Surveys of inhabitants on the intertidal and subtidal oyster reef in Apalachicola Bay and Ocholckonee Bay, FL, 2013-2019

Website: https://www.bco-dmo.org/dataset/821071
Data Type: Other Field Results
Version: 1
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Project
» Collaborative Research: RAPID: Quantifying mechanisms by which Hurricane Michael facilitates a stable-state reversal on oyster reefs (Oyster Reef Reversal)

Contributors	Affiliation	Role
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Abstract
Surveys of inhabitants on the intertidal and subtidal oyster reef in Apalachicola Bay and Ocholckonee Bay, Florida, 2013-2019. This data includes the total numbers of adults, spat, live oysters, new and old gapers, and whether mussels, barnacles crabs, or gastropods were present.

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Coverage

Spatial Extent: **N**:29.9668 **E**:-84.33371 **S**:29.64192 **W**:-85.18346
Temporal Extent: 2013-01-10 - 2019-12-17

Dataset Description

Surveys of inhabitants on the intertidal and subtidal oyster reef in Apalachicola Bay and Ocholckonee Bay, Florida, 2013-2019. This data includes the total numbers of adults, spat, live oysters, new and old gapers, and whether mussels, barnacles crabs, or gastropods were present.

Methods & Sampling

Site Selection- From Hanley et. al 2019, this was a multi-step process that first involved using ArcGIS to partition the bay's oyster reefs (commercial and non-commercial) into six zones. Zone assignment was based on the reef's relative distance by water from the river input (near, mid, far) as well as a reef's east-west orientation to the river (East Apalachicola and West Apalachicola). Next, we randomly selected three reefs out of all possible reefs (including the experimental reefs) within each zone.

Surveys- Methods for surveys done from 2013-2016 were taken from Hanley et al. 2019.

Surveys 2013-2016-On each reef subtidal reef, we obtained spatially balanced samples by extending four 20 m transects at 90 degree angles from the boat. Along each transect, we overlaid a 0.25 m2 weighted quadrat at the 5, 10, 15, and 20 m marks. For each quadrat, we collected the entire contents of the quadrat into a uniquely labeled mesh bag, transported the bag to the surface, and placed the bag on ice to be processed at the lab. For intertidal reefs, we sampled 2 quadrats per reef, 'low' (located at the low water level) and 'high' (2 m above the low transect) quadrats centered along a 20 m transect on each reef.

Surveys 2019- Sites were selected from previously sampled reefs. Subtidal surveys were conducted by divers on SCUBA. A buoy was dropped at the sites. The divers attached a 10m transect to the buoy and surveyed the area in the four cardinal directions (North, South, East and West). We characterized the substrate 0.5m on each side of the transect as mud, sand or shell hash, as well as quantified the amount of oyster shells and counted the number of Oyster Drills (Stramonita haemastoma). If there were oysters or shells at meter 5 or meter 10 along the transect then everything in a 0.25m2 quadrat was collected and processed at the lab. We only sampled the intertidal sites in December 2019. We laid a transect across the crest of the reef and then divided the length of the transect by 7 to get a consistent sampling interval. At each sampling interval we recorded the width of the sampling side and then placed a 0.0625m2 quadrat at the midpoint of the sampling width and collected all the contents to be brought back to the lab and processed.

Data Processing Description

BCO-DMO Processing Notes:
- data submitted in Excel file "Apalachicola_Data_2013-2019_ABP_4.xlsx" sheet "Survey.totals" extracted to csv
- added conventional header with dataset name, PI name, version date
- modified parameter names to conform with BCO-DMO naming conventions
- replaced missing data 'NA' and 'not entered in origiNAl data' with 'nd'
- changed commas in the notes columns to semicolons
- joined this table with sheet "Reef Location" table in order to include lat/lon info
- re-formatted 'harvest_date' and 'process_date' from m/d/yyyy to yyyy-mm-dd
- re-ordered columns
- sorted rows by {reef_type}{estuary}{region}{distance}{harvest_date}{reef_name}{reef}{transect}{quadrat}

