Marine BON Data Management

2016 May 3

Margaret O'Brien, Rob Bochenek, Matt Howard, Jenn Patterson

Outline

A. Individual updates

   a. Santa Barbara Channel - *Margaret O'Brien*

   b. Alaska - *Rob Bochenek*

   c. Sanctuaries - *Jenn Patterson*

B. Cross BON coordination - *Margaret O'Brien*

C. Prototype datasets - *Margaret O'Brien*

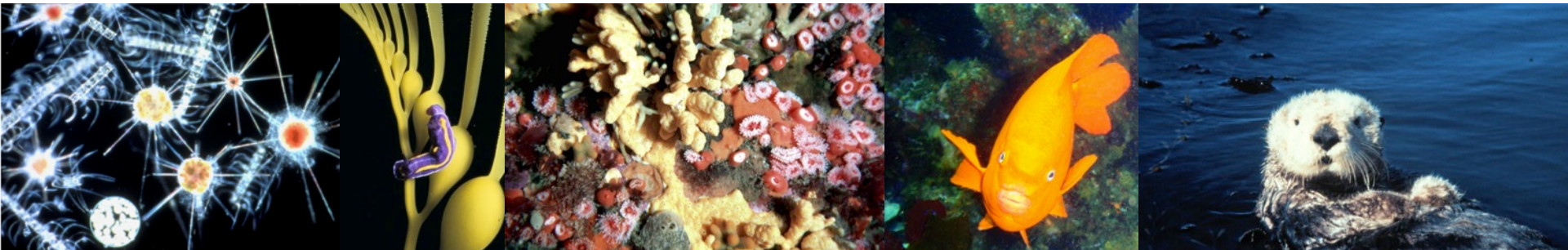
D. Prototype mapping tool - *Rob Bochenek*

E. Integration with environmental data - *Matt Howard*

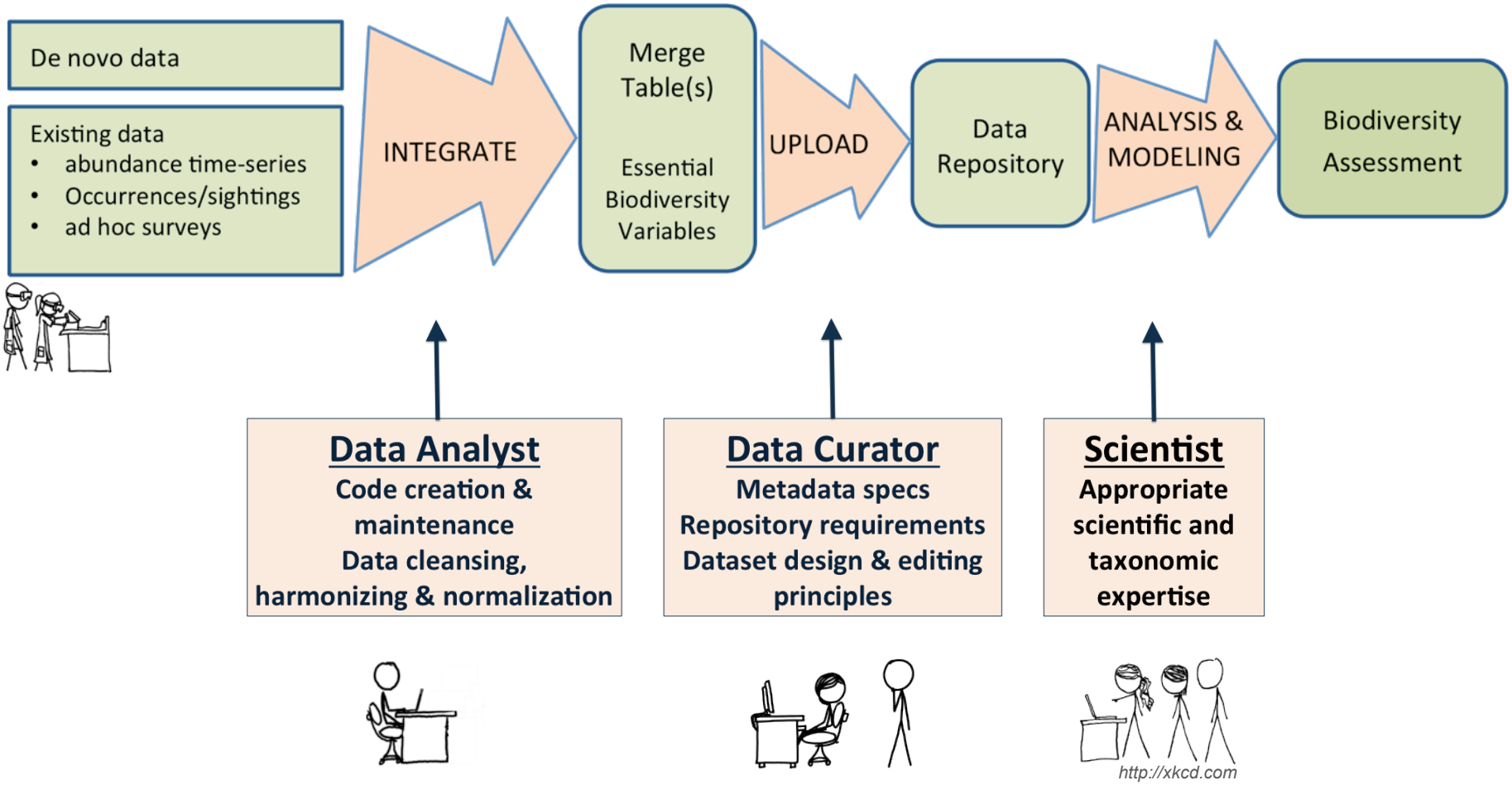
F. Biological data variables - *Margaret O'Brien (open discussion)*

