

Echosounder data from goliath grouper aggregations in Jupiter, FL from August 31 until November 30, 2020.

Website: <https://www.bco-dmo.org/dataset/858599>

Data Type: Other Field Results

Version: 1

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Project

» [Collaborative Research: RAPID: Storm and tropical cyclone effects on the spawning activity, larval dispersal, and ecosystem impacts of an endangered marine predator](#) (Storm effect on predator)

Contributors	Affiliation	Role
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Abstract

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Coverage

Spatial Extent: N:26.98223177 E:-80.0048 S:26.95842445 W:-80.03035344

Temporal Extent: 2020-08-30 - 2020-11-29

Dataset Description

Data have been published “as is”. Final review by the data submitter was not received after it was imported into the BCO-DMO data system.

Methods & Sampling

Hydroacoustic surveys were conducted at three well known artificial reefs in Jupiter, Florida (approximately: 27N, 80W). Sites include MG111 Barge and Warriors Reef (referred to as “mg” in data files), Sun Mariner Tugboat (referred to as “sun” in data files), and the Wreck Train complex (Zion, Miss Jenny, and Esso Bonaire) (referred to as “wrt” in data files). Surveys consisted of 20 350m long evenly spaced (10m) parallel transects.

Two Simrad split-beam echosounders (ES38-10 and ES 120-7C) were towed at approximately 2.5m s⁻¹ on a custom built towfish, approximately 12m behind the research vessel (7m center console). GPS position is referenced at the center of the research vessel, but the correction has not been applied to these data. The distance between echosounders and antenna is approximately 15.5m.

Data were collected in Continuous Wave (pulse duration: 0.256 μ s, sampling interval: 10Hz) and Frequency Modulation (pulse duration: 2.048 μ s, sampling interval: 10Hz) modes at 38kHz (FM: 35-45kHz) and 120kHz (FM: 90-170kHz) between 31 August and November 29, 2020. Data from 31 August to 15 October were collected in CW, and data from 30 October to 29 November were collected in FM. Echosounders were calibrated using standard techniques described by Demer et al. (2015).

Surveys were conducted biweekly during peak new and full moon periods. Missing surveys are attributed to power supply malfunctions and periods of inclement weather.

Data Processing Description

Data were processed in Echoview 11.1.34 (Echoview Software Pty Ltd). Exported survey data were merged into four master survey files based on frequency (38/120kHz) and collection mode (CW/FM). Files included are "cw38_2020_repos.csv", "cw120_2020_repos.csv", "fm38_2020_repos.csv", and "fm120_2020_repos.csv".

CW processing: Bottom and surface exclusion regions were first applied to remove bad data. Impulsive noise and background noise removal algorithms were then used to remove interference produced by the boat and electrical systems based on the techniques presented by Ryan et al. (2015) and De Robertis & Higginbottom (2007). The default Echoview settings were used. Impulse noise was evaluated based using three consecutive pings, and ten samples in the vertical domain. Data were removed if an adjacent region was >10dB greater or less than the reference region. Background noise was evaluated based on 20 consecutive pings, and five samples in the vertical domain. The maximum noise threshold was set to -125dB and the signal-to-noise ratio was set to 10.0. Those samples that did not meet the criteria were excluded. Data were then divided into 5m vertical by 5m horizontal cells and exported as .csv files.

FM processing: Bottom and surface exclusion regions were first applied to remove bad data. Data were then divided into 5m vertical by 5m horizontal cells. No further processing was completed.

Additional dataset description: Each row represents a 5m vertical x 5m horizontal cell along the transect. Individual cells can be identified by interval and layer. "_M" indicates mean for the respective variable. For example, "Time_M" is the mean time within interval "x", and "Lat_M" is the mean latitude within interval "x".

BCO-DMO processing notes:

- merged all 4 datasets into 1 file
- converted data to ISO_DateTime_UTC

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Data Files

File
hydroacoustics_all.csv (Comma Separated Values (.csv), 82.13 MB) MD5:1ec495f8d4707806b23707f9a4d4db8
Primary data file for dataset ID 858599

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Related Publications

De Robertis, A., & Higginbottom, I. (2007). A post-processing technique to estimate the signal-to-noise ratio and remove echosounder background noise. ICES Journal of Marine Science, 64(6), 1282-1291.

doi:[10.1093/icesjms/fsm112](https://doi.org/10.1093/icesjms/fsm112)

Methods

Demer, D. A.; Berger, L.; Bernasconi, M.; Bethke, E.; Boswell, K.; Chu, D.; Domokos, R. Et Al. (2015). Calibration

of acoustic instruments. *ICES*. <https://doi.org/10.17895/ICES.PUB.5494>
<https://doi.org/10.17895/ices.pub.5494>

