GCOOS Build-out Plan and Marine Mammals

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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
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

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

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

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

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

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

<table>
<thead>
<tr>
<th>Autonomous Technology</th>
<th>Buoys</th>
<th>High-Frequency Radar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drones with cameras and basic environmental sensors</td>
<td>Fixed hydrophones (and arrays), env. sensors</td>
<td>Ecosystem factors – e.g., Surface currents, some waves</td>
</tr>
<tr>
<td>Autonomous Underwater Vehicles (passive acoustics, environmental sensors)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Autonomous Surface Vehicles (passive acoustics, e.g., HARPS, env. sensors)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# How GCOOS Can Help With MM Needs

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

<table>
<thead>
<tr>
<th>Satellites</th>
<th>Seafloor mounted observations</th>
<th>Data portals and products</th>
<th>Modeling</th>
</tr>
</thead>
<tbody>
<tr>
<td>SST, SSH imagery</td>
<td>Hydrophones</td>
<td>iTag, others</td>
<td>Gulf circulation and currents, ecosystem modeling</td>
</tr>
</tbody>
</table>
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
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**

**Beta product, developed by Bob Currier, GCOOS**

<table>
<thead>
<tr>
<th>PI</th>
<th>Email</th>
<th>Date Reported</th>
<th>Manufacturer</th>
<th>Model</th>
<th>VUE ID</th>
<th>Serial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Currier</td>
<td><a href="mailto:robertdcurrier@gmail.com">robertdcurrier@gmail.com</a></td>
<td>Fri Feb 06 2015 13:26:02 GMT-0500 (Eastern Standard Time)</td>
<td>Vemco</td>
<td>V9</td>
<td>A69-1234-33445</td>
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<td>V6</td>
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<td>Vemco</td>
<td>V8</td>
<td>A69-123-88775</td>
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Show 10 rows per page
Enhanced to handle tag and receiver data

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### Receiver Inventory

<table>
<thead>
<tr>
<th>PI</th>
<th>Manufacturer</th>
<th>Model</th>
<th>Serial</th>
<th>Latitude</th>
<th>Longitude</th>
<th>Array</th>
<th>Deployed</th>
<th>Bottom Depth</th>
<th>Receiver Depth</th>
<th>Privacy</th>
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<th>Delete</th>
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<tr>
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<td>10</td>
<td>10</td>
<td>public</td>
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</tbody>
</table>

### Tag Inventory

<table>
<thead>
<tr>
<th>PI</th>
<th>Manufacturer</th>
<th>Model</th>
<th>Serial</th>
<th>Coding System</th>
<th>Transmitter Name</th>
<th>Transmitter Type</th>
<th>Release Latitude</th>
<th>Release Longitude</th>
<th>Release Date</th>
<th>Privacy</th>
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<th>Delete</th>
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</thead>
<tbody>
<tr>
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<td>444333</td>
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<td>Pinger</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>
Integrating tracking data with observing system data

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**

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