data Management and Modeling

Our team worked with the NOAA Southeast Fisheries Science Center to segregate the RVC data into 37 ecologically relevant trophic groups for data from 1994 to 2012. We estimated diet composition (Figure 6. below), biomass, and other parameter estimates for each trophic group using related Caribbean and Gulf of Mexico based ecosystem models (Figure 2 next page, top right).

Currently, we are accumulating fishing related mortality data to improve our production estimates. We are now in the position to make adjustments to the initial Ecopath mass-balance model for use in the spatially explicit Ecospace model.

Data Management and GIS Work

Much time has been spent converting the multitude of different FWC datasets to GIS formats, particularly from the crustaceans group in the Keys. Getting the data out of Access and Excel databases proved to be tricky since not all of the data were in an easily readable state by GIS. Many tables had to be converted and linked together to make the databases complete, because of the one to many links used in Access.

After converting the data to a GIS format (Geodatabase / Feature Class), metadata was attached and edited based on discussion from the contributing scientists and recent publications. After the data was finished on our local server, it was added to the production server and published through ArcGIS Server so it would be accessible to all MBON members. The new data layers were also linked to the MBON Javascript Viewer for all users without ArcMap or GIS software.

A list of all the data layers is provided (see next page). Some of the latest data released were the Lobster Abundance Transects, Post-larval Collectors data, RVC 1980-2012, Queen Conch Survey Sites, and the Reef.org Fish Sightings data.

