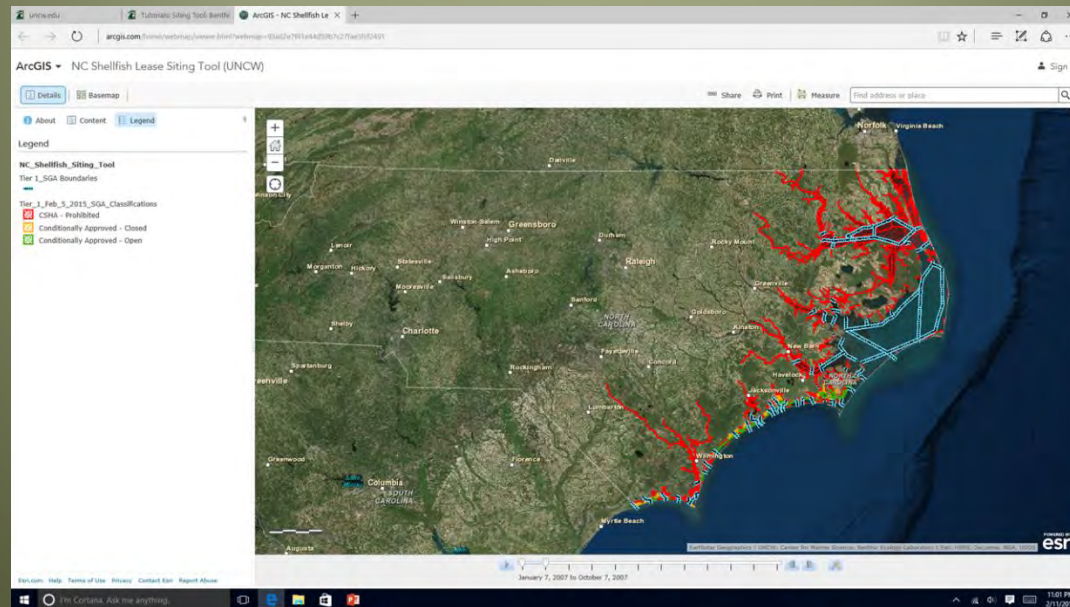


How to use North Carolina Shellfish Aquaculture Siting Tool

Troy D. Alphin,
and Martin Posey

University of North Carolina Wilmington, Center for Marine Science



Today

- What is the tool?
 - Development
- Goals for creating tool
 - Why use it.
- Tutorial
- Coming soon
- Future direction



NC Shellfish GIS Based Siting Tool

- Here we have developed an interactive online tool, specifically designed to help potential Shellfish growers with site selection for further investigation.
- Here we provide visualization of public datasets related to coastal conditions.
- This is not a substitute for on site verification



Special Thanks and Acknowledgments to

- Sharon Tatem
- Megan Rudolf
- Jay Styron
- Patti Fowler
- Brian Conrad
- Brad Pogue
- Matt Hayes



Trend Indicate a Greater Need

- According to NOAA
 - Aquaculture needs to fill a great portion of demand
- Obstacles to the overall industry
 - Regulations
 - Market factors
 - Timing
 - Siting of new operations



NC Grower's Concerned

- Water Quality
- Storms
- Human interactions
- Locations
- Others
 - Marketing
 - Distribution
 - Finance

North Carolina's Shellfish Industry: Site Conditions and Economic Impacts

A statewide survey of shellfish leaseholders



Marc J. Turano, North Carolina Sea Grant
Martin Posey, University of North Carolina Wilmington
Troy Alphin, University of North Carolina Wilmington

North Carolina Coast from Ocracoke to Bald Head Island.

Orthoimagery from NC
Dept. of Agriculture and
Consumer Services.

NCDENR

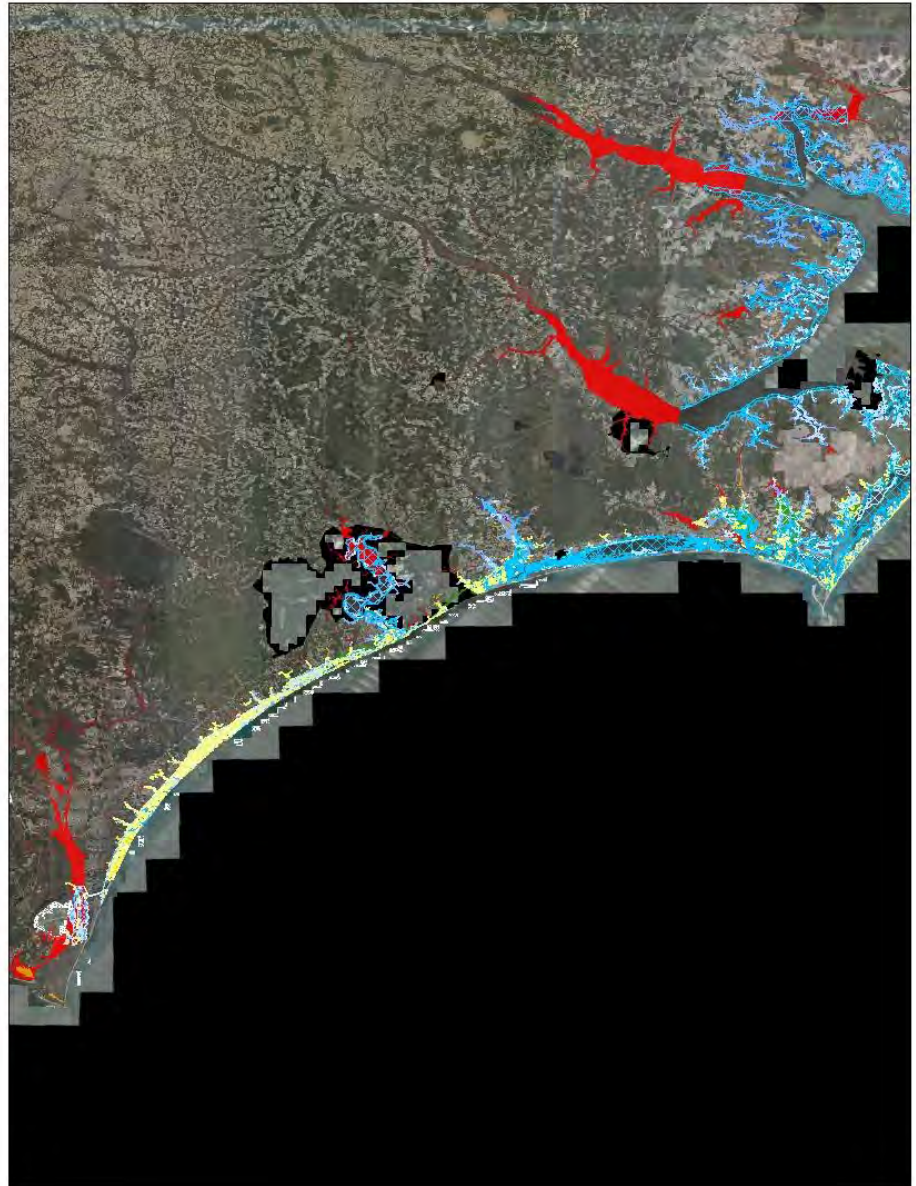
DMF

DCM

NOAA

NCONE MAP

SOSM



How to Select New Areas

- New to the industry or new to the area
- Provides some info on classification and conditions
- Provides only public information
- For those that are familiar with your growing area tool
Historical data and metadata