Santa Barbara Channel Marine BON Data Management

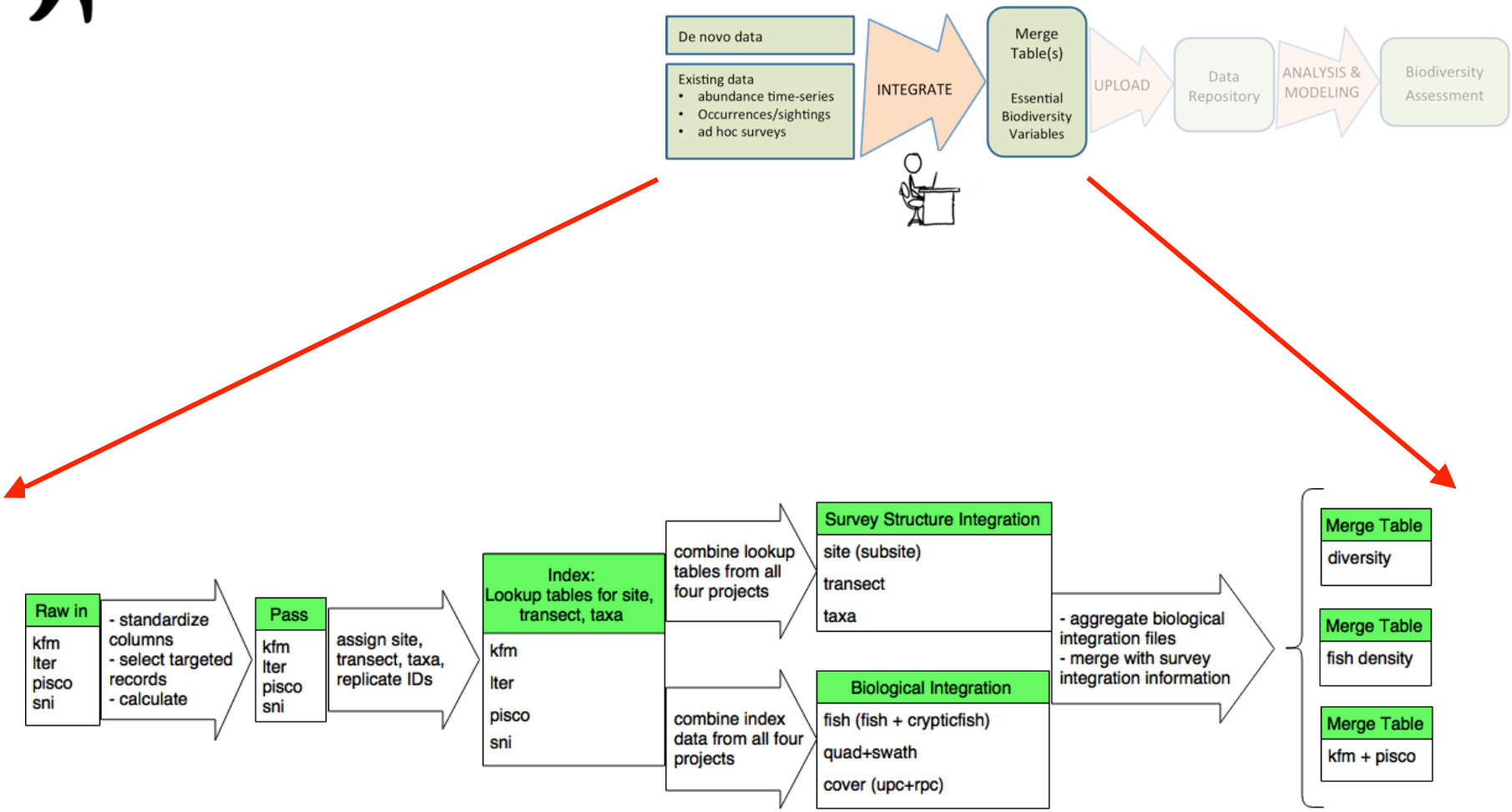
Margaret O’Brien



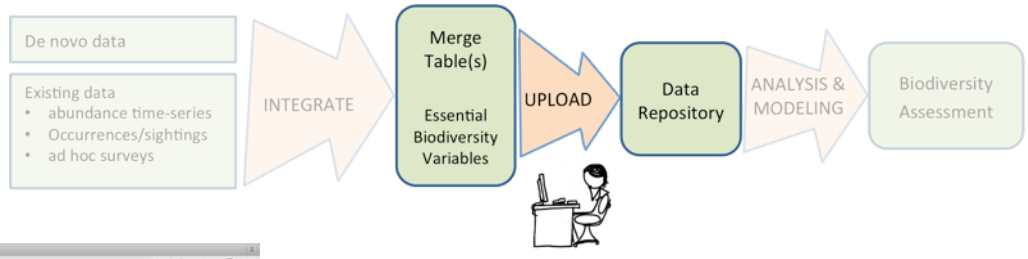
Santa Barbara Channel MBON

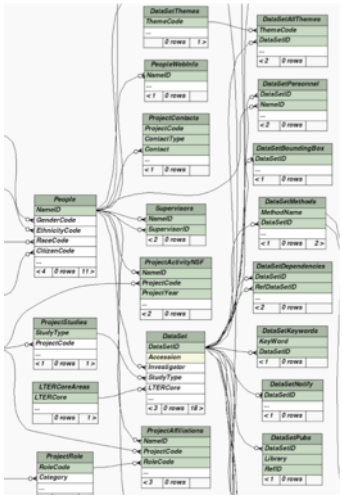


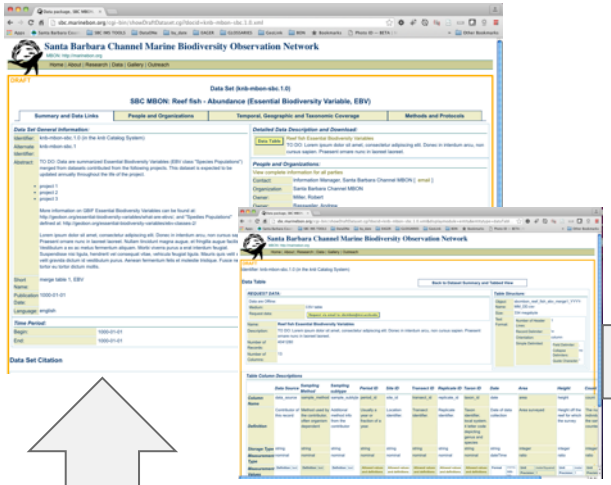
SBC MBON - Data Integration



SBC MBON - Data Cataloging





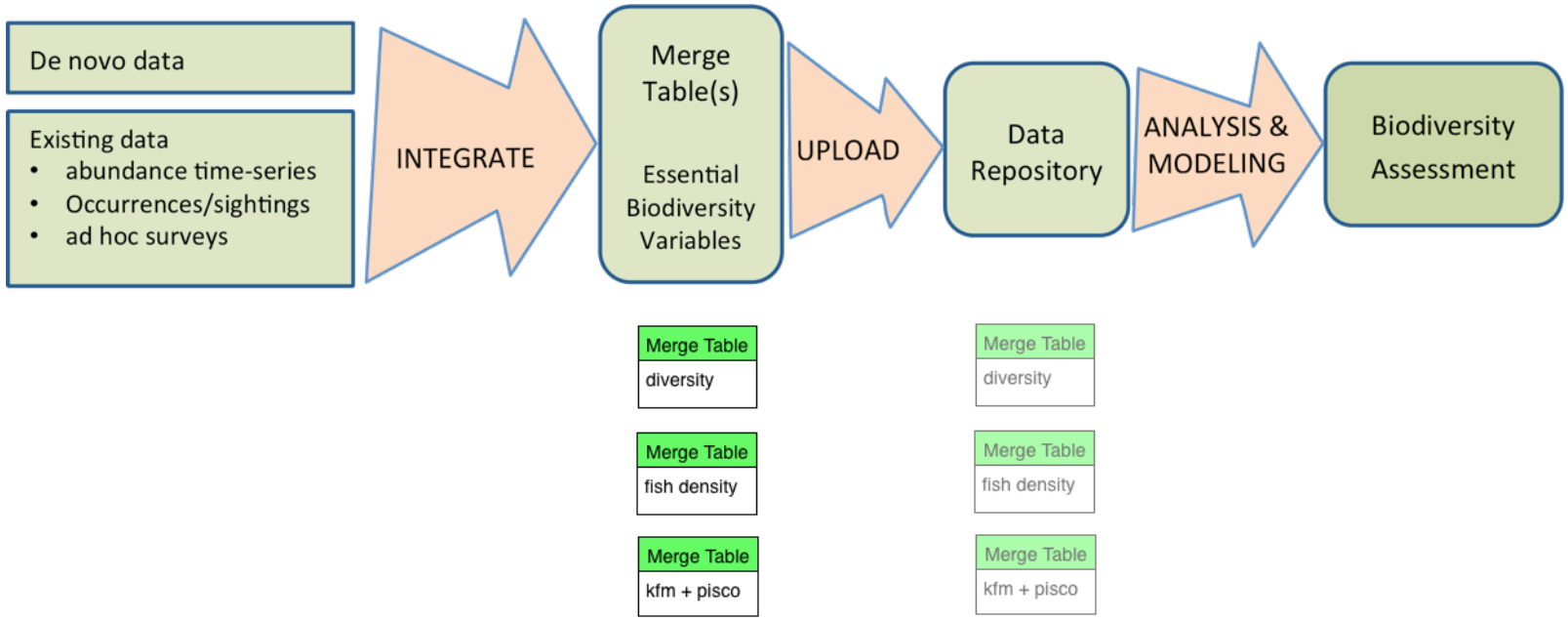


Repository features:

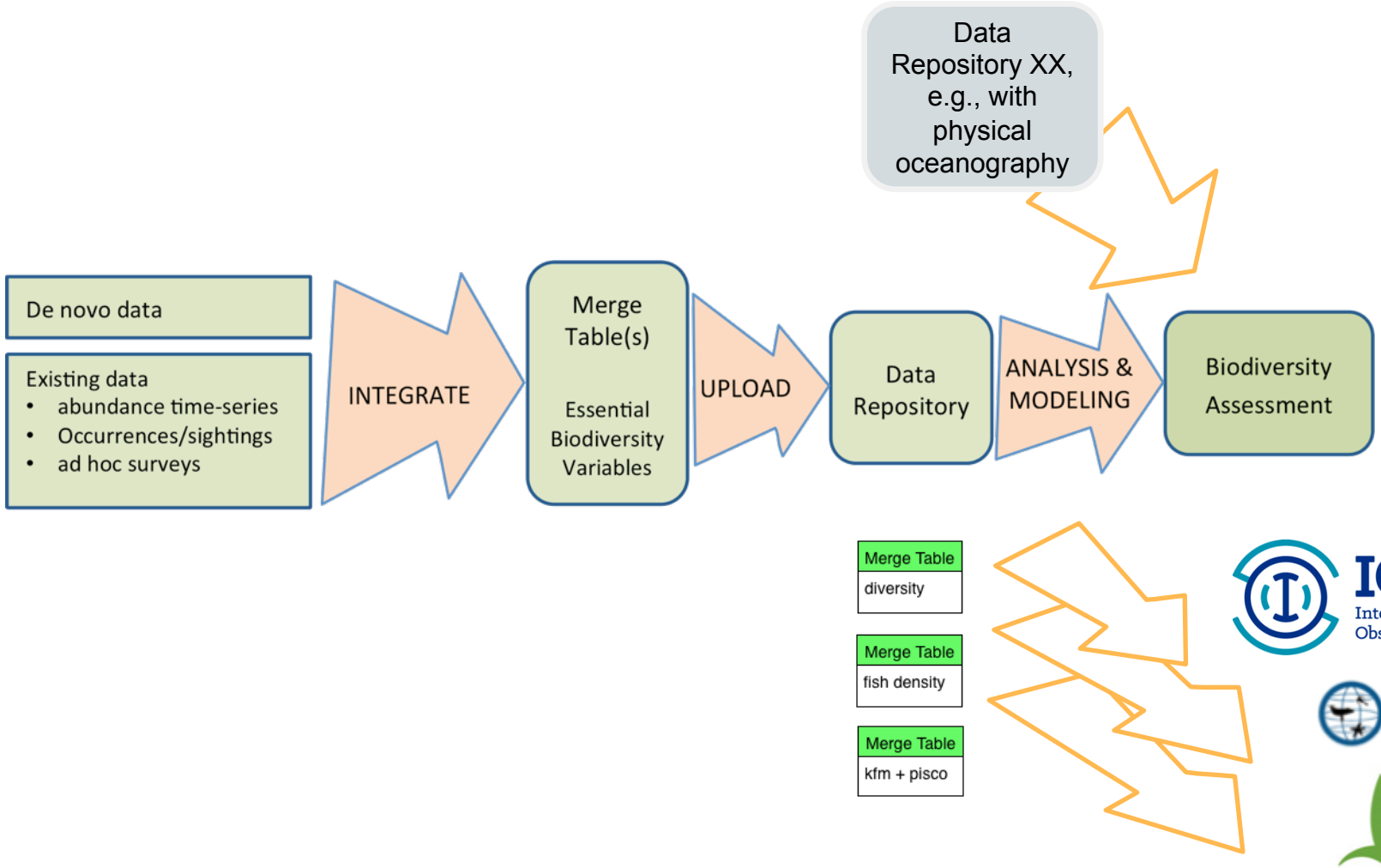
- Persistent identifiers
- Metadata specification
- Interoperability (or imminent)
- Community familiarity
- Funders' request

Merge Table
fish density

SBC MBON


De novo data
Existing data
• abundance time-series
• Occurrences/sightings
• ad hoc surveys
INTEGRATE
Merge Table(s)
Essential Biodiversity Variables
UPLOAD
Data Repository
ANALYSIS & MODELING
Biodiversity Assessment
Merge Table
diversity
Merge Table
fish density
Merge Table
kfm + pisco
Merge Table
diversity
Merge Table
fish density
Merge Table
kfm + pisco

SBC MBON

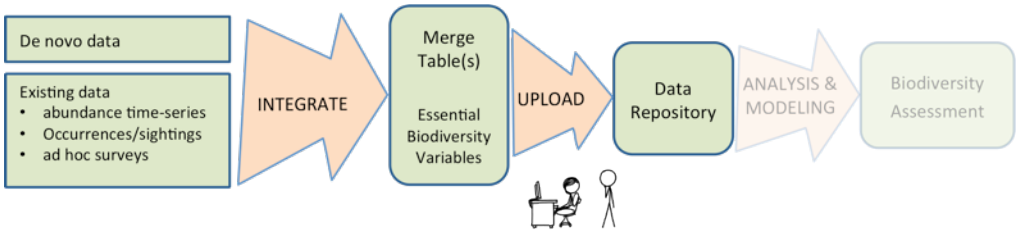


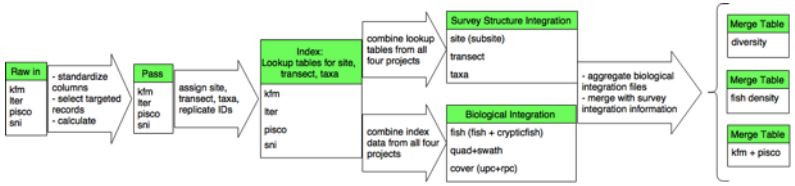
IOOS Integrated Ocean Observing System

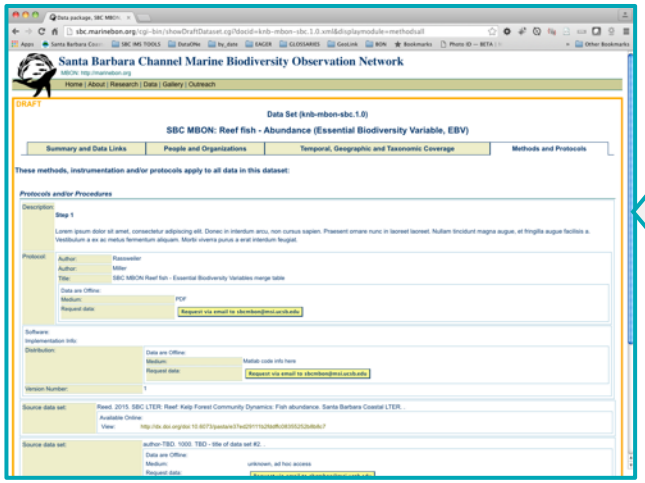
OBIS

GBIF www.gbif.org

SBC MBON - Provenance

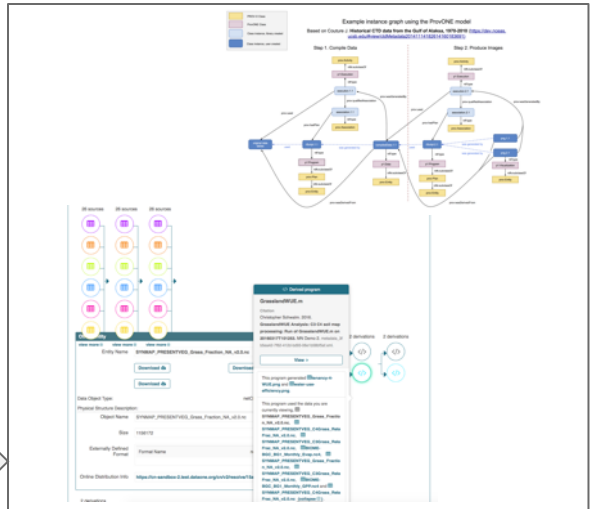






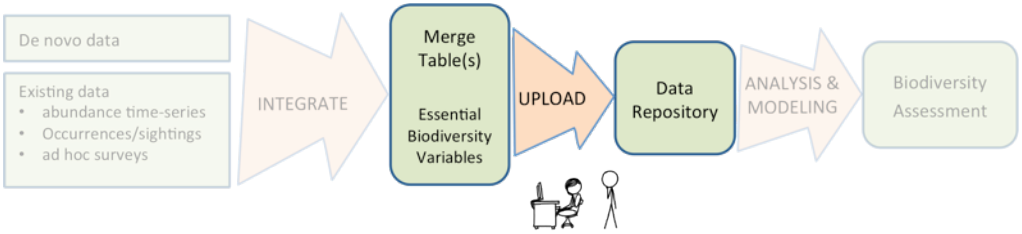
Initially: Descriptions of steps and code with metadata "Methods"