Group Name Pred/Prey)	1	2	3	4	5	5a	6	6a	7	7a	8	9	10	11	11a	12	12a	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Requiem sharks	0.018	0.010	0.043	0.018	0.005	0	0.006	0	0.002	0.002	0.008	0.000	0.002	0.006	0.006	0.007	0.007	0.005	0.005	0.000	0.006	0.005	0.005	0.011	0.000	0.05	0	0.000	0.000	0.000	0.106	0.100	0.127	0.000	0.088	0	0.000
Nurse Sharks	0.000	0.000	0.000	0.006	0.006	0	0.006	0	0.006	4E-05	0.000	0.000	0.006	0.006	0.006	0.006	0.006	0.000	0.006	0.000	0.006	0.006	0.006	0.006	0.000	0	0	0.000	0.000	0.000	0.025	0.050	0.050	0.000	0.000	0	0.000
Rays	0.000	0.000	0.000	0.001	0.001	0	0.001	0	0.001	0	0.000	0.000	0.001	0.004	0.004	0.001	0.001	0.000	0.001	0.000	0.001	0.001	0.010	0.005	0.000	0	0	0.000	0.000	0.000	0.139	0.023	0.081	0.000	0.000	0	0.000
Mid-water Opportunists	0.000	0.000	0.000	0.064	0.002	7E-05	0.003	0.002	0.021	2E-04	0.000	0.006	0.013	0.099	0.099	0.021	0.021	0.005	0.026	0.000	0.051	0.060	0.034	0.100	0.000	0	0	0.000	0.000	0.000	0.125	0.250	0.097	0.280	0.000	2E-04	0.000
Piscivorous Grouper Large	0.000	0.000	0.000	0.048	0.005	1E-04	0.004	0.005	0.004	3E-04	0.000	0.000	0.023	0.042	0.042	0.037	0.037	0.006	0.012	0.000	0.076	0.031	0.034	0.024	0.000	0	0	0.000	0.000	0.000	0.025	0.000	0.110	0.000	0.000	0	0.000
Small Pisc Grouper	0	0	0	0	0	4E-04	0	0	3E-04	3E-04	0.044			0.006	0.006							0.091		0.016	0	0	0	0.063	6E-04	0	0.003	4E-05	0.012	0	0	0	0
Invertivorous Grouper Large	0.000	0.000	0.000	0.000	0.000	0	0.000	0	0.000	0	0.000	0.000	0.000	0.028	0.028	0.000	0.000	0.003	0.010	0.000	0.057	0.069	0.012	0.036	0.000	0	0	0.000	0.000	0.000	0.033	0.000	0.263	0.265	0.000	0	0.000
Small Invert Grouper	0	0	0	0	0	0	0	0	0	0	0.048			0.003	0.003							0.041		3E-04	0.011	0	0	0.068	0	6E-05	0.012	0.017	0.058	0	0	0	0
Snapper Large	0.000	0.000	0.047	0.000	0.010	0	0.005	0	0.000	0	0.000	0.041	0.025	0.030	0.030	0.021	0.021	0.023	0.019	0.000	0.007	0.038	0.020	0.061	0.014	0	0	0.000	0.000	0.000	0.030	0.014	0.093	0.295	0.000	0	0.027
Small Snapper	0	0	0	0	0	0	0	0	0	0	0.032			0	0							0.058		0.055	0.003	0	0	0.047	3E-05	0	0.035	0	0.052	0	0	0	0
Barracudas	0.000	0.000	0.000	0.021	0.000	0	0.000	0	0.053	1E-05	0.053	0.000	0.000	0.031	0.031	0.006	0.006	0.005	0.005	0.000	0.000	0.000	0.053	0.029	0.000	0	0	0.000	0.000	0.000	0.103	0.000	0.058	0.019	0.000	0	0.000
Hogfish	0.000	0.000	0.000	0.000	0.000		0.000		0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0	0.000	0.000	0.000	0.146	0.129	0.065	0.000	0.000		0.000
Small Labridae	0.000	0.000	0.000	0.000	0.000		0.000		0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0	0.001	0.000	0.000	0.104	0.093	0.074	0.601	0.000		0.000
Demersal Carnivorous Reef Fish (Small/Large	0.000	0.000	0.000	0.016	0.003	0	0.025	0	0.252	3E-05	0.000	0.000	0.007	0.035	0.035	0.111	0.111	0.064	0.064	0.000	0.034	0.031	0.021	0.088	0.068	0	0	0.001	0.000	0.019	0.099	0.120	0.158	0.326	0.015	0	0.317
Small DCRF	0.000	0.000	0.000	0.000	0.000	0	0.000	0	0.000	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0	0.000	0.010	0.150	0.230	0.010	0.300	0.000	0.000	0	0.000
Grunt Large	0.000	0.000	0.000	0.000	0.000		0.000		0.000		0.000	0.000	0.160	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.020	0.000	0.002	0.010	0	0	0.005	0.000	0.000	0.067	0.127	0.076	0.129	0.000		0.000
Small Grunt	0.000	0.000	0.000	0.000	0.000	0	0.000	0	0.000	0	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.001	0.013	0	0	0.005	0.000	0.013	0.017	0.127	0.117	0.129	0.000	0	0.013
Cropping Parrotfish	0.000	0.000	0.000	0.000	0.000		0.000		0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0	0	0.002	0.000	0.001	0.001	0.001	0.001	0.000	0.000		0.993
Grazing Parrotfish	0.000	0.000	0.000	0.000	0.000		0.000		0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.006	0	0	0.000	0.000	0.006	0.000	0.000	0.000	0.000	0.000		0.993
Lionfish	0.000	0.000	0.000	0.000	0.000		0.000	0.351	0.000		0.000	0.000	0.010	0.000	0.003	0.000	0.364	0.000	0.094	0.000	0.011	0.009	0.001	0.000	0.000	0	0	0.000	0.000	0.000	0.001	0.000	0.093	0.000	0.000		0.000
Gobies and Blennies	0.000	0.000	0.000	0.000	0.000		0.000		0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0	0.000	0.000	0.014	0.094	0.105	0.314	0.504	0.415		0.415
Omnivores	0.000	0.000	0.000	0.000	0.000	0	0.000	0	0.000	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.141	0	0	0.020	0.000	0.055	0.093	0.049	0.050	0.232	0.255	0.001	0.256
Herbivores	0.000	0.000	0.000	0.000	0.000		0.000		0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0	0.000	0.000	0.001	0.002	0.000	0.000	0.003	0.464		0.720
Small Forage Fish	0.000	0.000	0.000	0.000	0.000	0	0.000	0	0.000	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.285	0.000	0	0	0.028	0.700	0.000	0.137	0.000	0.059	0.627	0.233	0	0.445
Sessile Animals	0.000	0.000	0.000	0.000	0.000	0	0.000	0	0.000	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0	0.240	0.450	0.000	0.000	0.000	0.000	0.117	0.286	1E-03	0.000
Birds	0	0	0	0.013	0	0	0	0	0	0	0			0.012	0.012							0.064		0.153	0	0	0	0	0	0	0	0	0	0	0	0	0
Dolphins	0	0.002	0.002	0.03	0	0	0	0	0	0	0.079			0.006	0.006							0.133		0.092	0	0	0	0	0	0	0	0	0	0	0	0	0
Zooplankton	0.000	0.000	0.000	0.000	0.000	0	0.000	0	0.000	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0	0.000	0.200	0.000	0.000	0.000	0.000	0.800	0.000	0	0.000
Phyotplankton	0.000	0.000	0.000	0.000	0.000	0	0.000	0	0.000	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.017	0.000
Macroalgae	0.000	0.000	0.000	0.000	0.000	0	0.000	0	0.000	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0.000
Molluscs and Annelids	0.000	0.000	0.000	0.000	0.000	0	0.000	0	0.000	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.016	0	0	0.200	0.150	0.000	0.188	0.014	0.017	0.232	0.434	0	0.410
Echinoderms	0.000	0.000	0.000	0.000	0.000	0	0.000	0	0.000	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.040	0	0	0.030	0.050	0.255	0.064	0.030	0.020	0.110	0.363	0	0.283
Crustaceans	0.000	0.000	0.000	0.000	0.000	0	0.000	0	0.000	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.127	0	0	0.149	0.160	0.000	0.233	0.021	0.041	0.110	0.120	0	0.377
Decomposers & Microfauna	0.000	0.000	0.000	0.000	0.000	0	0.000	0	0.000	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0.000
Detritus	0.000	0.000	0.000	0.000	0.000		0.000		0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.000
Jellies	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.128	0.017	0	0	0	0	0.13	0.025	0	0
Seagrass	0.000	0.000	0.000	0.000	0.000		0.000		0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0.000

Figure 1. Diet composition estimates per trophic group. Changes in color track data sources.

