Comprehensive Spatial Mapping of South Carolina Resources and Activities

Bob Van Dolah and Jessica Boynton
South Carolina Department of Natural Resources
Marine Resources Division
Marine Resources Research Institute
Charleston, SC

South Carolina
Energy Office Grant

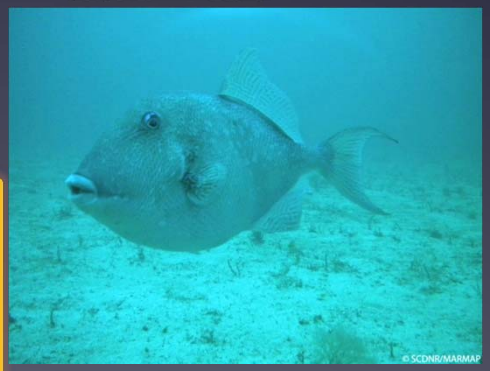
- Goals:
  - Gather or create all available spatial datasets of SC coastal and offshore resources and activities
  - Provide complete metadata for each dataset
  - Make all datasets available to the public and agencies for coastal planning
    - For wind energy, or other coastal activities

Data Search and Creation

- 75+ datasets
- Organized into three file geodatabases
  - Biological Resources
  - Habitat Resources
  - Human Uses

Biological Resources	*Source*	*Priority*	*Activity*
Seabird Colonies	**SCDNR-Wildlife & Freshwater Fisheries**	**High**	**Transmission construction**
Benthic Fauna	**SCDNR-MRD, NOAA, Coastal Science Association**	**Low**	**Platform/transmission construction**
Offshore Fisheries (MARMAP): Bank sea bass, black sea bass, gag, grey triggerfish, knobbed porgy, red grouper, red snapper, sand perch, scamp, scup, spottail pinfish, spotted moray eel, tomtate, vermilion snapper, white grunt	**SCDNR-MRD**	**Moderate**	**Platform construction/operation**
Nearshore Fisheries (SEAMAP): Atlantic croaker, bluefish, brown shrimp, Atlantic sharpnose shark, southern kingfish, spot, weakfish, white shrimp	**SCDNR-MRD**	**Moderate**	**Platform construction/operation**
North Atlantic Right Whale	**NARWC**	**Moderate**	**Platform contruction/operation**
Sea Turtle Nesting sites	**SCDNR-MRD**	**high**	**Transmission construction**
Sea Turtle In-water	**SCDNR-MRD**	**Moderate**	**Platform construction/operation**
Sea Turtle (SEAMAP)	**SCDNR-MRD**	**Moderate**	**Platform construction/operation**
SC Live and Washed shell Oyster beds	**SCDNR-MRD**	**High**	**Transmission construction**
Seabird/sea duck data	**USFWS (unable to obtain within time frame of project)**	**High**	**Platform operation**
Avian migration routes	**Unable to obtain within time frame of project**	**High**	**Platform operation**
Avian distributions	**Unable to obtain within time frame of project**	**High**	**Platform operation**
Whale critical habitat map	**Unable to obtain within time frame of project**	**High**	**Platform construction/operation**

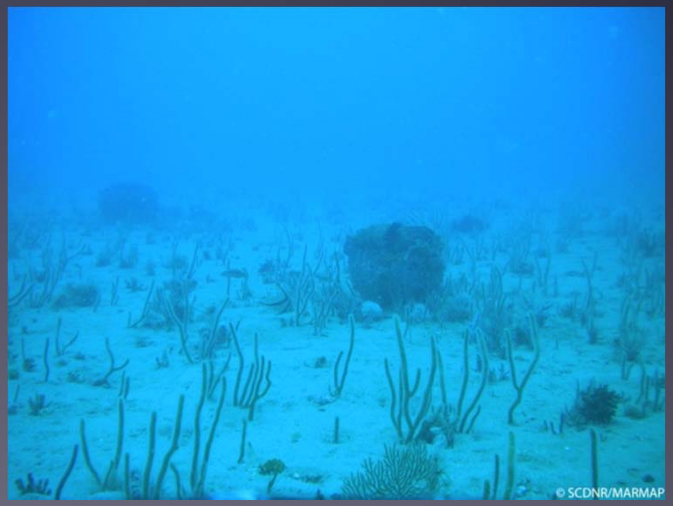
Spatial Data Layers



- Biological Resources
  - Offshore finfish, near-shore finfish/crustaceans, sea turtles, avian nesting, marine mammals, benthic invertebrate communities

Spatial Data Layers

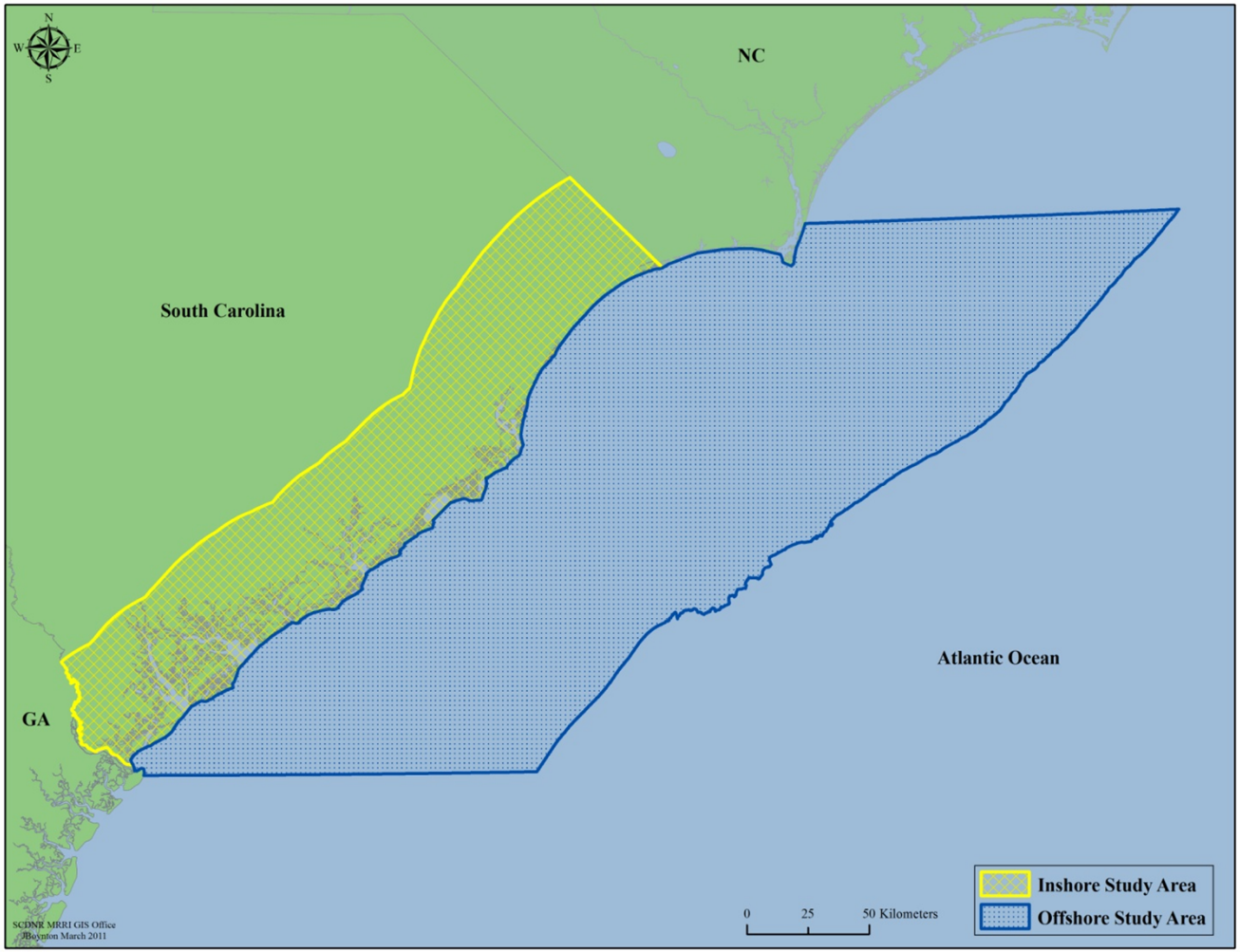
- Biological Resources
  - Offshore finfish, near-shore finfish/crustaceans, sea turtles, avian nesting, marine mammals, benthic invertebrate communities
- Habitat Resources
  - Natural reef habitats, artificial reefs, oyster reefs , ocean sediment, wind, protected areas, critical habitat, bathymetric, hydrology, land cover



Spatial Data Layers

- Biological Resources
  - Offshore finfish, near-shore finfish/crustaceans, sea turtles, avian nesting, marine mammals, benthic invertebrate communities
- Habitat Resources
  - Oyster reefs, artificial reefs, natural reef habitats, ocean sediment, wind, protected areas, critical habitat, bathymetric, hydrology, land cover
- Human Uses
  - Commercial and recreational fishing, obstructions, sand borrow sites, disposal areas, nav. charts, military areas, shipping lanes and activity

