

GCOOS Build-out Plan and Marine Mammals



**Barb Kirkpatrick, Chris Simoniello,
Stephanie Watson, and Matt Howard**
*Gulf of Mexico Coastal Ocean Observing
System (GCOOS) Regional Association*

**Marine Mammal Research & Monitoring
Workshop**
New Orleans, LA
April 7-8, 2015

Photos by C. Simoniello



Overview

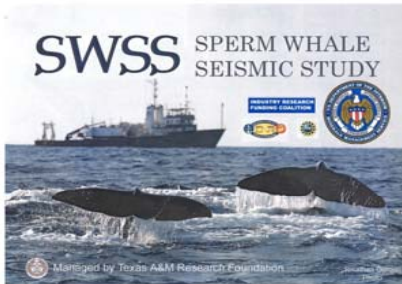
- Brief History of GCOOS-Regional Association (RA)
- GCOOS Build-out Plan (BOP) V.2.1
 - Overview and development
 - Needs and recommendations for marine mammals
- GCOOS Data Portal, iTag and ATN
- How other RAs are addressing marine mammal needs
- Summary



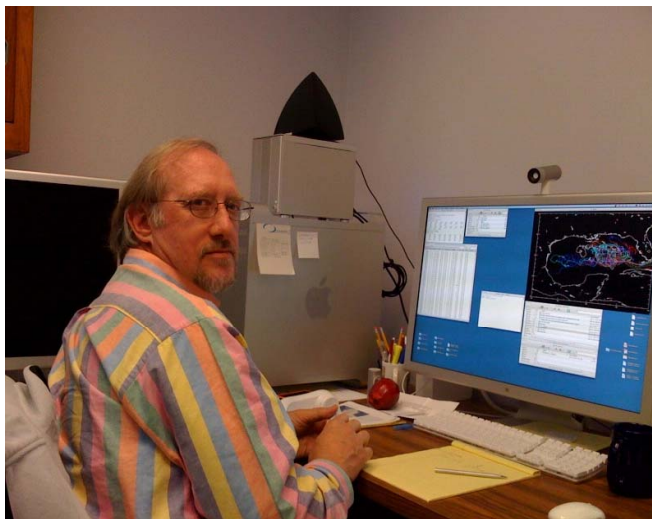
Photo by C. Simoniello

GCOOS

Sperm Whale Seismic Study (SWSS) 2002-2005

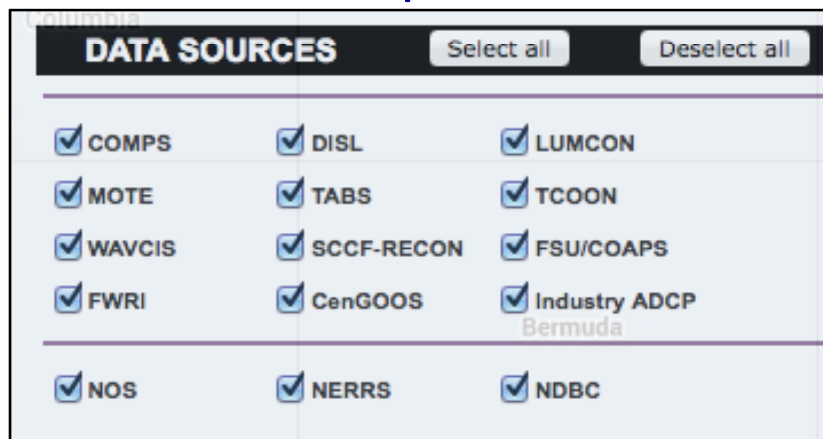


- Physical data, phytoplankton biomass, satellite images, satellite-tracked tags, digital-acoustic tags, passive acoustic follows, focal follows, genetic samples photo ID, social behavior. ~1.5TB of data submitted to BOEM (then MMS).
- <http://seawater.tamu.edu/SWSS>