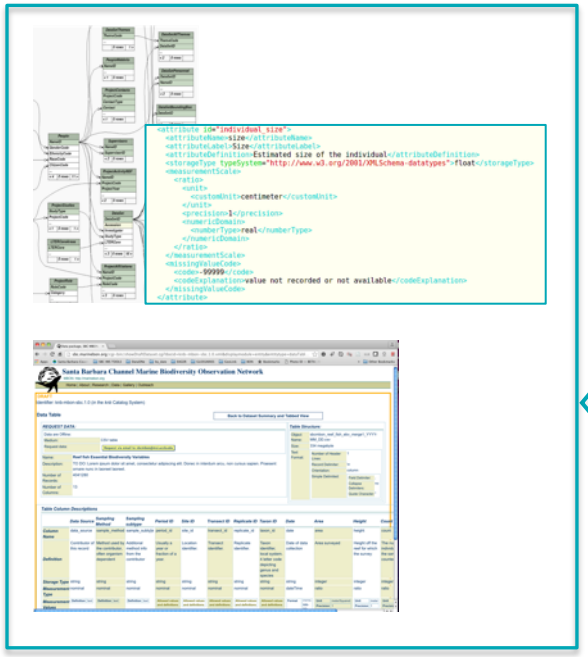
Ideally: Traceable provenance annotations



Credit: DataONE project (http:/datone.org)

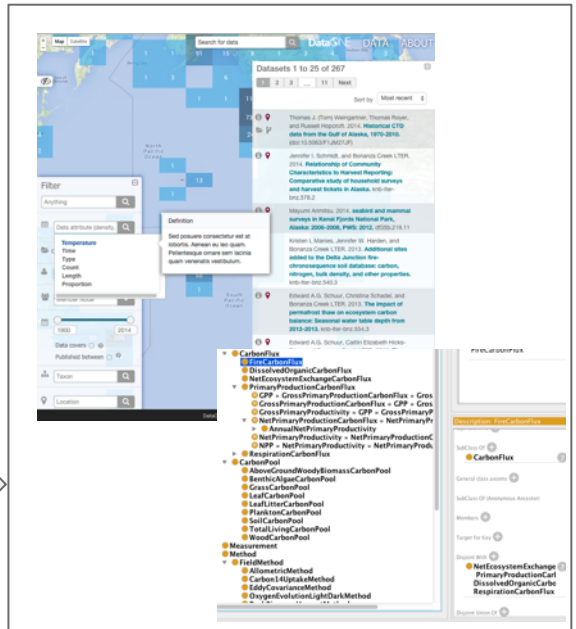
SBC MBON – Variables & Measurements





Initially: Variables in metadata, defined and controlled locally

Ideally: Variables defined and structured in a community vocabulary



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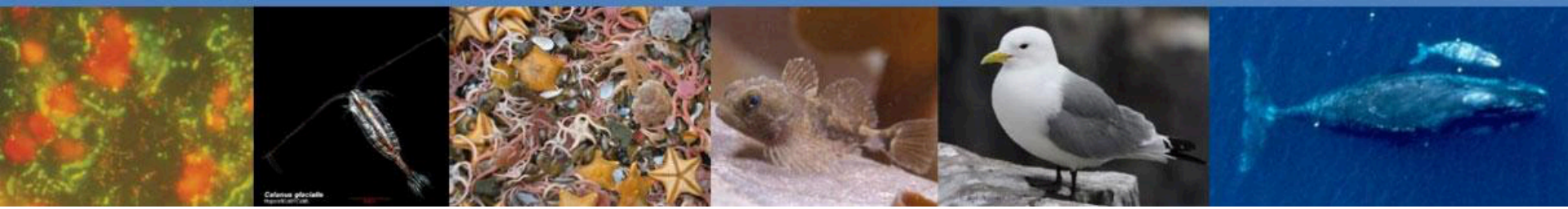
Arctic Marine Biodiversity Observation Network

Arctic biodiversity from microbes to whales

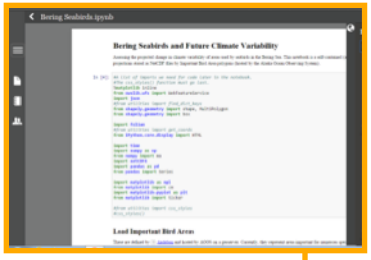


Arctic MBON- DMAC

Axiom
DATA SCIENCE

Rob Bochenek

Unstructured Data Lifecycle

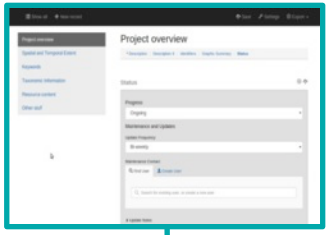


REUSE & TRANSFORMATION

Workspace Ipython (next gen) & biodiversity indices

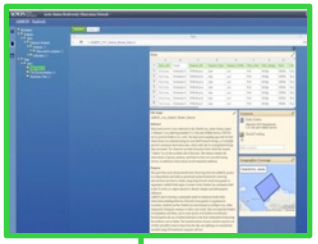
DATA CREATION & QUALITY CONTROL

Scientists



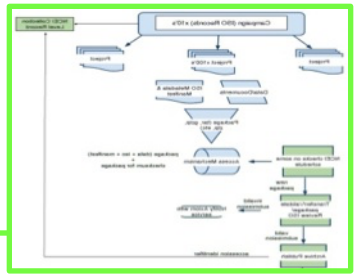
DATA DESCRIPTION

Metadata Editor



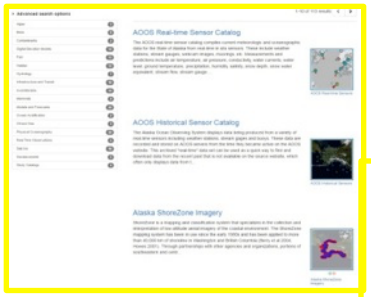
DATA STORAGE

Workspace



ARCHIVE & PRESERVATION

Repository submission pathway



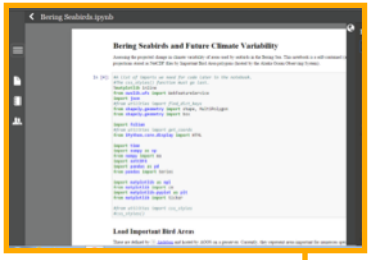
DATA ACCESS & DISCOVERY

Data portals & search catalogs

Axiom DATA SCIENCE

AOOS Alaska Ocean Observing System

Unstructured Data Lifecycle



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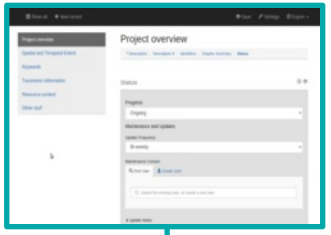
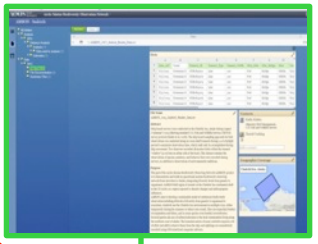