Study Area



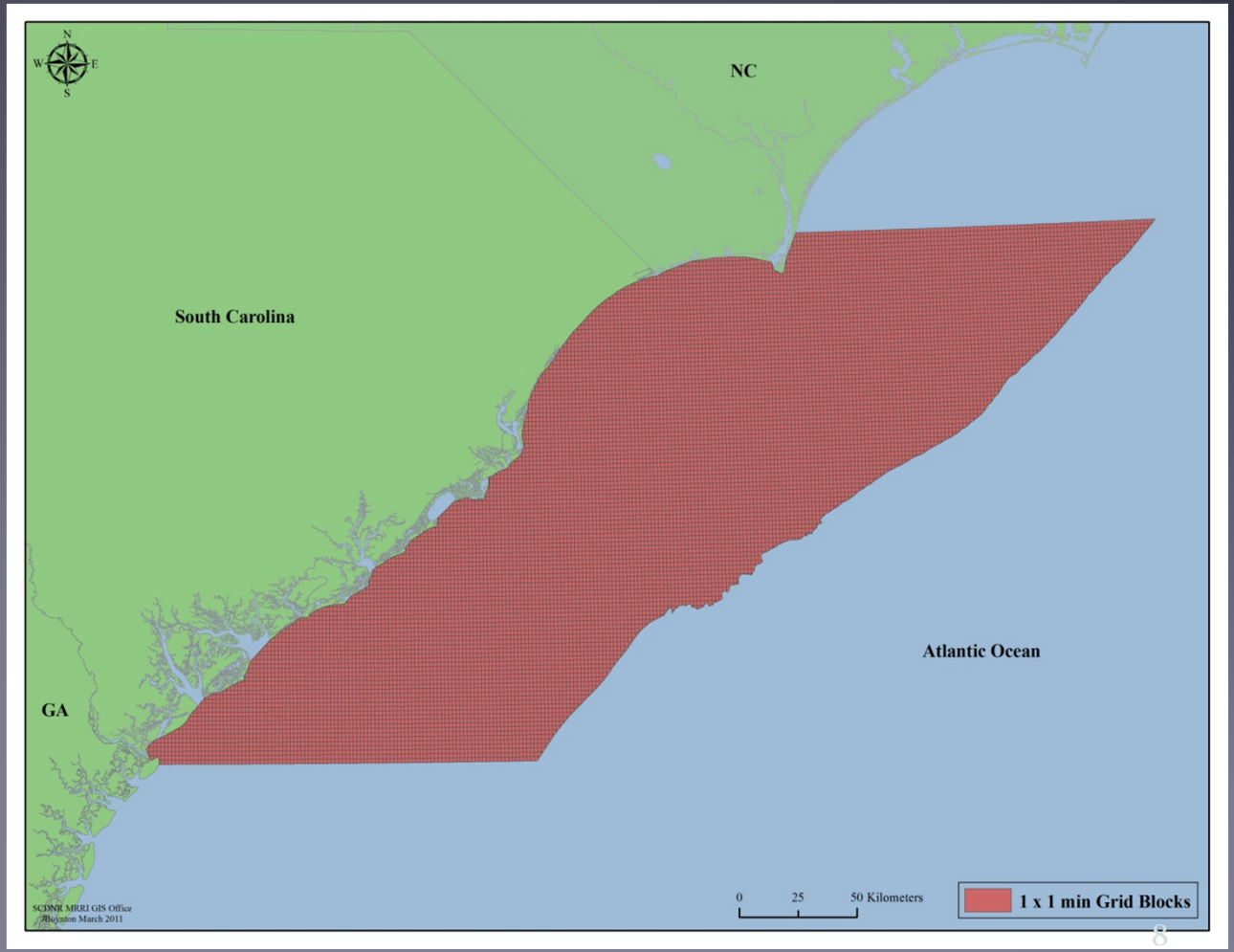
- North - South:
  32 – 34 degrees latitude
- East – West:
  30 miles inland – 200 meter bathymetric depth

Data Processing

- Created 1 x 1 min grid
  - Offshore finfish
  - Nearshore finfish/crustaceans
  - Juvenile sea turtles
  - Bottom characteristics
  - Shipping activities
- Over 13,900 grid cells

•Finfish example

- # of samples
- Ave. catch/unit effort
- Grid cell #
- Display based on relative abundance
  - no catch
  - up to 25% (low)
  - 25.1-75% (moderate)
  - 75.1-100% (high)

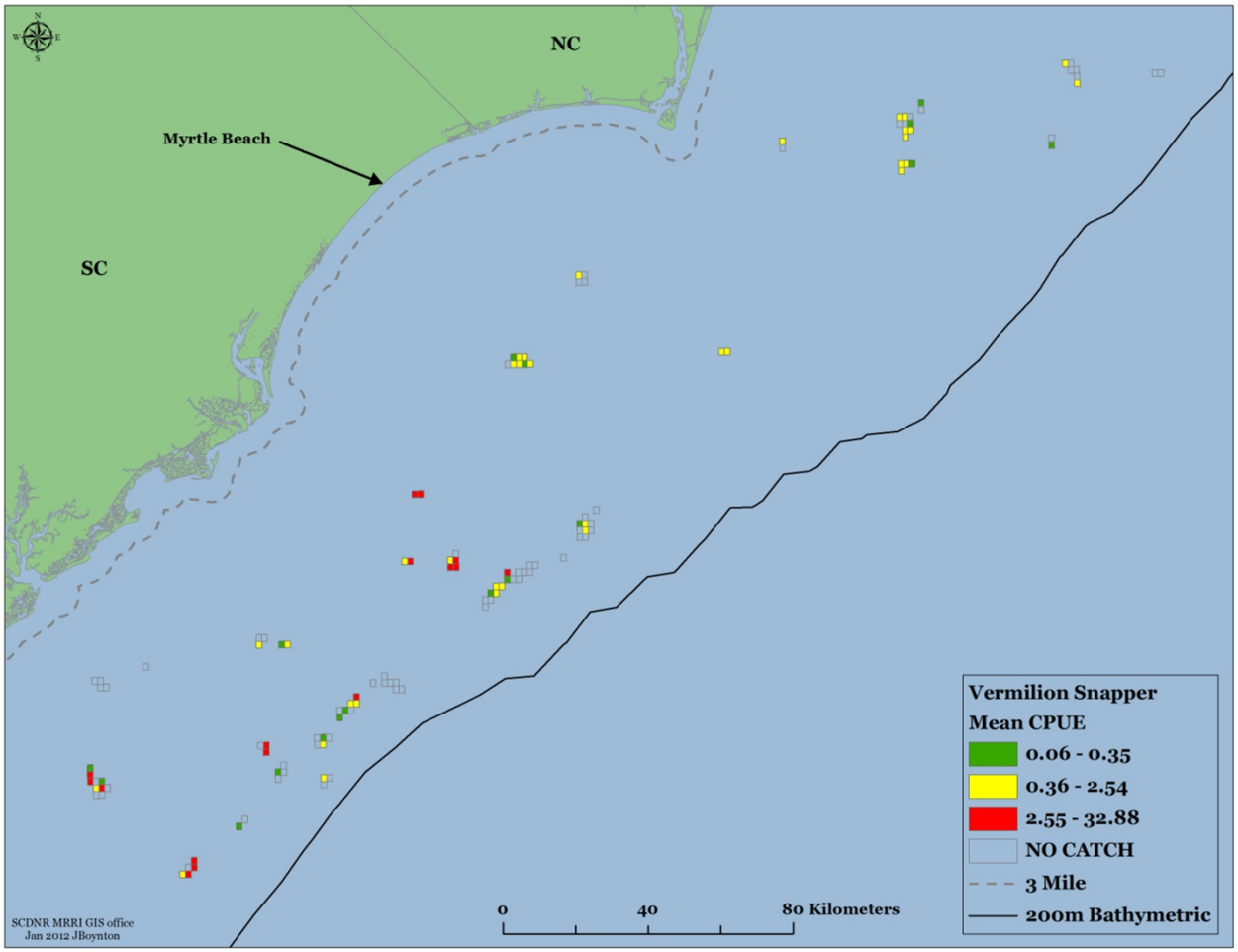


Biological Resources: Offshore Finfish

- MARMAP: Offshore fisheries-independent program
- 35+ years of monitoring population status and structure of reef fish
- 2006-2010 included
- 19 species from chevron traps
- Species mapped include:
  - Tomtate, scup, white grunt, vermillion snapper, spotted moray eel, spottail pinfish, speckled hind, sand perch, black sea bass, bank sea bass, gray triggerfish, scamp, gag, red grouper, snowy grouper, red snapper, red porgy, knobbed porgy

