



IOOS-GCOOS Animal Telemetry Network Workshop

A workshop to understand Gulf of Mexico (GoM) informational needs related to a national Animal Telemetry Network (ATN) was held in New Orleans, LA, 23-24 January 2018. This workshop was organized by a steering committee and sponsored by the U.S. Integrated Ocean Observing System (IOOS) and the Gulf of Mexico Coastal Ocean Observing System Regional Association (GCOOS-RA). Participant names and affiliations are given in [Appendix 1](#). The workshop agenda is given in [Appendix 2](#).

Background

Regional Associations of the U.S. IOOS Program Office have been working with Bill Woodward and the U.S. ATN to host a series of workshops aimed at identifying regional needs and priorities for animal telemetry observations of aquatic species. Information here constitutes the report for the fourth workshop in the series to identify needs for the Gulf of Mexico.

Following a welcome and introductions led by [Dr. Barbara Kirkpatrick](#), GCOOS-RA Executive Director, Dr. Chris Simoniello, GCOOS Outreach and Education Manager, reviewed workshop objectives and deliverables, and [Bill Woodward](#), NOAA IOOS ATN Coordinator, provided an overview of the national ATN. Major ATN supporters include NOAA, the Office of Naval Research and the Bureau of Ocean Energy Management (BOEM). The premise for a national ATN is that existing telemetry efforts have little connectivity; different funding sources and objectives making collaboration difficult; emotional and technical limitations to data sharing; no centralized national accessibility; lack of sustained commitment to maintain infrastructure; and finite duration, project-based funding. Sustained funding is being sought to support baseline observation infrastructure and data management.

Questions arose about the different levels of engagement the IOOS regions have with the telemetry community. MARACOOS, SECOORA and CARICOOS engage with their local community networks (e.g., Atlantic Cooperative Telemetry and Florida Atlantic Coast Telemetry networks). GCOOS has worked with the Florida Fish and Wildlife Conservation Commission's iTAG group, but regional goals for the ATN are much broader in vision, including Mexico/the entire GoM, Cuba and Caribbean. Enabling data layering with existing GCOOS, GRIID C, Texas Knowledge Base and other IOOS-compliant data are important elements of the Gulf ATN. Several researchers in the room use Movebank as a resource. However, it is unknown what the long-term commitment for maintenance of the system might be.

Protected species are a driver of telemetry observations for both resource managers and commercial interests. Port dredging operations consider nesting shorebirds as well as marine animals. The Florida ports council talks about environmental issues, storm water and water quality issues, and fish and wildlife populations. They are interested in promoting best management practices in the industry and see participation in ATN as a way to building partnerships with agencies and researchers, help avoid major impacts to projected resources and avoid bad PR.

Session Talks and Panel Discussions

Day 1 topics were presented by invited talks in three sessions with 30 minutes of panel discussions following each set of speakers.

Session 1: Commercial Sector Perspectives

[Chris Cooley](#), Director, Environmental Affairs, Port Tampa Bay, described activities of the large, diverse port that spans about 5,000 acres, mainly in estuary habitat. The port is the 2nd in the country with a dedicated environmental position. Long Beach, CA, is the other. About 80,000 jobs are tied to the port which handles about 35 M tons of cargo annually and has an economic value of \$15B. It is mainly a bulk material port, with fertilizer going out and other materials tied to the phosphate and fertilizer industries coming in.

[Benny Gallaway](#), LGL Ecological Research Associates, is focused on applied research and consulting. Projects include benchmark environmental surveys and stock assessments. Areas of expertise include marine fisheries, sea turtles and marine mammals. The team works in the U.S., Canada and other countries. Infrastructure that would be useful to their work would be a systematic receiver array across the GoM, especially on decommissioned oil and gas platforms. Understanding the ecological value of the platforms (historically, about 4,000 platforms; currently about 2,000) is a priority. Information about where/how animals move between sites is needed to determine if the platforms should be removed, dropped on site or relocated for artificial reefs. ATN infrastructure can help address numerous topics of concern: red snapper site fidelity on platforms; fishing mortality on platforms; aggregations around sites; production vs aggregation; extent and importance of platforms as critical habitat for sea turtles; and stock delineation of coastal/ocean bottlenose dolphin ecotopes to improve precision of incidental take estimates. One idea was to put receivers in *Sargassum* to determine how floating habitats are being used.

Panel Discussion

The commercial sector panel discussion was moderated by Dr. Mark Luther, University of South Florida College of Marine Science. When companies are looking for telemetry subcontractors, it would be helpful to have a regional directory of people and capabilities. GCOOS will assemble a directory from workshop participant information. Industry does not currently have open access to data. Credits and niceties need to be articulated before it becomes widespread practice. Despite being noisy places, rigs and ports can still provide useful acoustic data.

