

Uca pugilator: Assessment of individual's position within a herd at 3 min. intervals analyzed at USC in 2014 (Variation in Metabolic Processes project)

Website: <https://www.bco-dmo.org/dataset/642057>

Data Type: experimental

Version:

Version Date: 2016-04-08

Project

» [Linking Variation in Metabolic Processes as a Key to Prediction](#) (Variation in Metabolic Processes)

| Contributors | Affiliation | Role |
|------------------------------------|---|------------------------|
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Coverage

Spatial Extent: Lat:33.32689722 Lon:-79.2066

Temporal Extent: 2014-07-08 - 2014-08-10

Dataset Description

Sub-project: "Individual personality is sufficient to determine and maintain dynamic spatial positioning within *Uca pugilator* herds."

Related Reference: Knotts ER, Griffen BD (2016) Individual movement rates are sufficient to determine and maintain dynamic spatial positioning within *Uca pugilator* herds. *Behavioral Ecology and Sociobiology* 70:639-646

Related Datasets:

[Uca pugilator: behavior change with carapace marking](#)

[Uca pugilator: herd position proportion](#)

[Uca pugilator: search space distribution](#)

Methods & Sampling

U. pugilator (those with the daily upper and lower extremes of searching space as measured above) were returned to the field within 24 hours of the first interactions during low tide, and were released into pre-existing herds of conspecifics that were foraging on the exposed mudflats at North Inlet Estuary (33°19'36.83"N,

79°12'23.76"W) in Georgetown, South Carolina, USA.

All individuals on a given day were released back onto the mudflat at the same moment by placing them all under a single cover and then raising this cover up remotely. After disturbing the herds during initial setup, we remained motionless until fiddler crabs within the herd resumed their feeding behavior prior to lifting the cover to release the marked crabs. The number of released crabs in one session ranged from four to six fiddler crabs. Following release, we assessed the location of each marked crab within the herd (edge vs. center) every three minutes by observing the crabs from a close proximity (though from a sufficient distance so as not to disturb the herd) using binoculars. An individual was tracked using its sex and carapace color as indicators for specific crab identification. The location assessment of the marked crab was characterized by the individual's position (edge vs. center) within the herd. These observations took place every three minutes for one hour or until all marked *U. pugilator* were lost from sight (38.71 min \pm 9.39 min, mean \pm SD).

Data Processing Description

Analyses were conducted with the statistical program R, v.3.1.0. We analyzed the data using a generalized linear model with the proportion of observations for each crab where it was observed on the edge of a herd as the response variable, and with the following fixed factors: personality type, carapace width, and gender, and with the number of observations made during the field session as a weighting factor. We initially included collection date as a random blocking factor; however, this term had no effect on model results (determined using AIC) and so data were pooled across all sampling dates.

BCO-DMO Processing:

- added conventional header with dataset name, PI name, version date, reference information
- renamed parameters to BCO-DMO standard
- reformatted date from m/d/yyyy to yyyy-mm-dd
- added site, lat, lon columns for mapping purposes

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Data Files

| File |
|--|
| field_position.csv (Comma Separated Values (.csv), 157.00 KB) MD5:29a3a8f5c6f8a0d3e42de7abf44e803c |
| Primary data file for dataset ID 642057 |

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Parameters

| Parameter | Description | Units |
|--------------|---|-----------------|
| site | sampling location | unitless |
| lat | latitude; north is positive | decimal degrees |
| lon | longitude; east is positive | decimal degrees |
| personality | Personality | unitless |
| crab | crab | unitless |
| date | Date | yyyy-mm-dd |
| time | Time (GMT) | HH:MM |
| sex | Gender | unitless |
| carap_width | Carapace Width | mm |
| search | Search Space: The number of quadrats entered by the crab's full body with allowance for re-entry in an aquarium [55x30x35cm] in which eight equal size quadrats (area ~206cm ²) were marked | integer |
| time_elapsed | The number of minutes passed after the initial release of U. pugilator into the field | minutes |
| position | The observed position of the individual crab after each specific time interval. The "0" represents a central position or that the individual was hiding. The "1" represents an edge position or that the individual was alone. The "nd" represents that the individual was lost from sight. | unitless |