Pictures are courtesy of J.Stephen, MARMAP, SCDNR

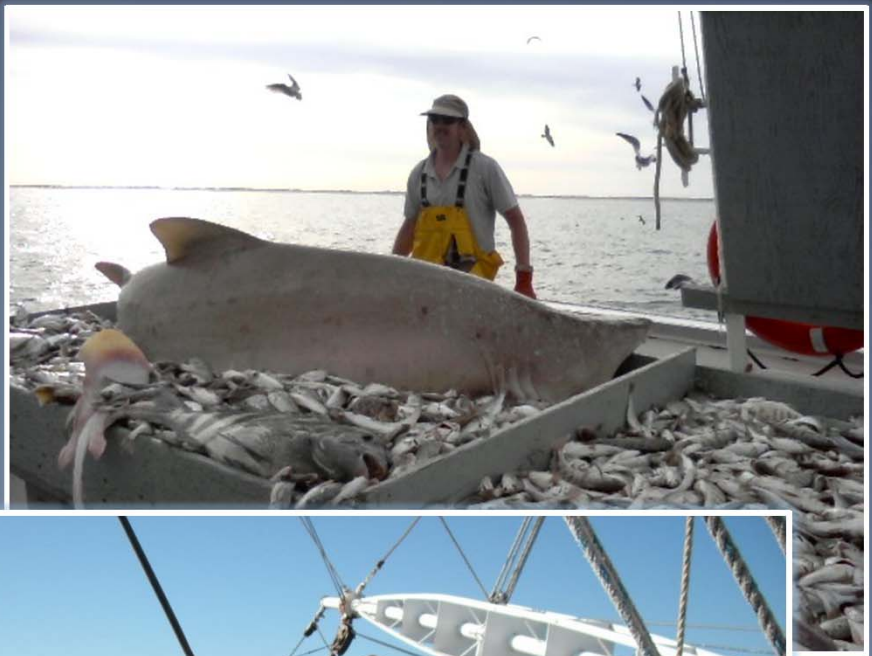
Biological Resources: Offshore Finfish



Picture is courtesy of J.Stephen, MARMAP, SCDNR

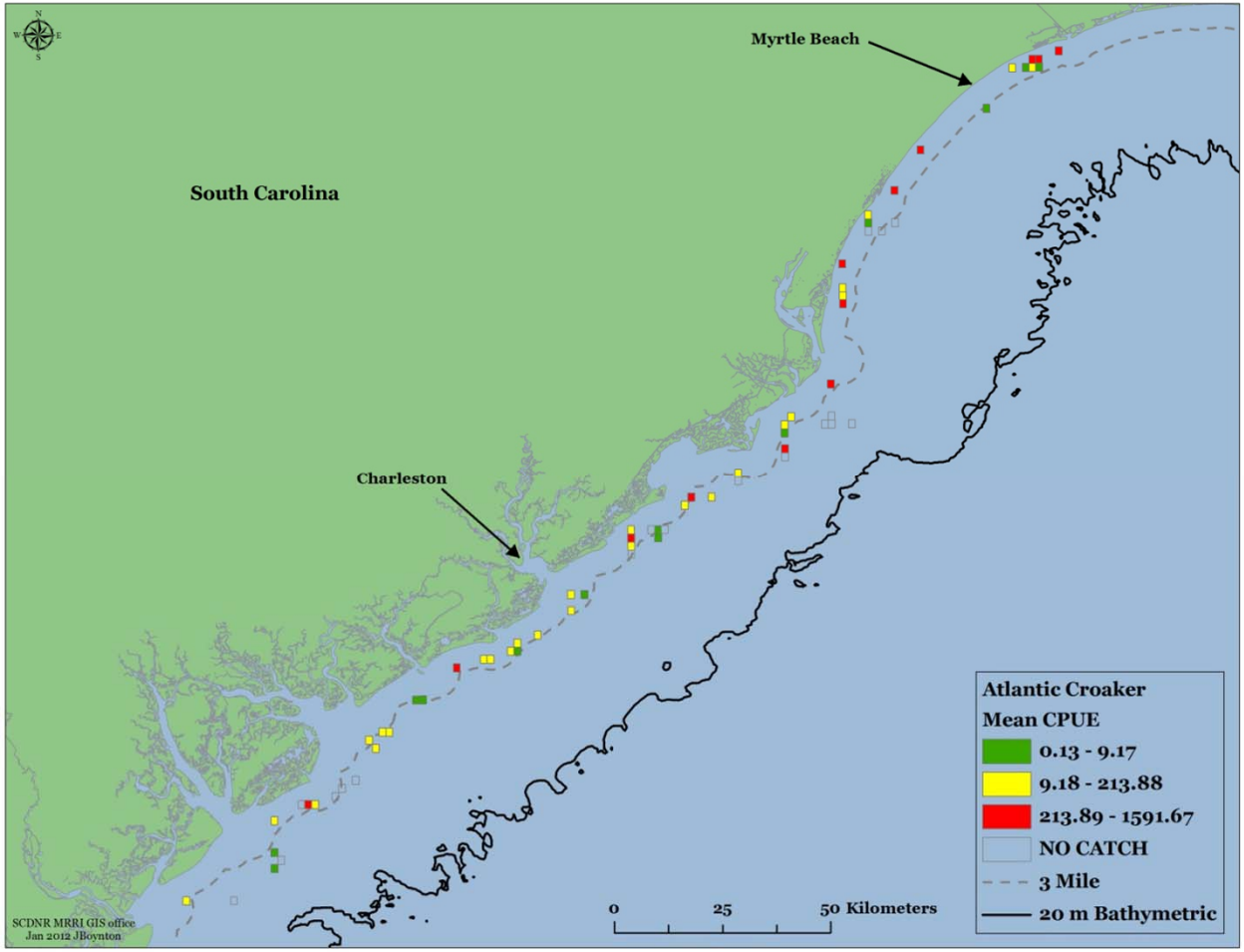
Biological Resources: Nearshore Finfish

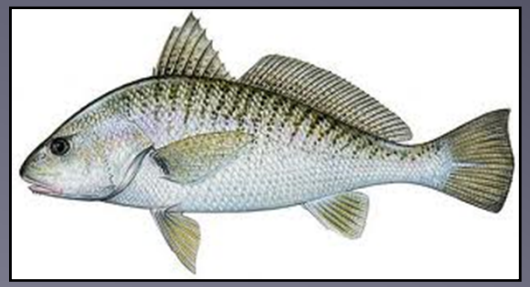
- SEAMAP: Shallow water trawl survey
- 20+ years of data collection to monitor status and trends of coastal species
- 2006-2010
- Mean CPUE
- 8 species included:
  - Brown shrimp, Atlantic croaker, weakfish, spot, bluefish, white shrimp, southern kingfish, and Atlantic sharpnose shark



Pictures are courtesy of P.Webster, SCDNR

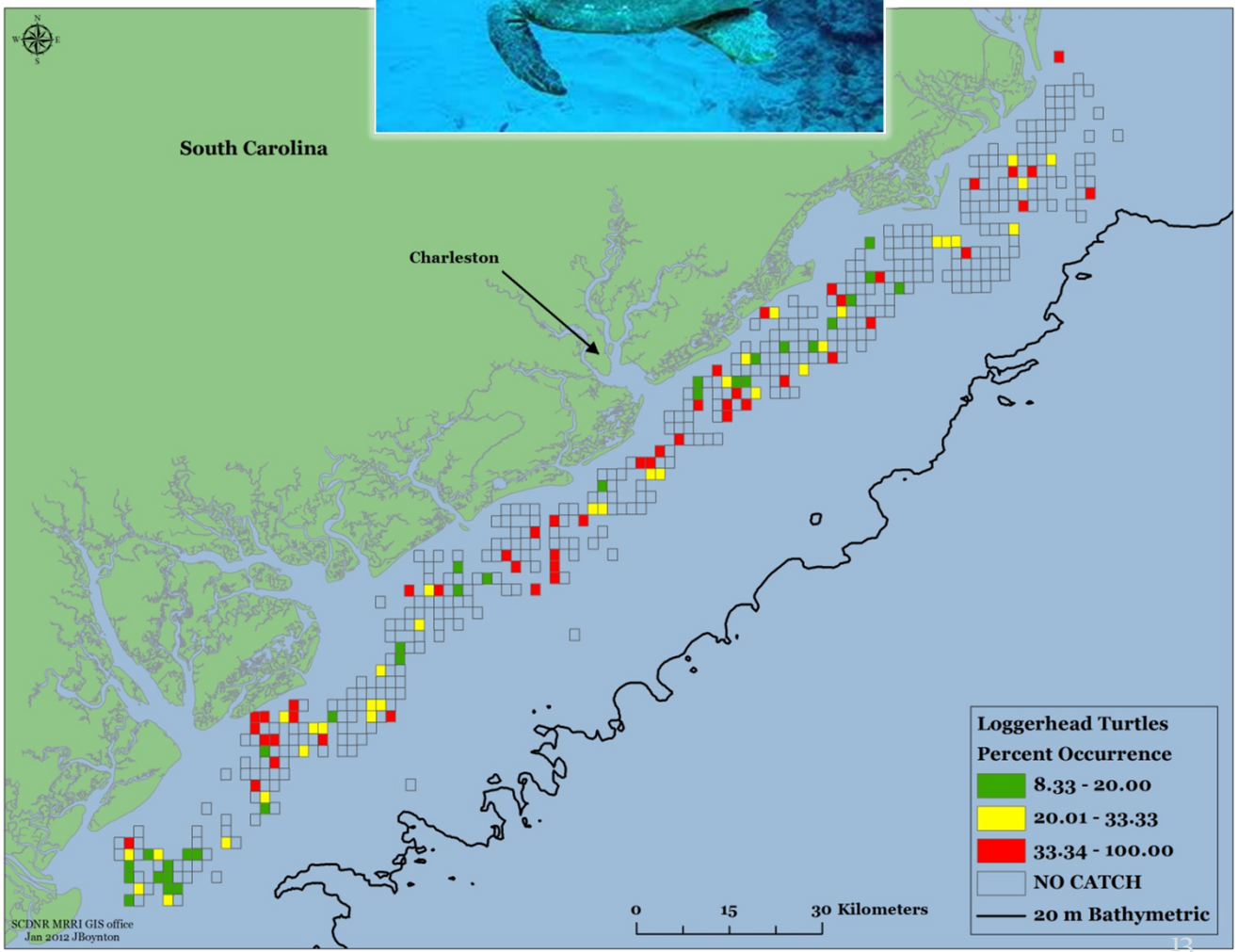
Biological Resources: Nearshore Finfish/Crustacean