Figure 2

Home | Model Parameters | Basic input

Define groups... | Edit multi-stanza... | Set:

	Group name	Habitat area (fraction)	Biomass in habitat area (t/km²)	Z (/year)	Production / biomass (/year)	Consumption / biomass (/year)	Ecotrophic efficiency	Other mortality	Production / consumption	Unassimil. / consumption	Detritus import (t/km²/year)
1	Requiem Sharks	1.000	0.000000		0.250	5.390				0.200	
2	Nurse Sharks	1.000	0.427		0.240	4.500				0.200	
3	Rays	1.000	0.698		0.240	5.670				0.200	
4	Mid-Water Opportunist	1.000	0.767		0.910	10.74				0.200	
⊟	Pisc Grouper										
5	Pisc Grouper Larg	1.000	161.8			1.308				0.200	
6	Pisc Grouper Smal	1.000	0.119			5.850				0.200	
⊟	Invert Grouper										
7	Invert Grouper Lar	1.000	5.711			3.047	0.430			0.200	
8	Invert Grouper Sm	1.000	0.00420			13.63	0.140			0.200	
⊟	Snapper										
9	Snapper Large	1.000	1061			1.713	0.430			0.200	
10	Snapper Small	1.000	0.780			7.660	0.140			0.200	
11	Barracudas	1.000	0.311			4.440	0.200			0.200	
12	Hogfish	1.000	0.467			5.130	0.200			0.200	
13	Small Labridae	1.000	0.287			9.960	0.610			0.200	
⊟	Demers Carn Reef Fish										
14	Demers Carn Reef	1.000	112.7			2.464	0.500			0.200	
15	Demers Carn Reef	1.000	0.0829			11.02	0.500			0.200	
⊟	Grunt										
16	Grunt Large	1.000	963.3			2.622				0.200	
17	Grunt Small	1.000	0.708			11.73				0.200	
18	Cropping Parrotfish	1.000	0.625		0.660	15.02				0.200	
19	Grazing Parrotfish	1.000	1.389		1.020	25.44				0.200	
20	Lionfish	1.000	0.000000		0.570	9.960				0.200	
21	Gobies and Blennies	1.000	0.00560		2.400	29.04				0.200	
22	Omnivores	1.000	1.247		1.440	13.70				0.200	
23	Herbivores	1.000	2.115		0.830	27.91				0.200	
24	Small Forage Fish										
25	Sessile Animals										
26	Birds										
27	Dolphins										
28	Zooplankton										
29	Phytoplankton										
30	Macroalgae										
31	Molluscs and Annelids										
32	Echinoderms										
33	Crustaceans										
34	Decomposers and Mic										
35	Jellyfish										
36	Seagrass										
37	Detritus										

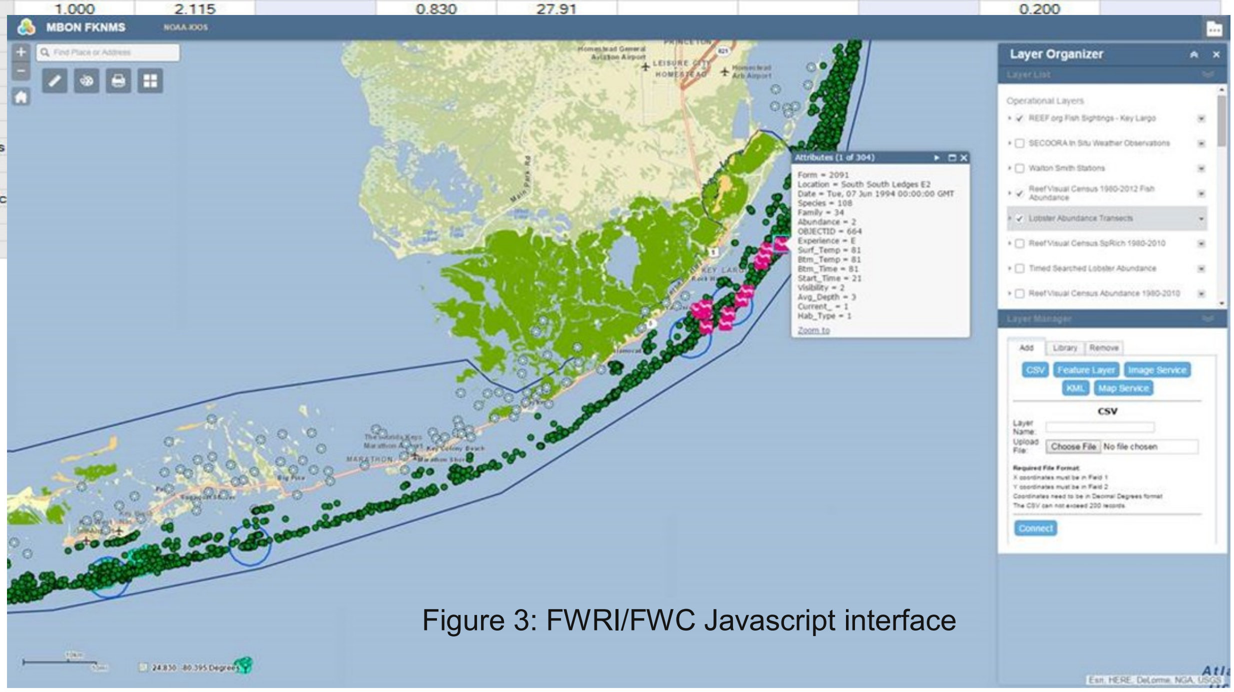

Figure 3: FWRI/FWC Javascript interface

Data Layers relevant to the FKNMS MBON:

SECOORA In Situ Weather Observations (0)
Lobster Abundance Transects (1)
Timed Searched Lobster Abundance (2)
Postlarval Collectors (3)
Queen Conch Survey Sites (4)
REEF.org Fish Sightings - Key Largo (5)
Walton Smith Stations (6)
Reef Visual Census 1980-2012 Fish Abundance (7)
Reef Visual Census SpRich 1980-2010 (8)
Reef Visual Census Abundance 1980-2010 (9)
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Acropora Presence/Absense Locations in Caribbean (18)
Rare and Imperiled Fish (19)
Artificial Reefs Florida (20)
Patch Reefs SE FL (21)
Coral Reef Evaluation and Monitoring Projects in FL (CREMP, SECREMP, DRTO CREMP) (22)
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Seagrass Florida (27)
Saltwater Marsh Florida (28)
Tidal Flats Florida (29)
Coral Hardbottom (30)