The environmental port committee in Florida includes 14 ports. Business tends to focus on the bottom line and be discussed across all ports. Science matters tend to be handled port by port. All are concerned with anything requiring regulations. According to Chris, "When you've seen one port, you've seen one port." All are different with management. He provided several examples of how ATN can be helpful to ports. With ongoing port enhancements and deepening to 50 ft for the Panama expansion, there are concerns about impacts from sound related to pile driving. Also, there are concerns from NMFS because of all the species that use the habitat. OTN is working with Port St. John. They discovered an area for overwintering sturgeon. Fred Whoriskey, OTN Executive Director, cautioned that real-time telemetry creates volumes of data so always looking for novel ways to subset, parse and compress and recreate at the other end. Real Time transmissions are costly so best to spend money elsewhere unless RT information is mission critical.

Many participants were interested in bird telemetry. In coastal Louisiana, 10 of 30 VHF receiver stations have been deployed to pick up passive tags. These log the data and are compatible with MOTUS. Funding from Conoco-Phillips was received to expand and there was interest in mounting on offshore rigs. However, the rig of interest is slated to be decommissioned. Benny

says we need to negotiate with companies and federal agencies to keep infrastructure. Port Tampa is also partnering on a bird telemetry project with the Florida Aquarium and TECO Electric based at the Apollo Beach outdoor classroom. Towers are being installed around the state to track migratory birds. Information on the shore birds helps the port plan dredge operations because the spoil islands are used as breeding grounds, especially around August and September.

Other comments of interest:

- Sentinel sites: knowing where and when species aggregate can be an important starting point to longer-term monitoring and tracking;
- The oceans are vast; mobile sensors on AUVs can help position assets and increase probability of detection;
- What products would maximize utility of telemetry data? Synthesized products that show monthly or seasonal patterns? What could we provide that would help ports with their information needs? Utilization by protected species of port area; or location-specific information tied to port expansion or work about to take place; how often do you see particular animals in various parts of habitat (eg shallow vs deeper water); is having data for ESI statement valuable?

Do no harm to industry but if can provide data on the front end, might get financial support. Benny believes the mindset of industry has changed regarding identifying and heading off sensitive subjects. Most ports have a master buildout plan. If we can identify where expansions will be taking place and get ahead of the activity with data there will be clear value in the information. Landlord ports like Tampa avoid anything that brings additional regulation because they are in global competition for carriers; over-regulating gives them a bad reputation. However, data in hand to move forward is win-win.

Session 2: Resource Management Perspectives

Five speakers provided background information prior to a panel discussion led by Bill Woodward.

[Pedro Ulloa](#), Instituto Nacional de Pesca (INAPESCA), Mexico, summarized work on Atlantic and Pacific highly migratory species. INAPESCA and NOAA's Southeast Fisheries Science Center have had a joint effort since 2012 to create a scientific and technical base to inform the International Commission for the Conservation of Atlantic Tunas (ICCAT). There are currently about six tuna being tracked. There's been a formal tuna fleet since 1982, with an Observer Program since 1993. Observers on board long liners have a sense of catch and the information is used to inform site selection for Bluefin tuna tagging efforts. Large Marine Ecosystem work includes the U.S., Mexico and Cuba. Pedro says there is a king mackerel study underway.

[Rebecca Green](#), Bureau of Ocean Energy Management Office of Environment, summarized the agencies mission to manage development of Outer Continental Shelf energy and mineral resources in an environmentally and economically responsible manner. Oil and gas, renewable energy and marine minerals are the three main programs they oversee. The former is most active with nearly 3,000 active leases, mainly in the central and western Gulf. A renewable energy feasibility study is currently being performed in the Gulf. Marine minerals include offshore sand and gravel for coastal restoration efforts. OCS Lands Act, NEPA, ESA, Marine Mammal Protection Act and many other laws and acts govern their work. BOEM is interested in telemetry-related research to inform oversight activities; conduct impact analyses; understand habitat use; predict where animals are in space and time; determine site fidelity; and ID potential threats across range. Multi-year monitoring is needed to detect changes in trends of habitat use and productivity from natural and other causes. The majority of oil and gas activities are in deep,

federal waters, so these deeper offshore regions are a focus for continued and future studies. BOEM is collaborating with the Navy and IOOS to improve telemetry connectivity throughout the OCS and Gulf. The collaborative can provide unprecedented information about use of the Large Marine Ecosystem. BOEM is currently funding studies which include tagging of eastern brown pelicans, sea turtles and red snapper in the Gulf region.

[Jorge Brenner](#), The Nature Conservancy, provided a summary of TNCs coastal and offshore projects that range from biodiversity to impacts of human activities. TNC owns a network of preserves and collects information to manage. Migratory species work the past three years has been focused on identifying corridors of movement or the concept of “blueways”. ATN is a valuable tool because it supports movement data—a dynamic piece of information previously unavailable in ocean systems. TNC mainly uses satellite tracking data for pelagic fishes, sea turtles and mammals. Work involves developing pathway analysis tools to understand habitat use and species interactions throughout all life stages to support management.