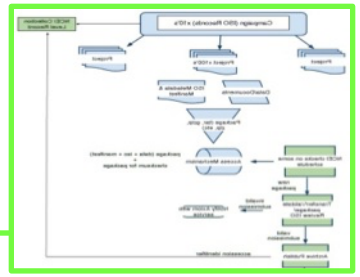
DATA DESCRIPTION

Metadata Editor



DATA STORAGE

Workspace



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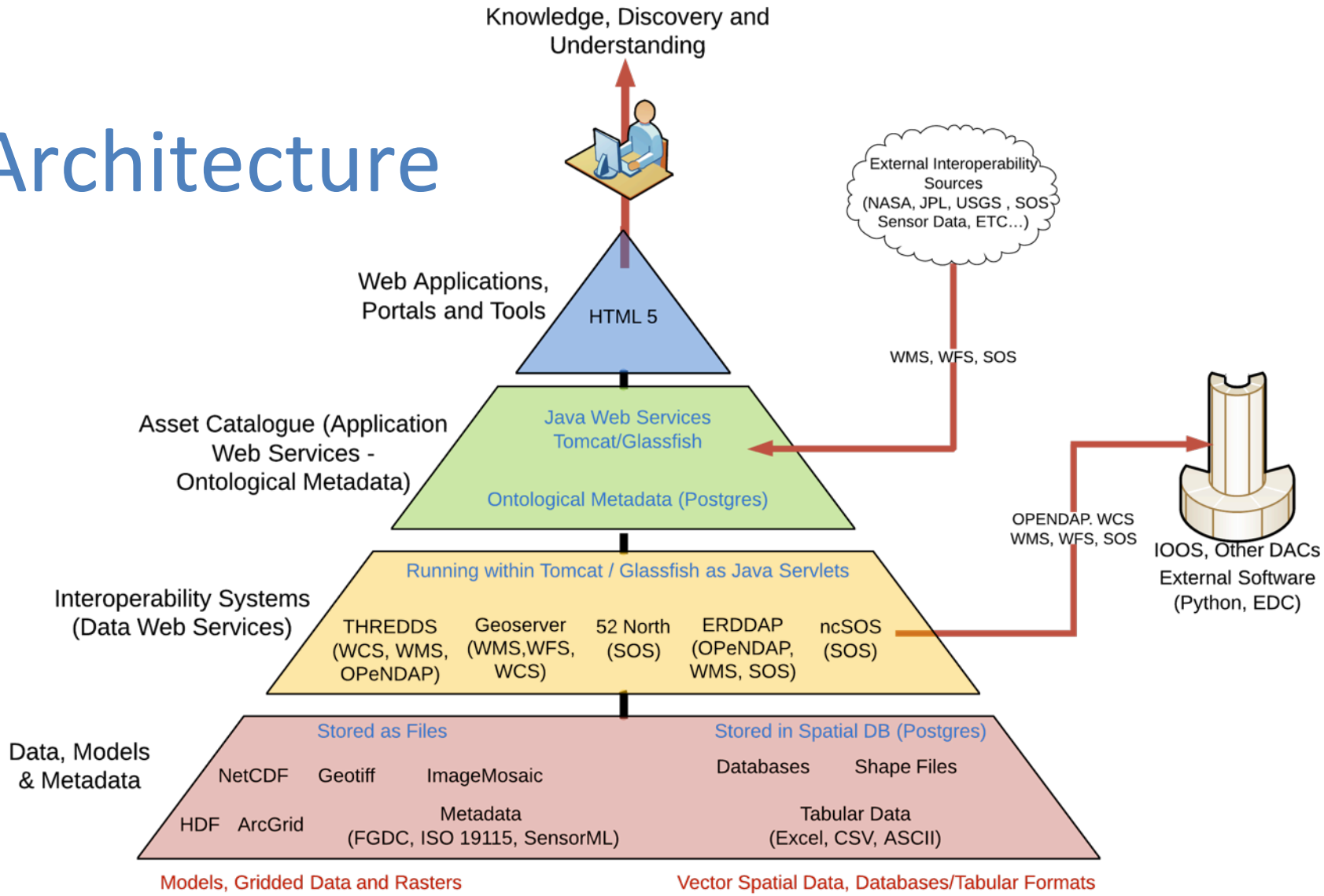
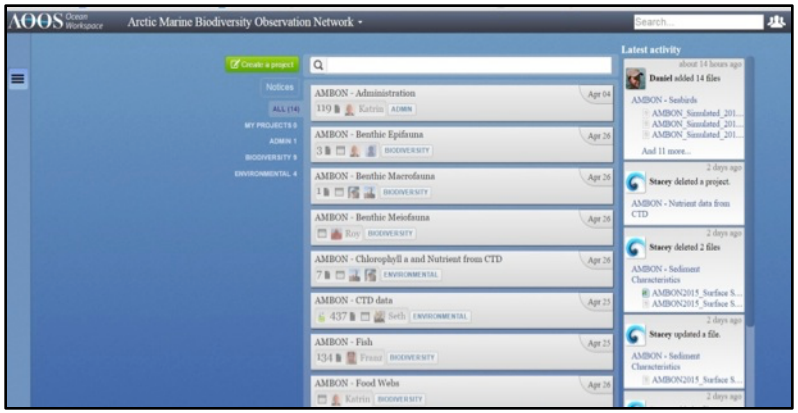
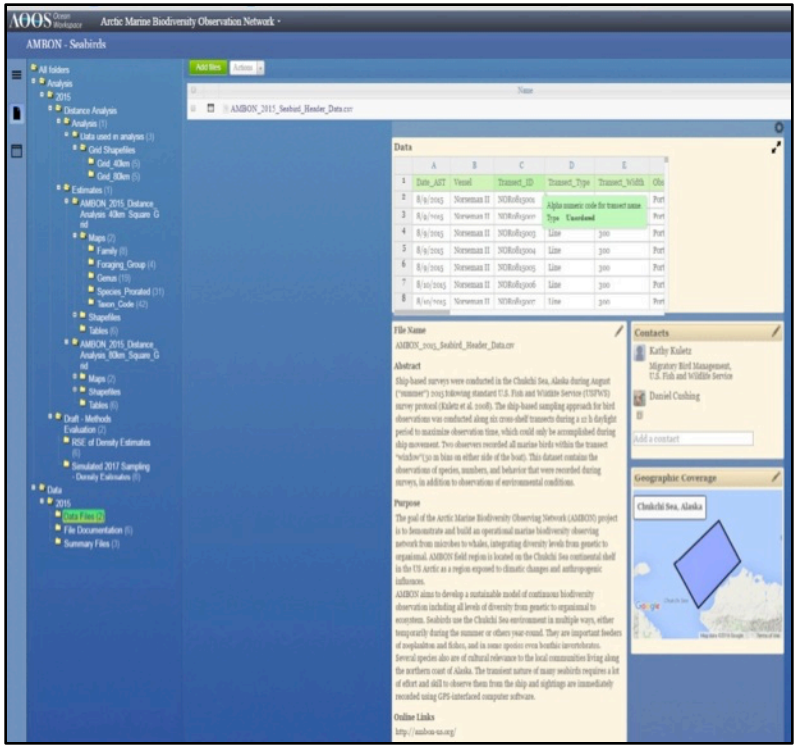
Architecture



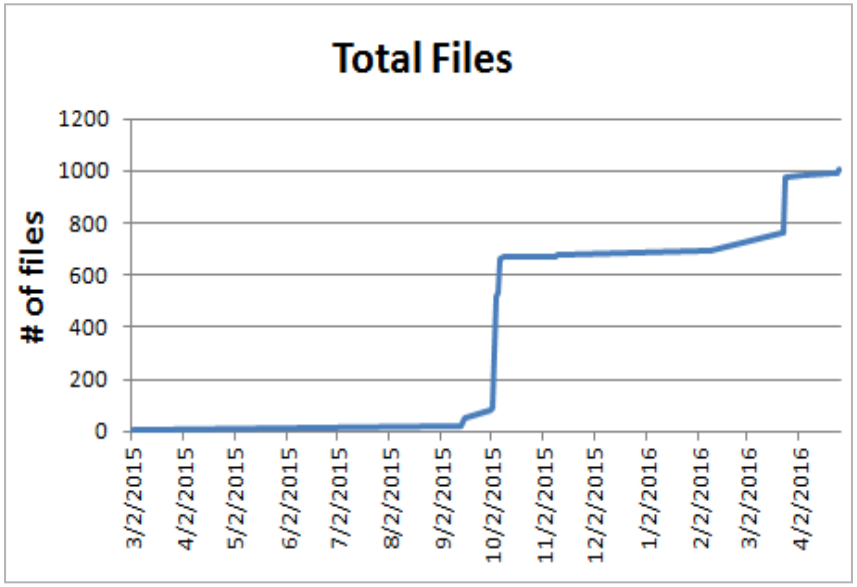
Research Workspace

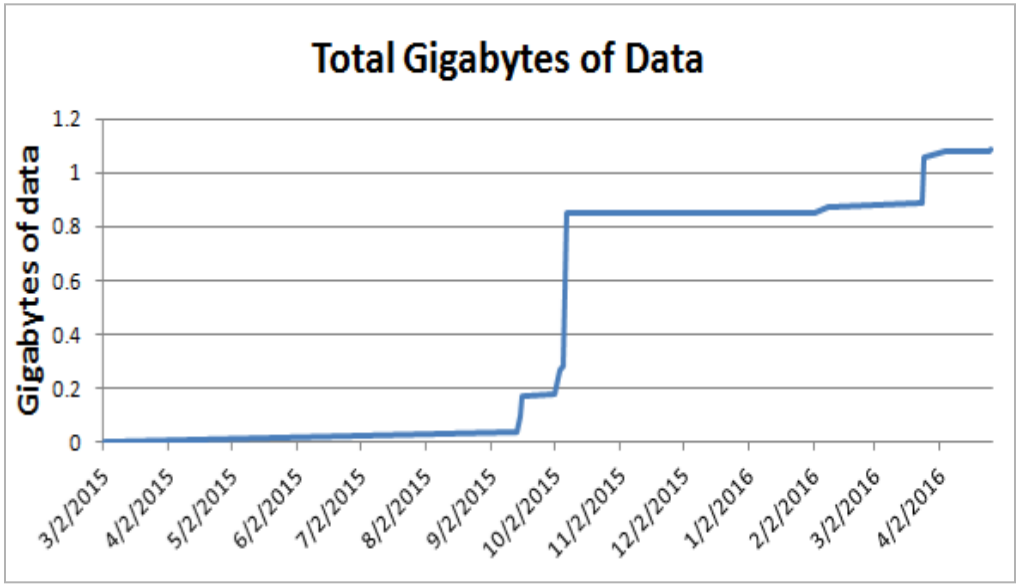
- ➢Facilitates research collaboration
- ➢Data sharing platform
- ➢Project management & file versioning
- ➢ISO-compliant metadata content
- ➢Publishes to public-facing AOOS search catalog





AMBON Workspace Status

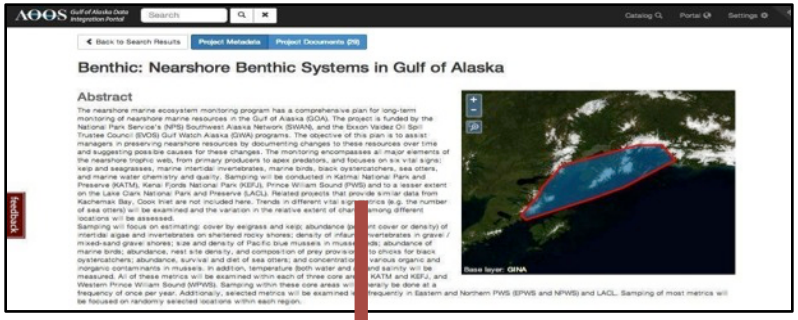


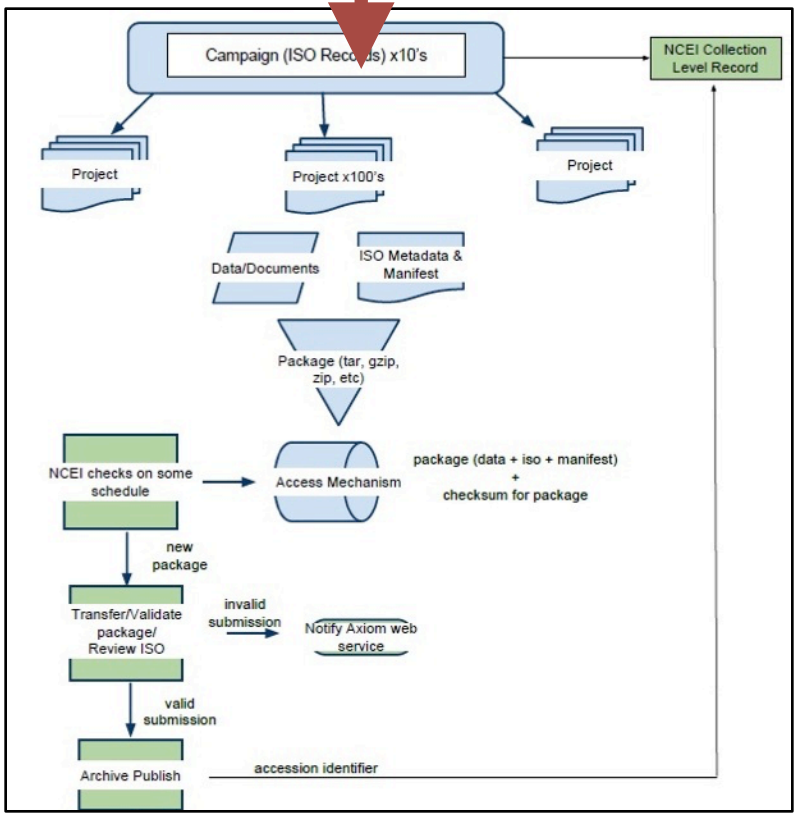


- Complete 2015 data available with metadata documentation : 7 projects (54%)
- Preliminary 2015 data analysis available: 6 projects (48%)

Data Discovery & Archive

- Workspace: gateway for public data sharing through AOOS Ocean Data Explorer (ODE)
- When ready, scientists can publish 2015 data to ODE & AMBON website
- Automated submission pathway under development to national data repositories (NCEI)





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Sanctuaries DMAC

Matt Howard
GCOOS

Jennifer Patterson
CeNCOOS

Rob Bochenek
Axiom

DMAC Objectives

Integrate Data, Information

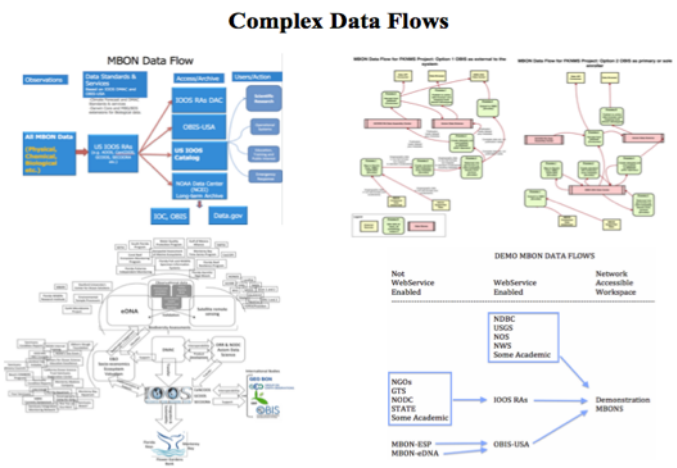
Design, Build, Deliver Products/Services

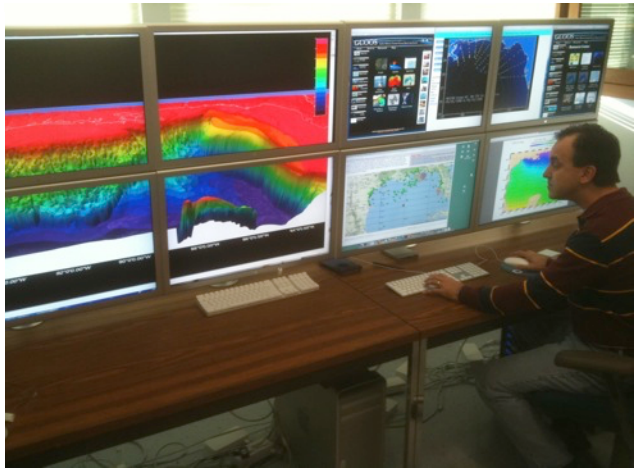
IOOS | Integrated Ocean Observing System

Data Management and Communications (DMAC)

Data Management Deliverables (from the proposal)

- Centralized Data Management Plan
- Inventory System for Satellite and *In Situ* Observations
- Aggregate Existing Resources
- Interactive Online Biodiversity Information System





Sanctuaries DMAC Data Management Plan

FK and MB Data Inventories

Community conventions - metadata, vocabularies...

