Fatty acid concentration extracted from A. pisonii eggs from three habitats along the Florida eastern coast, 2016

Website: https://www.bco-dmo.org/dataset/741219
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 concentrations of fatty acids from eggs of mangrove tree crabs, A. pisonii, from three habitats: mangrove, saltmarsh and mangrove collected along the eastern Florida coast in 2016.

Table of Contents

Coverage

Spatial Extent: **N**:30.1325 **E**:-80.28611 **S**:27.43 **W**:-81.38556
Temporal Extent: 2016-06 - 2016-10

Dataset Description

This dataset includes concentrations of fatty acids from eggs of mangrove tree crabs, A. pisonii, from three habitats: mangrove, saltmarsh and mangrove collected along the eastern Florida coast in 2016.

Methods & Sampling

We collected 10 ovigerous females with stage-1 non-eyed eggs by hand and from each habitat (mangrove, salt marsh, dock) during the week preceding the full moon of each of five consecutive months throughout the A. pisonii reproductive season. Crabs were immediately placed on dry ice and stored at -80oC until dissection at which time the size and gut-width were determined and the whole egg clutch was carefully removed from the pleopods. The egg clutch was then freeze-fried and stored at -80oC until analysis.

Lipids were extracted from eggs using a modified Folch extraction and the fatty acids were then methylated. We then analyzed the methylated fatty acids via gas chromatography-mass spectrometry using an Agilent 6890 GC 5975 Mass Spectrometer fitted with a Restek 30m FAMEWAX column. The concentration of each FA was then determined from a diluton curve derived from a Supelco 37 Fatty Acid mix. The FA peak areas were first normalized to recovery standard then concentrations were determined using the regression curves of the external standards. This concentration was then corrected for the volume of the sample to obtain the mass of the fatty acid extracted from the egg.

Gut-width:carapace-width ratio was calculated as the ratio of the size of the gut of the crab and the size of the crab.

The mass of Omega-3 Fatty Acids was determined by combining the masses of Alpha Linoleic Acid, Eicosatrienoic Acid, Eicosapentaenoic Acid, and Docosahexaenoic Acid.

The mass of Omega-6 Fatty Acids was determined by combining the masses of cis-Linoleic Acid, trans-Linoleic Acid, Eicosadienoic Acid, Dihomo-Gamma-Linolenic Acid, Arachidonic Acid, and Docosahexaenoic Acid.

The mass of the highly-unsaturated Fatty Acids was determined by combining the masses of Eicosapentaenoic Acid, Arachidonic Acid, and Docosahexaenoic Acid.

The mass of odd-numbered Fatty Acids was determined by combining the masses of C15:0 fatty acid, C15:1 fatty acid, C17:0 fatty acid, and C17:1 fatty acid.

The mass of each fatty acid extracted from the eggs was divided by the mass of the eggs from which fatty acids were extracted to obtain the concentration of that fatty acid in the eggs as the proportion of the egg mass.

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:
- reduced decimal precision of: GW_CW from 9 to 3 places

[table of contents | back to top]

Data Files

File
Apisonii_fatty_acids.csv (Comma Separated Values (.csv), 59.53 KB) MD5:319f20ab547f7dd81e7ef54f7215ff48 Primary data file for dataset ID 741219

[table of contents | back to top]

Parameters

Parameter	Description	Units
Sample	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; ANA=Anastasia State Park; GTM= Guana-Tolomato-Matanzas NERR; VM=Vilano Inlet; PV= Palm Valley/Nocatee Canoe Launch; YC=St. Augustine Yacht Club; BC=Boating Club Road	unitless
Year	Year of collection	unitless
Month	Number of month (1-12) that crab was collected	unitless
CW	Size of crab; measured as carapace-width	millimeters
GW_CW	gut-width:carapace-width ratio	unitless
Egg_ug	Mass of the eggs from which the fatty acids were extracted.	micrograms
C14_0	Mass of C14:0 fatty acid extracted from eggs.	micrograms
C14_1	Mass of C14:1 fatty acid extracted from eggs.	micrograms
C15_0	Mass of C15:0 fatty acid extracted from eggs.	micrograms
C15_1	Mass of C15:1 fatty acid extracted from eggs.	micrograms
C16_0	Mass of C16:0 fatty acid extracted from eggs.	micrograms
C16_1	Mass of C16:1 fatty acid extracted from eggs.	micrograms
C17_0	Mass of C17:0 fatty acid extracted from eggs.	micrograms
C17_1	Mass of C17:1 fatty acid extracted from eggs.	micrograms
C18_0	Mass of C18:0 fatty acid extracted from eggs.	micrograms
C18_1n9	Mass of C18:1n9 fatty acid extracted from eggs.	micrograms
cLA	Mass of cis-Linoleic Acid extracted from eggs.	micrograms
tLA	Mass of trans-Linoleic Acid extracted from eggs.	micrograms
GLA	Mass of Gamma-Linolenic Acid extracted from eggs.	micrograms
ALA	Mass of Alpha Linoleic Acid extracted from eggs.	micrograms
C20_0	Mass of C20:0 fatty acid extracted from eggs.	micrograms
C20_1n9	Mass of C20:1n9 fatty acid extracted from eggs.	micrograms
EicoA	Mass of Eicosadienoic Acid extracted from eggs.	micrograms
DGLA	Mass of Dihomo-Gamma-Linolenic Acid extracted from eggs.	micrograms
AA	Mass of Arachidonic Acid extracted from eggs.	micrograms
ETE	Mass of Eicosatrienoic Acid extracted from eggs.	micrograms
EPA	Mass of Eicosapentaenoic Acid extracted from eggs.	micrograms
DHA	Mass of Docosahexaenoic Acid extracted from eggs.	micrograms
O3	Mass of Omega-3 Fatty Acids extracted from eggs.	micrograms
O6	Mass of Omega-6 Fatty Acids extracted from eggs.	micrograms
O3_O6	Ratio of the masses of the Omega-3 and Omega-6 Fatty Acids extracted from eggs	unitless
EPA_DHA	Ratio of the masses of Eicosapentaenoic Acid and Docosahexaenoic Acid extracted from eggs	unitless
HUFA	Mass of the highly-unsaturated Fatty Acids extracted from eggs.	micrograms
OFA	Mass of the odd-numbered Fatty Acids extracted from eggs.	micrograms
C14_0_Egg	Concentration of C14:0 fatty acid as the proportion of the mass of the eggs from which the fatty acids were extracted.	unitless

