Adult Black Sea Bass (Centropristis striata) winter survival and lipid accumulation in wild-caught fish in Long Island Sound in Sept of 2022 to Apr of 2023

Website: https://www.bco-dmo.org/dataset/938012
Data Type: Other Field Results
Version: 1
Version Date: 2024-09-23

Project
» Collaborative research: The genomic underpinnings of local adaptation despite gene flow along a coastal environmental cline (GenomAdapt)

Contributors	Affiliation	Role
Baumann, Hannes	University of Connecticut (UConn)	Principal Investigator
Zavell, Max D.	University of Connecticut (UConn)	Student
York, Amber D.	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	Data Manager

Abstract
This dataset contains adult Black Sea Bass (Centropristis striata) winter survival and lipid accumulation in wild-caught fish in Long Island Sound (September 2022 to April 2023). This dataset includes data from fish collected concurrently with those used in a related mesocosm experiment (run Oct 2022 to Apr 2023), with fish collected at the same reef (see 'Related Datasets' section). Study description: We experimentally examined overwintering potential of adult Black Sea Bass (Centropristis striata), an ecologically and economically important fish that seasonally migrates from offshore overwintering grounds to coastal feeding and nursery areas. We collected adults from Long Island Sound in September 2022 and reared them in a laboratory-mesocosm experiment under a contemporary seasonal temperature profile for Long Island Sound (LIS; October 2022 – April 2023) to assess their potential to survive and accumulate lipids throughout the winter. We also fed experimental adults two diet items (blue mussels and Atlantic herring), which are commonly found in Long Island Sound. In addition, we sampled fish from the same reef in LIS at the start (October) and end (April) of the experiment to identify lipid dynamics in wild fish that migrate offshore. Experimental C. striata growth throughout the winter was negligible with high mortality (> 50% observed). While survivors fed herring had higher tissue lipid contents, mortality was 2x higher than for fish fed mussels. In contrast, to the experimental fish, wild-captured fish in the spring had higher gonadosmatic indices than that for survivors across both diet treatments, which was most similar to fall-captured fish. While some fish survived throughout the winter, current winter bottom temperatures still preclude a year-round C. striata presence within Long Island Sound. Overwintering inshore is still disadvantageous compared to seasonally migrating due to surviving experimental fish having lower gonadosomatic indices, suggesting that the offshore overwintering period is a time to build energy reserves. However, as coastal waters continue to warm, changing conditions could lead populations to become year-round residents of Long Island Sound, thus increasing C. striata abundance.

Table of Contents

Coverage

Location: Long Island Sound; Northwest Atlantic shelf
Spatial Extent: **Lat**:41.3045 **Lon**:-71.9332
Temporal Extent: 2022-09-15 - 2023-04-27

Methods & Sampling

17 adult specimens were collected by boat off Stonington Borough, CT (41° 20’37.8” N 71° 54’51.4” W) between September 15th and October 10th, 2022 to act as a wild ‘pre-migratory’ baseline (‘fall’, n = 17) and an additional 21 individuals were collected from the same location on April 27th 2021 to act as a wild “post-migratory” baseline (‘spring’, n = 21). Upon collection, individuals were immediately euthanized with MS-222 and measured for length (TL; 33.7 ± 4.4 cm), body depth (BD; 8 ± 0.9 cm), and wet weight (wW; 532.6 ± 227 g). During dissections, the stomach was removed to calculate a stomachless whole weight to standardize for consumed prey items, and the liver and gonad was then removed, individually weighed (0.01 g) and frozen at -20°C for future lipid extractions. A subsample of dorsally located white muscle tissue was also removed and frozen.

For all adults, we calculated gonadosomatic (GSI; %) and hepatosomatic (HSI; %) indices using stomachless fish mass (wW – stomach mass), to standardize for stomach contents, as {e.g., 100 × [(gonad or liver mass, g) / (stomachless fish mass)].

