Physical data collected by towed plankton imaging system in a subtropical, pelagic environment from R/V F.G. Walton Smith cruises WS1406 and WS15161 in the Straits of Florida from 2014-2015 (OSTRICH project)

Website: https://www.bco-dmo.org/dataset/654159
Data Type: Cruise Results
Version: 23 Aug 2016
Version Date: 2016-08-23

Project
» Spatial variability of larval fish in relation to their prey and predator fields: Patterns and interactions from cm to 10s of km in a subtropical, pelagic environment (OSTRICH)

Contributors	Affiliation	Role
Cowen, Robert K.	Oregon State University (OSU-HMSC)	Principal Investigator
Sponaugle, Su	Oregon State University (OSU-HMSC)	Co-Principal Investigator
Robinson, Kelly L.	University of Louisiana at Lafayette	Contact
Rauch, Shannon	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Table of Contents

Dataset Description

Physical data collected by at towed plankton imaging system in a subtropical, pelagic environment; collected on R/V Walton Smith cruises, WS1406 and WS15161.

Status note: These data are restricted from public access until the related manuscript has been published.

Methods & Sampling

The *In Situ* Ichthyoplankton Imaging System (ISIIS) is a high resolution imaging system designed to image sufficient volumes of water to accurately quantify rare meso- and macroplankton such as fish and crab larvae, and also associated plankters (e.g., ctenophores, larvaceans, euphausiids, chaetognaths, hydrozoans, scyphozoans, pteropods, copepods) *in situ* (Cowen & Guigand 2008). An additional, finer scale imaging system has been added to the current system (ISIIS-2) and is capable of imaging up to 140 L per second, with pixel resolution of 45-68 um. This yields particle resolution down to ~ 450 um, adding considerable breadth to the full size range of organisms that can be detected and enumerated. The ISIIS is also instrumented with a set of environmental sensors including: Seabird CTD (SBE 49), Biospherical PAR (QCP2300), Seabird dissolved O2 (SBE 43), and Wet Labs Fluorometer (ECO). All data are passed via fiber optic cable to an onboard computer, time-stamped for cross-referencing, and saved on a high-speed disk array. Oxygen data from 2014 were excluded as they were found to be outside the calibrated range of the sensor.

Related references:
Cowen RK, Guigand CM. 2008. In situ Ichthyoplankton Imaging System (ISIIS): system design and preliminary

results. Limnol Oceanogr Methods. 6: 126-132. doi:10.4319/lom.2008.6.126

Data Processing Description

Temperature, salinity, pressure, depth, oxygen, fluorescence, and irradiance data are collected at a higher temporal frequency than latitude and longitude observations that come from the ship's NEMA system. Latitude and longitude values have been linearly interpolated between observations using time.

In 2014, latitude and longitude data from the NEMA system were not automatically logged with the physical data during ISIIS tows. To address this, temperature, salinity, pressure, depth, oxygen, fluorescence, and irradiance data were binned to the nearest second (mean for each second bin) in order to merge them with the ship's GPS data.

Seawater density (kg per cubic meter) was calculated from pressure, temperature, and salinity using the UNESCO equation of state from the 'R' Library 'OCE' package.

Temperature, salinity, oxygen, fluorescence, irradiance values less than zero were excluded as they are erroneous

Density values less than 1000 kg per cubic meter were excluded as they are erroneous

Oxygen (2015 only) was corrected for post-calibration sensor drift using the equation:
Final oxygen (ml L-1) = Initial oxygen (ml L-1)*1.0649702 – 0.0029434

Fluorescence (volts) data from the Wet Labs Eco Fluorometer was converted to chlorophyll (ug/L) using the following equation:
chlorophyll (µg L-1) = scale factor*(volts – dark counts)
2014: Scale factor = 25; Dark counts = 0.028. 2015: Scale factor = 24; Dark counts = 0.026.

