Current meter data from the 5, 6, and 8 meter sites, offshore Calumet Park, La Jolla, Southern California, April 2014 through November 2016

Website: https://www.bco-dmo.org/dataset/707078
Data Type: Other Field Results
Version: 1
Version Date: 2017-06-29

Project
» Nearshore larval transport: physical and biological processes (Nearshore larval transport)
» RAPID: Nearshore settlement and hydrodynamics in Southern California during El Nino, and the transition to normal ocean conditions: boom and bust? (RAPID_Settlement_Hydrodynamics)

Contributors	Affiliation	Role
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Abstract
Current meter data from the 5, 6, and 8 meter sites, offshore Calumet Park, La Jolla, Southern California, April 2014 through November 2016.

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Coverage

Spatial Extent: **N**:32.8689 **E**:-117.2578 **S**:32.8104 **W**:-117.281
Temporal Extent: 2014-04-18 - 2016-11-20

Dataset Description

Eastern and northern currents from 5, 6, and 8 meter sites located near Bird Rock, Dike Rock, and offshore Calumet Park, La Jolla, Southern California, April 2014 through December 2015.

Note that this is a very large file and is slow to load. It may be easier to load/download subsets: http://dmoserv3.whoi.edu/jg/dir/BCO-DMO/Nearshore_Larval_Transport/

Methods & Sampling

Current profilers, pressure sensors and temperature sensors were mounted on bottom frames.

Refer to the following sampling reports for details:
NLT_spring2014_sampling_report.
NLT_fall2014_sampling_report
NLT_spring2015_sampling_report
NLT_fall2015_sampling_report
NLT_2016_sampling_report

Data Processing Description

Quality control and samples were averaged to a common hourly time base.

BCO-DMO processing:
-Added conventional header with dataset name, PI name, version date
- Renamed parameters to BCO-DMO standard by replacing decimal points with underscores and preceeded value with letter 'c_' for 'current' to conform to BCO-DMO standards (must start with letter; only _ for special chars) eg. 1.21 -> C_1_21
- Changed N/A to nd ('no data')
- Removed blank spaces
- Made 'toplevel' files to serve both eastern and northern currents in one object. The 2014 and 2015 spring data could be combined for each depth but not the 2015 fall data as it had different column headers.Then created a new single data object with links to all 6 of the current data sub-objects.
- Hour 24 is not a legal value in our system so changed them to 23 and incremented the day; at the end of each month, incremented the month; and at end of year, incremented the year.

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Data Files

File
current_rs.csv (Comma Separated Values (.csv), 97.78 MB) MD5:cc891c37ea6a414e41b05b6235fddb3b Primary data file for dataset ID 707078

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Supplemental Files

File	
NLT_2016_sampling_report filename: NLT_2016_sampling_report.pdf NLT_2016_sampling_report	(Portable Document Format (.pdf), 299.69 KB) MD5:ab3ade2297be2e2f9e6477082a8e42a0
NLT_fall2014_sampling_report filename: NLT_fall2014_sampling_report.pdf NLT_fall2014_sampling_report	(Portable Document Format (.pdf), 373.21 KB) MD5:9b41d09d4dec6f220a8b0c8e99be912a
NLT_fall2015_sampling_report filename: NLT_fall2015_sampling_report.pdf NLT_fall2015_sampling_report	(Portable Document Format (.pdf), 131.83 KB) MD5:42bdaad95ea234e365351e0ae4c5f574
NLT_spring2014_sampling_report filename: NLT_spring2014_sampling_report.pdf NLT_spring2014_sampling_report	(Portable Document Format (.pdf), 393.51 KB) MD5:239ffc2c18fe02177dbdc1c2c3109580
NLT_spring2015_sampling_report filename: NLT_spring2015_sampling_report.pdf NLT_spring2015_sampling_report	(Portable Document Format (.pdf), 155.72 KB) MD5:8e62f5d574ff6dc28ab92dbbd45978b1

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Parameters

Parameter	Description	Units
year_season	year and season of data; or site name (Bird Rock or Dike Rock)	unitless
direction	direction of current vector: northward or eastward	unitless
depth_sta	depth of current profiler	meters
lat	latitude; north is positive	decimal degrees
lon	longitude; east is positive	decimal degrees
year	year of data record	years
month	month of data record	months
day	day of data record	days
hour	hour of data record	hours
min	minute of data record	minutes
sec	second of data record	seconds
ISO_DateTime_UTC	date and time formatted based on ISO 8601:2004E; formatted as YYYY-MM-DDTHH:MM:SS.xxZ	unitless
yrday_utc	UTC day and decimal time; eg. 326.5 for the 326th day of the year or November 22 at 1200 hours (noon)	days
depth	current meter depth	meters
current	current speed	centimeters per second (cm/s)

