

# Zooplankton biovolumes from R/V Connecticut, SSV Corwith Cramer, CT2010, C223A, C230A, C235A, C241A from Atlantis and Veatch Canyons, Atlantic Ocean from 2009-2012 (Canyon Krill project)

**Website:** <https://www.bco-dmo.org/dataset/3904>

**Data Type:** Cruise Results

**Version:**

**Version Date:** 2013-04-02

## Project

» [Canyon Krill](#) (Canyon Krill)

Contributors	Affiliation	Role
<a href="#">Lawson, Gareth</a>	Woods Hole Oceanographic Institution (WHOI)	Principal Investigator
<a href="#">Copley, Nancy</a>	Woods Hole Oceanographic Institution (WHOI)	Technician, BCO-DMO Data Manager

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## Dataset Description

Zooplankton displacement volumes from MOCNESS and Tucker Trawl net tows in and around Atlantis and Veatch Canyons south of Cape Cod.

## Methods & Sampling

CT2010: A standard 1m<sup>2</sup> Multiple Opening/Closing Net and Environmental Sensing System (MOCNESS) was used to collect zooplankton in order to determine the taxonomic composition of the zooplankton in the study region and also to ground truth acoustic data collected with the HTI multi-frequency and Edgetech broadband systems. The MOCNESS has 9 nets with a 335 µm mesh size that can sample different regions of the water column. The underwater unit used was #169.

In addition to the standard temperature and conductivity probes the system also had a beta-type strobe-light unit for reducing avoidance of the nets by some zooplankton, notably krill, and possibly small fish. The strobe system has two units each with 12 LED sets (LUXEON Rebel LED) with peak output between 490-520 nm. Two of the 24 LED sets were working inconsistently at the start of the sampling. The LEDs are powered by the MOCNESS battery and their pulse width, amplitude, flash rate period, and on/off are controlled by the MOCNESS software. For EN484, the pulse width was 2 ms, the relative amplitude was 99%, and the flash interval was 100 ms. For EN487, the pulse width was 40 ms, the relative amplitude was 99%, and the flash interval was 1000 ms.

The MOCNESS was launched and recovered from the stern A-frame. Samples were brought into the wet lab for processing. Net 0 typically went from the surface to depth and nets 1-8 fished at discrete depths from depth to the surface. Nets 1-8 were preserved in buffered formalin. Often the net 0 samples were so large that they would have taken multiple jars so either the entirety or a large fraction was frozen in the -80C freezer, in the

hopes that they might be useful.

SV/Cramer cruises: These are Tucker Trawl samples collected on annual 'JP new student cruises'.

### Displacement Volume Measurement:

Samples were poured into a 1000 ml graduated cylinders and measured. Then the sample was poured through a 330 um sieve, allowed to drain, and the volume of water measured. The difference between the two volume measurements was the displacement volume. The displacement volume of each sample was divided by the volume filtered by the net ( $m^3$ ) and the result is reported here in units of  $cc/m^3$ . Animals larger than 5 cc were measured individually and reported here.

### Data Processing Description

#### Related information:

Wiebe, P.H., K.H. Burt, S.H. Boyd, and A.W. Morton, A multiple opening-closing net and environmental sensing system for sampling zooplankton, J. Mar. Res., 34, 312-326, 1976.

Wiebe, P.H., A.W. Morton, A.M. Bradley, J.E. Craddock, T.J. Cowles, V.A. Barber, R.H. Backus, and G.R. Flierl, New developments in the MOCNESS, an apparatus for sampling zooplankton and micronekton, Mar. Biol., 87, 313-323, 1985.

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### Data Files

File
<b>disp_vols_Canyons.csv</b> (Comma Separated Values (.csv), 17.28 KB) MD5:311ddcd10ea10c963ca99fd9554102ce
Primary data file for dataset ID 3904

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### Parameters

Parameter	Description	Units
cruise_id	cruise identification	alphanumeric
date_local	local date of tow	yyyymmdd
tow	MOCNESS tow number	integer
site	location of tow	text
lat_start	latitude at start of cruise; north is positive	decimal degrees
lon_start	longitude at start of cruise; east is positive	decimal degrees

lat_end	latitude at end of cruise; north is positive	decimal degrees
lon_end	longitude at end of cruise; east is positive	decimal degrees
yday_local	local day and decimal time; e.g. 326.5 for the 326th day of the year November 22 at 1200 hours (noon)	nd
time_local	local time	HHMM
day_night	whether cruise was taken in day or night	text
net	net number	integer
depth_range	depth range of sample	meters
depth_open	depth where net opened	meters
depth_close	depth where net closed	meters
depth_mid	mid-depth of sample	meters
depth_interval	depth interval	meters
vol_filt	volume filtered by net	cubic meters
disp_vol_m3	displacement volume per cubic meter	cc/meter <sup>3</sup>
comments_sample	comments pertaining to the sample	text
zoop_gt5cc_id	identification of animals > 5cc	text
disp_vol_lg	displacement volume of large animals	cc
dominants	dominant zooplankton in the sample	text
inst	The instrument used to make zooplankton collections: MOC = MOCNESS 1m <sup>2</sup> ; TT = Tucker Trawl.	text

