Temperature, pH, DO, and salinity data from Mumford Cove, Connecticut, USA from 2015-2025

Website: https://www.bco-dmo.org/dataset/659874
Data Type: Other Field Results
Version: 4
Version Date: 2025-08-21

Project
» Collaborative research: Understanding the effects of acidification and hypoxia within and across generations in a coastal marine fish (HYPOA)
» ORCC: Collaborative Research: Mechanisms underpinning the unusual, high CO2 sensitivity of sand lances, key forage fishes on the Northwest Atlantic Shelf (Mechanisms for sand lance (Ammodytes spp) high CO2 sensitivity)

Contributors	Affiliation	Role
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Abstract
Despite their importance for research and environmental protection, there's still a shortage of high quality and high-resolution temperature, pH, and oxygen data particularly in shallow coastal habitats. We monitor five important environmental parameters (i.e., depth, temperature, salinity, pH, and dissolved oxygen) at 30 minute intervals in Mumford Cove, CT (41 degrees 19'25"N, 72 degrees 01'07"W), a small (2 km N-S × 0.5 km E-W), shallow (1-5 meters), cone-shaped embayment opening to northeastern Long Island Sound, with protected marsh habitat along its western side, marsh and beach habitat along its eastern side, and an extensive seagrass (Zostera marina) cover. Continuous monitoring is achieved by swapping identical and recalibrated probes (Eureka Manta Sub2) every 3-5 weeks.

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Coverage

Spatial Extent: **N**:41.32526111 **E**:-72.020875 **S**:41 **W**:-72.02088
Temporal Extent: 2015-04-14 - 2025-07-15

Dataset Description

Since April 2015, pH, DO, temperature, and salinity measurements have been taken in 30-minute intervals in Mumford Cove, CT, United States. This is a shallow cove that is typical for the area.

This dataset includes records from April 14, 2015 to July 15, 2025.

A complete technical description of the pH, DO, Temp, depth, and salinity sensors can be found at http://www.waterprobes.com/#!water-quality-sensor-specifications-/c11g

Monitoring website: https://befel.marinesciences.uconn.edu/monitoring/

Methods & Sampling

All measurements were made with Eureka Manta Sub2 probes (www.waterprobes.com). The measurement interval was 30 minutes. All measurements were made in Mumford Cove, CT, ~ 0.5 meters above the sandy bottom. Deployment time of each sensor varied between 3-6 weeks. All probes were calibrated prior to deployment for salinity, pH, 100% air-saturated water oxygen. The probe was attached to a local subsurface buoy.

pH: calibrated with 3-point, NIST certified buffers, accuracy +/- 0.1, precision: 0.01, automatic temperature correction
Optically Measured Dissolved Oxygen (HDO): calibrated with 100% air-saturated water
Salinity: Calibrated with FisherScientific Conductivity standard 50,000 uS/cm

Data Processing Description

Data Processing:
QA/QC consisted of identifying and deleting salinity data that 'jumped' within a single 30 minute interval more than 1 salinity unit. pH was corrected for linear drift, using the post-calibration offset.

For data added in version 4, dated December 2022-12-09T13:30 to 2025-07-15T12:00 (local time), all salinity values <20 psu and > 35 psu were treated as out of range and deleted.

BCO-DMO Processing Notes:
Version 1:
(version 1 includes data from April 2015 to June 2016)
- reformatted date to yyyy-mm-dd; added date/time column in ISO8601 format;
- replaced spaces with underscores in the location name;
- filled blank cells with "nd" ("no data").

Version 2:
(version 2 includes data from April 2015 to February 2020)
- 2020-March-20: appended data from second dataset submission (monitoringMC_02).

Version 3:
(version 3 includes data from April 2015 to December 2022)
- replaced dataset with the new version, which includes all previous data and extends the sampling period to December 2022;
- converted dates to ISO 8601 format and added a column for UTC time zone;
- renamed fields to comply with BCO-DMO naming conventions.

Version 4:
(version 4 includes data from December 2022 to July 2025)
- Imported the new data with original file name "Set4 - 10.26008:1912:bco-dmo.659874.4.xlsx" into the BCO-DMO system.
- Converted Datetime column to ISO 8601 format (EST) and removed the original Datetime, DATE, and TIME columns
- Renamed fields to match the same as v3.
- Added ISO Date-time column in UTC.
- Loaded the v3 data file, "mumford_cove_monitoring_v3.csv", into the BCO-DMO processing system.
- Concatenated the new data onto the previous data.
- Rounded lat column to 8 decimal places.
- Rounded pH column to 2 decimal places.
- Removed the pH_mV column.
- Saved the final file as "659874_v4_mumford_cove_monitoring.csv".

BCO-DMO Processing Description

See 'Processing Description' field for details on BCO-DMO processing and version history of dataset.

