

Datasets: Underwater Passive Acoustic Data Spanning the Hudson River National Estuarine Research Reserve

This document provides detailed information about two datasets that were generated through a Collaborative Research project titled *Leveraging Conservation Technology to Improve Protected Species Management Efforts and Enhancing Ecosystem Services within the Hudson River NERR*. This [webpage](#) provides information about the project. The project was supported by the National Estuarine Research Reserve System (NERRS) Science Collaborative, which is funded by the National Oceanic and Atmospheric Administration. All Science Collaborative supported projects that collect new data adhere to federal data sharing and archiving requirements.

About the Associated Project

Project page: <https://nerrssciencecollaborative.org/project/Rice22>

Grant Type: Collaborative Research

Focus Area(s): Habitat Restoration

Keyword(s): acoustic monitoring, fisheries

Reserve(s): Hudson River, NY

Project Duration: October 2022 - March 2024

Grant Amount: \$399,976.00

Project Contacts:

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Project Description

The Hudson River Estuary (HRE) supports a wide range of fish species, including a number of migratory and endangered species. The Hudson River National Estuarine Research Reserve (HRNERR), partners closely with the New York State Department of Environmental Conservation (NYSDEC) Fisheries Unit to monitor these fish species to inform fisheries management. Traditional monitoring approaches for migratory and resident fish in the Hudson River Estuary have been unable to fill critical information gaps on several key fish species, impeding effective management of their populations.

To fill these information gaps, the HRNERR needs development of non-invasive techniques capable of answering questions about phenology, abundance, and spatial patterns of habitat use of priority fish species. Passive acoustic monitoring (PAM; also referred to as bioacoustics) has emerged as an effective technology that is well suited for this purpose. In a close collaboration between HRNERR, NYSDEC, and Cornell University, this project team helped augment traditional

survey methods with passive acoustic monitoring techniques. The team deployed PAM devices at 12 locations in and around the reserve. These devices allowed the team to record soundscapes at each site, gathering information about individual species, natural phenomena (e.g. rain), and human activity (e.g. vessels, trains). With the resulting data, the team characterized a diverse range of soundscapes across a latitudinal and salinity gradient along the Hudson River, and compared sounds from tributary and wetland habitats to those of the main channel of the river.

This collaborative bioacoustics research and education effort has yielded the largest data set of riverine acoustic recordings in the world and produced several important products that directly contribute to management, conservation, and education outcomes. One of the team's most significant findings was the identification of spawning-related sounds produced by Atlantic sturgeon, a federally listed endangered species. The novel documentation of species-specific sounds from sturgeon enables further PAM studies to characterize sturgeon spawning and migration phenology, patterns of spatial occurrence, and habitat use. Another key finding was the acoustic prevalence of non-native freshwater drum at the Atlantic sturgeon spawning site. While freshwater drum are known to be present in the Hudson River, the extent of their colonization, and their interactions with native species, are not well characterized. Freshwater drum chorusing was observed to dominate the underwater soundscape for several hours each day between early June and late July, overlapping with the Atlantic sturgeon spawning period. This finding led to a follow-on project funded by the New York State Water Resources Institute (WRI) aimed at using sound to characterize space use by Atlantic sturgeon and freshwater drum at this site, and quantify overlaps, to identify possible negative impacts on the sturgeon and inform freshwater drum management strategies. Key educational outputs from this project also include an in-person public listening exhibit with a library of sounds from the Hudson River, and interactive Story Map and curriculum which lay the foundation for training students as investigators.

Overview of Datasets

Two datasets are described in this document:

- **Dataset 1: Main stem calibrated passive acoustic data**
Calibrated passive acoustic recordings collected by SoundTrap recorders deployed in the Hudson River main channel to investigate the use of bioacoustics for fish species and habitat monitoring.
- **Dataset 2: Tributary/marsh uncalibrated passive acoustic data**
Uncalibrated passive acoustic recordings collected by Swift Units deployed in tributaries and marshes of the Hudson River to investigate the use of bioacoustics for fish species and habitat monitoring.

