Salinity tolerance of oysters without acclimation in lab conditions: Water Quality

Website: https://www.bco-dmo.org/dataset/870316
Data Type: experimental
Version: 1
Version Date: 2023-02-17

Project
» Collaborative Research: Testing for local adaptation and responses to multiple stressors in populations of eastern oysters inhabiting a natural salinity gradient (Oyster adaptation)

Contributors	Affiliation	Role
Kelly, Morgan	Louisiana State University (LSU)	Principal Investigator
Pollack, Jennifer Beseres	Texas A&M, Corpus Christi (TAMU-CC)	Principal Investigator, Contact
La Peyre, Jerome	Louisiana State University (LSU)	Co-Principal Investigator
Breaux, Natasha	Texas A&M, Corpus Christi (TAMU-CC)	Technician
Palmer, Terry	Texas A&M, Corpus Christi (TAMU-CC)	Data Manager
Soenen, Karen	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
The mortality of oyster spat spawned from four different wild broodstocks (first filial generation) was measured when exposed to five different salinities (without acclimation) under controlled laboratory conditions. Oyster broodstocks were sourced from two populations in Louisiana (Calcasieu Lake; 29°50′58′′N, 93°17′1′′W, and Vermilion Bay; 29°34′47′′N, 92°2′4′′W) and two populations in Texas (Packery Channel; 27°37′38′′N, 97°13′59′′W, and Aransas Bay; 28°7′38′′N, 96°59′8′′W). Mortality was recorded in oyster spat that were exposed to salinities of 2, 4, 20, 38 and 44 without acclimation under laboratory conditions. Changes in water quality and spat size were also recorded.

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Coverage

Spatial Extent: **N**:29.86611 **E**:-92.03444 **S**:27.62722 **W**:-97.23306
Temporal Extent: 2018-11-29 - 2019-04-19

Dataset Description

A detailed description of methods was written by Marshall et al. (2021). In summary, mortality of oyster spat spawned from four different broodstocks was measured when exposed to five different salinities (without acclimation) under controlled laboratory conditions. Oyster broodstocks were sourced from two populations in

Louisiana (Calcasieu Lake; 29°50′58′′N, 93°17′1′′W, and Vermilion Bay; 29°34′47′′N, 92°2′4′′W) and two populations in Texas (Packery Channel; 27°37′38′′N, 97°13′59′′W, and Aransas Bay; 28°7′38′′N, 96°59′8′′W). This salinity tolerance experiment was conducted in November–December 2018 (Trial 1) and March–April 2019 (Trial 2) at Texas A&M University-Corpus Christi.

Methods & Sampling

In each trial, 25 oysters from each stock were placed in labelled petri dishes within 15 38-L tanks (100 oysters per tank) with aerated artificial seawater (using Instant Ocean Reef Crystals Reef Salt, Blacksburg, Virginia) at 25 °C and salinities of 2.0, 4.0, 20.0, 38.0 and 44.0; each salinity treatment was replicated three times (5 salinity treatments × 3 replicate groups = 15 tanks). The temperature of each tank was maintained using Hydor 100W submersible glass aquarium heaters. Oxygen was supplied to each aquarium via air pump/stone, and tanks were heated to approx. 25 oC. Temperature and salinity from each tank were recorded daily. Nutrient (NO2, NO2, NH3/NH4) concentrations in each tank were measured approximately weekly. Oysters were fed daily with Shellfish Diet 1800® at approximately 3mL/100 oysters unless the water was cloudy (i.e., food from the previous day hadn't been consumed). Trial 2 is a repeat of the same experiment conducted in Nov/Dec 2018 using the same oyster stock. The only difference is that three aquaria of salinity 20 were added with no airstone to compare oyster mortality in low and high oxygen concentrations.

Data Processing Description

Every other day, the numbers of live and dead oysters of each stock in each tank were counted over a 3-week period and the dead oysters were removed. Oysters were determined to be dead if their valves (shells) remained open despite any handling.

Water temperature was measured using an aquarium thermometer or YSI ProDSS multiprobe. Salinity was measured using a Fisher Scientific portable refractometer or YSI ProDSS multiprobe. Dissolved oxygen concentrations and saturation, and pH were measured using a YSI ProDSS multiprobe. Nutrients were measured using API test strips or API Liquid Test Kit. YSI ProDSS sensors were calibrated at least weekly.

BCO-DMO processing:
* Added ISO_DateTime_UTC column based on date and time (in CDT) columns.
* Replaced , to ; in comments section to comply with database requirements
* Adjusted column names to comply with database requirements

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Data Files

File
water_quality.csv (Comma Separated Values (.csv), 119.73 KB) MD5:ef7ab3e7a8b5ef90f2d3b6caf1140609 Primary data file for dataset ID 870316

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Related Publications

Marshall, D.A., S.M. Casas, W.C. Walton, F.S. Rikard, T.A. Palmer, N. Breaux, M.K. La Peyre, J. Beseres Pollack, M. Kelly and J.F. La Peyre, Divergence in salinity tolerance of northern Gulf of Mexico eastern oysters under field and laboratory exposure, Conservation Physiology, Volume 9, Issue 1, 2021, coab065, https://doi.org/10.1093/conphys/coab065
Results

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Related Datasets

IsRelatedTo

Pollack, J. B., Palmer, T., Breaux, N., Kelly, M., La Peyre, J. (2023) **Salinity tolerance of oysters without acclimation in lab conditions: mortality.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2023-02-24 doi:10.26008/1912/bco-dmo.870210.1 [view at BCO-DMO]
Relationship Description: Observations of same experiment.