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Data Files

File
survey_totals.csv (Comma Separated Values (.csv), 353.67 KB) MD5:c3e2cf0cd051fffd61e7d1896196fd24 Primary data file for dataset ID 821071

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Related Publications

Hanley, T., White, J., Stallings, C., & Kimbro, D. (2019). Environmental gradients shape the combined effects of multiple parasites on oyster hosts in the northern Gulf of Mexico. Marine Ecology Progress Series, 612, 111–125. doi:10.3354/meps12849
Methods

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Parameters

Parameter	Description	Units
reef_type	whether reef is subtidal or intertidal	unitless
estuary	name of the estuary: Apalachicola or Ocholckonee	unitless
region	region: east/west/Ochlockonee	unitless
distance	distance from the river: zone 1 or 2 or 3. 1 is the closest and 3 is the furthest from freshwater input	unitless
harvest_date	date sample was collected; formatted as yyyy-mm-dd	unitless
reef_name	name of reef	unitless
reef	reef identifier within reef_name categories	unitless
transect	transect identifier: high/low for intertidal; C1/C2/S1/S2 for old reef sampling; N/E/S/W for 2015 sampling; 0/130/240 for 2016 sampling	unitless
quadrat	meter mark of the quadrat; refers to the location along a 20 meter transect at which point the Quadrat was deployed and the sample was taken. Usually quadrats were deployed at 5 meter; 10 meter; 15 meter; and 20 meter marks on the transect tape.	unitless
latitude	latitude; north is positive	decimal degrees
longitude	longitude; east is positive	decimal degrees
process_date	date sample was processed; formatted as yyyy-mm-dd	unitless
days_til_process	days between collection and processing	days
processed	whether the collected sample was processed or not (yes/no)	unitless
wt_samp_kg	sample weight	kilograms
total_adults	total number of adults. Oysters 25mm or greater	oysters
total_spat	total number of spat. Oysters less than 25mm	oysters
total_live	total number of live oysters	oysters
total_newg	total number of new gapers	oysters
total_oldg	total number of old gapers	oysters
muss_present	whether mussels were present: yes/no	unitless
barn_present	whether barnacles were present: yes/no	unitless
transect_stone_crab_burrows	number of stone crabs counted along the transect; only one observation per transect (not per quadrat) so value was assigned to quadrat 5 for each transect for all subtidal reefs; and the first quadrat meter mark for low & high transects at intertidal reefs	burrows
transect_blue_crab	number of blue crabs counted along the transect; only one observation per transect (not per quadrat) so value was assigned to quadrat 5 for each transect for all subtidal reefs; and the first quadrat meter mark for low & high transects at intertidal reefs	blue crabs
transect_drills	number of oyster drills counted along the transect; only one observation per transect (not per quadrat) so value was assigned to quadrat 5 for each transect for all subtidal reefs; and the first quadrat meter mark for low & high transects at intertidal reefs	oyster drills

transect_conch	number of conch counted along the transect; only one observation per transect (not per quadrat) so value was assigned to quadrat 5 for each transect for all subtidal reefs; and the first quadrat meter mark for low & high transects at intertidal reefs	conch
transect_gastropod	conch and drills along the transect were identified in 2016 only. So for 2016; transect_gastropod is the sum of transect_drills and transect_conch; for all other years transect_gastropod is the count of all gastropods observed on the transect (species not id'd or limited to drill and conch)	gastropods
visibility_m	distance visible along underwater transect	meters
notes	notes from a previous data file	unitless
pred_notes	if there were oddities in the predator data; a note was made here	unitless
lat_long_notes	notes about discrepancies or oddities that were found in the data and a decision about which lat/long to use	unitless
data_notes	if there were oddities in the data; a note was made here	unitless

