Data Documentation

Dataset Information

Dataset Title:

NCCOS Mapping: Comprehensive Seafloor Substrate Mapping and Model Validation in the New York Bight from 2017-10-20 to 2019-03-27

Description:

This collection of benthic habitat mapping data is an inventory of hydrographic multibeam sonar surveys, georeferenced benthic photographs and video clips, seafloor morphometric analysis, and predictive models all collected in the New York Wind Energy Areas (NYWEA) designated by the Bureau of Ocean Energy Management (BOEM) in the Northeast Atlantic. These areas are located in a region known as the New York Bight, offshore of the New Jersey and Long Island, NY, coastlines. The multibeam data sets contain both bathymetry and backscatter data of the call areas from 2015-2018. Multibeam products were then processed into a series of topographic morphometrics using an R script and the Bathymetry and Reflectivity-based Estimator for Seafloor Segmentation (BRESS) tool. These products were used as predictions for local and regional substrate modeling and habitat characterization. HD underwater video, still photos, and sediment samples were collected in 2018 for ground validation (GV) and accuracy assessment (AA) of the predictive models. All of the seafloor imagery were analyzed and compiled into a comprehensive benthic habitat map of the NYWEA.

Purpose:

In September 2011, BOEM received an unsolicited request from the NY Power Authority (NYPA) for a commercial lease that proposed an offshore wind power project south of Long Island, New York. Subsequently, BOEM determined that competitive interest in the area proposed by NYPA (hereafter referred to as the New York Wind Energy Area, or NYWEA) exists and initiated the competitive leasing process. On June 21, 2016, BOEM and NOAA established an Interagency Agreement to conduct a three-year National Centers of Coastal Ocean Science (NCCOS) study of NYWEA and mid-Atlantic region titled, “Comprehensive Seafloor Substrate Mapping and Model Validation in the Atlantic”. The NYWEA (321 km2), located south of Long Island, was leased to Statoil Wind US LLC (now Equinox Wind US LLC) on December 16, 2016, for commercial wind energy development. The NYWEA offshore wind energy development also furthers New York State’s objective to provide 50% of its electricity from renewable energy by 2030, and to implement a comprehensive Offshore Wind Master Plan. These datasets are to inform BOEM managers on the distribution of substrate, geoforms, and biotic cover of the seafloor for the planning of large scale offshore wind farms.

Methods:

Multibeam sonar data (seabed elevation) and acoustic imagery data (backscatter) were collected using a 400khz Reson 7125 multibeam echosounders (MBES) on the NOAA Ship *Ferdinand Hassler* (2013) and the NOAA Ship *Nancy Foster* (2017-2018). The *Foster* also collected Em710 data during the 2017 survey simultaneously with the Reson 7125 at 100 khz to analyze sub surface sediment textures, and 400 khz Em2040 multibeam which replaced the

7125 in 2018. The *Hassler* survey (H12629) was collected, processed, and archived by the NOAA Office of Coast Survey (OCS) and downloaded from NCEI (https://www.ngdc.noaa.gov/nos/H12001-H14000/H12629.html). The multibeam datasets from the *Foster* were preliminarily processed by NCCOS who conducted initial processing to corrected for motion, sound speed, and other major artifacts using CARIS HIPS and SIPS workflow.

The final data from the *Foster* 2017 survey were processed and reviewed to ensure IHO S-44 specs by SolMar Hydro, using the Smoothed, Best Estimated Trajectory (SBETs) work flow from the Real Time Kinematic Marinestar GPS system. The 2018 data was collected to resurvey areas from the 2017 survey where data quality was poor due to bad weather and seastate, however that survey was affected by bad weather as well and was not used in the habitat mapping analysis or to supersede existing survey data. The backscatter from the multibeam datasets were mosaicked using the Fledermaus Geocoder Toolbox (FMGT) software. Once the bathymetric and backscatter datasets were finalized, a suite of morphometrics were generated using the Bathymetry and Reflectivity-based Estimator for Seafloor Segmentation (BRESS) software, and from an R script created by NCCOS. The morphometrics were used as predictors for the Boosted Regression Tree (BRT) predictions of the benthic substrate, biotic cover, and geoform components using a pixel based classification method.

