Thalassia testudinum belowground carbohydrate measurements from experimental plots in the Western Atlantic from Winter 2019 (Tropicalization Seagrass Beds project)

Website: https://www.bco-dmo.org/dataset/917954
Data Type: experimental, Other Field Results
Version: 1
Version Date: 2024-01-09

Project
» Collaborative Research: The tropicalization of Western Atlantic seagrass beds (Tropicalization Seagrass Beds)

Contributors	Affiliation	Role
Campbell, Justin	Florida International University (FIU)	Principal Investigator, Contact
Newman, Sawyer	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
This dataset includes seagrass belowground carbohydrates (Thalassia testudinum) from 89 experimental plots distributed across 9 sites in the Western Atlantic. Belowground biomass was collected at the end of the winter season in 2019. This material was then dried, ground to a fine powder and analyzed for soluble carbohydrates by the UC Davis plant lab. Sites include: Bocas del Toro, Panama; Lac Bay, Bonaire; Carrie Bow, Belize; Puerto Morelos, Mexico; Andros, Bahamas; Galveston, Texas; Crystal River, Florida; St. Joes, Florida; and Riddell's Bay, Bermuda.

Table of Contents

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

Coverage

Location: Subtropical Western Atlantic
Spatial Extent: **N**:32.2639 **E**:-64.8307 **S**:9.35161 **W**:-95.171
Temporal Extent: 2019-02 - 2019-03

Methods & Sampling

Sampling details

Small seagrass plots (0.25m2, all comprised of one species, Thalassia testudinum) were established at 9 shallow sites in the western Atlantic. Each plot was assigned to one of two treatments (n=5/treatment): (1) control plot or (2) plots with the canopy fully clipped. Plots were maintained for 12 months, and at the end, seagrass biomass cores (15cm in diameter) were used to harvest belowground plant material in each plot. Belowground biomass (rhizomes only) were separated from all other material, dried to a constant weight in a 60C oven and ground to a fine powder. This belowground material was then sent to the UC Davis plant lab for the analysis of total soluble carbohydrates (glucose, fructose, sucrose) following the protocols of Smith (1969).

Total Glucose for Total Nonstructural Carbohydrate (TNC) and Startch Methods Summary

The dataset shows soluble carbohydrates expressed as a percentage of belowground dry mass. Nonstructural carbohydrates are those that can be accumulated and then readily mobilized in order to be metabolized or translocated to other plant parts. This method quantitatively determines the amount of the total glucose following enzymatic hydrolysis. Total non-structural carbohydrates (TNC) is the sum of total glucose, free fructose and free sucrose. Starch is the total glucose minus the free glucose multiplied by 0.9. The free carbohydrates are determined by a separate analysis. The samples for total glucose are enzymatically hydrolyzed at 55°C with amyloglucosidase for 12 hours and analyzed by HPLC with mass selective detection. The analysis uses a Phenomenex Luna NH2 (250 mm x 4.6 mm) HPLC column at a flow rate of 2.75 mL min-1 acetonitrile:water (78:22).

The method has a detection limit of 0.5% and is reproducible to within 10% (relative).

Smith, Dale. Removing and Analyzing Total Nonstructural Carbohydrates from Plant Tissue. Wisconsin Agric. Exp. Sta. Res. Report 41. 1969.

Site location details

ANDR: Andros, Bahamas (24°53'54.3" N, 77°54'25.2" W)

BERM: Bailey's Bay, Bermuda (32°15'49.9" N, 64°49'50.5" W)

BOCA: Bocas Del Toro, Panama (9°21'05.8" N, 82°15'27.8" W)

BONA: Lac Bay, Bonaire (12°06'44.3" N, 68°13'42.0" W)

CARR: Carrie Bow Cay, Belize (16°49'24.8" N, 88°06'16.2" W)

CAYM: Little Cayman, Cayman Islands (19°40'14.6" N, 80°03'21.3" W)

CORP: Corpus Christi, TX (27°55'47.9" N, 97°02'05.2" W)

CRYS: Crystal River, FL (28°42'50.4" N, 82°49'08.4" W)

ELEU: Eleuthera, Bahamas (25°27'53.5" N, 76°37'35.8" W)

GALV: Galveston, TX (29°02'41.8" N, 95°10'15.7" W)

JOES: St. Joe's Bay, FL (29°42'05.0" N, 85°19'34.6" W)

NAPL: Naples, FL (26°29'48.6" N, 82°09'40.0" W)

PUER: Puerto Morelos, Mexico (20°52'04.5" N, 86°51'35.4" W)

BCO-DMO Processing Description

- removed units from column headers
- converted latitude and longitude columns from degrees, minutes, seconds to decimal degrees
- latitude and longitude values rounded to 6 degrees of precision
- spaces removed from column names and replaced with underscores ("_")
- special characters removed from column names
- split the season field ("Spring 2019") into two separate fields for season ("Spring") and year ("2019")

[table of contents | back to top]

Related Publications

Smith, D. (1969) Removing and Analyzing Total Nonstructural Carbohydrates from Plant Tissue. Research Report No. 41, Wisconsin Agricultural Experiment Station.

