



## LIVING MARINE RESOURCES PROJECT 46

# Tethys Capability Enhancements

### NEED

The Navy's need for efficient methods to analyze passive acoustic data continues to grow with the increasing amount of data collected by the Navy's Marine Species Monitoring Program. While publicly available acoustic analysis software applications have improved over the years, additional improvements are needed to enhance overall processing efficiency when identifying, characterizing and cataloging acoustic signals of interest.

### SOLUTION

This project is enhancing Tethys, a workbench and standardization scheme for archiving and using acoustic metadata. Tethys offers researchers and mitigation specialists a method to record these data in a manner that can be preserved over long time periods and accessed from a variety of platforms such as web browsers, Matlab, Java, Python, and R.

The current version of Tethys was developed under a previous LMR project (Project 18), which was co-funded by the Bureau of Ocean Energy Management (BOEM). That project built upon early work funded by the Office of Naval Research Marine Mammal Biology program. As the Tethys user group expanded and became increasingly diverse, the need for additional enhancements to make the workbench more accessible became apparent.

This new project is working to address key enhancements, including:

- Technology updates to ensure security and prevent obsolescence
- A drag and drop data import interface to map field names from researcher specific data formats to the standardized field names in Tethys

- An advanced mapping interface for visualizing both acoustic and environmental data
- A beta-user program
- Responsive help and enhancements to address user needs.

In addition to these five primary tasks, three optional tasks also will be considered as the project moves forward. All are summarized below.

### METHODOLOGY

The five primary tasks are:

#### 1. Technology updates

There are two primary components that are targeted for upgrade. The server code is being migrated to the most recent version of Python. This requires minor code changes to the core code base and reengineering functionality to account for library packages that are no longer supported. The second major direction of the code update is the replacement of the underlying data storage technology to upgrade the database engine to the most recent version of Oracle's Berkeley extended markup language database (Berkeley DBXML). Recent changes to the system provide high-performance indices which will provide additional scalability.

#### 2. Data import

While the current data import methods are both usable and teachable, user feedback indicates that the text file specification requirement now in place can be confusing for new users. This project will build an alternative method that provides a drag and drop type interface.

The goal is to combine a simpler interface with a software agent that offers advice, such as suggestions on potential matches for common non-standard data field names and help on fields that are required but not yet matched.

### 3. Advanced mapping interface

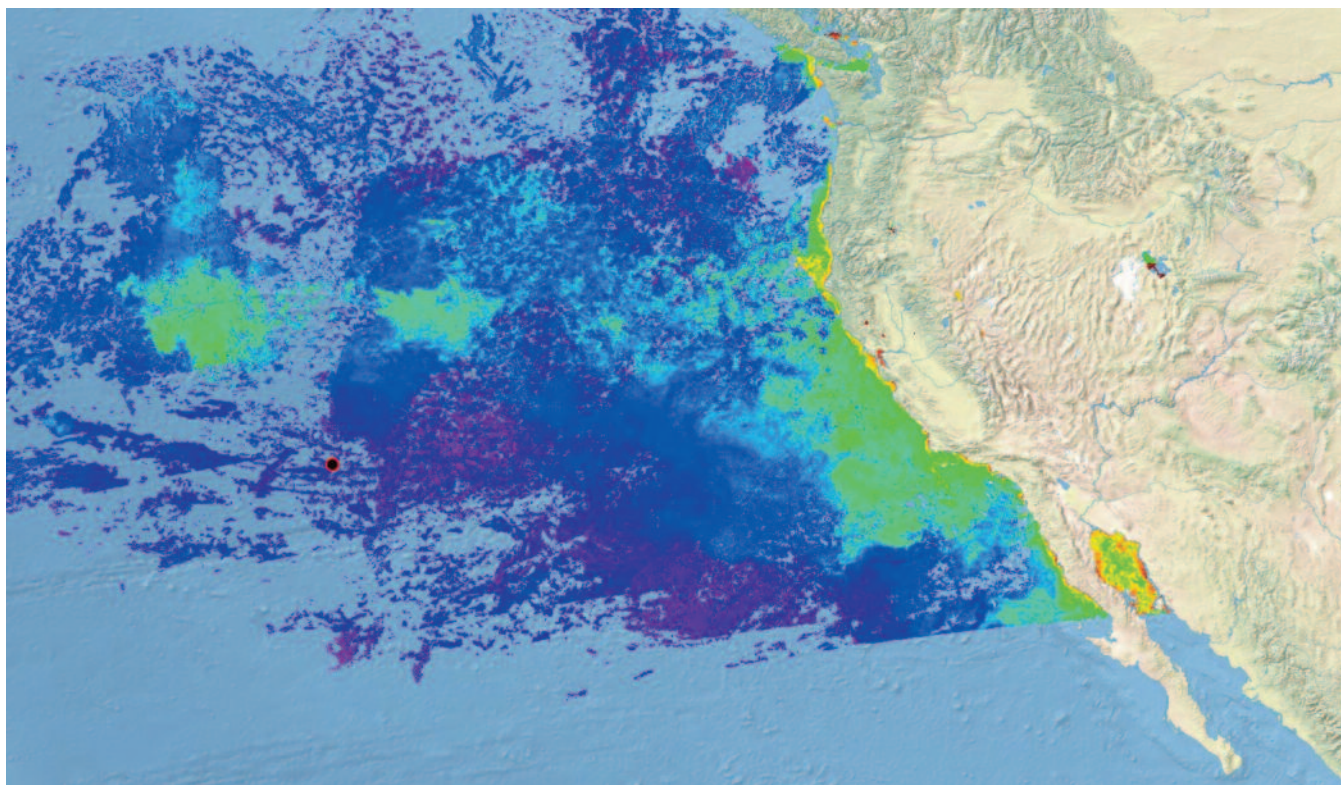
The project will migrate from the current proprietary Google Maps application programming interface to using the open-source OpenLayers map library. The team will provide the capability to add data layers on existing web client maps. The project team anticipates that this will provide improved functionality over what can be implemented with the current Google Maps interface. It will support overlaying oceanographic and atmospheric data (sea surface temperature, wind, etc.) onto animal detections, and when applicable, the ability to show the evolution of these data over time.

