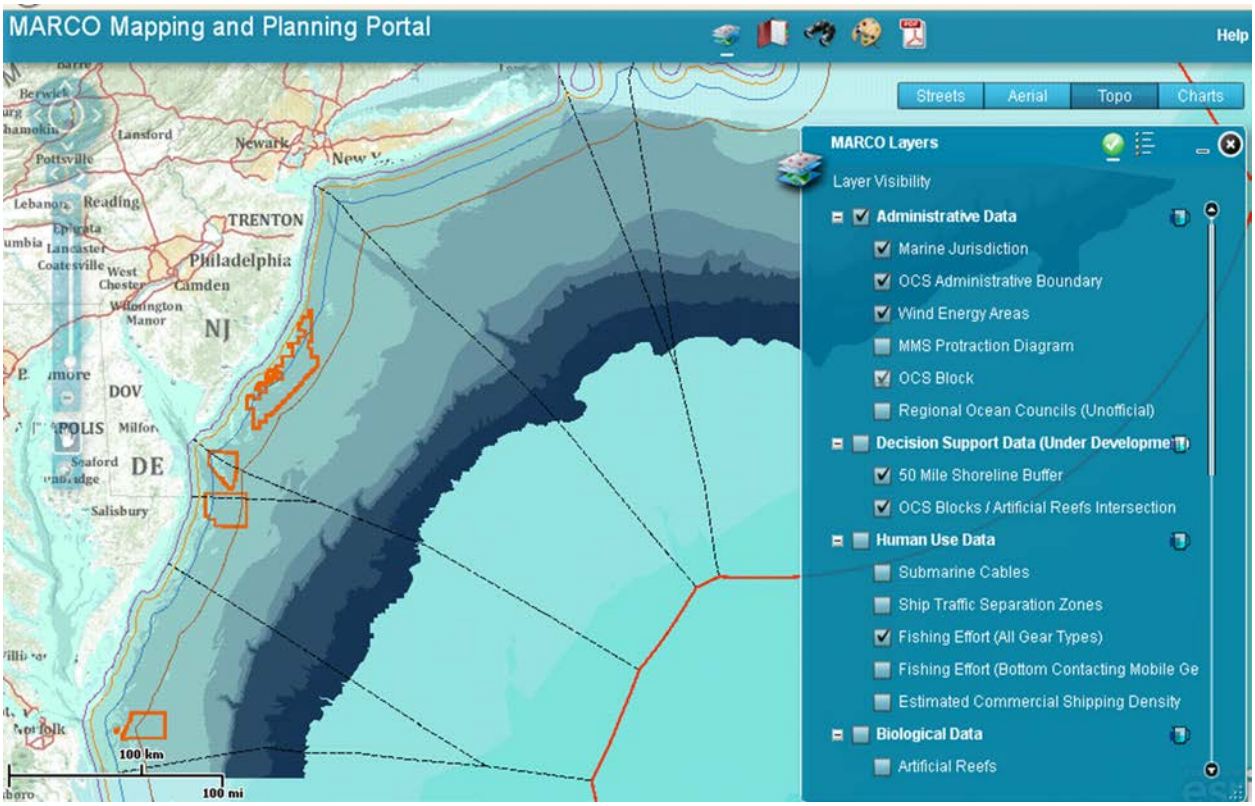
MARCO GIS Portal Final Report

NOAA Grant # NA10NOS41902505

Task 93.01 FY 2010

Report to Virginia Coastal Management Program

August 15, 2012



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August 15, 2012

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Virginia Coastal Zone Management Program

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I. Introduction

The Mid-Atlantic Regional Council on the Ocean (MARCO) was created in June 2009 through an agreement signed by the Governors of New York, New Jersey, Delaware, Maryland and Virginia and is recognized by NOAA as the Regional Ocean Partnership (ROP) for the region. In MARCO's action plan entitled *Actions, Timelines and Leadership to Advance the Mid-Atlantic Governors' Agreement on Ocean Conservation*, the following four priorities are identified for regional collaboration among the five states: (i) habitat protection, (ii) sustainable development of offshore renewable energy resources, (iii) water quality, and (iv) climate change.

One of the "shared actions" that cuts across all of these regional priorities is the need for a better data and tools to support regional ocean collaboration, planning and decision-making. The MARCO Board decided to add comprehensive regional ocean planning as a fifth priority with special emphasis on using ocean planning to facilitate the siting of renewable energy and protection of habitats. Toward this end, in FY 2009, Virginia Coastal Zone Management Program (CZM) provided funding for The Nature Conservancy (TNC) to produce the nation's first online ROP map portal to display key data needed for MARCO's regional partnership initiatives, including ocean planning. VA CZM followed up the first grant with a second grant (the "CZM MARCO II grant") to provide additional and ongoing support for the portal. The current MARCO portal funded by these two CZM grants positioned MARCO partners to receive an additional $1.35 million in federal funding from the National Oceanic and Atmospheric Administration's competitive Regional Ocean Partnership Funding Program (ROPFP). This grant is being used to continue to enhance and build the next generation regional ocean portal in the Mid-Atlantic for MARCO.

The funded NOAA proposal entitled "Enhancement of a Mapping and Planning Portal and Stakeholder Engagement to Support Regional Ocean Planning in the Mid-Atlantic" is currently being managed by Monmouth University, TNC, Rutgers University, University of Delaware, and Portal software development contractors Ecotrust (collectively known as the "Monmouth Team"). The funding provided through the ROPFP is enabling MARCO and the Monmouth Team to build on and fully leverage VA CZM's prescient investment in the MARCO portal. The enhanced portal represents a progressive evolution from the original portal. The focus of the enhanced portal is to provide essential ocean data and state-of-the-art mapping and visualization tools to equip and empower ocean managers and stakeholders from multiple sectors across the five states to best plan for future uses of the Mid-Atlantic Ocean. These efforts are consistent with the July 2010 *Final Recommendations of the Interagency Ocean Policy Task Force* (IOPTF).

The data systems, methods, protocols and best practices TNC developed during the design, building and maintenance of the current portal have been transferred for direct benefits and cost savings for the enhanced portal project. We are currently in a transition period between the existing and enhanced portals. The current portal will remain publically available until the enhanced version is ready for public release in mid-September, 2012. In this report, we focus on the progress made during the period of the CZM MARCO II grant in populating the existing portal with new data and improving functions that have in turn charted the course for the

enhanced MARCO portal and informed development of similar ocean data mapping projects around the nation.

II. Portal Data Development

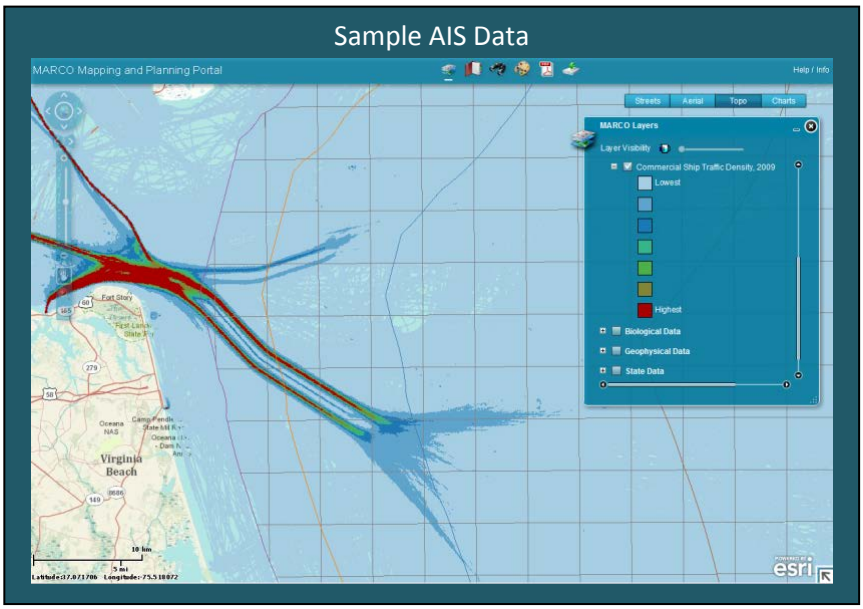
Over the duration of the CZM MARCO II grant, our top priority has been coordinating with federal and state agencies that are source providers or managers of marine spatial data relevant to ocean planning efforts. Toward this end, TNC has led and participated in numerous conference calls and discussions with state and federal agency representatives and others to identify met and unmet spatial data needs for regional ocean planning. We have done this in close consultation with MARCO's Ocean Planning Action Team throughout the project. Together with the Ocean Action Planning Team, we have collaborated closely with NOAA's Coastal Services Center and the Bureau of Ocean Energy Management to identify and make progress filling data gaps and assure effective coordination with the National Ocean Portal (Ocean.Data.Gov) and the Multi-Purpose Marine Cadastre.