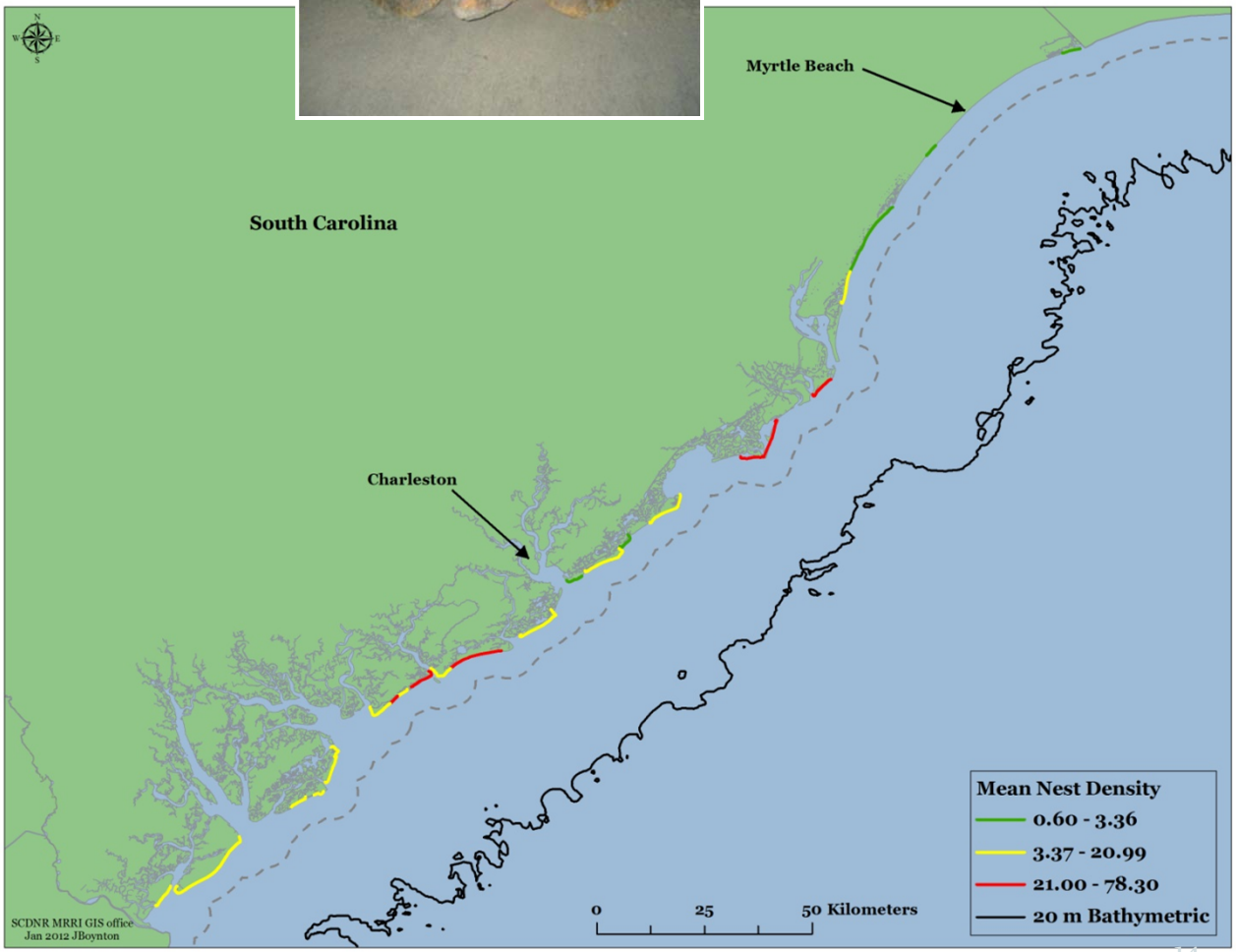
Biological Resources: Sea Turtle

- In water trawl survey of sea turtles from Winyah Bay, SC to St. Augustine, FL
- 10 + years
- Loggerhead turtles (94% of catch)
- 2006-2010
- Ave. catch/unit effort (CPUE)



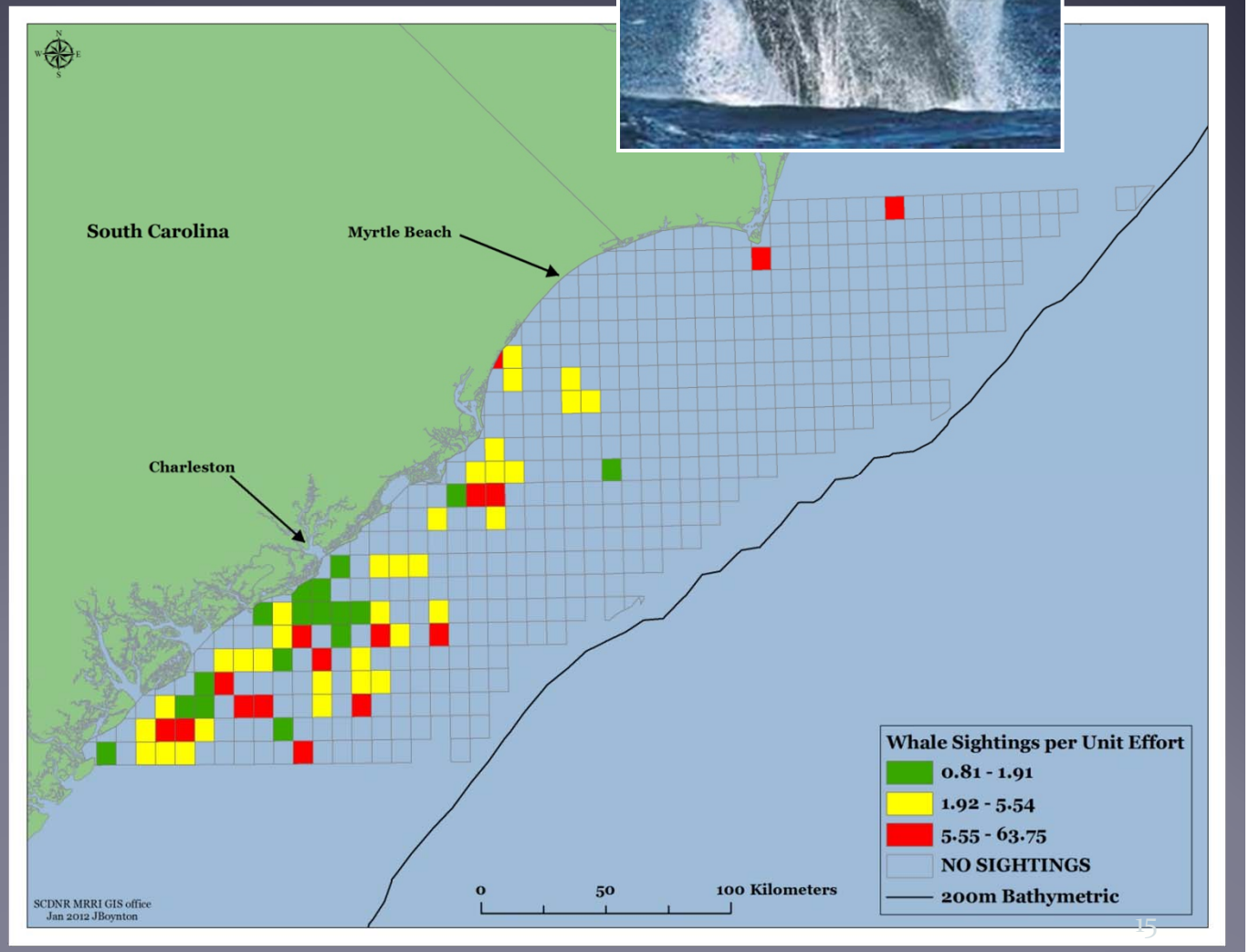
Biological Resources: Sea Turtle Nesting

- 26 islands surveyed from the ground
- 2001-2010
- Mean nesting density (nests/km surveyed)
- Number of years



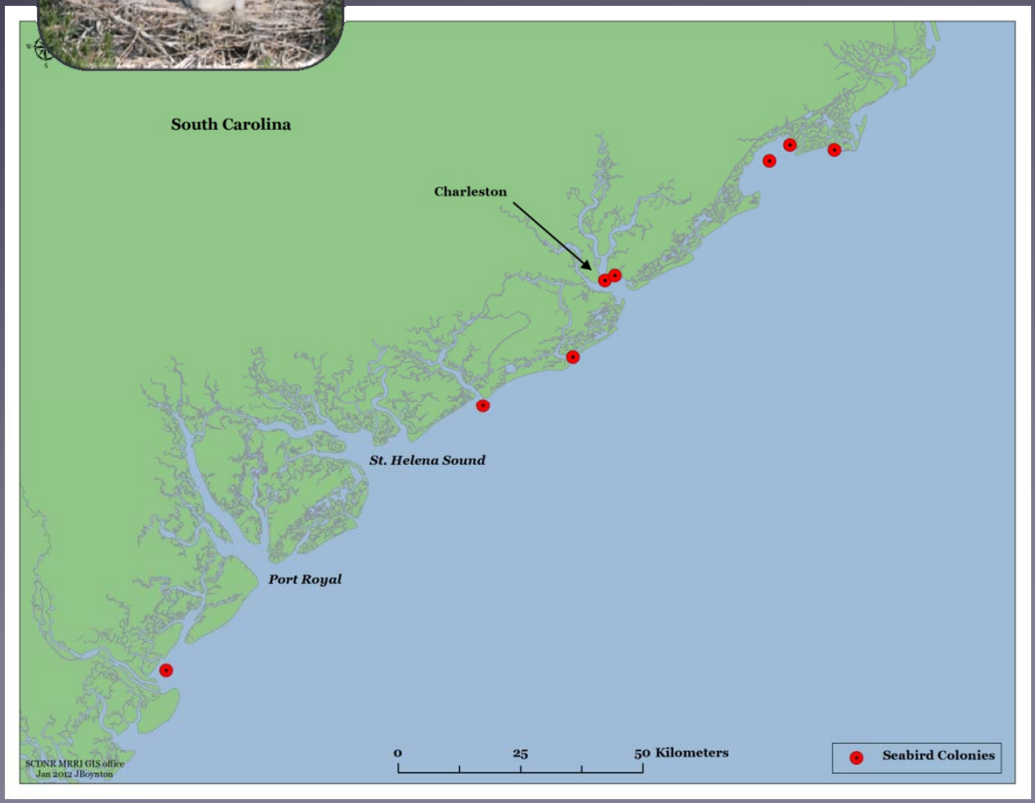
Biological Resources: North Atlantic Right Whale

- North Atlantic Right Whale Consortium
- 2002-2010
- November - April
- 5 x 5 min grid
- SPUE (sightings per unit effort)
- Mostly aerial survey