Data access and archival:

Datasets have been archived in the NOAA National Centers for Environmental Information (NCEI) Passive Acoustic Data archive and can be downloaded at the following link:

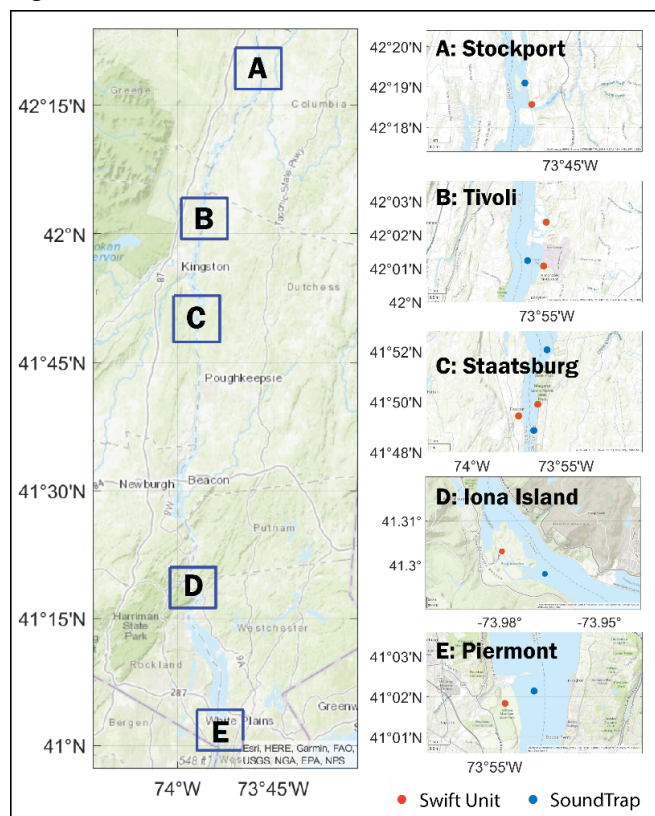
https://www.ncei.noaa.gov/maps/passive-acoustic-data/?projectName=NOAA-NERRS_HudsonRiver_2023-2024. For help accessing data, contact pad.info@noaa.gov.

Questions about these datasets can be directed to:

Aaron Rice, Cornell University, arice@cornell.edu

Maps and schematics for data collection:

Figure 1: Data collection locations



About the Project Datasets

Detailed dataset descriptions are provided below.

Dataset 1: Main stem calibrated passive acoustic data

Data overview:

Calibrated passive acoustic recordings collected by SoundTrap recorders deployed in the Hudson River main channel to investigate the use of bioacoustics for fish species and habitat monitoring.

Recorders were securely lashed to rigid concrete-and-rebar moorings. To avoid the possibility of strumming noise during high flow rates, anchor lines were connected to separate attachment hardware and did not come in contact with the recorders or their rebar mounts.

Data collection period:

January 2023 to October 2024

Geographic extent:

Data were collected from 5 regions of the Hudson River:

- Stockport, NY (approx. 42.31825°N, -73.77528°W)
- Tivoli, NY (approx. 42.023348°N, -73.934236°W)
- Staatsburg, NY (approx. 41.814143°N, -73.947048°W)
- Iona Island, NY (approx. 41.298060°N, -73.966390°W)
- Piermont, NY (approx. 41.033456°N, -73.890237°W)

Exact deployment coordinates are provided with each deployment.

File format:

FLAC audio files. This is a lossless compression format.

File name(s):

Each audio file name contains the sampling rate, deployment name, device type, device serial number, and start date with time zone.

Data access and archival:

Data have been archived in the NOAA National Centers for Environmental Information (NCEI) Passive Acoustic Data archive and are freely available for download from their website (https://www.ncei.noaa.gov/maps/passive-acoustic-data/?projectName=NOAA-NERRS_HudsonRiver_2023-2024). For help accessing data, contact pad.info@noaa.gov.

Maps and schematics for data collection:

See Figure 1.

Dataset 2: Tributary/Marsh Uncalibrated Passive Acoustic Data

Data overview

Uncalibrated passive acoustic recordings collected by Swift Units deployed in tributaries and marshes of the Hudson River to investigate the use of bioacoustics for fish species and habitat monitoring. Swift Units were custom modified to accept input from HTI cabled hydrophones.

Swift Units were securely lashed to trees at the water's edge. Hydrophone cables were run from the Swift Units out to rebar that had been driven into the river bottom; hydrophones were affixed to the rebar approximately ½ m above the bottom. Cables were trenched a few inches into the substrate to protect them and avoid movement and tangling.

Data collection period:

January 2023 to October 2024

Geographic extent:

Data were collected from 5 regions of the Hudson River:

- Stockport, NY (approx. 42.31825°N, -73.77528°W)
- Tivoli, NY (approx. 42.023348°N, -73.934236°W)
- Staatsburg, NY (approx. 41.814143°N, -73.947048°W)
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Maps and schematics for data collection:

See Figure 1.