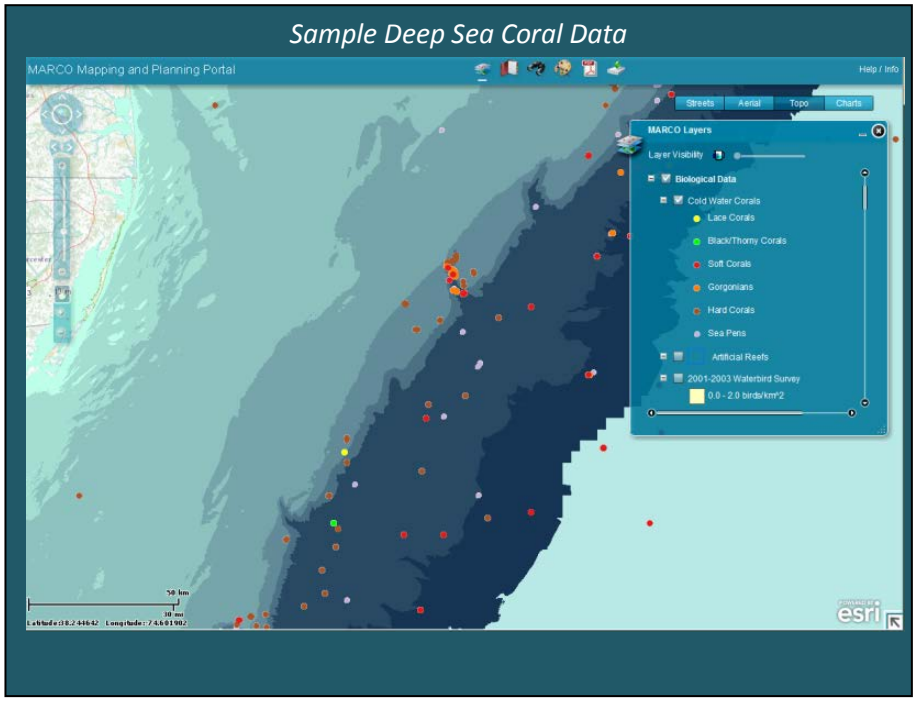
Additionally, we coordinated closely with the Northeast Regional Ocean Council (NROC) to identify and exploit opportunities for collaboration and avoid duplication of efforts. Several key data layers seamlessly covering both regions with identical cartography are now hosted by both sites. We also engaged the Mid-Atlantic regional ocean research and management community to foster better understanding of overall data needs and priorities. Details of all of this work are captured in the "Spatial Data Needs and Updates for Mid-Atlantic Ocean Planning" document which was revised and approved by the MARCO Board and is currently posted the MARCO website for download (Appendix A). This document is a summary of detailed information on the status of data collection and analysis efforts, responsible parties, and timelines for completion.

During the course of the CZM MARCO II grant period, we added several priority data layers to the MARCO portal, creating fact sheets and metadata for each. Below is a synopsis of each data layer added to the portal. Fact sheets were created for each of the highlighted data layers and can be found in Appendix B.

C*ommercial Ship Traffic Density 2009*

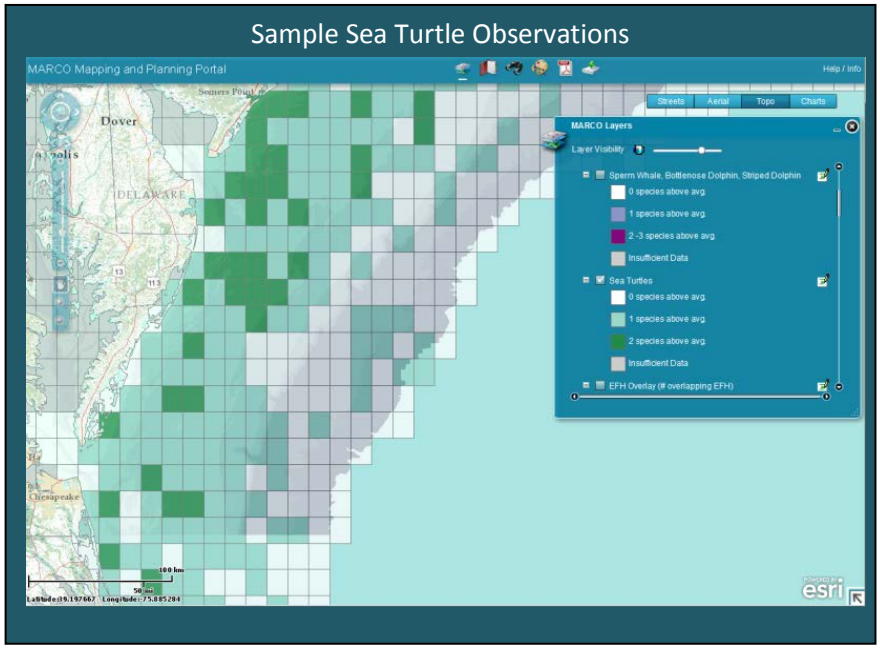
Automatic Identification System (AIS) data are collected by the U.S. Coast Guard using automated two-way radio transmissions to track real-time vessel information such as ship identity, purpose, course, and speed, primarily in coastal U.S. waters. This particular data set is derived from archived 2009 AIS data and is intended to be used by the ocean planning community to better understand vessel traffic patterns.





Deep Sea Corals

The National Database of Deep Sea Coral Observations has been developed to serve the needs of natural resource managers, scientific researchers, and the public. These records were obtained from historical sources. Observations record only where surveys have been conducted. Absence of an observation should not be interpreted as absence of corals. The source for these data is the NOAA Deep Sea Coral Research and Technology Program.