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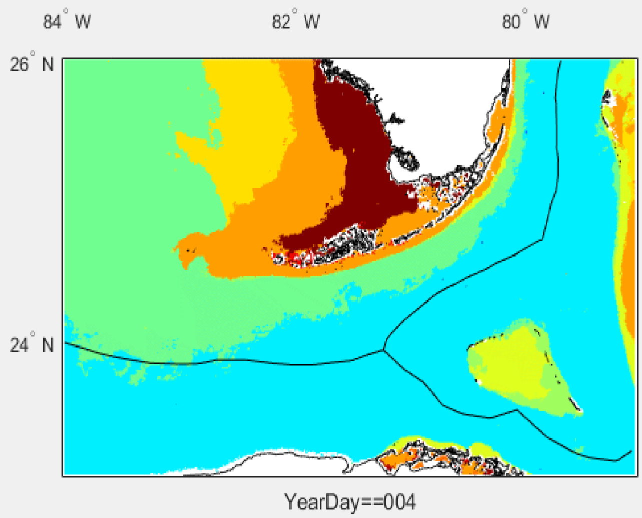
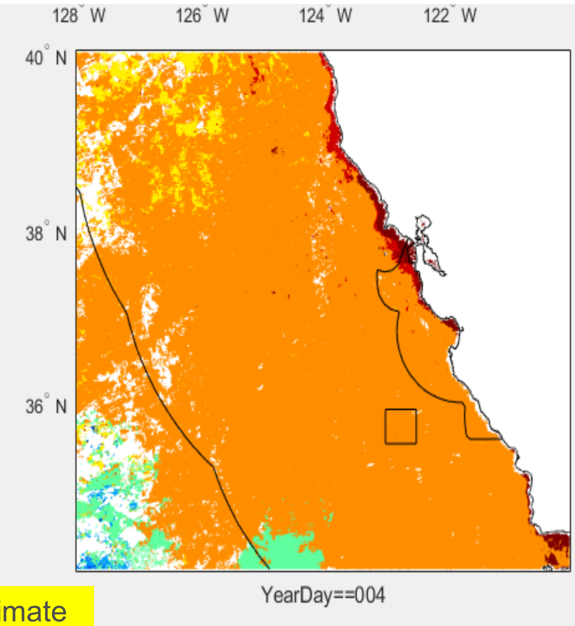
NearshoreHardbottom_Algae (32)
NearshoreHardbottom_Fish (33)
NearshoreHardbottom_Lobster (34)
NearshoreHardbottom_MotileInverts (35)
NearshoreHardbottom_Surveys_master (36)
NearshoreHardbottom_SessileInverts (37)





Click a Photo to Animate

Florida Keys Figure 4 **Monterey Bay Figure 5**

SEASCAPES UPDATE

Maria Kavanaugh and Scott Doney, Woods Hole Oceanographic Institute, are merging ecology, geography, and ocean dynamics to observe, manage, and conserve species embedded in a dynamic seascape mosaic, where the boundaries, extent, and location of features change with time. Objective classification of seascapes using satellite remote sensing data allows for synoptic assessment of dynamic biogeographic patterns in real time.

Seascapes have been classified over the MODIS-Aqua record within the Florida Keys (Figure 4) and Monterey Bay (Figure 5) National Marine Sanctuaries. Within the two Sanctuaries, seascape maps have been produced at 1 km resolution and eight–day time steps; maps for the larger ecoregion (i.e. Gulf of Mexico and California Current, respectively) are produced at 4 km resolution and monthly time steps. At this stage, 18 seascapes have been classified for the FKNMS, and 12 for the MBNMS.

The MODIS Aqua time-series (2002-present) satellite images are obtained from NASA's Ocean Biology Processing Group (OBPG) and processed from Level-1A at the USF Institute for Marine Remote Sensing (IMaRS). Satellite products generated for Seascapes analysis include chlorophyll-a concentration, photosynthetically available radiation (PAR), sea-surface temperature (SST) and normalized fluorescence line height (nFLH).

An automated system was implemented to obtain the most recent images at IMaRS from OBPG via an ftp data subscription. Every eight days, a new composite image will be automatically generated and sent to WHOI. Then, the Seascapes generated at WHOI are uploaded to a second ftp site for transfer to Axiom.

Our goal is to generate continually updated seascape time series for each X-MBON project, and to serve data through the MBON IOOS DMAC portals.

Following the October 2015 MBON meeting, we embarked on the following activities:

- Completed a global demonstration product to highlight at the Mexico GEOBON meeting (2015).
- Created a poster for the annual CalCOFI meeting.
- Refined high frequency, high resolution algorithm to account for differences in units associated with NASA L3 OBPG processing and products generated by SeaDAS.
- Coordinated with AMBON project to expand seascape classification to Arctic.
- Implemented several phytoplankton functional type algorithms focused on fucoxanthin, size classes, and dominance of blooms by dinoflagellates or diatoms.
- Initiated a funded project to investigate the utility of drone-based hyperspectral remote sensing for nearshore water quality and phytoplankton diversity.