Large camera parameters used in volume imaged calculations:
2014:
Image width: 2048 pixels
Scan rate: 35,000 lines s-1
Depth of field: 50 cm
Field of view: 11.2 cm

2015:
Image width: 2048 pixels
Scan rate: 35,000 lines s-1
Depth of field: 50 cm
Field of view: 11 cm

Small camera parameters used in volume imaged calculations:
2014:
Image width: 1024 pixels
Scan rate: 62,000 lines s-1
Depth of field: 10 cm
Field of view: 6 cm

2015:
Image width: 1024 pixels
Scan rate: 55,000 lines s-1
Depth of field: 10 cm
Field of view: 4.6 cm

Derived camera data calculated using equations below:
lg.hz.line = horizontal.velocity (cm s-1) / lg.scan.rate
lg.eff.image.length (cm) = lg.image.width *lg.hz.line
lg.vol.image (cm3) = lg.dof*lg.fov*lg.eff.image.length
lg.image.sec (images s-1) = horizontal.velocity (cm s-1)/lg.eff.image.length
lg.vol.rate (m3 s-1) = (lg.image.sec*lg.vol.image)*1E-06
sm.hz.line = horizontal.velocity (cm s-1) / sm.scan.rate

sm.eff.image.length (cm) = sm.image.width *sm.hz.line
sm.vol.image (cm3) = sm.dof*sm.fov*sm.eff.image.length
sm.image.sec (images s-1) = horizontal.velocity (cm s-1)/sm.eff.image.length
sm.vol.rate (m3 s-1) = (sm.image.sec*sm.vol.image)*1E-06

[table of contents | back to top]

Parameters

Parameter	Description	Units
cruise_name	Cruise name	unitless
cruise_id	Official cruise identifier	unitless
transect	Unique transect identifier	unitless
depth	Depth	meters (m)
ISO_DateTime_Local	Local date and time (EDT) of observation (24h) formatted to ISO8601 standard	unitless
lat	Vehicle position latitude	decimal degrees North
lon	Vehicle position longitude	decimal degrees West
temp	Water temperature	degrees Celsius
sal	Salinity	parts per thousand
press	Pressure	decibars (db)
density	Seawater density	kilograms per cubic meter (kg/m3)
fluor_v	Fluorescence	volts
chl	Derived chlorophyll from fluorescence	micrograms per Liter (ug/L)
irradiance	Irradiance	microEinsteins per square cm (uE/cm2)
heading	Vehicle heading	degrees
hz_vel_mm_s	Vehicle horizontal velocity	millimeters per second (mm/s)
hz_vel_cm_s	Vehicle horizontal velocity	centimeters per second (cm/s)
vert_vel	Vehicle vertical velocity	millimeters per second (mm/s)
pitch	Vehicle pitch	degrees
lg_hz_line	Large camera horizontal line	centimeters per line (cm/line)
lg_eff_image_len	Large camera effective image length	centimeters (cm)
lg_images_sec	Large camera images per second	images/s
lg_vol_imaged	Large camera volume imaged	cubic centimeters (cm3)
lg_vol_rate	Large camera volume rate	cubic meters per second (m3/s)
sm_hz_line	Small camera horizontal line	centimeters per line (cm/line)
sm_eff_image_len	Small camera effective image length	centimeters (cm)
sm_images_sec	Small camera images per second	images/s
sm_vol_imaged	Small camera imaged volume	cubic centimeters (cm3)
sm_vol_rate	Small camera volume rate	cubic meters per second (m3/s)
oxygen	Dissolved oxygen	milliliters per liter (mL/L)

