Total lipid measurements for field-collected animals from the Gulf of Mexico Estuary near Port Aransas and Mud Island, Texas from 2020 to 2021

Website: https://www.bco-dmo.org/dataset/908189
Data Type: Other Field Results
Version: 1
Version Date: 2023-09-12

Project
» Counter-gradient Flow of Fatty Acids in Marine Food Webs Through Egg Boons (Egg Boon Food Webs)

Contributors	Affiliation	Role
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Abstract

Total lipid measurements for field-collected animals from the Gulf of Mexico Estuary near Port Aransas and Mud Island, Texas from 2020 to 2021.

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Coverage

Spatial Extent: **N**:27.9362 **E**:-97.0218 **S**:27.8396 **W**:-97.0827
Temporal Extent: 2020-07-04 - 2021-09-10

Methods & Sampling

Location: Gulf of Mexico Estuary near Port Aransas, Texas. FAML: pier at in Corpus Christi Channel, Port Aransas, TX, United States, Fisheries and Mariculture Laboratory of the University of Texas Marine Science Institute (lat. 27.8396111, lon. -97.0827222); MI: Mud Island in Aransas Bay, TX, United States (lat. 27.9362222, lon. -97.0217777)).

Methods & Sampling

Total lipids were measured for samples of marine animals and fish eggs collected from the field. Plankton net (500-μm mesh) samples were sorted immediately after collection (live material). Samples of jellyfish were collected using dip net. Animals were transferred to holding tanks to evacuate their guts for 4-5 hours. Fish were collected using cast net and seines. Fishes were immediately euthanized with lethal dose of MS-222. The euthanized fish were placed on ice and liver was collected. Each sample was rinsed twice in distilled water and frozen at -80°C for subsequent analysis. The time between collection and analysis ranged from 2 months to a year.

For total lipids, each sample was lyophilized, homogenized, and weighed. Total lipid was measured by the phosphosulphovanillin method (Barnes and Blackstock, 1973). Briefly, lipids were cold extracted from lyophilized and homogenized samples with 2:1 chloroform: methanol (v/v). A calibration curve was prepared by performing 1:2 serial dilutions on a cholesterol standard (Millipore-Sigma, Burlington, MA, USA) dissolved in 2:1 chloroform:methanol (v/v). Blank, standards, and extracted lipid samples were reacted with concentrated sulphuric acid and vanillin (vanillin in 4:1 85% phosphoric acid: water v/v) and were run in duplicate. Absorbance was measured using a Spectramax 190 Microplate Reader (Molecular Devices, San Jose, CA, USA) at a wavelength of 520 nm. Total lipids were expressed as mg g−1 dry weight.

Data Processing Description

A calibration curve was obtained by performing 7, 1:2 dilutions on standard stock solution. Standard stock solution was made by dissolving approximately 8 mg cholesterol in approximately 4 ml 2:1 chloroform:methanol. The measured absorbance was subtracted from the blank (2:1 chloroform:methanol), and the calibration curve was used to calculate total lipids in mg g−1dry weight.

BCO-DMO Processing Description

BCO-DMO Data Manager Processing Notes:
* Sheet 1 of file "Total lipid field data.xlsx" (submitted in our online submission system 2023-06-23) was imported into the BCO-DMO data system with values "NA" as missing data values.
** Missing data values are displayed differently based on the file format you download. They are blank in csv files, "NaN" in MatLab files, etc.
* Column names adjusted to conform to BCO-DMO naming conventions designed to support broad re-use by a variety of research tools and scripting languages. [Only numbers, letters, and underscores. Can not start with a number]
* Taxon name and associated LSID for names in this dataset as of 2023-12-01 (source: World Register of Marine Species). Added this list to Methods and Sampling section.
* lat and lon columns were added for sites from locations provided in metadata.

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Data Files

File
908189_v1_total_lipids_field.csv(Comma Separated Values (.csv), 34.82 KB) MD5:4ae4c83bf916107d3a27053f7bb376e6
Primary data table for 908189 version 1

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Supplemental Files

File

Species List and Taxonomic Identifiers

filename: 908189_species_list.csv

(Comma Separated Values (.csv), 4.11 KB)
MD5:642118be5ce9588abbbeb7f910e52a71

Unique species list for this dataset with the matched taxonomic identifiers. Match performed using the World Register of Marine Species (WoRMS) taxa match tool on 2023-12-01. All exact matches to known taxonomic names. Taxon_in_dataset "Salpa" for "salps" was matched to family taxon Salpidae.

columns:
Taxon_in_dataset, Taxon(category) name in the dataset which may contain lifestage terms as well as taxon name (e.g. "Sciaenops ocellatus lab eggs").
ScientificName, Taxon name matched to the "Taxon_in_dataset" which does not include lifestage terms or sp.
Common_name_in_dataset, Common name in the dataset for the category
AphiaID, Taxonomic identifier (AphiaID) for the taxonomic name used in the dataset (see World Register of Marine Species)
LSID, Lifesciences Identifier (LSID) for the taxonomic name used in the dataset.
Taxon status, Status of the name used in the dataset (denotes if the currently accepted name or a currently unaccepted synonym as of the date 2023-12-01)
ScientificName_accepted, The currently accepted name for the taxonomic name used in the dataset.
AphiaID_accepted, The taxonomic identifier (AphiaID) for the currently accepted name (see World Register of Marine Species)