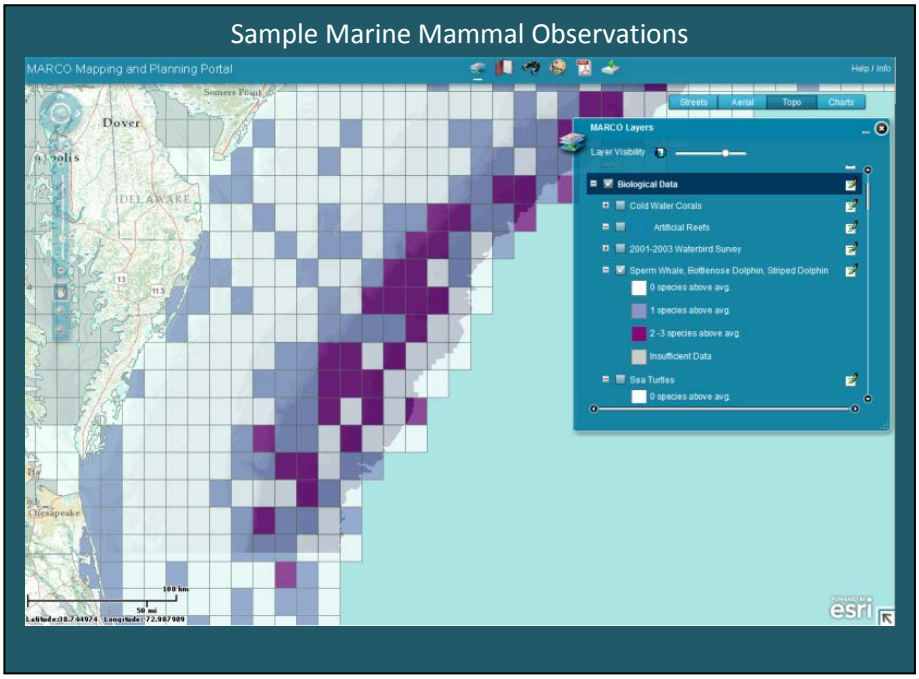


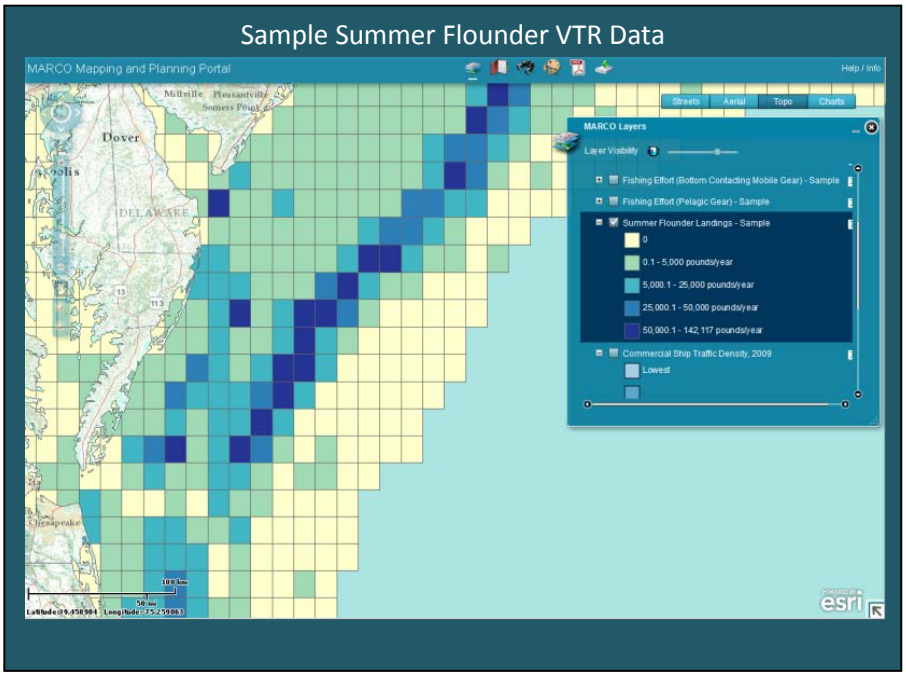
Important Areas for Sea Turtles

This data product was created as part of The Nature Conservancy's Northwest Atlantic Marine Ecoregional Assessment using geospatial data obtained from the United States Navy (effort corrected data compiled from multiple sources). Sightings Per Unit Effort (SPUE) was calculated for three sea turtle species: green sea turtle, leatherback sea turtle, and loggerhead sea turtle. The mean number of sightings per ten minute square was calculated, and the squares where the number of sightings was two standard deviations above the regional mean were identified as regionally important.

Important Areas for Marine Mammals

This data product was created as part of The Nature Conservancy's Northwest Atlantic Marine Ecoregional Assessment using geospatial data obtained from the United States Navy (effort corrected data compiled from multiple sources). Sightings Per Unit Effort (SPUE) was calculated for three species of marine mammals: sperm whale, bottlenose dolphin, and striped dolphin. The mean number of sightings per ten minute square was calculated, and the squares where the number of sightings was two standard deviations above the regional mean were identified as regionally important.



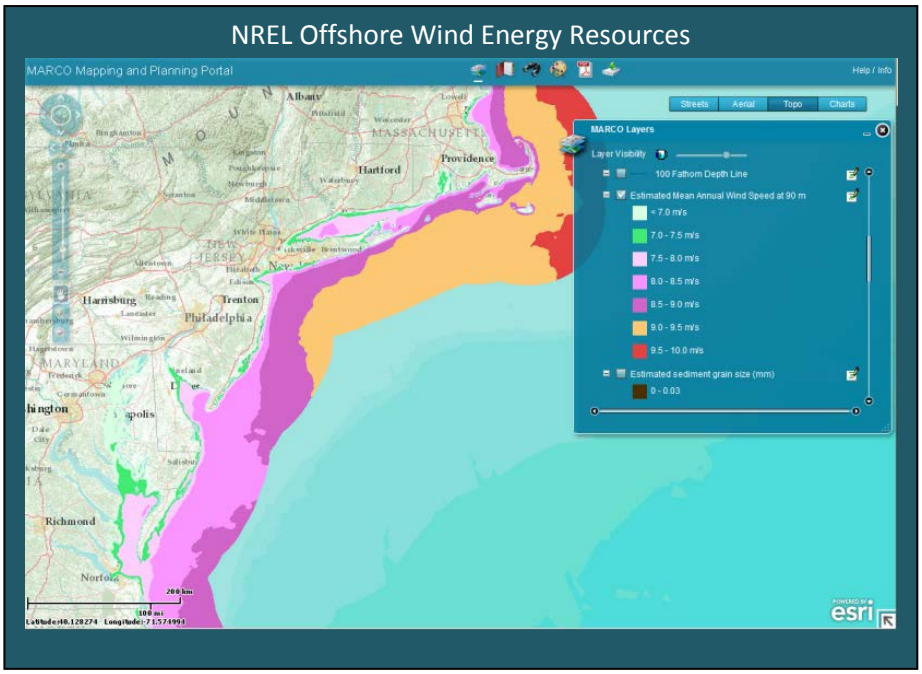


Commercial fishing vessel trip report data for select species

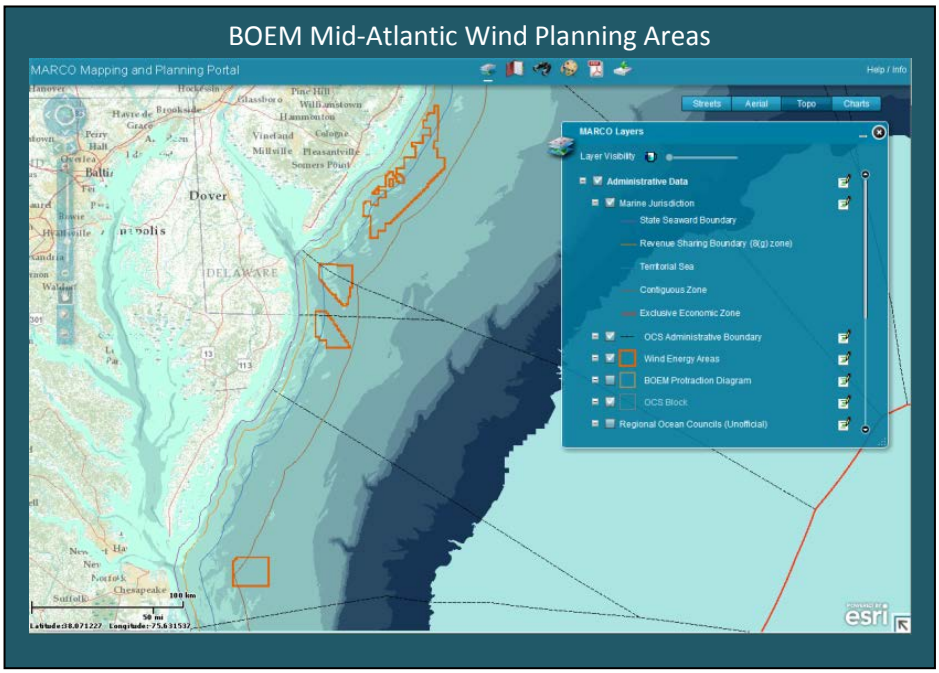
While existing Fishing Vessel Trip Report data provided by the National Marine Fisheries Service shows commercial fishing effort grouped by gear type (bottom contacting versus pelagic), we have also acquired VTR data from NMFS for select individual species of fish managed in the Mid-Atlantic. We have created a sample map layer showing number of pounds landed for one species (summer flounder) for the portal. Additional map layers to better represent both commercial and recreational fishing interests are currently being developed in close coordination with fishery stakeholders and management entities.

Offshore wind energy resources

The data were created by the National Renewable Energy Laboratory (NREL) and AWS Truepower. Wind speed data for all of the MARCO states was created as part of onshore wind mapping projects, a major source of uncertainty in the data. Speed data was extrapolated to 50 nautical miles offshore by NREL and 90 m wind speed was calculated by a linear interpolation between 70 m and 100 m wind speeds. This layer can be used for planning purposes to give a general idea of where offshore wind resources exist.