We quantified gonad, liver, and white muscle, storage lipid, lean-mass, and ash weights of each surviving experimental individual and baseline specimen. Samples were frozen at -50°C for 1 week and remeasured for whole body dry weight (dWb, 0.001 g). Following published protocols (Schultz and Conover 1997, Guo et al. 2021, 2022, Zavell et al. 2023), dried specimens were loaded into preweighed Alundum medium-porosity extraction thimbles and transferred to a custom-designed Soxhlet apparatus, where they were bathed in petroleum ether for 3.5 h to extract all metabolically available lipids. Samples were then dried overnight (60°C) and re-measured, with the change in pre- and post-extraction weights (ΔdW), representing the storage-lipid fraction (dWLipid). Samples were then muffle furnaced for 4 h at 550°C and reweighed with ΔdW, representing the lean-mass fraction (dWLean) and the remaining mass represents the inorganic fraction (dWAsh).

Organism Identifier (LSID, Life Sciences Identifier)
Centropristis striata, urn:lsid:marinespecies.org:taxname:159348

Data Processing Description

See methods section.

BCO-DMO Processing Description

* Sheet "Wild Fish" of submitted file "Adult-BSB-Overwintering-Wild-Fish-BCO-DMO-V4.xlsx" was imported into the BCO-DMO data system as the primary data table for this dataset.
** 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]

* Dates converted to ISO 8601 format
* Latitude and Longitude converted to decimal degree format (South and west are negative). example lon 71.9332°W to -71.9332

Problem Description

The gonads from "fall" wild fish were not saved for lipid / lean analysis, resulting in the blanks within the "wild fish" dataset.

[table of contents | back to top]

Data Files

File
938012_v1_bsb-survival-lipids-wild-fish.csv (Comma Separated Values (.csv), 12.20 KB) MD5:3b0ae1f8f92f4155ba63e3b48230f740 Primary data file for dataset ID 938012, version 1

[table of contents | back to top]

Related Publications

Fulton, T. W. "The Rate of Growth of Fishes. 20th Annual Report of the Fishery Board of Scotland." (1902): 326-446.
Methods

Guo, L. W., Jordaan, A., Schultz, E. T., & McCormick, S. D. (2022). Identification of supraoptimal temperatures in juvenile blueback herring (Alosa aestivalis) using survival, growth rate and scaled energy reserves. Conservation Physiology, 10(1). https://doi.org/10.1093/conphys/coac022
Methods

Guo, L. W., McCormick, S. D., Schultz, E. T., & Jordaan, A. (2021). Direct and size-mediated effects of temperature and ration-dependent growth rates on energy reserves in juvenile anadromous alewives (Alosa pseudoharengus). Journal of Fish Biology, 99(4), 1236–1246. Portico. https://doi.org/10.1111/jfb.14824
Methods

Ricker, W. E. (1975). Computation and interpretation of biological statistics of fish populations. Fish. Res. Board Can. Bull., 191, 1-382.
Methods

Zavell, M. D., Mouland, M. E. P., Matassa, C. M., Schultz, E. T., & Baumann, H. (2023). Temperature- and ration-dependent winter growth in northern-stock Black Sea Bass juveniles. Transactions of the American Fisheries Society, 153(2), 163–179. Portico. https://doi.org/10.1002/tafs.10452
Methods

Zavell, M.D., Mouland, E.P., Barnum, D.L., Matassa, C.M., Schultz, E.T., and Baumann, H. (Submitted). Can adult Black Sea Bass overwinter in Long Island Sound, USA? Submitted to Marine and Coastal Fisheries
Results

[table of contents | back to top]

Related Datasets

IsRelatedTo

Baumann, H., Zavell, M. D. (2024) **Adult Black Sea Bass (Centropristis striata) winter survival and lipid accumulation under varying diet and temperature conditions from a laboratory mesocosm experiment (Oct 2022 to Apr 2023) with individuals collected in Long Island Sound.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2024-09-23 doi:10.26008/1912/bco-dmo.938004.1 [view at BCO-DMO]

Zavell, M. D., Baumann, H. (2023) **Temperature-dependence of juvenile Black sea bass growth and lipid accumulation determined through lab experiments conducted from September 2021 to February 2022 at UConn Avery Point.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2023-07-18 doi:10.26008/1912/bco-dmo.898012.1 [view at BCO-DMO]