Pollack, J. B., Palmer, T., Breaux, N., Kelly, M., La Peyre, J. (2023) **Salinity tolerance of oysters without acclimation in lab conditions: shell heights.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2023-02-24 doi:10.26008/1912/bco-dmo.870248.1 [view at BCO-DMO]
Relationship Description: Observations of same experiment.

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Parameters

Parameter	Description	Units
Trial	Trial number, trial 1 or trial 2	unitless
Date	Date in CDT timezone in ddMMMyyyy format	unitless
Time	Time in CDT timezone in hh:mm (24 hr) format	unitless
ISO_DateTime_UTC	Sampling date and time in UTC timezone in ISO format	unitless
Tank	Tank	numbered 1-15
Rep	Replicate	numbered 1-3
Treatment	Salinity Treatment (2, 4, 20, 38, 44)	unitless
Temp	Recorded Temperature (YSI ProDSS or aquarium thermometer)	Degrees Celsius (°C)
Salinity	Recorded Salinity (Fisher portable refractometer or YSI ProDSS)	unitless
NH3_NH4	Ammonia/Ammonium (API Test Strips/Liquid Test Kit)	ppm (mg/L)
NO2	Nitrite (Api Test Strips)	ppm (mg/L)
NO3	Nitrate (Api Test Strips)	ppm (mg/L)

pH	pH (YSI ProDSS)	unitless
DO	Dissolved Oxygen (YSI ProDSS)	mg/L
Source	Refractometer or YSI sonde, API strips or test kit	unitless
Heater_Adjusted	Was heater adjusted? Y or N	unitless
F_W_added	Volume of freshwater added	liters (L)
Water_Change	Volume of water (of equal salinity) exchanged with tank	liters (L)
Qty_Fed	Quantity of Reed 1800 Shellfish Diet provided (3mL Disposable Pippette)	mL
Comments	Comments	unitless

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Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	Salinity Sensor
Dataset-specific Description	Fisher Scientific portable refractometer or YSI ProDSS multiprobe
Generic Instrument Description	Category of instrument that simultaneously measures electrical conductivity and temperature in the water column to provide temperature and salinity data.

Dataset-specific Instrument Name	YSI ProDSS multiprobe
Generic Instrument Name	Water Quality Multiprobe
Dataset-specific Description	Water temperature was measured using an aquarium thermometer or YSI ProDSS multiprobe.Dissolved oxygen concentrations and saturation, and pH were measured using a YSI ProDSS multiprobe. YSI ProDSS sensors were calibrated at least weekly.
Generic Instrument Description	An instrument which measures multiple water quality parameters based on the sensor configuration.

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Project Information

Collaborative Research: Testing for local adaptation and responses to multiple stressors in populations of eastern oysters inhabiting a natural salinity gradient (Oyster adaptation)

Coverage: Gulf of Mexico, North America

NSF Award Abstract:

The project focuses on understanding how oysters from different regions in the Gulf of Mexico (GOM) will be affected by ongoing changes to salinity and temperature caused by a warming climate, altered rainfall patterns, and changes in land use in this region. The oyster fishery in the GOM provides more than half of the national total, and these oyster reefs provide water filtration, shoreline stability, and critical habitat for other species. By investigating how present-day oyster populations respond to changes in temperature and salinity, this research will provide valuable information to ecologists, conservation biologists, state managers, and small-scale farmers as they plan for the effects of future changes in the environment. By identifying populations of oysters that are the most resilient to environmental changes, this research will identify potential source populations that may be used in future restoration efforts aimed at declining populations. Additionally this project will integrate research and education through a semester-long immersive research experience. Three undergraduates, two graduate students, and a postdoctoral scholar will be mentored. Public outreach will be conducted through development of middle school lesson plans, public lectures, and dissemination of results to managers.

This research will test whether eastern oysters (Crassotrea virginica) in the Gulf of Mexico are locally adapted to salinity, and whether combined changes in salinity and temperature will have synergistic effects on oyster physiology and ecology. Both temperature and salinity are expected to change rapidly in the Gulf of Mexico over the coming century, due to effects of climate change, altered rainfall patterns, and changes to coastal hydrology. Oysters are a critical habitat-forming species in this region, and while they inhabit a wide range of salinities, preliminary data indicate substantial differences in salinity tolerances among populations. This research will integrate genomic and physiological tools with controlled rearing experiments to (1) quantify genomic variation among populations of C. virginica, (2) test for local adaptation, and (3) measure physiological rates and gene expression as a function of temperature and salinity. The investigators will then use these data to build estuary-specific dynamic energy budget models, linking salinity and temperature to population growth. This project will provide critical support to ongoing restoration efforts, identifying adaptive variation among populations targeted for supportive breeding programs and informing management decisions in the face of ongoing ocean warming and changes to coastal hydrology.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1737207

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