

# Movies of mysid aggregations in Damariscotta Estuary, Maine obtained during the summer of 2023

**Website:** <https://www.bco-dmo.org/dataset/925893>

**Data Type:** Other Field Results

**Version:** 1

**Version Date:** 2024-04-25

## Project

» [Collaborative Research: Characterizing benthic mysid ecology and animal-fluid interactions in response to background flow, food, and light conditions](#) (Mysid ecology)

Contributors	Affiliation	Role
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## Abstract

Mysid shrimp are a group of zooplankton that are distributed in diverse aquatic environments – freshwater, marine and estuarine – in both shallow and deep waters throughout the world. Due to their ubiquitous presence, mysids form a critical link in marine food webs; however, much remains unknown about their ecology and interactions with their local surroundings. This study aims to conduct a comprehensive investigation of mysid behavior in their natural environment, including their interactions and distribution under varying local flow, food and light conditions. The survey will involve developing and deploying a novel in situ imaging system to study mysids in coastal Maine over the span of two summers. This dataset contains raw movies of mysid aggregations obtained during summer 2023.

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## Coverage

**Location:** Damariscotta Estuary, in the vicinity of the Darling Marine Center, Walpole, Maine, USA

**Spatial Extent:** Lat:43.93419 Lon:-69.57958

**Temporal Extent:** 2023-07-26 - 2023-08-04

## Dataset Description

This dataset contains image files and a metadata table in the "Data Files" section and additional "Supplemental Files" including processing code and a file inventory.

## Methods & Sampling

For in situ mysid behavioral observations, we have developed and deployed a custom-built stereoimaging system capable of capturing synchronized high-quality images at a high frame rate (up to 21 fps). Our current setup features Teledyne Blackfly S GigE cameras with 5 MP resolution, IEEE1588 clock synchronization, and PoE support. Navitar lenses, with focal lengths of 12 mm or 25 mm, are attached via C-type lens mounts to ensure compatibility. Lighting is provided by a TrustFire DF50 scuba diving light with white and red LED modes. The stereo housing, designed in-house, comprises galvanized aluminum structures and acrylic end caps housing optical-grade glass lenses. It offers flexibility in inter-camera distance and angle. Custom-made underwater DragonFish Ethernet cables facilitate power and data transfer, enabling live feed monitoring, and synchronized camera frame storage, while also simplifying power management, thus extending deployment time.

The stereo housing and lighting system are affixed to an aluminum bar frame, which is lowered into the water using a crane. Initially, the frame is positioned at a shallow depth for calibration purposes. An 8x9 checkboard pattern with a 10 mm square size, printed on an aluminum composite panel, is submerged for calibration. Synchronized images are captured by both cameras as the checkerboard is moved to cover the common field of view and focused depth. Once calibration images are recorded, the camera rig is lowered to the desired recording depth. Live feed monitoring ensures proper lighting and clear visibility before recording synchronized images commences. After sufficient images are captured, recording is stopped, and the stored data undergoes quality and synchronization analysis. Finally, details such as the data recording location, folder identification, camera synchronization status, and the number of recorded images are documented in our field notes before proceeding to the next data recording session. Calibration is typically required only once at each location. File naming conventions: Maine2023\_Pxx or Maine2023\_Sxx as the naming protocol (for primary and secondary cameras, where xx represents the number of the dataset, e.g., P80, S80).

## Data Processing Description

The original field data comprises 8-bit monochrome TIFF or BMP image files recorded synchronously by two cameras. The uploaded data consists of movies (MP4 video format) of the raw images, i.e., each movie is a compilation of all the raw images in a single dataset.

A Python script was used to process a sequence of image files from a specified folder (a single dataset) and generate an output video using the 'mp4v' codec. The video's frame rate matches that of the image recording rate. You can find the Python script code we used within a python notebook for this purpose within the supplemental file 'video\_from\_imgs.txt'

## BCO-DMO Processing Description

Mysid videos were bundled up into two zip packages with zip64 support using 7z. These two zip files were added to the "Data File" section (Mysid\_movies\_summer2023\_Maine\_P.zip, Mysid\_movies\_summer2023\_Maine\_S.zip).

\* File inventory was created containing the imagename, filesize and checksums. Added columns to contain identifiers within the image name: image set id (primary or secondary folder), and Primary\_or\_Secondary indicating if it was the primary or secondary camera. (file\_inventory.csv)

Sheet "Metadata" within file Maine\_dataset\_report\_5.xlsx was imported into the BCO-DMO data system. With additional added columns with the associated primary and secondary movie name. Metadata table added as a supplemental file.

