Abundance of mysid shrimp and zooplankton along with environmental variables from surveys in Damariscotta River estuary, Maine from June 2023 to Feb 2024

Website: https://www.bco-dmo.org/dataset/925613
Data Type: Other Field Results
Version: 1
Version Date: 2025-09-04

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 small crustaceans that are of particular importance in estuaries due to their role in nutrient subsidies and their importance in the diet of juvenile fishes. Despite their importance, they are typically undersampled relative to other zooplankton taxa. High abundances of Neomysis americana have been documented in the Damariscotta River estuary (DRE), Maine in late summer. While their summer abundance and small-scale diel migration behavior has been well described in the DRE, details about their basic ecology, life history, and reproduction in the DRE across seasons remains unknown. The purpose of this survey is to describe the seasonal abundance and population structure of N. americana in relation to environmental parameters and zooplankton-prey abundance. The survey was conducted every two weeks beginning in May of 2023 through October 2023 with monthly sampling being completed from November 2023 through May 2024. Mysid and zooplankton samples were collected from the dock at the Darling Marine Center These data files include environmental measurements made with a YSI sonde. Sonde-measured parameters include temperature, salinity, chlorophyll-a, and turbidity. These data files also include density and biomass information for zooplankton and mysid shrimp.

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Coverage

Location: Damariscotta River, Maine, USA
Spatial Extent: **Lat**:43.934 **Lon**:-69.58
Temporal Extent: 2023-06-07 - 2024-02-12

Dataset Description

Additional description: These data were collected in the Damariscotta River estuary in Walpole, Maine. Environmental parameters were measured using a YSI-EXO multi-parameter sonde. Environmental measurements were collected approximately 0.5 m above the substrate and therefore, represent bottom-water measurements. Zooplankton were collected from midwater using an 80 micrometer mesh net. Mysid shrimp were collection just above the substrate with a 1000 micrometer mesh net.

Methods & Sampling

Mysid shrimp and zooplankton collection

Neomysis americana (LSID urn:lsid:marinespecies.org:taxname:157807) were collected in the Damariscotta River Estuary every 2 weeks beginning in May 2023 and ending in October 2023, giving approximately 12 sample dates for their growing season. Additionally, we conducted high-frequency sampling over three days in August 2023 alongside the optical equipment, giving a total of 20 sampling dates with 2-3 replicates for each sample. Starting in November 2023, we began sampling monthly and will continue this monthly survey until May of 2024 to capture seasonal patterns. During each sampling trip, we collected samples from the muddy bottom near the pedestrian dock at the Darling Marine Center dock, at a depth of 1.5 - 4 m, depending on the tidal cycle. A 45 cm x 25 cm rectangular 1000 µm net equipped with a flowmeter was deployed from the dock down to the substrate and hand towed along the bottom. The contents of the cod end were emptied into a container on the dock and all mysids were immediately preserved in 4% neutral buffered formalin for later analysis. The same net was then deployed vertically, resting just off the bottom for 2 minutes, to capture mysids in the water column.

To capture smaller zooplankton that might serve as prey for mysids, we lowered an 80 µm mesh ring net with a 0.5 m diameter opening into the water at mid-depth from the dock and let water flow through the for 10 minutes. An attached flow meter was used to estimate the volume of water sampled by the net. Zooplankton were immediately preserved in 15% EtOH and taken to the lab for drying and identification. After splitting the sample with a plankton wheel (Wildco), one half was filtered through a pre-weighed, cone coffee filter and dried in an oven at a temperature of 60°C for 24-48 hours, or until constant weight was achieved. Zooplankton biomass is expressed as mg/m³ according to the formula B = W / V, where B is the zooplankton biomass (mg), W is the weight of the sample, and V is the filtered water volume (m³). The other half of the sample was cold preserved at 4°C in 50% EtOH/seawater until visual analysis, when the organisms were identified to the genus level. Subsample aliquots of organisms 100 individuals were measured to the nearest µm using a dissecting microscope with an attached camera and measuring software (CellSense, Olympus).

Phytoplankton collection and processing :

To capture phytoplankton that might serve as food for mysid shrimp, we towed a 20 µm plankton net just below the surface along the end of the dock 10 times (approx. 20m). On deck, we rinsed the net with 1L of seawater, washing the sample into a bucket. We then collected a 125ml subsample and preserved with 10ml Lugol's iodine solution in a dark bottle and stored at 4°C for further analysis. To determine which phytoplankton species were present, a subsample was identified to genus level using a compound microscope.