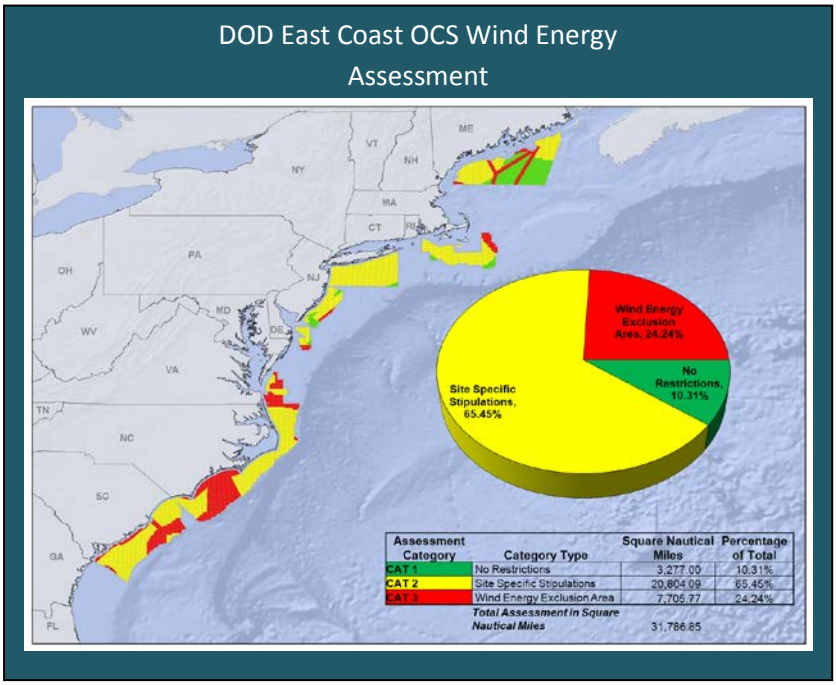
Mid-Atlantic Wind Planning Areas



This data set provided by BOEM represents changes made to the Wind Development Planning Areas in the Atlantic in the spring of 2012. Wind Planning Areas in this dataset represent up to seven different types of BOEM announcements within the US Federal Register that can be used to show the current status of an area that is being considered for offshore wind power development. This layer supersedes the earlier Wind Energy Areas (WEAs).

Forthcoming Data

We still have yet to obtain some of the critical geospatial data layers identified for regional ocean planning in the Mid-Atlantic listed on our data needs list. However, we have made notable progress in identifying key data custodians and working with them on necessary steps for obtaining and processing spatial data for hosting on the enhanced version of the portal in the near future.



For example, Department of Defense (DOD) has evaluated the compatibility of military operations with both offshore wind and oil and gas development operations in the Atlantic Ocean (see inset). However, while DOD has produced these spatial data layers, they have not yet made them available for sharing on regional ocean portals. TNC has worked closely with NOAA CSC staff on a coordinated strategy to request these data layers for display in the national Cadastre as well as the regional ocean portals, including the Mid-Atlantic portal.

NOAA and TNC are engaged in active discussions with individuals at DOD to ensure our requests are reviewed and approved though proper channels and chain of command.

Similarly, we are working closely with the U.S. Coast Guard to ensure we coordinate and incorporate findings from the ongoing Atlantic Coast Port Access Route Study (ACPARS). We are working with the ACPARS project director to ensure we classify and display AIS data in ways that are appropriate and consistent and useful to the Coast Guard and the port authorities in the Mid-Atlantic.

III. New Portal Functions

Over the duration of the CZM MARCO II grant, we have made several updates to the look, feel and functionality of the portal. We upgraded the portal to Esri's Flex Viewer Version 2.4. This update enabled new functionality to be added to the portal such as the "MARCO Layers" widget that shows layer visibility and legend information in the same view and contains links to a quick summary of each layer with further links to fact sheets and metadata.
This new version also allows users to click anywhere on the map and receive attribute information about the top-most layer at that location. Similar functions will be available in the enhanced version of the portal.

In addition, we created the ability for users to be able to download available data with a function called "clip and ship". One of the value-added features of this function is that spatial data can be downloaded in a custom map extent. Similar functionality will be evaluated for potential implementation in the enhanced portal.

We also were able to find and implement a technical solution to replace portal's URL address from a tnc.org address to a MARCO address, to make it clear who "owned" the site. However, TNC has continued to host the portal on our Worldwide Office server. This has been an issue of concern regarding the long-term sustainability of the portal which is being addressed and resolved through the ROPFP grant. The enhanced portal will be hosted on a cloud server and can be managed by MARCO or whomever they designate.

Finally, TNC has been working to develop "spatial design criteria" for wind energy development—factors relating to physical, biological and human use patterns that limit, constrain or enhance development opportunities. This work will be visualized in a series of overlay analyses and also leveraged to parameterize analysis features of the enhanced portal (Appendix C).

IV. Conclusion: Transition to Enhanced Portal

Overall, this project work has been an extremely productive and fruitful learning experience that provided value to managers and diverse portal users and also served a strategic purpose of laying the foundation for securing additional capacity and substantial resources to enable the evolution to the next generation of the portal. Many of the improvements currently underway as part of the ROPFP are a result of the adaptive management of our existing portal built with Virginia CZM funds.

One of the most significant shifts in the enhanced portal is that we are creating a user interface in full consideration of the needs of the non-technical ocean stakeholder or decision-maker who has no previous experience in GIS. We want the portal to be a ready-made, easy-to-use, intuitive and accessible tool to effectively facilitate ocean planning in the Mid-Atlantic. Some of the highlights of the enhanced portal that are helping us to meet this goal include:

- Rather than the portal being defined merely as a stand-alone web mapping service, the enhanced portal will be a comprehensive website that provides news and updates, a fully documented data catalogue, and the ability to visualize and analyze ocean data in the "Marine Planner". The website will provide context and resources for using the Marine Planner tool for regional ocean planning applications.
- The enhanced portal's user interface is built around seven key "themes" using a flexible and customizable open source platform. The themes include: "Fishing", "Recreation", "Marine Life", "Security", "Maritime Industry", "Administrative" and "Renewable Energy". These themes more intuitively connect relevant data for various ocean sectors to ocean planning needs and applications for the user.
- As part of the enhanced portal website, we have added a content heading called "Explore" that includes both current ocean data ("Explore Data Catalog") and future information needs ("Explore Data Priorities"). The Data Catalog includes current data holdings that are organized by ocean planning theme, provides links to view data in the Marine Planner, download data in several different formats, and access metadata and the original source of the data.
- The Explore heading will also include a live version of the "Spatial Data Needs and Updates for Mid-Atlantic Ocean Planning" that will be an active section in the site that is updated as needed. Each dataset listed will include the following attributes (consistent with current version): Dataset type/name, Source, Status, Contact, Expected Date of Incorporation, Notes.
- The Marine Planner will have advanced planning functions that include the ability to create and evaluate areas based on sector-specific filters and criteria, compare areas, and examine tradeoffs between areas in meeting prescribed ocean management goals. These functions will only be accessible via permission granted by the MARCO Board.

We are very pleased that the enhanced portal has built on, streamlined and broadened the functions found in the original portal. We expect that the next generation MARCO Portal will provide robust support for efforts by MARCO and the emerging Mid-Atlantic Regional Planning

Body to develop a transparent, inclusive and well-informed ocean planning process with broad stakeholder engagement. Virginia CZM's grants to create the first iteration of the Portal have charted the course for MARCO to help lead the nation with a model that demonstrates state-of-the-art tools for regional ocean planning.

Appendix A:

Spatial Data Needs and Updates for

Mid-Atlantic

Ocean Planning

Spatial Data Needs and Updates for Mid-Atlantic Ocean Planning

The Mid-Atlantic Regional Council on the Ocean (MARCO) has developed a web-based portal for sharing geographic data for managing ocean and coastal resources. The MARCO Mapping and Planning Portal is an online tool that allows state, federal, and local decision-makers and the public to visualize, query, map, and analyze ocean and coastal data in the Mid-Atlantic region.

The table below identifies some of the highest priority unmet ocean planning data needs as well as data currently under development, but not yet available for the Mid-Atlantic Region. Note that the Northeast Regional Ocean Council (NROC) shares many of these data needs and MARCO and NROC are coordinating on the collection and development of data that cover both regions. The data and information identified for MARCO are fundamental to moving forward with regional ocean planning efforts in the Mid-Atlantic, especially in light of state and Federal goals for accelerating offshore wind power development along the Atlantic Coast. Federal agencies have both data and expertise that could help meet these needs and many relevant studies are currently underway.

We are specifically asking governmental representatives and others in the Mid-Atlantic region:

- Do you have spatial data that might address an identified data gap?
    - If so, please describe the data set and provide a POC (name, telephone, email) that we could contact for additional information.
- Are you aware of any plans to collect data that might address specific identified data gaps?
    - If so, please describe the data collection effort and provide a POC (name, telephone, email) that we could contact for additional information.
- Are there additional ocean planning data needs we have not identified?

The list of data needs includes attributes for the source of the data, the status of data development, the point of contact for the data, and the expected date by which the data will be uploaded to the portal. The notes column contains information about what is already known about the needed data. In some cases, the data and information exist or are currently under development but significant additional effort (e.g. permissions, analysis and formatting) will be required to acquire and prepare the data for use within the regional planning portal. In other cases, the data likely do not currently exist and additional survey and analysis efforts will be needed. As ocean planning moves forward, we expect that additional data needs will be identified (e.g., for socio-economic data) and this list will be updated accordingly.