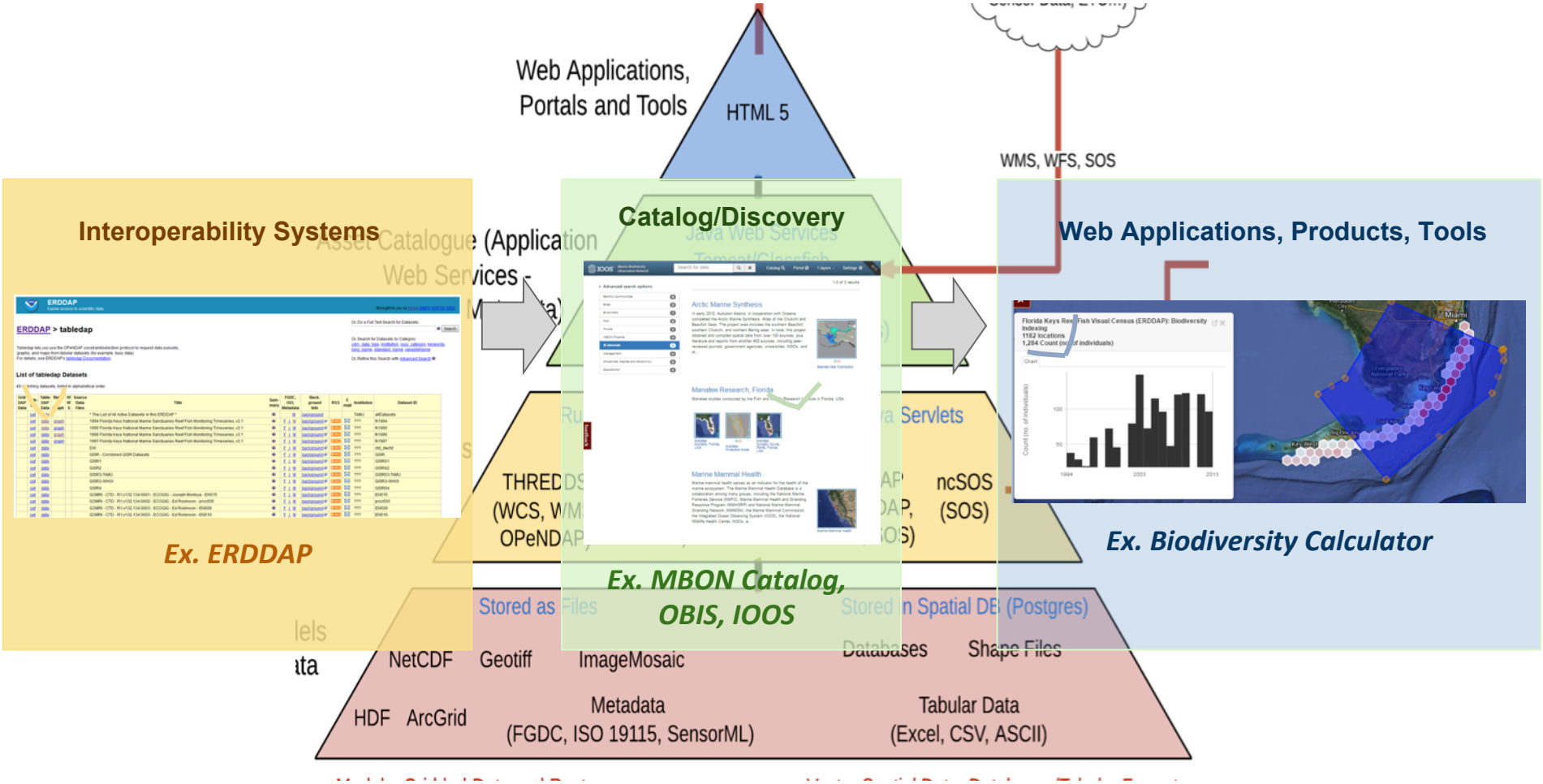
Data Sharing, Discovery, re-use

Path(s) to archive

Demonstration Data Sets

XBON Data Management Template

Sanctuaries DMAC Integration, Data Systems



Sanctuaries Interoperability Systems

Foundational Connection Layer

1) connect to: individual data sets, individual research project data

2) serve to: catalogs like MBON catalog, OBIS catalog, GeoBON, etc

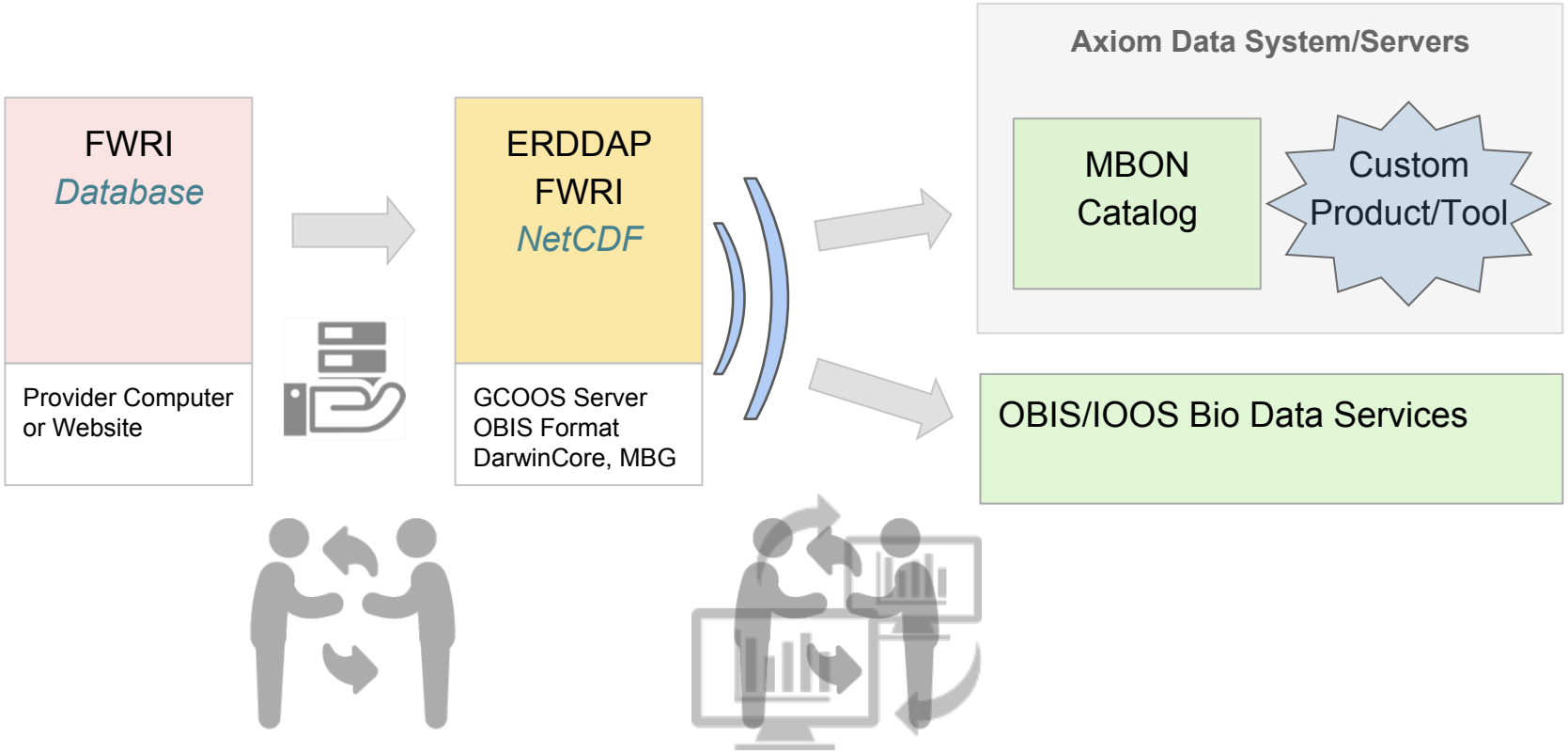
3) supply data to web applications

Learn more from Matt in our environmental data interoperability slides coming later

Sanctuaries Demonstration Data Set

Reef Fish Database

18 years Florida Reef Visual Census data



Sanctuaries - Next steps

Review demo data set integration and product

Continue Data Ingest and Integration Efforts

XBON Coordination - *summer workshop, updated data management plans*

Questions/Comments:
jpatterson@mbari.org

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B. Cross MBON data management coordination

Combined technical expertise:

- Commonly used metadata specs (*e.g., EML, ISO-19115*)
- Standards and practices for ecological dataset design (e.g., *from LTER*)
- Current NOAA practices and technologies (*e.g., Data Stewardship Maturity Matrix, OpenDAP*)
- Data cataloging & web application design, (*e.g., XSL transforms, map services*)

Active collaborations:

- IOOS Network - CeNCOOS, SCCOOS, AOOS, GCOOS
- National Marine Sanctuaries
- Earth Science Information Partners (ESIP)
- OBIS, Darwin Core Metadata group
- NSF-funded ecoinformatics projects (*DataONE, EarthCube, EML*)

B. Cross MBON data management coordination

Year 1-2

- Develop mappings and mechanisms for data transfer
- Common Data Portal – roadmap

Years 3

- Repository contributions planned (schedule, content, feasibility)
- Data portal: phase 1

Years 4-5

- Repository contributions implemented
- Data portal phase 2

To produce

IOOS Biological Core Variables - Species and Abundance

Fish, Phytoplankton, Zooplankton, Coral, Invertebrates, Marine mammals, Sea birds, Sea turtles, Submerged vegetation, Microbes

B. Cross MBON data management coordination

- Aligning Data Management Plans
  - Policies
  - Anticipated inventory
  - Community conventions - metadata, vocabularies
  - Data Sharing, Discovery, re-use
  - Long-term archive

- Workshop to align individual DM activities - Summer 2016
  - Objectives:
    - Outline needs of sample customer (e.g., NMS Condition Reports)
    - Compare local practices, constraints
    - Plan for measurement vocabulary

