Physiological parameters derived from dissection of mangrove crabs, A. pisonii, from three habitats along Florida's east coast in 2015 and 2016

Website: https://www.bco-dmo.org/dataset/741114
Data Type: experimental
Version: 1
Version Date: 2018-07-16

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

Contributors	Affiliation	Role
Griffen, Blaine D.	University of South Carolina	Principal Investigator
Cannizzo, Zachary J.	University of South Carolina	Co-Principal Investigator, Contact
Copley, Nancy	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
This dataset includes multiple physiological parameters derived from dissection of mangrove tree crabs, A. pisonii, from three habitats: mangrove, saltmarsh and mangrove.

Table of Contents

Coverage

Spatial Extent: **N**:30.1325 **E**:-80.28611 **S**:27.43 **W**:-81.38556
Temporal Extent: 2015-06-17 - 2016-09-04

Dataset Description

This dataset includes multiple physiological parameters derived from dissection of mangrove tree crabs, A. pisonii, from three habitats: mangrove, saltmarsh and mangrove.

Methods & Sampling

On each of 9 randomly selected days in each habitat, 15 individual adult A. pisonii were collected by hand and immediately placed on dry ice. In the mangrove and saltmarsh, we collected these crabs in three groups of five at three distinct tidal periods: just after losing access to the sediment on the flood tide, at slack high tide, and just before regaining access to the sediment on the ebb tide. Crabs were kept frozen until dissection. Prior to dissection, we determined the sex and carapace width of each crab. Upon dissection we ascertained gut-width as the width of the cardiac stomach.

We ascertained the gut fullness of each crab to obtain a snap-shot of the quantity of food consumed during each tidal period by removing the gut contents and drying them at 60-70oC to constant weight. We standardized gut fullness by dividing the mass of the gut contents by the volume of the gut ( ) where a is a correction factor of 0.92.

We also separated the hepatopancreas, reproductive tissue (gonads and eggs), feces still in the intestines, the gut, and the somatic tissue of each crab and dried them to a constant weight at 60-70oC.

The dry mass of each parameter was determined by subtracting the mass of the weigh boat used for that parameter from the dry mass of that parameter on the weigh-boat.

Hepatosomatic index was calculated as the ratio of the dry masses of the hepatopancreas and the somatic tissue.
Gonadosomatic index was calculated as the ratio of the dry masses of the reproductive tissues and the somatic tissue.
Gut volume was calculated using the equation ( ) where a is a correction factor of 0.92.

Locations: Florida East Coast.
Round Island Park: 27o33'33"N 80o19'53"W
Pepper Park: 27o29'42'N 80o18'12"W
North Causeway Park: 27o28'28"N 80o19'12"W
Oslo Road: 27o35'14"N 80o21'55"W
Anastasia State Park: 29o52'40"N 81o16'32"W
Guana-Tolomato-Matanzas NERR: 30o0'49"N 81o20'42"W
Vilano Inlet: 29o55'16"N 81o17'57"W
Palm Valley/Nocatee Canoe Launch: 30o07'57"N 81o23'08"W
St. Augustine Yacht Club: 29o53'09"N 81o17'08"W
Boating Club Road: 29o56'34"N 81o18'31"W

Data Processing Description

BCO-DMO Processing
- added Year and ISO_Date columns; removed Date (d-Mon) column from display
- reduced decimal precision of GV, GW_CW from 9 to 3; HIS, GSI and GC_GV from 9 to 4

[table of contents | back to top]

Data Files

File	
Apisonii_dissection.csv	(Comma Separated Values (.csv), 83.62 KB) MD5:706cb7f7a17b8d128243d84daf56967a
Primary data file for dataset ID 741114	

[table of contents | back to top]

Related Publications

Cannizzo, Z. J., Dixon, S. R., & Griffen, B. D. (2018). An anthropogenic habitat within a suboptimal colonized ecosystem provides improved conditions for a range-shifting species. Ecology and Evolution, 8(3), 1521–1533. doi:10.1002/ece3.3739
Results

[table of contents | back to top]

Parameters

Parameter	Description	Units
ID	Individual ID number given to each crab	unitless
Habitat	The habitat where the crab was collected and observed	unitless
Site	Site of observation/collection. RI= Round Island Park; PP=Pepper Park; NC=North Causeway Park; Oslo=Oslo Road; BP=Bear Point; ANA=Anastasia State Park; GTM= Guana-Tolomato-Matanzas NERR; PV= Palm Valley/Nocatee Canoe Launch; YC=St. Augustine Yacht Club	unitless
Year	Year of collection	unitless
ISO_Date	Date in ISO format (yyyy-mm-dd)	unitless
Tide	Tidal period of collection. 1=As crabs lost access to sediment on the flood-tide; 2=Slack-high tide; 3=Just before crabs regained access to the sediment on the ebb-tide	unitless
Sex	Sex of crab	unitless
Gravid	Reproductive state of female crabs. 0=non-ovigerous; 1-ovigerous (egg carrying)	unitless
CW	Size of crab; measured as carapace-width	mm
GW	Gut width measured as the width of cardiac stomach.	mm
GV	Gut volume measured as the volume of the cardiac stomach.	mm3
GW_CW	gut-width:carapace-width ratio	unitless
S_WB	Mass of weight boat for somatic tissue.	grams
S_Dry	Dry mass of somatic tissue on weigh boat.	grams
S	Dry mass of somatic tissue.	grams
F_WB	Mass of weigh-boat for feces.	grams
F_Dry	Dry mass of feces on weigh-boat.	grams

F	Dry mass of feces.	grams
G_WB	Mass of weigh-boat for reproductive tissue.	grams
G_Dry	Dry mass of reproductive tissue on weigh-boat.	grams
G	Dry mass of reproductive tissue	grams
H_WB	Mass of weigh-boat for hepatopancreas.	grams
H_Dry	Dry mass of hepatopancreas on weigh-boat.	grams
H	Dry mass of hepatopancreas.	grams
GT_WB	Mass of weigh-boat for gut.	grams
GT_Dry	Dry mass of gut on weigh-boat.	grams
GT	Dry mass of gut.	grams
GC_WB	Mass of weigh-boat for gut-content.	grams
GC_Dry	Dry mass of gut-content on weigh-boat.	grams
GC	Dry mass of gut-content.	grams
HIS	Hepato-somatic index of crab	unitless
GSI	Gonado-somatic index of crab	unitless
GC_GV	Ratio of the mass of the gut content and the volume of the gut	unitless

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	scale or balance
Dataset-specific Description	Used to measure wet and dry weights of eggs
Generic Instrument Description	Devices that determine the mass or weight of a sample.

[table of contents | back to top]

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*.
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 (Ecol-Evol 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 consuption 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

[table of contents | back to top]

Funding

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

[table of contents | back to top]