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Instruments

| | |
|---|--|
| Dataset-specific Instrument Name | |
| Generic Instrument Name | Binoculars Handheld |
| Generic Instrument Description | Handheld binoculars, generally used for bird or mammal observations. |

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Deployments

Griffen_2014

| | |
|--------------------|---|
| Website | https://www.bco-dmo.org/deployment/629829 |
| Platform | Univ_S_Carolina |
| Start Date | 2014-05-31 |
| End Date | 2014-10-25 |
| Description | Blue crab studies |

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Project Information

Linking Variation in Metabolic Processes as a Key to Prediction (Variation in Metabolic Processes)

Description from NSF award abstract:

A major goal of biological and ecological sciences is to understand natural systems well enough to predict how species and populations will respond to a rapidly changing world (i.e., climate change, habitat loss, etc.). A population under any conditions will grow, shrink, or disappear altogether depending on how efficiently individuals consume resources (food), utilize that food metabolically, and eventually reproduce. However, making accurate predictions based on these metabolic processes is complicated by the realities that each species has different resource requirements and that no two individuals within a species are exactly alike. Rather, individuals vary and this variation, both within and across species, is central to many ecological and evolutionary processes. Developing the ability to predict responses of biological systems to a changing world therefore requires a mechanistic understanding of variation. The goal of this project is to improve this mechanistic understanding by examining variation within a metabolic context across a range of species that have a spectrum of commonly-seen resource requirements. Further, the work capitalizes on a unique biological characteristic of this group of species that allows control and manipulation of individual reproduction, facilitating experimental study of the mechanistic links between variation in individual consumption, metabolism, and reproduction. The foundation this research is a combination of field measurements and laboratory experiments using both well-established and newly-developed techniques to quantify these links. The result will be a quantitative framework to predict how individuals will respond reproductively to changes in resource use. Because of the close link between individual reproduction and population dynamics, this research will contribute substantially to predictions in population dynamics under realistic conditions where individuals use more than a single resource, and improve the prediction of responses to current and future ecological changes.

The following publications and data resulted from this project:

Belgrad, B. and B. Griffen. 2016. Predator-prey interactions mediated by prey personality and predator identity. *Proc. Roy. Soc. B*: In Review. [2016-01-20]

[P. herbstii mortality data](#): Mortality of crabs when exposed to either a single blue crab, toadfish, or no predator for a week

[P. herbstii personality data](#): Refuge use of crabs when exposed to predator odor cues from either blue crabs, toadfish, or control of no cue

[P. herbstii predator behavior data](#): Refuge use and mobility of blue crabs and toadfish while in mesocosms for a week - behavior measured during two days.

Belgrad, B. and B. Griffen. 2016. The influence of dietary shifts on fitness of the blue crab, *Callinectes sapidus*. *PLoS One*. DOI: [10.1371/journal.pone.0145481](https://doi.org/10.1371/journal.pone.0145481).

[Blue crab activity](#): Activity of crabs fed different diets over a summer

[Blue crab egg size](#): Volume of eggs for crabs fed different diets

[Blue crab hepatopancreas index \(HSI\)](#): Weight of hepatopancreas for crabs fed different diets

[Blue crab hepatopancreas lipid content](#): Hepatopancreas lipid content of crabs fed different diets

[Blue crab reproductive tissue analysis \(GSI\)](#): Gonadosomatic index of blue crabs on various diets

[Blue crab survival](#): Blue crab survival data during the dietary study

Knotts ER, Griffen BD. 2016. Individual movement rates are sufficient to determine and maintain dynamic spatial positioning within *Uca pugilator* herds. *Behavioral Ecology and Sociobiology* 70:639-646

[Uca pugilator: behavior change with carapace marking](#): Search space behavior due to carapace treatment (control, nail polish, and food dye)

[Uca pugilator: field spatial position](#): Assessment of individual's position within a herd at 3 min. intervals; for proportion of time found at edge of herd

[Uca pugilator: herd position proportion](#): Individual's proportion of time spent in an edge/alone position among a herd

[Uca pugilator: search space distribution](#): Search space that crabs traveled; to evaluate the sample's distribution of exploratory behavior

Belgrad, B. and B. Griffen. 2015. Rhizocephalan infection modifies host food consumption by reducing host activity levels. *Journal of Experimental Marine Biology and Ecology*. 466: 70-75.

