

# Zooplankton and copepod egg production from R/V Wecoma multiple cruises in the Northeast Pacific coastal waters off states of Washington and Oregon from 2004 to 2006 (RISE project)

**Website:** <https://www.bco-dmo.org/dataset/3253>

**Version:** 09 November 2009

**Version Date:** 2009-11-09

## Project

» [River Influences on Shelf Ecosystems](#) (RISE)

Contributors	Affiliation	Role
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## Dataset Description

### RISE - Zooplankton - Copepod Egg Production

Egg production rates of the copepods *Calanus pacificus* and *Calanus marshallae*

*Data collectors' identifying numbers, e.g., cruise and leg numbers, cast numbers*

Rise cruises conducted aboard the R/V Wecoma are numbered sequentially: RISE 1W, RISE 2W, RISE 3W, RISE 4W, with the "W" for "Wecoma". There were concurrent RISE cruises on the R/V Pt. Sur, hence the designation of the ship in the cruise name. Data in the spreadsheets associated with this metadata are identified by station name. The station name is generally two letters and two numbers (eg: HR05) although some stations have only one letter (eg: P09) and some stations may have another letter following the numbers (eg: AC05c). The inclusion of a "0" in station names with only one number was not followed consistently among different groups sampling on the same cruises, so other data sets from these cruises (CTD, chl, nut, etc.) may show a station name as P9 rather than P09. These differences in naming styles still refer to the same sampling station.

## Methods & Sampling

This dataset contains measurements of egg production rates of the copepods *Calanus pacificus* and *Calanus marshallae*. These data were collected as part of the RISE project off Oregon and Washington, USA, between 2004-2006.

Each line of data in each spreadsheet is a measurement of one individual animal and includes cruise name, station name, date, latitude, longitude, and water depth.

These data were collected as part of the RISE project to look at vital rates of zooplankton off of Washington and address the hypothesis that higher observed zooplankton biomass in this area could be explained to some degree by higher growth and/or egg production rates of the zooplankton.

*Data parameter(s):*

Copepod brood sizes are in units of number of eggs per brood per female.

*Information on data precision, observation methodology, gear identification, analysis methodology, and data processing is contained in the following citations:*

Shaw, T. L. Feinberg and W. Peterson. Protocols for measuring molting rate and egg production of live euphausiids. <http://www.pices.int/projects/Euphasiid/euphasiid.aspx>

Feinberg, L.R., C.T. Shaw, and W.T. Peterson. 2007. Long-term laboratory observations of Euphausia pacifica fecundity: comparison of two geographic regions. Mar. Ecol. Prog. Ser. 341:141-152.

Shaw, C.T., L.R. Feinberg, and W.T. Peterson. 2009. Interannual variations in vital rates of copepods and euphausiids during the RISE study 2004 - 2006. Journal of Geophysical Research, in press.

## Data Processing Description

### BCO-DMO Processing Notes

Generated from original single sheet xls file contributed to BCO-DMO by Tracy Shaw

### BCO-DMO Edits

- Some parameters renamed to conform to BCO-DMO convention
- Date formatted to YYYYMMDD
- decimal data values padded to consistent decimal places
- Cruise changed from "RISE\_1,2,3,4" to RISE04W1, etc for consistency with other data sets

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## Data Files

File
<b>Cope_eggpro.csv</b> (Comma Separated Values (.csv), 67.81 KB) MD5:410814752c0c590f1033d1ad5c4e170a Primary data file for dataset ID 3253

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## Parameters

Parameter	Description	Units
Cruise	Cruise name and number	text
Station	Standard station ID	text
date	Date	YYYYMMDD
lon	Longitude	decimal degrees
lat	Latitude	decimal degrees
depth	Depth	meters
Species	Copepod Species	text
Eggs_per_brood	Number of eggs per brood per female	number of eggs per brood per female