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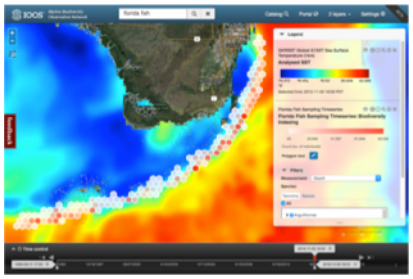
C. Prototype datasets

SBC:

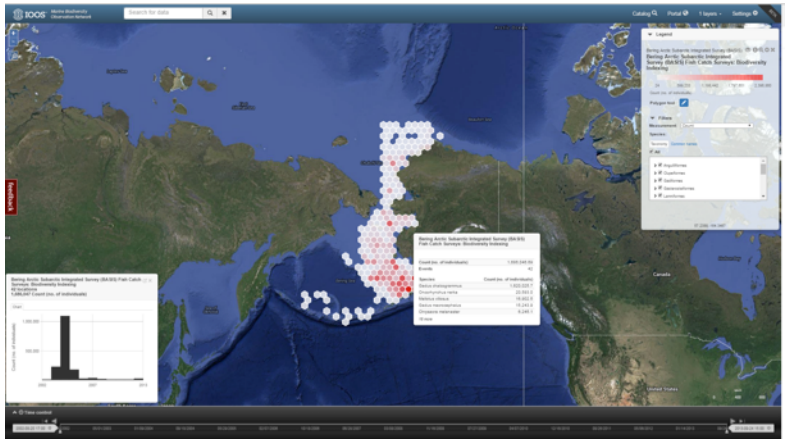
http://sbc.marinebon.org/cgi-bin/showDraftDataset.cgi?docid=knb-mbon-sbc.1.0.xml

http://sbc.marinebon.org/cgi-bin/showDraftDataset.cgi?docid=knb-mbon-sbc.2.0.xml

Florida/Monterey:



BASIS:



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D. Demonstration of prototype MBON tool

Florida Keys Reef Fish Visual Census: Biodiversity Indexing

MBON Data Catalog

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E. Plans for Integrating Environmental Data

Acquire Existing Data Products

Biodiversity data from NOAA National Marine Sanctuaries
Key indicator groups, satellite and *in situ* data observations (T, Chl-a, PAR)
Ocean circulation models Time series from GCOOS/CenCOOS
Citizen Scientist Habitat Maps, GAME, etc. Satellite Data
Historical fisheries and oceanographic observations back to the 1940s

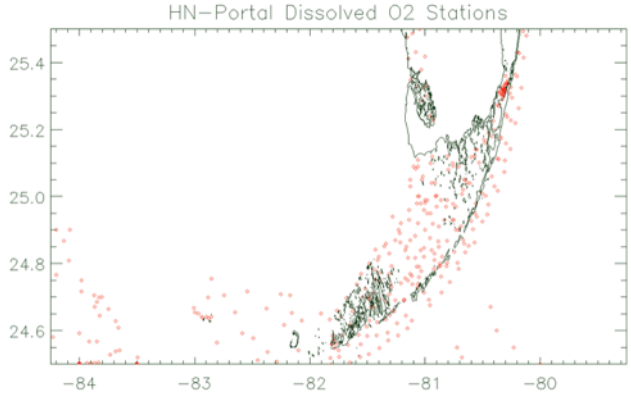
Data Partners

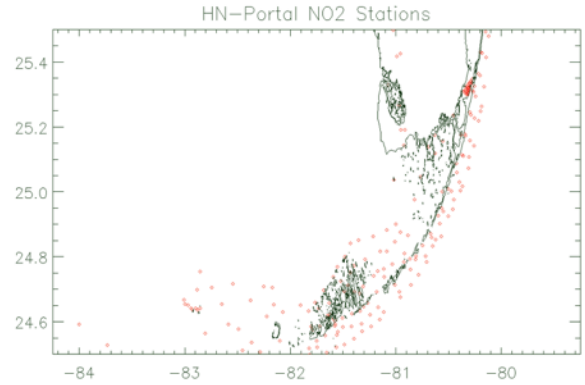
IOOS OBIS-USA CENCOOS GCOOS AOML MyFWC

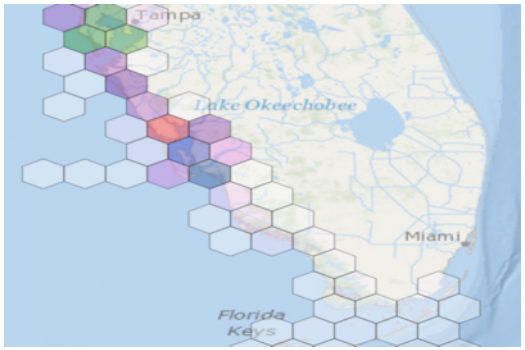
Title	Region	Variables
Coral reef diversity time series data	fk	bio
Environmental DNA	both	bio
shore stations	both	all
buoys, NDBC and other	both	all
glider	both	all
satellite-chl	both	bio
satellite- sst	both	phys
satellite- altimetry	both	phys
satellite- near coastal winds	both	phys
satellite- salinity	both	phys
climatology, regional scale	both	phys
AOML South Florida Program (SFP)	fk	all
AOML biomonthly interdisciplinary, 1995-2012	fk	all
River flow, USGS	both	phys
USF oceanographic observations	fk	all
NOAA's shallow-water benthic coral reef habitat maps	fk	phys
Fish and Wildlife Specimen Information System, FWC SIS	fk	bio
FWC Fisheries Independent Monitoring (FIM)	fk	bio

Florida Keys NMS Water Quality Data

Biological Research Associates
Charlotte Harbor National Estuaries Program
City of Sanibel Natural Resources Department
Collier County Coastal Zone Management Department
Collier County Pollution Control
Dade Environmental Resource Management
FDEP Charlotte Harbor Aquatic/Buffer Preserves
FDEP Water Quality Standards and Special Projects
FDEP Watershed Assessment Section (WAS)
FL Dept of Environmental Protection / Bream Fisherman Assoc.
FL Dept. Environmental Protection / Southwest District
FL Dept. of Environmental Protection / South District
FL Dept. of Environmental Protection/ OCEC
Florida Fish & Wildlife C C / Marine Research Institute
Florida Fish and Wildlife Conservation Commission
Hillsborough County Environmental
PROJECT COAST - Southwest Florida Water Management District
Peace River Manasota Regional Water Supply Authority (FL)
Pinellas County Dept. of Environmental Management
Sanibel Captiva Conservation Foundation
Sarasota County Environmental Services
South Florida Water Management District
Southwest Florida Water Management District
Tampa Bay Water
The Conservancy of Southwest Florida
USGS Florida Water Science Center







Item	Count	Remarks
Organizations	80	Organizations or departments that reported data to a repository.
Platforms	285,391	Distinct locations where data were collected.
Variable: Chlorophyll	55,889	Chlorophyll-a concentration (mg L-1).
Variable: Dissolved Oxygen	785,554	Dissolved oxygen concentration (mg L-1).
Variable: Enterococcus	244,727	Enterococcus bacteria (counts).
Variable: Fecal coliform	155,654	Fecal coliform bacteria (counts).
Variable: Nitrogen	44,086	Nitrogen (nitrite, nitrate, ammonia and organic nitrogen) concentration (mg L-1) as N.
Variable: pH	6,381,872	Measure of the acidity or basicity of a water sample.
Variable: Phosphorus	107,304	Dissolved Total Phosphorus concentration (mg L-1).
Variable: Salinity	5,937,533	Measure of salt content following UNESCO standards.
Variable: Water temperature	6,146,860	In situ water temperature measured in degrees Celsius.
Variable: Silicate	47,767	Silicate concentration (uM L-1).
Total observation records	**19,907,246**	

Geographic Information System (GIS) Data

Florida Fish and Wildlife Conservation Commission
Florida Fish and Wildlife Research Institute
GIS & Mapping Data Downloads

Florida Fish and Wildlife Conservation Commission ArcGIS

ArcGIS REST Services Directory — Login | Get Token

Home > services > MBON > MBON_FKNMS (MapServer) — Help | API Reference

JSON | SOAP | WMS

MBON/MBON_FKNMS (MapServer)

View In: ArcGIS JavaScript ArcGIS.com Map Google Earth ArcMap ArcGIS Explorer

View Footprint In: ArcGIS.com Map

Service Description: Marine Biodiversity Observing System (MBON) Florida Keys National Marine Sanctuary (FKNMS) Biodiversity is most simply defined as the number of different organisms or types of organisms that are found in a specific geographic region. However, the number of different organisms is not the only key to biodiversity since different ecosystems will vary not only in numbers of species but in the abundance and composition of their communities. In this sense it is the preservation of the characteristic biodiversity of an ecosystem that is important. Given the likelihood of growing pressures on resources due to climate change and societal problems in the future, one challenge is to establish an accurate biodiversity baseline by which we can monitor changes. This map service serves as the FKNMS group's online data repository for project planning associated with MBON. NOAA's National Marine Sanctuaries system. NOAA-NOS-IOOS-2014-2003803.

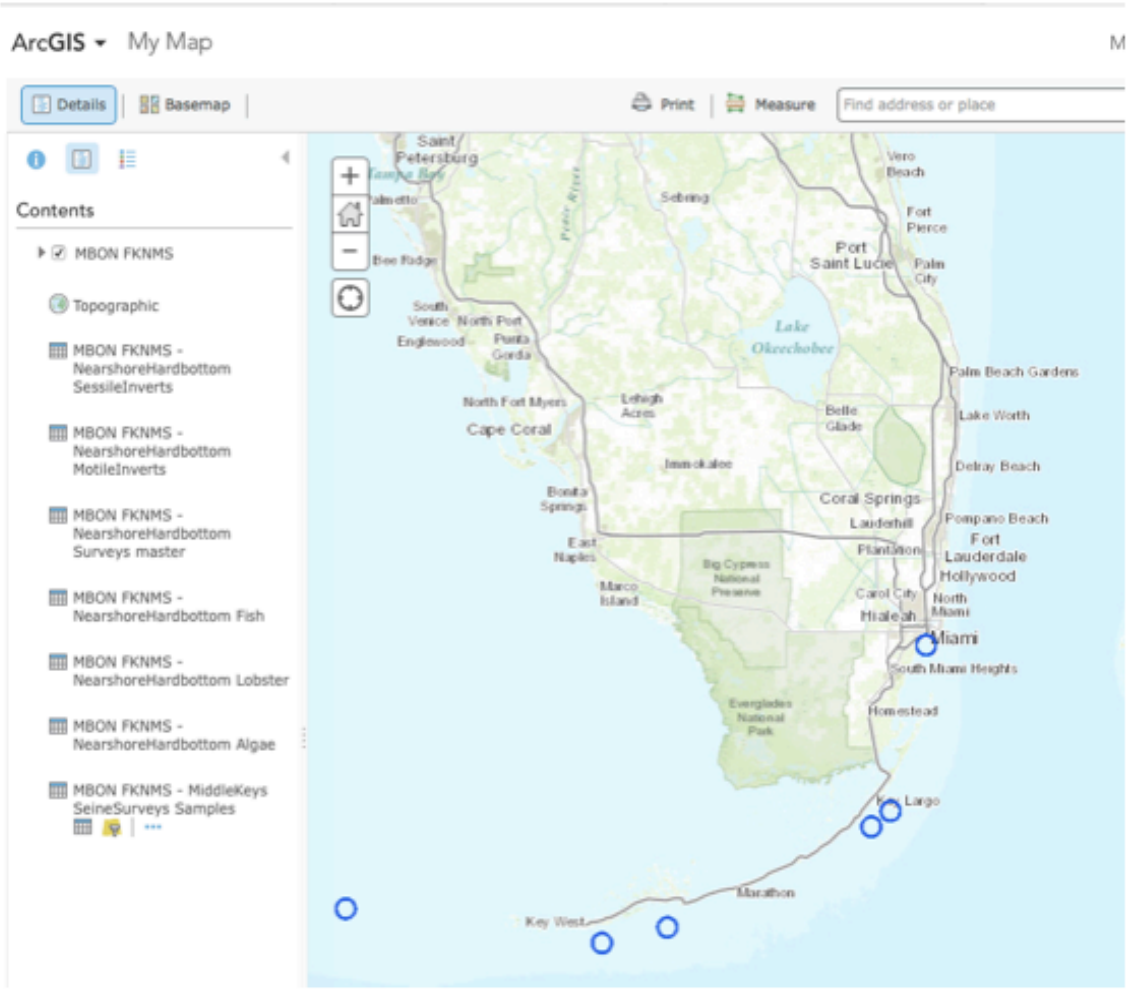
Map Name: Layers

Legend

All Layers and Tables

Layers:

- 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)
- Middle Keys Nearshore Hardbottom Survey (10)
- FIM Inshore SFL Subset (11)
- FIM Offshore Tortugas (12)
- FIM Middle Keys Seine Surveys Sample Locations (13)
- FKNMS Observed Fish Aggregations (14)
- Recent HAB Events (2013-2015) (15)
- Terrapin Observation Locations in Florida (16)
- Manatee Synoptic Survey (17)
- 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)
- National Benthic Inventory (NBI) (23)
- Water Quality STORET EPA FL (24)
- Proposed Sites (25)
- Unified Florida Reef Tract Benthic Habitat (26)
- Seagrass Florida (27)
- Saltwater Marsh Florida (28)
- Tidal Flats Florida (29)
- Coral Hardbottom (30)



http://ocean.floridamarine.org/arcgis/rest/services/MBON/MBON_FKNMS/MapServer

FWRI Data Layers http://myfwc.com/research/gis/

Name	Habitat	Category
Boundary		
National Parks	Estuary, Nearshore,Offshore	Boundaries
FL State Parks	Estuary, Nearshore,Offshore	Boundaries
Aquatic Preserves	Estuary, Nearshore,Offshore	Boundaries
FL Research Reserves	Estuary, Nearshore,Offshore	Boundaries
FL Aquatic Preservers	Estuary, Nearshore,Offshore	Boundaries
FKNMS 2001 No Land Poly	Nearshore, Offshore	Boundaries
Managed Areas FL	Nearshore, Offshore, Terrestrial	Boundaries
Water		
Karenia brevis Sampling 2013-2014	Estuary, Nearshore	Water Quality
Walton Smith Stations	Nearshore	Water Quality
SECOORA In Situ Observation Stations	Nearshore	Water Quality
EPA Water Quality Monitoring (STORET)	Estuary, Nearshore	Water Quality
National Data Buoy Center Observations	Nearshore, Offshore	Water Quality
LMR		
Water Bird Colonies	Estuary, Nearshore	Birds
FWC FIM Sampling (GAME)	Estuary, Nearshore	Fish/Inverts
Reef Visual Census SpRich 1980-2010	Nearshore	Fish
Reef Visual Census Abundance 1980-2010	Nearshore	Fish
Manatee Synoptic Survey Sightings Florida 1991 to 2014	Estuary, Nearshore	Marine Mammal
Acropora Presence/Absence Locations South FL	Nearshore	Reef
Observed Fish Aggregations	Nearshore	Fish
Atlas of amphibians and reptiles in Florida	Estuary, Nearshore	Amphibians and Reptiles
Marsh Bird 2012 Observations in Florida	Estuary	Birds
FL Fish, rare, and imperiled species	Estuary	Fish
Sea Turtle Nesting Beaches Florida	Estuary	Amphibians
Terrapin Observation Locations in Florida	Estuary	Amphibians
FL Beach Nesting Birds 2005-2010	Estuary	Birds
Marine Industry Group Species Layers?	Estuary, Nearshore, Offshore	
Habitats		
Reef Track	Estuary, Nearshore	Benthic
SECOORA Coral Mounds	Nearshore	Reef
SECOORA Artificial Reefs	Nearshore	Reef
FWC Patch Reef Survey Locations	Nearshore	Reef
Corarl HardBottom	Estuary, Nearshore	Reef
Mangroves Florida (from Landuse)	Estuary	Landcover
Saltwater Marsh Florida (from Landuse)	Estuary	Landcover
TidalFlats Florida (from Landuse)	Estuary	Landcover
National Benthic Inventory (NBI)	Estuary, Nearshore	Benthic
South Florida Water Management District (Landuse)	Estuary	Landcover
FL Seagrass Cover	Estuary, Nearshore	Seagrass
Coral Reef Evaluation Monitoring Project (CREMP)	Nearshore	Coral

ERDDAP/TDS - Human & M2M Access to Numbers

ERDDAP
Easier access to scientific data

ERDDAP > List of All Datasets

Pick a Dataset

68 matching datasets, listed in alphabetical order.

Grid DAP Data	Sub-set	Table DAP Data	Make A Graph	W M S	Source Data Files	Title
	set	data				* The List of All Active Datasets in this ERDDAP *
	set	data	graph			1994 Florida Keys National Marine Sanctuaries Reef Fish Monitoring Timeseries, v3.1
	set	data	graph			1995 Florida Keys National Marine Sanctuaries Reef Fish Monitoring Timeseries, v3.1
	set	data	graph			1996 Florida Keys National Marine Sanctuaries Reef Fish Monitoring Timeseries, v3.1
	set	data	graph			1997 Florida Keys National Marine Sanctuaries Reef Fish Monitoring Timeseries, v3.1
	set	data	graph			1998 Florida Keys National Marine Sanctuaries Reef Fish Monitoring Timeseries, v3.1
	set	data	graph			1999 Dry Tortugas National Marine Sanctuaries Reef Fish Monitoring Timeseries
	set	data	graph			1999 Florida Keys National Marine Sanctuaries Reef Fish Monitoring Timeseries, v3.1
	set	data	graph			2000 Florida Keys National Marine Sanctuaries Reef Fish Monitoring Timeseries, v3.1
	set	data	graph			2001 Florida Keys National Marine Sanctuaries Reef Fish Monitoring Timeseries, v3.1
	set	data	graph			2002 Florida Keys National Marine Sanctuaries Reef Fish Monitoring Timeseries, v3.1
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	set	data	graph			2004 Florida Keys National Marine Sanctuaries Reef Fish Monitoring Timeseries, v3.1
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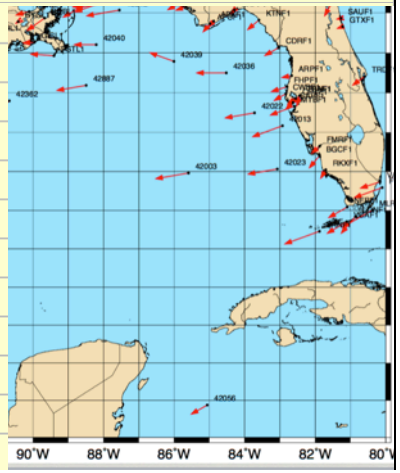
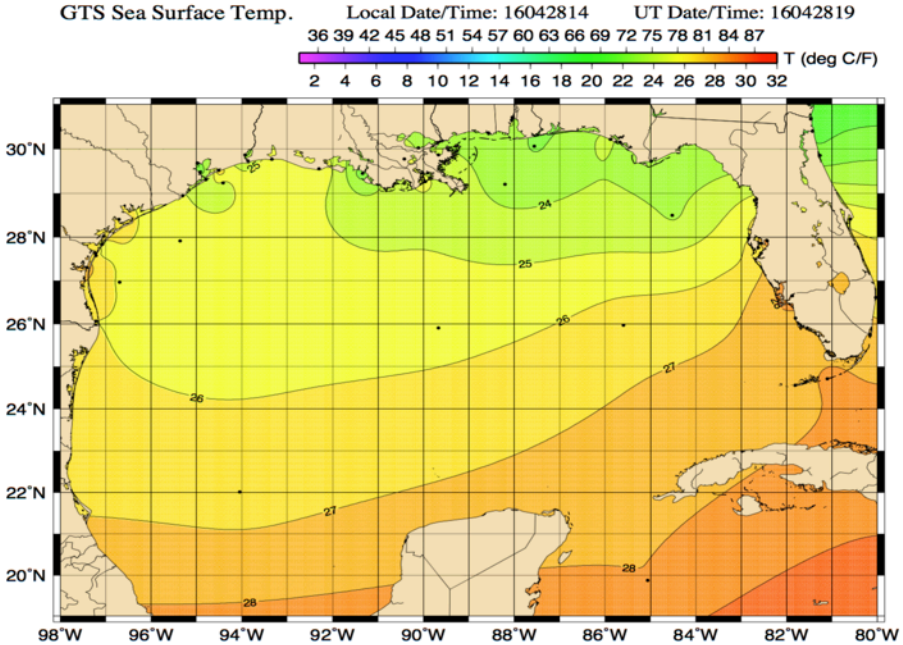
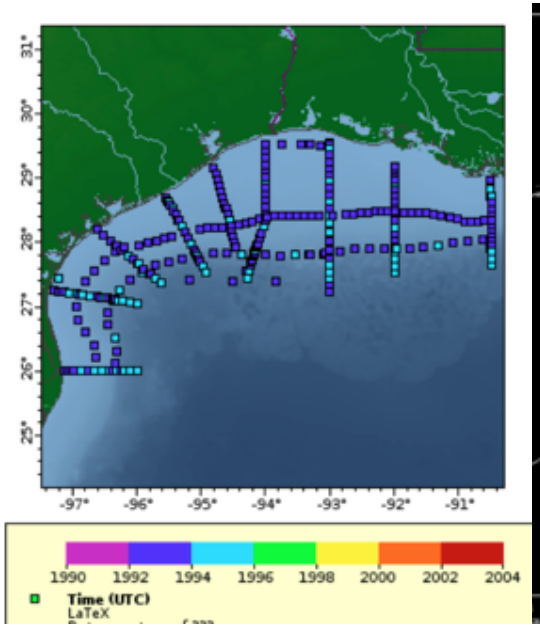
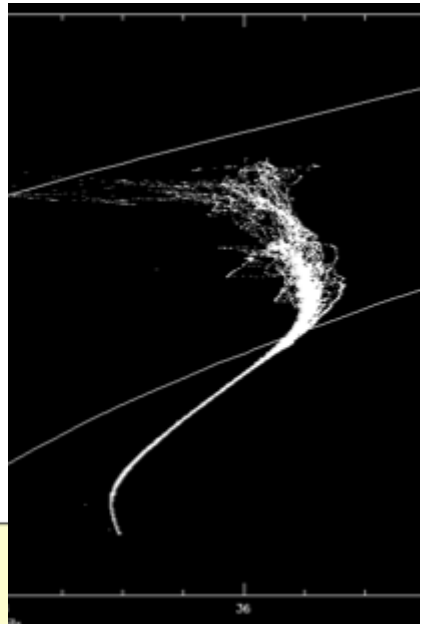
	set	data	graph			2009 Florida Keys National Marine Sanctuaries Reef Fish Monitoring Timeseries, v3.1
	set	data	graph			2010 Florida Keys National Marine Sanctuaries Reef Fish Monitoring Timeseries, v3.1
	set	data	graph			2011 Florida Keys National Marine Sanctuaries Reef Fish Monitoring Timeseries, v3.1
	set	data	graph			2012 Florida Keys National Marine Sanctuaries Reef Fish Monitoring Timeseries
	set	data	graph			2014 Florida Keys National Marine Sanctuaries Reef Fish Monitoring Timeseries
						CAGES Florida Bottom Type
						CAGES Florida Bottom Vegetation
						CAGES Florida Bycatch
						CAGES Florida CPUE
						CAGES Florida Habitat
						CAGES Florida Hydrological
						CAGES Florida Lengths
						CAGES Florida Physical
						CAGES Florida Shore Type
						CAGES Florida Species
						CAGES Florida Stations
						CAGES Florida Trawls



