Acartia tonsa mortality from Niskin bottles and associated CTD data from R/V Hugh Sharp HRS1316, HRS1317 in mid-Chesapeake Bay, Aug-Sept. 2013 (CopesPopDynHypoZone project)

Website: https://www.bco-dmo.org/dataset/723551
Data Type: Cruise Results
Version:
Version Date: 2018-01-12

Project
» Copepod Population Dynamics in Hypoxic Coastal Waters: Physical and Behavioral Regulation of Resupply and Advective Losses (CopesPopDynHypoZone)

Contributors	Affiliation	Role
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Coverage

Spatial Extent: **N**:38.561 **E**:-76.309 **S**:38.36833 **W**:-76.48417
Temporal Extent: 2013-08-26 - 2013-09-17

Dataset Description

This dataset includes *Acartia tonsa* mortality from Niskin bottle samples and associated CTD information.

Related Datasets:
Niskin count and CTD data

Methods & Sampling

This is mortality data was obtained from two week-long cruises (1301 in August and 1302 in September) during which Niskin samples were taken from the mid-bay of the Chesapeake from 9 stations in a box

formation; 3 stations in a northern transect across the bay (N1-N3), 3 in a midline transect (M1-M3), and 3 in a southern transect (S1-S3).

The Niskin bottles used were General Oceanics 1010x External Spring Water Sampler with a 10L capacity (part number: 101010X). 12 of these were deployed rosette style on the SBE 32 Carousel Water Sampler from the starboard winch of the RV Sharp, along with the SBE 9plus unit which was attached to the rosette. On each downcast, instrument readings were sent from the SBE 9plus unit on the rosette to the SBE 11plus V2 Deck Unit. Based on these data, sampling depths were selected which fell into three areas of interest: above, within, and below the pycnocline. If a pycnocline was not evident and density seemed consistent, only two samples were taken. On the upcast, Niskins were triggered to close electronically from the dry lab.

For mortality assessment, three Niskin bottles were triggered at each chosen depth to give a total sampled volume of 30L. Once on board, Niskin bottles were carefully drained through sieves with 64µm mesh, stained, and preserved following the procedure below, as developed by Elliott and Tang. Sieves with 64µm mesh were selected to catch all life stages of the copepod *Acartia tonsa* since *Acartia tonsa* eggs are about 75µm in diameter and all subsequent life stages are larger.

Sieves were placed in a water bath with the salinity and temperature to which the animals were accustomed. To reduce stress on the copepods, tubes were connected to the Niskin stopcock and squeezed briefly to force air bubbles to flow out; once the water bath began to fill, the flow rate was reduced. Overflow from the water bath was collected in a squirt bottle for later transferring the animals.

Once one Niskin drained, the sieve tube was transferred to the next Niskin to begin draining while the bottom of the drained Niskin was emptied into a wide-mouth plastic beaker, poured into the corresponding sieve, and rinsed with the water collected earlier. After 30L were drained, the contents of each sieve were gently transferred to numbered jars for incubation; date, time, station, depth sampled, and cast numbers were entered into a log.

Neutral red stain was added based on the volume in the jar- the desired concentration was 150 µl per 100ml (for a stock solution of 0.1g Neutral Red powder per 10 ml DI water). The jars were returned to the water baths and incubated in the shade for 15-20 minutes.

After incubation, each sample was vacuum filtered onto a 64µm mesh filter which was transferred to a small petri dish. The dish was capped and labeled with the date, CTD number, and depth of the sample, then wrapped in parafilm to seal. The samples were placed in a Ziploc baggie labeled with the date and given a burst of Flash Freeze, then stored in a -20°C freezer for later analysis.

After returning from the cruises, samples were stored in -20°C freezers; one set (1301) with David Elliott at the Virginia Institute of Marine Science, College of William and Mary, Gloucester Point, VA, USA and the other (1302) with Jamie Pierson at University of Maryland Center for Environmental Science, Horn Point Laboratory, Cambridge, MD, USA. Samples were individually processed using the procedure developed by Elliott and Tang:

The Petri dish containing the sample was thawed at room temperature, then the mesh was submerged in filtered seawater and gently shaken to resuspend the sample. The sample was then transferred to a counting wheel where it was checked for density and subsampled if necessary.

The sample was then slightly acidified by adding 10% HCl drop-wise until the stained animals distinctly changed from faded pink to bright pink. The sample was then tallied for live or dead status and general stage under dissecting microscope with darkfield illumination. Copepods which were bright red were considered alive at the time of staining; copepods which had no stain, were cloudy white, or were only light pink were considered dead.