Brief GCOOS-RA History

- Global Ocean Observing System >U.S. IOOS>GCOOS
- 2005-2015: 10 years old
- 5 themes of GCOOS
 - *Public Health and Safety*
 - *Healthy Ecosystems and Water Quality*
 - *Mitigation of Effects of Coastal Hazards*
 - *Safe and Efficient Marine Operations*
 - *Long-Term Ocean Variability and Changes*
- Membership and Partnership Model



The screenshot shows a web interface titled "DATA SOURCES" with "Select all" and "Deselect all" buttons. Below is a grid of data sources, each with a checked checkbox:

DATA SOURCES		
<input checked="" type="checkbox"/> COMPS	<input checked="" type="checkbox"/> DISL	<input checked="" type="checkbox"/> LUMCON
<input checked="" type="checkbox"/> MOTE	<input checked="" type="checkbox"/> TABS	<input checked="" type="checkbox"/> TCOON
<input checked="" type="checkbox"/> WAVCIS	<input checked="" type="checkbox"/> SCCF-RECON	<input checked="" type="checkbox"/> FSU/COAPS
<input checked="" type="checkbox"/> FWRI	<input checked="" type="checkbox"/> CenGOOS	<input checked="" type="checkbox"/> Industry ADCP Bermuda
<input checked="" type="checkbox"/> NOS	<input checked="" type="checkbox"/> NERRS	<input checked="" type="checkbox"/> NDBC



Data Portal and Products:

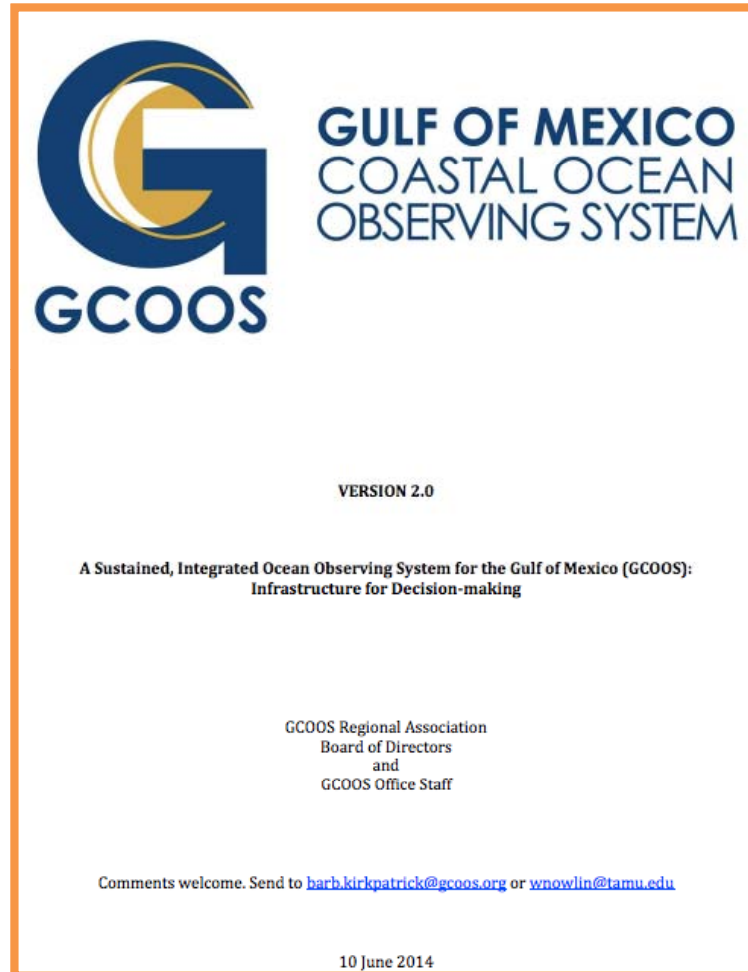
- Integrated Data for Emergency, Resource Managers and Others
- Data Products to Meet Public Stakeholder Needs
- Integrated Data for Private Sector Use in Building Business