For further information contact Laura McKay, (804) 698-4323, Laura.McKay@deq.virginia.gov

Spatial Data Needs and Updates for Mid-Atlantic Ocean Planning

Note: MARCO has already collected many essential ocean planning data layers.

Category	Data Type	Description	Source of Data	Status	Contact Name	Expected Date of Upload to Portal	Notes
I. Existing and Available Data							
Administrative	Military, hazard and restricted areas	Information pertaining to uses of the marine environment by the Department of Defense for training, classified or restricted areas, with unexploded ordinances, etc.	USCG & DOD including ACOE, Navy, etc.	Efforts underway to incorporate authorized data into Portal	Brian Smith, NOAA CSC	Unknown	DOD has produced draft East Coast OCS Wind Energy Assessment for BOEM; in addition, DOD Oil and Gas Stipulation Layer exists on Cadastre
Biological	Coldwater coral locations	Known point locations on coldwater corals and associated taxonomic information in Mid-Atlantic	Multiple sources	Efforts underway to incorporate authorized data into Portal	Dan Dorfman, NOAA Biogeography Branch	June, 2012	Points represent only where corals were observed. The absence of a point does not necessarily indicate the absence of corals.
Biological	Marine Mammals--Sightings per Unit Effort (SPUE)	Important areas for marine mammals were determined from point sightings data. Data were assessed, combined and converted from seasonal species sightings into ten minute squares and effort-corrected. The resulting sightings per unit effort (SPUE) grids were used to identify important areas within the region for each species.	TNC NAM ERA compiled data; source of data U.S. Navy Marine Resource Assessment (MRA) for the Northeast and Virginia Capes	Efforts underway to incorporate authorized data into Portal	Jennifer Greene, The Nature Conservancy	As soon as vetted by Portal Data Review Team	Need to add summary data layers with SPUE grids combined for multiple species and seasons (e.g. all toothed whales). Assessed species include include fin whale, humpback whale, minke whale, northern Atlantic right whale, sperm whale, sei whale, Atlantic whitesided dolphin, bottlenose dolphin, harbor porpoise, and Atlantic striped dolphin.
Biological	Turtles --Sightings per Unit Effort (SPUE)	Important areas for sea turtles were determined from point sightings data. Data were assessed, combined and converted from seasonal species sightings into ten minute squares and effort-corrected. The resulting sightings per unit effort (SPUE) grids were used to identify important areas within the region for each species.	TNC NAM ERA compiled data; source of data U.S. Navy Marine Resource Assessment (MRA) for the Northeast and Virginia Capes	Efforts underway to incorporate authorized data into Portal	Jennifer Greene, The Nature Conservancy	As soon as vetted by Portal Data Review Team	Need to add summary SPUE grid for all three species assessed (green, leatherback and Atlantic loggerhead turtles) across seasons.

Category	Data Type	Description	Source of Data	Status	Contact Name	Expected Date of Upload to Portal	Notes
Biological	Turtles -- Distribrution and Nesting Areas (ESI)	Sea turtle areas displayed on the maps are limited to nesting beaches, and several well-known in-water concentration areas. Sea turtle nesting beaches include sand beach areas where sea turtles come ashore to nest.	TNC NAM ERA compiled; source data from Environmental Sensitivity Index, NOAA	Efforts underway to incorporate authorized data into Portal	Jennifer Greene, The Nature Conservancy	As soon as vetted by Portal Data Review Team	ESI maps provide a concise summary of coastal resources that are at risk if an oil spill occurs nearby. Vector polygons in this data set represent turtle distribution.
Biological	Large Pelagic Species (sharks, tuna, marlin)--Species Richness, Pesistence and EFH	Target species richness: Total # of target species by age class observed within a TMS summed and mapped based on all available data (1965-2004) Persistence: Sum of the number of decades that a	TNC NAM ERA compiled; source data from NMFS-SEFSC and NMFS-	Efforts underway to incorporate authorized data into Portal	Jennifer Greene, The Nature Conservancy	As soon as vetted by Portal Data Review Team	14 species respresented include: Albacore Tuna, Bigeye Thresher, Blue Marlin, Bluefin Tuna, Dusky shark, Great Hammerhead*, Porbeagle,
Human Use	Vessel Trip Report (VTR) data	Data on effort, catch and value for many commercially important species aggregated to ten minute squares.	NOAA/NMFS	Efforts underway to incorporate authorized data into Portal	Jennifer Greene, The Nature Conservancy	June, 2012	VTR data are available upon request and can be posted on the portal at appropriate scale and with appropriate attribution. Data will need to be depicted in consideration of confidentiality requirements.
Human Use	Vessel Monitoring System (VMS) fishing data	VMS are required for many commercial fisheries to monitor the position, time at a position, and course and speed of fishing vessels.	NOAA/ NMFS	Data under development	Jennifer Greene, The Nature Conservancy	December, 2012	Data has been transferred from NMFS; Data will need to be processed to provide maximum utility in consideration of confidentiality requirements.
Human Use	Sand, gravel, cobble mining locations; Identified resources	Resource areas where materials are actively mined from the seafloor; Areas which have been identified as potential "donor" sites for materials.	Multiple agencies including ACOE, BOEM, States	Data under development	John Bognar, Rutgers CRSSA	TBD	Currently, we have detailed information for MD only.
Human Use	State landings and fishing effort data	State level information about fishery landings and fishing effort.	States	Not initiated, return on investment for compilation is being evaluated.	Jay Odell, The Nature Conservancy	TBD (beyond scope of current portal enhancement funding)	Most ocean fisheries data is covered by federal reporting systems but there are gaps for some state managed fisheries.
Human Use	Municipal and private discharge	Discharge of effluent from waste water treatment plants receiving waste water from households, commercial establishments, and industries in the coastal drainage basin.	EPA	Data under development	John Bognar, Rutgers CRSSA	TBD	In addition to point locations, effluent plume models may be useful for informing ocean planning efforts.

Category	Data Type	Description	Source of Data	Status	Contact Name	Expected Date of Upload to Portal	Notes
Human Use	Energy facilities	Examples include nuclear power plant locations and discharge pipe locations, potential/existing hydrokinetic sites, etc.	Multiple agencies including FERC, NREL, NRC, and the EPA	Data under development	John Bognar, Rutgers CRSSA	TBD	
Human Use	Automatic Identification System (AIS) shipping data	AIS is an automated tracking system used on ships and by Vessel Traffic Services for identifying and locating vessels by electronically exchanging data with other nearby ships and VTS stations and provides information such as unique identification, position, course, and speed.	NOAA	Data available	Eric Howard, The Nature Conservancy	June, 2012	
Human Use	Port locations and attributes	Locations of ports, how they relate to shipping traffic and their capacity for servicing offshore energy development	ACOE; Individual ports	Data under development	Chris Bruce, The Nature Conservancy	August, 2012	
II. Data to be Collected and/or Developed							
Biological	Marine mammal migration paths	Critical seasonal migratory pathways for large whales (toothed and baleen), dolphins and porpoises.	DOE grant to BRI. VA CZM Section 309 grant to VA Aquarium	Data under development	Multiple contacts: see notes	Early 2014	Multiple data collection efforts ongoing currently, including AMAPPS (funded by BOEM, contact Dr. Deborah Epperson), BRI study (funded by DOE, contact Kate Williams), VA Aquarium study (funded by VACZM, contact Laura McKay)
Biological	Coldwater coral predictive distribution model	A high resolution, predictive model of coral habitat and distribution.	Multiple sources	Efforts underway to incorporate authorized data into Portal	Dan Dorfman, NOAA Biogeography Branch	Early 2013	NCCOS and NEFSC working on a predictive model for the Mid-Atlantic.
Biological	Regional scale sea bird and sea duck predictive distribution model	A high resolution, predictive model for sea bird and sea duck habitat and distribution.	Manomet's CETAP	Data under development	Charlie Menza, NOAA Biogeography Branch	Early 2013	BOEM-funded project underway to enable NCCOS to expand New York scale work to Mid-Atlantic region. Data expected in late 2012.
Biological	Important coastal bird habitat	Point and polygon data on coastal bird use of coastal and marine habitats for nesting, breeding, wintering and stopover.	Multiple sources	No efforts currently underway to obtain and compile data	Chris Bruce, The Nature Conservancy	TBD	Need to leverage existing data and efforts; additional data need to be collected.

