

## IRA RFA Topic Area 2 Potential Project of Interest

### 1.f: Coordinated integration of long-term passive acoustic monitoring and acoustic telemetry within RA infrastructure

#### Goal

Coordinate integration of long-term passive acoustic monitoring (PAM) and/or acoustic telemetry networks across the RA infrastructure, leveraging existing capacities for data collection and data management to support comparability of standard data products from local to global scales, and advancing the coordinated build out and operation of nationally interoperable passive acoustic and/or acoustic telemetry networks (ATN) that align with emerging national and international standards.

#### Project Description

Improving the collection, dissemination, and use of actionable marine life and ecosystem data, information, and services is critical to ensure local communities and decision-makers have the knowledge necessary for coastal resilience and to mitigate and adapt to impacts of climate change; to sustain coastal and marine resource dependent communities; and to effectively manage fisheries, habitats and protected areas and resources. However, marine life data are collected by disparate groups using a range of methods and are often not shared, presenting challenges for effective and sustainable management of ocean health and living resources. Efforts to protect marine life and ecosystems require data that can be shared across sectors and from local to global scales. Progress has been made in some disciplines to advance standard approaches to managing and sharing such data; the IOOS Regional Associations are uniquely positioned to advance these approaches and the national-scale coordination of marine life information in several areas, including PAM and acoustic telemetry.

Passive Acoustic Monitoring: Sound is important to marine ecosystems and essential to quantify ocean health. Marine mammals, fish, and invertebrates use sound to communicate and navigate their environment. PAM data collection has grown exponentially over the past decade resulting in petabytes of data that document our ocean soundscapes, how they change over time, and how and what animals are using these ecosystems on hourly to seasonal to multi-year time-scales. Efficiently extracting this critical information and comparing it to other datasets in the context of ecosystem-based research management is a Big Data challenge that traditional desktop processing methods cannot address. Machine learning (ML) and artificial intelligence (AI) technologies are increasingly playing a role in research applications for PAM datasets to assist in the identification of presence and distribution, habitat use, and behaviors of marine animals. The curation, management, and dissemination of passive acoustic datasets is another Big Data challenge where collaborative progress is needed. The National Centers for Environmental Information (NCEI) with IOOS, NOAA, interagency and international partners are developing a community focused national cyberinfrastructure capability for PAM data,

technology, and best practices, to promote improved, scalable and sustainable accessibility and applications for management and science (the SoundCOOP project). The project is establishing an IOOS Data Management and Cyberinfrastructure (DMAC) capability to integrate PAM data with other DMAC-stewarded environmental and biological datasets and operationalize this approach with IOOS and other partners. NCEI has also established a PAM data archive to support stewardship of these data collected by NOAA line offices and partners.

NOAA's National Marine Fisheries Service (NMFS), National Ocean Service (NOS)/Office of National Marine Sanctuaries (ONMS), and Office of Oceanic and Atmospheric Research (OAR) currently support collection and dissemination of raw and standardized PAM data products from nationally-distributed arrays (NOAA Noise Reference Station Network and ONMS Sanctuary Sound Monitoring Program), which are accessible via NCEI. Beginning in FY22 and 23, a few IOOS RAs piloted a role for IOOS in administering support for regional non-federal long-term sound monitoring stations that would contribute to the same data archiving and delivery pipeline, with coordination by ONMS regional sound coordinators. With investment in coordination, proposals to advance regional arrays can expect to leverage significant existing NOAA data collection and management investment while building out sampling at stationary locations or using mobile assets to address regional IOOS priorities (e.g., offshore energy development, climate influence, etc.). Finally, acoustic telemetry receivers can be integrated in most, if not all PAM moorings, as is currently the case for many NOAA-maintained stations, allowing for cost-sharing in maintaining PAM and ATN capacities.

Acoustic Telemetry Networks: Critical gaps exist in our ability to scale operational acoustic telemetry observations from regional to national levels. Hundreds of researchers nationwide deploy thousands of acoustic tags and receiver stations to track the movements of marine and anadromous species. Most hardware and data are standardized and interoperable, however, regional acoustic telemetry data "nodes" are required for compatible acoustic tracking infrastructure and networking to facilitate data sharing and tag detection matching among research programs. Several RAs are invested in acoustic telemetry data collections for various species, consistent with their regional priorities. These data nodes benefit from working with the RAs to adopt existing data and metadata standards and best practices (e.g., the Ocean Tracking Network (OTN) framework) and maximize data sharing and availability of acoustic telemetry information at multiple scales, allowing tag detections to be matched across nodes and increasing the likelihood that researchers will receive detections of their tagged animals. However, not all regions have an acoustic telemetry node.