The GCOOS Build-out Plan

631
workshop
contributors

From 297
organizations

90 plans
reviewed



50 additional
contributors

19 elements
in the BOP

13 subject
matter expert
writing teams

<http://gcoos.tamu.edu/BuildOut/BuildOutPlan-V2-1.pdf>



BOP and Marine Mammal Needs

Ecosystem and Habitats	Population Status and Trends	Information on Individuals
Monitoring of MM movement, prey, and habitat use	MM species and abundance; More population information needed; many classified “unknown”	Physiological and health monitoring
Identify, characterize, protect, and monitor habitats for each protected Gulf MM species; mapping of MM habitats and migration corridors to identify priorities for conservation	Genetics information to classify populations	Health status and contaminant loads of stranded or live-captured animals, necropsies of dead animals, MM fecundity, controlled exposure experiments, genomics
Monitoring physical and chemical factors affecting MM; coupling behavior with physical parameters	Need population structure, in addition to population size and trends	Obs. of condition of stranded animals, changes in diet as determined by observations of foraging behavior, stomach content
Identification of stressors	Assess daily and seasonal movements and inter-area exchange via telemetry and centrally-accessible photo-ids.	Observations of stranded animals, analysis of tissues for evidence of toxins, monitoring of HABS and hypoxia

Sources: MMC reports, BOEM ESP, NMFS Recovery Plans, NRC/NAS, NRDA, GCOOS-RA workshops, NOAA RESTORE Science Plan Draft, NOAA plans and reports, expert input, JIP Sound & Marine Life

BOP and Marine Mammal Needs

Effects of Marine Sound	Modeling	Data Products and Integration
Monitor marine sound with emphasis on MM habitat	Comprehensive models of the Gulf (w/drivers)	Need for a data portal and data integration
Characterize the spectrum of ambient and MM sound in Gulf (especially 1 to 200,000 Hz) , how it varies spatially and effects on MM	Model health and sustainability of MM populations	Use of data management standards (interoperability, QA/QC, etc.)
Sound source characterization and propagation, physical and physiological effects and hearing, behavioral reactions and biological significant effects, mitigation and monitoring, research tools	Model sound propagation	

Sources: MMC reports, BOEM ESP, NMFS Recovery Plans, NRC/NAS, NRDA, GCOOS-RA workshops, NOAA RESTORE Science Plan Draft, NOAA plans and reports, expert input, JIP Sound & Marine Life

How GCOOS Can Help With MM Needs

Autonomous Technology	Buoys	High-Frequency Radar
Drones with cameras and basic environmental sensors	Fixed hydrophones (and arrays), env. sensors	Ecosystem factors – e.g., Surface currents, some waves
Autonomous Underwater Vehicles (passive acoustics, environmental sensors)		
Autonomous Surface Vehicles (passive acoustics, e.g., HARPS, env. sensors)		