Environmental parameters:

We conducted vertical profiles of environmental variables using a YSI-EXO multi parameter sonde. Dock samples were collected from the dock at the Darling Marine Center and all other estuarine samples were collected from the R/V Ira C. To begin a profile, the sonde was lowered by hand at a rate of app. 0.3 ms-1 until the sonde reached the bottom and then slowly raised to the surface. The sonde recorded temperature, salinity, turbidity, and fluorescence throughout the water column. What is reported here in this file are the bottom-water values because these values are most relevant to our target species, Neomysis americana which resides just above the substrate. We are currently working on processing files for the entire water column and those data are forthcoming (when submitted to BCO-DMO these will be discoverable from the project page).

Location: Measurements were made from the pedestrian dock at the Darling Marine Center, Walpole, Maine, USA (43.934 N, 69.579 W). Damariscotta River estuary, Walpole, Maine, USA.

BCO-DMO Processing Description

* Sheet 1 of submitted file "Mysid & Zoop Survey Data RUI 2023_BCO DMO.xlsx" was imported exported as csv and imported into the BCO-DMO data system for this dataset. This table will appear on this dataset as 925613_v1_mysid-zoo-environmental.csv.
* Submitter highlighted issue "Note, two date values displayed as "7/2023" are 7/20/2023." so that change was made in the data published from this dataset. Date will appear as ISO format 2023-07-20 for those two 7/2023 values.
* "na" values were imported as missing data identifiers.

** Missing data values are displayed differently based on the file format you download. They are blank in csv files, "NaN" in MatLab files, etc.

* 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]

* Date converted to ISO 8601 format
* ISO_DateTime_UTC column added (From local EST/EDT date and times provided)

* Organism names in this dataset were matched to Life Science Identifiers (LSIDs) using the World Register of Marine Species (WoRMS) on 2025-05-06.

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Data Files

File	
925613_v1_mysid-zoo-environmental.csv	(Comma Separated Values (.csv), 4.48 KB) MD5:2708648cddf51c39e1d4372ead9ac859
Primary data file for dataset ID 925613, version 1	

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Parameters

Parameter	Description	Units
Date	Date (local time zone; EST/EDT)	unitless
Time	Time (local time zone; EST/EDT)	unitless
ISO_DateTime_UTC	Datetime with timezone (ISO 8601 format, UTC)	unitless
Site	Site name	unitless
Latitude	Latitude	decimal degrees
Longitude	Longitude	decimal degrees
Max_Depth	description	units
Temp	Temperature	degrees Celsius
Salinity	Salinity	PSU (practical salinity units)
Turbidity	Turbidity	NTU (nephelometric turbidity units)
Chlorophyll	Chlorophyll fluorescence. chlorophyll is in relative fluorescence units which is converted in the sonde to micrograms per L	microgram per liter (ug/L)
Zooplankton_biomass	Zooplankton biomass	milligrams per cubic meter (mg/m3)
Mysid_density	Mysid density	individuals per cubic meter (#/m3)

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Instruments

Dataset-specific Instrument Name	dissecting microscope
Generic Instrument Name	Microscope - Optical
Generic Instrument Description	Instruments that generate enlarged images of samples using the phenomena of reflection and absorption of visible light. Includes conventional and inverted instruments. Also called a "light microscope".

Dataset-specific Instrument Name	
Generic Instrument Name	YSI EXO multiparameter water quality sondes
Dataset-specific Description	YSI-EXO Multiparameter Sonde, SKU 577501-00 Yellow Springs Instruments, OH 45387
Generic Instrument Description	Comprehensive multi-parameter, water-quality monitoring sondes designed for long-term monitoring, profiling and spot sampling. The EXO sondes are split into several categories: EXO1 Sonde, EXO2 Sonde, EXO3 Sonde. Each category has a slightly different design purpose with the EXO2 and EXO3 containing more sensor ports than the EXO1. Data are collected using up to four user-replaceable sensors and an integral pressure transducer. Users communicate with the sonde via a field cable to an EXO Handheld, via Bluetooth wireless connection to a PC, or a USB connection to a PC. Typical parameter specifications for relevant sensors include dissolved oxygen with ranges of 0-50 mg/l, with a resolution of +/- 0.1 mg/l, an accuracy of 1 percent of reading for values between 0-20 mg/l and an accuracy of +/- 5 percent of reading for values 20-50 mg/l. Temp ranges are from-5 to +50 degC, with an accuracy of +/- 0.001 degC. Conductivity has a range of 0-200 mS/cm, with an accuracy of +/-0.5 percent of reading + 0.001 mS/cm and a resolution of 0.0001 - 0.01 mS/cm.

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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
NSF Division of Ocean Sciences (NSF OCE)	OCE-2138839

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