Starting points

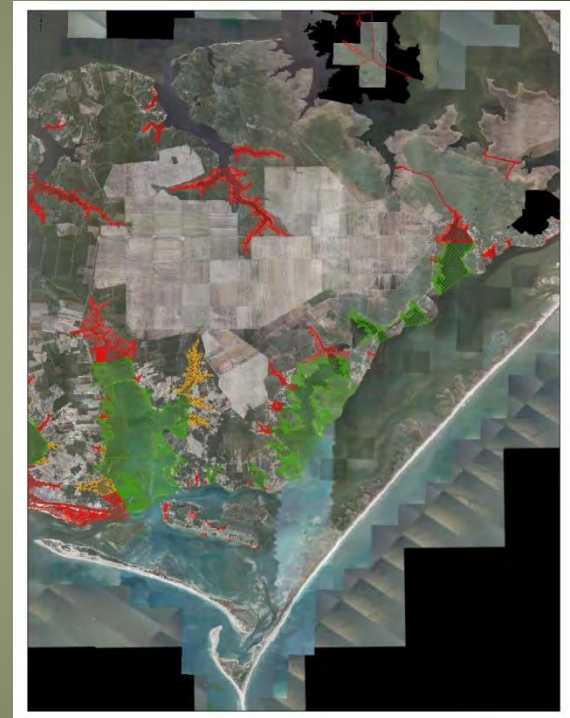
All images display January 2012 Shellfish Growing Areas



Masonboro Sound



Stump Sound



Core Sound

What Parameters are Most Important?

- Tier I
 - Classification
 - Depth
 - Salinity
 - Existing Leases
- Tier II
 - Bottom Type
 - Land-use
 - % impervious surface
 - Rainfall



Classification Only



Legend

Classification SGA_2012_01_23

<all other values>

HA_CLASS

Approved



CSHA - Prohibited



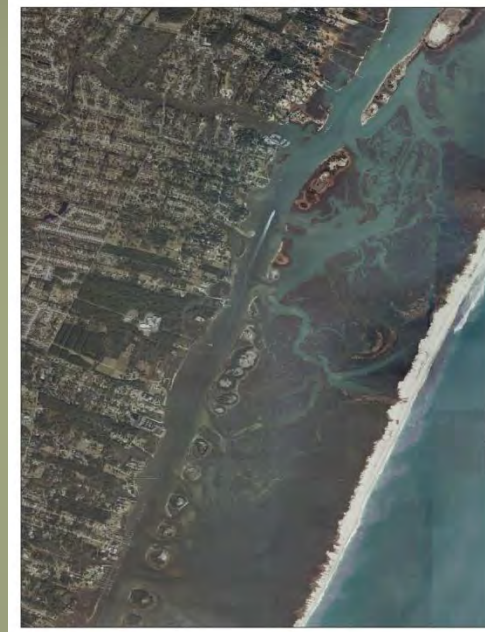
Conditionally Approved - Closed



Conditionally Approved - Open

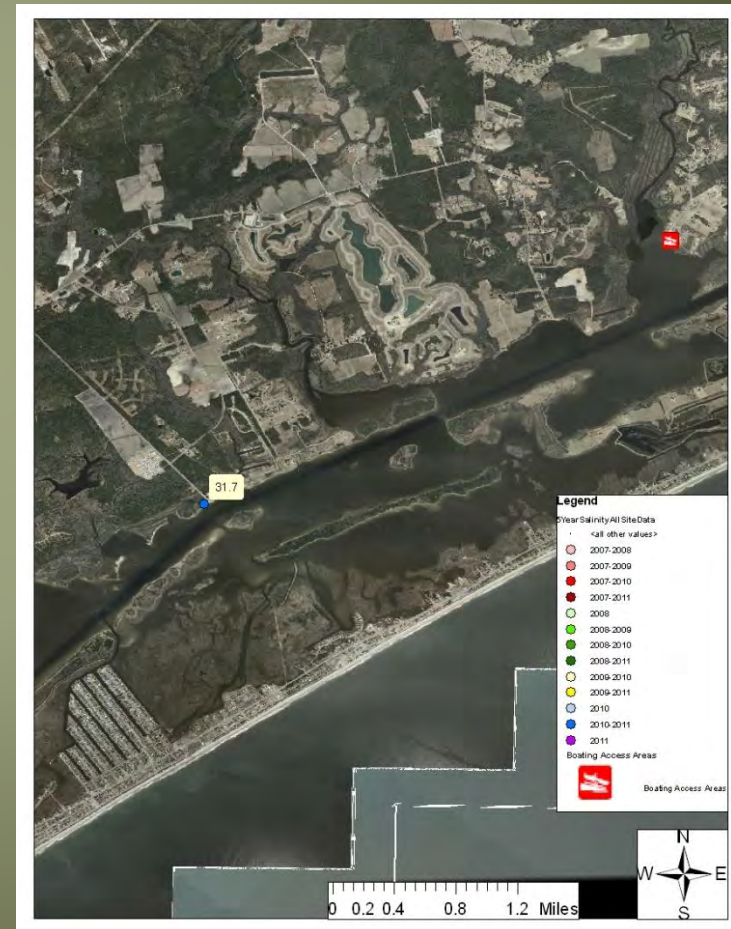
Depth Contour

- Multiple file types
- Differences in precision
- Clarity
- Raster data currently available



Salinity

- No clear comprehensive data set
 - Consistency
 - Missing metadata
- 5 yr mean
 - Min and Max