MBON IN THE NEWS

ARTICLES IN DEVELOPMENT

Libby Johns, physical oceanographer at NOAA's Atlantic Oceanographic and Meteorology Laboratory in Miami, is working on two papers. In the first, *"A new temperature, precipitation, and drought climatology for Florida, 1895 to 2015,"* Johns is generating a new temperature, precipitation, and drought climatology for Florida's seven climate divisions from 1895 to 2015, using data from NOAA's National Climatic Data Center. This paper will relate details of the climatology to large-scale meteorological forcing and climate indices such as ENSO, NAO, AMO, etc. The results will aid in the interpretation of south Florida coastal ocean variability and marine ecosystem health.

In the second, "*Means and extremes of surface temperature, salinity, and chlorophyll in south Florida coastal waters,*" Johns is analyzing the south Florida program surface temperature, salinity, and chlorophyll time series from 1998 through 2015. This paper will identify means and extremes of the three parameters, analyze the observed variability on a range of time scales from episodic to interannual, and interpret the results in the context of the large-scale meteorological and oceanographic forcing experienced during the 1998 - 2015 time period.

Maria Kavanaugh is writing "*Quo Vadimus: Seascapes as a new vernacular for ocean monitoring, management and conservation,"* for a special issue of ICES *Journal of Marine Science.* Kavanaugh outlines the conceptual transfer from landscape ecology to seascape ecology for marine ecosystem management. She explains how remote sensing, autonomous, and ship-based measurements enable real-time characterization of seascapes to manage and conserve species embedded in a dynamic, constantly changing mosaic of global seascapes.

PRESENTATIONS

October 2015: Poster titled "National Marine Sanctuaries as Sentinel Sites for a Demonstration Marine Biodiversity Observation Network (MBON): Remote Sensing of Dynamic Biogeographical Seascapes" was present at the Trait-Based Approaches to Ocean Life conference at Waterville Valley. Authors: E.Montes, M. T. Kavanaugh, S. Doney, F. Muller-Karger, F. Chavez, M. Messie, and S. Gittings.

December 2015: Poster titled "Monterey Bay Marine Biodiversity Observation Network (MBON): Integrating multidisciplinary regional data to track biodiversity and inform resource management" was presented at the 2015 California Cooperative Oceanic Fisheries Investigations (CalCOFI) conference at Moss Landing Marine Laboratories. Authors: J, Brown, S.J. Bograd, F. Chavez, A, DeVogelaere, J.C. Field, E.L. Hazen, J. Jahncke, M.T. Kavanaugh, J.A. Santora, and I.D. Schroeder.

MBNMS Condition Report Released Jan. 2016

The "Monterey Bay National Marine Sanctuary Condition Report Partial Update: A New Assessment of the State of Sanctuary Resources 2015" was released.

The MBON grant and funders are acknowledged and MBON data products used in the report helped answer several key questions for the pelagic ecosystem:

What is the status of biodiversity and key species, and how is this changing?

Are specific or multiple stressors, including changing oceanographic and atmospheric conditions, affecting water quality and how are they changing?

Team Studies El Niño Effects

The "blob," a large warm-water mass that persists off the coast of California, followed by El Niño brought strange conditions that allowed northern and southern species to overlap in time and space.

Isaac Schroeder, Jarrod Santora, Elliott Hazen, John Field and Steven Bograd are finishing their analysis of the unusual juvenile rockfish biodiversity recorded during a 2015 cruise.

FLORIDA KEYS UPDATE

In 2015, the USF, NOAA's South Florida Program (SFP), led by the NOAA Atlantic Oceanographic and Meteorological Laboratory (AOML), and FKNMS science personnel began bi-monthly sampling at Molasses Reef, Looe Key, and Western Sambo (Figure 6). Sampling is conducted aboard of the *R/V Walton Smith* (U of Miami) as part of the SFP, and on small (29 ft.) boats from the FKNMS during months between SFP cruises. Samples are thus collected monthly at the MBON sites.

Observations include physical (temperature, salinity, light, currents), chemical (nutrient) data, chlorophyll-a and High Performance Liquid Chromatography (HPLC) pigment concentrations, environmental DNA (eDNA), bio-optical measurements, and phytoplankton and zooplankton samples for taxonomy and primary productivity. *In situ* bio-optical measurements include surface remote sensing reflectance (Rrs), chlorophyll-a and colored dissolved organic matter (CDOM) fluorescence, and specific absorption spectra of phytoplankton and detritus.

During the bi-monthly ship cruises we also collect profiles of light intensity. The ship has along-track observations of chlorophyll fluorescence and light attenuation.

In addition to the three core MBON stations, we collect observations at 30 other stations, including transects of stations near the Shark River off the Florida Everglades (Figure 4), for HLPC pigments, in situ surface Rrs, and eDNA. HPLC pigments, surface Rrs, and specific absorption measurements will aid in the calibration of satellites, seascapes analyses, and assessment of phytoplankton functional types (PFT) distribution.

