The effect of relatedness on survival, growth, and reproduction of Bugula neritina in the Gulf of Mexico, Florida from March to June 2022.

Website: https://www.bco-dmo.org/dataset/968545
Data Type: experimental
Version: 1
Version Date: 2025-07-16

Project
» Consequences of kin structure in benthic marine systems (Marine kin structure)

Contributors	Affiliation	Role
Burgess, Scott	Florida State University (FSU)	Principal Investigator, Contact
Barnes, Danielle	Florida State University (FSU)	Student
Soenen, Karen	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
In the Gulf of Mexico, Florida, we performed a series of field experiments using an experimentally tractable species (the bryozoan Bugula neritina) to test the hypothesis that the density, spatial arrangement, and genetic relatedness of neighbours differentially affect survival, growth, reproduction, paternity, and sperm dispersal. We manipulated the density and relatedness of neighbours and found that increased density reduced survival but not growth rate, and that there was no effect of relatedness on survival, growth, or fecundity, in contrast to previous studies. We also manipulated the distances to the nearest neighbour and used genetic markers to assign paternity within known mother–offspring groups to estimate how proximity affects mating success. Distance to the nearest neighbour did not affect the number of settlers produced, the paternity share, or the degree of multiple paternity. Overall, larger than expected sperm dispersal led to high multiple paternity, regardless of the distance to the nearest neighbour.

Table of Contents

- Coverage
- Dataset Description
  - Methods & Sampling
  - BCO-DMO Processing Description
- Data Files
- Related Publications
- Related Datasets
- Parameters
- Project Information
- Funding

Coverage

Location: Gulf of Mexico, Florida, USA
Spatial Extent: **Lat**:29.828333 **Lon**:-84.580806
Temporal Extent: 2022-03 - 2022-06

Methods & Sampling

Experiment 2: the effect of relatedness on survival, growth, and reproduction

The second experiment ran from March to June of 2022. Individual colonies were arranged into two treatments, related and unrelated, each with 10 replicate On each replicate dish, there were 10 colonies randomly assigned to a position in a 3 × 4 cm grid, reflecting a common density in the field at times when the population is large, and at the middle density used in Experiment 1. Overall, there were 21 maternal families. In

the “related” treatment, 10 of these maternal families were used, where each of the 10 replicates comprised offspring from a different maternal family (i.e., replicate 1 had 10 offspring from family X, replicate 2 had 10 offspring from family Y, and so on). In the “unrelated” treatment, each of the 10 replicates comprised one offspring randomly chosen from one of the 21 maternal families, such that the 10 maternal families in the related treatment were also used in the unrelated treatments, plus an additional 11 maternal families to achieve the desired density. Petri dishes were randomly assigned to PVC poles. There were 10 replicate Petri dishes in each treatment at the start of the experiment; however, two dishes were lost after deployment, resulting in eight Petri dishes in the unrelated treatment.

After 20 days in the field, individual colonies were collected and returned to the laboratory. The surviving individuals were preserved in 95% ethanol. Survival (present or absent), size (number of zooids), and reproductive output (total number of ovicells) were recorded for each individual colony under a dissecting microscope. The number of ovicells is considered proportional to the production of sperm and eggs and the potential number of brooded larvae.

BCO-DMO Processing Description

* adjusted field names to comply with database requirements
* added sampling latitude and longitude to data itself

[table of contents | back to top]

Data Files

File
968545_v1_experiment2.csv (Comma Separated Values (.csv), 22.67 KB) MD5:534e79cacd7a5a22563417bab54b6501 Primary data file for dataset ID 968545, version 1

[table of contents | back to top]

Related Publications

Barnes, D. K., & Burgess, S. C. (2024). Fitness consequences of marine larval dispersal: the role of neighbourhood density, arrangement, and genetic relatedness on survival, growth, reproduction, and paternity in a sessile invertebrate. Journal of Evolutionary Biology. https://doi.org/10.1093/jeb/voae125
Results

[table of contents | back to top]

Related Datasets

IsRelatedTo

Scott Burgess. (2024). *scottcburgess/neigborhood-effects-on-dispersal-fitness: neigborhood-effects-on-dispersal-fitness* (Version v1.0) [Computer software]. Zenodo. https://doi.org/10.5281/ZENODO.13821158 https://doi.org/10.5281/zenodo.13821158