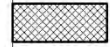
Existing Leases

- Draft data
- Only shows relative size and position
- No identifier in dataset

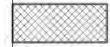
Legend

Shellfish_Leases_and_Franchises_1APR2011

<all other values>



Active



Legal



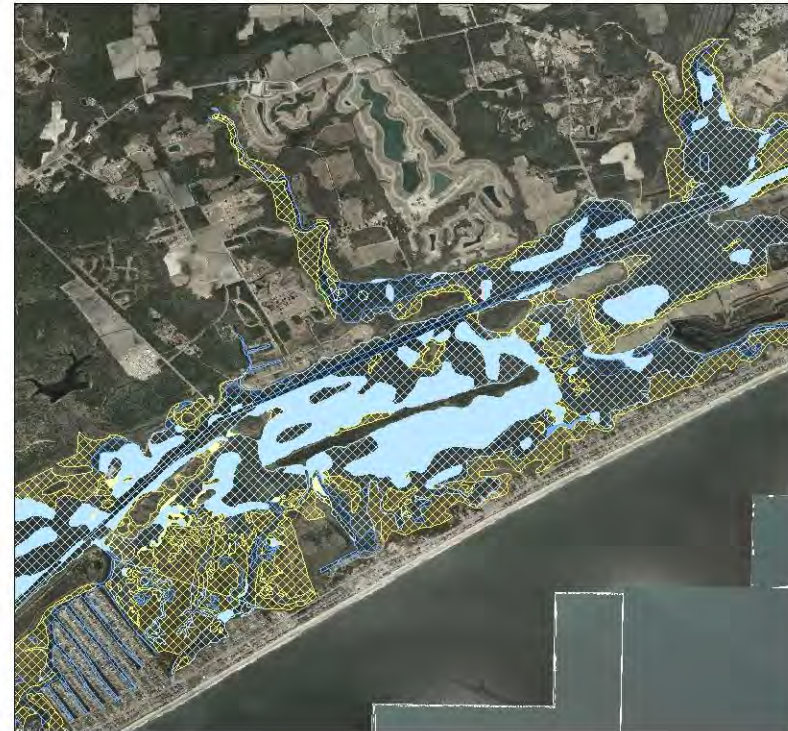
Proposed



Bottom Type Information

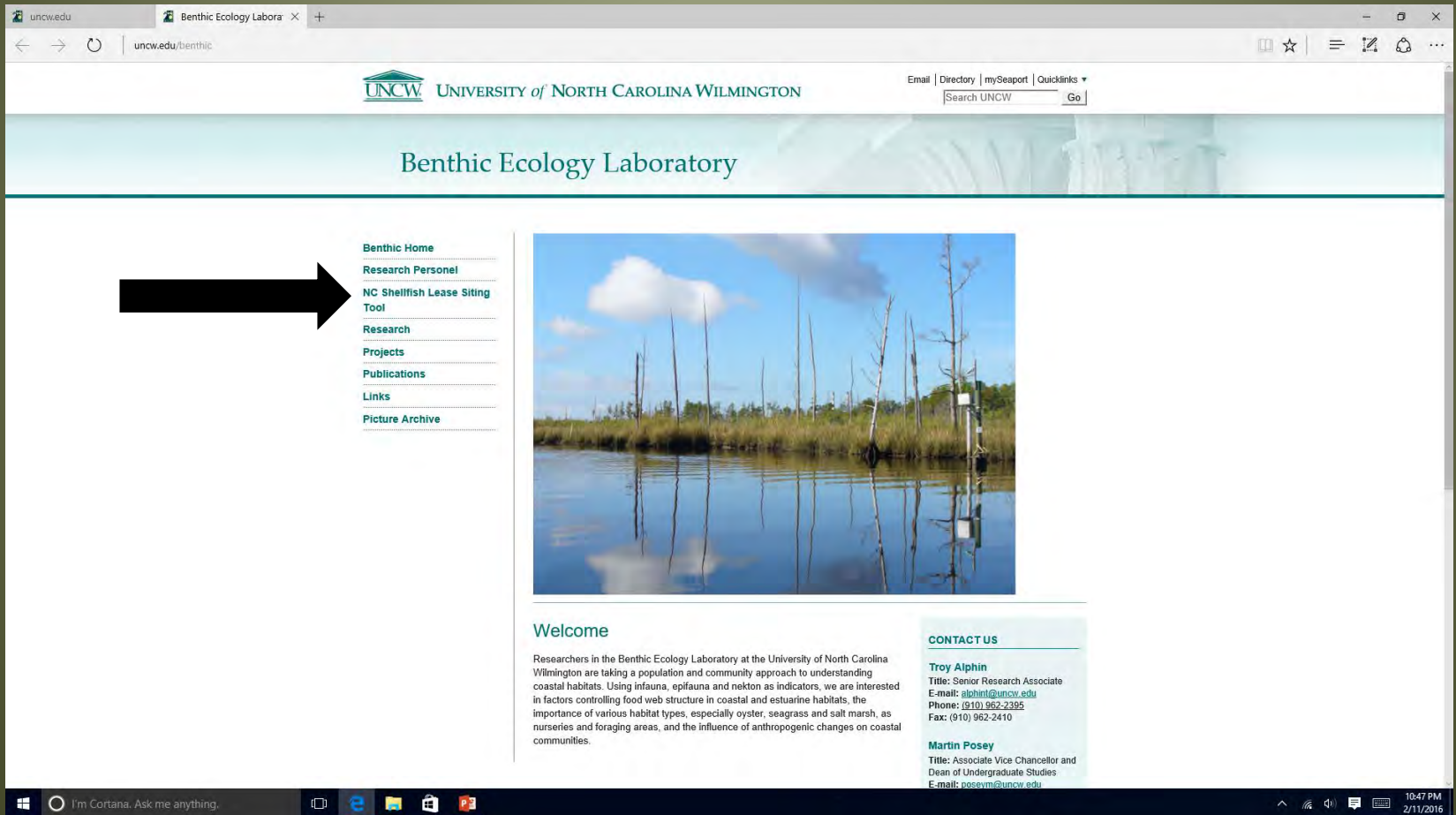
- Draft data
- Data verification
- Note date data was collected

Legend	
Bottom Type	
<all other values>	
STRATA_D	
	Intertidal Firm Non-vegetated Shell
	Intertidal Firm Non-vegetated w/o Shell
	Intertidal Firm Vegetated Shell
	Intertidal Firm Vegetated w/o Shell
	Intertidal Hard Non-vegetated Shell
	Intertidal Hard Non-vegetated w/o Shell
	Intertidal Hard Vegetated Shell
	Intertidal Hard Vegetated w/o Shell
	Intertidal Soft Non-vegetated Shell
	Intertidal Soft Non-vegetated w/o Shell
	Intertidal Soft Vegetated w/o Shell
	Subtidal Firm Non-vegetated Shell
	Subtidal Firm Non-vegetated w/o Shell
	Subtidal Firm Vegetated Shell
	Subtidal Firm Vegetated w/o Shell
	Subtidal Hard Non-vegetated Shell
	Subtidal Hard Non-vegetated w/o Shell
	Subtidal Hard Vegetated Shell
	Subtidal Hard Vegetated w/o Shell
	Subtidal Soft Non-vegetated Shell
	Subtidal Soft Non-vegetated w/o Shell
	Subtidal Soft Vegetated w/o Shell



How does it work

<http://uncw.edu/benthic/>



The screenshot shows a web browser window with the address bar displaying "uncw.edu/benthic". The page header includes the UNCW logo and the text "UNIVERSITY of NORTH CAROLINA WILMINGTON". A navigation bar contains links for "Email", "Directory", "mySeaport", and "Quicklinks", along with a search box labeled "Search UNCW" and a "Go" button. The main heading is "Benthic Ecology Laboratory". On the left, a vertical menu lists: "Benthic Home", "Research Personnel", "NC Shellfish Lease Siting Tool", "Research", "Projects", "Publications", "Links", and "Picture Archive". A large black arrow points to the "Benthic Home" link. To the right of the menu is a large photograph of a coastal wetland with tall grasses and bare trees reflected in the water. Below the photo is a "Welcome" section with text about the laboratory's research focus. On the right side, there is a "CONTACT US" section listing contact information for Troy Alphin and Martin Posey.

uncw.edu Benthic Ecology Labora x +

uncw.edu/benthic

UNCW UNIVERSITY of NORTH CAROLINA WILMINGTON

Email | Directory | mySeaport | Quicklinks

Search UNCW Go

Benthic Ecology Laboratory

Benthic Home

Research Personnel

NC Shellfish Lease Siting Tool


Research

Projects

Publications

Links

Picture Archive



Welcome

Researchers in the Benthic Ecology Laboratory at the University of North Carolina Wilmington are taking a population and community approach to understanding coastal habitats. Using infauna, epifauna and nekton as indicators, we are interested in factors controlling food web structure in coastal and estuarine habitats, the importance of various habitat types, especially oyster, seagrass and salt marsh, as nurseries and foraging areas, and the influence of anthropogenic changes on coastal communities.

