Biomass of phytoplankton and microzooplankton taxa groups collected from cruises W0306A, W0308C, AT11-17, AT11-30, TUIM14MV, TN200 from the Coastal Waters off Washington State and Vancouver Island; 2003-2006 (ECOHAB-PNW project)

Website: https://www.bco-dmo.org/dataset/3229
Version: 30 January 2009
Version Date: 2009-01-30

Project
» ECOHAB - Pacific Northwest (ECOHAB-PNW)

Contributors	Affiliation	Role
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Table of Contents

Dataset Description

ECOHAB/PNW - Biomass of phytoplankton and microzooplankton taxa groups

Methods & Sampling

Methods for Phototrophic and Heterotrophic Plankton Taxa Sampling, Preservation,

Enumeration and Biomass Estimation

(Modified from Frame and Lessard, in press)

Biomass of phytoplankton and microzooplankton taxa groups was measured in the initial samples for dilution experiments off the Washington coast taken during six ECOHAB PNW cruises 2003-2006.

Replicate samples for phytoplankton and microzooplankton identification, enumeration, and sizing were preserved with either acid Lugol's (5% final conc.) or gluteraldehyde (0.5% final conc.). Gluteraldehyde-fixed samples were stained with DAPI and proflavin, then filtered onto 0.8µm and

0.2µm black polycarbonate membranes (Lessard and Murrell 1996). Slides were stored frozen until analysis onshore.

Microscope counts

Known volumes of the Lugols-preserved samples were settled in counting chambers for enumeration of ciliates (including mixotrophs), diatoms and larger dinoflagellates. Counts were performed on a Zeiss inverted microscope at 250x magnification. Glutarldehyde-preserved samples on 0.8µm filters were examined with a Zeiss standard epifluorescence microscope at 400x magnification for enumeration of microphytoplankton including photosynthetic dinoflagellates (typically
an unidentified raphidophyte. Samples on the 0.2µm filters were examined at 1000x magnification for cyanobacteria, picoeukaryotes (2-10µm).

Biomass estimates

Picoplankton (cyanobacteria and picoeukaryotes) were sized using images taken with a QImaging Retiga EX charged coupled device (CCD) camera and Image Pro Plus software. Dimensions of all other cells were measured using a computer-aided digitizing system (Roff and Hopcroft 1986). Cell volumes were calculated using appropriate geometric formulas and carbon was calculated using the carbon to volume equations of Menden-Deuer and Lessard (2000) for diatoms, nanoplankton and dinoflagellates, and of Worden et al. (2004) for picoplankton. Ciliate carbon was estimated using the conversion from Putt and Stoecker (1989).

References for further details:

Lessard, E.J. and M.C. Murrell (1996), Distribution, abundance and size composition of heterotrophic dinoflagellates and ciliates in the Sargasso Sea near Bermuda, Deep Sea Research Part I, 43(7), 1045-1065.

Frame, E.R. Frame and E.J. Lessard. Does the Columbia River Plume influence phytoplankton community structure along the Washington and Oregon coasts? In press. J. Geophysical Res.

Menden-Deuer, S., and E. J. Lessard (2000), Carbon to volume relationships for dinoflagellates, diatoms, and other protist plankton. Limnol. Oceanogr., 45, 569-579.

Putt, M., and D. K. Stoecker. 1989. An experimentally determined carbon:volume ratio for marine "oligotrichous" ciliates from estuarine and coastal waters. Limnol. Oceanogr. 34: 1097-1103.

Roff, J. C. and R. R. Hopcroft (1986), High precision microcomputer based measuring system for ecological research, Can. J. Fish. Aquat. Sci., 43, 2044-2048.

Worden, A.Z., J.K. Nolan, and B. Palenik (2004), Assessing the dynamics and ecology of marine picophytoplankton:

the importance of the eukaryotic component, Limnol. Oceanogr., 49(1), 168-179.

Data Processing Description

BCO-DMO Processing Notes

Generated from original file ECOHAB_PNW_biomass_plankton_taxa_groups.xls
contributed to BCO-DMO as a single sheet xls file by Evelyn Lessard

BCO-DMO Edits

- Parameter names modified to conform to BCO-DMO convention

- date reformatted to YYYYMMDD

- spaces in Cruise text field converted to "_"

- decimal data values padded to consistent decimal places

[table of contents | back to top]

Data Files

File
Biomass.csv (Comma Separated Values (.csv), 8.29 KB) MD5:ab80428303be4c45ec765134c3d435fc Primary data file for dataset ID 3229

[table of contents | back to top]

