Particle tracking from the appendicularian Oikopleura dioica feeding behavior experiments conducted in 2016 at the Sars Centre for Marine Molecular Biology in Bergen, Norway (Mucus net filter feeders project)

Website: https://www.bco-dmo.org/dataset/709337
Data Type: experimental
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Project
» Selective feeding by mucous-net filter feeders on the ocean's smallest organisms (Mucus net filter feeders)

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Dataset Description

This dataset contains data related to feeding behavior of the appendicularian *Oikopleura dioica*. The data include fluid direction and particle orientation of beads suspended in fluid filtered by *O. dioica.* The experiments took place in 2016 at the Sars Centre for Marine Molecular Biology in Bergen, Norway.

These data will be published in:
Conley KR, Sutherland KR (In Revision) Particle shape impacts export and fate in the ocean through interactions with a globally abundant appendicularian, *Oikopleura dioica*. PLOS ONE, Fig. 6

Methods & Sampling

All experimental animals were obtained from the appendicularian culture facility at the Sars Centre for Marine Molecular Biology in Bergen, Norway on May 16, 2016. Immature day-6 *Oikopleura dioica* were filmed individually using a Sony 4K FDR-AX100 (HD resolution, 120 fps) mounted to a Nikon Eclipse E400 with a 10x objective using a Martin Microscope M99 Camcorder Adapter. Animals were filmed in a glass embryo dish filtering a suspension of 10 mm-diameter spheres and ellipsoids of similar width (L=22 +- 2.4 mm and W=7.8 +- 1.1 mm; *n*=5; mean +- SD).

For measurements of ellipsoidal particle orientation, the image stack was registered using the StackReg plugin with an Affine transform to account for the inflation and deflation of the feeding mesh. Images were then inverted and frames for trajectory analysis were color-coded in one of six channels using the Stack-to-Hyperstack tool. Stacks were Z-projected and the composite image was used to show trajectories. Measurements of ellipsoidal particle orientation were made using the straight line angle tool in ImageJ (41) and converted to be relative to the fluid flow.

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Data Files

File
ellipsoid_orientation.csv (Comma Separated Values (.csv), 10.35 KB) MD5:08465708b5b24835a60310714514f285 Primary data file for dataset ID 709337

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Parameters

Parameter	Description	Units
Location	Location in animal; fluid or food collecting mesh	unitless
Video	Video identifier	unitless
Frame	Video frame number or range	unitless
Time_elapsed	Time of measurement based on frame rate of 120 frames per second	seconds
Bead	Bead identifier; Beads are spherical and rod-shaped particles used in the feeding experiments	unitless
Point_ID	Rod (ellipsoid-shaped particle) angle identifier; multiple measurements per bead	unitless
Rod_angle_0	Rod (ellipsoid-shaped particle) angle relative to zero degrees; horizontal	degrees
Fluid_direction	Direction of fluid relative to zero degrees; horizontal	degrees
Rod_angle_fluid	Rod angle relative to fluid angle	degrees

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Instruments

Dataset-specific Instrument Name	Sony 4K FDR-AX100
Generic Instrument Name	Camera
Dataset-specific Description	Sony 4K FDR-AX100 (HD resolution, 120 fps) mounted to a Nikon Eclipse E400 with a 10x objective using a Martin Microscope M99 Camcorder Adapter.
Generic Instrument Description	All types of photographic equipment including stills, video, film and digital systems.

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Project Information

Selective feeding by mucous-net filter feeders on the ocean's smallest organisms (Mucus net filter feeders)

Coverage: Oregon, USA; Bergen, Norway

NSF abstract:

The surface of the ocean is dominated by microscopic plants and animals called picoplankton, which are at the base of the marine food web. Jelly-like animals called appendicularians specialize in feeding on these miniature organisms by filtering large quantities of water using nets made out of mucus. In the past, it was thought that appendicularians eat anything that passes through the mucous net, but new work shows that feeding may be selective. The most abundant group of microorganisms in the ocean, called SAR 11, seems to evade the appendicularian, while similar-sized photosynthetic microbes are captured. In this study, a series of lab and field experiments will be conducted in Oregon, USA, and Villefranche-sur-mer, France, to uncover the mechanisms for selectivity. The research will test the effect of particle shape (e.g. spherical vs. ellipsoidal), adhesion properties of particles to mucous meshes, and the role of hydrodynamics. It will focus on the cosmopolitan appendicularian Oikopleura dioica, an important grazer of picoplankton. Results will be important for understanding the role of mucous-net filter feeders in shaping the structure of the ocean's microbial community as well as biogeochemical cycling.

Picoplankton occur at densities of up to a million per mL and numerically dominate the upper ocean prey field. Since appendicularians influence pico- and nano-particle flux through their high filtration rates and the production of mucous aggregates, selective grazing will have important ramifications for microbial loop dynamics and vertical flux. Therefore, this work will provide insights into the mechanisms governing bacterioplankton community structure in the upper ocean and increase understanding of microbial-metazoan food web interactions in both neritic and oceanic ecosystems. The specific goals of the project are to a) determine the role of flow morphology in regulating particle capture within the houses of free-swimming appendicularians using micro-Particle Image Velocimetry, b) determine the effect of particle shape on retention efficiencies by appendicularians, and compare this effect between synthetic and biological particles, and c) quantify particle adhesion to the mucous filtration apparatus in order to determine if picoplankton cell surface properties influence retention efficiencies by mucous-net filter-feeders.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1537201

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