Category	Data Type	Description	Source of Data	Status	Contact Name	Expected Date of Upload to Portal	Notes
Geophysical	Finite Volume Coastal Ocean Model (FVCOM) results	FVCOM is a coastal ocean circulation model developed by UMASSD-WHOI and includes information on current, wave regime, temperature, salinity and density.	Multiple including UMASS Dartmouth, Rutgers, NERACOOS, and MARACOOS	Data under development	Rick Lathrop, Rutgers CRSSA	TBD	FVCOM will include all of the NROC area and the northern part of MARCO area; additional modeling may be needed for MARCO.
Human Use	Commercial fishing activity	Spatial data interpreted and created using the Fishing Vessel Trip Report and Vessel Monitoring System databases in collaboration with commercial fishing stakeholders to illustrate the distribution, timing, and intensity of commercial fishing activity, with attributes for gear type and harvest species. Additional attributes collected through stakeholder engagement may include information about the specific socio-economic value of fishing locations to communities.	Commercial fishers via MARCO stakeholder engagement efforts	Data under development	Rick Lathrop, Rutgers CRSSA	June, 2013	Data will need to be processed in consulation with stakeholders to provide maximum utility in consideration of confidentiality requirements. No FVTR or VMS derived data products will be made available without prior approval from NFMS authorities.
Human Use	Recreational fishing activity	Areas where non-commercial fishing (recreational/sport fishing) occurs.	Recreational fishers via MARCO stakeholder engagement efforts	Data under development	Rick Lathrop, Rutgers CRSSA	June, 2013	Variable existing data; Engagement with recreational fishers to begin Summer, 2012
Human Use	Recreational boating activity	Areas where recreational boating (regattas, pleasure, cruises, water skiing, etc.) occurs.	Recreational boaters via MARCO stakeholder engagement efforts	Data development not yet initiated	Rick Lathrop, Rutgers CRSSA	TBD	
Human Use	Areas for non-fishing, non-boating recreational uses	Areas where diving, surfing, swimming, nature viewing, etc. occurs.	Recreational users via MARCO stakeholder engagement efforts	Data under development	Rick Lathrop, Rutgers CRSSA	June, 2013	
Human Use	Cultural use areas	Areas significant to Tribal Nations and other cultures.	Tribe leaders via MARCO stakeholder engagement efforts	Data under development	Rick Lathrop, Rutgers CRSSA	June, 2013	Development and use of these data will be subject to outcome of discussions between Tribal leaders and state and federal agency representatives.

Appendix B:

Fact Sheets for MARCO Portal Data Layers

(subset added for NOAA Grant # NA10NOS41902505)

AIS Shipping Density

Use Constraints / Caveats

- **This is a simplified view of a very complex and detailed data set. Hundreds of millions of individual points were processed and condensed into a generalized density raster. This raster shows a good overview of the density of most commercial shipping traffic but does not necessarily represent all shipping traffic at a fine level of detail.**

Purpose/Description

Automatic Identification System (AIS) data are collected by the U.S. Coast Guard using automated two-way radio transmissions to track real-time vessel information such as ship identity, purpose, course, and speed, primarily in coastal U.S. waters. This particular data set is derived from archived 2009 AIS data and is intended to be used by the ocean planning community to better understand vessel traffic patterns.

This particular AIS Vessel Trackline Density grid depicts the concentration of a majority of commercial shipping traffic within U.S. coastal and offshore waters. The density grid was created using tracklines that were generated from a 2009 AIS Database using a custom built trackline tool. Vessel tracklines were created separately for each month using the file geodatabases for UTM zones 18 and 19. A unique density grid was created for each combination of month and UTM zone. These grids were then summed together and clipped to the Mid-Atlantic region. To simplify display in on-line data viewers, the summed floating point grid was reclassified into 7 discrete classes using increments of 1/2 standard deviations from the mean density value from 1/2 to 3 standard deviations.

Common Uses

- AIS transmissions are used to help prevent ship collisions and for overall ship traffic management to improve maritime safety and security. Summarized AIS data is often used for analyzing patterns of commercial shipping traffic in coastal and offshore waters. This analysis can be used to inform local and regional marine planning efforts.

Other Information

Publication Date: 2012

Data format: ESRI File Geodatabase Raster
Date(s) of Data Collection: 2009
Date of Next Update: unknown
Accuracy / Resolution: 68m resolution raster derived from ship trackline data
Citation Information: The Nature Conservancy

Contact

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Cold Water Corals

Use Constraints / Caveats

These records were obtained from historical sources and are not confirmed or validated. Observations record only where surveys have been conducted. Absence of an observation should not be interpreted as absence of corals.

Purpose/Description

- The National Database of Deep Sea Coral Observations has been developed to serve the needs of natural resource managers, scientific researchers, and the public.

Other Information

Publication Date: 2012
Data format: ESRI geodatabase raster
Date(s) of Data Collection: This data set is based on observations from multiple sources that often date back many decades.
Date of Next Update: none planned
Accuracy / Resolution: widely varied
Citation Information: NOAA Deep Sea Coral Research and Technology Program

Contact

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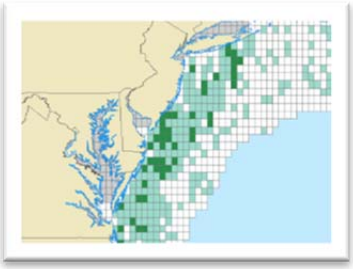
Important Areas for Sea Turtles



Use Constraints / Caveats

These data were created to be used for planning purposes only at an ecoregional scale. They represent a summary of effort-corrected sightings data for three species: green sea turtle, leatherback sea turtle and loggerhead sea turtle. The summary units are ten minute squares, an area ten minutes of latitude by ten minutes of longitude (roughly 100 square miles at Mid-Atlantic latitudes). As such, these data do not represent migration patterns or specific habitats.

Purpose/Description

- This data product was created as part of the Northwest Atlantic Marine Ecoregional Assessment. The Nature Conservancy developed this science-based ecoregional assessment for the Northwest Atlantic Marine region (Bay of Fundy to Cape Hatteras, North Carolina). For more information and a detailed report, please visit http://nature.org/namera/.

Geospatial data obtained from the United States Navy included point shapefiles of valid sightings for numerous marine mammal and turtle species and pre-calculated effort grids for each season. Sightings data were taken from NMFS-NEFSC Aerial Surveys, NMFS-NEFSC Shipboard Surveys, and the North Atlantic Right Whale Consortium database. The validity of sightings was carefully screened and verified by United States Navy contractors before inclusion in the model. Invalid records were not included in the analysis. Sightings for each ten minute square were divided by the effort for each ten minute square to calculate Sightings Per Unit Effort (SPUE). SPUE was calculated for each species, for each season, and for each ten minute square.

Seasonal effort-corrected sightings data on the three sea turtle species characteristic of this region, green sea turtle, leatherback sea turtle, and loggerhead sea turtle, were compiled and analyzed to identify those areas where each species had been consistently sited over many years. These data span approximately 25 years and include 2,078 documented sightings. For each species, the total number of effort-corrected sightings within each ten minute square (TMS) was calculated. Subsequently, for all TMS, the mean number of sightings per square was calculated, and the TMS where the number of sightings was two standard deviations above the regional mean were identified. These

TMS were tagged with a “1” and the number of “1s” was summed for each square across all species. The numbers shown in this dataset represent for each ten minute square how many of the three sea turtle species had a number of sightings at least two standard deviations above the regional mean.

Common Uses

- These data were developed for marine conservation planning and development of effective marine conservation strategies.

Other Information

Publication Date: 2010
Data format: ESRI geodatabase feature class
Date(s) of Data Collection: These products were derived from marine mammal sightings data collected over a wide range of dates.
Date of Next Update: unknown
Accuracy / Resolution: ten minute squares
Citation Information: The Nature Conservancy

Contact

Melissa Clark, Spatial Data Manager
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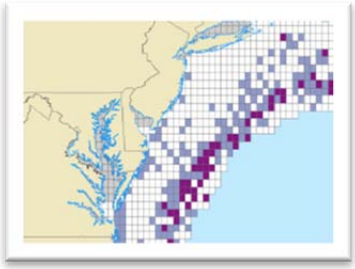
Important Areas for Toothed Whales



Use Constraints / Caveats

These data were created to be used for planning purposes only at an ecoregional scale. They represent a summary of effort-corrected sightings data for three species: sperm whale, bottlenose dolphin, and striped dolphin. The summary units are ten minute squares, an area ten minutes of latitude by ten minutes of longitude (roughly 100 square miles at Mid-Atlantic latitudes). As such, these data do not represent migration patterns or specific habitats.

