Database of marine invertebrate dispersal parameters and species ranges including locations along East Coast of North America (CoastBenthBiogeo project)

Website: https://www.bco-dmo.org/dataset/555322
Data Type: model results
Version: waiting for validation
Version Date: 2015-04-06

Project
» A mechanistic understanding of biogeographic patterns and life histories in benthic organisms in advective coastal environments (CoastBenthBiogeo)

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Coverage

Spatial Extent: **N**:45.7503 **E**:-60.833 **S**:25 **W**:-97.3333

Dataset Description

This is a database of marine invertebrate dispersal parameters and species ranges along East Coast of North America with latitude and longitude calculated and added programmatically.

The raw data for range was gathered from occurrence data in the GBIF dataset.

Life history was gathered from a Literature Review.

The complete dataset methodology is detailed in Pappalardo P, Pringle J, Wares J, and J Byers (2015): The location, strength, and mechanisms behind marine biogeographic boundaries of the east coast of North America. Ecography 38: 001–010, 2015

There are two other datasets associated with this coordinate system:
http://www.bco-dmo.org/dataset/554871: Database of marine invertebrate dispersal parameters and species ranges (NE Coast N. America)
and
http://www.bco-dmo.org/dataset/554893: A series of coordinates and ranges from South and North America to which species occurrences are mapped according to a model.

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Data Files

File
range_taxon_life_combo.csv (Comma Separated Values (.csv), 264.99 KB) MD5:dfc6894320634fd74686c84314c40062 Primary data file for dataset ID 555322

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Parameters

Parameter	Description	Units
phylum	the Phylum of the species	text
class	the Class of the species	text
order	the Order of the species	text
family	the Family of the species	text
genus_species	the binomial species name	text
type_of_dispersal	short” or “long” as defined in reference. If the there is a 'q'(instead of question mark) after “short” or “long” it means the dispersal style was guessed from taxonomic inference	text
range_min	the southern-most extent of the species range	number
range_max	the northern-most extent of the species range	number
N_occur	the number of valid and geo-referenced species occurrences used to calculate range	number
median_depth_occur	the median depth of the water at the location of GBIF occurrences	meters
references	a short pointer to the literature source for life history data; the full reference is in the file in the metadata section	text
lat_min	North is positive.	decimal degrees
lat_max	North is positive.	decimal degrees
lon_min	West is negative	decimal degrees
lon_max	West is negative.	decimal degrees

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Deployments

lab_UNH-model

Website	https://www.bco-dmo.org/deployment/58056
Platform	UNH
Start Date	1999-01-01
End Date	2011-10-01
Description	model results

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Project Information

A mechanistic understanding of biogeographic patterns and life histories in benthic organisms in advective coastal environments (CoastBenthBiogeo)

Coverage: East Coast of North America

Description from NSF award abstract:
The biological and physical mechanisms that establish and maintain species boundaries in the ocean are controversial. Contributing factors are offspring of species with planktonic larvae being physically transported outside their natal range, and adults thriving when transplanted into regions immediately beyond their natural distributions. It is unclear, however, why long-distance dispersal of a benthic organism's larva should persist on evolutionary timescales. There is more larval dispersal from natal habitat than would seem propitious. Furthermore, long larval duration is known to increase reproductive output for species persistence, makes population retention of favorable alleles less likely, and reduces the genetic diversity of the population.

The Co-PIs have shown that maintenance of range boundaries for a species are governed by a function analogous to that derived for allelic frequency/genetic clines in the coastal ocean. As with other recent advances in biodiversity theory, this work suggests a convergence between conditions that maintain the distribution of alleles within species and those that maintain the distribution of species themselves. This confluence of theory provides substantial opportunity for development of inter- and intra-species competition in an advective environment. It potentially would unify genetic and population-level theory, and create a holistic view of life in advective environs.

It is clear from preliminary work that a synthesis would depend critically on tradeoffs between dispersal mode and successful reproductive output. The theory would be developed both by pushing its analytical envelope, and by drawing upon extensive, existing databases to quantitatively constrain reproductive and dispersal tradeoffs. For example, although tradeoffs between larval quantity versus quality (i.e., many "energetically cheap" larvae versus few "highly provisioned" individuals) have long been the subject of qualitative models, they have not been quantitatively defined for life history characteristics of different benthic marine taxa. Combining analytical developments and observed life-history tradeoffs would provide 1) evolutionarily stable states for a range of dispersal strategies, 2) mechanisms that define species boundaries as a function of physical (e.g., temperature and alongshore variation in currents) and biological (like larval mortality) parameters and 3) quantitative origins of dispersal behaviors that would locally retain larvae, and result in relationships between inter- and intra-species fitness.

Such findings would predict species boundary locations and the presence/absence of various dispersal strategies as a function of local circulation, environmental conditions and their gradients. Predictions would be tested against data on species ranges gathered as part of an extensive literature and database search.

This research would allow a better mechanistic understanding species' ranges that occur due to changes in the Earth's climate. For example, this study will test the hypothesis that warming favors species with longer larval planktonic duration. Therefore, high-latitude areas now dominated by species with direct development would shift to a mixture of planktonic dispersers and direct developers as the climate warms. The research would allow managers to understand how disruption to habitat can alter species ranges by changing alongshore sources and transport of planktonic larvae. A quantitative theory of species range will also help managers understand what sets the ultimate limits of recently introduced exotic species, allowing improvement of management strategies.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0961344
NSF Division of Ocean Sciences (NSF OCE)	OCE-0961830

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