CTD profiles of temperature, oxygen, salinity, density, fluorescence, PAR, and pH collected in Hood Canal on cruises CB1072, CB1077, and RC008 during 2017 and 2018

Website: https://www.bco-dmo.org/dataset/826281
Data Type: Cruise Results
Version: 1
Version Date: 2020-10-09

Project
» Causes and consequences of hypoxia and pH impacts on zooplankton: Linking movement behavior to vertical distribution. (Zooplankton Swimming)

Contributors	Affiliation	Role
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Abstract
CTD profiles of temperature, oxygen, salinity, density, fluorescence, PAR, and pH collected in Hood Canal on cruises CB1072, CB1077, and RC008 during 2017 and 2018.

Table of Contents

Coverage

Spatial Extent: **N**:47.42 **E**:-123.01 **S**:47.38 **W**:-123.11
Temporal Extent: 2017-06-13 - 2018-09-27

Dataset Description

CTD profiles of temperature, oxygen, salinity, density, fluorescence, PAR, and pH collected in Hood Canal on cruises CB1072, CB1077, and RC008 during 2017 and 2018.

Methods & Sampling

CTD data were collected from near surface to 5-10 m off the seafloor. Winkler titrations were used to calculate a calibration for oxygen data (equation provided, but not applied to this dataset).

Data Processing Description

CTD data from near surface to 5-10 m off the seafloor were processed using Sea Bird software to create 1-m data bins. Oxygen was aligned. Dates and times are in local time, PDT.

Based on modified Winkler titrations, the formula y = 0.9144x + 0.1975 can be applied to the CTD data to calibrate the "Oxygen, SBE 43 (mg/l)" for the 2017 cruises. The formula y = 0.9698x + 0.0691 can be applied for the 2018 cruises.

BCO-DMO Processing:
- concatenated data from separate cruises into one dataset;
- renamed fields.

[table of contents | back to top]

Data Files

File
CTD.csv (Comma Separated Values (.csv), 485.90 KB) MD5:adb2d7077fe2d58941d27c72b330d4de Primary data file for dataset ID 826281

[table of contents | back to top]

Parameters

Parameter	Description	Units
year_month	Year and month (UTC) of cruise	unitless
cruise	Cruise identifier	unitless
file_name	Original file name	unitless
Density	Density	kilograms per cubic meter (Kg/m^3)
Depth	Depth (salt water)	meters (m)
Fluorescence	Fluorescence, WET Labs ECO-AFL/FL	milligrams per cubic meter (mg/m^3)
Latitude	Latitude	degrees North
Longitude	Longitude	degrees East
Oxygen_raw	Oxygen raw, SBE 43	volts (V)
Oxygen_SBE_43	Oxygen, SBE 43	milligrams per liter (mg/l)
Oxygen_saturation_Garcia_Gordon	Oxygen saturation, Garcia & Gordon	milligrams per liter (mg/l)
Oxygen_saturation_Weiss	Oxygen saturation, Weiss	milligrams per liter (mg/l)
PAR_Irradiance	PAR/ Irradiance, Biospherical/Licor	micromoles photons per square meter per second (umol photons/m^2/s^1)
pH	pH	unitless
Salinity_Practical	Salinity, Practical	PSU
Sound_Velocity_Delgrosso	Sound Velocity (Delgrosso)	meters per second (m/s)
Temperature	Temperature (ITS-9)	degrees Celsius
Voltage_0	Voltage 0	volts (V)

Voltage_1	Voltage 1	volts (V)
Voltage_2	Voltage 2	volts (V)
Voltage_3	Voltage 3	volts (V)
Voltage_4	Voltage 4	volts (V)
Voltage_5	Voltage 5	volts (V)
Voltage_6	Voltage 6	volts (V)
Voltage_7	Voltage 7	volts (V)
Descent_Rate	Descent Rate	meters per second (m/s)
Pressure_Temperature	Pressure Temperature	degrees Celsius
Pressure_db	Pressure, Digiquartz	decibars (db)
Pressure_psi	Pressure, Digiquartz	psi
Sound_Velocity_Chen_Millero	Sound Velocity (Chen-Millero)	meters per second (m/s)
Sound_Velocity_Wilson	Sound Velocity (Wilson)	meters per second (m/s)
Average_Sound_Velocity_Delgrosso	Average Sound Velocity (Delgrosso)	meters per second (m/s)
Oxygen_SBE_43_Aligned	Oxygen, SBE 43, offset corrected	milligrams per liter (mg/l)
Flag	flag	unitless

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	Sea-Bird SBE9 CTD
Generic Instrument Name	CTD Sea-Bird 9
Dataset-specific Description	Sea-Bird SBE9 CTD profiler equipped with a pH sensor (SBE 18), oxygen sensor (SBE 43), fluorometer (WETLabs ECO-AFL), and Niskin bottles.
Generic Instrument Description	The Sea-Bird SBE 9 is a type of CTD instrument package. The SBE 9 is the Underwater Unit and is most often combined with the SBE 11 Deck Unit (for real-time readout using conductive wire) when deployed from a research vessel. The combination of the SBE 9 and SBE 11 is called a SBE 911. The SBE 9 uses Sea-Bird's standard modular temperature and conductivity sensors (SBE 3 and SBE 4). The SBE 9 CTD can be configured with auxiliary sensors to measure other parameters including dissolved oxygen, pH, turbidity, fluorometer, altimeter, etc.). Note that in most cases, it is more accurate to specify SBE 911 than SBE 9 since it is likely a SBE 11 deck unit was used. more information from Sea-Bird Electronics

Dataset-specific Instrument Name	SBE 18
Generic Instrument Name	pH Sensor
Dataset-specific Description	Sea-Bird SBE9 CTD profiler equipped with a pH sensor (SBE 18), oxygen sensor (SBE 43), fluorometer (WETLabs ECO-AFL), and Niskin bottles.
Generic Instrument Description	An instrument that measures the hydrogen ion activity in solutions. The overall concentration of hydrogen ions is inversely related to its pH. The pH scale ranges from 0 to 14 and indicates whether acidic (more H+) or basic (less H+).