The *Foster* 2017 mission also collected Simrad EK60 split beam echo sounder (SBES) data to analyze fish and other biota in the water column. These datasets were cleaned and converted into a CSV file using Echoview software then processed into a point density data using an R script. The point density data could then be projected into ArcMap as a shapefile and was then interpolated into a raster for fish distribution analysis.

NCCOS returned to the NYWEA on the R/V *Tiki XIV* in 2018 to collect ground validation and accuracy assessment data using the Seaviewer system and Gopro Hero 4 underwater cameras and sediment grabs using a modified van Veen sampler. The video and contents from the sediment grabs were used to correct the habitat predictions and estimate biogenic cover. Sediment grab samples were sent to TDI-Brooks to be sieved and separated into the Wentworth phi and grainsize classes. The sediment grab data was also projected onto maps of grainsize distribution using Bayesian Kriging. Once the bathymetric models and grab sample data were finalized for the NYWEA priority area, that information were compiled into a regional substrate and hardbottom model using BRT and Max-Ent, respectively.

For more details, see Battista *et al*. (2019).

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Software and Data Sources:

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People & Projects

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- Chris Taylor, NCCOS
- Ian Hartwell, NCCOS
- Andrew Mason, NCCOS
- Juan Ramirez, TDI-Brooks International, Inc.
- Ryan Caillouet, US DOC; NOAA; NMFS; Southeast Fisheries Science Center (SEFSC)

Partners:

- US DOC; NOAA; NOS; Office of Coast Survey

Funding:

- US DOC; NOAA; NOS; National Centers for Coastal Ocean Science (NCCOS)
- US DOI; BOEM; Office of Renewable Energy Programs (OREP)

Associated Projects:

- NCCOS Project #279, BOEM Project #2018-010, "Modeling and mapping marine bird distribution on the U.S. Atlantic Outer Continental Shelf to support offshore renewable energy planning," https://coastalscience.noaa.gov/project/statistical-modeling-marine-bird-distributions/
- NCCOS Project #165, BOEM Project #2016-013, "Benthic Habitat Mapping and Assessment in the Wilmington-East Wind Energy Call Area," https://coastalscience.noaa.gov/project/mapping-biological-assessments-wind-energy-area-north-carolina/

Extents

Start Date:	2017-10-20
End Date:	2019-03-27
Northern Boundary:	41.4411623611
Southern Boundary:	38.0862025278
Western Boundary:	-75.9965530833
Eastern Boundary:	-68.9075817777

Keywords

Sea Areas, Water Bodies, Marine Protected Areas:

- Northeast Atlantic Ocean
- Continental Shelf
- New York Bight
- Sediment Analysis

NOAA Ships, Other Ships, Platforms:

- NOAA SHIP NANCY FOSTER
- NOAA SHIP FERDINAND HASSLER
- M/V TIKI XIII

NCCOS Keywords:

- NCCOS Research Priority > Marine Spatial Ecology
- NCCOS Research Topic > Habitat Mapping
- NCCOS Research Location > Region > East Coast
- NCCOS Research Location > U.S. States and Territories > New York
- NCCOS Research Data Type > Geospatial
- NCCOS Research Data Type > Field Observation
- NCCOS Research Data Type > Derived Data Product

Scientific Keywords:

- Wind Farm
- Renewable Energy
- Sediment Analysis
- Predictive Modeling
- Hardbottom Modeling
- Habitat Modeling
- Multibeam Bathymetry
- Multibeam Backscatter
- Seafloor Morphometrics

GCMD Keywords:

- Earth Science > Biosphere > Ecosystems > Marine Ecosystems > Benthic
- Earth Science > Oceans > Bathymetry/Seafloor Topography > Bathymetry
- Earth Science > Oceans > Bathymetry/Seafloor Topography > Seafloor Topography
- Earth Science > Oceans > Marine Sediments > Biogenic Sediments
- Earth Science > Oceans > Marine Sediments > Sediment Composition
- Continent > North America > United States Of America > New York
- Ocean > Atlantic Ocean > North Atlantic Ocean
- In Situ/Laboratory Instruments > Profilers/Sounders > Acoustic Sounders > MBES > Multibeam Mapping
- In Situ/Laboratory Instruments > Samplers > Grabbers/Traps/Collectors > GRAB SAMPLERS

File Information

Total File Size: 1.16 GB total, 285 files in 8 folders (unzipped), 809 MB (zipped)

Data Files:

- Seafloor Acoustic Data
  - NYWEA_AcousticMultibeamData_Reson7125_Backscatter_8m.tif
  - NYWEA_AcousticMultibeamData_Reson7125_Bathymetry_8m.tif
  - NYBight_HardBottomModeling_Rscript_MeanDepth_200m.tif
- Morphometric Predictors
  - NYWEA_MorphometricAnalysis_BRESS_AreaRatio_8m.tif
  - NYWEA_MorphometricAnalysis_BRESS_AverageAzimuth_8m.tif
  - NYWEA_MorphometricAnalysis_BRESS_AverageHeight_8m.tif
  - NYWEA_MorphometricAnalysis_BRESS_Elongation_8m.tif
  - NYWEA_MorphometricAnalysis_BRESS_HeightRange_8m.tif
  - NYWEA_MorphometricAnalysis_BRESS_HeightVariance_8m.tif
  - NYWEA_MorphometricAnalysis_BRESS_Landforms_8m.tif
  - NYWEA_MorphometricAnalysis_BRESS_MaxHeight_8m.tif
  - NYWEA_MorphometricAnalysis_BRESS_MaxWidth_8m.tif
  - NYWEA_MorphometricAnalysis_BRESS_Segments_8m.tif
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  - NYWEA_MorphometricAnalysis_Rscript_GeneralCurvature_8m.tif
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  - NYWEA_MorphometricAnalysis_Rscript_ProfileCurvature_8m.tif
  - NYWEA_MorphometricAnalysis_Rscript_SineAspect_8m.tif
  - NYWEA_MorphometricAnalysis_Rscript_Slope_8m.tif
  - NYWEA_MorphometricAnalysis_Rscript_SlopeofSlope_8m.tif
  - NYWEA_MorphometricAnalysis_Rscript_StdDevDepth_8m.tif
  - NYWEA_MorphometricAnalysis_Rscript_TotalCurvature_8m.tif
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  - NYBight_HardBottomModeling_Rscript_MeanCosineAspect_200m.tif
  - NYBight_HardBottomModeling_Rscript_MeanGeneralCurvature_200m.tif
  - NYBight_HardBottomModeling_Rscript_MeanPlanCurvature_200m.tif
  - NYBight_HardBottomModeling_Rscript_MeanProfileCurvature_200m.tif
  - NYBight_HardBottomModeling_Rscript_MeanSlope_200m.tif
- Sediment Analysis
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  - NYWEA_SedimentAnalysis_BayKrig_Granules_30m.tif
  - NYWEA_SedimentAnalysis_BayKrig_MedSand_30m.tif
  - NYWEA_SedimentAnalysis_BayKrig_Mud_30m.tif
  - NYWEA_SedimentAnalysis_BayKrig_Pebbles_30m.tif
  - NYWEA_SedimentAnalysis_BayKrig_SmallPebbles_30m.tif
  - NYWEA_SedimentAnalysis_BayKrig_VeryFineSand_30m.tif
  - NYWEA_SedimentAnalysis_BayKrig_VeryCoarseSand_30m.tif
  - NYBight_SedimentAnalysis_IDW3D_MedianGrainSize_200m.tif
  - NYBight_SedimentAnalysis_IDW3D_PercentGravel_200m.tif
  - NYBight_SedimentAnalysis_IDW3D_PercentMud_200m.tif
  - NYWEA_SedimentAnalysis_IDW3D_PercentSand_200m.tif