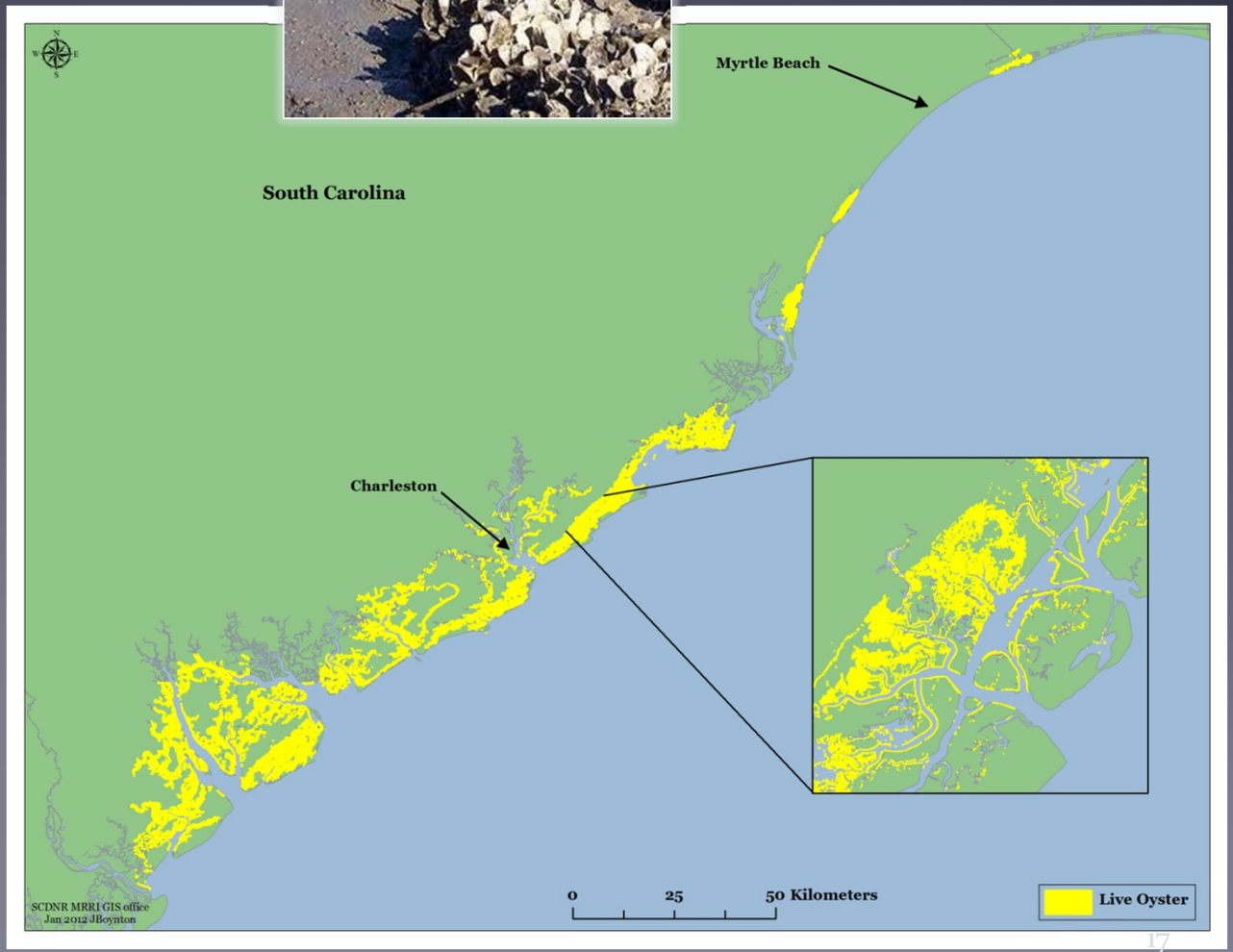
Biological Resources: Seabird Colonies

- Brown pelican, snowy egret, tricolored heron, black skimmer, royal tern, ibis
- Nest counts conducted yearly
- 2006 - 2010



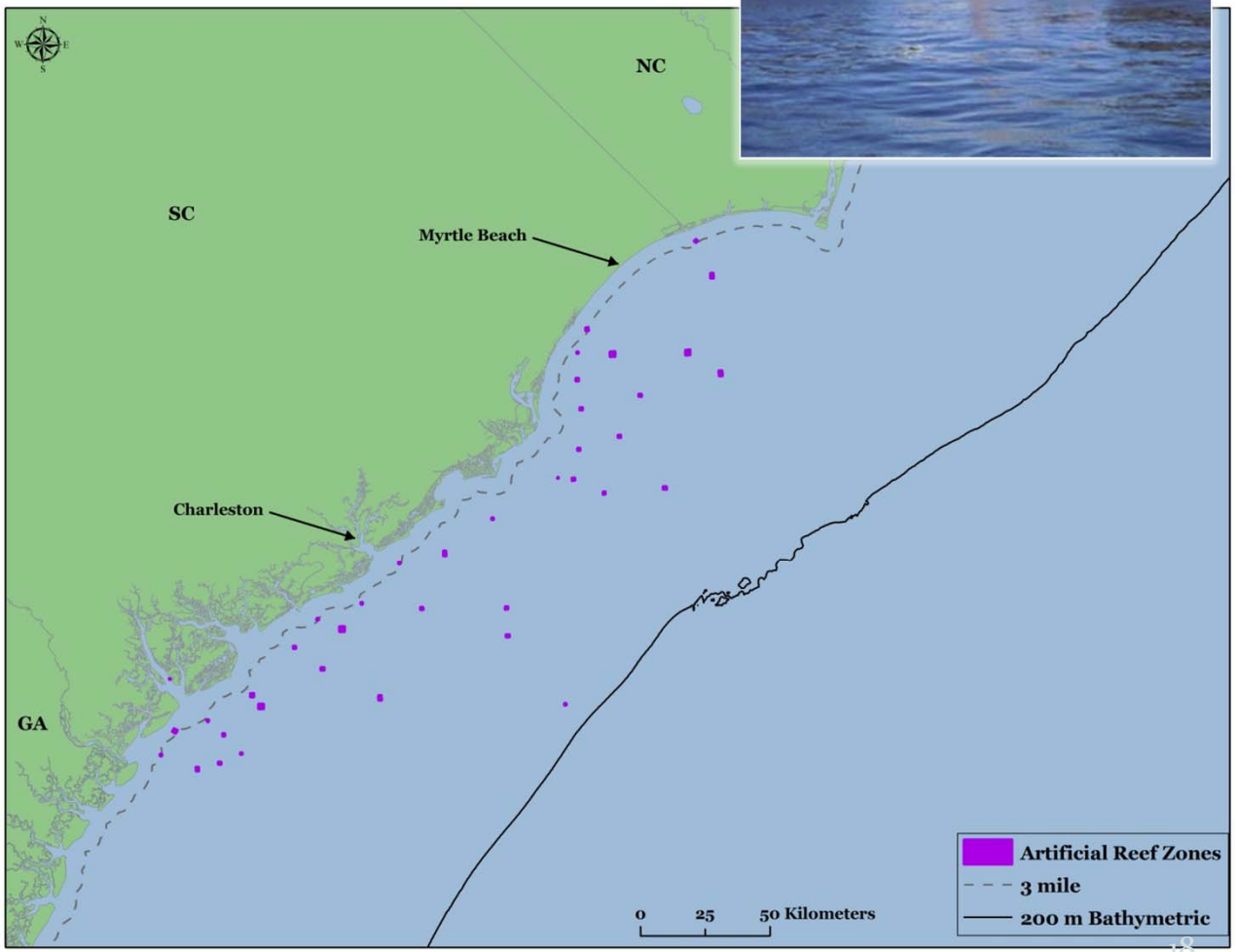
Habitat Resources: Oysters

- SC intertidal oysters
  - Very imp. habitat
  - Economically valuable
- Created from high resolution aerial imagery.
- Ground-truthed by boat, online resources, and helicopter
- Very accurate database



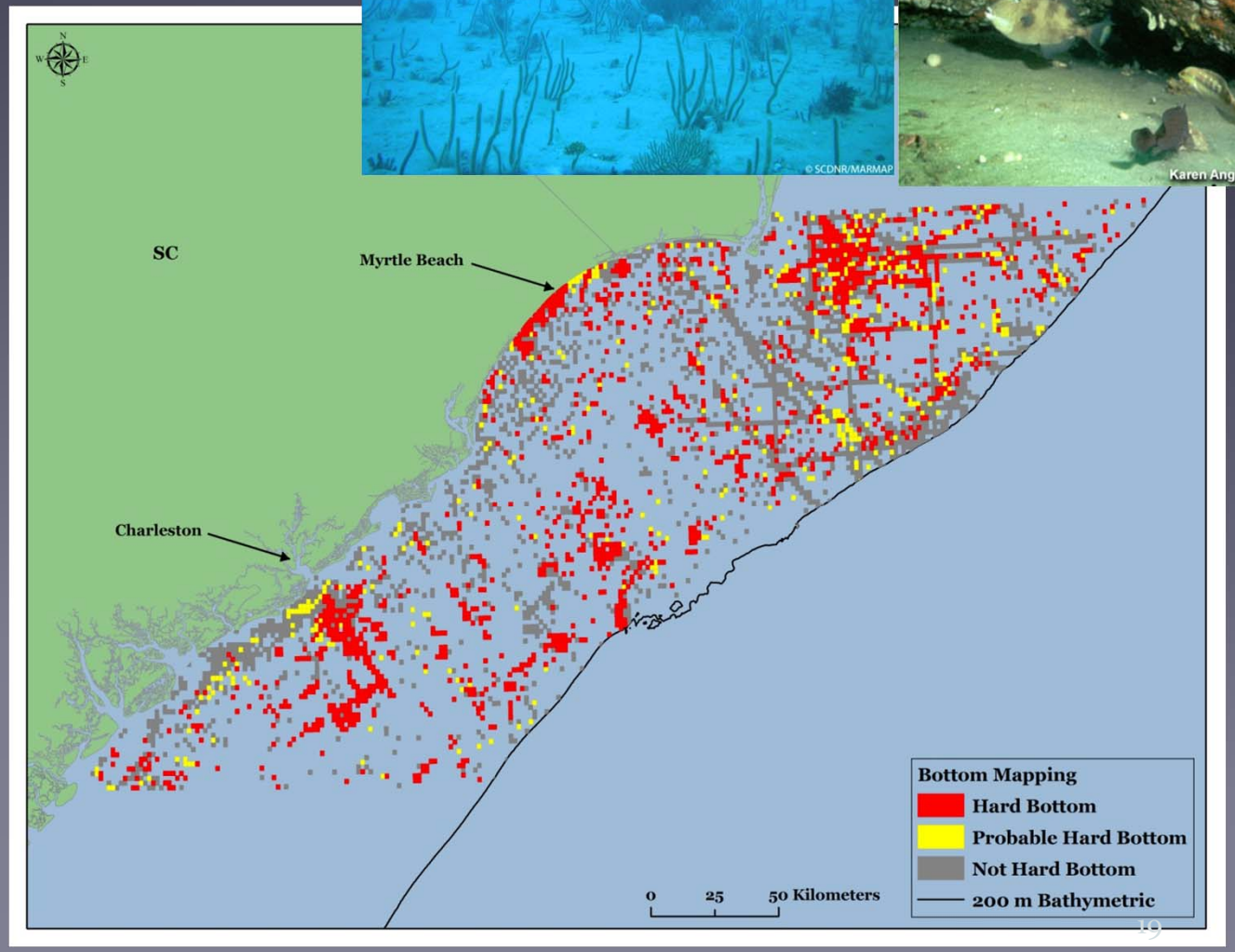
Habitat Resources: Artificial Reefs

- Reefs are managed by the Marine Artificial Reef Program since 1973
- Permits for 38 reef sites
- Reefs are constructed from ships, trains, military tanks, and other scrap.
- Used to enhance fishing and diving