[Auriel Fournier](#), Mississippi State University, presented on behalf of Mark Woodrey, MSU and Grand Bay National Estuarine Research Reserve. Work is focused on avian species and identifying how threats are changing through space and time. The team looks at habitat use changes and movement cycles on various time scales. A challenge with current telemetry funding is that long term projects need flexibility to incorporate new technologies and explore new questions while still addressing originally funded questions. While there are MOTUS receiver stations throughout the Gulf, there is no standardized network to share information, technology or best practices for experiment design and analyses. There is some sharing via the MoveBank data repository. Like Jorge and “blueways” emphasis was on the need for migratory connectivity studies and enhanced coordination across taxa. An added challenge is that fresh and saltwater environments require different tags for the animals.

[Ashley Ferguson](#), Louisiana Department of Wildlife and Fisheries, provided an example of how the department is using movement information to inform management challenges. There is a joint project with Ashely Melancon Baer, Fish and Wildlife Service and LSU graduate student, studying spotted sea trout in Calcasieu. In addition to ~175 tagged sea trout, there are juvenile bull sharks and red drum. The goal is to generate baseline behavior data. LADWF is currently exploring a skeleton array with FWC to understand how species are adjusting to changes in coastal marshes; create a baseline for understanding impacts of riverine input to lake Pontchartrain with the opening of levees; and to inform CPRA diversion projects. There is interest in learning how others are incorporating telemetry data into fisheries management.

Panel Discussion

The Resource Management sector discussion was moderated by Bill Woodward. Ashley was asked how freshwater influx impacted sea trout in the LA study and she replied that the riverine water stayed south and the fish stayed north. Rebecca was asked about the distribution of satellite vs acoustic telemetry efforts. BOEM has supported a lot of satellite telemetry but is moving to acoustics to understand side fidelity with platforms. Overall, a recent paper showed an even spread between acoustic and satellite telemetry efforts though acoustic tags seem to be increasing, likely because they are less costly. Jill Hendon’s team is working with Rachel Graham and Mar Alliance. They are based in Belize and have an extensive array for tracking whale sharks and mantas. Rebecca was asked if BOEM is currently funding tracking of large pelagic fishes and she replied they are not but that they are accepting new ideas and priorities from stakeholders until February 5th. There was discussion about Lotek and Vemco not

collaborating on sharing code space. There is concern that you can't be conclusive about what is being tracked if more than one entity doling out codes. A code space agreement might be needed to establish conventions. MOTUS is a single tracking network with main frequencies at 69 and 180 kHz. Only a couple vendors sell tags and there is a quick response to requests for coding information. That is not always the case for coding information requests for marine species. Fred asked if/how ICCAT information is being used. Pedro says he uses public ICCAT data but that it has limited use for his projects. TNC uses some of the data but has not yet integrated observer data into migratory tuna data because a lot of information is scattered and not systematic. The question arose about if there is enough information available to quantify fishing effort in the U.S. and Mexico.

Participants were provided lunch before the afternoon research talks commenced.

Session 3: Research Sector Perspectives

Two research sector sessions were held, both moderated by Bill Woodward.

[Matthew Howard](#), Texas A&M University-College Station and GCOOS Data Manager, summarized GCOOS data capabilities. GCOOS's main ATN interest is in data stewardship--end-to-end handling from shore-side stations to archives with services for users; and providing access in user-preferred forms and formats. He also described current social mining activities to capture public comments about beaches to use as a guide for Everything Beaches work.

[Eduardo Cuevas](#), CINVESTAV (Center for Research and Advanced Studies of the National Polytechnic Institute), Mexico, summarized hawksbill telemetry work to gather ecological and biological information about the decreasing number of nests. He is working with TNC on blueways to understand how nesting females are connected throughout the Gulf and to understand accumulated threats—natural and human. Seven countries are involved in satellite tracking and mark/recapture methods. They are extending the area of study as they gather new information about geographical ranges. The U.S., Mexico, Barbados, Bonaire, US VI, Puerto Rico and Cuba are collaborating. A lot of resources have been invested in the information and the question now is how to build a bridge to connect and collaborate on a management strategy.

[Judd Curtis](#), Texas A&M University-Corpus Christi, summarized the TEXAAN system in Aransas Pass and Packery Channel. There is limited water exchange in some of the back bay areas. They set up gateways to look at egress and ingress of species, including drum and seatrout. They are also looking at fine-scale habitat use by red snapper and preference for different artificial reef materials. The array includes seven sites for sandbar sharks. Areal extent of the array is project-specific but some general gateways benefit from long-term infrastructure. However, investment is needed for maintenance of this observing network.