- Seafloor Predictions
    - NYBight_HardBottomModeling_MaxEnt_CoefVarPredicted_200m.tif
    - NYBight_HardBottomModeling_MaxEnt_MeanPredicted_200m.tif
    - NYWEA_HabitatMaps_BRT_Crustacean_MeanPredicted_8m.tif
    - NYWEA_HabitatMaps_BRT_Crustacean_CoefVarPredicted_8m.tif
    - NYWEA_HabitatMaps_BRT_Echinoderm_MeanPredicted_8m.tif
    - NYWEA_HabitatMaps_BRT_Echinoderm_CoefVarPredicted_8m.tif
    - NYWEA_HabitatMaps_BRT_LessThan5pcentCov_MeanPredicted_8m.tif
    - NYWEA_HabitatMaps_BRT_LessThan5pcentCov_CoefVarPredicted_8m.tif
    - NYWEA_HabitatMaps_BRT_MegaRipple_MeanPredicted_8m.tif
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    - NYWEA_HabitatMaps_BRT_NoCover_MeanPredicted_8m.tif
    - NYWEA_HabitatMaps_BRT_NoCover_CoefVarPredicted_8m.tif
    - NYWEA_HabitatMaps_BRT_Pebbles_MeanPredicted_8m.tif
    - NYWEA_HabitatMaps_BRT_Pebbles_CoefVarPredicted_8m.tif
    - NYWEA_HabitatMaps_BRT_Ripples_MeanPredicted_8m.tif
    - NYWEA_HabitatMaps_BRT_Ripples_CoefVarPredicted_8m.tif
    - NYWEA_HabitatMaps_BRT_CompositeHabitatMap_8m.tif
- Fish Acoustics Analysis
    - NYWEA_FishAcousticsAnalysis_Density_AllFish_150m.tif
    - NYWEA_FishAcousticsAnalysis_Density_LargeFish_150m.tif
    - NYWEA_FishAcousticsAnalysis_Density_MediumFish_150m.tif
    - NYWEA_FishAcousticsAnalysis_Density_SmallFish_150m.tif
- Ground Validation and Accuracy Assessment (GVAA) Data
    - NYWEA_GVAA_SedimentGrabAnalysis_Substrate.shp
    - NYWEA_GVAA_VideoAnalysis_Cover.shp

Data File Formats:

- GeoTiff .TIF (and ancillary files .TFW, .AUX, .OVR, .XML)
- ShapeFile .SHP (and ancillary files .CPG, .DBF, .PRJ, .SBN, .SBX, .SHX, .XML)

Data File Compression: no compression

Data File Resolution:

- 8x8 (NYWEA predictors and predictions)
- 30x30 (NYWEA Sediment Analysis Interp)
- 150x150 (Fish Acoustics)
- 200x200 (Regional predictors and predictions)

GIS Projection: NAD 1983 UTM Zone 17N

Documentation Files:

- BOEM-New-York-Bight_BrowseGraphic.JPG
- BOEM-New-York-Bight_PreviewGraphic.JPG
- BOEM-New-York-Bight_DataDocumentation.PDF
- BOEM-New-York-Bight_DataDictionary_GIS.XLS
- BOEM-New-York-Bight_DataDictionary_GVAA-Benthic-Grab-Analysis.XLS
- BOEM-New-York-Bight_DataDictionary_GVAA-Video-Annotation-Analysis.XLS

Parameter Information

Major parameters:

- Acoustic Bathymetry
- Acoustic Backscatter
- Grain Size Distribution
- Fish Density
- Composite Habitat Type

Parameter Descriptions:

Parameter: Acoustic Bathymetry
Property Type: measured
Units: depth (m)
Observation Category: in situ
Sampling Instrument: Reson 7125 Multibeam Echo sounder
Sampling and Analyzing Method:

Measurement of depth of the seafloor. Acoustic bathymetry was collected aboard NOAA Ships *Hassler* (H12629) and *Foster* (NF1709, W00438) using Reson 7125 multibeam echosounders (MBES) and processed by NCCOS using CARIS HIPS and SIPS software. The raw soundings were cleaned and had sound velocity profiles and GPS navigation applied to create a Combined Uncertainty Bathymetric Estimation (CUBE) surface of the survey area. The Hassler and the Nancy Foster data were merged seamlessly using ArcMap. For more details, see Battista *et al*. (2019).