\* Date converted to ISO 8601 format, ISO timestamps with timezone added (UTC) in addition to local times.

\* Lat lon converted to decimal degrees

\* Column names adjusted to conform to BCO-DMO naming conventions designed to support broad re-use by a variety of research tools and scripting languages. [Only numbers, letters, and underscores. Can not start with a number]

## Problem Description

N/A

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## Data Files

File	
<b>Metadata for Primary and Secondary Camera Movies</b> filename: 925893_v1_mysid-movies.csv  Collection and camera metadata associated with mysid movies (primary and secondary cameras). See "Parameters" section for column information (descriptions, units).	(Comma Separated Values (.csv), 8.99 KB) MD5:1df61a3815bb0660fda71280147f8629
<b>Mysid movies - Summer 2023 Maine - Primary Camera</b> filename: Mysid_movies_summer2023_Maine_P.zip  Zip package containing 39 videos (MP4 format) of the raw images from the primary camera. Each movie is a compilation of all the raw images in a single dataset (e.g. P80). See "Data processing" section for more details.  File naming conventions: Maine_2023_Pxx_FPS_yy or Maine_2023_Sxx_FPS_yy as the naming protocol (for primary and secondary cameras, where xx represent the number of the dataset, e.g., P80, S80 and yy represents the frame rate at which the data is recorded).	(ZIP Archive (ZIP), 27.34 GB) MD5:250abf79d1da588dbe81aa72974400db
<b>Mysid movies - Summer 2023 Maine - Secondary Camera</b> filename: Mysid_movies_summer2023_Maine_S.zip  Zip package containing 39 videos (MP4 format) of the raw images from the primary camera. Each movie is a compilation of all the raw images in a single dataset (e.g. P80). See "Data processing" section for more details.  File naming conventions: Maine_2023_Pxx_FPS_yy or Maine_2023_Sxx_FPS_yy as the naming protocol (for primary and secondary cameras, where xx represent the number of the dataset, e.g., P80, S80 and yy represents the frame rate at which the data is recorded).	(ZIP Archive (ZIP), 27.11 GB) MD5:4767528598fa0d939cb97323abcb3774

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## Supplemental Files

File	
<b>File inventory table</b> filename: file_inventory.csv  Inventory table for each of the .mp4 files provided in this dataset.  Columns: filename, video filename filesize_bytes, filesize in bytes md5sum, checksum (md5) that can be used to verify integrity of the file after transfers within_zip_package, the name of the .zip package this file is within in the dataset	(Comma Separated Values (.csv), 9.74 KB) MD5:05c82c9274ecdff1456ce7e7b1714c72e
<b>Python code for creating movie from Raw Images</b> filename: video_from_imgs.txt  Python script which converts a sequence of images into a video file using OpenCV library. Amber's edit: Python code which converts a sequence of images into a video file using OpenCV library. Code as used within a python notebook.	(Plain Text, 2.90 KB) MD5:bd45257f02cef522e6e28905cb9d4155

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## Parameters

Parameter	Description	Units
Date_Local	The date on which the field data is recorded (time zone EST/EDT).	unitless

Start_Time_Local	The start time of field data recording.	unitless
End_Time_Local	The end time of field data recording.	unitless
Location	The location at which the data is recorded. The datas are recorded at two docks of the Darling Marine Center. DMC Pedestrian dock: Darling Marine Center Pedestrian dock; DMC Main dock: Darling Marine Center Mine Dock.	decimal degrees
Latitude	Latitude of the data recording location	decimal degrees
Longitude	Longitude of the data recording location.	unitless
Primary_Folder	Reference folder name of the camera which initiates the trigger for camera synchronization.	unitless
Primary_Movie	Filename of the movie for the primary Primary_Folder images	unitless
Secondary_Folder	Reference folder name of the camera which receives the trigger for camera synchronization.	unitless
Secondary_Movie	Filename of the movie for the Secondary_Folder images	unitless
Camera_FPS	Camera frame per second (FPS) set for the data recording. For all the recordings the same FPS is maintained for both cameras.	unitless
Strobe_Light_Color	Strobe light color. The used strobe light is a battery-powered LED touch which has four modes: Bright White/White/Red/UV.	unitless
Image_Numbers	Image Numbers (Primary Camera/Secondary Camera ). Number of images captured by primary and secondary camera. Similar image numbers indicate that the cameras capture images in a synchronized manner.	unitless
Camera_Orientation	Camera orientation description. Two different camera orientations are used: one parallel to the waterbed looking horizontally and the other vertical to the waterbed looking downwards.	unitless
Start_DateTime_UTC	The start timestamp with timezone (UTC) of field data recording. Datetime format is ISO 8601.	unitless
End_DateTime_UTC	The end timestamp with timezone (UTC) of field data recording. Datetime format is ISO 8601.	unitless