[Mike Dance](#), Texas A&M University-Galveston, works with both acoustic and satellite tags and is interested in multi-species interactions and habitat use. Movement related to vertical and horizontal oceanographic features, habitat partitioning, basin-scale connectivity and predatory/prey interactions are among the research topics. Species include southern flounder, coastal sharks, tuna and billfish. Some of the work is in collaboration with Rick Klein, University of Texas Rio Grand Valley. Receivers are placed at choke points along barrier islands. Currently working on having ~65 receivers in the eastern part of the bay, with the next phase focused on the western part of the bay. Working with OTN, HRI, NPS and others, there are five gates from Mexico to the TX/LA border that make up the Western Gulf of Mexico Coastal Gates system.

There are acoustic tags on flounder, drum, trout and bull sharks, and satellite tags on tuna, blue and white marlin and sailfish.

[Jennifer Doerr](#), National Marine Fisheries Service-Galveston, TX, was unable to attend due to the government shutdown. Her planned presentation on conch tracking work in the Caribbean is included with the other presentations to capture information of interest to MPA management.

[Natalia Sidorovskaia](#), University of Louisiana at Lafayette, is an acoustician conducting work in the littoral acoustic demonstration center. She has GOMRI funding for the Gulf Ecological Monitoring and Modeling consortium (LADC-GEMM) to study the effects of anthropogenic noise on marine mammals. Scripps and Cornell are consortium members. The work uses passive acoustic monitoring—typically receivers are deployed near the DWH site and picked up four to five months later. Passive acoustic data is allowing information about regional whale and dolphin populations and niche habitat use to be extracted. Sperm whales and beaked whales are among the animals studied. Missing in the work is the ability to correlate marine mammal data with physical and biological processes and prey distributions. Real-time capabilities are needed to get optimal spatial and temporal telemetry information. Sustained Gulf infrastructure will require development of stationary and mobile networks of dedicated and opportunistic acoustic receivers and new software tools for data mining and processing.

[Kayla DaCosta](#) and [Reid Nelson](#), Dauphin Island Sea Lab, AL, presented on behalf of DISL's manatee tracking project. Since 2009, they have put tags on 12 animals to understand migration patterns and habitat use. Animals have been tracked between the Northern Gulf and Tampa. They use a redundant system of acoustic and satellite telemetry. They have nine receivers in Alabama and two in Florida, deployed in collaboration with Sea to Shore Alliance, Sea World Orlando and USFWS. Increased spatial cover of hydrophones is needed. The tagged population is male-biased. Because Reid was unable to attend, Kayla presented his work looking at red drum and speckled trout mortality differences between fishing vs natural causes, range and site fidelity. Current and future research would benefit from complete coverage of passes into and out of Mobile Bay.

Panel Discussion

Discussions about code space issues across vendors and the need for the tagging community to incentivize vendors to collaborate started the session. It is difficult to broaden the network if systems are not compatible. Vemco operates at 76.8 kHz but can get picked up on both Vemco and Lotek. It's a fixed vs. mixed interval so tags can be differentiated. Bill said this is a recurring theme across workshops. There are other vendors (e.g., Sonotron, Thelma Biotel--Norway) that might more readily work to make systems interoperable. Investigators wanting to be compatible with others tend to use what others in region are using; conversely, other products are used if they do not want to collaborate. Jayne provided an example of how her work was impacted while using VR2 receivers and Lotek dual mode tags. She was issued tags for her black tip sharks that were shared with someone else's tarpon. Fred suggested working with the vendors to determine what they are willing to serve through their systems.

Bill asked Judd if he would be able to prioritize critical areas for receivers in the TEXAAN array. There were many gates around barrier islands incorporating entry and exit points. If there was money for sustained observations, what locations would be optimal? The questions being asked first need to be prioritized before can determine the array location. Bill sees the national ATN as providing sustained capabilities for baseline observations and local groups adding to the infrastructure as necessary based on some priority. Judd made the distinction that monitoring and research have different goals. There was discussion about how there are more initiatives

and willingness to share data as more people become involved with telemetry. The idea that “we do not know what we do not know” came up to emphasize that it is difficult to agree upon infrastructure location without first putting out exploratory arrays. Bill said it would be an option to put such systems out to determine where longer-term systems would be most beneficial. An ideal testbed will consider multiple species and multiple pathways but what might be an ideal array for BOEM is not the same for OR&R or other entity. One common area of interest to a variety of stakeholders is movement of species between coastal and offshore areas. If infrastructure is focused on reliable gated areas across choke points, resources can be added as needed for specific questions. Often, preliminary information sparks the next round of questions. For example, species previously unknown to be transiting habitats might be identified.

