Inlet particle speeds from 5 high-speed video frames at 3 temperature treatments from Oikopleura dioica particle tracking experiments conducted in December 2015

Website: https://www.bco-dmo.org/dataset/897682
Data Type: experimental
Version: 1
Version Date: 2023-06-15

Project
» Collaborative Research: Comparative feeding by gelatinous grazers on microbial prey (Gelatinous Grazer Feeding)

Contributors	Affiliation	Role
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Abstract
These data include tail beat kinematics measurements and particle tracking from the appendicularian Oikopleura dioica during experiments conducted in December 2015 at the Sars Centre for Marine Molecular Biology in Bergen, Norway. The data were collected from high-speed video frames. The experiments comprised 3 temperature treatments. This dataset includes measurements of particle movement. Manual particle tracking was used to estimate flow speeds across the inlet filter as driven by tail beating in O. dioica. Data were used to describe how flow and particle movement across food concentrating filters is affected by temperature.

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Coverage

Temporal Extent: 2015-12-05 - 2015-12-10

Dataset Description

The primary data file for this dataset, "897682_particle_speed.csv", contains the raw data. The supplemental file, "897682_particle_speed_averages_and_maximums.csv", contains the maximum speed and average speed

for each video, as well as the population mean maximum speeds. The videos are attached as Supplemental Files (there is one .zip folder for each temperature treatment).

Methods & Sampling

All experimental animals were obtained from the appendicularian culture facility at the Sars Centre for Marine Molecular Biology in Bergen, Norway in December 2015. *Oikopleura dioica* were filmed individually following Gemmell et al. (2014). Images were recorded using an Edgertronic high-speed camera (1280 × 1024-pixel resolution, 500 frames per second) with brightfield illumination from a fiber optic light source, or a Photron FastCam Mini Ux100 (1280x1024, 125-1000 frames per second) with darkfield illumination from a tilting mirror base. The filming vessel was positioned on a manually adjustable stage between the light source and the camera. A long working-distance microscope objective (4x or 40x) was mounted to an adjustable-height optics clamp positioned between the filming vessel and the camera. Videos were converted to image stacks in QuickTime Pro. Day 1 animals were filmed in a 50-milliliter glass cuvette in treatments comprising 3 temperatures: 5° Celsius, 15° Celsius, and 25° Celsius.

Data Processing Description

Data Processing:
Particle tracking to estimate inlet flow speeds were measured in ImageJ. Flow speeds were determined by manual particle tracking, with distance over time obtained from the first and last of 10 frames. An average and maximum of 5 particle speeds were recorded for all individuals.

BCO-DMO Processing:
- separated the original data file into two resources: one with the averages and maximums (summary statistics) and one with the raw data;
- renamed fields for both resources to comply with BCO-DMO naming conventions;
- bundled the videos into 3 .zip files (see Supplemental Files).

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Data Files

File	
897682_particle_speed.csv	(Comma Separated Values (.csv), 126.79 KB) MD5:e73cac013d6431814f61e9404ca72f05
Primary data file for dataset ID 897682.	

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Supplemental Files

File	
15C.zip	(ZIP Archive (ZIP), 1.94 GB) MD5:5ee628c77dd3b5079923bb2d4004a5dc
This .zip contains 17 .mov video files from the 15 degrees Celsius treatments. See the file inventory (Appendicularian_Video_Inventory.csv) for a description of each file.	
25C.zip	(ZIP Archive (ZIP), 2.01 GB) MD5:02928e5f9fd97b1f5f73cd4dc8f5e6c4
This .zip contains 16 .mov video files from the 25 degrees Celsius treatments. See the file inventory (Appendicularian_Video_Inventory.csv) for a description of each file.	
5C.zip	(ZIP Archive (ZIP), 2.49 GB) MD5:6888cc317e68626484f97c5fd5a53df6
This .zip contains 20 .mov video files from the 5 degrees Celsius treatments. See the file inventory (Appendicularian_Video_Inventory.csv) for a description of each file.	
897682_particle_speed_averages_and_maximums.csv	(Comma Separated Values (.csv), 9.15 KB) MD5:8a723728bac0b144bf8a14c9a699c0ce
Supplemental file for dataset ID 897682. This file contains the maximum speed and average speed for each video, as well as the population mean maximum speeds. Column descriptions: (column_name, definition, units, type) Temperature,Temperature treatment,degrees Celsius,Float Video,Video identifier,unitless,String Max_Speed,Maximum particle speed of the video,millimeters per second (mm/s),Float Avg_Speed,Average particle speed of the video,millimeters per second (mm/s),Float Pop_Mean_Max_Speed,Maximum particle speed for all particles in one video,millimeters per second (mm/s),Float	
Appendicularian_Video_Inventory.csv	(Comma Separated Values (.csv), 2.77 KB) MD5:3984ad11c2e6a3e4373883742f6988ad
Inventory/description of video files contained in the three .zip files - one for each temperature treatment. This inventory was originally provided as an Excel file and was converted to .csv by BCO-DMO.	