Image_Storage_GB	Storage volume (Video). Camera captures 8-bit monochrome images saved in '.tiff' format. These values show the total hard drive space required to save both the primary and secondary image folders.	Gigabytes (GB)
Video_Storage_GB	Storage volume (Video). We employed a Python script to create a video file (.mp4 format) from a designated folder containing the raw image files (.tiff format). The column values indicate the cumulative hard drive space necessary to store the videos from both the primary and secondary folders.	Gigabytes (GB)

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## Instruments

<b>Dataset-specific Instrument Name</b>	In-house custom-developed stereoimaging system for zooplankton observations: Teledyne Blackfly S GigE cameras
<b>Generic Instrument Name</b>	Camera
<b>Dataset-specific Description</b>	A custom-built stereoimaging system capable of capturing synchronized high-quality images at a high frame rate (up to 21 fps). Our current setup features Teledyne Blackfly S GigE cameras with 5 MP resolution, IEEE1588 clock synchronization, and PoE support. Navitar lenses, with focal lengths of 12 mm or 25 mm, are attached via C-type lens mounts to ensure compatibility. Lighting is provided by a TrustFire DF50 scuba diving light with white and red LED modes.
<b>Generic Instrument Description</b>	All types of photographic equipment including stills, video, film and digital systems.

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## Project Information

### **Collaborative Research: Characterizing benthic mysid ecology and animal-fluid interactions in response to background flow, food, and light conditions (Mysid ecology)**

**Coverage:** Damariscotta River Estuary, Maine, USA

#### *NSF Award Abstract:*

Mysid shrimp are a group of zooplankton that are distributed in diverse aquatic environments – freshwater, marine and estuarine – in both shallow and deep waters throughout the world. Due to their ubiquitous presence, mysids form a critical link in marine food webs, yet little is known about their ecology and interactions with their local surroundings. An interdisciplinary team of investigators will develop and deploy a novel in situ imaging system in coastal Maine over the span of two summers, conducting a comprehensive investigation of mysid behavior in their natural environment, including their interactions and distribution under varying local flow, food, and light conditions. The investigators will train two graduate students at the interface of fluid mechanics, instrumentation, and ecology. In addition, ten students from Florida Atlantic University and the University of Southern Maine will be invited to participate in annual workshops on ecological fluid mechanics, with first-generation college students or those from other underrepresented communities encouraged to apply. The cutting-edge instrumentation suite, including the imaging system being developed as part of this project, can be used to address different questions associated with spatial patterns and zooplankton or fish behavior in the future. Image datasets will be openly accessible to the scientific community

and the public. Project results will be disseminated through public outreach lectures at the Harbor Branch Oceanographic Institute, Darling Marine Center, and the Woods Hole Oceanographic Institution.

Mysids have been historically understudied compared to other zooplankton groups (e.g., copepods, krill), despite their ubiquitous presence and importance to marine food webs. This project will investigate mysid behavior, feeding ecology, and swarm distributions in relation to prey availability, light levels, and background flow conditions, focusing on a single mysid species – *Neomysis americana*. The investigators will use a state-of-the-art suite of instruments in the field, including two separate imaging systems and a high resolution Acoustic Doppler Profiler, to conduct field experiments at the Damariscotta River Estuary. This instrumentation suite will collect data to analyze mysid distributions and animal-fluid interactions in their natural environment, as well as ancillary data on benthic particle/plankton community composition and physical parameters (including currents, waves, temperature and depth). Multi-spectral analysis will find correlation patterns with water turbidity, flow conditions, bottom topography, mysid abundance, and food source concentrations. Mysid samples will be collected several times a week throughout the summer months to monitor changes in the mysid population abundance, sex ratio, and stage structure. The investigators will determine how seasonal changes in environmental variables and *Neomysis* population structure affect distribution within the estuary, as well as small-scale swimming and aggregation behavior. They will answer questions related to how swarm organization, aggregation, and swimming behavior differ under conditions of varying zooplankton abundance and swarm composition. Results will ultimately improve our understanding of marine ecosystem dynamics.

This project is jointly funded by the Biological Oceanography Program and the Established Program to Stimulate Competitive Research (EPSCoR).

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.

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## Funding

Funding Source	Award
<a href="#">NSF Division of Ocean Sciences (NSF OCE)</a>	<a href="#">OCE-2138465</a>

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