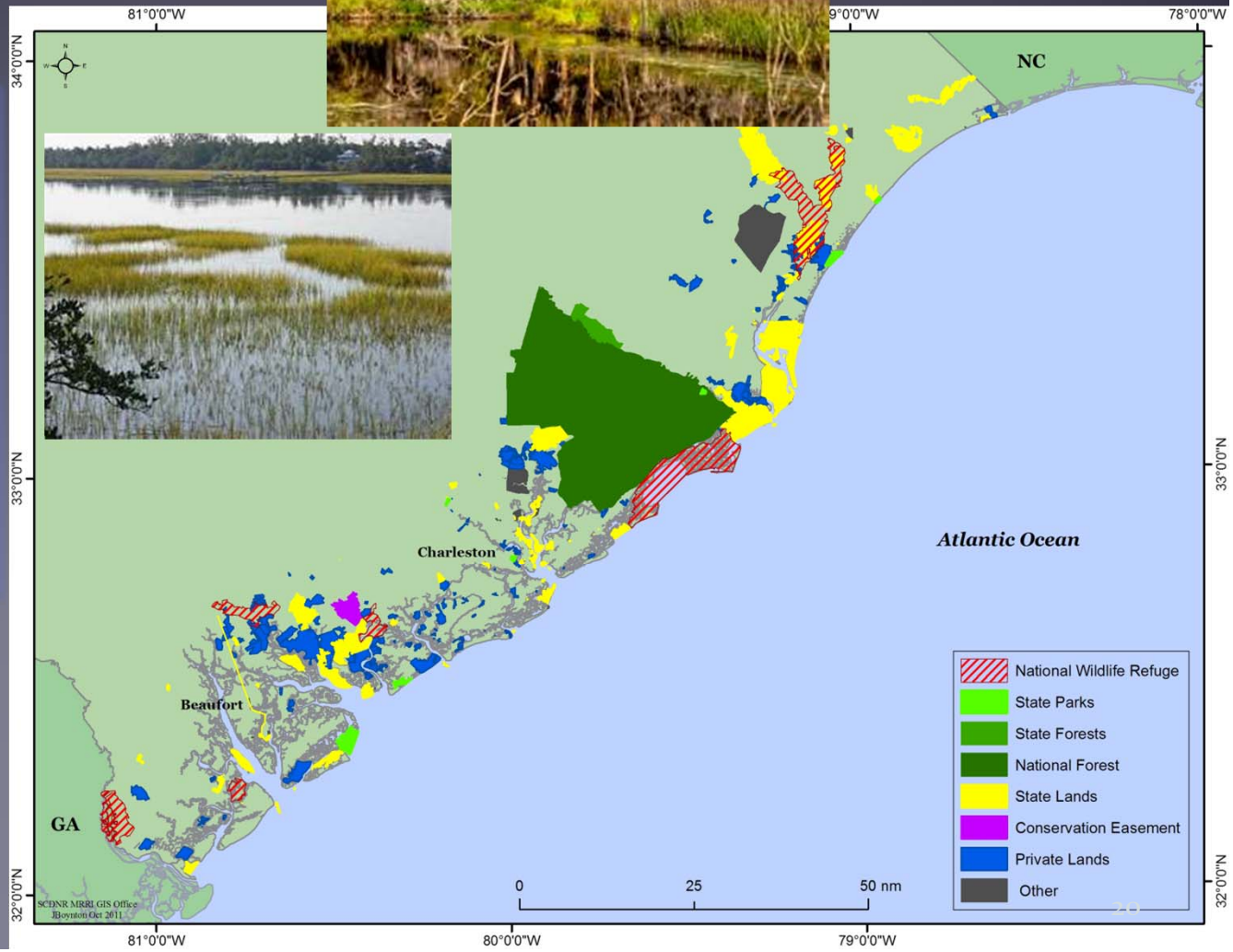
Habitat Resources: Bottom Mapping

- Multi-agency project to gather and summarize datasets to classify bottom habitat.
- NC, SC, GA, FL
- Bottom habitat data sources:
  - Towed television cameras
  - Diver observations
  - Trawls/traps
  - Side scan sonar



Habitat Resources: Protected Lands

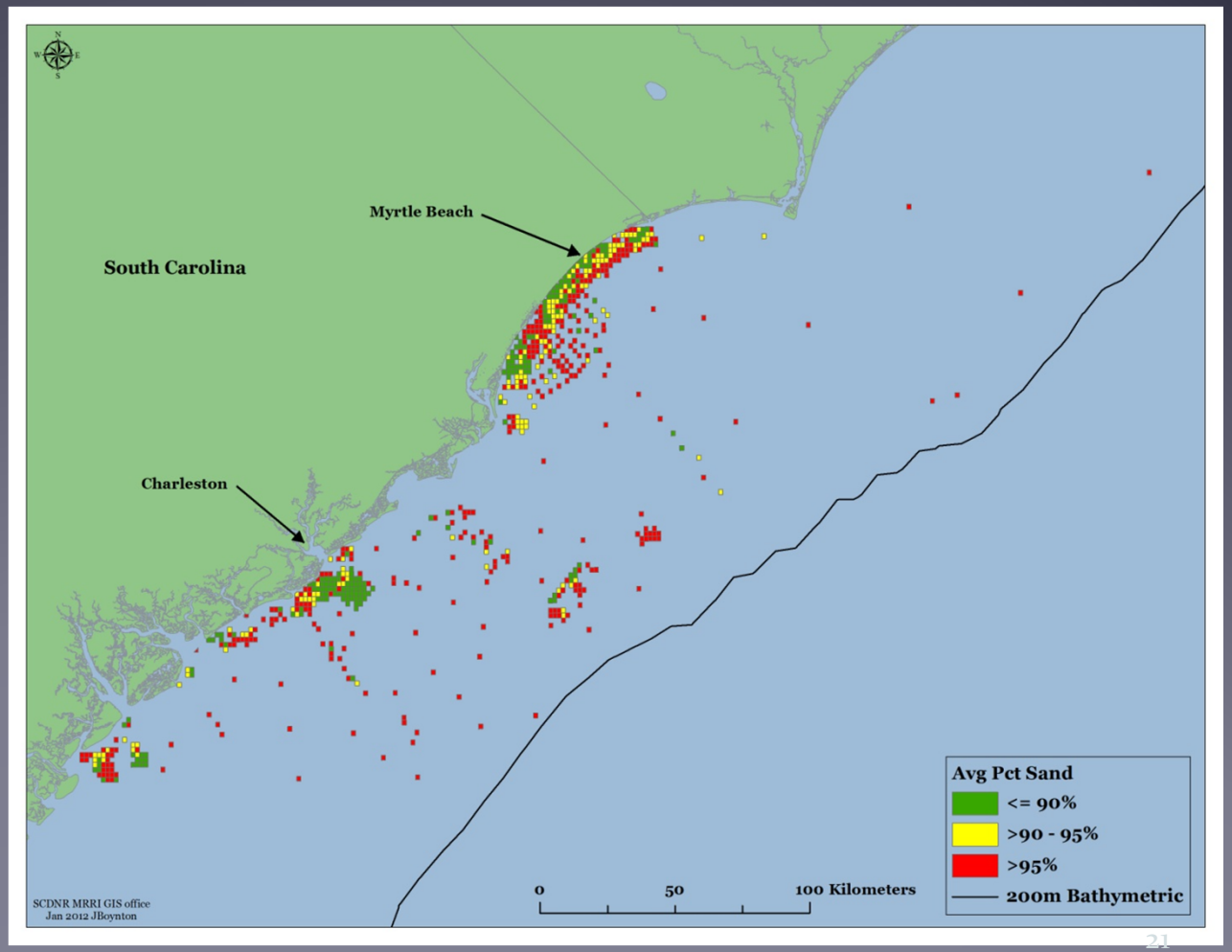
- National Refuges and Forests
- State Forests, Lands & Parks
- Conservation Easements & Private Lands



