Semibalanus balanoides recruitment surveys in southwest England, Wales, and Scotland from 2015-2016 (EUROWINTER2 project)

Website: https://www.bco-dmo.org/dataset/683132
Data Type: Other Field Results
Version: 1
Version Date: 2017-02-27

Project
» Climate Change and Biogeography: Effects of Extreme Events (EUROWINTER2)

Contributors	Affiliation	Role
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Abstract
This dataset contains recruitment survey results of Semibalanus balanoides and Chthamalus sp. in southwestern UK, 2015-2016.

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Coverage

Spatial Extent: **N**:58.49128 **E**:-3.51321 **S**:50.00487 **W**:-6.99345
Temporal Extent: 2015-05-15 - 2016-06-06

Acquisition Description

Sampling and Analytical Methodology:
Sampling occurred May - June 2015, September 2015, and May - July 2016. Recruitment was sampled at thirty intertidal sites along the west coast of the United Kingdom, encompassing a latitudinal range of approximately 50 to 58 degrees N. Sites were spaced at approximately 50 km intervals, based on estimated dispersal distance for barnacle larvae (Southward, 1967). Five quadrats (15cm x 15 cm) were established at the mid-tidal level at each site. Each quadrat was divided into four sub-quadrats, three of which were scraped completely free of barnacles; the unmanipulated sub-quadrat was a control treatment.

The experimental scrapes allowed for the observation of de novo recruitment. Photographic sampling was used to determine recruitment levels. Recruitment density was analyzed for the barnacles Semibalanus balanoides, Chthamalus montagui, Chthamalus stellatus, and Austrominius modestus. Photos of each quadrat were taken using an Olympus TG-4 digital camera, positioned with a focal-framer.

Temperature Methodology:
NOAA Optimum Interpolation Daily Sea Surface Temperature Version 2 (Reynolds et al. 2007) data were obtained from the NOAA National Climatic Data Center https://www.ncdc.noaa.gov/oisst. These daily data are on a 1/4° latitude-longitude grid. For each sample site, the nearest OISST ocean pixel was chosen, and the number of days with Sea Surface temperature (SST) below 10°C between November 1 of the year prior to sampling and February 28 of the year of sampling was determined. These values were categorized into groups: 1=less than 4 weeks below 10°C, 2=four to 6 weeks below 10°C, 3=greater than 6 weeks below 10°C.

Processing Description

Photos were analyzed using the open source software Image J (Abramoff et al. 2004). The edge of the square quadrat frame (15 cm) was used to set the scale within the image. An analysis area of 30.25 cm2 was delineated in the center of a sub-quadrat and all barnacles within this space were quantified and identified by species. The analysis area was placed in the center of the sub-quadrat to prevent edge effects. All newly recruited barnacles were identified based on plate number and shape as described by Abernot-Le Gac et al. (2016: p 152) and Southward (1976). Individuals of S. balanoides could be confidently differentiated from other common intertidal species in the region, including Chthamalus stellatus, C. montagui, and Austrominius modestus (Southward 1976).

BCO-DMO Processing:
- combined 2015 and 2016 into one dataset
- added conventional header with dataset name, PI name, version date
- renamed parameters to BCO-DMO standard
- reformatted date from d-Mon-yy to yyyy-mm-dd
- replaced spaces with underscores - reduced number of significant digits of lat, lon (from 8 to 5) and density values (from 9 to 2) due to sampling precision methods

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Related Publications

Abernot-Le Gac C, Antajan E, Courtay G, Drévès L, Martin J, Pierre-Duplessix O, Schlaich I. 2016. Surveillance écologique et halieutique du site électronucléaire de Flamanville, Année 2015. IFREMER Report http://archimer.ifremer.fr/doc/00327/43799/43360.pdf
Methods

Abramoff MD, Magalhães PJ, Ram SJ. 2004. Image processing with ImageJ. Biophotonics International 11(7): 36–42
Methods

Reynolds, R. W., Smith, T. M., Liu, C., Chelton, D. B., Casey, K. S., & Schlax, M. G. (2007). Daily High-Resolution-Blended Analyses for Sea Surface Temperature. Journal of Climate, 20(22), 5473–5496. doi:10.1175/2007jcli1824.1 https://doi.org/10.1175/2007JCLI1824.1
Methods