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## Instruments

<b>Dataset-specific Instrument Name</b>	Bongo Nets
<b>Generic Instrument Name</b>	Bongo Net
<b>Generic Instrument Description</b>	A Bongo Net consists of paired plankton nets, typically with a 60 cm diameter mouth opening and varying mesh sizes, 10 to 1000 micron. The Bongo Frame was designed by the National Marine Fisheries Service for use in the MARMAP program. It consists of two cylindrical collars connected with a yoke so that replicate samples are collected at the same time. Variations in models are designed for either vertical hauls (OI-2500 = NMFS Pairovet-Style, MARMAP Bongo, CaIVET) or both oblique and vertical hauls (Aquatic Research). The OI-1200 has an opening and closing mechanism that allows discrete "known-depth" sampling. This model is large enough to filter water at the rate of 47.5 m <sup>3</sup> /minute when towing at a speed of two knots. More information: Ocean Instruments, Aquatic Research, Sea-Gear

<b>Dataset-specific Instrument Name</b>	RingNet
<b>Generic Instrument Name</b>	Ring Net
<b>Generic Instrument Description</b>	A Ring Net is a generic plankton net, made by attaching a net of any mesh size to a metal ring of any diameter. There are 1 meter, .75 meter, .25 meter and .5 meter nets that are used regularly. The most common zooplankton ring net is 1 meter in diameter and of mesh size .333mm, also known as a 'meter net' (see Meter Net).

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## Deployments

### W0407A

<b>Website</b>	<a href="https://www.bco-dmo.org/deployment/58008">https://www.bco-dmo.org/deployment/58008</a>
<b>Platform</b>	R/V Wecoma
<b>Report</b>	<a href="http://bcodata.whoi.edu/RISE/CruiseReports/RISE-1_Wecoma_CruiseReport.pdf">http://bcodata.whoi.edu/RISE/CruiseReports/RISE-1_Wecoma_CruiseReport.pdf</a>
<b>Start Date</b>	2004-07-08
<b>End Date</b>	2004-07-28
<b>Description</b>	<p>W0407A, RISE-1, RISE1W, RISE04W1 This cruise is the first of four cruises in the RISE program aboard the R/V Wecoma, which was charged with the task of conducting hydrographic surveys. The R/V Pt. Sur conducted studies of the Columbia R. plume frontal structure, mixing processes and zooplankton dynamics concurrently with this cruise on the R/V Wecoma. Cruise Objectives The purpose of this cruise was to make physical, chemical and biological measurements within the plume of the Columbia River and over the shelves north and south of the river mouth, with the objective of determining the effect of the river plume on regional productivity. Historical observations have shown that in spite of weaker upwelling winds the Washington shelf is more highly productive than much of the Oregon shelf. Comparative measurements of biological rates, chemical constituents including iron and other micro nutrients and plankton growth and grazing as well as community distributions were made in the three regions. These data complement data from three moored arrays deployed in the study area, data from a second ship, the R/V Pt. Sur, that focused on mixing rates and large scale physical, nitrate, fluorescence surveys as well as frontal processes, and data from remote sensing and model studies. RISE-1 Figures: Cruise Track Stations and Moorings Wind Events</p>

### W0505C

<b>Website</b>	<a href="https://www.bco-dmo.org/deployment/58010">https://www.bco-dmo.org/deployment/58010</a>
<b>Platform</b>	R/V Wecoma
<b>Report</b>	<a href="http://bcodata.whoi.edu/RISE/CruiseReports/RISE-2_Wecoma_CruiseReport.pdf">http://bcodata.whoi.edu/RISE/CruiseReports/RISE-2_Wecoma_CruiseReport.pdf</a>
<b>Start Date</b>	2005-05-29
<b>End Date</b>	2005-06-21
<b>Description</b>	<p>W0505C, RISE-2, RISE2W, RISE05W2 This cruise is the second of four cruises in the RISE program aboard the R/V Wecoma, which was charged with the task of conducting hydrographic surveys. Cruise information and original data are available from the NSF R2R data catalog. The R/V Pt. Sur, concurrently with this cruise on the R/V Wecoma, conducted studies of the Columbia R. plume frontal structure, mixing processes and a Triaxis survey of the shelf</p>