IOOS presently supports three regional acoustic telemetry nodes to varying degrees. The Atlantic Cooperative Telemetry (ACT) Network, based at Smithsonian Environmental Research Center, is supported through MARACOOS and coordinates tag detections in New England and Mid-Atlantic waters. The Florida Atlantic Coast Telemetry (FACT) Network, based at the Florida Fish and Wildlife Research Institute, is supported by SECOORA and coordinates tag detections off the southeastern U.S. and Caribbean. The Pacific Islands Region Acoustic Telemetry (PIRAT) Network, based at the University of Hawaii, is supported by PacIOOS to coordinate tag detections across the U.S. Pacific Islands. These nodes grew out of grassroots efforts and

agreements by neighboring researchers to share tag detection data for the benefit of all regional users. Each is primarily comprised of a dedicated data coordinator and a data servicing contract (e.g., cloud-based repository, database support). The data coordinator is responsible for the compilation and quality control of detection data, managing the database, sending tag detection matches to network users, facilitating collaborations, and providing customer support (e.g. data formatting and web portals) to the node. Acoustic telemetry nodes in other regions not currently supported by IOOS include Great Lakes Acoustic Telemetry Observation System (GLATOS) in the Great Lakes and Integrated Tracking of Aquatic Animals in the Gulf of Mexico (iTAG) in the Gulf of Mexico, but these struggle without sustained funding and may not be compatible with global standards. There are no nodes along the U.S. west coast, despite numerous users and acoustic telemetry studies. IOOS has an opportunity to facilitate data coordination and interoperability at the national level by establishing 'cross-regional' acoustic telemetry nodes that ensure alignment with global networks and support the transition to an operational capacity.

## Projects requested

The IOOS Marine Life Program is seeking opportunities to expand its data collection potential and enhance biological products and services. We are requesting applications for projects that advance PAM and/or acoustic telemetry priorities as follows:

Passive Acoustic Monitoring (PAM): IOOS requests proposals that advance regional sound monitoring arrays, leverage existing NOAA data collection and management investments, address regional and national IOOS priorities, and ensure cross-regional and national coordination of PAM data consistent with national NOAA and interagency priorities for data collection, management, and information delivery. PAM projects should:

- Support cross-regional and national coordination of IOOS-supported PAM, including both short-term and long-term efforts funded through RAs and the Marine Biodiversity Observation Network (MBON), collaborating with NOS, NMFS and OAR leads of the Ocean Noise Strategy
- Enhance or initiate IOOS support for key long-term PAM capacity, ensuring coordination with existing long-term NOAA-maintained stationary arrays (the NOAA Noise Reference Station Network and the Office of National Marine Sanctuaries' Sound Monitoring )
- Leverage investments in SoundCOOP to ensure that IOOS supports regional as well as national priorities for passive acoustic data collection, sharing and archival in a well-documented, standardized way that can advance integration with other observation data including via cloud-computing and AI/ML techniques
- Support interoperability of PAM data and advance community acceptance of recommendations on formatting, metadata, and submitting passive acoustic data to the NCEI archive as documented here <https://ioos.github.io/passive-acoustics/> and here <https://www.ncei.noaa.gov/products/passive-acoustic-data>

Acoustic Telemetry Networks: IOOS requests proposals to ensure the full complement of acoustic telemetry nodes for national coverage and interoperability of detections from all nodes facilitated by the Animal Telemetry Network (ATN) and OTN. Acoustic Telemetry projects should:

- Establish or maintain ATN/OTN-compatible acoustic telemetry data nodes at regional or cross-RA scales
- Ensure standards-based, centralized data sharing and management
- Support the acoustic telemetry community by facilitating data integration, archive, and interoperability as well as scientific collaboration and data delivery to marine resource managers

### For More Information or to Ask Questions

Please contact Gabrielle Canonico at [gabrielle.canonico@noaa.gov](mailto:gabrielle.canonico@noaa.gov) with questions on this project theme or to be connected to subject matter experts in NOAA for technical assistance with this project. Please send general questions about the RFA to [ioos.regions@noaa.gov](mailto:ioos.regions@noaa.gov).