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Data Files

File
659874_v4_mumford_cove_monitoring.csv (Comma Separated Values (.csv), 22.85 MB) MD5:8a38470920a0ee9e5945e3d9e0b1bd38 Primary data file for dataset ID 659874, version 4

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Parameters

Parameter	Description	Units
location	Location where measurments were taken. All measurements were made at the same location, i.e., Mumford Cove, CT, USA.	unitless
lat	Latitude (positive values = North)	decimal degrees
lon	Longitude (negative values = West)	decimal degrees
serial_number	Serial number of the corresponding probe (i.e., 3151818, 3151819, 3152273)	unitless
ISO_DateTime_EST	Date and time of sampling in EST time zone in ISO 8601 format	unitless
temp	Water temperature	degrees Celsius
pH	pH; NIST calibrated with three point NIST calibration buffers (4.00; 7.00; 10.00)	pH units
pH_Flag	pH quality flag: 1=good, Q=questionable, 0=no data	unitless
cond	Specific conductivity; Calibrated with FisherScientific Conductivity standard 50,000 µS/cm	microsiemens per centimeter (µS/cm)
HDO_mgl	Dissolved oxygen saturation; calibrated using 100% air-saturated water	milligrams per liter (mg/L)
HDO_percentSat	Dissolved oxygen percent saturation; calibrated using 100% air-saturated water	percent

salinity	Salinity	PSS
salinity_flag	Salinity quality flag: 1=good, Q=questionable (Q < 20 and >33 psu)	unitless
depth	Depth where measurement was taken; earlier measurements did not have a depth sensor, which was later refitted to all probes. Note that the sensor position ~0.5m above bottom did not change	meters (m)
comments	Notes about sensor deployment, post-calibration and drift corrections	unitless
ISO_DateTime_UTC	Date and time of sampling converted to UTC time zone in ISO 8601 format	unitless

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Instruments

Dataset-specific Instrument Name	Eureka Manta Sub2 probe
Generic Instrument Name	Water Quality Multiprobe
Dataset-specific Description	Took data on temperature, pH, DO, and salinity
Generic Instrument Description	An instrument which measures multiple water quality parameters based on the sensor configuration.

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Deployments

Mumford_Cove_Subsurface_Buoy

Website	https://www.bco-dmo.org/deployment/659887
Platform	Avery_Point
Start Date	2015-04-04
Description	Local subsurface buoy in Mumford Cove, CT, a shallow, coastal embayment in outer Long Island Sound, US Atlantic coast.

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Project Information

Collaborative research: Understanding the effects of acidification and hypoxia within and across generations in a coastal marine fish (HYPOA)

Coverage: Eastern Long Island Sound, CT, USA

Description from NSF award abstract:
Coastal marine ecosystems provide a number of important services and resources for humans, and at the same time, coastal waters are subject to environmental stressors such as increases in ocean acidification and reductions in dissolved oxygen. The effects of these stressors on coastal marine organisms remain poorly understood because most research to date has examined the sensitivity of species to one factor, but not to more than one in combination. This project will determine how a model fish species, the Atlantic silverside, will respond to observed and predicted levels of dissolved carbon dioxide (CO2) and oxygen (O2). Shorter-term experiments will measure embryo and larval survival, growth, and metabolism, and determine whether parents experiencing stressful conditions produce more robust offspring. Longer-term experiments will study the consequences of ocean acidification over the entire life span by quantifying the effects of high-CO2 conditions on the ratio of males to females, lifetime growth, and reproductive investment. These studies will provide a more comprehensive view of how multiple stressors may impact populations of Atlantic silversides and potentially other important forage fish species. This collaborative project will support and train three graduate students at the University of Connecticut and the Stony Brook University (NY), two institutions that attract students from minority groups. It will also provide a variety of opportunities for undergraduates to participate in research and the public to learn about the study, through summer research projects, incorporation in the "Women in Science and Engineering" program, and interactive displays of environmental data from monitoring buoys. The two early-career investigators are committed to increasing ocean literacy and awareness of NSF-funded research through public talks and presentations.