## Instruments

<b>Dataset-specific Instrument Name</b>	
<b>Generic Instrument Name</b>	Hydroacoustic Technology Incorporated echosounder
<b>Generic Instrument Description</b>	The Hydroacoustic Technology Inc. (HTI) multi-frequency system is a towed digital split-beam/single-beam hydroacoustic system designed specifically to assess the abundance and distribution of fish and plankton. Digital signal processing hardware is combined with a MS Windows2000/XP -based user interface to produce results in real time. ( <a href="http://www.htisonar.com/multi_frequency_echo_sounder.htm">http://www.htisonar.com/multi_frequency_echo_sounder.htm</a> )

<b>Dataset-specific Instrument Name</b>	MOCNESS
<b>Generic Instrument Name</b>	MOCNESS
<b>Dataset-specific Description</b>	1 m <sup>2</sup> MOCNESS with 335 micron mesh, 9 nets.
<b>Generic Instrument Description</b>	The Multiple Opening/Closing Net and Environmental Sensing System or MOCNESS is a family of net systems based on the Tucker Trawl principle. There are currently 8 different sizes of MOCNESS in existence which are designed for capture of different size ranges of zooplankton and micro-nekton Each system is designated according to the size of the net mouth opening and in two cases, the number of nets it carries. The original MOCNESS (Wiebe et al, 1976) was a redesigned and improved version of a system described by Frost and McCrone (1974). (from MOCNESS manual)

<b>Dataset-specific Instrument Name</b>	Tucker Trawl
<b>Generic Instrument Name</b>	Tucker Trawl
<b>Dataset-specific Description</b>	1 m <sup>2</sup> mouth opening with 335 micron mesh and 3 nets.
<b>Generic Instrument Description</b>	The original Tucker Trawl, a net with a rectangular mouth opening first built in 1951 by G.H. Tucker, was not an opening/closing system, but shortly thereafter it was modified so that it could be opened and closed. The original had a 183 cm by 183 cm flexible rectangular mouth opening 914 cm long net with 1.8 cm stretched mesh for the first 457 cm and 1.3 cm mesh for last 457 cm. 152 cm of coarse plankton or muslin netting lined the end of the net. Tucker designed the net to collect animals associated with the deep scattering layers, principally euphausiids, siphonophores, and midwater fish. (from Wiebe and Benfield, 2003). Currently used Tucker Trawls usually have 1-m <sup>2</sup> openings and can have a single net or multiple nets on the frame.

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## Deployments

**CT2010**

<b>Website</b>	<a href="https://www.bco-dmo.org/deployment/58661">https://www.bco-dmo.org/deployment/58661</a>
<b>Platform</b>	R/V Connecticut
<b>Start Date</b>	2010-07-08
<b>End Date</b>	2010-07-16
<b>Description</b>	The CT2010 cruise was supported by funds from Woods Hole Sea Grant, and field work was done on the southern New England Shelf and in nearby slope waters. This is a different study area from the sites visited by the other Krill project cruises that sampled in the Gulf of Maine.

**C223A**

<b>Website</b>	<a href="https://www.bco-dmo.org/deployment/59021">https://www.bco-dmo.org/deployment/59021</a>
<b>Platform</b>	SSV Corwith Cramer
<b>Start Date</b>	2009-06-30
<b>End Date</b>	2009-07-02
<b>Description</b>	WHOI/MIT Joint Program new student cruise

**C230A**

<b>Website</b>	<a href="https://www.bco-dmo.org/deployment/59022">https://www.bco-dmo.org/deployment/59022</a>
<b>Platform</b>	SSV Corwith Cramer
<b>Start Date</b>	2010-07-25
<b>End Date</b>	2010-07-26
<b>Description</b>	WHOI/MIT Joint Program new student cruise

**C235A**

<b>Website</b>	<a href="https://www.bco-dmo.org/deployment/59023">https://www.bco-dmo.org/deployment/59023</a>
<b>Platform</b>	SSV Corwith Cramer
<b>Start Date</b>	2011-07-02
<b>End Date</b>	2011-07-03
<b>Description</b>	WHOI/MIT Joint Program new student cruise

**C241A**

<b>Website</b>	<a href="https://www.bco-dmo.org/deployment/59024">https://www.bco-dmo.org/deployment/59024</a>
<b>Platform</b>	SSV Corwith Cramer
<b>Start Date</b>	2012-07-01
<b>End Date</b>	2012-07-02
<b>Description</b>	WHOI/MIT Joint Program new student cruise

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**Project Information**

## **Canyon Krill (Canyon Krill)**

**Coverage:** NW Atlantic slope canyons

Study of the krill populations in and around Atlantis and Veatch Canyons along the Slope Waters south of Cape Cod. Zooplankton samples were collected with MOCNESS nets on the RV/Connecticut in 2010 and with a Tucker Trawl annually on the SVV/Corwith Cramer as part of the MIT/WHOI Joint Program new student cruise. The RV/Connecticut cruise included broadband acoustics measurements of the water column to be correlated with the net samples.