CONTACT US

Troy Alphin
Title: Senior Research Associate
E-mail: alaphin@uncw.edu
Phone: (910) 962-2395
Fax: (910) 962-2410

Martin Posey
Title: Associate Vice Chancellor and Dean of Undergraduate Studies
E-mail: poseym@uncw.edu

I'm Cortana. Ask me anything.

10:47 PM 2/11/2016

Contact Info and Tutorials

University of North Carolina Wilmington

The North Carolina Shellfish Siting Tool

Tutorials → [About the Shellfish Industry Tutorials](#)

Contact information → **CONTACT US**

Troy Alphin
Title: Senior Research Associate
E-mail: alaphi@uncw.edu
Phone: (910) 962-2395
Fax: (910) 962-2410

Martin Posey
Title: Associate Vice Chancellor and Dean of Undergraduate Studies
E-mail: mposey@uncw.edu
Phone: (910) 962-3810
Website: www.uncw.edu/bio/faculty_posey.html

Megan Rudolf
Title: Research Technician
E-mail: rudolfm@uncw.edu
Phone: (910) 962-2325
Fax: (910) 962-2410

Our Mailing Address
Benthic Ecology Laboratory
UNCW Center for Marine Science
5600 Marvin K. Moss Lane
Wilmington, NC 28409

IMPORTANT LINKS
[Shellfish Lease and Franchise Program](#)
[NC Shellfish Lease Application](#)
[NC Shellfish Industry Report \(2009-2011\) \(PDF\)](#)

Project Objectives
Promote shellfish aquaculture and expand the industry in North Carolina by:

- ◆ Increase access to, and knowledge of, publicly available datasets.
- ◆ Reduce time involved in selecting an aquaculture site location.
- ◆ Help streamline the shellfish bottom lease site selection process by providing an overview of likely sites in a shellfish growing area.

Project Background

Select Tutorial or Get Started

uncw.edu Tutorials: Siting Tool: Be X +

uncw.edu/benthic/sitingtool/tutorials.html

UNCW UNIVERSITY of NORTH CAROLINA WILMINGTON

Email | Directory | mySeaport | Quicklinks

Search UNCW Go

Benthic Ecology Laboratory

Benthic Home

Research Personnel

NC Shellfish Lease Siting Tool

- About the Shellfish Industry
- Tutorials
- Layers
- Acknowledgements
- Siting Tool Map

Research

Projects

Publications

Links

Picture Archive

Tutorials

These are tutorials on how to use the online NC Shellfish Siting Tool, details of the layers, and the background of the project.

How to Use the NC Shellfish Siting Tool

This video shows step-by-step how to navigate the online map and its functions.

The functions include:

- ~ Expanding the legend
- ~ Turning on and off layers
- ~ Zooming into areas of the map
- ~ Measuring areas and distances
- ~ GPS coordinates of locations
- ~ Search and Query options

To zoom out from a specific area of the map, left click the "x" at the upper corner of the map.

Details of the Layers

This video shows an in-depth review of the layers including viewing the time enabled data of the SGA Classification layer.

The time slider will automatically move and display the classification changes on the map.