C14_1_Egg	Concentration of C14:1 fatty acid as the proportion of the mass of the eggs from which the fatty acids were extracted.	unitless
C15_0_Egg	Concentration of C15:0 fatty acid as the proportion of the mass of the eggs from which the fatty acids were extracted.	unitless
C15_1_Egg	Concentration of C15:1 fatty acid as the proportion of the mass of the eggs from which the fatty acids were extracted.	unitless
C16_0_Egg	Concentration of C16:0 fatty acid as the proportion of the mass of the eggs from which the fatty acids were extracted.	unitless
C16_1_Egg	Concentration of C16:1 fatty as the proportion of the mass of the eggs from which the fatty acids were extracted.	unitless
C17_0_Egg	Concentration of C17:0 fatty acid as the proportion of the mass of the eggs from which the fatty acids were extracted.	unitless
C17_1_Egg	Concentration of C17:1 fatty acid as the proportion of the mass of the eggs from which the fatty acids were extracted.	unitless
C18_0_Egg	Concentration of C18:0 fatty acid as the proportion of the mass of the eggs from which the fatty acids were extracted.	unitless
C18_1n9_Egg	Concentration of C18:1n9 fatty acid as the proportion of the mass of the eggs from which the fatty acids were extracted..	unitless
cLA_Egg	Concentration of cis-Linoleic Acid as the proportion of the mass of the eggs from which the fatty acids were extracted.	unitless
tLA_Egg	Concentration of trans-Linoleic Acid as the proportion of the mass of the eggs from which the fatty acids were extracted.	unitless
GLA_Egg	Concentration of Gamma-Linolenic Acid as the proportion of the mass of the eggs from which the fatty acids were extracted.	unitless
ALA_Egg	Concentration of Alpha Linoleic Acid as the proportion of the mass of the eggs from which the fatty acids were extracted.	unitless
C20_0_Egg	Concentration of C20:0 fatty acid as the proportion of the mass of the eggs from which the fatty acids were extracted.	unitless
C20_1n9_Egg	Concentration of C20:1n9 fatty acid as the proportion of the mass of the eggs from which the fatty acids were extracted.	unitless
EicoA_Egg	Concentration of Eicosadienoic Acid as the proportion of the mass of the eggs from which the fatty acids were extracted.	unitless
DGLA_Egg	Concentration of Dihomo-Gamma-Linolenic Acid as the proportion of the mass of the eggs from which the fatty acids were extracted.	unitless
AA_Egg	Concentration of Arachidonic Acid as the proportion of the mass of the eggs from which the fatty acids were extracted.	unitless
ETE_Egg	Concentration of Eicosatrienoic Acid as the proportion of the mass of the eggs from which the fatty acids were extracted.	unitless
EPA_Egg	Concentration of Eicosapentaenoic Acid as the proportion of the mass of the eggs from which the fatty acids were extracted.	unitless
DHA_Egg	Concentration of Docosahexaenoic Acid as the proportion of the mass of the eggs from which the fatty acids were extracted.	unitless
O3_Egg	Concentration of Omega-3 Fatty Acids as the proportion of the mass of the eggs from which the fatty acids were extracted.	unitless
O6_Egg	Concentration of Omega-6 Fatty Acids as the proportion of the mass of the eggs from which the fatty acids were extracted.	unitless
HUFA_Egg	Concentration of the highly-unsaturated Fatty Acids as the proportion of the mass of the eggs from which the fatty acids were extracted.	unitless
OFA_Egg	Concentration of the odd-numbered Fatty Acids as the proportion of the mass of the eggs from which the fatty acids were extracted.	unitless

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	Agilent 6890 GC 5975 Mass Spectrometer
Generic Instrument Name	Mass Spectrometer
Generic Instrument Description	General term for instruments used to measure the mass-to-charge ratio of ions; generally used to find the composition of a sample by generating a mass spectrum representing the masses of sample components.

Dataset-specific Instrument Name	
Generic Instrument Name	scale
Generic Instrument Description	An instrument used to measure weight or mass.

[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]