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Instruments

Dataset-specific Instrument Name	RDI ADCP (Teledyne Marine), Aquadopp (Nortek International)
Generic Instrument Name	Acoustic Doppler Current Profiler
Dataset-specific Description	See sampling reports for details.
Generic Instrument Description	The ADCP measures water currents with sound, using a principle of sound waves called the Doppler effect. A sound wave has a higher frequency, or pitch, when it moves to you than when it moves away. You hear the Doppler effect in action when a car speeds past with a characteristic building of sound that fades when the car passes. The ADCP works by transmitting "pings" of sound at a constant frequency into the water. (The pings are so highly pitched that humans and even dolphins can't hear them.) As the sound waves travel, they ricochet off particles suspended in the moving water, and reflect back to the instrument. Due to the Doppler effect, sound waves bounced back from a particle moving away from the profiler have a slightly lowered frequency when they return. Particles moving toward the instrument send back higher frequency waves. The difference in frequency between the waves the profiler sends out and the waves it receives is called the Doppler shift. The instrument uses this shift to calculate how fast the particle and the water around it are moving. Sound waves that hit particles far from the profiler take longer to come back than waves that strike close by. By measuring the time it takes for the waves to bounce back and the Doppler shift, the profiler can measure current speed at many different depths with each series of pings. (More from WHOI instruments listing).

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Deployments

Pineda_small_boat

Website	https://www.bco-dmo.org/deployment/542994
Platform	R/V Gaia
Report	http://dmoserv3.whoi.edu/data_docs/Nearshore_Larval_Transport/sampling_report_nearshore_transport_spring2014.pdf
Start Date	2014-04-18
End Date	2015-11-20
Description	Series of nearshore and intertidal cruises during Spring 2014 and continuing in 2015. R/V Gaia is a University of San Diego vessel (a 7 m Parker, with outboard motor). Description of deployment events: 18 April 2014: deployed subsurface temperature mooring in 8m; deployed ADCP with temperature logger and Seaguage in 8m. Deployed two temperature loggers in intertidal under rocks with settlement plates. 21 April 2014: deployed temperature telemetry mooring in 8m. 23 April 2014: deployed 12 settlement plates in intertidal (checked daily). 1 May: deployed temperature loggers in 0.5m and 1m within intertidal. 2 May: deployed bottom frame in 4m with Nortek, temperature logger, and Seaguage. Plankton cruises: 5/9/2014; 5/14/2014; 5/23/2014; 5/26/2014; 6/3/2014; 6/4/2014; 6/6/2014; 6/11/2014; 6/15/2014; 6/16/2014; 6/17/2014; 6/25/2014; 6/27/2024; 7/2/2014; 7/7/2014; 7/11/2014; 7/14/2014. Recovery events: Recovered telemetry mooring and 4m frame on 15 July 2014. Recovered subsurface temperature mooring and ADCP from 8m on 16 July 2014. Recovered instruments and settlement plates from rocky intertidal 16 July 2014. Refer to the proposed spring 2014 sampling plan (PDF), spring 2015 sampling report (PDF), fall-2014/spring-2015/fall-2015 sampling plan (PDF).

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Project Information

Nearshore larval transport: physical and biological processes (Nearshore larval transport)

Coverage: Southern California

Description from NSF award abstract:
Providing an award for this study will provide essential knowledge required for management of coastal resources. This study addresses near shore cross-shore larval transport processes that operate over wide geographic areas in open coast settings, namely larval transport by wave circulation / Stokes drift, and by internal tidal bores. Larval transport by wave circulation / Stokes drift is a ubiquitous process that has not been studied observationally, and it is not known how internal tidal bores deliver larvae to intertidal habitats. This project will examine near shore (region between 20 m depth and intertidal) physical and biological processes that account for the delivery of larvae to adult habitats. The study system in Southern California shares similarities with most other temperate areas and we will study marine taxa that are widely distributed and successful in a variety of environments.