Session 3: Research Sector Perspectives continued

Paul Grammer presented on behalf of Mike Andres, University of Southern Mississippi. Research is focused on movement ecology, habitat use and mortality of a variety of species including Gulf Sturgeon, red drum, bull sharks, striped bass, seatrout, snapper and grouper. Movement patterns are correlated with proximity to certain biologic and bathymetric features, and to historic prey information. The team is working around Ship and Horn Islands with Tod Slack, USACOE Engineer Research and Development Center. They are looking at restoration effects on sturgeon which come to feed in late summer/early fall. There are gaps in data because they've had to pull systems as a result of limited funding. The USACOE likes the leveraging and is willing to collaborate more if there is support from other groups. The Gulf sturgeon community is tight and finds a way to meet annually.

Randy Wells, Chicago Zoological Society and Mote Marine Laboratory, has led the Sarasota Dolphin Research program, since 1975. It is the world's longest running dolphin monitoring program, with approximately 160 individuals spanning five generations in the Sarasota Bay population. Recent work is focused on development and testing of new electronic tags and applications, especially for post-intervention monitoring. The threshold for survival after rescue/rehabilitation seems to be ~45 days post-release. His team is working with ATN to look at the impacts tags and attachment designs have on a variety of mammals including bottlenose dolphins, pilot whales and Franciscanas. There is not a lot of work in the open Gulf of Mexico. Working with bow riding dolphins, his team has built a prototype tag delivery system for open water that also collects genetic samples. Also looking at more shore-based stations to improve ability to get nearshore data. There is hope that working with David Mann's acoustic expertise he can eventually move toward identification of individuals based on clicks and whistles.

Randy Wells on behalf of Kim Bassos-Hull, Mote Marine Laboratory, summarized work on passive and active acoustics in the Sarasota Bay Acoustic Array, emphasizing the array is focused on gateways between Sarasota Bay and the Gulf of Mexico. There are 44 receivers out, some of these on nearby reefs. Tagging of spotted eagle rays (24 to date) takes advantage of tonic immobility. The animals move southward or offshore during the winter and also leave the area during extreme red tide events. There is interest in learning how bull shark and dolphin movements respond to each other.

Jayne Gardiner, New College of Florida, is focused on identifying shark nursery habitats and Essential Fish Habitat. She has directional gates near the main mouth of the Manatee River and Terra Ceia Bay. There are a lot of juvenile black tip sharks here but it is not understood if/how females return to natal areas to birth pups or to what degree they stray to other nurseries. Neonatal sharks have been tagged and one left in advance of Irma, returned after the storm

until the end of the season before leaving again with the first cold front. Tags with 10 yr battery life are becoming available and are opening up opportunities for long-term studies.

[Joy Young](#), Florida Fish and Wildlife Conservation Commission and FACT Network, said that the community has buying power and receives discounts on tags. The Florida Atlantic Coast Telemetry Array uses passive acoustic telemetry and has representation mainly from groups in eastern Florida but also NC, SC, GA, Puerto Rico and the U.S. Virgin Islands. There are currently no methodologies for standardized data collection but it is something the group is discussing. Information from the system is intended to help guide management strategies for species of economic value or those requiring special conservation attention. GA/FL collaboration on tripletail management was provided as an example.

[Will Patterson](#), University of Florida, is working on lionfish home ranges and site fidelity, reef fish release mortality, red drum spatial dynamics, spawning and catchability, and spatially-explicit vulnerability. He is working on a gear calibration experiment using side-looking passive acoustic receivers from OTN and stereo cameras. Work is aimed at creating a bio-economic model for a lionfish fishery. He reiterated that focus on acoustic telemetry infrastructure requires knowing the objective of questions to be addressed, understanding whether it is the best tool for the job and determining the opportunity costs of a sustained telemetry observing system.

Panel Discussion

Talks in this session ran overtime so panel discussions were limited. Several comments were made about the cost of participating vs. not participating in a network. Paul provided an example comparing rigorous gatekeeping on small spatial scales vs. a more dilute array over a larger area. What is the least amount of information that can provide an adequate answer for a research questions? Because projects ebb and flow, can you predict how the array is going to change over time? Erin Leone, FWC statistician, developed a social network model to identify where nodes might be most valuable and used to develop a backbone. Important information is gathered along the array line but what is missing outside the line? Detection probabilities can be simulated but what is the cost of missing something to the overall analysis? Data from missing animals are currently undervalued. Randy asked what it would take to have “tags of opportunity” available. There is typically an eight-week lead time needed to build tags but for rescue and rehabilitation work, these are lost opportunities. Users have narrowed down the selection to two styles they like. Bill said making some available is possible. There was interest from the group in sustaining a Gulf community of practice for animal telemetry. Bill said there should be funding as part of long-term planning efforts for the regional associations to host annual ATN meetings.

The day concluded with participants being thanked for their input and details being provided for an informal reception sponsored by LGL Ecological Research Associates and GCOOS.