### 4. Beta-user program

The Tethys team will engage with a set of bioacoustics “power users” identified by the LMR program. The team will provide a set of educational resources, direct training and responses to issues identified by these users. Training could include a combination of short online sessions and one multiple day in-person training. Feedback from this set of users will influence if and how to proceed with optional tasks.

### 5. User needs

Experience has shown that each user group can have specific data organization needs that are not currently addressed within the Tethys schema. The project team will continue, within reasonable levels of effort, to provide necessary enhancements and training. The team also will remain alert to potential overlaps of needs among user groups to avoid duplication.



An open-source OpenLayers map showing chlorophyll concentrations in the Eastern Pacific. This is an example of environmental data the new mapping interface library would provide for overlaying with monitoring data, such as marine mammal tracks or detections.

Three optional tasks have been identified that might be considered as the project proceeds. These are:

**1. PAMGuard/Tethys integration**

The team would develop interfaces between Tethys and PAMGuard to enable a seamless transfer of PAMGuard detection and localization data to Tethys.

**2. Database consultant review**

A database technology company, identified by the LMR program, would review of the technologies used in the Tethys project, with the goal of identifying areas that could be improved and lead to desired outcomes such as a central repository. The Tethys team would provide time to support the review.

**3. Standards development**

Previous Tethys work included moving the Tethys schemata towards an American National Standards Institute (ANSI) standard. The existing standards committee has addressed many of the issues related to deployments, detection and classification. However, the beta user group noted above may identify additional needs to be incorporated into the ongoing standards work.

## SCHEDULE

The basic project is scheduled over two years, with products being completed by the close of 2022. The drag-and-drop interface will be an early focus and is expected before the end of 2021. Technology updates will be ongoing, with the most significant portions complete by mid-2022. The advanced mapping components will be addressed primarily during 2022. User support will occur as needed throughout the project period.

## NAVY BENEFITS

This project will help the Navy to retain long-term information about marine mammal species that is needed for Navy monitoring and mitigation plans. As previous research has demonstrated, Tethys's data preservation and the ability to reuse data have expanded the scope of science and policy-based questions that can be asked. Retaining data from large scale spatial and temporal studies provides clear benefits for advancing science, enhancing the Navy's capabilities to monitor cetaceans and preparing detailed environmental impact assessments.

## TRANSITION

Products will include software and documentation, training and a standards document for the ANSI standards group. Training workshops and videos will be developed to aid users. Videos will be available on the Tethys website: <https://tethys.sdsu.edu>. As in the past, several research publications that use Tethys to manage their data are anticipated. All software is open source and hosted on publicly available repositories.

## ABOUT THE PRINCIPAL INVESTIGATOR

Marie Roch is an interdisciplinary computer scientist whose work on the bioacoustics of marine mammals is internationally recognized. She is a professor of computer science at San Diego State University and is affiliated with Scripps Institution of Oceanography's Marine Acoustics Laboratories. Dr. Roch holds a Ph.D. in computer science from the University of Iowa.



## About the LMR Program

The Living Marine Resources (LMR) program seeks to develop, demonstrate, and assess data and technology solutions to protect living marine resources by minimizing the environmental risks of Navy at-sea training and testing activities while preserving core Navy readiness capabilities. For more information, contact the LMR program manager at [exwc\\_lmr\\_program@navy.mil](mailto:exwc_lmr_program@navy.mil) or visit [www.navfac.navy.mil/lmr](http://www.navfac.navy.mil/lmr).