THE SITING MAP TOOL

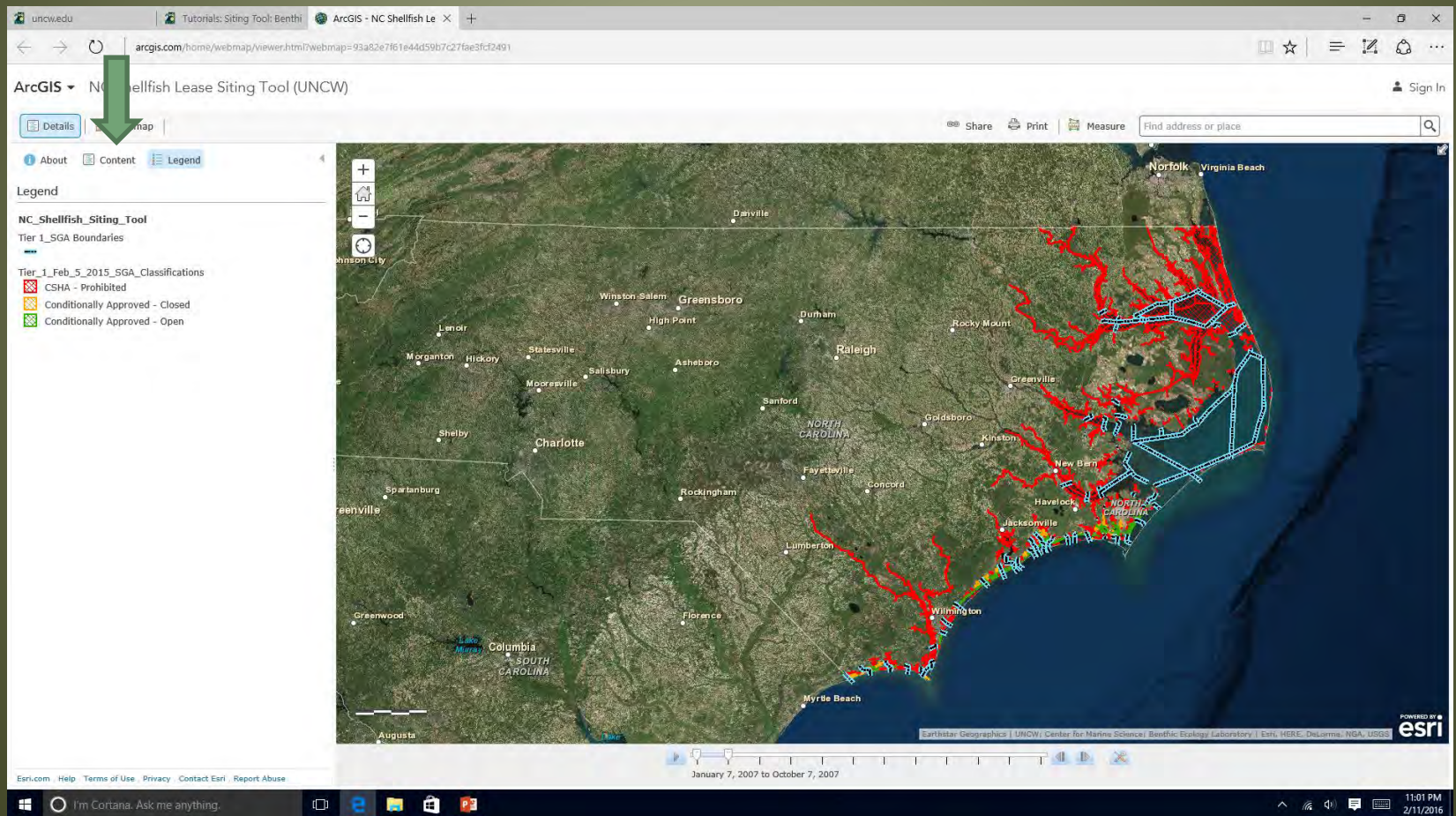
Siting Tool Layers

IMPORTANT LINKS

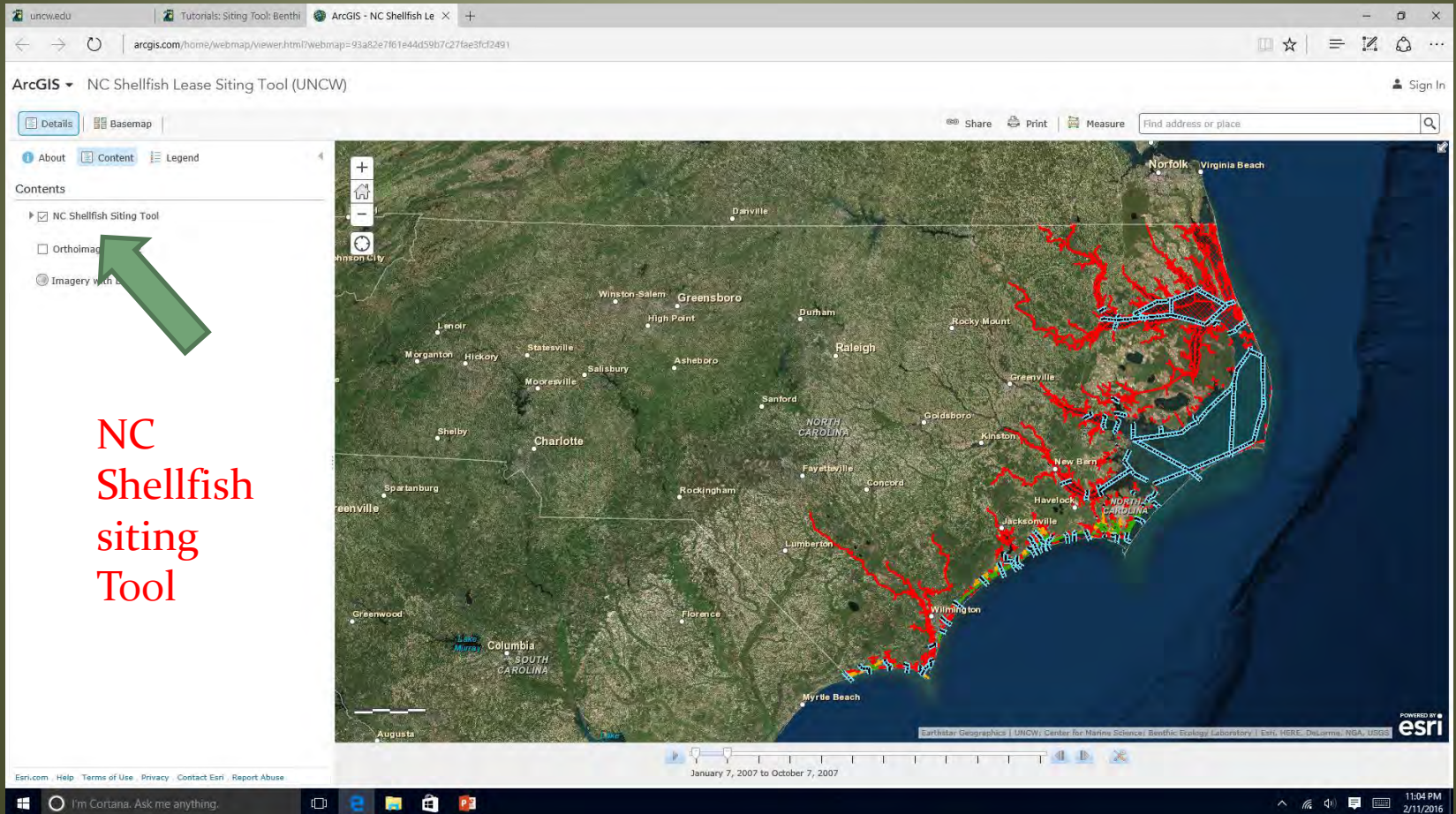
- [Shellfish Lease and Franchise Program](#)
- [NC Shellfish Lease Application](#)
- [NC Shellfish Industry Report \(2009-2011\) \(PDF\)](#)
- [NC Shellfish Sanitation](#)
- [NC Shellfish Closure Maps](#)
- [NC Shellfish Closure Proclamations](#)

← The Map Tool

The Starting Map



Reveal the Layers



The screenshot shows the ArcGIS web application interface for the 'NC Shellfish Lease Siting Tool (UNCW)'. The browser address bar displays the URL: arcgis.com/home/webmap/viewer.html?webmap=93a82e7161e44d59b7c27fae3fd2491. The interface includes a 'Details' tab, a 'Basemap' button, and a 'Share' button. The 'Contents' panel on the left lists the following layers:

- ☒ NC Shellfish Siting Tool
- ☐ Orthoimag
- ☐ Imagery with L

A green arrow points to the 'NC Shellfish Siting Tool' layer. The map displays the coastal region of North and South Carolina, with various lease areas highlighted in red and blue. The map includes a scale bar and a date range from January 7, 2007 to October 7, 2007. The bottom of the screen shows the Windows taskbar with the time 11:04 PM and date 2/11/2016.

uncw.edu | Tutorials: Siting Tool: Benthic | ArcGIS - NC Shellfish Le...

arcgis.com/home/webmap/viewer.html?webmap=93a82e7161e44d59b7c27fae3fc2491

ArcGIS - NC Shellfish Lease Siting Tool (UNCW)

Share | Print | Measure | Find address or place

About | Content | Legend

Contents

- ☒ NC Shellfish Siting Tool
 - ☐ Tier 1 2007-2015 Salinity, Water, Air, and Rain
 - ☒ Tier 1 SGA Boundaries
 - ☐ Tier 1 Shellfish Leases
 - ☒ Tier 1 Feb 5 2015 SGA Classifications
 - ☐ Tier 1 2007-2015 SGA Classifications
 - ☐ Tier 1 NC Depths (feet)
 - ☐ Tier 2 Boating Access Areas
 - ☐ Tier 2 Artificial Reefs
 - ☐ Tier 2 Rivers and Streams
 - ☐ Tier 2 Submerged Aquatic Vegetation
 - ☐ Tier 2 Fishing Nursery Areas
 - ☐ Tier 2 Bottom Type
 - ☐ Tier 2 Lands Managed
 - ☐ Tier 2 NC Land Cover
 - ☐ Orthoimagery 2012
 - ☒ Imagery with Labels

January 7, 2007 to October 7, 2007

Powered by Esri

Esri.com | Help | Terms of Use | Privacy | Contact Esri | Report Abuse

I'm Cortana. Ask me anything.

11:07 PM 2/11/2016

Focus on Target area

uncwedu | Tutorials: Siting Tool: Benthic | ArcGIS - NC Shellfish Le...

arcgis.com/home/webmap/viewer.html?webmap=93a82e7f61e44d59b7c27fae3fc2491

ArcGIS - NC Shellfish Lease Siting Tool (UNCW)

Details | Basemap

Share | Print | Measure | Find address or place

Sign In

About | Content | Legend

Contents

- ☒ NC Shellfish Siting Tool
 - ☐ Tier 1 2007-2015 Salinity, Water, Air, and Rain
 - ☒ Tier 1 SGA Boundaries
 - ☐ Tier 1 Shellfish Leases
 - ☒ Tier 1 Feb 5 2015 SGA Classifications
 - ☒ Tier 1 2007-2015 SGA Classifications
 - ☒ CSHA - Prohibited
 - ☐ Conditionally Approved - Closed
 - ☐ Conditionally Approved - Open
 - ☐ Tier 1 NC Depths (feet)
 - ☐ Tier 2 Boating Access Areas
 - ☐ Tier 2 Artificial Reefs
 - ☐ Tier 2 Rivers and Streams
 - ☐ Tier 2 Submerged Aquatic Vegetation
 - ☐ Tier 2 Fishing Nursery Areas
 - ☐ Tier 2 Bottom Type
 - ☐ Tier 2 Lands Managed
 - ☐ Tier 2 NC Land Cover
- ☐ Orthoimagery 2012

Imagery with Labels

USDA FSA, Microsoft | UNCW: Center for Marine Science; Benthic Ecology Laboratory | State of North Carolina DOT, Esri, HERE,...