Parameters

Parameter	Description	Units
dilExID	Experiment number	?????
CTD	CTD number	Text
lat	Latitude	Decimal degrees North positive
lon	Longitude	Decimal degrees East positive
date	Local date	YYYYMMDD
depth	Depth of sample	meters
diatom	diatom biomass	microg Carbon l-1
ciliate	heterotrophic and mixotrophic ciliates	microg Carbon l-1
hdino	heterotrophic dinoflagellates	microg Carbon l-1
pdino	phototrophic dinoflagellates	microg Carbon l-1
crypto	cryptophytes	microg Carbon l-1
peuk	picoeukaryotes	microg Carbon l-1
cyano	cyanobacteria	microg Carbon l-1
pnan	photosynthetic nanoflagellates	microg Carbon l-1
hnan	heterotrophic nanoflagellates	microg Carbon l-1
Cruise	Other name of this deployment	

[table of contents | back to top]

Deployments

W0306A

Website	https://www.bco-dmo.org/deployment/58001
Platform	R/V Wecoma
Report	http://bcodata.whoi.edu/ECOHAB_PNW/ECOHAB_Cruise1_Report.pdf
Start Date	2003-06-02
End Date	2003-06-23
Description	W0306A: This is ECOHAB_1 (ECOHAB Cruise 1) First cruise of the 6 ECOHAB/PNW cruises. Numbered sequentially from Cruise_1 - Cruise_6 as ECOHAB_1 - ECOHAB_6. .

W0308C

Website	https://www.bco-dmo.org/deployment/58002
Platform	R/V Wecoma
Report	http://bcodata.whoi.edu/ECOHAB_PNW/ECOHAB_Cruise2_Report.pdf
Start Date	2003-08-30
End Date	2003-09-19
Description	W0308C: This is ECOHAB_2 (ECOHAB Cruise 2). Second cruise of the 6 ECOHAB-PNW cruises. Numbered sequentially from Cruise_1 - Cruise_6 as ECOHAB_1 - ECOHAB_6.

AT11-17

Website	https://www.bco-dmo.org/deployment/58003
Platform	R/V Atlantis
Report	http://bcodata.whoi.edu/ECOHAB_PNW/ECOHAB_Cruise3_Report.pdf
Start Date	2004-09-08
End Date	2004-09-28
Description	AT11-17: This is ECOHAB_3 (ECOHAB Cruise 3). Third cruise of the 6 ECOHAB-PNW cruises. Numbered sequentially from Cruise_1 - Cruise_6 as ECOHAB_1 - ECOHAB_6. Original cruise data are available from the NSF R2R data catalog

AT11-30

Website	https://www.bco-dmo.org/deployment/58004
Platform	R/V Atlantis
Report	http://bcodata.whoi.edu/ECOHAB_PNW/ECOHAB_Cruise4_Report.pdf
Start Date	2005-07-07
End Date	2005-07-27
Description	AT11-30: This is ECOHAB_4 (ECOHAB Cruise 4). Fourth cruise of the 6 ECOHAB-PNW cruises. Numbered sequentially from Cruise_1 - Cruise_6 as ECOHAB_1 - ECOHAB_6 Original cruise data are available from the NSF R2R data catalog

TUIM14MV

Website	https://www.bco-dmo.org/deployment/58005
Platform	R/V Melville
Report	http://bcodata.whoi.edu/ECOHAB_PNW/ECOHAB_Cruise5_Report.pdf
Start Date	2005-09-02
End Date	2005-09-22
Description	Cruise TUIM14MV is also known as ECOHAB_5 (ECOHAB Cruise 5) the fifth cruise of the 6 ECOHAB-PNW cruises; numbered sequentially from Cruise_1 - Cruise_6 as ECOHAB_1 - ECOHAB_6. Cruise information and original data are available from the NSF R2R data catalog.

TN200

Website	https://www.bco-dmo.org/deployment/58006
Platform	R/V Thomas G. Thompson
Report	http://bcodata.whoi.edu/ECOHAB_PNW/ECOHAB_Cruise6_Report.pdf
Start Date	2006-09-11
End Date	2006-10-04
Description	Cruise TN200 is also known as ECOHAB_6 (ECOHAB Cruise 6) the sixth of 6 ECOHAB-PNW cruises that are numbered sequentially from Cruise_1 - Cruise_6 as ECOHAB_1 - ECOHAB_6. Cruise information and original data are available from the NSF R2R data catalog.

[table of contents | back to top]

Project Information

ECOHAB - Pacific Northwest (ECOHAB-PNW)

Coverage: Off the Pacific Northwest coast

ECOHAB-PNW is a 5-year multi-disciplinary project that will study the physiology, toxicology, ecology and oceanography of toxic Pseudo-nitzschia species off the Pacific Northwest coast.

