Sediment Stability
Northeast United States
February 2016

Prepared for:
Northeast Regional Ocean Council (NROC)
Northeast Ocean Data
www.northeastoceandata.org

Prepared by:
School of Marine Science and Technology (SMAST)
University of Massachusetts Dartmouth
Contact: Dr. Kevin Stokesbury. kstokesbury@umassd.edu

1. INTRODUCTION

This data product shows sediment stability from the southern Mid-Atlantic to the USA-Canadian border on eastern Georges Bank. This is an expansion of previous work by Harris et al. 2012 on Georges Bank. Areas with values between 0 and 1 are considered "Stable" sediments while areas with values above 1 are considered "Unstable" sediments.

This layer was created with substrate information collected by the University of Massachusetts Dartmouth School of Marine Science and Technology (SMAST) video survey from 1999 through 2012 and shear stress estimates from the Northeast Coastal Ocean Forecast System (NECOFS), which is a part of the unstructured Finite-Volume Community Ocean Model (FVCOM) (Chen et al. 2011). With the aid of the commercial scallop fishing industry, the video survey covered the Continental Shelf from the southern Mid-Atlantic to the USA-Canadian border on eastern Georges Bank. The survey followed a centric systematic sampling design, with four quadrats sampled at each station. At each quadrat a pyramid was dropped with two downward looking live feed video cameras and a digital still camera. A third live feed video camera provided a horizontal view across the sea floor. Surficial sediment stability was estimated by determining where benthic shear stresses derived from the ocean model matched or exceeded the critical shear stress of the observed surficial sediments (Harris et al. 2012). Mean maximum bi-weekly benthic boundary shear stresses were estimated using the sum of the M2 (i.e. gravitational pull of the moon) and S2 (i.e. gravitational pull of the sun) constituents of the tidal currents. The logarithmic law of the wall formulation with a depth dependent sea bed roughness (Bradshaw and Huang 1995) was used to derive the stress from the bottom tidal velocities (Harris et al. 2012).

This file was created using the Natural Neighbor (Spatial Analyst) tool with the sediment stability values at all stations observed from 1999 through 2012 as the input point features. Output cell size is 1-km. For visualization purposes, we separated this data product in two: Unstable regimes (values >1) and Stable regimes (values < 1).

2. PURPOSE

The main goal of this project (the "Offshore Video Survey and Oceanographic Analysis: Georges Bank to the Chesapeake") was to provide a better picture of the marine environment on the highly productive U.S. Northeast Shelf, from the Hague Line to the Chesapeake. This project, which was managed by The Nature Conservancy (TNC) and funded by the Gordon and Betty Moore foundation, introduced spatial data products that will significantly advance the understanding of marine habitats and ecological function in the Northwest Atlantic. This study provided new information about several species groups observed in a video survey. Additionally, the project has provided a comprehensive baseline of information on the benthic habitat and associated oceanographic conditions on the U.S. Northeast Shelf at a scale that is useful to fisheries managers, spatial planners, and the wider community of stakeholders.

3. SOURCES AND AUTHORITIES

- Bradshaw, P., Huang, G.P., 1995. The law of the wall in turbulent flow. Proceedings: Mathematical and Physical Sciences 451 (1941), 165–188.
- Chen, C., Huang, H., Beardsley, R.C., Xu, Q., Limeburner, R., Cowles, G.W., Sun, Y., Qi, J., Lin, H., 2011. Tidal dynamics in the Gulf of Maine and New England Shelf: an application of FVCOM. Journal of Geophysical Research, 116.
- Harris, B.P., G.W. Cowles and K.D.E. Stokesbury. 2012. Surficials sediment stability on Georges Bank in the Great South Channel and on eastern Nantucket Shoals. Cont. Shelf Res. 49:65-72.
- Harris, B.P., Stokesbury, K.D.E., 2010. The spatial structure of local surficial sediment characteristics on Georges Bank, USA. Continental Shelf Research 30 (17), 1840–1853.
- Lorang, M.S., Hauer, F.R., 2003. Flow competence and streambed stability: an evaluation of technique and application. Journal of the North American Benthological Society 22 (4), 475–491.

4. DATABASE DESIGN AND CONTENT

Native storage format: ArcGIS File Geodatabase Raster
Columns and Rows: 879, 579
Number of Bands: 1
Cell Size: 1000 meters

Source Type: generic
Pixel Type: floating point
Pixel Depth: 32 Bit
Statistics:
Minimum: 0.0001183969216072001
Maximum: 37.19016265869141
Mean: 0.5699533772925222
Standard Deviation: 0.984567014333734

Dataset Name: SedimentStability, SedimentStabilityStable, SedimentStabilityUnstable

Dataset Status: Complete

5. SPATIAL REPRESENTATION

Reference System: GCS North American 1983
Horizontal Datum: North American Datum 1983
Ellipsoid: Geodetic Reference System 1980
Linear Unit: Meter (1.0)
Angular Unit: Degree (0.0174532925199433)
False Easting: 0.0
False Northing: 0.0
Central Meridian: 0.0

Geographic extent: -75.61 to -66.30, 36.41 to 42.55

IS0 19115 Topic Category: environment, oceans

Place Names:
Atlantic Ocean, Georges Bank, Gulf of Maine, Long Island Sound, Massachusetts Bay, Nantucket Shoals , Wilkinson Basin.

Recommended Cartographic Properties:
(Using ArcGIS ArcMap nomenclature)

Stretch, 1.5 Standard Deviations, color mode: RGB
Dark-blue: 0 – 38 – 115
Light-blue: 207 – 238 – 255
Light-yellow: 255 – 255 – 115
Red: 255 – 0 – 0

Statistics from Custom settings:

Min: 0
Max: 37.2
Mean: 1
Std Dev.: 0.75

Scale range for optimal visualization: 5,000,000

6. DATA PROCESSING

Processing environment: ArcGIS 10.2.2, Spatial Analyst Extension, Windows 7 Professional.

	Process Steps Description
1	Calculate shear stress and sediment stability for each 1 km cell (see introduction and sources for references)
2	Use NATURAL NEIGHBOR function from ArcGIS Spatial Analyst extension to interpolate raster surface, with cell size of 1000m.

7. QUALITY PROCESS

Attribute Accuracy: Original attribution was retained from source material and are considered authoritative.

Logical Consistency: These data are believed to be logically consistent.

Completeness: Data are complete based on input source data from SMAST.

Positional Accuracy: Sample locations based on SMAST video scallop survey. Accuracy based on GPS in video pyramid used for this survey and interpolation method used to derive surface.

Timeliness: Source data are up to date, as of April 2016.

Use restrictions: Not for Navigation

Distribution Liability: Data provided as is. Neither SMAST nor any of the participants on this project makes any warranty, expressed or implied as to the use or appropriateness of use of the enclosed data, nor are there warranties of merchantability or fitness for a particular purpose or use. No representation is made as to the currency, accuracy or completeness of the information in this dataset or of the data sources on which it is based. Neither SMAST nor

any of the participants in this project shall be liable for any lost profits or consequential damages, or claims against the user by third parties.