January 7, 2007 to October 7, 2007

11:11 PM 2/11/2016

Turn on as Many Layers as Needed

ArcGIS - NC Shellfish Le

arcgis.com/home/webmap/viewer.html?webmap=93a82e7f61e44d59b7c27fae3fc2491

ArcGIS - NC Shellfish Lease Siting Tool (UNCW)

Details Basemap

Share Print Measure Find address or place

About Content Legend

Contents

- ☒ NC Shellfish Siting Tool
 - ☐ Tier 1 2007-2015 Salinity, Water, Air, and Rain
 - ☒ Tier 1 SGA Boundaries
 - ☒ Tier 1 Shellfish Leases
 - ☐ Active
 - ☐ Legal
 - ☐ Proposed
 - ☒ TERMINATED
 - ☒ Tier 1 Feb 5 2015 SGA Classifications
 - ☒ Tier 1 2007-2015 SGA Classifications
 - ☒ CSHA - Prohibited
 - ☐ Conditionally Approved - Closed
 - ☐ Conditionally Approved - Open
 - ☐ Tier 1 NC Depths (feet)
 - ☐ Tier 2 Boating Access Areas
 - ☐ Tier 2 Artificial Reefs
 - ☐ Tier 2 Rivers and Streams
 - ☐ Tier 2 Submerged Aquatic Vegetation
 - ☐ Tier 2 Fishing Nursery Areas
 - ☐ Tier 2 Bottom Type
 - ☐ Tier 2 Lands Managed

Map showing various shellfish lease areas and classifications. Labels include: Snedds Ferry, Alligator Bay, Chowhatchee Bay, Howard Bay, and Mumfords Bay. A scale bar indicates distances from 0 to 1 mile. The map is powered by Esri.

January 7, 2007 to October 7, 2007

11:13 PM 2/11/2016

Explore the Data Source and Attributes

uncw.edu | Tutorials: Siting Tool: Benthic | ArcGIS - NC Shellfish Le... | Layer: Tier 2_Submerged Aq

arcgis.com/home/webmap/viewer.html?webmap=93a82e7f61e44d59b7c27fae3fcf2491

ArcGIS - NC Shellfish Lease Siting Tool (UNCW)

Details | Basemap

Share | Print | Measure | Find address or place

About | Content | Legend

Contents

- NC Shellfish Siting Tool
 - ☐ Tier 1 2007-2015 Salinity, Water, Air, and Rain
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 - ☐ Tier 1 Shellfish Leases
 - ☒ Tier 1 Feb 5 2015 SGA Classifications
 - ☒ Tier 1 2007-2015 SGA Classifications
 - CSHA - Prohibited
 - Conditionally Approved - Closed
 - Conditionally Approved - Open
 - ☐ Tier 1 NC Depths (feet)
 - ☐ Tier 2 Boating Access Areas
 - ☐ Tier 2 Artificial Reefs
 - ☐ Tier 2 Rivers and Streams
 - ☒ Tier 2 Submerged Aquatic Vegetation
 - DENSE
 - PATCHY
 - ☐ Tier 2 Fishing Nursery
 - ☐ Tier 2 Bottom Type
 - ☐ Tier 2 Lands Managed
 - ☐ Tier 2 NC Land Cover

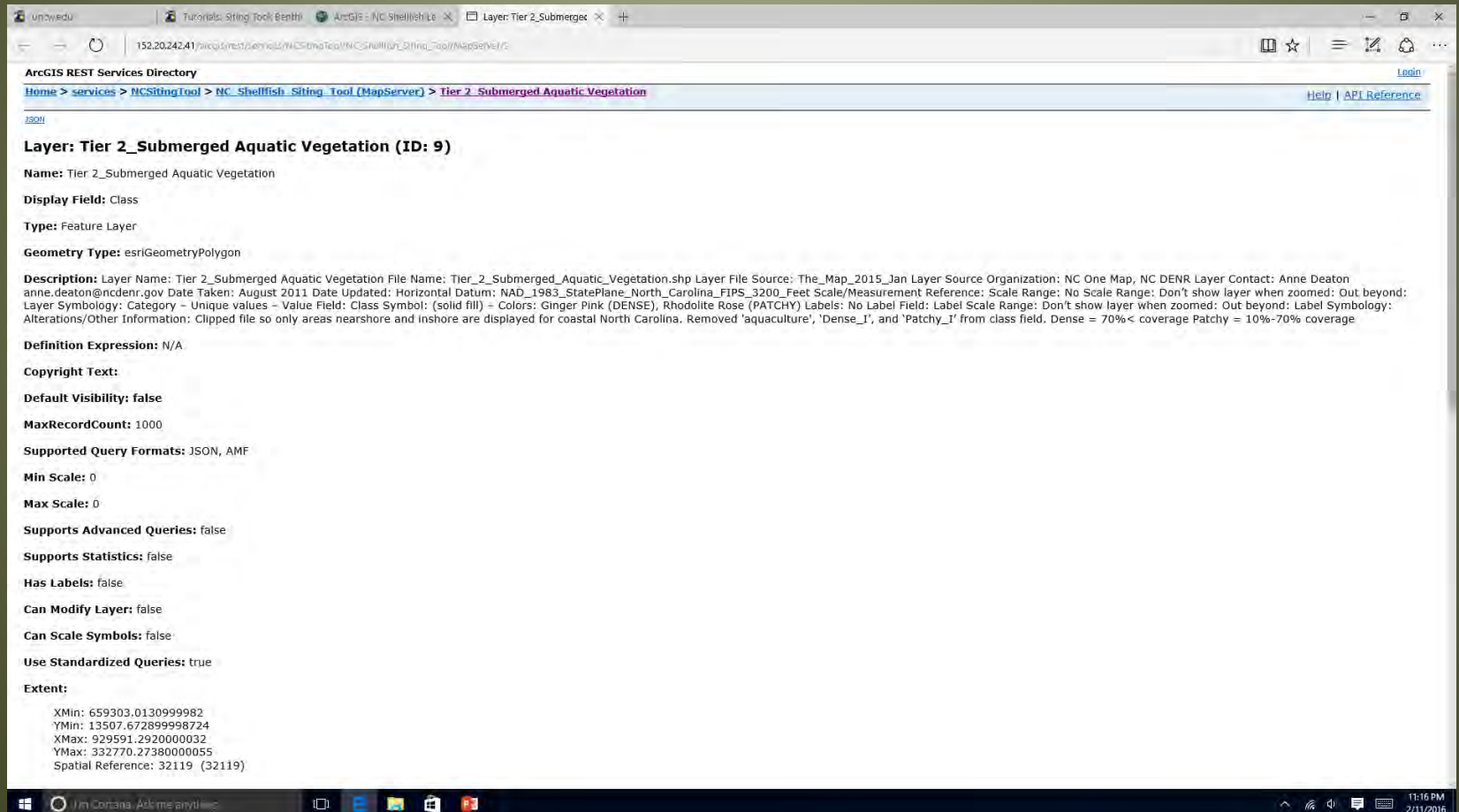
January 7, 2007 to October 7, 2007

USDA FSA, Microsoft | UNCW: Center for Marine Science; Benthic Ecology Laboratory | State of North Carolina DOT, Esri, HERE,...