How GCOOS Can Help With MM Needs

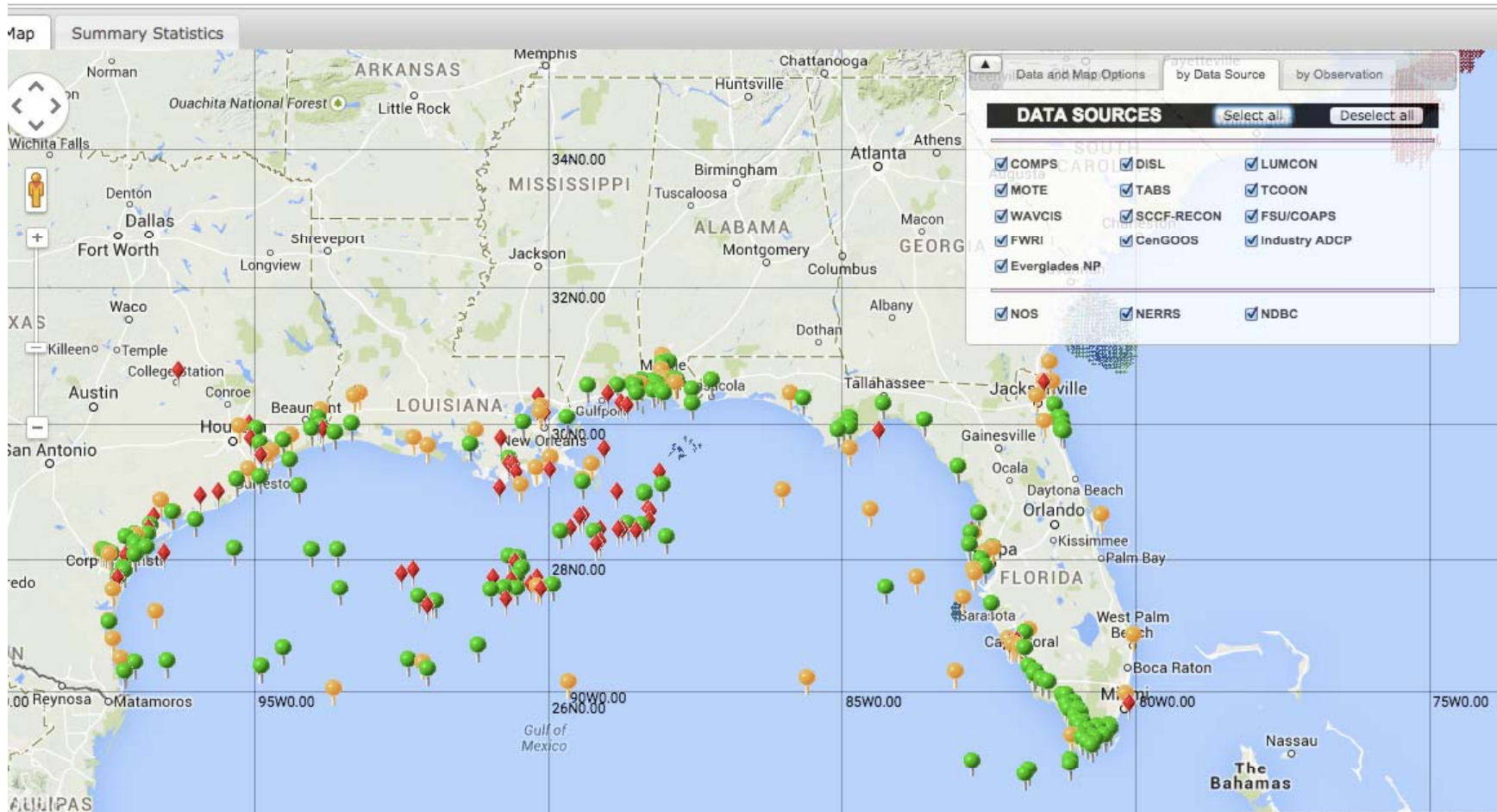
Aircraft	Ships	Tags/Receivers (acoustic, satellite, archival)	Drones/UAS
Visual (MMO) and camera surveys	Towed acoustic arrays, environmental sensors	Additional receiver locations and tags, tagging data portal	Camera (video and images)
Environmental sensors	Visual Surveys (MMO)	Environmental sensors	

Satellites	Seafloor mounted observations	Data portals and products	Modeling
SST, SSH imagery	Hydrophones	iTag, others	Gulf circulation and currents, ecosystem modeling



GCOOS Data Portal

<http://data.gcoos.org>



1900+ near real-time sensors reporting hourly or more often.



GCOOS Data and Products Portals

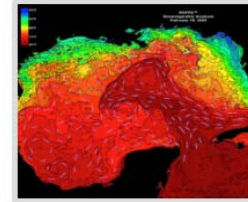
- Historical Data
 - Water Quality
 - Field Cruises
 - Model Forecasts
 - MBON
 - Sea Surface Height
 - Bathymetry
 - Satellite Data
 - Gliders
 - Fish



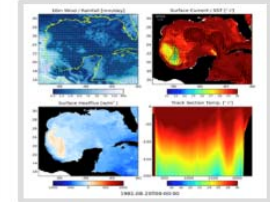
Observations



Gliders



Model Forecasts



Model Resources



Oil and Gas



Bathymetry



HABs



Satellites



Outreach



Climate



Fish



GeoPortal

New/Updated Map Products



MSU Wave gliders

During the 2014 Hurricane Seasons, three Unmanned Surface Vehicles known as Wave Gliders leased from Liquid Robotics have been deployed into the eastern Gulf of Mexico.