Southward, A. J. (1967). Recent changes in abundance of intertidal barnacles in south-west England: a possible effect of climatic deterioration. Journal of the Marine Biological Association of the United Kingdom, 47(01), 81. doi:10.1017/s0025315400033580 https://doi.org/10.1017/S0025315400033580
Methods

Southward, A. J. (1976). On the taxonomic status and distribution of Chthamalus stellatus (Cirripedia) in the north-east Atlantic region: with a key to the common intertidal barnacles of Britain. Journal of the Marine Biological Association of the United Kingdom, 56(04), 1007. doi:10.1017/s0025315400021044 https://doi.org/10.1017/S0025315400021044
Methods

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Parameters

Parameter	Description	Units
site	collection site	unitless
lat	latitude; north is positive	decimal degrees
lon	longitude; east is positive	decimal degrees
date_collected	collection date	unitless
image_file	Original photograph file name	unitless
area	measured area in photograph	centimeter ^2 (cm^2)
density_Sbalanoides	Density of S. balanoides recruits	per cm^2
density_Chthamalus	Density of Chthamalus sp. recruits	per cm^2
temp_category	Measurement of length of time a location spent below 10°C from November 1 to February 28. 1 = less than four weeks 2 = four to six weeks 3 = greater than six weeks	unitless

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Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	Camera
Generic Instrument Description	All types of photographic equipment including stills, video, film and digital systems.

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Deployments

EUROWINTER2-UK

Website	https://www.bco-dmo.org/deployment/637476
Platform	SW_England
Start Date	2011-05-10
End Date	2012-06-12
Description	population studies

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Project Information

Climate Change and Biogeography: Effects of Extreme Events (EUROWINTER2)

Website: http://tbone.biol.sc.edu/forecasting_test

Coverage: Atlantic coast of Europe from central Portugal to northern Scotland

The long term goal of this project is to make verifiable forecasts of the biodiversity consequences of climate change in the coastal zone. By falsifying some and corroborating other biogeographic hypotheses, the investigators will establish a mechanistic framework for forecasting that can be verified by hindcasting the biogeographic changes that have been documented over the past century of climate change. The confluence of the rich biogeographic history of the European intertidal, the extreme conditions of the past 3 cold winters, and our rapidly expanding abilities in ecological forecasting provide a unique opportunity to make extraordinary progress in forecasting biodiversity responses to climate change. The investigators will quantify the metapopulation dynamics of ecologically dominant intertidal species to determine mechanisms responsible for setting geographic limits, and develop long term forecasts of future change. This research will also allow them to test the effect of episodic extreme events on the usefulness of ensemble methods for biogeographic forecasting. In a changing climate, with increasing frequencies of extreme events, it is important to determine whether the biogeography can ever "catch up", or whether the time lags caused by the demographic storage effect and connectivity will prevent the biology from ever tracking the long term change. The methods for ecological engineer and biodiversity forecasting and hindcasting that are described here have general applicability to marine habitats worldwide. All ecosystems have ecologically dominant species that control the rest of the assemblage of organisms, and they all are metapopulations whose connectivity and age structure determines their sensitivity to climate change and extreme events via the demographic storage effect. The players change from place to place and the oceanographic context also changes, but the methods applied here are broadly transferable.

Intellectual Merit: The results of this study will impact dramatically the discourse on the impacts of climate change. Results to date have centered on descriptions of gradual biogeographic range changes and exploration of the mechanisms driving those changes. Rarely in this literature is there discussion of the importance of broadscale episodic catastrophic events on biogeographic ranges, or how to capture those events in forecasting ecological response to climate change. A central prediction of climate change is an increase in the frequency of such potentially catastrophic climatic events which have the power to periodically reset the range boundaries of species in a ratchet-like manner. Of central interest is the degree to which such resets by extreme events determine long-term biogeographic patterns due to the combination of metapopulation dynamics and time lags caused by "storage effects" of long-lived individuals.

Broader Impacts: This project will produce an annotated bibliography of biogeographic data from the Portuguese, Spanish, and French biodiversity literature of the 19th and early 20th centuries, much of which is unavailable in North America. The project will develop a climate change atlas of the European coast including measures of historical risk and the distribution of extreme events. A forecast atlas of the

next century will be developed by coupling population models to regional climate forecasts. These products will be used as models of ways to translate scientific results into products of greater utility. The PIs have used this approach in their web-based 7-day ecological forecasts of stress in marine communities, which are in the initial phase of transition to NOAA operational status. The PIs have also engaged policy makers and have worked closely with resource managers.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1129401
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