The Benefits and Challenges of Integrating Animal Telemetry into Ocean Observatories

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The Challenge -
Form this growing list into a linked federation of pre-operational observatories
To seek, discover & apply new knowledge & understanding of our coastal ocean
Personal Example (2009)

Was contacted by a shark researcher in the mid-Atlantic who asked if I could annotate the track of a Blue shark and a Mako shark.

This was intriguing.
Analyzing long-lived individuals to try and understand migration and population dynamics

Usually bigger than a butterfish
Aquatic animal telemetry
A panoramic window into underwater world

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Major Telemetry Groups in the Mid-Atlantic

- The Atlantic Cooperative Telemetry Network
- Ocean Tracking Network
- Animal Telemetry Network
- MATOS (Mid-Atlantic Acoustic Telemetry Observation System)
- MARACOOS (Ocean Information for a Changing World)
Welcome to the ACT Network

The ACT Network is a grassroots effort to facilitate datasharing between researchers utilizing acoustic telemetry to gain a greater understanding of a wide variety of aquatic species.

ACT began to take shape in 2006 during an Atlantic States Marine Fisheries Commission - Atlantic Sturgeon Technical Committee Meeting. As researchers began utilizing acoustic telemetry technology more extensively along the eastern coast of the United States, the potential benefits of collaborating in order to share telemetry data from existing arrays beyond those in their own system became apparent. What started with 15 researchers working on Atlantic and Shortnose Sturgeon that year has expanded to over 100 from Maine to Florida working with over 80 different species. We are also collaborating with researchers from the Canadian Maritimes as well as individuals of the Florida Acoustic Cooperative Telemetry (FACT) group. To date, there are over 11,000 known transmitters deployed since 2004, with more being deployed annually.

Researchers maintain their own arrays, so transmitters deployed and array sizes are dependent on seasonal conditions, research needs, and available funding. It is up to the individual researchers to provide information regarding transmitters and arrays. Researches can maintain a level of involvement in the network that is appropriate for their needs and abilities; from just sharing general tag code information to collaborating with other researcher and leveraging other arrays to gain additional funding.

We hope to make exchanging information about “unknown” transmitter codes simpler and more straightforward, further strengthen collaboration. One of the main challenges ACT faces as we continue to expand is developing and maintaining standards in data collecting and sharing, so as we grow, we will be able to incorporate our telemetry data with other physical/environmental
The Ocean Tracking Network: A contribution to global biological ocean observation

To create a global partnership to construct and sustain a scientific platform and the associated trained personnel to collect, store, share, analyze, and use aquatic tracking and environmental data to support sustainable management of valued aquatic species.

CTD  VMT
Atlantic Bluefin Tuna: Where they go?

SST data from NOAA SWFSC ERDDAP server and Tuna tracks from the Census of Marine Life Tagging Of Pelagic Predators Program (CoML TOPP) data housed at Stanford Univ. server.
MATOS Web compiles acoustic telemetry project information and helps users learn more about ongoing acoustic telemetry projects in the Mid Atlantic. Scientists have been implanting Mid Atlantic fish with transmitters and, like the GPS on a car, have been tracking fish movement through a network of receivers placed on the bottom of the lakes. The purpose of MATOS is to help scientists and the public learn more about Mid Atlantic acoustic telemetry projects and their contribution to research.

What is Acoustic Telemetry?

About MATOS

Have Data?
The establishment of these global networks raises new challenges over data sharing and will require strategies to address data management, ownership, and public release. Successful models exist in the physical oceanography, ocean chemistry, and molecular genetic domains – Hussey et al, Science 2015

The Challenge - Form this growing list into a linked federation of pre-operational observatories

Major Telemetry Groups in the Mid-Atlantic
Shrinking the Haystack: Using an AUV in an Integrated Ocean Observatory to Map Atlantic Sturgeon in the Coastal Ocean

Telemetry data made avail through ACT
Gliderpalooza 2013

- Vemco VMT receivers deployed on 9 of 16 gliders
- Key Species: Right Whales, tiger sharks, Atlantic sturgeon, Atlantic Salmon
- Data organized by OTN
• Vemco receivers detected 16 animals
• Species: Blue Shark and Atlantic Sturgeon.

<table>
<thead>
<tr>
<th>Group</th>
<th>Glider Name</th>
<th>Species</th>
<th>#</th>
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<td>U Delaware</td>
<td>Otis</td>
<td>Glider lost at sea</td>
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<tr>
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<td>Salacia</td>
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<tr>
<td>U Georgia</td>
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Glider Acoustic Telemetry
- **Mission**
  - October 5th – 23rd 2012
  - 337km traveled
  - Detected 23 different Sand Tiger sharks
  - Glider just as efficient as a single receiver
  - Working on uploading full glider and telemetry data to OTN
• What is the appropriate scale for matching environmental data?
Habitat selection of a coastal shark species estimated from an autonomous underwater vehicle

Leveraging observatory assets help estimate detectability questions
Distance Between Transmitter and Receiver (km) vs Number of Detections

- Externally mounted VMT: 124 detections
- Integrated bottom VR2C: 175 detections
- Integrated top VR2C: 188 detections
- Integrated VR2C (top and bottom): 264 detections
Conclusions

Telemetry observation networks are rapidly developing.

A lot of potential for collaboration with existing ocean observing networks that benefit fisheries and oceanography communities.

Potential to significantly increase fisheries independent observations.

Coupled species locations/environmental data.

Platforms of opportunity lead to new discoveries.

Adaptability of missions with integration observatory integration.

Opportunity to act on real-time data with telemetry integrated into ocean observatories.