Zavell, M. D., Baumann, H. (2023) **Winter growth and lipid accumulation in juvenile Black sea bass**

exposed to varying food and temperature conditions during lab experiments conducted from September 2021 to April 2022 at UConn Avery Point. Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2023-07-18 doi:10.26008/1912/bco-dmo.897895.1 [view at BCO-DMO]

Zavell, M. D., Baumann, H. (2025) **Juvenile Black Sea Bass (Centropristis striata) winter survival and lipid accumulation from a laboratory mesocosm experiment (Oct 2022 to May 2023) with individuals collected from Long Island Sound.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2025-06-24 doi:10.26008/1912/bco-dmo.965079.1 [view at BCO-DMO]

[table of contents | back to top]

Parameters

Parameter	Description	Units
Species	Black Sea Bass - Centropristis striata. LSID: urn:lsid:marinespecies.org:taxname:159348	unitless
Collection_Location	Stonington Borough, CT	unitless
Collection_Longitude	Longitute of collection site (Stonington Borough)	decimal degrees
Collection_Latitude	Latitude of collection site (Stonington Borough)	decimal degrees
Collection_Date	Date of fish collection in the wild	unitless
Sampling_Date	Date of fish sampling	unitless
Fish_ID	ID of each individual fish	unitless
Season	Sampling Season (fall or spring)	unitless
TL	Total length at sampling date	centimenter (cm)
wW	Whole body wet weight at sampling date	grams (g)
Kwet	Fulton's condition index using wet weight at sampling date. Fulton’s Condition Index is: (Weight / TL^3)*100 (see Fulton, TW (1902); Ricker, WE (1975)).	grams per cubic centimeter(g/cm3)
stomach_wW	Stomach weight at sampling date	grams (g)
stomachless_wW	Stomachless weight at tat experiment end (wWF - Stomach.wW)	grams (g)

stomach_content_wW	Weight of stomach contants	grams (g)
gonad_wW	Gonad wet weight at sampling date	grams (g)
gonad_dW	Gonad dry weight at sampling date	grams (g)
liver_wW	Liver wet weight at sampling date	grams (g)
liver_dW	Liver dry weight at sampling date	grams (g)
w_muscle_sub_dW	Dry weight of the subsample of white muscle used to run lipid and lean analysis	grams (g)
Sex	Sex via visual observation of the gonads (M = male, F = female, U = unknown)	unitless
GSI	Gonadosomatic Index (gonad_wW / wWF *100)	percent (%)
HSI	Hepatosomatic Index (liver_wW / wWF *100)	percent (%)
gonad_lipid_g	Total gonad lipid content	grams (g)
gonad_lean_g	Total gonad lean content	grams (g)
liver_lipid_g	Total liver lipid content	grams (g)
liver_lean_g	Total liver lean content	grams (g)
P_gonad_lipid	Percent gonad lipid content (gonad_lipid_g /gonad_dW*100)	percent (%)
P_gonad_lean	Percent gonad lean content (gonad_lean_g/gonad_dW*100)	percent (%)
P_liver_lipd	Percent liver lipid content (liver_lipid_g /liver_dW*100)	percent (%)
P_liver_lean	Percent liver lean content (liver_lean_g/liver_dW*100)	percent (%)
w_muscle_lipid_g	Total white muscle lipid in subsample	grams (g)

w_muscle_lean_g	Total white muscle lean in subsample	grams (g)
p_w_muscle_lip	Percent white muscle lipid content (w_muscle_lipid_g/w_muscle_sub_dW*100)	percent (%)
p_w_muscle_lean	Percent white muscle lean content (w_muscle_lean_g/w_muscle_sub_dW*100)	percent (%)
Notes	Notes	unitless

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	Hach Handheld pH and Temperature probe (HQ2200 Multi/2 Channel)
Generic Instrument Name	Multi Parameter Portable Meter
Generic Instrument Description	An analytical instrument that can measure multiple parameters, such as pH, EC, TDS, DO and temperature with one device and is portable or hand-held.

Dataset-specific Instrument Name	Mettler Toledo Balance (XPR1202S)
Generic Instrument Name	scale or balance
Generic Instrument Description	Devices that determine the mass or weight of a sample.