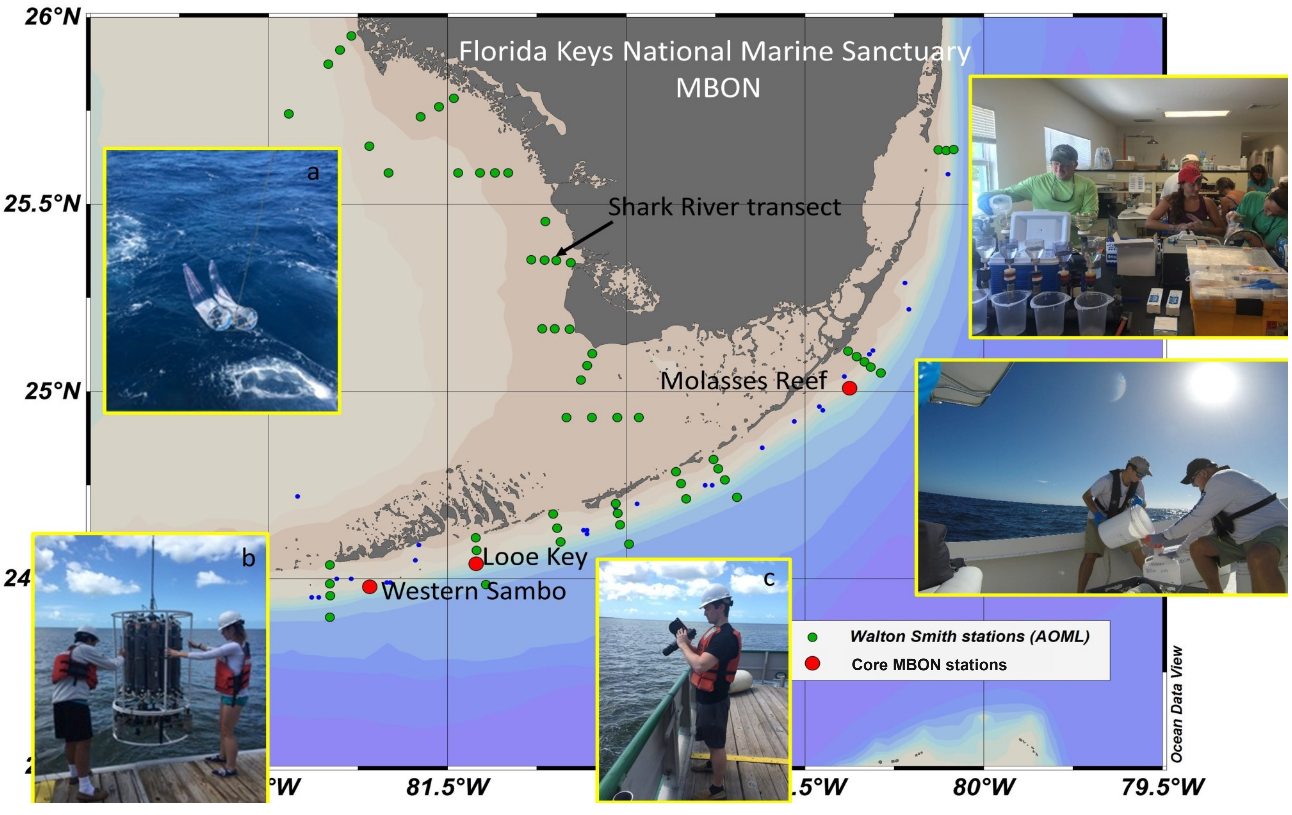


Figure 6. Locations occupied bi-monthly by the South Florida Program research cruises (green dots) and monthly by the MBON project (red dots). Bongo net tows (a), surface and bottom water sample collections (b), and surface R_{rs} measurements (c) are carried during SFP cruises. The SFP cruises also collect a suite of along-track bio-optical parameters and physical measurements including current velocities. FKNMS science staff collect surface and bottom water samples at the MBON stations from small boats using a 5-liter Niskin bottle (d) during months between SFP cruises, and transport samples to FKNMS facilities for processing (e).

Preliminary results show that *in situ* optics are effective for detecting specific phytoplankton functional types (PFT) in the Florida Keys. Specifically, chlorophyll-specific absorption spectra of phytoplankton (a^*_{phy}) from samples collected at the three MBON sites in July 27-31, 2015, indicate high abundance of blue-green algae (very likely *Trichodesmium spp.)* shown as absorption peaks at 545 nm (Figure 5). Time series of (a^*_{phy}) and complementary optical observations therefore serve as a practical tool for studying changes in biodiversity of lower trophic levels in this region and aid in the improvement of satellite ocean color algorithms for detecting shifts in phytoplankton community composition.