## W0508

<b>Website</b>	<a href="https://www.bco-dmo.org/deployment/58012">https://www.bco-dmo.org/deployment/58012</a>
<b>Platform</b>	R/V Wecoma
<b>Report</b>	<a href="http://bcodata.whoi.edu/RISE/CruiseReports/RISE-3_CruiseReport_Daily.pdf">http://bcodata.whoi.edu/RISE/CruiseReports/RISE-3_CruiseReport_Daily.pdf</a>
<b>Start Date</b>	2005-08-04
<b>End Date</b>	2005-08-26
<b>Description</b>	W0508, RISE-3, RISE3W, RISE05W3 This cruise is the third of four cruises in the RISE program aboard the R/V Wecoma, which was charged with the task of conducting hydrographic surveys. The R/V Pt. Sur, concurrently with this cruise on the R/V Wecoma, conducted studies of the Columbia R. plume frontal structure, mixing processes and a Triaxis survey of the shelf Stations and Moorings

## W0605B

<b>Website</b>	<a href="https://www.bco-dmo.org/deployment/58015">https://www.bco-dmo.org/deployment/58015</a>
<b>Platform</b>	R/V Wecoma
<b>Report</b>	<a href="http://bcodata.whoi.edu/RISE/CruiseReports/RISE-4_Wecoma_CruiseReport_F_TDP.pdf">http://bcodata.whoi.edu/RISE/CruiseReports/RISE-4_Wecoma_CruiseReport_F_TDP.pdf</a>
<b>Start Date</b>	2006-05-21
<b>End Date</b>	2006-06-13
<b>Description</b>	W0605B, RISE-4, RISE4W, RISE06W4 This cruise is the fourth of four cruises in the RISE program aboard the R/V Wecoma, which was charged with the task of conducting hydrographic surveys. Cruise information and original data are available from the NSF R2R data catalog. The R/V Pt. Sur, concurrently with this cruise on the R/V Wecoma, conducted studies of the Columbia R. plume frontal structure, mixing processes and a Triaxis survey of the shelf

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## Project Information

### River Influences on Shelf Ecosystems (RISE)

**Website:** <http://www.ocean.washington.edu/rise>

**Coverage:** Northeast Pacific, coastal waters off states of Washington and Oregon

### River Influences on Shelf Ecosystems (RISE) - A Study of the Columbia River Plume A Multi-Institutional Collaborative Project Sponsored by the National Science Foundation

In 2004 an interdisciplinary study "River Influences on Shelf Ecosystems" (RISE) was initiated to determine the extent to which alongshore gradients in ecosystem productivity might be related to the existence of the massive freshwater plume from the Columbia River. RISE was designed to test three hypotheses: - During upwelling the growth rate of phytoplankton within the Columbia plume exceeds that in nearby areas outside the plume being fueled by the same upwelling nitrate.

- The plume enhances cross-margin transport of plankton and nutrients.
- Plume-specific nutrients (Fe and Si) alter and enhance productivity on adjacent shelves.

Within those constraints, RISE provides the first comprehensive interdisciplinary study of the rates and dynamics governing the mixing of river and coastal waters in an eastern boundary system, as well as the effects of the plume formed by the mixing processes on rates, standing stocks and community structure of plankton in the local ecosystem. The RISE project, includes 4 field and two different numerical model applications. We collected simultaneous measurements of water chemistry, phytoplankton growth and grazing rates, zooplankton populations, water currents, and turbulent mixing. These are being combined with data

from satellites, radar, and moorings, as well as detailed numerical simulations, to develop a deeper understanding of this important ecosystem.