Gulf gliders map

Near real-time glider tracking map in the Northern Gulf of Mexico.
Updated in January 2015



Lionfish observations

Observations of red lionfish from 1985-2014 have been recorded and shown in a map
Updated in July 2014

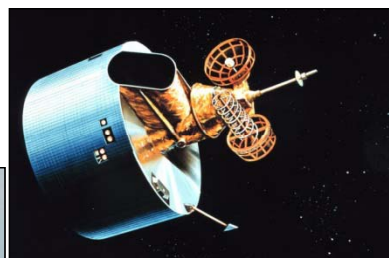


Information for Mobile/Tablet Users





Integrating Tracking Data with Existing Ocean Observing System Infrastructure



- Ocean Circulation
- Upwelling
- Temperature
- Salinity
- Meteorological Conditions
- Bathymetry
- Climate Data
- Primary Production
- Harmful Algal Blooms/Pathogens
- Water Quality
- Invasive Species
- Extreme Events
- Habitat Type



Orphan Tag Inventory

Data Base to Report Lost Tags and Search Found Tags

The screenshot shows a web browser window with the URL `itag.gcoos.org:3000/members/inventory/orphans`. The page header features a banner for the Gulf Of Mexico Coastal Ocean Observing System (GCOOS) with the subtitle "iTAG: Integrated Tracking of Aquatic Animals in the Gulf of Mexico". Below the banner is a navigation menu with links for "View", "Orphan Tags", "My Hardware", "Message Board", and "Members". The user's email, `robertdcurrier@gmail.com`, is displayed in the top right corner.

Orphan Tag Inventory

Filter

PI	Email	Date Reported	Manufacturer	Model	VUE ID	Serial	Edit	Delete
Currier	robertdcurrier@gmail.com	Fri Feb 06 2015 13:26:02 GMT-0500 (Eastern Standard Time)	Vemco	V9	A69-1234-33445	33445		
Smith	rdc@mote.org	Fri Feb 06 2015 13:29:53 GMT-0500 (Eastern Standard Time)	Vemco	V6	A69-876-54321	54321		
Smith	rdc@mote.org	Fri Feb 06 2015 15:13:15 GMT-0500 (Eastern Standard Time)	Vemco	V8	A69-123-88775	88775		

Show rows per page Page of 1

Beta product, developed
by Bob Currier, GCOOS

The Windows taskbar at the bottom shows the system tray with the date and time: 3:23 PM, 2/6/2015.

Enhanced to handle tag and receiver data

ITAG itag.gcoos.org:3000/members/inventory/receivers Google

Gulf Of Mexico Coastal Ocean Observing System

iTAG: Integrated Tracking of Aquatic Animals in the Gulf of Mexico

ITAG [View](#) [Orphan Tags](#) [My Hardware](#) [Message Board](#) [Members](#) robertdcurrier@gmail.com

Receiver Inventory

Filter

PI ▼	Manufacturer	Model	Serial	Latitude	Longitude	Array	Deployed	Bottom Depth	Receiver Depth	Privacy	Edit	Delete
Currier	Vemco	V9	123455	21.2	-82.2	array_1	2015-02-05	12	12	private		
Currier	Vemco	V8	999333	25.5	-83.3	array_2	2012-02-02	12	12	public		
Currier	Vemco	V8	444555	28.8	-80.1	array_3	2012-12-12	10	10	private		
Currier	Vemco	V8	111999	29.5	-88.3	array_3	2014-12-12	12	12	private		
Currier	Vemco	V9	666555	29.9	-89.2	array	2015-02-06	10	10	private		
Smith	Vemco	V9	1230000	27.1	-83.3	testing	2012-12-12	10	10	public		
Smith	Vemco	V5	998765	28.9	-91.1	array	2015-02-06	10	10	public		