Day 2 began with a light breakfast followed by a recap of Day 1. Bill presented slides summarizing some of the key discussion topics. The port authority goal is to avoid major impacts to projected resources. A strategic array across the Gulf can capture major offshore/onshore gateways. Little effort has been spent determining the effects of platforms on animal behavior. The offshore bottlenose dolphin ecotype is completely unknown on the continental shelf. HF receiver stations compatible with MOTUS can enable seabird movements to be incorporated as part of a broader view of marine apex predators, including the southern Gulf. Opportunities exist to strengthen ordering of long-term tuna fishing in the Gulf through bilateral relations between the US and Mexico and using the framework of ICCAT. Identifying blueways in the Gulf can be a focus to improve connectivity of research, help identify telemetry priorities, enable animal movements to be used to solve international management problems,

and allow the study of population connectivity at multiple spatial and species scales. Data stewardship and social media mining are areas where GCOOS can support the Gulf ATN community. Can existing PAM receivers be used to assess connectivity and efficacy of MPAs? Information can be used to refine our definition of EFH and inform prioritization of conservation areas. The U.S. Caribbean Acoustic Network has more than 900 tags and 60 M detections of 27 species allowing monitoring through time and across species—a foundation to understand movement in response to fluctuating biotic parameters.

After the Day 1 recap, the breakout process was described and participants were divided into two groups. Because some content outlined in the breakout sessions was previously addressed during the presentations and panel discussions, flexibility was retained to maximize efficiency. During session A, participants were asked to identify animal telemetry observation needs in the GCOOS region vs. assets that are currently in place to collect them. During session B, they were asked to identify potential projects that could demonstrate the value of an integrated ATN in the Gulf of Mexico. Group 1 was facilitated by Woodward with Fred Whoriskey taking notes. Group 2 was facilitated by Mark Luther, with Simoniello taking notes. Notes from Group 2 can be found in Appendix 3. Information included in the Report Out Session follows.

Report-out from Breakout Sessions

Groups 1 and 2 were each given 15 minutes to report out from their breakout sessions. Previous ATN workshops focused on the following five elements in their reports: 1) A matrix of telemetry needs, including existing assets and gaps; 2) Challenges and concerns of tagging efforts in the Gulf; 3) Value-added benefits of a network approach to telemetry; 4) A description of what a baseline ATN for the Gulf might look like; and 5) Prioritized animal telemetry needs for the Gulf of Mexico. Because much of the information was included in presentations and addressed during the panel discussions, the report outs focused on the task of identifying demonstration project ideas.

Bill Woodward presented on behalf of Group 1. The group created a matrix to show assets, activities and capabilities based on input from approximately five workshop participants. Effort was measured on a scale from 0-3, with 0= not aware of anything being done; to 3= extensive work has been done. The exercise was intended to provide ATN a snapshot of telemetry activities in the region. The small group precluded an accurate picture of regional acoustic, satellite and archive tags. However, approximately 20 speakers had previously described their tagging efforts and a more comprehensive matrix can be gleaned from the information in those presentations. A comment was made about the need to balance infrastructure with the vision of funders. Many factors must be considered, including state boundaries, ecological boundaries and management goals.

Woodward explained that supporting baseline observations and data capabilities are core activities of ATN. The goal is to build regional alliances working through IOOS regional associations. Ecological connections between the northern and southern GoM need to be better understood. Several funding opportunities lend themselves well to building the ATN. We need to ask the right science questions and identify the resources needed to address at appropriate temporal and spatial scales. The GCOOS-RA brings strong capabilities, especially in data management and data sharing standards. Australia (AAT/ANS) is currently testing the feasibility of joint standards. Participants shared frustration that it is hard to find and access summarized telemetry data from the Gulf. It is virtually impossible to readily integrate acoustic data with satellite telemetry data. The telemetry support tool developed for GCOOS by Bob Currier

addresses some of these issues. There are also practical benefits to participating in the ATN. Legacy data are preserved, there is sharing of common analytical code, ATN is working to offset Argo costs for participating PIs and can act as a bargaining chip negotiating equipment purchases from vendors.

The Group 2 report was given by Caitlin Young. The matrix of telemetry assets showed fairly good coverage near rivers and the coast but lacked coverage near the shelf and offshore. There was discussion about how rigs might be utilized for offshore telemetry and the research priorities surrounding decommissioned rigs. There was consensus about needing to first know where animals are going before understanding where to instrument. It would be helpful to first put satellite tags on commercially important/keystone species and use the information to inform placement of acoustic arrays. Vessels and platforms of opportunities and gliders have potential to instrument. An adaptive system would be ideal where there is a pool of receivers that could be deployed on opportunistic platforms, especially those where other data are being collected to make information most meaningful. The group requested sustained engagement for the Gulf Community of Practice for ATN and asked if funds would be available to support another workshop next year. There was agreement that if there is serious interest in designing a regional array, more people engaged in Gulf telemetry need to be present to make sure the design is most effective. Early career scientists expressed interest in wanting to learn about effective designs from their colleagues.