The overall RISE sampling strategy was to compare mixing rates, nutrient supply, and phytoplankton production, grazing and community structure within the plume and outside the plume; i.e. on the shelf to the north of the river mouth, presumed more productive, and on the shelf to the south of the river mouth, presumed less productive, as well as in the important "plume lift off" area (the region where the plume loses contact with the bottom) near the river mouth and the plume "near field". The backbone for this project consists of data collected during four cruises that took place in the seasonally high-flow period (May-June) in each of three years (2004-06) and in a low-flow period in the second year (August, 2005). The sampling was spread over three years to attempt to include interannual differences in processes related to wind and river flow variability. The 21-day length of the cruises ensured that a variety of circulation and growth regimes, including upwelling and relaxation/downwelling and neap/spring tides, were observed.

The field studies used two vessels operating simultaneously. The R/V *Wecoma* obtained primarily biological and chemical rate data: a) at individual stations on cardinal lines north and south of the river mouth (off Grays Harbor, WA and Cape Meares, OR) and near the river mouth; b) at selected process study stations; and c) at fixed stations near the river mouth during strong neap and spring tides (time series). A towed sensor package was used to obtain micronutrient samples near the sea surface on cardinal lines and other selected transects. Underway measurements included macronutrients (N, P, Si), dissolved trace metals (Fe, Mn), supplemented with discrete samples from the underway system (microscopy, FlowCAM and particulate trace metals). At CTD stations vertical profiles (0-200 m where possible; and 500 m at selected stations) of T, S, vertical shear and currents, dissolved O<sub>2</sub>, in vivo fluorescence, PAR, chlorophyll a, dissolved macronutrients (NO<sub>3</sub>, NH<sub>4</sub>, urea, PO<sub>4</sub>, SiO<sub>4</sub>), dissolved trace metals, and heterotrophic and autotrophic plankton composition were obtained. Surface drifters were used to follow the mixing of individual plumes and to provide information on surface currents.

On the R/V *Pt. Sur*, synoptic mesoscale and fine-scale features were sampled with underway measurements of near-surface T, S, velocity, particle size and concentration, PAR, transmissivity and fluorescence and nitrate+nitrite. The *Pt. Sur*'s *Triaxus* tow fish provided high-resolution sections of T, S, zooplankton (Laser-OPC), PAR and transmissivity, fluorescence, particle size and concentration (LISST-FLOC25X), UV absorption and nitrate (Satlantic ISUS) and radiance/irradiance (7 channels) through the upper water column to 50 m. Rapidly-executed transects of turbulence and fine-structure were also carried out using the Chameleon profiler; these provide full-depth profiles of T, S, optics (880 nm backscatter and fluorescence), turbulence dissipation rates and turbulent fluxes every 1-3 minutes. During selected periods, transects were repeated hourly to capture the high-frequency evolution in the plume's nearfield and river estuary. Acoustics (surface-deployed 1200 kHz ADCP and 120 kHz echosounder) were used to image fine-scale features of the velocity and backscatter fields, resolving fronts, nonlinear internal waves, and turbulent billows.

The temporal context for observed variability was provided by an array of moored sensors deployed in the plume near field as well as on the shelf north and south of the plume (complemented by the pre-existing long-term estuarine and plume stations of the CORIE/SATURN network). To better resolve regional differences, moorings were moved farther north and south to the cardinal sampling lines after the first year of the program. Surface currents were mapped hourly from shore using HF radar with two simultaneously operating arrays, one with a 40 km range and a 2 km range resolution, the other with a 150 km range and a 6 km range resolution. Satellite ocean color, sea surface temperature, turbidity and synthetic aperture radar (SAR) were also obtained when available.