Data Quality Method:

Bathymetry was vertically and horizontally corrected by the POS MV system to the ellipsoid and then converted to the NOAA Mean-Low Low Water (MLLW) datum for NOAA hydrographic survey specs and deliverables. Acoustic noise and vessel motion artifacts were filtered by setting a threshold of the standard deviations of the nodes form the CUBE surface. For more details, see Battista *et al*. (2019).

Parameter: Acoustic Backscatter
Property Type: measured
Units: decibels (dB)
Observation Category: in situ
Sampling Instrument: Reson 7125 Multibeam Echo sounder
Sampling and Analyzing Method:

Measurement of relative intensity of the sea floor. Acoustic imagery data (backscatter) was collected aboard NOAA Ships *Hassler* (H12629) and *Foster* (NF1709, W00438) using Reson 7125 multibeam echosounders (MBES) and processed by NCCOS using FMGT software. The raw sounding and beam form were combined to create a mosaic of the survey area. Datasets were manually edited for constantly of intensity over multiple years and sampling systems. The intensity mosaics were merged seamlessly using ArcMap. For more details, see Battista *et al*. (2019).

Data Quality Method:

NCCOS reviewed and processed the acoustic imagery (backscatter) aspect data using Fledermaus geocoder toolbox (FMGT). FMGT combined the raw intensity from the MBES with the edited/cleaned bathymetry data from CARIS HDCS to get a mosaic cleared of noise and data artifacts. For more details, see Battista *et al*. (2019).

Parameter: Grain Size Distribution
Property Type: calculated
Units: percent composition
Observation Category: in situ
Sampling Instrument: Van Veen Grab Sampler
Sampling and Analyzing Method:

The grain size distribution models were derived from the Van Veen Grab samples using Bayesian Kriging for the local NYWEA and 3D Inverse Distance weighting for the regional sediment models. Each sediment grab sample had a ~8 oz sub sample TDI-Brooks Int. Laboratories where they were sorted into different grain sizes using a sediment sieve. The local grain size distribution models of the NYWEA were classified using the Phi scale, whereas the Regional models were classified by grouping Phi's into a general sediment texture (gravels, sands, and clays). The results were then interpolated using the two different geostatistical methods and produced a percent distribution model for each grain size class. For more details, see Battista *et al*. (2019).

Data Quality Method:

Samples were homogenized in the field and dried before the sieving process. Samples were kept cool but never frozen to prevent concretionary build up. Each sample was sieved for the same amount of time in the laboratory. The models were all produced using the same thresholds for each grain size. For more details, see Battista *et al*. (2019).

Parameter: Fish Density
Property Type: calculated
Units: Fish per 100m2
Observation Category: in situ
Sampling Instrument: EK60 Split beam Echo sounder
Sampling and Analyzing Method:

The fish densities were derived from the cleaned EK60 data using Echoview software. The fish returns were then spatially modeled into data points using an R-script and then classified into size groups (small, medium, large, and all). Then the four point classes were all converted to raster with a 100m cell size to create an almost continuous surface. For more details, see Battista *et al*. (2019).

Data Quality Method:

Data was thoroughly reviewed by a fisheries scientist before it was classified as a fish density target. Data was not resurveyed between night and day for diel patterns nor was it cleaned for vessel motion. For more details, see Battista *et al*. (2019).

Parameter: Composite Habitat Type
Property Type: calculated
Units: none
Observation Category: model output
Sampling Instrument: Models/Analyses > Data Analysis > Environmental Modeling
Sampling and Analyzing Method:

The final composite map of the of the predicted spatial distribution of three commonly co-occurring combinations of substrate, geoform, and biotic cover types. For more details, see Battista *et al*. (2019).

Data Quality Method:

For more details, see Battista *et al*. (2019).

Document Information

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