Methods

Ryan, T. E., Downie, R. A., Kloser, R. J., & Keith, G. (2015). Reducing bias due to noise and attenuation in open-ocean echo integration data. *ICES Journal of Marine Science*, 72(8), 2482–2493. doi:[10.1093/icesjms/fsv121](https://doi.org/10.1093/icesjms/fsv121)
Methods

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Parameters

Parameter	Description	Units
Collection_Mode	Continuous Wave (pulse duration: 0.256 μ s, sampling interval: 10Hz) and Frequency Modulation (pulse duration: 2.048 μ s, sampling interval: 10Hz)	unitless
Frequency	Frequency mode: 38kHz (FM: 35-45kHz) and 120kHz (FM: 90-170kHz)	kHz
Interval	Represents a 5m wide column along transect	unitless
Layer	Represents a 5m high layer in the water column	unitless
Sv_mean	Mean Volume Back Scattering Strength	dB re 1m ⁻¹
NASC	Nautical Area Scattering Coefficient	m ² nmi ⁻²
Depth_mean	Depth of 5m x 5m cel	meters (m)
Date_M	Date of surv	unitless
Time_M	24hr format, UTC	unitless
Lat_M	Mean latitude within a cell	decimal degrees
Lon_M	Mean longitude within a cell	decimal degrees
Beam_volume_sum	Volume of cell determined by echosounder opening angle and depth	meters (m)
Source	Survey ID provides site code, date, and survey period (day/night)	unitless
ISO_DateTime_UTC	description	units

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Instruments

Dataset-specific Instrument Name	Simrad EK80 Scientific Wideband Transceivers
Generic Instrument Name	Simrad EK80 echo sounder
Dataset-specific Description	Simrad EK80 Scientific Wideband Transceivers were used with Simrad ES38-10 and ES120-7C Splitbeam echosounders. Echosounders were calibrated using standard techniques described by Demer et al. (2015).
Generic Instrument Description	A high precision scientific echo sounder, designed to simultaneously operate frequencies ranging from 10 to 500 kHz. EK80 is a modular echo sounder system, and can operate with a combination of split and single beam transducers facilitated by a built-in calibration application. This system was built in succession to the EK60 echo sounder.

Dataset-specific Instrument Name	Simrad ES38-10 and ES120-7C Splitbeam echosounders
Generic Instrument Name	Split-Beam Echosounder
Dataset-specific Description	Simrad ES38-10 and ES120-7C Splitbeam echosounders. Echosounders were calibrated using standard techniques described by Demer et al. (2015).
Generic Instrument Description	"The split-beam echosounder has a transducer which is divided into four quadrants. The target direction is determined by comparing the signals received by each quadrant... The transmission pulse is applied to the whole transducer but the signals received by each quadrant are processed separately... The target strength is estimated from the transducer sensitivity in the relevant direction, namely the beam pattern and the on-axis sensitivity." From "Fisheries Acoustics: Theory and Practice" by E. John Simmonds, D. N. MacLennan, Wiley-Blackwell; 2 edition.

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Project Information

Collaborative Research: RAPID: Storm and tropical cyclone effects on the spawning activity, larval dispersal, and ecosystem impacts of an endangered marine predator (Storm effect on predator)

Coverage: Jupiter, Florida; and Bahamas

NSF Award Abstract:

Many species of reef fish form large seasonal gatherings at specific locations to spawn. Such aggregations may lead to population overfishing if not well managed. Additionally, spawning aggregations in shallow coastal areas may also be susceptible to prolonged surge, high volumes of freshwater run-off and potentially changes in salinity associated with large storms and tropical cyclones. Yet, the impact from such events, which are becoming increasingly prevalent, has not been studied. This study investigates the impacts of hurricane Dorian on spawning activity of the endangered goliath grouper (*Epinephelus itajara*) fish species off the southeast coast of Florida. The broader impacts of the project relate to its value to inform fisheries management plans for goliath grouper. The project supports two early career faculty members and training of a postdoctoral researcher, a graduate student, and several undergraduate students at Florida International University.

Hurricane Dorian occurred at the peak of goliath grouper's spawning aggregation in Florida's shallow waters.

This project takes advantage of ongoing acoustic surveys since 2017, telemetry, biophysical modelling, and behavioral studies of goliath grouper at spawning sites to assess how hurricane Dorian: 1) influenced the duration of spawning events and the size of aggregations, 2) affected individual residency to spawning sites and spawning behavior, 3) changed the dispersal patterns of goliath grouper larvae and identify nursery habitats with/without storm or hurricane events, and 4) influenced trophic cascades at the reef ecosystem level due to goliath grouper spawning aggregations as determined by changes on lower trophic level foraging rates and the subsequent changes to the benthos. The combination of methods provide insight into how storms affects spawning behavior from the individual to the group level, and how subsequent larval recruitment may be influenced. Finally, this project tests the utility of acceleration sensors for identifying spawning behavior in free ranging fishes, which will be of major significance to spawning studies across taxa.

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-2006293
NSF Division of Ocean Sciences (NSF OCE)	OCE-2006295

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