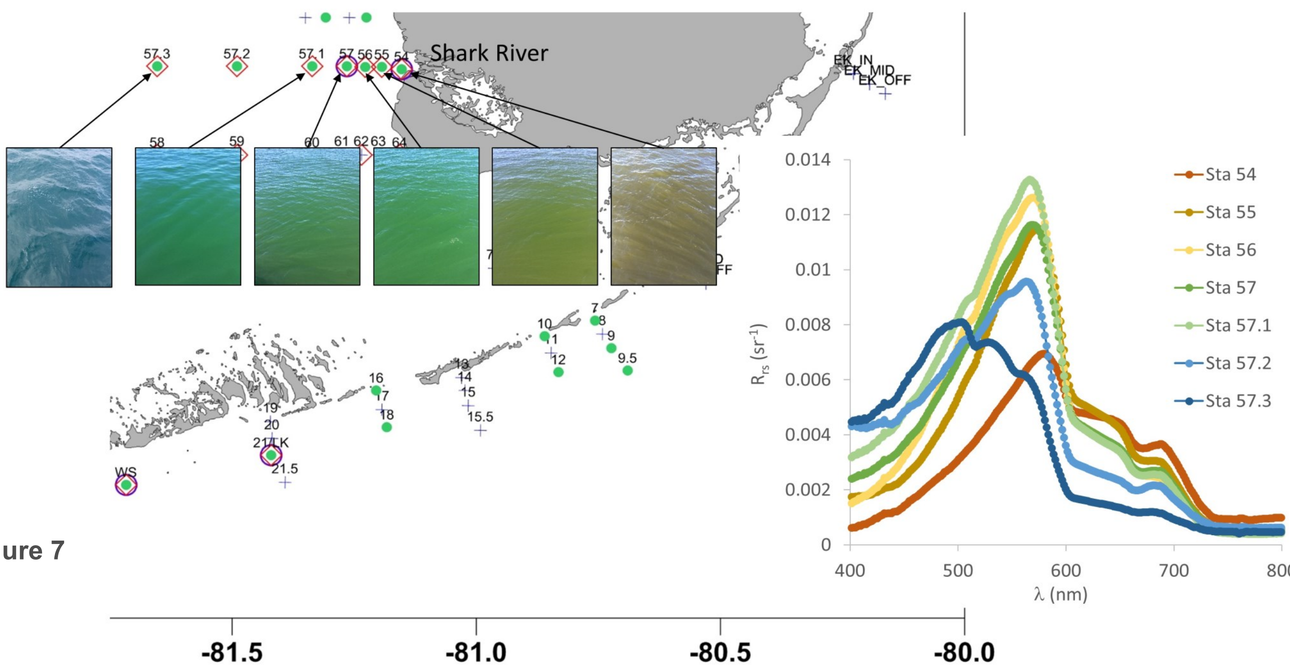


Figure 7

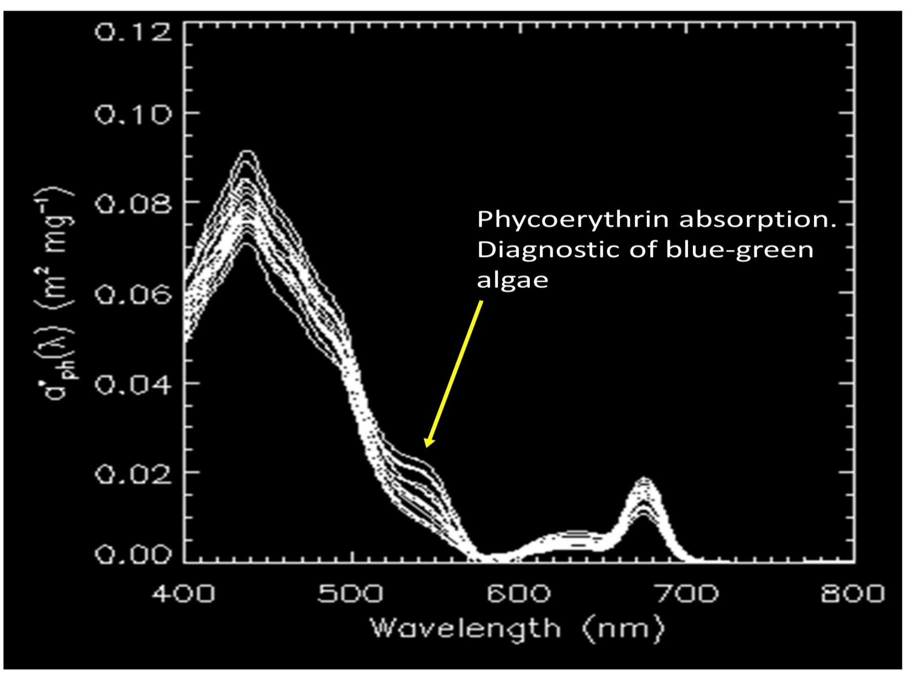


Figure 8. Chlorophyll-specific phytoplankton absorption (a^*_{phy}) spectra of surface and bottom samples from the three MBON sites during July 27-31, 2015. Absorption peaks at 545 nm are indicative of the presence of the pigment phycoerythrin, and therefore of cyanobacteria in the

GENOMICS UPDATE

Stanford, MBARI and USF have been working on MBON eDNA methods. We are testing whether we can standardize the choice of filter type and DNA extraction method to capture eDNA from multiple trophic levels simultaneously (i.e. bacteria, phytoplankton, zooplankton, vertebrates).

Field and lab work are complete and data analysis and a draft manuscript are underway. Stanford is processing samples collected on an MBARI CANON cruise in fall 2015 to assess the spatial distribution of vertebrate eDNA across nearshore and offshore locations (Figure 9).

Our six-month time-series at station M1 in Monterey Bay (6 cruises,10 depths sampled per cruise from 0-200 m) has yielded very low/absent amplification for 12S mtDNA (vertebrate eDNA); we have provided aliquots of this time-series to MBARI who has successfully amplified phytoplankton and zooplankton eDNA.

To test if water volume is related to vertebrate eDNA concentration in offshore waters, our team collected and filtered 1-L, 10-L, and 100-L seawater samples at station M1 using tangential flow filtration (TFF).

We are comparing species richness and diversity across these volumes and to conventional vacuum filtration. We have processed these samples and may repeat this experiment in another location before finalizing our results.

The Stanford team is also comparing two library prep methods for NGS to determine whether this step should be standardized across the three MBON genetic teams. Results should be obtained in the next two months.

Stanford is assisting MBARI with setting up a bioinformatic pipeline to process and analyze NGS data from eDNA studies. USF and FWRI are testing parts of this system. This pipeline will provide a standardized data analysis framework for different gene markers used by the MBON genetic teams.

The USF/FKNMS genomics team has collected monthly samples in the Florida Keys near some of the major coral reefs. Samples are collected with help of the USF remote sensing group and scientists at the FKNMS during cruises on the *R/V Walton Smith* and on small boats.

Currently, USF/FKNMS collect three samples from surface and bottom at each of the three key MBON stations - resulting in 18 samples per cruise. We already have 198 samples from the three stations and an additional 286 samples from the surrounding ocean!