Tag Inventory

Filter

PI ▼	Manufacturer	Model	Serial	Coding System	Transmitter Name	Transmitter Type	Release Latitude	Release Longitude	Release Date	Privacy	Edit	Delete
Currier	Vemco	V7	444333	UTF-8	Pinger	Pinger	28.8	-81.1	2012-12-12	private		

Show rows per page

Page of 1

Integrating tracking data with observing system data

The screenshot shows a web browser window displaying the ITAG (Integrated Tracking of Aquatic Animals in the Gulf of Mexico) website. The browser address bar shows `itag.gcoos.org:3000`. The website header features a banner with the text "Gulf Of Mexico Coastal Ocean Observing System" and "ITAG: Integrated Tracking of Aquatic Animals in the Gulf of Mexico". Below the banner is a navigation menu with links for "View", "Orphan Tags", "My Hardware", "Message Board", and "Members", along with the email address "rdc@mote.org".

The main content area displays a map of the Gulf of Mexico region, showing parts of Texas, Louisiana, and the Gulf of Mexico coastline. A green square marker is placed on the map, indicating the location of a receiver. A pop-up window is open over this marker, displaying the following information:

Receiver Serial: 999333

PI:	Currier
Privacy Setting:	public
Affiliation:	GCOOS
Array:	array_2
Deployed:	2012-02-02
Position:	-83.3 W 25.5 N
Receiver Model:	V8
Receiver Manufacturer:	Vemco
Data Records:	150

The Windows taskbar at the bottom of the screen shows various application icons, including Internet Explorer, File Explorer, Google Chrome, and Microsoft Office applications. The system tray on the right indicates the time as 3:36 PM on 2/6/2015.

Stoplight code indicates level of privacy/sharing by array operator.

Marine Animals as Mobile Monitoring Platforms

- Tags have many sensor options
- Indifferent to political boundaries
- All-weather sampling
- 24/7 technician not required
- AUVs are equipped with various sensors.
- Can be limited by political borders.
- Limited by conditions (e.g., weather, depth, strong density gradients)
- Require maintenance and technical support.



Tracking animals from AUV platforms is relatively new, but has great potential!

ASV C-Enduro

<http://www.asvglobal.com/science-survey/c-enduro>

GCOOS is not in the business of conducting telemetry projects!

Goals are to:

- Enable the integration of telemetry data with other data sets to maximize their utility.
 - Pilot project with the Dauphin Island Sea Lab GOM Acoustic Array Network.
- Facilitate data sharing and collaboration among investigators to gain economies of scale.
- For small, funding-limited projects, provide data services, as needed.