[E. depressus digestion time](#): Time taken for food to pass through gut of flat-backed mud crabs infected by a parasite

[E. depressus metabolism](#): Respiration rate of infected/uninfected flat-backed mud crabs

[E. depressus reaction time to prey](#): Time taken for infected/uninfected flat-backed mud crabs to react to the

presence of prey

Blakeslee, A.M., C.L. Keogh, A.E. Fowler, B. Griffen. 2015. Assessing the effects of trematode infection on invasive green crabs in eastern North America. *PLOS One* 10(6): e0128674.(pdf)

[Carcinus: hemocyte density](#): Counts of circulating hemocyte density in *Carcinus maenas*

[Carcinus: parasites physiology behavior](#): Behavior and physiology of *Carcinus maenas* infected with trematode parasite

Griffen BD, Norelli AP (2015) Spatially variable habitat quality contributes to within-population variation in reproductive success. *Ecology and Evolution* 5:1474-1483.

[P. herbstii diet: sampling site characteristics \(Eco-Evo 2015\)](#)

[P. herbstii diet: body measurements \(Eco-Evo 2015\)](#)

[P. herbstii diet & reproduction \(Eco-Evo 2015\)](#)

[P. herbstii: collection sites \(Eco-Evo 2015\)](#)

Griffen BD, Riley ME (2015) Potential impacts of invasive crabs on one life history strategy of native rock crabs in the Gulf of Maine. *Biological Invasions* 17:2533-2544.

[Cancer consumption and reproduction \(Bio.Inv. 2015\)](#): Lab experiment linking dietary consumption and reproduction

Griffen BD, Vogel M, Goulding L, Hartman R (2015) Energetic effects of diet choice by invasive Asian shore crabs: implications for persistence when prey are scarce. *Marine Ecology Progress Series* 522:181-192.

[Hemigrapsus diet 1 \(MEPS 2015\)](#)

[Hemigrapsus diet 2 \(MEPS 2015\)](#)

Hogan and Griffen (2014). The Dietary And Reproductive Consequences Of Fishery-Related Claw Removal For The Stone Crab *Menippe* Spp. *Journal of Shellfish Research*, Vol. 33, No. 3, 795-804.

[Stone crab: 052012-DietChoiceExp1](#): Prey choice for 2-clawed and 1-clawed Stone Crabs (*Menippe* spp.)

[Stone crab: 052012-LongTermConsumption](#): Long-term consumption for 2-clawed and 1-clawed Stone Crabs (*Menippe* spp.), summer of 2012

[Stone crab: 062013-DietChoiceExp2](#): Prey choice for 2-clawed and 1-clawed Stone Crabs (*Menippe* spp.)

[Stone crab: 062013-PreySizeSelection](#): Prey Size selection ranking for 2-clawed and 1-clawed Stone Crabs (*Menippe* spp.)

Riley M, Johnston CA, Feller IC, and Griffen B. 2014. Range expansion of *Aratus pisonii* (mangrove tree crab) into novel vegetative habitats. *Southeastern Naturalist* 13(4): 43-38

[A. pisonii: range expansion](#): *Aratus pisonii* survey in native mangrove and novel salt marsh habitats

Riley M, Vogel M, Griffen B. 2014. Fitness-associated consequences of an omnivorous diet for the mangrove tree crab *Aratus pisonii*. *Aquatic Biology* 20:35-43, DOI: 10.3354/ab00543

[A. pisonii: fitness and diet](#): Impact of diet variation on physiological and reproductive condition of *A. pisonii*

Toscano BJ, Newsome B, Griffen BD (2014) Parasite modification of predator functional response. *Oecologia* 175:345-352b