Habitat Resources: Sediment Mapping

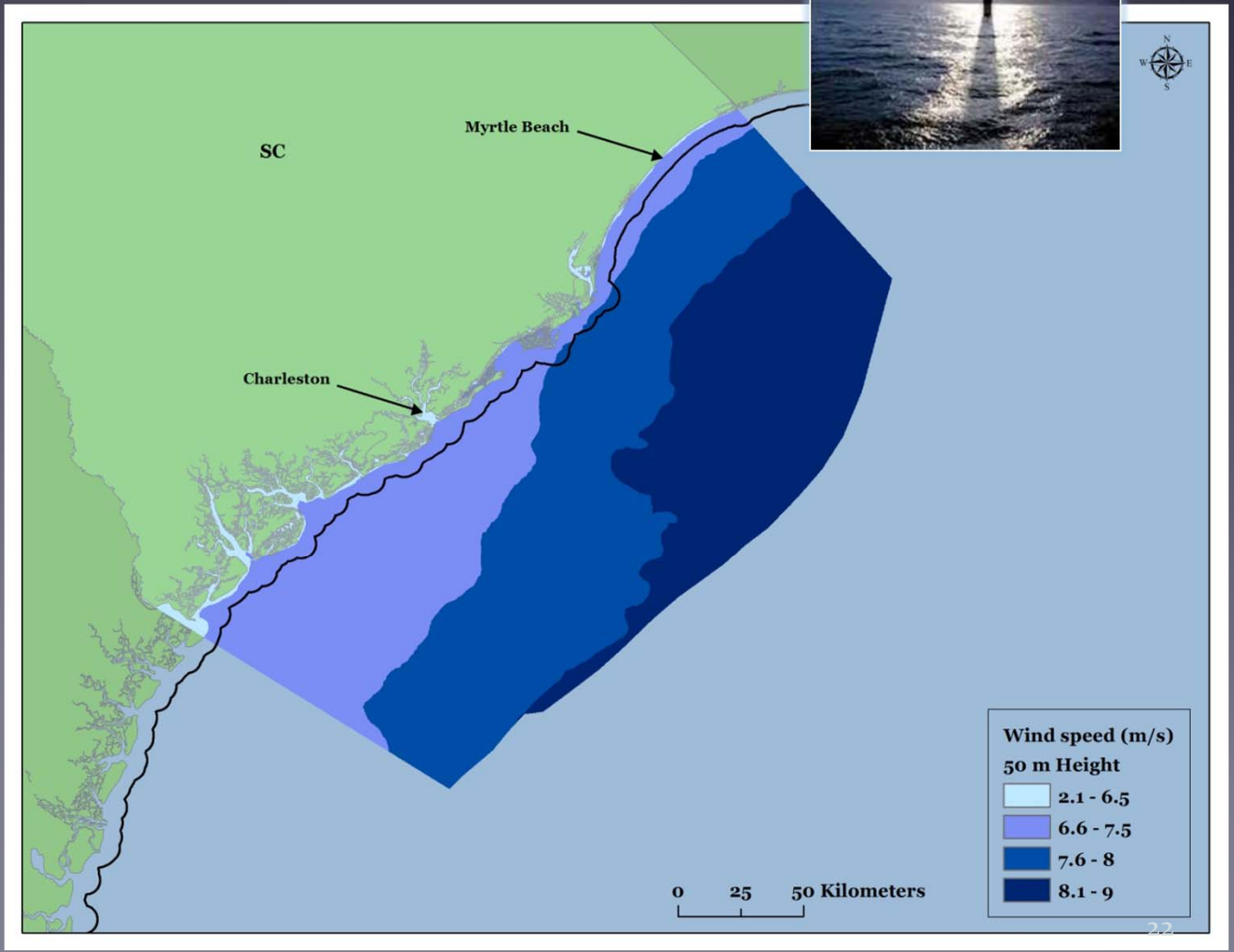
Ocean Sediment

- Average Percent Sand
- Average Phi size
- Average Sand Depth

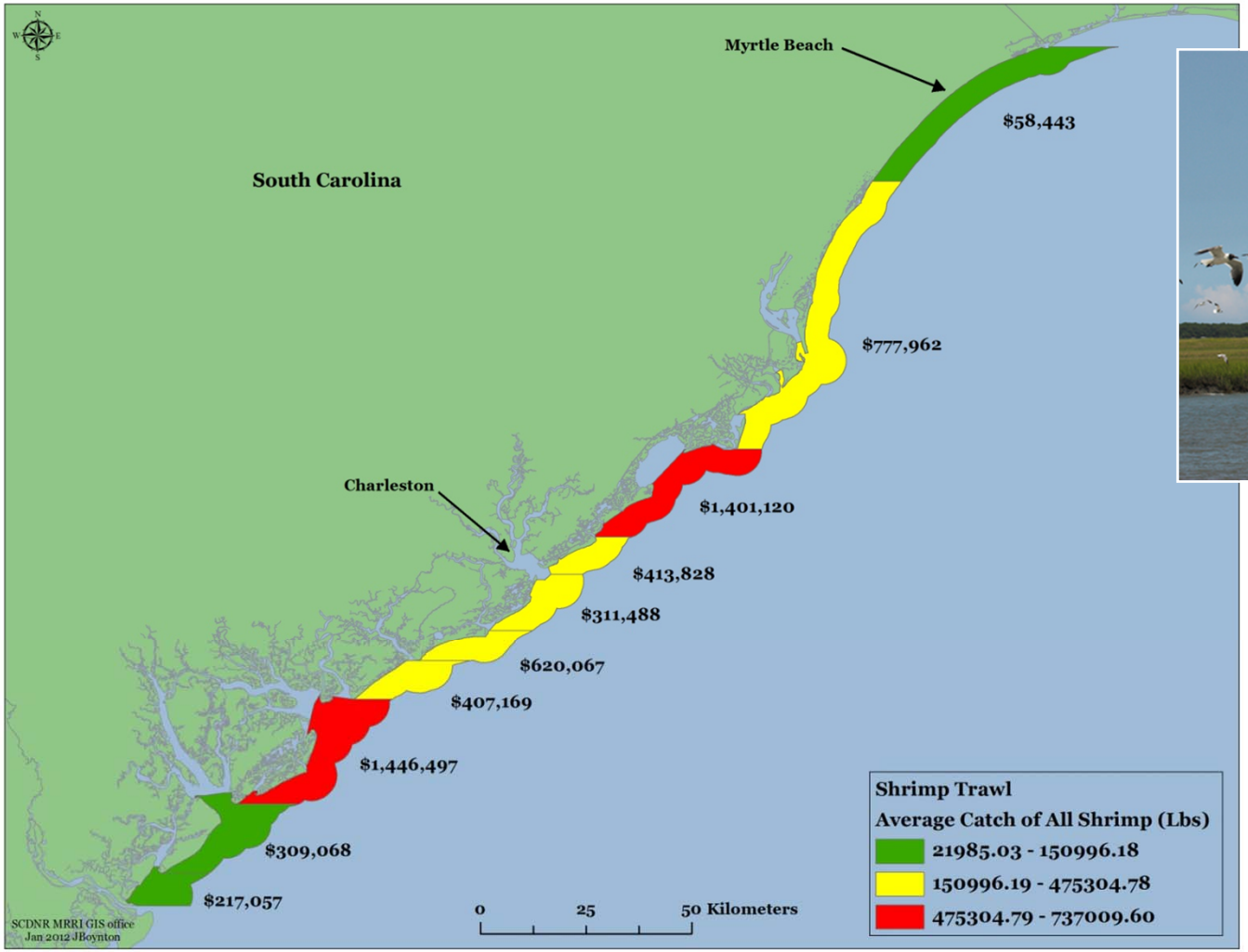


Habitat Resources: Wind Energy

- AWSTruewind™
- Wind speed also at 70m and 100m heights
- Wind power at 30, 50, 100 m