Purpose/Description

- This data product was created as part of the Northwest Atlantic Marine Ecoregional Assessment. The Nature Conservancy developed this science-based ecoregional assessment for the Northwest Atlantic Marine region (Bay of Fundy to Cape Hatteras, North Carolina). For more information and a detailed report, please visit http://nature.org/namera/.

Geospatial data obtained from the United States Navy included point shapefiles of valid sightings for numerous marine mammal and turtle species and pre-calculated effort grids for each season. Sightings data were taken from NMFS-NEFSC Aerial Surveys, NMFS-NEFSC Shipboard Surveys, and the North Atlantic Right Whale Consortium database. The validity of sightings was carefully screened and verified by United States Navy contractors before inclusion in the model. Invalid records were not included in the analysis. Sightings for each ten minute square were divided by the effort for each ten minute square to calculate Sightings Per Unit Effort (SPUE). SPUE was calculated for each species, for each season, and for each ten minute square.

Seasonal effort-corrected sightings data on the three marine mammal species characteristic of this region, sperm whale, bottlenose dolphin, and striped dolphin, were compiled and analyzed to identify those areas where each species had been consistently sighted over many years. These data span approximately 24 years. For each species, the total number of effort-corrected sightings within each ten minute square (TMS) was calculated. Subsequently, for all TMS, the mean number of sightings per square was calculated, and the TMS where the number of sightings was two standard deviations above the regional mean were identified. These TMS were tagged with a “1” and the number of “1s” was summed for each square across all species. The numbers shown in

this dataset represent for each ten minute square how many of the three marine mammal species had a number of sightings at least two standard deviations above the regional mean.

Common Uses

- These data were developed for marine conservation planning and development of effective marine conservation strategies.

Other Information

Publication Date: 2010
Data format: ESRI geodatabase feature class
Date(s) of Data Collection: These products were derived from marine mammal sightings data collected over a wide range of dates.
Date of Next Update: unknown
Accuracy / Resolution: ten minute squares
Citation Information: The Nature Conservancy

Contact

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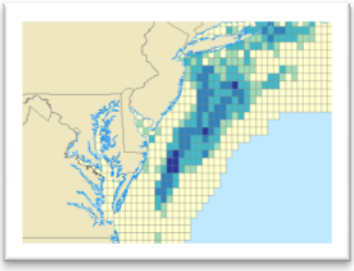
Fishing Effort/Landings



Use Constraints / Caveats

- **These data are sufficient for general planning purposes but errors in reporting or in transferring the paper reports to a digital format are not uncommon.**

Purpose/Description

- This is an extract of Fishing Vessel Trip Report (FVTR) data that The Nature Conservancy compiled from raw data received from the National Marine Fisheries Service (NMFS). The owner/operator of a vessel issued a federal fishery permit with FVTR requirements is required to submit FVTRs for each trip taken. The National Marine Fisheries Service requires this information for the conservation and management of marine fishery resources in accordance with the Magnuson-Stevens Fishery Conservation and Management Act. The data reported are used to develop, implement, and monitor fishery management strategies and for a variety of other uses.

  Reported information includes fishing effort, location and gear type for each trip, among other information. This particular data set represents fishing effort (days fished) and landings for one species (summer flounder) compiled by ten-minute square (areas that are 10 minutes of longitude by 10 minutes of latitude) for a 10-year period (2000-2009). The fishing effort data are broken down by various gear types. In the MARCO portal the data are displayed for a sum of all gear types, for a sum of all bottom contacting mobile gear (mostly dredges and bottom trawls) and for a sum of pelagic gear types.

Common Uses

- NMFS uses these data to develop, implement, and monitor fishery management strategies and for a variety of other uses. The Nature Conservancy compiled these data to inform marine spatial planning efforts.

Other Information

Publication Date: 2011
Data format: ESRI Shapefile
Date(s) of Data Collection: This layer includes data collected from 2000-2009.
Date of Next Update: unknown

Accuracy / Resolution: Data are shown by 10 minute square, which is an area 10 minutes of latitude by 10 minutes of longitude, which translates into roughly 14.5 km x 18 km
Citation Information: National Marine Fisheries Service

Contact
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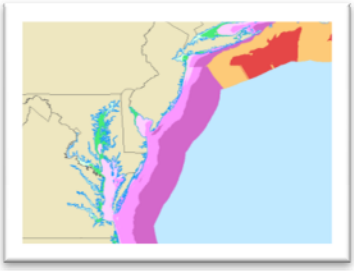
Estimated Mean Annual Wind Speed at 90m



Use Constraints / Caveats

- **This layer represents an *estimate* of offshore annual average wind speeds and is based primarily on data extrapolated from onshore wind data. This extrapolation is a major source of uncertainty in the data.**

Purpose/Description

- Annual average wind speeds are closely related to the available energy at a particular location and are categorized in these data by their value at a height of 90 meters above the surface. The data were created by the National Renewable Energy Laboratory (NREL) and AWS Truepower. Wind speed data for all of the MARCO states was created as part of onshore wind mapping projects. Speed data was extrapolated to 50 nautical miles offshore by NREL. The 90 m wind speed was calculated by a linear interpolation between 70 m and 100 m wind speeds. A horizontal discontinuity (seam) in the wind resource is present at the border of New York and New Jersey. Discontinuities in the data result from offshore data that is based on different versions of the numerical model used for the different onshore mapping projects and the way the extrapolation software interprets the data on either side of the seam.

- For more information visit nrel.gov and search for Technical Report TP-500-45889.

Common Uses

- This layer can be used for planning purposes to give a general idea of where offshore wind resources exist.

Other Information

Publication Date: 2010 (based on data originally published in 2003)
Data format: ESRI Shapefile
Date(s) of Data Collection: n/a
Date of Next Update: unknown
Accuracy / Resolution: Source data is 200m resolution raster
Citation Information: National Renewable Energy Laboratory

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Wind Planning Areas

Use Constraints / Caveats

- **The data was developed within the U.S. Government; no proprietary rights may be attached to them nor may they be sold to the U.S. Government as part of any procurement of ADP products or services.**

Purpose/Description

- This data set represents the most recent changes for the Wind Development Planning Areas in the Atlantic. Wind Planning Areas in this dataset represent up to six different types of announcements within the U.S. Federal Register that can be used to show the current status of an area that is being considered for Wind Power Development. The Smart from the Start Wind Energy Areas (WEAs) are also represented in this layer. When an area type changes status, it will be replaced entirely by the new area. The types of areas and their descriptions can be found in the Attributes section of the metadata record.

Common Uses

- To let those that are interested in Wind Energy Planning and Development know of the most recent updates to areas of interest for Wind Energy Development off the United States Coast within Federal Waters.

Other Information

Publication Date: 2012
Data format: ESRI Shapefile
Date(s) of Data Collection: 2010-2012
Date of Next Update: unknown
Accuracy / Resolution: Compiled from OCS blocks
Citation Information: Bureau of Ocean Energy Management

Contact

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Appendix C:

Scenarios for Future Offshore Wind Development
Using Spatial Design Criteria

Spatial Design Criteria for Wind Energy Development – Hypothetical Examples

It must be stressed that the following scenario descriptions and maps (Product #2) are completely hypothetical and developed simply for discussion regarding the potential for using spatial analysis to identify areas and characterize different types and degrees of practical, socio-economic and ecological constraints for current and new human uses of the ocean. Current wind planning areas are shown simply for reference and not for comparison of how well they align with these hypothetical scenarios. Several datasets used in this exercise are known to be too coarse or not robust or refined enough to drive planning decisions and our results in some cases highlight this inadequacy. For example the data used as proxies to represent potential conflicts with commercial fishing activity or marine life and habitat are binned into ten minute squares which may (depending on global position) be as large as 100 square miles—but in reality only a portion of a particular ten minute square may have the indicated feature.

It should also be noted that the spatial design criteria selected for this exercise are mostly arbitrary and may not reflect the real concerns of ocean users and state and federal resource managers—because they are not the result of a comprehensive and inclusive regional planning process with significant stakeholder engagement.

Therefore none of these scenarios represent opinions, findings or positions of The Nature Conservancy, NOAA or the Virginia Coastal Zone Program regarding the suitability of particular areas for wind power development. Our aim was simply to begin developing relevant data and methods for supporting and informing a regional ocean planning process, and to transfer and leverage this work as we continue to work with partners to develop more robust data and decision support tools.

