Data from freely drifting kelp plants tagged with drifters in the Santa Barbara Channel between November of 2015 and December of 2017

Website: https://www.bco-dmo.org/dataset/739111
Data Type: Other Field Results
Version: 1
Version Date: 2018-08-03

Project
» Linking nearshore kelp forest dynamics to sandy beach ecosystems (Linking Kelp to Beaches)

Contributors	Affiliation	Role
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Abstract
Kelp plants were tagged monthly with drifters in the Santa Barbara Channel between November of 2015 and December of 2017. This dataset contains GPS positions of freely drifting kelp plants (nominally) every 10 minutes. Tagged kelp plants begin at one of three kelp forests (Mohawk, Hope Ranch, or Isla Vista) off the Santa Barbara coast.

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Coverage

Spatial Extent: **N**:34.472431 **E**:-119.500015 **S**:34.162992 **W**:-120.449764
Temporal Extent: 2015-11-30 - 2017-10-13

Dataset Description

Various tabular formats of these data are available by clicking the "Get Data" button on this page and then selecting "Downloads & Other Options." These data are also available as a Matlab struct data type containing data for each drift deployment. Download: kelp_drifter_data.mat (865 KB)

Methods & Sampling

GPS positions were sampled every 10 minutes. Velocities were computed as centered differences in position (first differences at endpoints).

The instruments were deployed by finding kelp plants near the edges of the three study forests that had been detached from the bottom and were freely drifting, and then attaching gps buoys to the plants with 1/4” polypropylene line. The line was generally attached to part of the kelp plant nearest the surface. The instruments were then left to record their position every 10 minutes. The buoys were retrieved when they

reached the shoreline or when it appeared they were leaving the Santa Barbara Channel and would thus become unrecoverable.

More information about Microstar drifters (manufactured by Pacific Gyre Corp.) can be found in Ohlmann et al., 2005.

Data Processing Description

Velocities were computed as centered differences in position (first differences at endpoints). Matlab serial time (UTC) is computed from the recorded GPS time.

BCO-DMO Data Manager Processing Notes:
* added a conventional header with dataset name, PI name, version date
* modified parameter names to conform with BCO-DMO naming conventions
* Originally submitted data as matlab structs "day" and "readme" combined into one .mat file and made available for download as "kelp_drifter_data.mat"
* the "day" matlab struct converted to a tabular format (matlab Table). Date in format yyyy-mm-dd, time (HH:MM) and ISO timestamp in format yyyy-mm-ddTHH:MMZ were added as columns. Column "vel" was removed as it contained only NaN values. The .csv was imported into the BCO-DMO data system. Blank values are displayed as the default "nd" value for "no data" in the BCO-DMO system.

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Data Files

File	
kelp_drifter_data.csv	(Comma Separated Values (.csv), 2.60 MB) MD5:0c6eb80a051db1c510e2762cec2dce64
Primary data file for dataset ID 739111	

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Related Publications

Ohlmann, J. C., White, P. F., Sybrandy, A. L., & Niiler, P. P. (2005). GPS–Cellular Drifter Technology for Coastal Ocean Observing Systems. Journal of Atmospheric and Oceanic Technology, 22(9), 1381–1388. doi:10.1175/jtech1786.1 https://doi.org/10.1175/JTECH1786.1
Methods

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Parameters

Parameter	Description	Units
id	drifter id	unitless
lat	Latitude	decimal degrees
lon	Longitude	decimal degrees
matime	Matlab datenum data type	unitless
u	u velocity	centimeters per second (cm/s)
v	v velocity	centimeters per second (cm/s)
z	water depth interpolated from bathymetry data to each drifter position (negative values are beneath the sea surface)	meters (m)
date	date in format yyyy-mm-dd	unitlesss
time	time in format HH:MM	unitless
ISO_DateTime_UTC	timestamp (UTC) in standard ISO 8601:2004(E) format YYYY-mm-ddTHH:MMZ	unitless

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Instruments

Dataset-specific Instrument Name	Microstar drifter
Generic Instrument Name	Drifter Buoy
Dataset-specific Description	More information about Microstar drifters (manufactured by Pacific Gyre Corp.) can be found in Ohlmann et al., 2005.
Generic Instrument Description	Drifting buoys are free drifting platforms with a float or buoy that keep the drifter at the surface and underwater sails or socks that catch the current. These instruments sit at the surface of the ocean and are transported via near-surface ocean currents. They are not fixed to the ocean bottom, therefore they "drift" with the currents. For this reason, these instruments are referred to as drifters, or drifting buoys. The surface float contains sensors that measure different parameters, such as sea surface temperature, barometric pressure, salinity, wave height, etc. Data collected from these sensors are transmitted to satellites passing overhead, which are then relayed to land-based data centers. definition sources: https://mmisw.org/ont/ioos/platform/drifting_buoy and https://www.aoml.noaa.gov/phod/gdp/faq.php#drifter1

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Deployments

Dugan_UCSB_2015-2017

Website	https://www.bco-dmo.org/deployment/737386
Platform	lab_UCSB
Start Date	2015-07-02
End Date	2017-11-01
Description	Study of exported kelp fate and transport.