This program studies the physiology, toxicology, ecology and oceanography of toxic Pseudo-nitzschia species off the Pacific Northwest coast, a region in which both macro-nutrient supply and current patterns are primarily controlled by seasonal coastal upwelling processes. Recent studies suggest that the seasonal Juan de Fuca eddy, a nutrient rich retentive feature off the Washington coast serves as a "bioreactor" for the growth of phytoplankton, including diatoms of the genus Pseudo-nitzschia. Existing ship of opportunity data are consistent with the working hypothesis that the seasonal Juan de Fuca eddy is an initiation site for toxic Pseudo-nitzschia that impact the Washington coast and that upwelling sites adjacent to the coast are less likely to develop toxicity.

The long-term program goal is to develop a mechanistic basis for forecasting toxic Pseudo-nitzschia bloom development here and in other similar coastal regions in Eastern Boundary upwelling systems.

Specific study objectives are:
- 1.To determine the physical/biological/chemical factors that make the Juan de Fuca eddy region more viable for growth and sustenance of toxic Pseudo-nitzschia than the nearshore upwelling zone;
- 2. To determine the combination of environmental factors that regulate the production, accumulation, and/or release of domoic acid (DA) from Pseudo-nitzschia cells in the field;
- 3. To determine possible transport pathways between DA initiation sites and shellfish beds on the nearby coast.

The scientific operations of this study included obtaining multi-disciplinary data from a large scale grid, sampling water properties while following a drifter, deployment of surface drifters, satellite imagery, laboratory studies using water collected at selected sites, and numerical modeling of both the circulation and chlorophyll concentration. Water samples included macronutrients, iron, particulate and dissolved domoic acid, Pseudo-nitzschia species and numbers. Experiments were done to estimate growth and grazing rates. Moored arrays were deployed to provide time series of currents and water properties from May to October, each year from 2003-2006. Numerical modeling studies on a fine scale grid focused on the seasonal development
of the Juan de Fuca eddy and its change in structure during selected wind conditions. Conditions favorable to release of phytoplankton from the eddy region were assessed.

After four years of field work the research team is able to describe a possible sequence of events necessary to ingestion of domoic acid by coastal shellfish:
(1) Plankton must become concentrated in the bloom source region. ECOHAB PNW studies suggest this requires
a period of downwelling-favorable or lightly fluctuating winds.
(2) Next the plankton must undergo stress sufficient to cause an increase in cellular toxin: in the Juan de Fuca eddy region toxin can be found on any survey of the region in both early and late summer within a 21 day time scale.
(3) Patches of toxic plankton must then escape from the offshore source region. For the Juan de Fuca eddy region
escape is favored during upwelling-favorable wind conditions that allow the geostrophic constraint of the eddy circulation pattern to be broken.
(4) The patch must move alongshore to sites with shellfish populations, and
(5) must retain its toxicity during the time period of transport. For a toxic source in the Juan de Fuca eddy this requires southward advection across the shelf, as occurs during periods of upwelling-favorable winds in summer and early fall. ECOHAB PNW studies show that toxin can be maintained in the 7-14 days required for transport. For an Oregon source such as Heceta bank to impact the Washington shelf, this requires northward
advection across the shelf, as occurs during periods of downwelling-favorable winds in spring.
(6) Last, the toxic patch must move onshore to coastal beaches and/or estuaries,
(7) where it must remain there for a period sufficient for significant ingestion by shellfish.

Cruises/Platforms:
Cruise = ECOHAB-PNW cruises, numbered sequentially from

Cruise_1 - Cruise_6 as ECOHAB_1 - ECOHAB_6.

Cruise_1=ECOHAB_1, R/V Wecoma, W0306A, June 2-23, 2003 Cruise Report
Cruise_2=ECOHAB_2, R/V Wecoma, W0308C, August 30 - September 19, 2003 Cruise Report
Cruise_3=ECOHAB_3, R/V Atlantis, AT11-17, September 8-28, 2004 Cruise Report
Cruise_4=ECOHAB_4, R/V Atlantis, AT11-30, July 7-27,2005 Cruise Report
Cruise_5=ECOHAB_5, R/V Melville, TUIM14MV, September 2-22, 2005 Cruise Report
Cruise_6=ECOHAB_6, R/V Thomas G. Thompson, TN200, Sept. 11- Oct. 4, 2006 Cruise Report

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0234587
National Oceanic and Atmospheric Administration (NOAA)	NA170P2789

[table of contents | back to top]