POWERED BY esri

11:17 PM 2/11/2016

Information on Data Source



The screenshot shows a web browser window displaying the ArcGIS REST Services Directory. The browser's address bar shows the URL: `152.20.242.41/arcgis/rest/services/NC_Sheffish_Siting_Tool/MapServer/0`. The page title is "ArcGIS REST Services Directory". The breadcrumb navigation is: [Home](#) > [services](#) > [NC_Sheffish_Siting_Tool \(MapServer\)](#) > [Tier 2_Submerged Aquatic Vegetation](#). There are links for [Help](#) and [API Reference](#) in the top right corner, and a [Login](#) link.

Layer: Tier 2_Submerged Aquatic Vegetation (ID: 9)

Name: Tier 2_Submerged Aquatic Vegetation

Display Field: Class

Type: Feature Layer

Geometry Type: esriGeometryPolygon

Description: Layer Name: Tier 2_Submerged Aquatic Vegetation File Name: Tier_2_Submerged_Aquatic_Vegetation.shp Layer File Source: The_Map_2015_Jan Layer Source Organization: NC One Map, NC DENR Layer Contact: Anne Deaton anne.deaton@ncdenr.gov Date Taken: August 2011 Date Updated: Horizontal Datum: NAD_1983_StatePlane_North_Carolina_FIPS_3200_Feet Scale/Measurement Reference: Scale Range: No Scale Range: Don't show layer when zoomed: Out beyond: Layer Symbology: Category - Unique values - Value Field: Class Symbol: (solid fill) - Colors: Ginger Pink (DENSE), Rhodolite Rose (PATCHY) Labels: No Label Field: Label Scale Range: Don't show layer when zoomed: Out beyond: Label Symbology: Alterations/Other Information: Clipped file so only areas nearshore and inshore are displayed for coastal North Carolina. Removed 'aquaculture', 'Dense_I', and 'Patchy_I' from class field. Dense = 70%< coverage Patchy = 10%-70% coverage

Definition Expression: N/A

Copyright Text:

Default Visibility: false

MaxRecordCount: 1000

Supported Query Formats: JSON, AMF

Min Scale: 0

Max Scale: 0

Supports Advanced Queries: false

Supports Statistics: false

Has Labels: false

Can Modify Layer: false

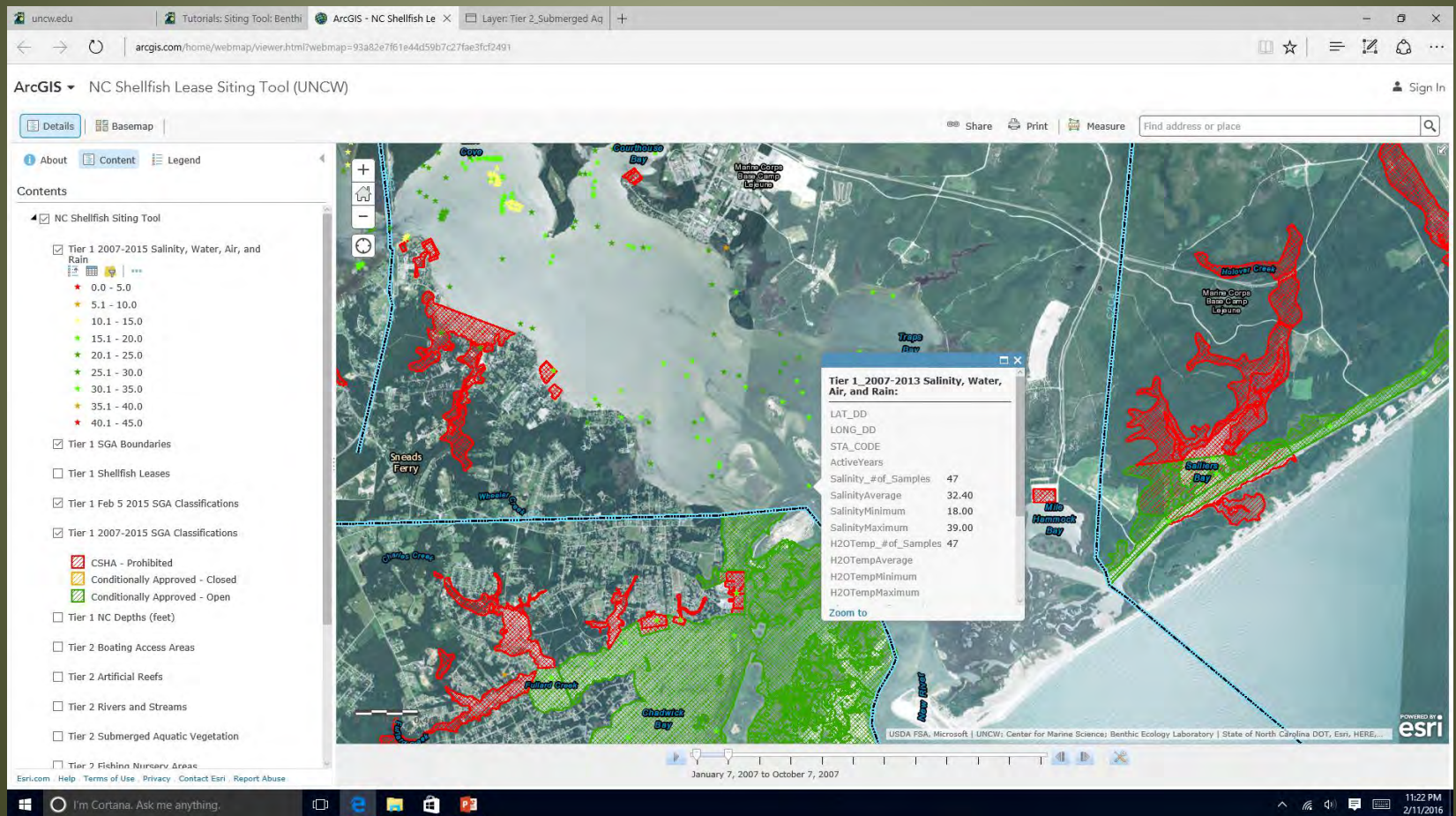
Can Scale Symbols: false

Use Standardized Queries: true

Extent:

XMin: 659303.0130999982
YMin: 13507.672899998724
XMax: 929591.2920000032
YMax: 332770.27380000055
Spatial Reference: 32119 (32119)

Explore Information cont'd



Coming Soon

- Rainfall data (source and documentation)
- Chl *a*
- Verification of existing data and % change
- Data Gap ID
- More user friendly
- Feedback tool

