Velocity data collected at Brady's Beach in Bamfield British Columbia, Canada in July 2024

Website: https://www.bco-dmo.org/dataset/986711
Data Type: Other Field Results
Version: 1
Version Date: 2025-10-13

Project
» Collaborative Research: Microscale interactions of foundation species with their fluid environment: biological feedbacks alter ecological interactions of mussels (Microscale Mussels)

Contributors	Affiliation	Role
Carrington, Emily	University of Washington (UW)	Principal Investigator
Reidenbach, Matthew	University of Virginia (UVA)	Principal Investigator
York, Amber D.	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
Velocity data collected with a Nortek Vectrino at Brady's Beach in conjunction with oxygen measurements. Velocity data was collected in a surge channel at the beach. Monday July 22 2024 Took rowboat across inlet and hiked to Brady’s beach at ~2:30 pm, high tide. Set up vectrino in a surge channel above bed of mussels.

Table of Contents

Coverage

Location: 48.828874, -125.153718British Columbia, Canada

Methods & Sampling

Set up Vectrino on tripod with person holding the instrument in surge channel. Instrument was cabled to computer for data recording.

Monday July 22 2024

Took rowboat across inlet and hiked to Brady’s beach witih Kindall, Chris, Emily, Matt ~2:30 pm, high tide.

Set up vectrino in a surge channel above bed of mussels.

Recorded first set in channel between two of Kindall’s sites.

Recording at 1 cm above the mussels, File name: Brady1.vno

1 cm above mussels: Brady1.vno

5 cm above mussels: Brady2.vno

10 cm above mussels: Brady3.vno

Moved instrument up the surge channel to a more protected site. About 10 m up the surge channel, roughly

10 cm up in elevation.

1 cm above mussels: Brady4.vno

5 cm above the mussels in the upper surge channel: Brady5.vno

Moved instrument to directly next to oxygen sensors at Brady Beach:

1 cm above mussels: Brady6.vno

Moved instrument next to tilt sensor at Brady Beach:

1 cm above mussels: Brady7.vno

Information contained within .hdr file corresponds to data presented in columns within the .dat file. For each column within the .dat file, the data are:

1	File mark (opt.)	(1-16777216)
2	Time (opt.)	(s)
3	Ensemble counter	(1-16777216)
4	Status	
5	Velocity (Beam1|X)	(m/s)
6	Velocity (Beam2|Y)	(m/s)
7	Velocity (Beam3|Z)	(m/s)
8	Velocity (Beam4|Z2)	(m/s)
9	Amplitude (Beam1)	(counts)
10	Amplitude (Beam2)	(counts)
11	Amplitude (Beam3)	(counts)
12	Amplitude (Beam4)	(counts)
13	SNR (Beam1)	(dB)
14	SNR (Beam2)	(dB)
15	SNR (Beam3)	(dB)
16	SNR (Beam4)	(dB)
17	Correlation (Beam1)	(%)
18	Correlation (Beam2)	(%)
19	Correlation (Beam3)	(%)
20	Correlation (Beam4)	(%)

Data Processing Description

Raw velocimeter data files are included. Data was collected at 50 Hz and statistics of mean values and turbulence can be computed.

[table of contents | back to top]

Parameters

Parameters for this dataset have not yet been identified

[table of contents | back to top]

Project Information

Collaborative Research: Microscale interactions of foundation species with their fluid environment: biological feedbacks alter ecological interactions of mussels (Microscale Mussels)

Coverage: University of Washington Friday Harbor Laboratories

NSF Award Abstract:
The project investigates how the metabolic activity of dense aggregations of marine organisms alter the water chemistry of their interstitial spaces, and how these microscale alterations feedback to affect the organisms' interactions in coastal ecosystems. The research team focuses on bivalve mussels, foundation species that form dense 'beds' typically known for facilitating other species by ameliorating harsh flow conditions. This ability can become a liability, however, if flow is not sufficient to flush the interstitial spaces and steep, metabolically-driven concentration gradients develop. The research evaluates whether corrosive chemical microclimates (such as low oxygen or low pH) are most extreme in low flow, high temperature conditions, especially for dense aggregations of mussels with large biomass and/or high respiration rates, and if they negatively impact mussel beds and the diverse biological communities they support. The research addresses a global societal concern, the impact of anthropogenic climate change on coastal marine ecosystems, and has potential applications to aquaculture and biofouling industries by informing adaptation strategies to "future-proof" mussel farms in the face of climate change and improved antifouling practices for ships, moorings, and industrial cooling systems. The project forges new collaborations with investigators from three campuses and integrates research and education through interdisciplinary training of a diverse group of graduate, undergraduate and high school students. STEM education and environmental stewardship is promoted by the development of a K-12 level science curriculum module and a hand's-on public exhibit of bivalve biology at a local shellfish farm. Research findings are disseminated in a variety of forums, including peer-reviewed scientific publications and research presentations at regional, national and international meetings.

The research team develops a framework that links environmental conditions measured at a coarse scale (100m-100km; e.g., most environmental observatories) and ecological processes at the organismal scale (1 cm – 10 m). Specifically, the project investigates how aggregations of foundation species impact flow through interstitial spaces, and how this ultimately impacts water chemistry immediately adjacent to the organisms. The research focuses on mytilid mussels, with the expectation that the aggregation alters the flow and chemical transport in two ways, one by creating a physical resistance, which reduces the exchange, and the other by enhancing the exchange due to their incurrent/excurrent pumping. These metabolically-driven feedbacks are expected to be strongest in densely packed, high biomass aggregations and under certain ambient environmental conditions, namely low flow and elevated temperature, and can lead to a range of negative ecological impacts that could not be predicted directly from coarse scale measures of ambient seawater chemistry or temperature. The team develops computational fluid dynamic (CFD) models to predict interstitial flows and concentration gradients of dissolved oxygen and pH within mussel beds. The CFD model incorporates mussel behavior and physiological activity (filtration, gaping, respiration) based on published values as well as new empirical work. Model predictions are compared to flow and concentration gradients measured in mussel aggregations in the laboratory and field. Finally, the team conducts several short-term experiments to quantify some of the potential negative ecological impacts of corrosive interstitial water chemistry on mussel aggregations, such as reduced growth, increased dislodgement, increased predation risk, and reduced biodiversity. Because the model is based on fluid dynamic principles and functional traits, the framework is readily adaptable to other species that form dense assemblages, thereby providing a useful tool for predicting the ability of foundation species to persist and provide desirable ecosystem services under current and future multidimensional climate scenarios.

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.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-2050345

[table of contents | back to top]