Two modeling systems were developed or enhanced during RISE. The system developed specifically for RISE employed a structured grid model (ROMS) and was used in hindcast mode (MacCready et al., 2008). The CORIE/SATURN modeling system (Baptista, 2006)- based on two unstructured-grid models (SELFE, Zhang and Baptista, 2008; and ELCIRC, Zhang et al., 2004)- was used in both near real-time prognostic mode and multi-year hindcast mode. Both modeling systems incorporated the estuary in the simulation domain (although at different resolutions) and used realistic river, ocean and atmospheric forcing conditions, tidal forcing, and Columbia River estuary forcing. Wind/heat flux model forcing for ROMS was derived from the 4 km MM5 regional wind/heat flux model. SELFE and ELCIRC were also forced by MM5. Conditions on open boundaries were provided by ~9 km resolution models from the Navy Research Laboratory (NRL) (NCOM); ROMS used the smaller domain NCOM-CCS NRL model, SELFE and ELCIRC used the larger domain Global-NCOM model. The biological model is a four-box ("NPZD") nitrogen-budget model that tracks nutrients, phytoplankton, zooplankton, and detritus in every cell of the ROMS grid. The rich RISE biological dataset allowed model validation against not just stocks (chlorophyll, microzooplankton, nutrients) but rates (phytoplankton growth and grazing) directly, a level of validation that is seldom possible. These rate observations also allowed the setting of key model parameters (e.g., zooplankton ingestion rate and mortality) empirically (Banas, et al.,

2008).

### **References:**

Banas, N. S., P. MacCready, and B. M. Hickey (2008), The Columbia River plume as cross-shelf exporter and along-coast barrier, doi:10.1016 Cont. Shelf Res., 2008.03.011

Baptista, A. M. (2006), CORIE: the first decade of a coastal-margin collaborative observatory, Oceans'06, MTS/ IEEE, Boston, MA.

Hickey, B.M., and the RISE Pls. River Influences on Shelf Ecosystems: Introduction to the RISE Volume, Cont. Shelf Res., in press.

MacCready, P., N. S. Banas, B. H. Hickey, E. P. Dever, and Y. Liu (2008), A model study of tide- and wind-induced mixing in the Columbia River Estuary and Plume, ,doi:10.1016/j. Cont. Shelf Res. 2008.03.015.

### **RISE Cruise Reports and Figures:**

#### **2004 RISE-1**

RISE04W1=R/V Wecoma, W0407A, July 8-28, 2004

[Cruise Report](#)

[Cruise Track](#)

[Stations and Moorings](#)

[Wind Events](#)

RISE2004=R/V Point Sur, (tbd), July 8-28, 2004

[Cruise Report](#)

#### **2005 RISE-2**

RISE05W2=R/V Wecoma, W0505C, May 29-June 21, 2005

[Cruise Report](#)

[Cruise Track](#)

[Stations and Moorings](#)

[Wind Events](#)

RISE2005a=R/V Point Sur, (tbd), May 29-June 21, 2005

[Cruise Report](#)

#### **2005 RISE-3**

RISE05W3=R/V Wecoma, W0508, August 4-August 26, 2005

[Daily Cruise Report](#)

[Lessard Cruise Report](#)

[Peterson/Shaw Zooplankton Report](#)

[Cruise Track](#)

[Stations and Moorings](#)

[Wind Events](#)

RISE2005b=R/V Point Sur, (tbd), August 2-August 27, 2005

[Cruise Report](#)

[Cruise Log](#)

#### **2006 RISE-4**

RISE06W4=R/V Wecoma, W0605B, May 21-June 13, 2006

[Cruise Report 1](#)

[Cruise Report 2](#)

[Cruise Track](#)

[Stations and Moorings](#)

[Wind Events](#)

RISE2006a=Leg 1, R/V Point Sur, (tbd), May 21-May 31, 2006

[Cruise Report Leg 1](#)

RISE2006b=Leg 2, R/V Point Sur, (tbd), June 2-June 12, 2006

[Cruise Report Leg 2](#)

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## Funding

Funding Source	Award
<a href="#">NSF Division of Ocean Sciences (NSF OCE)</a>	<a href="#">OCE-0239107</a>

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