NC Siting Tool Reference Information for Shellfish Lease Sites

Leasee: _____ Contact Information: _____

Site Label: _____

GPS Location: _____ W _____ N

Tier 1:

Shellfish Growing Area: _____

Shellfish Growing Area Classification (circle appropriate answer): _____ Open

CSHA-Prohibited Conditionally Approved-Open Conditionally Approved-Closed

Leases present in area (circle one): None Yes

If Yes, give information: _____

Depth: _____ meters _____ feet

Tier 2:

Submerged Aquatic Vegetation status (circle one): None Yes

If Yes (circle appropriate answer): Aquaculture Dense Patchy

Fishing Nursery Area Classification (circle appropriate answer): None Yes

If Yes (circle appropriate answer): Permanent Secondary Nursery Area

Primary Nursery Area Special Secondary Nursery Area

Bottom Type (circle appropriate answers): Non-vegetated Vegetated

Intertidal Subtidal

Firm Hard Soft

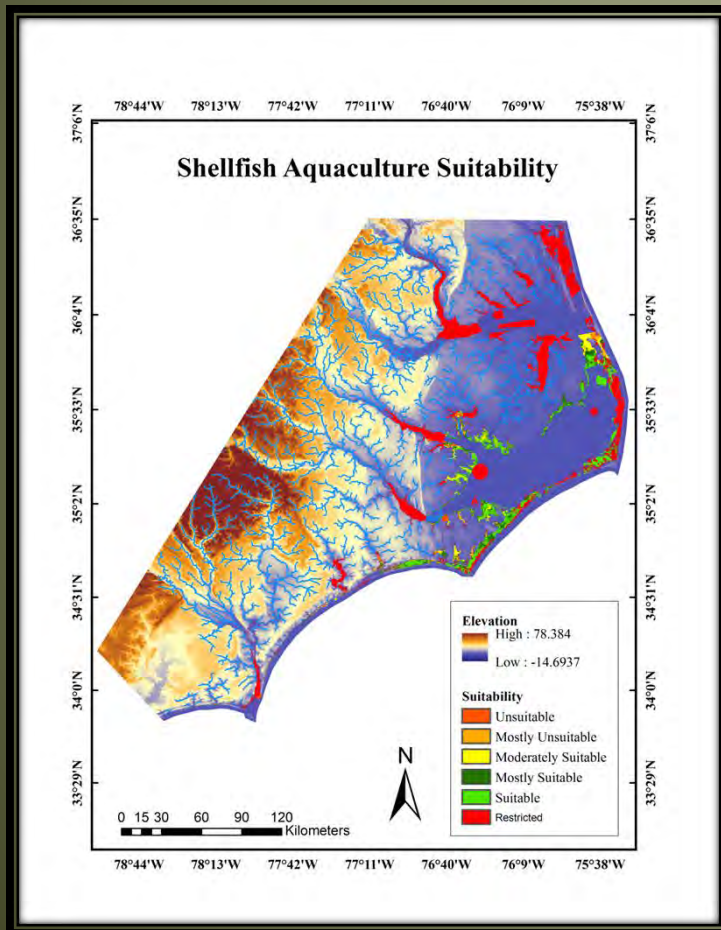
With Shell Without Shell

Land Management Area(s): _____

Land Cover Classification(s): _____

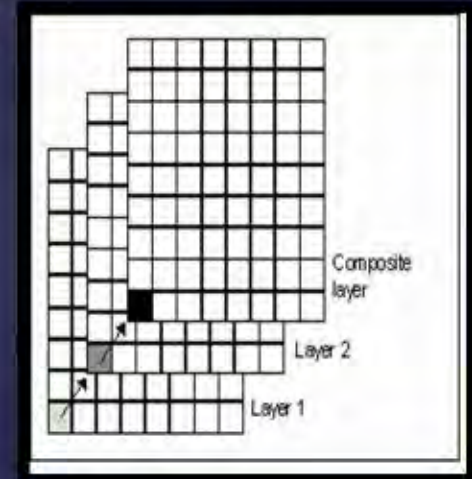
Other information/distances/course references to site location: _____ acres

Suitability Index



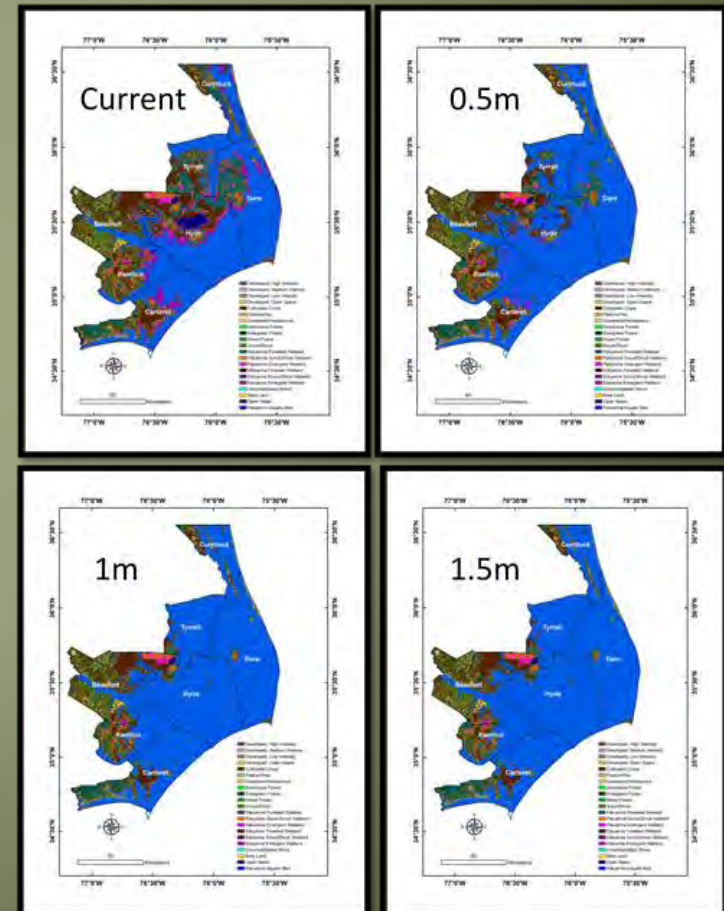
Model Design

- Raster Format (Grid)
- Cell Size ½ acre
- 12 Layers
- 2 Components
- Weighted Overlay
- Composite Map



Major Risk Factors and Constraints

- Changing salinity
- Water quality classifications
- Missing data
- Changing regulatory environment
- An additional interface for legislators and managers



Acknowledgements

- Parker Moran - UNCW Operations and Systems Administration
- Tony Copeland - UNCW Operations and Systems Administration
- Dr. Joanna Halls - UNCW Dept. of Geography and Geology
- Xiaoyan Qi - UNCW
- Carey Jenkins - ROK Global Applications Group, LLC
- Jason Harris - ROK Technologies
- Jason Rogers - CFCC Marine Technology Department
- Tim Shaw – CFCC Marine Technology Department
- Sharon Tatem (SOSM Project)
- Layla Kashlan (Army Corp)
- Dr. Rick Luettich (UNC)
- Anna Stefanowicz (NC WRC)
- Jeff Brown (NCCGIA)
- John Finnegan (NCCGIA)
- NOAA Coastal Services Center
- Richard Vandersnick (Senior Geomatics Analyst, SGT, Inc.)



Questions?