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Parameters

Parameter	Description	Units
Taxon	Taxonomic grouping of sample	unitless
Common_name	Common name of sample	unitless
Sample_ID	Sample identifier for a taxon on a sampling date	unitless
Site	location where sample was collected (FAML: pier at in Corpus Christi Channel, Port Aransas, TX, United States, Fisheries and Mariculture Laboratory of the University of Texas Marine Science Institute; MI: Mud Island in Aransas Bay, TX, United States.	unitless
lat	site latitude	decimal degrees
lon	site longitude	decimal degrees
Date_collected	Date sample was collected. ISO 8601 format.	unitless
Date_analyzed	Date sample was analyzed. ISO 8601 format.	unitless
Tissue	Tissue sampled	unitless
Primary_check	Primany QC check	unitless
Total_lipids	Total lipids	milligrams per gram dry weight (mg g-1 dw)

Instruments

Dataset-specific Instrument Name	Spectramax 190 Microplate Reader
Generic Instrument Name	microplate
Generic Instrument Description	A flat dish with multiple individual wells that are arrayed in a standardized number, size, and arrangement.

Project Information

Counter-gradient Flow of Fatty Acids in Marine Food Webs Through Egg Boons (Egg Boon Food Webs)

Coverage: Gulf of Mexico estuary at Port Aransas, Texas

NSF Award Abstract:
Marine animals release extremely large numbers of eggs when they spawn. Most of these eggs are eaten by animals ranging from microscopic plankton to fish. Many egg consumers are smaller than the animals that released the eggs, representing a reversal of the usual food web. The consumption of eggs provides animals with highly nutritious molecules called essential fatty acids which are very concentrated in eggs. These essential fatty acids are important for the health of animals and the health of the whole ecosystem. When marine fishes form spawning aggregations to coordinate the timing and location of spawning, they release trillions of eggs. This results in an "egg boon" an immense but temporary concentration of highly nutritious fatty acids. This project combines field-based sampling with laboratory experiments to assess how fatty acids in the egg boons affect food webs. The project is determining whether consumption of eggs is beneficial to the condition of the egg consumers. New findings from this project are advancing the understanding of aquatic food webs and contributing to improved management of marine resources. For example, commercial harvest of fish can remove tons of fatty acids from an ecosystem by reducing egg boons and leading to cascading and unforeseen effects on those biological communities. The project is fostering the participation of women in science by substantially advancing the professional training of a female postdoctoral fellow. The project is supporting K-12 STEM education through inquiry-based and place-based programs for teachers and youth. Findings are being communicated to the public locally and nationally through participation in public lectures and contributions to the Science and the SeaTM radio program, podcast, and website.

Super-abundances of eggs released in temporally and spatially discrete patches create pulsed nutritional resources for egg consumers, called "egg boons", which are potentially important components of marine food webs. While various marine animals have been shown to consume eggs, the role of egg boons in energy transfer through food webs has received little attention. Three hypotheses are being tested: 1) egg boons provide a pathway through which essential fatty acids (EFAs) are redistributed counter to the main direction of trophic flow; 2) stores of EFAs in egg consumers increase during egg boons and remain elevated after the spawning season; and 3) egg boons are beneficial to the condition of egg consumers. The proposed research takes advantage of an annual egg boon produced by a spawning aggregation of the marine fish, red drum (Sciaenops ocellatus) near Port Aransas, Texas. In a combination of field sampling and laboratory experiments, fatty acid profiles, lipid content, and bulk stable isotope ratios are measures used to define trophic links between the egg boon and a selection of lower-trophic-level taxa. Egg boons are simulated in laboratory feeding experiments that are designed to enhance interpretation of data collected from field based sampling by comparing taxa that consume fish eggs with those that do not. A nucleic acid biomarker (RNA/DNA ratios) is being used to assess changes in condition that can be attributed to egg consumption in target taxa. In the environment, the importance and persistence of counter-gradient flow of fatty acids in the food web is being gauged through comparisons of samples taken inside and outside the spatial and temporal extent of the egg boon. The effects of egg consumption on consumers is being quantified in controlled experiments to identify dietary biomarkers of egg consumption in consumer tissues that can be applied to field samples. The proposed research examines how egg consumption redistributes EFAs within food webs and provides a context for considering potential controls and trophic bottlenecks that cannot be explained from the traditional element-limitation models. The integration of fatty acid and stable isotope approaches is expected to provide greater resolution for tracking organic matter through food webs and to advance the application of multi-tracer techniques in trophic investigations. Further, if egg boons are indeed an important nutritional subsidy to select groups of consumers, then subsequent studies investigating the energetic contribution of egg boons to secondary production in marine food webs are warranted. An analysis of how reduction or removal of egg resources through the harvest of fishes in spawning aggregations changes nutrient flow in food webs could have implications for ecosystem-based fisheries management.

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-2023618