This project responds to the recognized need for multi-stressor assessments of species sensitivities to anthropogenic environmental change. It will combine environmental monitoring with advanced experimental approaches to characterize early and whole life consequences of acidification and hypoxia in the Atlantic silverside (Menidia menidia), a valued model species and important forage fish along most of the US east coast. Experiments will employ a newly constructed, computer-controlled fish rearing system to allow independent and combined manipulation of seawater pCO2 and dissolved oxygen (DO) content and the application of static and fluctuating pCO2 and DO levels that were chosen to represent contemporary and potential future scenarios in productive coastal habitats. First CO2, DO, and CO2 × DO dependent reaction norms will be quantified for fitness-relevant early life history (ELH) traits including pre- and post-hatch survival, time to hatch, post-hatch growth, by rearing offspring collected from wild adults from fertilization to 20 days post hatch (dph) using a full factorial design of 3 CO2 × 3 DO levels. Second, the effects of tidal and diel CO2 × DO fluctuations of different amplitudes on silverside ELH traits will be quantified. To address knowledge gaps regarding the CO2-sensitivity in this species, laboratory manipulations of adult spawner environments and reciprocal offspring exposure experiments will elucidate the role of transgenerational plasticity as a potential short-term mechanism to cope with changing environments. To better understand the mechanisms of fish early life CO2-sensitivity, the effects of temperature × CO2 on pre- and post-hatch metabolism will be robustly quantified. The final objective is to rear silversides from fertilization to maturity under different CO2 levels and assess potential CO2-effects on sex ratio and whole life growth and fecundity.

Related references:
Gobler, C.J. and Baumann, H. (2016) Hypoxia and acidification in ocean ecosystems: Coupled dynamics and effects on marine life. Biology Letters 12:20150976. doi:10.1098/rsbl.2015.0976

Baumann, H. (2016) Combined effects of ocean acidification, warming, and hypoxia on marine organisms. Limnology and Oceanography e-Lectures 6:1-43. doi:10.1002/loe2.10002

Depasquale, E., Baumann, H., and Gobler, C.J. (2015) Variation in early life stage vulnerability among Northwest Atlantic estuarine forage fish to ocean acidification and low oxygen Marine Ecology Progress Series 523: 145–156.doi:10.3354/meps11142

ORCC: Collaborative Research: Mechanisms underpinning the unusual, high CO2 sensitivity of sand lances, key forage fishes on the Northwest Atlantic Shelf (Mechanisms for sand lance (Ammodytes spp) high CO2 sensitivity)

Website: https://befel.marinesciences.uconn.edu/evolutionary-fish-ecology-lab/projects/

Coverage: Northwest Atlantic, sub-polar, temperate waters

NSF abstract:

Ocean warming and acidification are direct, predictable consequences of anthropogenic climate change with likely vast but still insufficiently understood consequences for marine life. So far, most tested fish species appear only mildly sensitive to ocean acidification, but sand lances are an exception. Sand lances are small, eel-like, schooling fishes of enormous importance as food for seabirds and mammals in temperate to polar ecosystems. Recent research conclusively demonstrated that many sand lance embryos have trouble developing and hatching under predicted future ocean conditions. This project uses modern experimental and molecular tools to understand exactly WHY sand lance embryos are so unusually sensitive and which genes and enzymes are responsible for this. Genes will also reveal whether some specific genotypes are less sensitive to warming and acidification, which can then be used to predict whether the species could evolve to be more tolerant over time. Another important objective is to test a closely related sand lance species to find out whether the high climate sensitivity might be of general concern in this important group of forage fishes. This research will provide critical information needed to protect the bioeconomy of fisheries. The project combines innovative ecological, evolutionary, and genomic research to help society anticipate looming marine ecosystem changes in the 21st century, while equipping the next generation of scientists with the needed tools and expertise to succeed in the challenges ahead. The project also creates opportunities for high school students from underprivileged Connecticut schools to accompany the team on sand lance sampling trips to Stellwagen Bank National Marine Sanctuary.

Two recent studies on Northern sand lance (Ammodytes dubius), a key forage fish on offshore sand banks across the Northwest Atlantic shelf, have robustly demonstrated that predicted future CO2 conditions induce some of the most severe reductions in embryo survival and hatching success seen yet among tested fish species. This project has four objectives for revealing the mechanisms underpinning this unusual, high CO2-sensitivity as well as the ubiquity and genetic basis of this phenomenon. [1] For the first time, we will rear A. dubius offspring produced from wild spawners to late larval stages at factorial CO2 × temperature conditions to test whether sand lance larvae are as CO2-sensitive as embryos. [2] For the first time, we will use transcriptomic tools (RNAseq, RT-qPCR) to elucidate mechanisms causing 'CO2-impaired hatching', focusing specifically on hatching enzymes, to better understand a newly discovered mortality mechanism due to high CO2 in fishes. [3] Modern genomic approaches (low-coverage whole genome sequencing; allele frequency shifts, relatedness analyses) will reveal whether high CO2-sensitivity has a genetic basis in sand lance and could therefore evolve. [4] And for the first time, we will extend CO2 × temperature experiments to a congener, the American sand lance (A. americanus), which provides an important scientific contrast between nearshore vs. offshore species CO2-sensitivities and will yield critical insights whether high CO2-sensitivity is a wider concern within the sand lance family.

This award was co-funded through the BIO/IOS Organismal Responses to Climate Change Program and the GEO/OCE Biological Oceanography Program.

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-1536336
NSF Division of Integrative Organismal Systems (NSF IOS)	IOS-2307813

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