From proposal:

### **OBJECTIVES:**

The proposed work seeks to understand how physical forcing interacting with local bathymetry and with euphausiid active behaviors leads to the formation, persistence, and availability to predators of euphausiid aggregations in the deep canyons of the New England continental shelf break, using newly-available broadband acoustic scattering techniques. The specific objectives are:

1. To identify and track a euphausiid aggregation in a shelf break canyon in order to quantify changes in aggregation structure and position associated with variations in environmental conditions. Specifically, we will address the hypothesis that the formation and variability of euphausiid aggregations in such canyons relate to the interaction of the flow field, especially upwelling, with the sloping canyon topography and with the euphausiids' vertical movements and active aggregative behaviors.
2. To test and demonstrate the power of newly-available broadband acoustic scattering techniques for remotely discriminating euphausiids from other sources of acoustic scattering and making accurate and high-resolution estimates of euphausiid abundance and size.

### **METHODOLOGY:**

To achieve these objectives, we propose an innovative and comprehensive field program targeting Atlantis Canyon, southwest of Georges Bank. An initial 24-hour 'canyon' survey will be conducted to characterize the overall distribution of euphausiids, other zooplankton (especially copepods), higher predators, and the physical environment. This will be followed by a 48-hour 'tracking' survey of an individual euphausiid aggregation. Surveys will be conducted in September 2010, timed to occur shortly after the Northeast Fisheries Science Center bottom trawl survey of the greater region. In both survey modes, the primary sampling instrument will be a broadband acoustic scattering system (40-600 kHz). Broadband measurements, supplemented by measurements from a more traditional narrowband multi-frequency acoustic system (43, 120, 200, 420 kHz), will be used to quantify the abundance, size, and aggregation structure of euphausiids, as well as the abundance of fish predators and other zooplankton (e.g., copepods). These acoustic estimates of biological quantities will be validated via direct samples collected concurrently with a depth-stratified net system and an image-forming optical system. Characterization of the physical environment and flow field will be achieved via an Acoustic Doppler Current Profiler (ADCP) and a Conductivity-Temperature-Depth (CTD) system also equipped with a fluorometer to estimate the abundance of phytoplankton. During analysis, measurements of the characteristics, movements, and distribution of euphausiid aggregations will be related to these concurrent measurements of the physical and biological environment.

### **RATIONALE:**

Euphausiids are common crustacean members of North Atlantic pelagic ecosystems, but their ecological role in the waters off New England is only poorly understood. Previous studies in the Gulf of Maine region have suggested that euphausiids (especially *Meganctiphanes norvegica* and *Thysanoessa* spp.) can be locally abundant and a key prey item for a variety of higher predators, including commercially-exploited fish and squid. Euphausiids are also notable among zooplankton for their strong swimming capabilities and occurrence in dense aggregations; the formation of such aggregations is thought to be instrumental in determining the availability of euphausiids to higher predators. Overall, however, relatively little is known about the biological and physical processes leading to the formation and persistence of euphausiid aggregations, the interaction of euphausiids with their predators, and the overall significance of euphausiids in the New England Shelf/Slope ecosystem.

Large and dense aggregations of euphausiids have been observed in the canyons of the New England shelf break. The continental shelf break represents a frontier region in current understanding of the dynamics of the western North Atlantic Ocean and its inhabitants, and this project is motivated by the hypothesis advanced in the literature that these aggregations play an important role in subsidizing the productivity of commercial fish and squid stocks in shallower reaches of the shelf. By addressing the bio-physical factors that lead to the

aggregation of euphausiids and that determine their availability to higher predators in these canyon regions, the proposed work will take a necessary first step towards defining the essential habitat of fish predators that target euphausiids and quantifying their interaction for the development of ecosystem-based management models. Beneficiaries of the project thus include scientists and managers with National Marine Fisheries Service, the fishing industry, and society as a whole. The project furthermore will demonstrate the feasibility of using newly-available broadband acoustic scattering techniques for quantifying the abundance and size of euphausiids and other pelagic animals, which we anticipate will be of substantial use in the monitoring of marine pelagic habitats globally.

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## Funding

Funding Source	Award
Office of Naval Research (ONR)	<a href="#">N00014-12-10898</a>

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