To account for individual discrepancies between counters, a calibration count was done during which David Elliott and Catherine Fitzgerald processed the same sample and tallied the live and dead one after the other, with no comparisons until all five samples were completed (a full profile of 3 samples, plus two random samples).

Data were entered into an Excel spreadsheet and checked for transcription errors, then imported into MatLab for data analysis.

Data Processing Description

Niskin electronic data was post processed using a series of MATLAB scripts to read the raw and processed data, and SBE Data Processing software was used to calculate summary statistics for each bottle.

Live zooplankton samples were stained immediately after capture with Neutral Red vital stain, incubated at ambient collection temperature and salinity for dye uptake, then flash-frozen for later analysis. Samples were sorted under a stereo dissecting microscope within 4 months of collection. General Acartia tonsa stages were identified, and other zooplankton were identified to lowest possible taxonomic level. All zooplankton were classed as live or dead according to staining.

BCO-DMO Data Processing Notes:
- added conventional header with dataset name, PI name, version date
- modified parameter names to conform with BCO-DMO naming conventions
- reduced decimal precision
- replaced commas with semicolons
- formatted time to 4 digits (added a preceding 0 for times less than 1000)
- moved the long comment columns to the end of the data table

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Data Files

File
Atonsa_mortality_Sharp.csv (Comma Separated Values (.csv), 125.02 KB) MD5:a4048a873e81610861c8cb23805f2326 Primary data file for dataset ID 723551

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Related Publications

Elliott, D. T., & Tang, K. W. (2009). Simple staining method for differentiating live and dead marine zooplankton in field samples. Limnology and Oceanography: Methods, 7(8), 585–594. doi:10.4319/lom.2009.7.585
Methods

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Parameters

Parameter	Description	Units
cruise	cruise identifier	unitless
date	Gergorian calendar date as recorded in the cruise log formatted as mm/dd/yyyy	unitless
time_EDT	Time in EDT as recorded in the cruise log formatted as hhmm	unitless
EDT_day	Numeric day of year calculated from year month and day as recorded in the cruise log	day
EDT_DOY	Day of year calculation using cruise log EDT time	decimal day

station	Station ID as recorded in the cruise log	unitless
CTD_num	Number ID of each CTD/niskin sampling rig cast	unitless
Bottle_num	Number ID of niskin bottle in sampling rosette/CTD rig from which the sample was taken	unitless
Depth	Depth at which sample was taken as recorded in the cruise log	meters
Genus	Genus or least specific identifier of organism in sample	unitless
Species	Species or most specific identifier of organism in sample	unitless
Stage	Life stage of organism in sample	unitless
Alive	Number of organism stained in sample and therefore live	specimens
Dead	Number of organism unstained in sample and therefore dead	specimens
Percent_live	Number of live organism out of total	unitless
Percent_dead	Number of dead organism out of total	unitless
Initials_of_counter	Initials of tech or student who counted the sample	unitless
Counter_comments_1	Additional comments from the counter about the sample	unitless
Counter_comments_2	Additional counter comments	unitless
Latitude	Average latitude traveled during collection for each CTD cast	decimal degrees
Longitude	Average longitude traveled during collection for each CTD cast	decimal degrees
GMT_DOY	Day of year calculation using CTD recorded GMT time for each cast	decimal day
Density00	Density recorded by CTD sensors for each bottle	?
Sigma_t00	Density recorded by CTD sensors for each bottle	?

Sal00	Salinity recorded by CTD sensor for each bottle	PSU
Sal11	Salinity recorded by second CTD sensor for each bottle	PSU
Sbeox0MgL	Dissolved oxygen calculated in SEB post-processing from oxygen data recorded by CTD sensors for each bottle	mg/L
Sbeox0PS	Dissolved oxygen pressure saturation calculated in SEB post-processing from oxygen data recorded by CTD sensors for each bottle (percent)	unitless
OxsatMgL	Dissolved oxygen percent saturation calculated in SEB post-processing from oxygen data recorded by CTD sensors for each bottle (percent)	unitless
PrDM	Pressure recorded by CTD sensors for each bottle	decibars
T090C	Temperature recorded by CTD sensor for each bottle	degrees Celsius
T190C	Temperature recorded by secondary CTD sensor for each bottle	degrees Celsius
FLECO_AFL	Fluorescence recorded by CTD sensors for each bottle	?
CStarTr0	Transmissometer data recorded for each bottle	unitless
Upoly0	Turbidity recorded by CTD sensors for each bottle	?