Recent studies suggest that larval transport in the near shore zone plays a central role in larval dispersal and connectivity of shallow water species. These recent advances, however, have not been matched with process-oriented studies addressing circulation and behavioral processes at the appropriate temporal and spatial scales, and only a few larval transport mechanisms have been considered for near shore open coastlines. Recent advances in our understanding of hydrodynamic processes driving cross-shore flows and growing awareness of the importance of the processes to larval transport, however, make this study timely. The investigators hypothesize that a series of physical and biological events results in the delivery of invertebrate larvae to the intertidal habitat. These events include physical transport due to wave circulation / Stokes drift near the surface and internal tide circulation near the bottom, alteration of behavior for terminal larval stages, and larval use of "adaptive" behavioral responses to exploit event-dependent flows. Further, they suggest that the predominance of wave circulation / Stokes drift and internal tide circulation varies seasonally, with internal tidal bores important in spring/summer, when the water column is well-stratified, and wave circulation / Stokes drift more pervasive in fall/winter, coinciding with winter storms. The hypotheses in this study will be tested with estimates of physical transport, larval supply and settlement. These measurements will be combined with use of adaptive sampling to test the dependence of larval vertical distribution on changes in hydrodynamic conditions.

Results from this study will have important ecological implications as wave circulation / Stokes drift and internal motions may represent critical and regular transport mechanisms for larvae of marine organisms that must return to near shore habitats to complete their life cycle, thereby impacting population connectivity and management strategies used by coastal planners (e.g., ecosystem-based fisheries management, placement of Marine Protected Areas).

RAPID: Nearshore settlement and hydrodynamics in Southern California during El Nino, and the transition to normal ocean conditions: boom and bust? (RAPID_Settlement_Hydrodynamics)

Coverage: Southern California

NSF Award Abstract:

Understanding how larvae are transported in the coastal ocean is key for characterizing the population fluctuations of marine organisms. Studies demonstrate that larvae of species that inhabit shallow waters can behaviorally respond to changing oceanographic conditions by moving vertically into currents that can promote their transport to coastal, nearshore habitats where

they settle to bottom habitats and complete their life cycle. However, the oceanographic mechanisms that promote such transport, and how they might be impacted by infrequent events such as El Niño, are poorly resolved. Given that El Niño events might increase in frequency and magnitude under climate change, it is imperative to assess how El Niño affects larval transport and larval settlement. To this end, this study will use an unprecedented set of nearshore biological and physical measurements spanning pre-El-Niño, during El Niño, and the predicted return to El Niño neutral conditions, to test mechanistically how larval transport and settlement respond in a nearshore coastal environment. This project will also provide educational and research opportunities for students at the University of San Diego, a liberal arts university. At least one laboratory exercise demonstrating the impacts of El Niño on larval transport and settlement will be developed for undergraduate students, and students will be recruited to participate in all aspects of the project to provide them with hands-on research experience. This research will form the basis for the thesis work of at least one M.S. graduate student. Finally, given that the research falls within a Marine Protected Area, results will be broadly disseminated and shared with coastal managers and the CA Department of Fish and Wildlife.
Larval transport and settlement are fundamental processes for understanding the population dynamics of benthic invertebrates. Previous studies and unpublished observations indicate that El Niño events profoundly impact community and population processes, and in Southern California, El Niño effects range from alteration of larval transport and settlement of local populations, to the geographic expansion of subtropical species. This research will test the hypothesis that the current (2015-2016) El Niño event will result in a reduction of barnacle larval transport and settlement in Southern California nearshore habitats. Two mechanisms might be involved; first, a deepening of the thermocline forced by El Niño would result in reduction of larval transport by internal tidal bores, a mechanism that requires shallowing of the thermocline. Second, the distribution of larvae of littoral barnacles would be deeper, more offshore, and less constrained to nearshore habitats during El Niño than in El Niño neutral conditions, resulting in a reduction of nearshore larval abundance and settlement. The effects of El Niño on nearshore circulation, hydrography, larval transport and settlement in Bird Rock, Southern California, will be measured by a) deploying an array of instrumentation to measure temperature, pressure (waves) and currents; b) measuring daily barnacle larval settlement, and; c) assessing cross-shore and depth distribution of invertebrate larvae. These observations will be contrasted with two years of comparable observations taken at Bird Rock in 2014 (El Niño neutral conditions) and 2015 (during El Niño). Additionally, the investigators will measure weekly settlement at Bird Rock, and at Dike Rock, a site 7 km to the north, where previous observations at the end of the 1997/1998 El Niño indicated that barnacle settlement was very high. This will enable the evaluation of the generality of the settlement response as El Niño conditions eclipse, and examination of how settlement varies along a coastline.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1357290
NSF Division of Ocean Sciences (NSF OCE)	OCE-1357327
NSF Division of Ocean Sciences (NSF OCE)	OCE-1630474
NSF Division of Ocean Sciences (NSF OCE)	OCE-1630459

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