[table of contents | back to top]

Parameters

Parameter	Description	Units
Latitude	Sampling latitude, south is negative	decimal degrees
Longitude	Sampling longitude, west is negative	decimal degrees
Unique_ID	Unique identifier for each F1 colony out planted to the field	unitless
Mother_colony	Mother identifier for each F1 colony out planted to the field.	unitless
Relatedness	Non=Non-related, F1 colonies from different mothers; Sib=Siblings, F1 colonies from the same mother	unitless
Grid_position	Numbers correspond to specific positions of colonies on the grid of the petri dish lid. 1 though 5 on top row right to left, 6 through 10 on second row right to left, 11 through 15 on third row right to left, and 16 through 20 on bottom row right to left.	unitless
X	X coordinate on the grid, 1-5	unitless
Y	Y coordinate on the grid, 1-4	unitless
Position	Relative position on the grid, positions 1-5, 6, 10, 11, 15, and 16-20 are considered outside, others are inside.	unitless
Date	Date of data collection	unitless
Age_days	Age of F1 focal colonies; days since settlement	unitless
Bifurcations	Number of bifurcations on the focal colony counting longest chain	unitless
Zooids	Number of zooids on the focal colony counted under the microscope	unitless
Survival	1=survived, 0=died	unitless
Fertilized_ovicells	Number of fertilized ovicells (black) on a focal colony, counted under the microscope	unitless
Ovicells_total	Number of total ovicells (fertilized and unfertilized) on a focal colony, counted under the microscope	unitless

[table of contents | back to top]

Project Information

Consequences of kin structure in benthic marine systems (Marine kin structure)

Coverage: Gulf of Mexico

NSF Award Abstract:
In marine systems, the production, dispersal, and recruitment of larvae are crucial processes that rebuild depleted adult stocks, facilitate changes in species geographic ranges, and modify the potential for adaptation under environmental stress. Traditionally, the tiny larvae of bottom-associated adults were thought to disperse far from their parents and from each other, making interactions among kin improbable. However, emerging evidence is challenging this view: larval dispersal does not always disrupt kin associations at settlement, and a large fraction of invertebrate diversity on the seafloor contains species in which most larvae disperse short distances. Limited dispersal increases the potential for interactions among kin, which has important consequences for individual fitness across many generations, and therefore the productivity of populations and the potential for adaptation. But when these consequences occur, and how exactly they manifest, remains largely unexplained. The key challenge now is to explain and predict when kin associations are likely to occur, and when they are likely to have positive or negative ecological consequences. Therefore, the key questions addressed by this research are: 1) how and when do kin associations arise and persist, and 2) what are the consequences of living with kin for survival, growth, and reproduction. This concept-driven research combines genomic approaches with experimental approaches in lab and field settings using an experimentally-tractable and representative invertebrate species. The project trains and mentors PhD students and a postdoctoral scholar at Florida State University (FSU). Field and laboratory activities are developed and incorporated into K–12 education programs and outreach opportunities at FSU.

The spatial proximity of relatives has fundamentally important consequences at multiple levels of biological organization. These consequences are likely to be particularly important in a large range of benthic marine systems, where competition, facilitation, and mating depend strongly on the proximity and number of neighbors. However, explaining and predicting the occurrence, magnitude, and direction of such effects remains challenging. Emerging evidence suggest that the ecological consequences of kin structure are unlikely to have a straight-forward relationship with dispersal potential. Therefore, it is crucial to discover new reasons for when kinship structure occurs and why it could have positive, negative, or neutral ecological consequences. This research aims to provide a new understanding of how dispersal and post-settlement processes generate spatial kin structure, how population density and relatedness influence post-settlement fitness, and how the relatedness of mating partners influences the number and fitness of their offspring (inbreeding and outbreeding). The research combines genomic approaches, experimental progeny arrays, and manipulative experiments in field and lab settings to test several hypotheses that are broadly applicable across species. By focusing on an experimentally tractable species to test broadly applicable hypotheses, the project achieves generality and a level of integration that has been difficult to achieve in previous work.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1948788

[table of contents | back to top]