Those working with birds suggested pairing in-water and in-air telemetry devices on a single piling could provide unique insight across trophic levels. An effective telemetry demonstration project will support adaptive management. The Gulf group can position themselves to evaluate long-term monitoring and assessment of restoration projects, making ATN valuable to National Academies, RESTORE and others. An example of how LADWF sturgeon telemetry helped save USFWS millions of dollars during a dredging project was shared.

There were a few ideas for a telemetry demonstration project in the Gulf. Most widely embraced was a region-wide project to understand existing assets, identify areas of opportunities and begin to fill identified gaps. The region-wide array, laid out like spokes around a wheel with a centralized offshore area, would have arrays radiating from inshore/riverine areas to the coast to offshore bluewater. A broad spectrum of taxa would be caught through choke points. Starting points might be Tampa Bay, Mobile Bay, Mississippi Sound, Lake Pontchartrain and Padre Island. The organized testbed would aim to test both technology and science applications in tandem. A color-coded map could be used to visualize the system, with green showing existing arrays and infrastructure; yellow showing resources that could support the work; and red showing where coordinated funding would be needed to fill in missing assets and resources.

Because we don't know what we don't know until exploratory work is conducted, the testbed could also inform development of a sustained Gulf ATN backbone, sustained observations to address long-term issues. There was interest in creating a GCOOS work group to focus on ATN development and possibly coordinate a consortium to seek funding for the described demonstration project. Simoniello and Luther were both willing to follow up with participants. There was also interest in having GCOOS host a workshop to help the telemetry community learn how to access and understand Gulf hydrographic information. Luther expressed interest in working with the Florida community. Simoniello will explore funding to host a workshop for the Gulf telemetry community to meet with the GCOOS data management and product development team. Going forward, the group was reminded that from the commercial perspective, the more industry is involved, the easier it is for programs like the ports and military to support the effort. It is much easier to support and leverage existing partnerships than to

create new ones. With their involvement, we are more likely to get a stronger infrastructure and more applications that are of interest to funders. It was mentioned that sand sediment resources is an up and coming hot topic (i.e. BOEM, BESSE) and demonstration projects showing the value of telemetry here can create opportunities.

The steering committee, speakers and participants were thanked for their contributions and the meeting was adjourned.

Appendix 1 Participant names and affiliations

Appendix 2 Workshop agenda

Appendix 3 Group 2 Notes

Participants included Mark, Benny, Chris C., Judd, Chris S, Matt, Nathan, John, Eric, Ruth, Jayne, Paul, Ashley and Caitlin. Caitlin agreed to present during the report-out on behalf of the group.

Breakout Session A

A gap analysis needs to consider multiple scales---gates at river mouths, bays, out to the coast and open ocean. Maps show big gaps in coverage around southwest LA, mainly because wide passes make gates challenging. We've mostly discussed acoustics but satellite tags are also important. In addition to geographic gaps are connectivity gaps between people funding and doing the work. Most systems are temporary and move frequently so today is just a static picture of what exists. One suggestion was to consider a movement-type approach for an ideal framework---anadromous species, coastal migrants, open sea species. A series of coastal gates can show nearshore patterns but completely miss offshore movement. How can acoustic monitoring in deepwater be improved? Some questions like those related to movement ecology/life stage habitat use require monitoring different types of regions---river, estuary, coastal and open ocean. Benny says he thinks of the Gulf as two big systems, the Eastern Gulf dominated by the Loop Current and the Central/Western Gulf dominated by Mississippi River/freshwater open marsh. Perhaps we are starting at too broad a resolution? There are a lot of estuarine dependent species moving long distances between the coast and offshore blue water. It makes it difficult to know where to start. In thinking about a basic observing backbone, Caitlin suggested thinking about the continuous management questions that need answering. Stock assessment is a priority, as are habitat questions related to EFH. What backbone would allow a layered approach to answer numerous questions? Could a handful of receivers around barrier islands help support a wide array of research? Julie framed the task in terms of what species we have tagged and what needs to be tagged in estuaries, coastal regions, etc. Others think we'd miss a lot if a species approach is taken.

Mark asked if there are requirements from production companies to support this kind of monitoring. Individual companies have decommissioning regulations and need to quantify if the platforms have environmental benefits to animals. Information before and after rigs are in place can be useful. For example, going in ahead of an event that a company needs information on is a valuable service. This is an area of opportunity for collaborating with Mexican colleagues as their energy program develops. Another area might be partnering with the Navy as they fly non-military glider operations for hurricanes and LC dynamics. They typically fly six to ten at a time. If information can help guide where the gliders fly, there might be interest. Oil and gas companies might be more interested if receiver packages could be designed to include

metocean sensors. Platforms really only offer a small dot of coverage in a big ocean; gliders will be integral for larger spatial coverage.