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Related Publications

Gemmell, B. J., Jiang, H., & Buskey, E. J. (2014). A new approach to micro-scale particle image velocimetry (μPIV) for quantifying flows around free-swimming zooplankton. Journal of Plankton Research, 36(5), 1396–1401. https://doi.org/10.1093/plankt/fbu067
Methods

Hiebert, TC, Gemmell, BJ, von Dassow, G, Conley, KR, & Sutherland, KR. (Under Review). The hydrodynamics and kinematics of the appendicularian tail underpin peristaltic pumping.
Results

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Related Datasets

IsRelatedTo

Gemmell, B. J., Sutherland, K. R., Conley, K. R., Hiebert, T. C., von Dassow, G. (2023) **Filter area**

measurements from Oikopleura dioica tail beat kinematics and particle tracking experiments conducted in December 2015. Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2023-06-15 doi:10.26008/1912/bco-dmo.897665.1 [view at BCO-DMO]

Gemmell, B. J., Sutherland, K. R., Conley, K. R., Hiebert, T. C., von Dassow, G. (2023) **Tail beat frequency in the appendicularian Oikopleura dioica during particle tracking experiments comprised of three temperature treatments conducted in December 2015.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2023-06-15 doi:10.26008/1912/bco-dmo.897617.1 [view at BCO-DMO]

Gemmell, B. J., Sutherland, K. R., Conley, K. R., Hiebert, T. C., von Dassow, G. (2023) **Tail wave amplitude from 5 high-speed video frames at 3 temperatures from Oikopleura dioica particle tracking experiments conducted in December 2015.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2023-06-22 doi:10.26008/1912/bco-dmo.897825.1 [view at BCO-DMO]

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Parameters

Parameter	Description	Units
Temperature	Temperature treatment	degrees Celsius
Video	Video identifier. This number is the last 5 digits of the .mov file names. The .mov files are provided in the attached .zip folders as Supplemental Files. The number following the dash represents the population of particles and the letter denotes each of 5 particles measured in that population. For example, "75974-1A" is the identifier for population 1, particle A in the .mov file ending in 75974, which is in the 5C.zip folder (5C contains movies from the 5 degrees C temperature treatment.)	unitless
Frame	Video frame number	unitless
Time	Time between frames	seconds
X	Particle x position	millimeters (mm)
Y	Particle y position	millimeters (mm)
Distance	Particle distance traveled (calculated)	millimeters (mm)
Speed	Particle speed (calculated)	millimeters per second (mm/s)

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Instruments

Dataset-specific Instrument Name	Edgertronic high-speed camera
Generic Instrument Name	Camera
Generic Instrument Description	All types of photographic equipment including stills, video, film and digital systems.

Dataset-specific Instrument Name	Photron FastCam Mini Ux100
Generic Instrument Name	Camera
Generic Instrument Description	All types of photographic equipment including stills, video, film and digital systems.

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Project Information

Collaborative Research: Comparative feeding by gelatinous grazers on microbial prey (Gelatinous Grazer Feeding)

Coverage: North Pacific Subtropical Gyre, at a field site 3 nautical miles offshore of Kona, Hawai'i (19.710746 N, 22.75 W) & Sars Centre for Marine Molecular Biology in Bergen, Norway

NSF Award Abstract:
The oceans are dominated by microscopic plants and animals (microorganisms) that are at the base of the food web and drive energy and carbon cycles on global scales. Soft jellylike animals called gelatinous grazers specialize in feeding on microorganisms using nets made out of mucus. Gelatinous grazers are abundant in the ocean and have high feeding rates on microorganisms so could have a very strong influence on the abundance and diversity of microorganisms and could change how oceanic food webs are currently understood. However, gelatinous grazers are very fragile and patchy in their distributions so it has been difficult to determine the magnitude and dynamics of these important predator-prey relationships on a meaningful scale using traditional approaches, thus they have typically been disregarded in food web studies. Learning more about the predator-prey relationship between gelatinous grazers and microorganisms will improve understanding of the structure, mechanics, and dynamics of the ocean's food web, which is a critical economic and ecosystem resource on Earth. This project is determining grazing rates by gelatinous animals on microbes to inform food web models. The project also trains students to communicate, disseminate, and interpret scientific findings. These broader impacts goals will be attained through partnerships at the University of Oregon (Applied Scientific Communication) and Portland State University (Advanced Technical Writing), training of 1 PhD student, 2 undergraduates, and 4 science communication interns, and development of a week-long workshop and establish student mentorship relationships towards production of communication products.

The project integrates laboratory and oceanographic approaches to address several specific aspects of the predator-prey relationship between gelatinous grazers and ocean microorganisms. Five distinct types of gelatinous grazers, each with different feeding morphologies and life history, will be studied in an oceanographic setting with an abundant and diverse natural microbial population. These target organisms include pelagic tunicates (salps, appendicularians, doliolods and pyrosomes) and thecosome pteropods. The approach quantifies: 1) grazing rates in the natural ocean environment, 2) particle selectivity with a focus on size and shape and, 3) the morphological and hydrodynamic properties of feeding that underlie the measured grazing rates and particle selection. The project uses a variety of techniques including sampling via SCUBA diving, laboratory experiments, high speed/high resolution videography, flow cytometry, and DNA sequencing techniques.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1851537

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