Acoustic Doppler Velocimeter (ADV) collected from the surface to the bottom at 30 cm intervals from the MBL dock in Woods Hole, MA, USA in 2012 (Mnemiopsis feeding in turbulence project)

Website: https://www.bco-dmo.org/dataset/554133
Version: 27 March 2015
Version Date: 2015-03-27

Project
» Turbulence and Suspension Feeding - a New Approach using the Lobate Ctenophore Mnemiopsis Leidyi (Mnemiopsis feeding in turbulence)

Contributors	Affiliation	Role
Costello, John H.	Providence College	Principal Investigator, Contact
Colin, Sean	Roger Williams University (RWU)	Co-Principal Investigator
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Dataset Description

Vertical water velocity measurements were collected from the surface to the bottom at 30 cm intervals from the MBL dock using an Acoustic Doppler Velocimeter (ADV; Nortek vector).

Reference:
Sutherland, K.R., Costello, J.H., Colin, S.P., and Dabiri, J.O. 2014. Ambient fluid motions influence swimming and feeding by the ctenophore *Mnemiopsis leidyi*. J. Plankton Res. 36(5): 1310–1322. doi:10.1093/plankt/fbu051

Methods & Sampling

Methods and precision described in:
Sutherland, K.R., Costello, J.H., Colin, S.P., and Dabiri, J.O. 2014. Ambient fluid motions influence swimming and feeding by the ctenophore *Mnemiopsis leidyi*. J. Plankton Res. 36(5): 1310–1322. doi:10.1093/plankt/fbu051

Data Processing Description

Mean and variance estimates have been assembled and listed by depth.

BCO-DMO edits:
- Modified parameter names to conform with BCO-DMO naming conventions.

- Inserted lat and lon of the pier (using values provided on the metadata form), location name, and date.

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Data Files

File
ADV_summary.csv (Comma Separated Values (.csv), 8.66 KB) MD5:db675105014ae92f987d5466139901ca Primary data file for dataset ID 554133

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Parameters

Parameter	Description	Units
location	Description of sampling location.	text
lat	Latitude of sampling location.	decimal degrees
lon	Longitude of sampling location.	decimal degrees
date	Month, day, and year of sampling. (Local time zone, EST)	mmddyyyy
treatment	Treatment type.	text
depth	Depth.	meters
TKE	Turbulence kinetic energy (TKE).	meters squared per seconds squared (m2/s2)
dissipation_rate	Dissipation rate.	meters squared per seconds cubed (m2/s3)
TKE_mean	Mean turbulence kinetic energy (TKE).	meters squared per seconds squared (m2/s2)
TKE_stdev	Standard deviation of mean turbulence kinetic energy (TKE).	meters squared per seconds squared (m2/s2)
dissipation_rate_mean	Mean dissipation rate.	meters squared per seconds cubed (m2/s3)
dissipation_rate_stdev	Standard deviation of mean dissipation rate.	meters squared per seconds cubed (m2/s3)

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Instruments

Dataset-specific Instrument Name	ADV
Generic Instrument Name	Acoustic Doppler Velocimeter
Dataset-specific Description	Vertical water velocity measurements were collected from the surface to the bottom at 30 cm intervals from the MBL dock using an Acoustic Doppler Velocimeter (ADV; Nortek vector)
Generic Instrument Description	ADV is the acronym for acoustic doppler velocimeter. The ADV is a remote-sensing, three-dimensional velocity sensor. Its operation is based on the Doppler shift effect. The sensor can be deployed either as a moored instrument or attached to a still structure near the seabed. Reference: G. Voulgaris and J. H. Trowbridge, 1998. Evaluation of the Acoustic Doppler Velocimeter (ADV) for Turbulence Measurements. J. Atmos. Oceanic Technol., 15, 272–289. doi: http://dx.doi.org/10.1175/1520-0426(1998)0152.0.CO;2

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Deployments

MBL_Dock_0812

Website	https://www.bco-dmo.org/deployment/554399
Platform	MBL
Start Date	2012-08-14
End Date	2012-08-14
Description	Field surface turbulence measurements made at the MBL dock, Woods Hole, MA, USA, August 14, 2012.

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Project Information

Turbulence and Suspension Feeding - a New Approach using the Lobate Ctenophore Mnemiopsis Leidyi (Mnemiopsis feeding in turbulence)

Coverage: Marine Biological Laboratory dock, Woods Hole, MA

Description from NSF award abstract:
Prey selection, intake and, ultimately, the trophic impact of predators are determined by a succession of events that occur at the organismal level -- individual interactions among predators prey, and their environments. Furthermore, because the majority of predator-prey interactions occur in moving fluids, it is critical to observe and quantify predator-prey interactions within a hydrodynamic context. Successful predictions of trophic patterns in natural settings are limited by the ability to: 1) observe directly the effects of turbulence on feeding in pelagic organisms; 2) understand the mechanistic bases of animal-fluid interactions in turbulent environments; and 3) relate quantitative observations from still-water laboratory studies to nature. These limitations are pervasive in studies of trophic exchange within the larger scope of marine ecology.

Recent technological advances, and the combined expertise of the Co-PIs, enables meaningful studies of the influence of turbulence on feeding by the notoriously invasive lobate ctenophore, *Mnemiopsis leidyi*. *Mnemiopsis* is a delicate gelatinous predator which uses a laminar feeding current to entrain and capture prey. Using a remarkably effective feeding strategy, zooplankton standing stocks and overall zooplankton biodiversity are

reduced, and standing stocks of phytoplankton are increased via a trophic cascade. Like many suspension feeders, however, the feeding current produced by *Mnemiopsis* may be vulnerable to hydrodynamic disruption by ambient flows. In fact, turbulent events may change the behavior, distribution and prey selection of lobate ctenophores such as *Mnemiopsis*. This species is an ideal model organism to determine the mechanisms by which turbulence affects trophic exchange patterns of ecologically influential planktonic suspension feeders.

Involving a combination of laboratory and in situ methods to quantify, at the organismal level, this study will determine effects of turbulent flows on the feeding mechanics and predator-prey interactions of *Mnemiopsis*. Understanding how these turbulent effects translate to the community level will be accomplished via in situ sampling techniques that relate natural turbulence levels to ingestion rates, prey selection and predatory impact of *Mnemiopsis* in the field. This approach extends beyond current laboratory and modeling studies, with the potential of establishing clear cause-and-effect relationships.

This research will: 1) directly quantify turbulent effects on in situ predator-prey interactions; 2) provide mechanistic understanding of key variables influencing the ecological impact of an important invasive marine species; and 3) develop a novel approach for studying small-scale physical-biological interactions both in the laboratory and in the field.

Knowing how turbulence affects feeding in lobate ctenophores is valuable at the scale of the organism, as well as ecologically. The approach developed here also may be applied to a variety of other turbulence-dominated situations (e.g., mixing at fronts, animal-marine snow interactions) or to other organisms (other plankton, benthic-water column exchanges). In all cases, the outcomes depend upon small-scale physical-biological processes.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1061353
NSF Division of Ocean Sciences (NSF OCE)	OCE-1061182
NSF Division of Ocean Sciences (NSF OCE)	OCE-1061268

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