Dataset-specific Instrument Name	
Generic Instrument Name	Soxhlet extractor
Dataset-specific Description	Custom-designed Soxhlet apparatus for Lipid/Lean analyzes – UConn Storrs – self designed and assembled
Generic Instrument Description	A Soxhlet extractor is a piece of laboratory apparatus designed for the extraction of a lipid from a solid material. The solid is placed in a filter paper thimble which is then placed into the main chamber of the Soxhlet extractor. The solvent (heated to reflux) travels into the main chamber and the partially soluble components are slowly transferred to the solvent.

Dataset-specific Instrument Name	HOBO Pendant MX Water Temperature Data Logger
Generic Instrument Name	Temperature Logger
Generic Instrument Description	Records temperature data over a period of time.

[table of contents | back to top]

Project Information

Collaborative research: The genomic underpinnings of local adaptation despite gene flow along a coastal environmental cline (GenomAdapt)

Website: https://befel.marinesciences.uconn.edu/2018/03/07/research-news-new-nsf-grant-to-study-silverside-genes/

Coverage: Eastern coastline of North America

NSF Abstract:

Oceans are large, open habitats, and it was previously believed that their lack of obvious barriers to dispersal would result in extensive mixing, preventing organisms from adapting genetically to particular habitats. It has recently become clear, however, that many marine species are subdivided into multiple populations that have evolved to thrive best under contrasting local environmental conditions. Nevertheless, we still know very little about the genomic mechanisms that enable divergent adaptations in the face of ongoing intermixing. This project focuses on the Atlantic silverside (Menidia menidia), a small estuarine fish that exhibits a remarkable degree of local adaptation in growth rates and a suite of other traits tightly associated with a climatic gradient across latitudes. Decades of prior lab and field studies have made Atlantic silverside one of the marine species for which we have the best understanding of evolutionary tradeoffs among traits and drivers of selection causing adaptive divergence. Yet, the underlying genomic basis is so far completely unknown. The investigators will integrate whole genome sequencing data from wild fish sampled across the distribution range with breeding experiments in the laboratory to decipher these genomic underpinnings. This will provide one of the most comprehensive assessments of the genomic basis for local adaptation in the oceans to date, thereby generating insights that are urgently needed for better predictions about how species can respond to rapid environmental change. The project will provide interdisciplinary training for a postdoc as well as two graduate and several undergraduate students from underrepresented minorities. The findings will also be leveraged to develop engaging teaching and outreach materials (e.g. a video documentary and popular science articles) to promote a better understanding of ecology, evolution, and local adaptation among science students and the general public.

The goal of the project is to characterize the genomic basis and architecture underlying local adaptation in M. menidia and examine how the adaptive divergence is shaped by varying levels of gene flow and maintained over ecological time scales. The project is organized into four interconnected components. Part 1 examines fine-scale spatial patterns of genomic differentiation along the adaptive cline to a) characterize the connectivity landscape, b) identify genomic regions under divergent selection, and c) deduce potential drivers and targets of selection by examining how allele frequencies vary in relation to environmental factors and biogeographic features. Part 2 maps key locally adapted traits to the genome to dissect their underlying genomic basis. Part 3 integrates patterns of variation in the wild (part 1) and the mapping of traits under controlled conditions (part 2) to a) examine how genomic architectures underlying local adaptation vary across gene flow regimes and b) elucidating the potential role of chromosomal rearrangements and other tight linkage among adaptive alleles in facilitating adaptation. Finally, part 4 examines dispersal - selection dynamics over seasonal time scales to a) infer how selection against migrants and their offspring maintains local adaptation despite homogenizing connectivity and b) validate candidate loci for local adaptation. Varying levels of gene flow across the species range create a natural experiment for testing general predictions about the genomic mechanisms that enable adaptive divergence in the face of gene flow. The findings will therefore have broad implications and will significantly advance our understanding of the role genomic architecture plays in modifying the gene flow - selection balance within coastal environments.

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1536336
NSF Division of Ocean Sciences (NSF OCE)	OCE-1756751
Connecticut Sea Grant (CTSG)	R/LR-30

[table of contents | back to top]