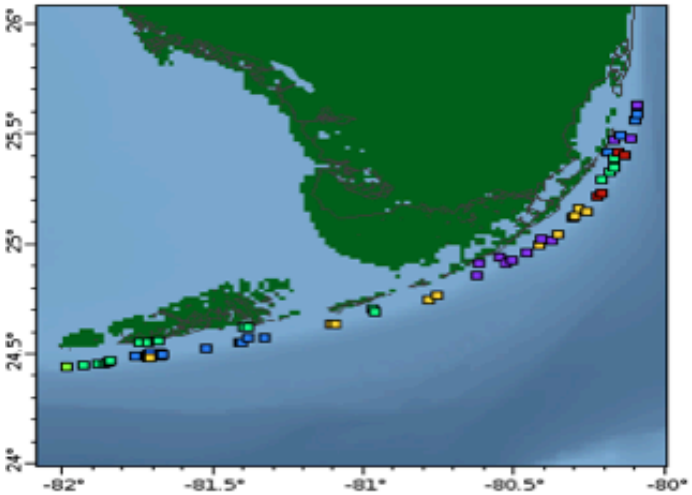






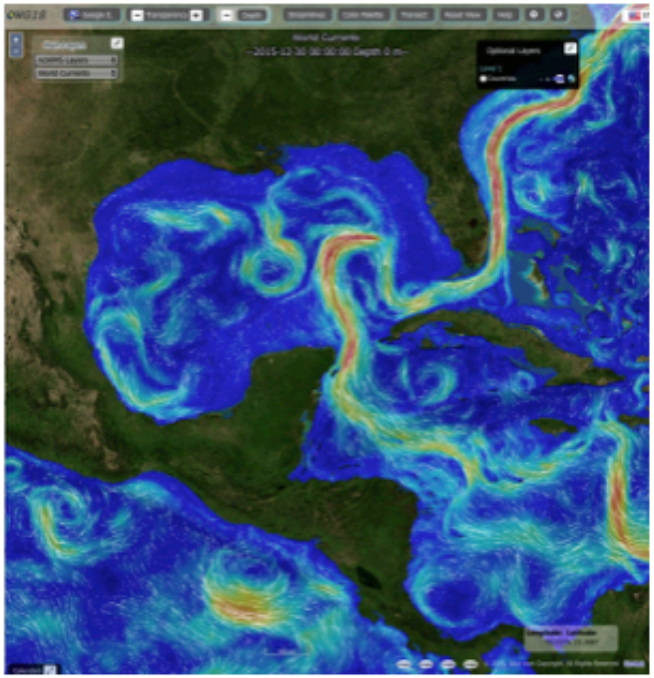
Sharing Data and Products

ERDDAP Server

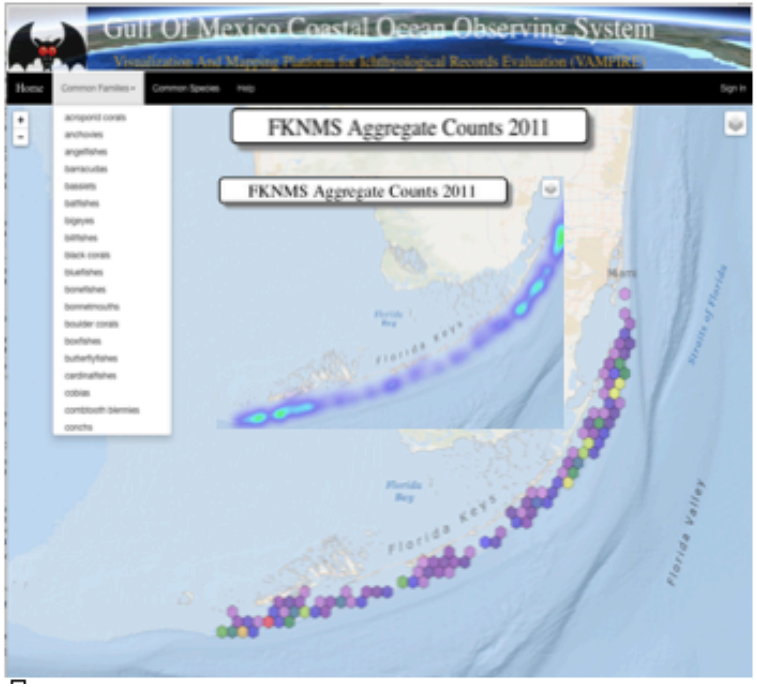


IOOS Research Workspace

Model-Data Viewer



Hex-Bin/Heat-Maps



Outline

A. Individual updates

   a. Santa Barbara Channel - *Margaret O'Brien*

   b. Alaska - *Rob Bochenek*

   c. Sanctuaries - *Jenn Patterson*

B. Cross BON coordination - *Margaret O'Brien*

C. Prototype datasets - *Margaret O'Brien*

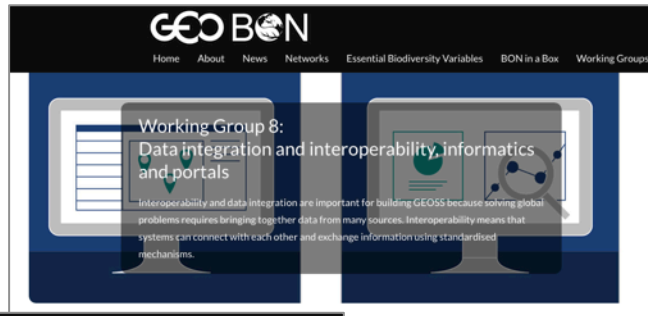
D. Prototype mapping tool - *Rob Bochenek*

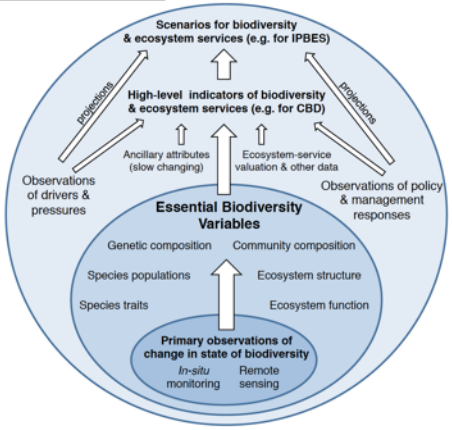
E. Integration with environmental data - *Matt Howard*

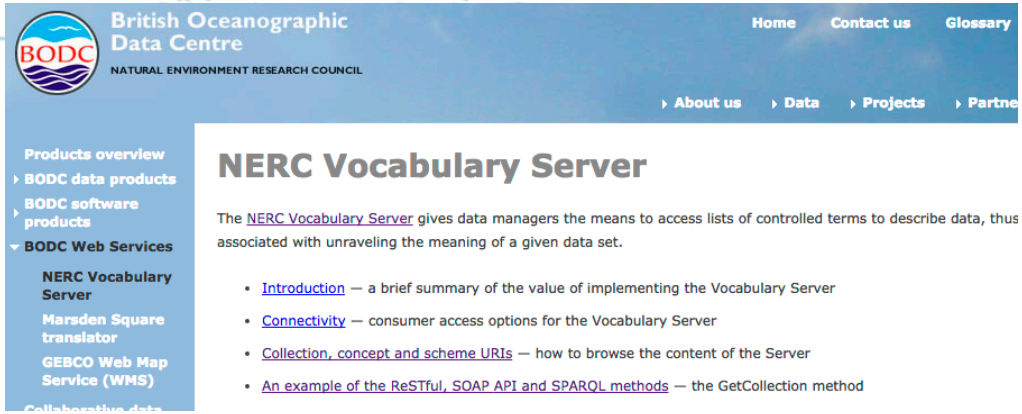
F. Biological data variables - *Margaret O'Brien (open discussion)*

F. Biological Data Variables

Variable	Methods	Sensors
Microbial species and abundance	Fluorescence microscopy Sequencing Flow Cytometry Metagenomics FISH	IFCB, etc NASBA ESP Filtered water samples
Phytoplankton species and abundance	Microscopy/Imaging Pigments Sequencing metagenomics/transcriptomics	IFCB, etc fluorometry, backscatter ESP filtered water samples
Zooplankton species and abundance	Active acoustics Nets/Microscopy Profiling imaging instruments Nets	Simrad, Biosonics, etc. Ring, bongo, others VPR, OPC
Invertebrate species and abundance	Active acoustics Benthic grabs (infauna) Nets	Humans ESP
Fish species and abundance	Active acoustics Nets Visual surveys (reefs) Photo/video surveys	Humans Simrad, Biosonics, etc. ESP
Coral species and abundance	Visual surveys Photo/video surveys Hyperspectral imaging	Humans (scuba) Remote sensing Image analysis
Submerged vegetation species and abundance	Visual surveys Photo/video surveys Hyperspectral imaging Airborne photography	Humans (scuba) Digital photography Image analysis
Sea turtle species and abundance	Visual surveys Mark-recapture Tagging	Humans (scuba) Satellite tags
Seabird species and abundance	Visual surveys Mark-recapture Tagging	Humans Satellite tags
Marine mammal species and abundance	Visual surveys Mark-recapture Tagging	Humans MARU, AMARS, DMON, etc. Satellite tags







Other considerations

What are the high priority measurements and variables?

What are the most appropriate data formats?

How should these be packaged?

Which is the most appropriate repository?

DM Workshop – planned products

Customer needs, sample products

2pp doc of example customer needs - *for PI/DMAC review*

2pp outline of support-tool major features and issues to be decided - *for PI/DMAC review*

Local systems descriptions

DM plans are archived - *for reference*

Schematic of data processing streams -*for internal reference/illustration*

Variable descriptions

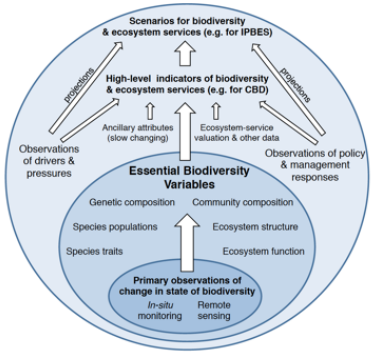
Outline process for producing EBVs - *for PI/DMAC review*

TBD: initial plans for named measurements based on EBVs in a schema.

Repository choices

Name	Advantages	Drawbacks
NCEI	Funder preferred, ISO, federated by DataONE	?provisions for biological data?
KNB	Familiar to ecologists, accepts all data, federated by DataONE,	

Cross-MBON DMAC



Cross BON coordination

Prototype datasets

Prototype mapping tool

Integration with environmental data

Biological data variables

Align individual DM activities - 2016

- Outline needs of sample customer
- Compare local practices, constraints
- Plan for measurement vocabulary

Variable	Methods	Sensors
Microbial species and abundance	Fluorescence microscopy Sequencing Flow Cytometry Metagenomics FISH	IFCB, etc NASBA ESP Filtered water samples
Phytoplankton species and abundance	Microscopy/Imaging Pigments Sequencing metagenomics/transcriptomics	IFCB, etc fluorometry, backscatter ESP filtered water samples
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