Participants questioned who the stakeholders of the exercise are in an attempt to understand what system is needed to satisfy some unclear question. Questions arose about if an array needs to consider both state and federal balance—out to the EEZ? Should it factor in Cuba and Mexico and connectivity needs? What integrates all stakeholders? There was agreement that open water gaps need to be filled and that rigs and gliders could potentially help. Julie asked if any species are considered indicator species for the Gulf of Mexico as a way to prioritize. Different stakeholders would give different answers.

Discussions ensued about the minimal amount of information that could be useful. For example, maybe a single gateway in and out of Lake Pontchartrain is enough to show present or not. John Pye has receivers on management lines and natural barriers and can distinguish use between the two habitats with specific qualities. For small arrays, management lines are a good approach with obvious benefits. Places like the U.S./Mexico border are more challenging because they lack major infrastructure. Basically drawing random lines in the sand. People are not going to put acoustic tags on pelagic species. Part of the problem is that people do not know where the animals are going; if it is not within 500 m of a listening station, it is not going to be detected. One suggestion is to have more satellite tags initially to identify hot spots and inform where to put acoustics. Long time series monitoring can show patterns that you might never otherwise see. Another suggestion was to put satellite and acoustic tags on the same animals to identify where the major boundaries are; dual tagging as a means to narrow down blueway corridors. Other ideas included using VMTs with external attachments that pop off and become mobile receivers that can then pick up other acoustically tagged animals; and adding cameras to trackers to identify habitat use.

What information does GCOOS have to guide placement of receivers in coastal and offshore environments? Stock assessment data and a lifetime of assets from a variety of sources.

Breakout Session B

Prior to discussing demonstration projects, participants expressed interest in a workshop to learn how to access and use regional oceanographic and other data to support their telemetry work. Interest included circulation from HFR and daily SSH and altimetry. There was also interest in the locations of observing infrastructure that might be able to accommodate receivers.

Requirements for a good demonstration project included: multiple layers of stakeholders, a strategic set of locations, something that informs management, ideally a partnership that includes industry, and a demonstration of inshore/offshore connectivity. One suggestion was a project to inform industry about what/how to decommission a platform by quantifying benefits vs risk. Benny said he has three sets of receiver arrays on platforms that are scheduled to be removed. He'd like to continue use for baseline studies. A two-year study is in progress but he'd like to extend and consider new hypotheses. Jayne suggested a demonstration project showing how an active port impacts an estuary of national significance, a designation that has a federal investment attached to it. Receivers in Port Tampa would be easy because there are already structures to support. Inshore/offshore connections and connections to artificial reefs could be made. A similar opportunity exists in Barataria Basin—a network can be established through the estuary, the coast and offshore. It's a more open system compared to Calcasieu and

Pontchartrain but challenges can be addressed. The timing is right because the estuary is looking for new priorities since they achieved their sea grass target goals. The demonstration idea could be a testbed for other ports and offer the opportunity to test both technology and animal research. Extensive leveraging opportunities exist in Tampa with the port, the Florida Aquarium, Mark Luther's PORTS team and other partnerships.

Simoniello suggested we frame a regional demonstration project that shows a gradient from nearshore to offshore around the Gulf: Port Tampa for Florida; Mobile Bay for Alabama, Mississippi Sound for MS, LADWF research site for LA and Texas barrier island choke points for Texas. The goal would be an idealized project like spokes on a wheel to bring in resources without duplicating efforts to fill in gaps along a gradient rather than the entire coast. GCOOS might be able to help fill in deep water gaps with receivers on existing infrastructure. The collaborative effort would pilot test technologies as well as include demonstrations of applications. Thoughts for success include linking with restoration projects, targeting dredging areas, including species of concern like sturgeon, and connecting movement of animals to management decisions. Sediment mapping is growing in importance and early links to plans can provide critical information linking it with animal health. To conceptualize the "spokes on the wheel" Julie suggested using a color coded map for the components showing green for existing assets and programs; yellow where possible infrastructure can support added capacity; and red for gaps where connections are needed. Mobile Bay and the Mississippi River are natural breaks in the Northern Gulf. A competitive proposal would show that for \$1M/year for 10 years, this is how the spokes on the map will change. OTN investment in Texas with Greg/Judd team and other resources might be available to piece together various elements. Caitlin asked if we could draw a base map right now, what would the color and location of the spokes on the wheel look like? An action is to stand up a working group to hash out a color-coded map coordinated through the RA...an ATN Community of Practice.

Rebecca said that BOEM is looking for new ideas. The broader the group that comes together the more effective. A large, multi-species, large spatial extent project could gain traction. The council especially likes to see leveraging. Simoniello suggested that we could ultimately get at questions related to carbon sequestration with telemetry of vertical migrators and deepsea species. Understanding of habitat use and connectivity between vents and mid-ocean ridges could resolve energy budgets--How much; Where it's going; How is it changing. These types of questions could lead to other funding opportunities. Matt said that being able to use telemetry data to assess the success of restoration activities would be huge. Can ATN information validate that salt grass was restored and serving ecological benefits to species?