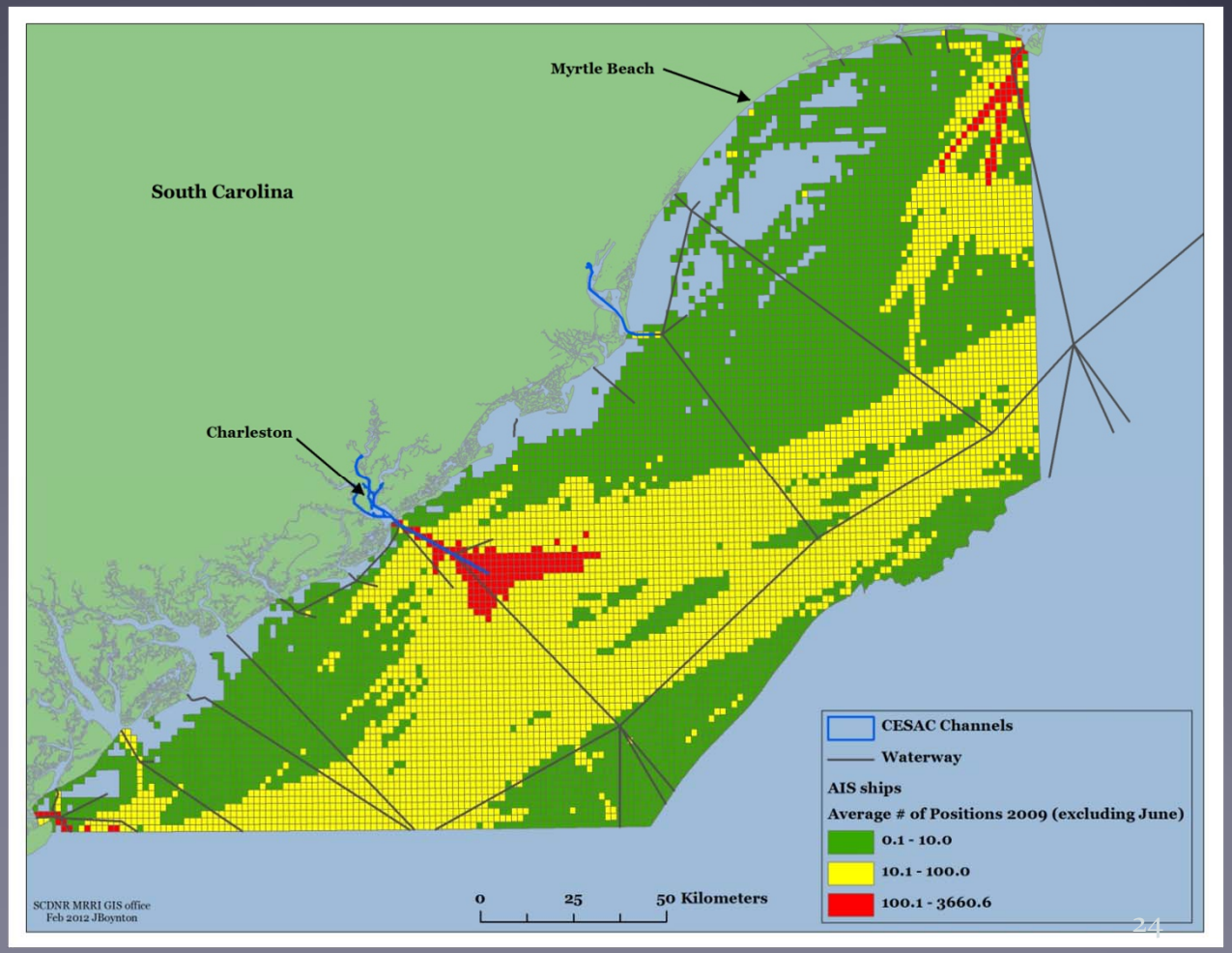


Human Use and Interactions: Shrimp Trawling



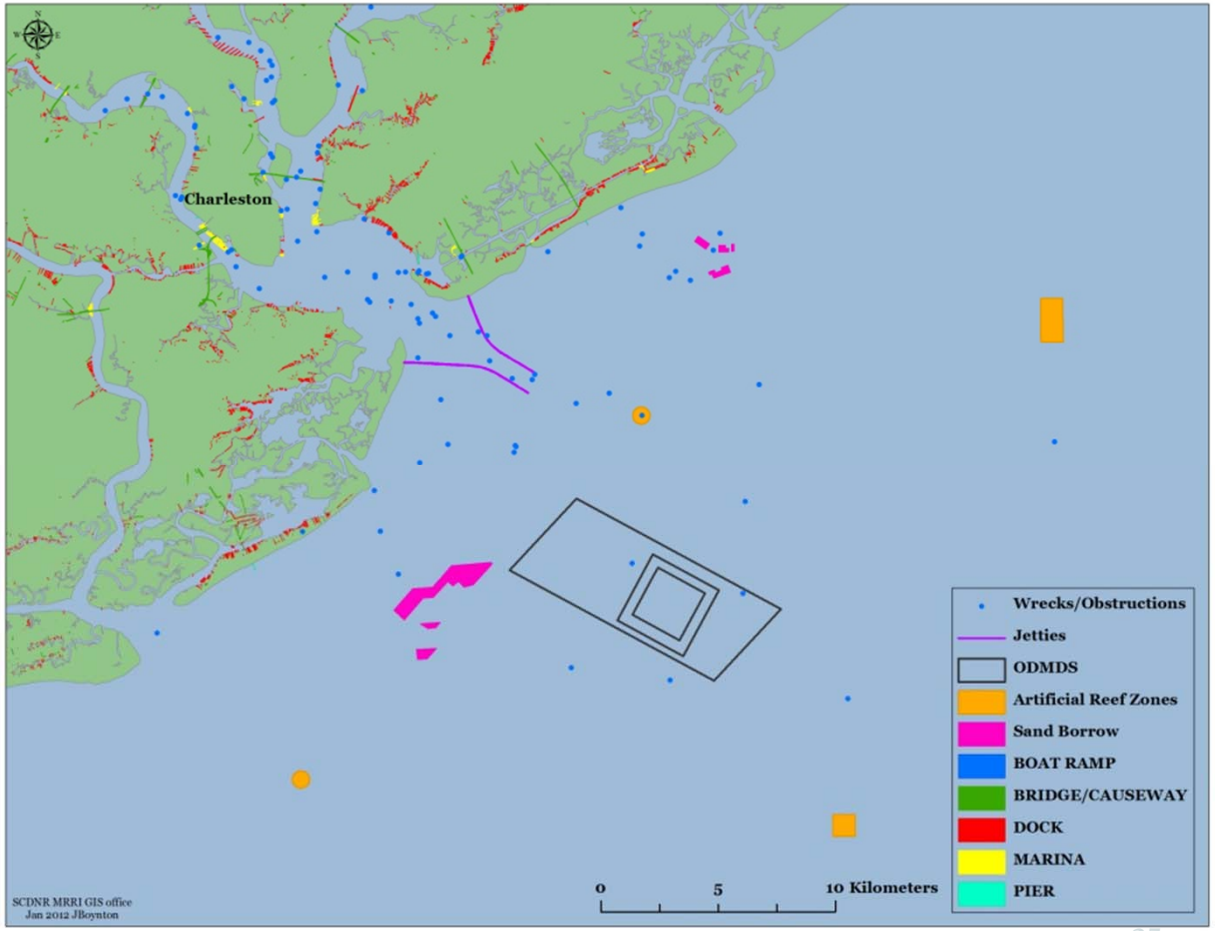
Human Use and Interactions: Shipping

- AIS: Automatic Identification System
- Tracking system
- Required for ships of 300 + tons and all passenger ships
- 40,000 ships carry Class A AIS
- Many thousands more carry Class B AIS
- 2009 data summed by grid for each month, totaled and averaged



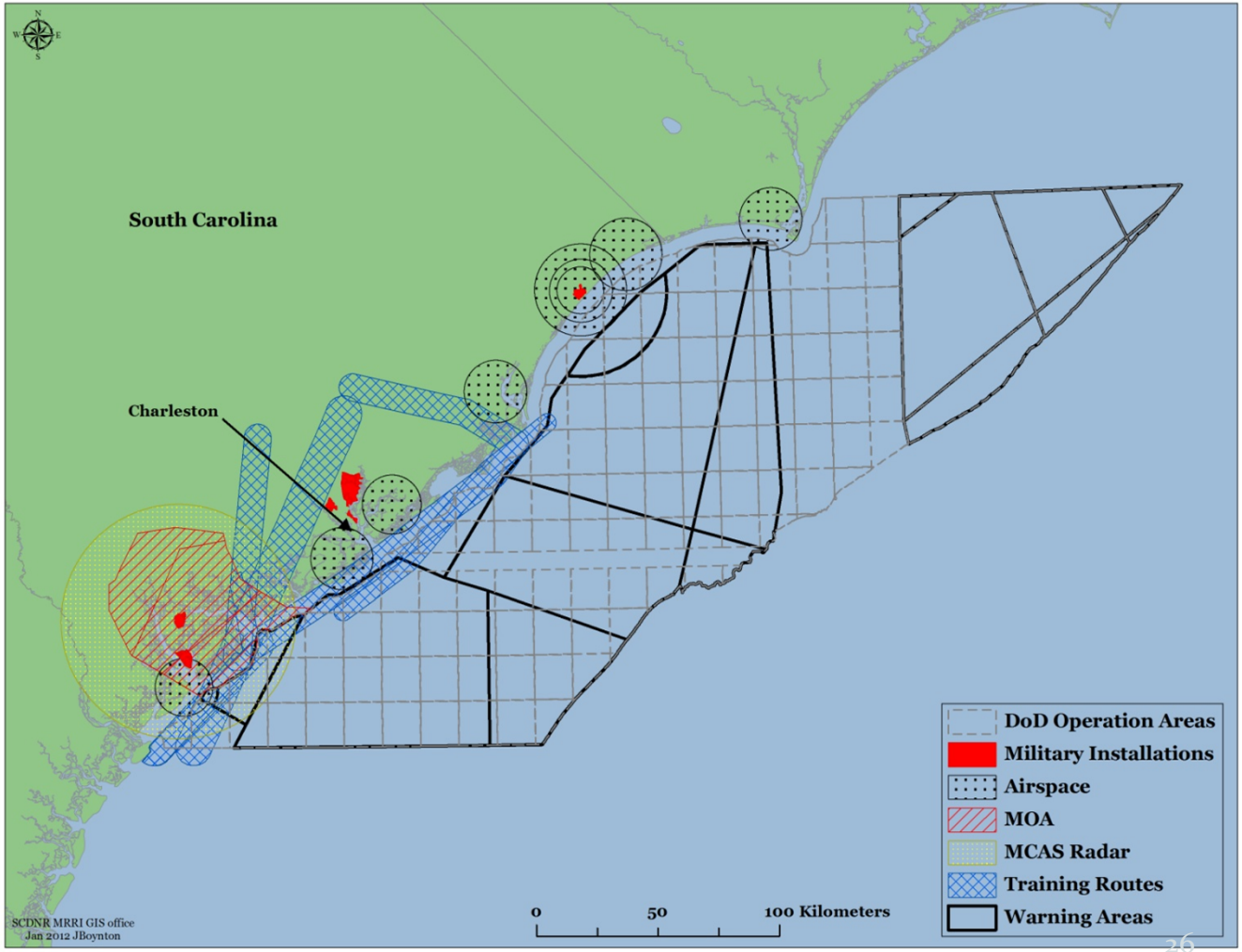
Human Use and Interactions

- Obstructions
- Docks, Bridges, Marinas
- Sand Borrow sites
- Artificial reef zones
- Jetties
- ODMDS (Ocean Dredged Material Disposal Sites)
  - Material from Charleston harbor deepening, Georgetown, and Port Royal



Human Use and Interactions: Military / Airspace

- Warning areas
- Military training routes
- Radar
- Military operations areas (MOA)
- Airspace designations
- Military installations
- DOD Operation Areas



Data Access

Posted to SCDNR website

http://www.dnr.sc.gov/GIS/gisenergy.html

- Final report (including data table)
- File geodatabases
- Links to oyster reefs, LiDAR data, and 2011 NAIP Imagery

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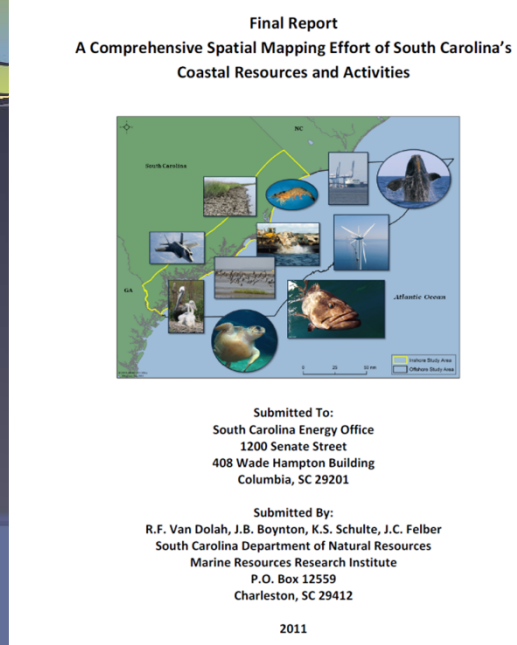

Final Report
A Comprehensive Spatial Mapping Effort of South Carolina's Coastal Resources and Activities

Submitted To:
South Carolina Energy Office
1200 Senate Street
408 Wade Hampton Building
Columbia, SC 29201

Submitted By:
R.F. Van Dolah, J.B. Boynton, K.S. Schulte, J.C. Felber
South Carolina Department of Natural Resources
Marine Resources Research Institute
P.O. Box 12559
Charleston, SC 29412

2011

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Acknowledgements

- **SCDNR**
  - Jessica Stephen and Marcel Reichert (MARMAP), Jeanne Boylan (SEAMAP), Mike Arendt (In Water turtle), DuBose Griffin (Turtle nesting and aerial tracking), Felicia Sanders (Seabird nesting), Bob Martore (Artificial Reefs), George Steele (commercial shrimping), Kristin Schulte, Jordan Felber (assistance in GIS analyses)
- **Florida Fish and Wildlife Conservation Commission**, Florida Marine Research Institute, Atlantic States Marine Fisheries Commission, NOAA, SCDNR): SEAMAP Bottom mapping project
- **North Atlantic Right Whale Consortium**
- **EPA and US Army Corps** (ODMDS)
- **BOEMRE** (DOD warning areas)
- **OCRM**: Josh Boulware (Docks/marinas/piers)
- **Santee Cooper**: Liz Kress (wind data)
- **Coastal Carolina University** (sediment data)
- **Atlantic Coastal Cooperative Statistic Program** (fisheries landing data)
- **US Fish and Wildlife Service**: Mark Caldwell (critical habitats)
- **NOAA CSC**: Daniel Martin (AIS data)