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Instruments

Dataset-specific Instrument Name	Seabird SBE 19plus V2
Generic Instrument Name	CTD Sea-Bird SBE SEACAT 19plus
Dataset-specific Description	Used to measure conductivity, temperature, and pressure and with auxiliary sensors, measures dissolved oxygen, pH, turbidity, fluorescence, oil, PAR, nitrates, altimeter, etc.
Generic Instrument Description	Self contained self powered CTD profiler. Measures conductivity, temperature and pressure in both profiling (samples at 4 scans/sec) and moored (sample rates of once every 5 seconds to once every 9 hours) mode. Available in plastic or titanium housing with depth ranges of 600m and 7000m respectively. Minature submersible pump provides water to conductivity cell.

Dataset-specific Instrument Name	YSI Pro 2030
Generic Instrument Name	Water Quality Multiprobe
Dataset-specific Description	Used to measure dissolved oxygen, temperature, salinity and pH.
Generic Instrument Description	An instrument which measures multiple water quality parameters based on the sensor configuration.

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Project Information

Collaborative Research: RAPID: Quantifying mechanisms by which Hurricane Michael facilitates a stable-state reversal on oyster reefs (Oyster Reef Reversal)

Coverage: Sub-tropic estuarine waters, subtidal and intertidal in Apalachicola Bay and Ocholckonee Bay

NSF Award Abstract:

Ecosystems can exhibit "tipping points" whereby an environmental disturbance pushes an ecosystem into an altered state from which it does not recover, even when the environment normalizes. This may have happened to valuable oyster reefs in Northwest Florida in 2012, when drought and low river flow allowed predators of oysters to flourish and consume nearly all the oysters. Despite subsequent years of normal rainfall and river flow, oysters have not recovered, suggesting the ecosystem may have crossed a tipping point. However, the timing and magnitude of the disturbance from Hurricane Michael (2018) may have pushed the ecosystem back towards its original, healthy state. In this project, investigators make field observations to gauge how predators and oysters are responding to Hurricane Michael and conduct lab experiments to test how predators and oysters respond to hurricane rainfall conditions. Additionally, they use mathematical models to predict whether effects observed in the field and lab could lead to a shift back past the tipping point. This is a rare opportunity to study how oyster ecosystems can shift back from altered to healthy states. However, a rapid response is essential before seasonal changes in the weather and bay obscure hurricane impacts. This research has several broader impacts. First, it will expand the ecological theory of tipping points. Second, it can support the management of the Apalachicola Bay oyster fishery, such as insight into the likely success of restoration efforts. The team coordinates with the Apalachicola National Estuarine Research Reserve to this end. Finally, research outputs are incorporated into ongoing public education and training efforts.

Ecosystems can rapidly shift from their original, high-value state to a new, degraded one. Such shifts have been observed in many ecosystems, but it is sometimes difficult to identify the mechanisms that mediate the shift beyond a "tipping point" and - to a greater extent - those that could mediate a shift back to the original state. Improving our understanding and predictive capability of tipping points depends on identifying the mechanisms that underlie bi-directional system shifts. In 2012, the oyster reefs of Apalachicola Bay, FL abruptly shifted into an oyster-less state when prolonged drought and low river flow allowed marine oyster predators to flourish. Despite subsequent years of normal rainfall and flow, there has not been a return shift, suggesting this ecosystem may have entered an alternate stable state. The hypothesis of this work is that in 2018 Hurricane Michael provided a sufficient disturbance to shift the system back into the attracting basin for its original state (prior observations support this prediction). This project couples field observations and lab experiments with population modeling to test whether and how Hurricane Michael initiated a reversal shift. A rapid response is essential before seasonal variability in this ecosystem obscures hurricane effects. The proposal's intellectual merit is based on its ability to address a central goal in ecology: identifying and predicting ecosystem tipping points. Combining empirical observations and models is a promising approach to advance this goal, but has not been widely applied in the field, mainly because researchers are not in place at the time of a shift. Hurricane Michael provides a unique opportunity to address this knowledge gap.

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.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1917015

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