Behavioral metrics of swimming Hydromedusae in a turbulence generator near Friday Harbor dock and laboratory in 2012 (Jellyfish predation in turbulence project)

Website: https://www.bco-dmo.org/dataset/650006
Data Type: experimental
Version:
Version Date: 2016-07-06

Project
» Influence of organism-scale turbulence on the predatory impacts of a suite of cnidarian medusae (jellyfish predation in turbulence)

Contributors	Affiliation	Role
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Dataset Description

Swimming behaviors of four species of cnidarian hydromedusae (*Aequorea victoria, Mitrocoma cellularia, Stomotoca atra, Aglantha digitale*) exposed to two flow conditions in a laboratory turbulence generator - still water and turbulent (ε ~10-7 m2 s-3).

Related Datasets:
HydroSwimParams_N
ANOVA means

Methods & Sampling

The x and z position of the most aboral point on the bell were digitized in ImageJ (NIH, Bethesda, Maryland, USA) at 1-s intervals to produce trajectories from a total of 82 individual hydromedusae from 34 tank trials. Resultant data don't agree well with in situ measurements suggesting that there may have been tank artifacts.

Measured swimming parameters from each individual hydromedusa included depth in the tank, observed speed, acceleration, the net-to-gross displacement ratio (NGDR), time spent swimming and swimming direction.

Data Processing Description

BCO-DMO Processing:

- added conventional header with dataset name, PI name, version date
- renamed parameters to BCO-DMO and BODC standards

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Data Files

File
HydroSwimParams_indstats.csv (Comma Separated Values (.csv), 1.00 KB) MD5:daf52706869af4a0ea8afd45cfac1dda Primary data file for dataset ID 650006

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Parameters

Parameter	Description	Units
species	hydromedusa genus	unitless
treatment	treatment: still or turbulent water	unitless
num_indiv	number of individuals	each
speed	speed of specimen	cm/sec
speed_sd	speed of specimen standard deviation	cm/sec
speed_mean_max	maximum swimming speed	cm/sec
speed_max_sd	maximum swimming speed standard deviation	cm/sec
accel	acceleration rate	cm/sec^2
accel_sd	acceleration rate	cm/sec^2
depth_mean	depth in turbulence generator (maximum depth of turbulence generator = 30 cm)	cm
depth_sd	standard deviation	cm
NGDR_mean	mean net-to-gross displacement ratio	unitless

NGDR_mean_sd	mean net-to-gross displacement ratio standard deviation	unitless
pcent_timeswim	percent time spent swimming faster than 0.2 cm/sec	unitless
pcent_timeswim_sd	percent time spent swimming	unitless
dir_mean_degr	mean swimming direction	degrees
dir_mean_degr_sd	mean swimming direction	degrees
Ua	average speed of plankton based on all instantaneous speeds	cm/sec
Ua_mean	Motility number: the ensemble average swim speed Ua divided by 2 component turbulence velocity q (Gallager 2004). q = 0.27	cm/sec

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Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	Camera
Dataset-specific Description	Sony HDR-HC9 camcorder (1920 x 1080 pixels, 30 frames s-1; Sony Electronics Inc., Fort Myers, FL, USA) with a 16 x 9 cm field-of view.
Generic Instrument Description	All types of photographic equipment including stills, video, film and digital systems.

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Deployments

FHL_Sutherland

Website	https://www.bco-dmo.org/deployment/649916
Platform	Friday_Harbor
Start Date	2012-06-01
End Date	2016-06-30

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Project Information

Influence of organism-scale turbulence on the predatory impacts of a suite of cnidarian medusae (jellyfish predation in turbulence)

Coverage: Friday Harbor Labs, WA

Bloom-forming jellyfish are increasing in number, frequency and magnitude, in part due to anthropogenic impacts, underscoring a need for enhanced understanding of trophic exchanges in jellyfish-dominated ecosystems. Interactions between jellyfish and their prey are driven by morphology, behavior, and unique fluid signatures that result in species-specific prey selection patterns. Fluid signatures generated by predators entrain prey, and motile prey organisms have evolved to sense and respond to these stereotyped fluid signatures. The shape and coherence of these unique fluid signatures are strongly mediated by turbulence, which is ubiquitous in the ocean. Yet, the effects of turbulence are almost always neglected in feeding studies. This three-year project will investigate the influence of turbulence on predator-prey interactions using a suite of cnidarian hydromedusae with unique morphologies, fluid signatures and prey selection patterns collected in the region of Friday Harbor Laboratory, WA.

This project seeks to establish a detailed, mechanistic understanding of the effects of turbulence on organism-scale predator-prey interactions using gelatinous zooplankton predators with contrasting predation modes. The PI will investigate prey selection under varying levels of turbulence by studying swimming behavior, wake structure, and predator-prey interactions in a laboratory turbulence generator designed for fragile plankton. The PI will also make in situ measurements of turbulence and observations of organism behavior using a Self-contained Underwater Velocimetry Apparatus (SCUVA). This is a fully submersible instrument for flow visualization, and its use will provide a cross-calibration of field and laboratory rates and behaviors. The influence of turbulence on trophic position among the different species of hydromedusae will be quantified through field studies of prey selection patterns. The proposed comparative approach using species with distinct predation modes will provide insights applicable to other planktonic predators that can be similarly grouped.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1155084

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