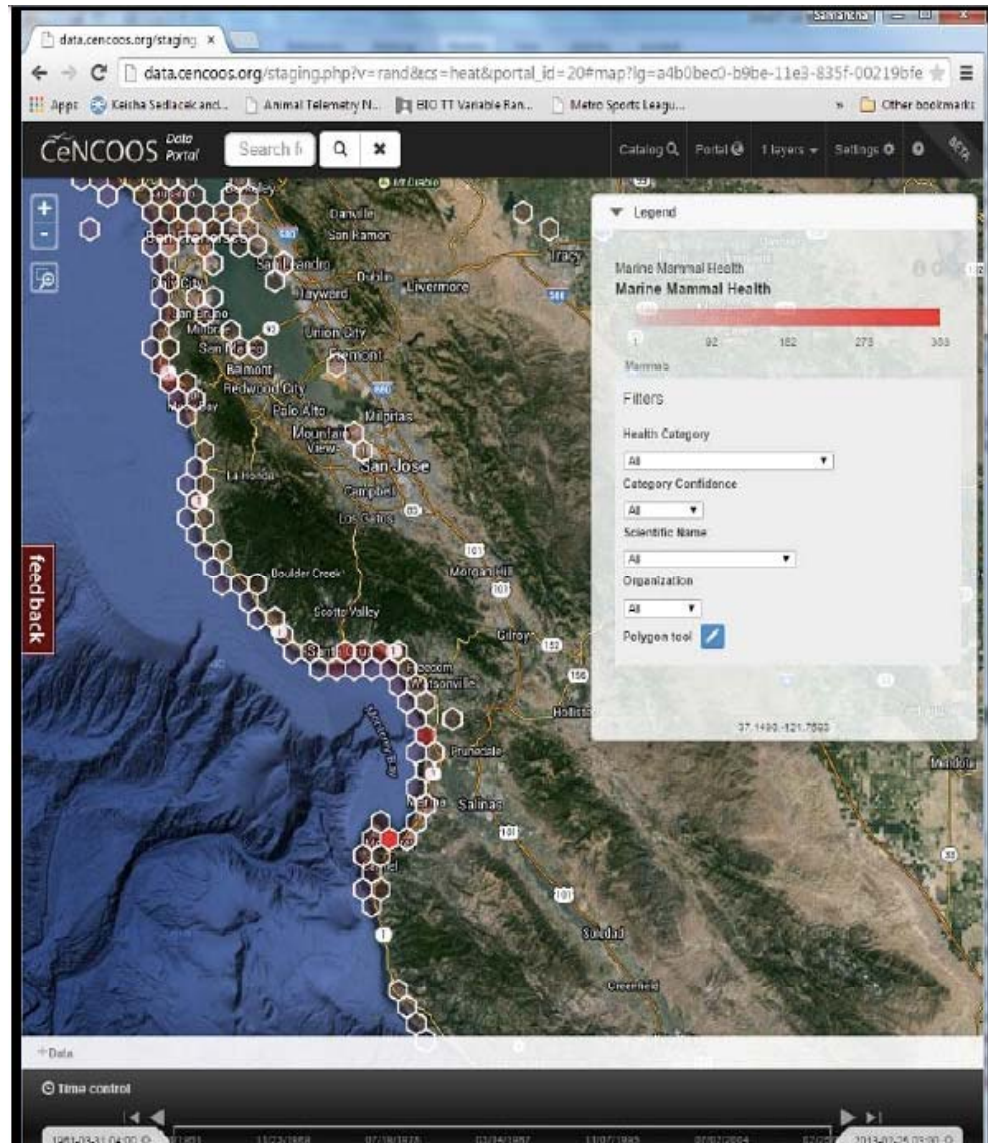
Alaska Ocean Observing System and Animal Telemetry Network

- Animal Telemetry Network (ATN) task team
 - Group is led by ONR & IOOS at request of Interagency Ocean Observation Committee
 - AOOS is one of IOOS RA representatives (also GLOS & MACOORA)
 - Developing a national ATN Vision, Strategy & Implementation Plan
 - National Data Assembly Center being developed by Barbara Block et al
- AOOS: facilitating Arctic ATN
 - Goal is circum-Arctic
 - Starting with US-Canada: MARES project

Alaska Ocean Observing System and Marine Mammals

- Belugas in Cook Inlet
 - Sightings database funded by NMFS (soon to be publicly available)
 - Beluga ecosystems application funded by NFWF (adds additional layers to our Cook Inlet portal)
- Whales in Gulf of Alaska (GOA)
 - Humpback whales & orcas: photo ID databases
 - Incorporated into Gulf Watch AK Program and GOA portion of data portal
- Whales & seals in Arctic
 - Whale glider pilot project: monitor presence/absence of marine mammals in near real-time w/acoustic recorder on glider
 - Seals: pilot to incorporate NMML tagged data into AOOS Ocean Data Explorer

CeNCOOS and Marine Mammal Health



Summary

- GCOOS-RA has a 10-year history in the Gulf
- GCOOS Build-out Plan (BOP) V.2.1
 - Includes needs and recommendations for marine mammals from experts, existing plans, workshop reports
- GCOOS Data Portal, iTag and ATN
 - Experience and ongoing projects with biological info.
- Regional Ocean Observing Systems can play a lead role in fulfilling needs for marine mammal monitoring