[E. depressus - parasite and feeding \(Oecologia, 2014\)](#): Feeding with and without parasitic barnacle infection

[E. depressus - parasite and prey handling \(Oecologia, 2014\)](#): Food handling with and without parasitic barnacle infection

[E. depressus - parasite study - field survey \(Oecologia, 2014\)](#): Parasitised field survey

Toscano BJ, Griffen BD (2014) Trait-mediated functional responses: predator behavioural type mediates prey consumption. *Journal of Animal Ecology* 83:1469-1477

[P. herbstii - activity and feeding \(JAE, 2014\)](#): Activity level and feeding with and without predator cue

Toscano BJ, Gatto J, Griffen BD (2014) Effects of predation threat on repeatability of individual crab behavior revealed by mark recapture. *Behavioral Ecology and Sociobiology* 68:519-527

[P. herbstii - recapture behavior \(BESB, 2014\)](#): Mud crabs refuge use and activity level - initial measurements

[P. herbstii - refuge use \(BESB, 2014\)](#): Effect of predation threat on repeatability of individual crab behavior revealed by mark-recapture

Griffen BD, Altman I, Bess BM, Hurley J, Penfield A (2012) The role of foraging in the success of invasive species. *Biological Invasions*. 14:2545-2558

[Hemigrapsus seasonal diet \(Bio.Inv. 2012\)](#): Percent herbivory and gut fullness for *Hemigrapsus sanguineus* at different times of year

Griffen BD, Toscano B, Gatto J (2012) The role of intraspecific trait variation in mediating indirect interactions.

Ecology 93:1935-1943

[P. herbstii refuge use \(Ecology, 2012\)](#): Proportion of time that Panopeus herbstii spent using refuge habitats in a lab experiment

[P. herbstii: Field personality distribution \(Ecology, 2012\)](#): Field distribution of personality types in the mud crab Panopeus herbstii relative to tidal height

[P. herbstii: Trait mediated indirect effect \(Ecology, 2012\)](#): Influence of refuge use by the mud crab Panopeus herbstii on consumption of bivalves

Riley ME, Griffen BD (2017) Habitat-specific differences alter traditional biogeographic patterns of life history in a climate-change induced range expansion. PLOS One 12(5):e0176263

[A. pisonii: egg size](#): Comparing egg size in Aratus pisonii populations from mangrove and salt marsh habitats

[A. pisonii: fecundity](#): Determining fecundity of Aratus pisonii populations in mangrove and salt marsh habitats

[A. pisonii: larval starvation resistance](#): Comparing larval quality in Aratus pisonii populations from mangrove and salt marsh habitats

[A. pisonii: latitudinal body size](#): Survey examining latitudinal body size patterns in Aratus pisonii

[A. pisonii: predation](#): Comparing predation pressure on Aratus pisonii in mangrove and salt marsh habitats

[A. pisonii: reproductive effort](#): Survey comparing Aratus pisonii reproductive effort in native and novel habitats

[A. pisonii: herbivory](#): Relationship between leaf herbivory, tree characteristics, and refuge availability

[A. pisonii: mangrove tree survey](#): Mangrove tree distribution and characteristics in a dwarf mangrove system

Cannizzo ZJ, Dixon SR & Griffen BD (2018). An anthropogenic habitat within a suboptimal colonized ecosystem provides improved conditions for a range-shifting species. Ecology and Evolution, 8(3):1524-1533.

[A. pisonii: behavior](#): Proportion of time the mangrove tree crab Aratus pisonii spent in different behaviors related to diet and energy storage

[A. pisonii: dock-marsh thermal](#): Thermal readings from under a dock and in a nearby salt marsh

[A. pisonii: sun-shade](#): Proportion of time that mangrove tree crab Aratus pisonii spent in sun and shade in three habitats, 2015-2016.

[A. pisonii: thermal picture](#): Thermal condition of A. pisonii in three habitats: under dock, mangroves, saltmarsh

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Funding

| Funding Source | Award |
|--|-----------------------------|
| NSF Division of Ocean Sciences (NSF OCE) | OCE-1129166 |

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