Methods
,
Methods

[table of contents | back to top]

Related Datasets

IsRelatedTo

Campbell, J. (2024) **Thalassia testudinum leaf morphometric measurements from experimental plots in the Western Atlantic from Summer 2018 and Winter 2019 (Tropicalization Seagrass Beds project).** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2024-01-09 http://lod.bco-dmo.org/id/dataset/917968 [view at BCO-DMO]

[table of contents | back to top]

Parameters

Parameter	Description	Units
site	Site name / location; ANDR = Andros, Bahamas, BERM = Bailey's Bay, Bermuda, BOCA = Bocas Del Toro, Panama, BONA = Lac Bay, Bonaire, CARR = Carrie Bow Cay, Belize, CAYM = Little Cayman, Cayman Islands, CORP = Corpus Christi, Texas, CRYS = Crystal River, FL, ELEU = Eleuthera, Bahamas, GALV = Galveston, TX, JOES = St. Joe's Bay, FL, NAPL = Naples, FL, PUER = Puerto Morelos, Mexico	unitless
latitude	Site latitude in decimal degrees; a positive value indicates a Northern coordinate	decimal degrees
longitude	Site longitude in decimal degrees; a negative value indicates a Western coordinate	decimal degrees
season	Season sample collection took place	unitless
year	Year sample collection took place	unitless
plot	Plot ID number	unitless
clipping	Level of seagrass plot canopy clipping; no = no clipping, partial = half canopy removed, full = full canopy removed	unitless
nutrients	Level of nutrients; ambient=no added nutrients, enriched=added nutrients	unitless
cage	Level of cage; no=no cage, partial=partial 4-sided cage,full=full cage	unitless
glucose_percentage	Soluble carbohydrates (glucose) expressed as a percentage of belowground dry mass (%)	unitless
sucrose_percentage	Soluble carbohydrates (sucrose) expressed as a percentage of belowground dry mass (%)	unitless
fructose_percentage	Soluble carbohydrates (fructose) expressed as a percentage of belowground dry mass (%)	unitless
total_nonstructural_carbohydrates_percentage	Non-structural carbohydrates percentage total (%)	unitless

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	Oven
Generic Instrument Name	Drying Oven
Dataset-specific Description	For initial processing, belowground biomass was dried in a 60 C oven.
Generic Instrument Description	a heated chamber for drying

Dataset-specific Instrument Name	Phenomenex Luna NH2 HPLC Column
Generic Instrument Name	Ion Chromatograph
Dataset-specific Description	Determination of soluble carbohydrates was completed with a Phenomenex Luna NH2 (250 mm x 4.6 mm) HPLC.
Generic Instrument Description	Ion chromatography is a form of liquid chromatography that measures concentrations of ionic species by separating them based on their interaction with a resin. Ionic species separate differently depending on species type and size. Ion chromatographs are able to measure concentrations of major anions, such as fluoride, chloride, nitrate, nitrite, and sulfate, as well as major cations such as lithium, sodium, ammonium, potassium, calcium, and magnesium in the parts-per-billion (ppb) range. (from http://serc.carleton.edu/microbelife/research_methods/biogeochemical/ic....)

[table of contents | back to top]

Project Information

Collaborative Research: The tropicalization of Western Atlantic seagrass beds (Tropicalization Seagrass Beds)

Website: https://marinegeo.si.edu/research/research-in-action/underwater-meadows-and-resilient-seas

Coverage: Western Atlantic

NSF Award Abstract:
The warming of temperate marine communities is becoming a global phenomenon, producing new biotic interactions that can result in a series of cascading effects on ecosystem structure. For example, the poleward expansion of herbivore populations can lead to the consumption of habitat-forming vegetation, which alters the ecological services provided by coastal environments (a phenomenon known as tropicalization). Many of the habitats at risk, such as kelp forest and seagrass beds, provide foundational habitat that supports complex food webs. Seagrass meadows along the Gulf of Mexico are currently experiencing an influx of tropical grazers, however a integrated understanding of how these communities might ultimately respond is lacking. This project describes the first experiment to quantify the disruptive effect of tropicalization on the ecology of a widely-distributed seagrass. A major contribution of this project will be the development of a seagrass research collaborative network to serve as a platform for broader scientific inquiry and future collaboration. The collaboration spans a total of 11 institutions, and this network will foster extensive collaborations among junior and senior scientists, as well as many undergraduate and graduate students. Given the geographic scope of this work, the research team will further pursue outreach opportunities across the network by hosting a series of public lectures and science café events promoting topics in marine ecology

and conservation.

This study will develop a large-scale manipulative experiment across the Caribbean, premised upon a comparative network of 15 marine sites, which will quantify how temperature and light interact with grazer effects on the dominant tropical seagrass, Thalassia testudinum. Sites have been selected along a latitudinal gradient (from Bermuda to Panama), such that light and temperature vary, allowing the investigators to test for the effects of abiotic factors on the ecological effects of increased grazing (tropicalization simulated via artificial leaf clipping). At each of the 15 marine sites, grazing treatments will be crossed with nutrient manipulations in a factorial design for 18 weeks, after which seagrass structure and functioning will be assessed via measurements of areal productivity, shoot density, aboveground biomass, and carbohydrate storage. Experiments will be conducted both in the summer and winter seasons, when abiotic gradients are at their weakest and strongest, respectively. Emerging statistical techniques in hierarchical mixed modeling and structural equation modeling will further allow for integration of experimental and observational data.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1737247

[table of contents | back to top]