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	ISIIS
Generic Instrument Name	In Situ Ichtyoplankton Imaging System
Dataset-specific Description	The In Situ Ichthyoplankton Imaging System (ISIIS) is a high resolution imaging system designed to image sufficient volumes of water to accurately quantify rare meso- and macroplankton such as fish and crab larvae, and also associated plankters (e.g., ctenophores, larvaceans, euphausiids, chaetognaths, hydrozoans, scyphozoans, pteropods, copepods) in situ (Cowen & Guigand 2008). An additional, finer scale imaging system has been added to the current system (ISIIS-2) and is capable of imaging up to 140 L s-1, with pixel resolution of 45-68 µm. This yields particle resolution down to ~ 450 µm, adding considerable breadth to the full size range of organisms that can be detected and enumerated. The ISIIS is also instrumented with a set of environmental sensors including: Seabird CTD (SBE 49), Biospherical PAR (QCP2300), Seabird dissolved O2 (SBE 43), and Wet Labs Fluorometer (ECO). All data are passed via fiber optic cable to an onboard computer, time-stamped for cross-referencing, and saved on a high-speed disk array. Oxygen data from 2014 were excluded as they were found to be outside the calibrated range of the sensor.
Generic Instrument Description	The In Situ Ichthyoplankton Imaging System (ISIIS) is an underwater imaging system aimed at capturing in situ, real time images of marine zooplankton of relatively low abundance such as fish larvae and fragile gelatinous organisms. The first prototype, delivered in 2007, was attached to a relatively simple vehicle towed by an oceanographic vessel at a speed of five knots. The vehicle, and associated imaging system and sensors, was moved up and down through the water column by paying cable in and out via an oceanographic winch. Subsequently, a new vehicle has been designed with the capacity of self undulation using motor actuated dive fins. The ISIIS system utilizes a high-resolution line-scanning camera with a Light Emitting Diode (LED) light source, modified by plano-convex optics, to create a collimated light field to back-light a parcel of water. ISIIS was developed in collaboration between the University of Miami's Rosenstiel School of Atmospheric and Marine Science (RSMAS) and the subsea engineering company, Bellamare, LLC, located in San Diego CA. See complete description from RSMAS. Reference: Cowen RK and Guigand CM. 2008. In situ Ichthyoplankton Imaging System (ISIIS): system design and preliminary results. Limnol. Oceanogr. Methods. 6:126-132. doi:10.4319/lom.2008.6.126

[table of contents | back to top]

Deployments

WS1406

Website	https://www.bco-dmo.org/deployment/654157
Platform	R/V F.G. Walton Smith
Start Date	2014-05-28
End Date	2014-06-14
Description	More information about this cruise is available from the Rolling Deck to Repository (R2R).

WS15161

Website	https://www.bco-dmo.org/deployment/654144
Platform	R/V F.G. Walton Smith
Start Date	2015-06-10
End Date	2015-06-27
Description	More information about this cruise is available from the Rolling Deck to Repository (R2R).

[table of contents | back to top]

Project Information

Spatial variability of larval fish in relation to their prey and predator fields: Patterns and interactions from cm to 10s of km in a subtropical, pelagic environment (OSTRICH)

Coverage: Straits of Florida, Western Atlantic

Description from NSF award abstract:
The spatial pattern of organisms within pelagic marine environments is of significant ecological importance, and this is particularly true for larval fishes. Patchy prey and predator environments should lead to variation in predator-prey interactions, and thus to variations in larval fish growth and survival. These have proven very difficult to resolve in nature, due in large part to the broad range of spatial scales involved and technological challenges with adequately sampling the various processes simultaneously. This study will use new technology (In Situ Ichthyoplankton Imaging System - ISIIS) to simultaneously measure the fine-scale distribution of larval fishes in relation to their prey, their planktonic predators, and the physical environment of the Straits of Florida. This will be combined with targeted fine-scale net sampling and analyses of individual recent daily larval growth. By sampling a series of water masses at very high resolution, this study will address specific hypotheses concerning: i) the drivers of aggregations and patchiness, and ii) the biological consequences of predator-prey interactions at fine scales.

The primary intellectual merit of the study is the unprecedented examination of plankton processes at scales of relevance to biological interactions among larval fishes, their prey, and their predators. This field study will further our understanding of the predator-prey interactions contributing to spatially explicit larval growth and mortality patterns. The focus on subtropical planktonic food webs will enhance scientific knowledge of these understudied pelagic ecosystems and provide valuable data for comparative analyses with pelagic food web dynamics at higher latitudes. A deeper understanding of pelagic planktonic ecosystems over a range of spatial and temporal scales is increasingly important as the oceans undergo major environmental changes. Substantial increases in the relative dominance of gelatinous organisms, for example, have the potential to cause major shifts in pelagic food webs. A better understanding of the fine-scale interactions of such food webs will help society anticipate and respond to the consequences of such changes.

Note (07 Oct 2014): Funding for this project transferred from award OCE-1333800 to OCE-1419987, coincident with the Principal Investigator's affiliation change from University of Miami to Oregon State University.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1419987

[table of contents | back to top]