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Project Information

Linking nearshore kelp forest dynamics to sandy beach ecosystems (Linking Kelp to Beaches)

Coverage: Santa Barbara Channel, California, USA 34 N, 119 W

This project is affiliated with the Santa Barbara Coastal LTER project.

Description from NSF award abstract:
Primary producers, such as plants and algae, form the basis of most food webs and their productivity and fate fundamentally shape ecosystems. Often, however, food and other resources are delivered to a food web from an outside source, providing a subsidy to the recipient ecosystem. Understanding these types of trophic connections and exchanges between ecosystems is necessary for predicting how food webs may respond to change, whether environmental or anthropogenic. Despite their potential importance, quantitative evaluations of cross-ecosystem material fluxes, variation of these fluxes in time and space, and ecological responses of recipient communities are lacking, particularly for marine ecosystems. By investigating links between a source ecosystem, kelp forests, and a recipient ecosystem, sandy beaches, this project will expand and transform our understanding of cross-ecosystem fluxes in the coastal ocean. Nearshore kelp forests are highly productive marine ecosystems characterized by large seasonal and interannual variations in net primary production (NPP). More than 90% of kelp forest NPP is exported to adjacent ecosystems including the intertidal zone. Lacking attached plants and algae, sandy beach ecosystems near kelp forests depend heavily on imported drift kelp (wrack) to support complex and diverse food webs. Although sandy beaches are a dominant shoreline type along all U.S. coasts, provide habitat and prey for wildlife, including endangered species, and are highly valued by society as recreational and cultural resources that drive vibrant coastal economies, they receive little ecological study compared to other shoreline types. This lack of knowledge hinders the conservation and management of beaches as ecosystems. Perched on the narrow rim between land and sea, beaches are highly vulnerable to climate change, particularly sea level rise, and will be impacted by changes in climate, as will kelp forests. This project integrates biological and physical approaches to achieve an understanding of the fate and transport of exported kelp, and how variability in this resource subsidy shapes the community structure and function of recipient beach ecosystems. Graduate and undergraduate students will be integral members of the research team, receiving scientific training and mentoring in coastal marine ecology and in public outreach and education. The training and participation of local residents and coastal managers in regular shoreline surveys for beached kelp plants will provide an essential research component of the study and enhance public awareness of scientific research, coastal ecology and the role of links between kelp forest and beach ecosystems. The results of this project will provide new insights into the dynamics of connectivity between coastal marine ecosystems that can be applied to their conservation and management.

The project seeks to understand trophic connectivity between a donor ecosystem, kelp forests, and a recipient ecosystem, sandy beaches, with two primary goals:

1) an evaluation of how variation in kelp wrack input affects patterns and processes in beach ecosystems and

2) a quantitative understanding of trophic connectivity through physical transport and input of drift kelp biomass from kelp forests to sandy beaches.

The project will begin with two years of intensive work at a well-studied kelp forest in the Santa Barbara Channel, Mohawk Reef, and along 10 km of adjacent coastline, where the research team will measure intertidal community structure over time in response to variability in kelp inputs. To assess effects of variation in wrack input on ecosystem function, they will also measure kelp consumption and secondary production rates of

intertidal consumers on adjacent beaches. They will directly observe fate and transport of kelp using complimentary approaches: 1) tracking kelp plants tagged at Mohawk Reef using drifters with GPS; and 2) tagging large numbers of kelp plants (2000) with "drift cards" at Mohawk Reef for recovery by the project team and trained volunteer beachcombers. Ending distributions of recovered drift cards and drifter tracks along the shoreline will then be computed. These data will be used to inform and validate a kelp forest-to-beach kelp transport model based on numerical simulations of coastal surface currents from the Regional Oceanic Modeling System (ROMS). Using predicted kelp beaching rates from this model run regionally, the investigators will then sample community structure and wrack biomass at a larger set of beaches spanning 100 km of the southern California shoreline to test the generality of research findings. This combination of fate and transport observations, beach community surveys and process measurements, and modeling will allow the investigators to characterize temporal variability in kelp subsidy inputs and the consequences of this variability for community structure and function of recipient beach ecosystems.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1458845

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