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Instruments

Dataset-specific Instrument Name	SBE 9plus
Generic Instrument Name	CTD - profiler
Dataset-specific Description	Used for sampling; There were twelve Niskin bottles on the SBE 32 Carousel Water Sampler, deployed from the starboard winch of the RV Sharp, along with the SBE 9plus unit which was attached to the rosette. Attached to an SBE 11plus V2 Deck Unit
Generic Instrument Description	The Conductivity, Temperature, Depth (CTD) unit is an integrated instrument package designed to measure the conductivity, temperature, and pressure (depth) of the water column. The instrument is lowered via cable through the water column. It permits scientists to observe the physical properties in real-time via a conducting cable, which is typically connected to a CTD to a deck unit and computer on a ship. The CTD is often configured with additional optional sensors including fluorometers, transmissometers and/or radiometers. It is often combined with a Rosette of water sampling bottles (e.g. Niskin, GO-FLO) for collecting discrete water samples during the cast. This term applies to profiling CTDs. For fixed CTDs, see https://www.bco-dmo.org/instrument/869934.

Dataset-specific Instrument Name	Dissecting microscope
Generic Instrument Name	Microscope - Optical
Dataset-specific Description	Used to count live and dead copepods.
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	General Oceanics 1010x External Spring Water Sampler
Generic Instrument Name	Niskin bottle
Dataset-specific Description	Used for water sampling; 10 liter capacity.
Generic Instrument Description	A Niskin bottle (a next generation water sampler based on the Nansen bottle) is a cylindrical, non-metallic water collection device with stoppers at both ends. The bottles can be attached individually on a hydrowire or deployed in 12, 24, or 36 bottle Rosette systems mounted on a frame and combined with a CTD. Niskin bottles are used to collect discrete water samples for a range of measurements including pigments, nutrients, plankton, etc.

Dataset-specific Instrument Name	
Generic Instrument Name	Shipboard Incubator
Dataset-specific Description	Used to incubate zooplankton
Generic Instrument Description	A device mounted on a ship that holds water samples under conditions of controlled temperature or controlled temperature and illumination.

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Deployments

HRS1316

Website	https://www.bco-dmo.org/deployment/707119
Platform	R/V Hugh R. Sharp
Report	http://ezid.cdlib.org/id/doi:10.7284/902881
Start Date	2013-08-25
End Date	2013-09-01
Description	R/V Hugh R Sharp 1316. Mid-bay of Chesapeake Bay, 38°N 76°W.

HRS1317

Website	https://www.bco-dmo.org/deployment/707274
Platform	R/V Hugh R. Sharp
Report	http://ezid.cdlib.org/id/doi:10.7284/902882
Start Date	2013-09-12
End Date	2013-09-17
Description	R/V Hugh R Sharp 1317. Mid-bay of Chesapeake Bay, 38°N 76°W.

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Project Information

Copepod Population Dynamics in Hypoxic Coastal Waters: Physical and Behavioral Regulation of Resupply and Advective Losses (CopesPopDynHypoZone)

Coverage: hypoxic zone of Chesapeake Bay

Description from NSF award abstract:
The PIs will develop a mechanistic understanding of how circulation interacts with hypoxia-induced behavioral and physiological changes to affect the population dynamics of coastal zooplankton. They will do this by assessing two potentially contrasting mechanisms influencing the dynamics of the copepod *Acartia tonsa* in the hypoxic zone of Chesapeake Bay. The first hypothesis is that maintenance of copepod populations in the hypoxic region requires replenishment by advection (immigration) of animals through wind-driven lateral transport processes. The second, counteractive, hypothesis is that bottom water hypoxia alters the vertical distribution of *A. tonsa*, thereby making them more susceptible to advective losses from the region (emigration) via surface water transport in the estuarine circulation. They will take advantage of a current NSF-

funded physical oceanography research program in Chesapeake Bay that will comprehensively measure and model axial and lateral water exchanges in the mid-Bay region.

The present study will use the physical oceanography study site as a Controlled Volume (CV) in which the oceanographic exchanges of water and the driving mechanisms for those exchanges will be well defined. The PIs will conduct high-resolution spatial and temporal sampling of zooplankton and combine the data with measurements of copepod behavior, mortality and egg production in the hypoxic region. They will use an improved Individual-Based Model of the life history of *A. tonsa* coupled with the circulation to explore the combined effects of advection, behavior, egg production, and mortality on population dynamics. In addition to increasing our knowledge of the impacts of bottom water hypoxia on copepod populations in Chesapeake Bay, the study will improve our general understanding of the regulation of zooplankton populations by physical and biological processes and the impacts of hypoxia on secondary production and food webs in coastal waters.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1259691

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