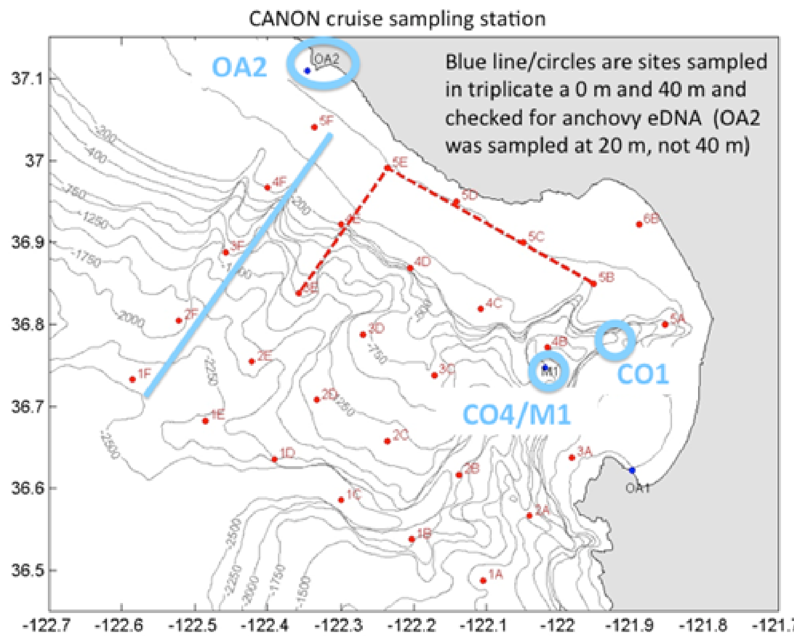


Figure 9. Fall 2015 CANON cruise sampling

The USF group has also collected samples for zooplankton morphological identifications, eDNA genomics, and for sequencing tissue of whole zooplankton communities. The goal is to ground truth the eDNA method for zooplankton and move forward to eventually use only eDNA to assess zooplankton diversity and seasonal oscillations in the Florida keys.

Morphological zooplankton identification is almost done and we plan to have the sequencing ready for the Genomics Team (USF, FWC, Stanford, and MBARI) meeting at MBARI on Feb.10-12. This will enable comparison of zooplankton data between the Florida Keys and Monterey Bay. At the meeting, the genomics teams will decide on a final method for sample collection and data analysis going forward.

X-MBON UPDATE

The X-MBON team submitted a proposal to the Group on Earth Observations Biodiversity Observation Network (GEO BON) to establish an international Thematic MBON. Discussions are underway with members of the Global Ocean Observing System (GOOS) Biological and Ecological Panel (GOOS BioEco Panel) to help formulate a set of practical Essential Ocean Variables with a biological and biodiversity focus. We are also looking for practical ways to support the UN's Convention of Biological Diversity (CBD).

Discussions at the GEO summit in Nov. 2015 in Mexico City led to the proposal by Mexico's Eduardo Santamaria (Universidad Autonoma de Baja California – UABC) for the development of a Pole-to-Pole MBON in the Americas (from the Arctic to Antarctica) under the aegis of Group of Earth Observations System of Systems for the Americas (AmeriGEOSS).

This initiative will serve as cornerstone for a global MBON. Partnership with GEO BON is an ongoing collaboration that includes the enhancement of the BON in a Box, an online resource which will provide access to tools for assessing biodiversity in the marine environment.

Canonico, Muller-Karger and Chavez are in discussions with Mike Gill and Nic Bax to see how the thematic MBON is presented at the next Convention on Biodiversity (CBD) Scientific, Technical, and Technological Advice (SBSTTA) meeting in April, in Montreal. Several Aichi Targets focus on coastal ocean and marine ecosystems given the very significant ecosystem services that these provide to people. These targets are difficult to achieve without a coordinated network of observing efforts across the biodiversity levels of the CBD, namely gene, species, and ecosystem.

COLLABORATIONS

The U.S. Geological Survey (USGS) , Esri, and a team of international experts are developing a new map of global ecological marine units (EMUs) using data from NOAA's World Ocean Atlas (2013) resource. The project lead Roger Sayer, USGS, and Maria Kavanaugh, WHOI, are discussing potential opportunities for data sharing and collaboration.

OUTREACH UPDATE

In December 2015, copy for the marinebon.org website was written and photos were selected. The website will be live prior to Ocean Sciences and will link to each of the MBON projects, as well as highlight the core research objectives and international activities. Potential taglines were developed and will be circulated for "voting" to select the preferred options. Graphic designers are also creating an MBON logo.

OCEAN SCIENCES ACTIVITIES

There are 20+ MBON posters and talks scheduled at Ocean Sciences in New Orleans. A list will be circulated. The **X-MBON project meeting is scheduled for Wed. Feb. 24, 10:00-12:00 in Room 201-202** (second floor) of the Morial Convention Center. For information contact Enrique Montes Herrera at: emontesh@mail.usf.edu

Reminder: Publications should acknowledge the support by NASA, through grant NNX14AP62A 'National Marine Sanctuaries as Sentinel Sites for a Demonstration Marine Biodiversity Observation Network (MBON)' funded under the National Ocean Partnership Program (NOPP RFP NOAA-NOS-IOOS-2014-2003803 in partnership between NOAA, BOEM, and NASA), the NOAA Integrated Ocean Observing System (IOOS) Program Office, the NOAA National Marine Fisheries Service, the NOAA Office of Exploration, and NOAA Oceanic and Atmospheric Research.

The MBON Project Update is written by team members and compiled/edited by CJ Reynolds. Send comments to: cjreynolds@usf.edu.
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