Dataset-specific Instrument Name	SBE 43
Generic Instrument Name	Sea-Bird SBE 43 Dissolved Oxygen Sensor
Dataset-specific Description	Sea-Bird SBE9 CTD profiler equipped with a pH sensor (SBE 18), oxygen sensor (SBE 43), fluorometer (WETLabs ECO-AFL), and Niskin bottles.
Generic Instrument Description	The Sea-Bird SBE 43 dissolved oxygen sensor is a redesign of the Clark polarographic membrane type of dissolved oxygen sensors. more information from Sea-Bird Electronics

Dataset-specific Instrument Name	WETLabs ECO-AFL
Generic Instrument Name	Wet Labs ECO-AFL/FL Fluorometer
Dataset-specific Description	Sea-Bird SBE9 CTD profiler equipped with a pH sensor (SBE 18), oxygen sensor (SBE 43), fluorometer (WETLabs ECO-AFL), and Niskin bottles.
Generic Instrument Description	The Environmental Characterization Optics (ECO) series of single channel fluorometers delivers both high resolution and wide ranges across the entire line of parameters using 14 bit digital processing. The ECO series excels in biological monitoring and dye trace studies. The potted optics block results in long term stability of the instrument and the optional anti-biofouling technology delivers truly long term field measurements. more information from Wet Labs

[table of contents | back to top]

Deployments

CB1077

Website	https://www.bco-dmo.org/deployment/735746
Platform	R/V Clifford A. Barnes
Start Date	2017-08-15
End Date	2017-08-22
Description	Cruise plan: August_cruise_plan.pdf

CB1072

Website	https://www.bco-dmo.org/deployment/735748
Platform	R/V Clifford A. Barnes
Start Date	2017-06-13
End Date	2017-06-20
Description	Cruise Plan: June_cruise_plan.pdf

RC008

Website	https://www.bco-dmo.org/deployment/775288
Platform	R/V Rachel Carson
Report	https://datadocs.bco-dmo.org/docs/Zooplankton_Swimming/data_docs/RC008_cruise_plan.pdf
Start Date	2018-09-18
End Date	2018-09-26

[table of contents | back to top]

Project Information

Causes and consequences of hypoxia and pH impacts on zooplankton: Linking movement behavior to vertical distribution. (Zooplankton Swimming)

Coverage: Puget Sound, WA

NSF Award Abstract:
Low oxygen (hypoxia) and low pH are known to have profound physiological effects on zooplankton, the microscopic animals of the sea. It is likely that many individual zooplankton change vertical mirgration behaviors to reduce or avoid these stresses. However, avoidance responses and their consequences for zooplankton distributions, and for interactions of zooplankton with their predators and prey, are poorly understood. This study will provide information on small-scale behavioral responses of zooplankton to oxygen and pH using video systems deployed in the field in a seasonally hypoxic estuary. The results will deepen our understanding of how zooplankton respond to low oxygen and pH conditions in ways that could profoundly affect marine ecosystems and fisheries through changes in their populations and distributions. This project will train graduate students and will engage K-12 students and teachers in under-served coastal communities by developing ocean technology-based citizen-scientist activities and curricular materials in plankton ecology, ocean change, construction and use of biological sensors, and quantitative analysis of environmental data.

Individual directional motility is a primary mechanism underlying spatio-temporal patterns in zooplankton population distributions. Motility is used by most zooplankton species to select among water column positions that differ in biotic and abiotic variables such as prey, predators, light, oxygen concentration, and pH. Species-specific movement responses to de-oxygenation and acidification are likely mechanisms through which short-term, localized impacts of these stressful conditions on individual zooplankton will be magnified or suppressed as they propagate up to population, community, and ecosystem-level dynamics. This study will quantify responses by key zooplankton species to oxygen and pH using in situ video systems to measure changes in individual behavior in hypoxic, low- pH versus well-oxygenated, high-pH regions of a seasonally hypoxic estuary. Distributions and movements of zooplankton will be quantified using three approaches: 1) an imaging system deployed in situ on a profiling mooring over two summers in a hypoxic region, 2) imagers deployed on Lagrangian drifters to sample simultaneously throughout the water column, and 3) vertically-stratified pumps and net tows to verify species identification and video-based abundance estimates. These field observations will be combined with laboratory analysis of zooplankton movements in oxygen and pH gradients, and with spatially-explicit models to predict how behavioral mechanisms lead to large-scale impacts of environmental stresses.

The following deployments were conducted in 2017 and 2018:
CB1077: https://www.bco-dmo.org/deployment/735746
CB1072: https://www.bco-dmo.org/deployment/735748
Zoocam_ORCA_Twanoh_2017: https://www.bco-dmo.org/deployment/735762
RC0008: https://www.bco-dmo.org/deployment/775288
Mooring ORCA_Hoodsport; NANOOS-APL4: https://www.bco-dmo.org/deployment/775291

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1657992

[table of contents | back to top]