The tools that we envision will be most effective for regional ocean planning will not show hard bright lines on the water as an endpoint, but rather will stimulate very well informed dialogue about ocean management choices in a context where compatibilities and constraints based on clearly stated assumptions and data limitations are illustrated and documented.

Notes: For this exercise “shipping lanes” are defined as fairways from NOAA charts combined with highest density ship traffic areas using 2009 AIS data. We considered but did not apply criteria based on wind speed because available wind resource data indicated all Mid-Atlantic areas had average speeds of 6.5 m/sec, generally thought to be suitable using current technology. When higher resolution data is available, additional analysis will be possible.

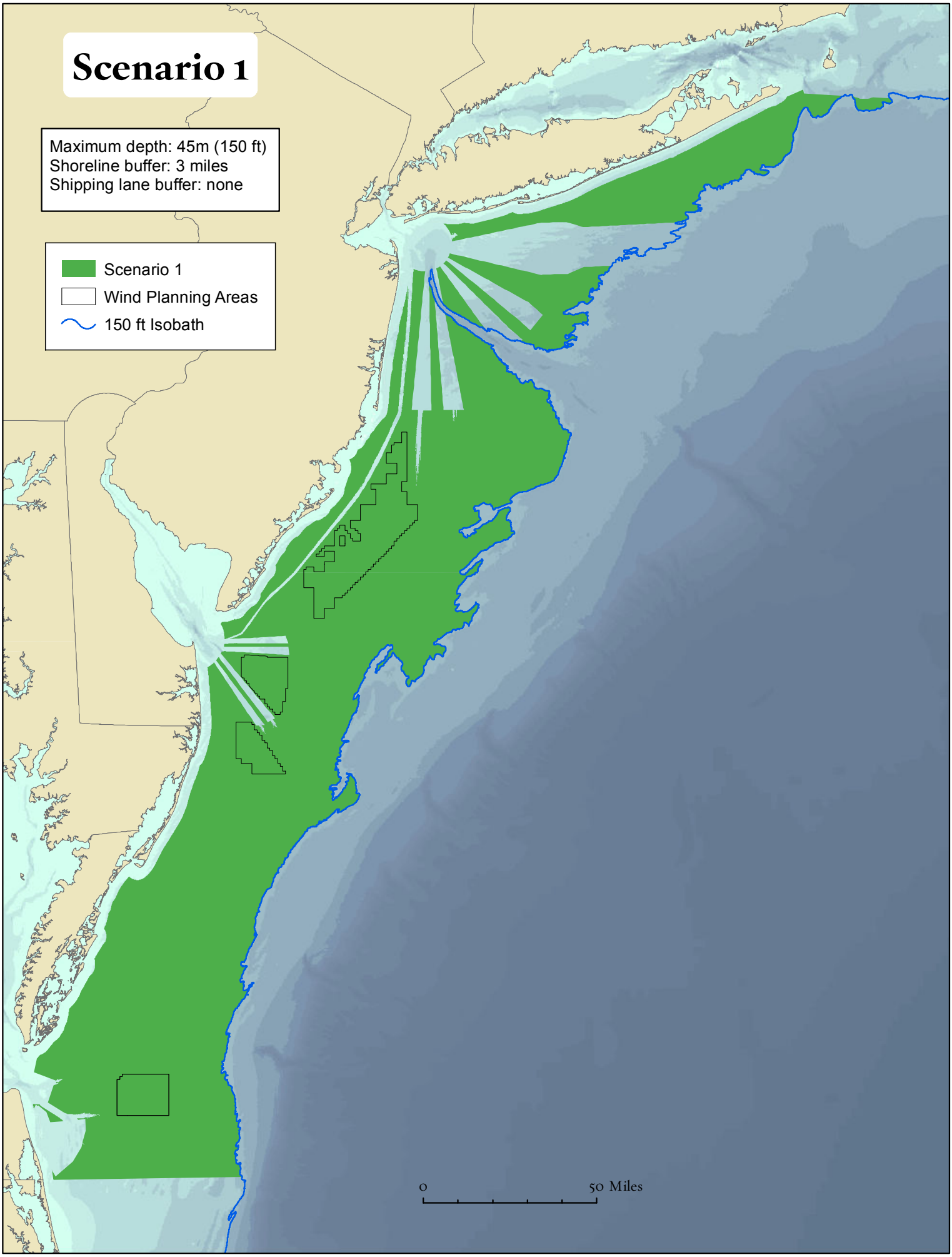
Scenario 1: This is the least restrictive scenario, with no buffer added to the “shipping lanes” and all areas seaward of three miles (federal waters) included.

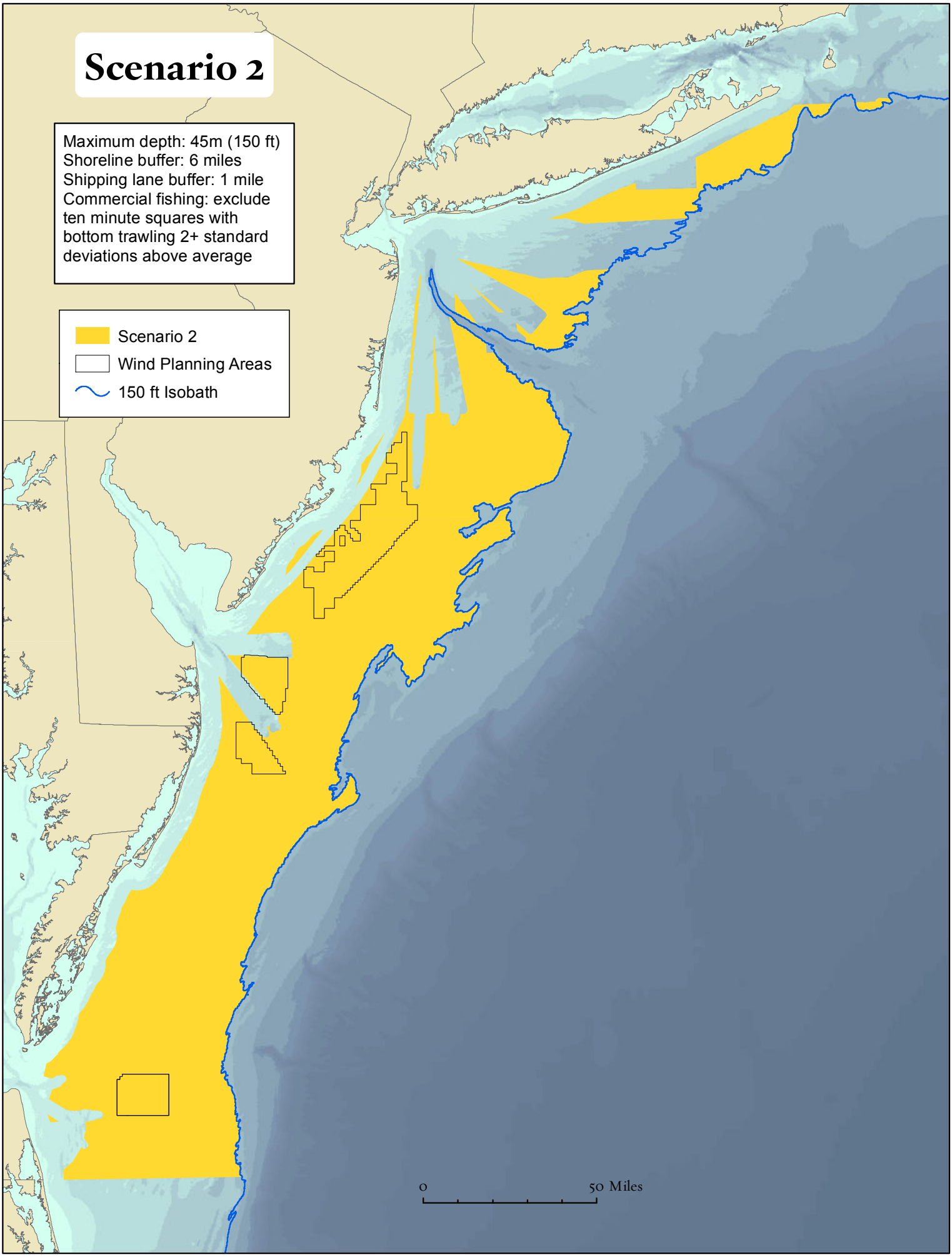
Scenario 2: This scenario excludes areas within six miles of shore and a one mile "shipping lane" buffer is added. Additionally, areas (ten minute squares) where vessel trip report data indicates bottom trawling activity (days fished) is two or more standard deviations higher than the regional average (2000-2009) are excluded.

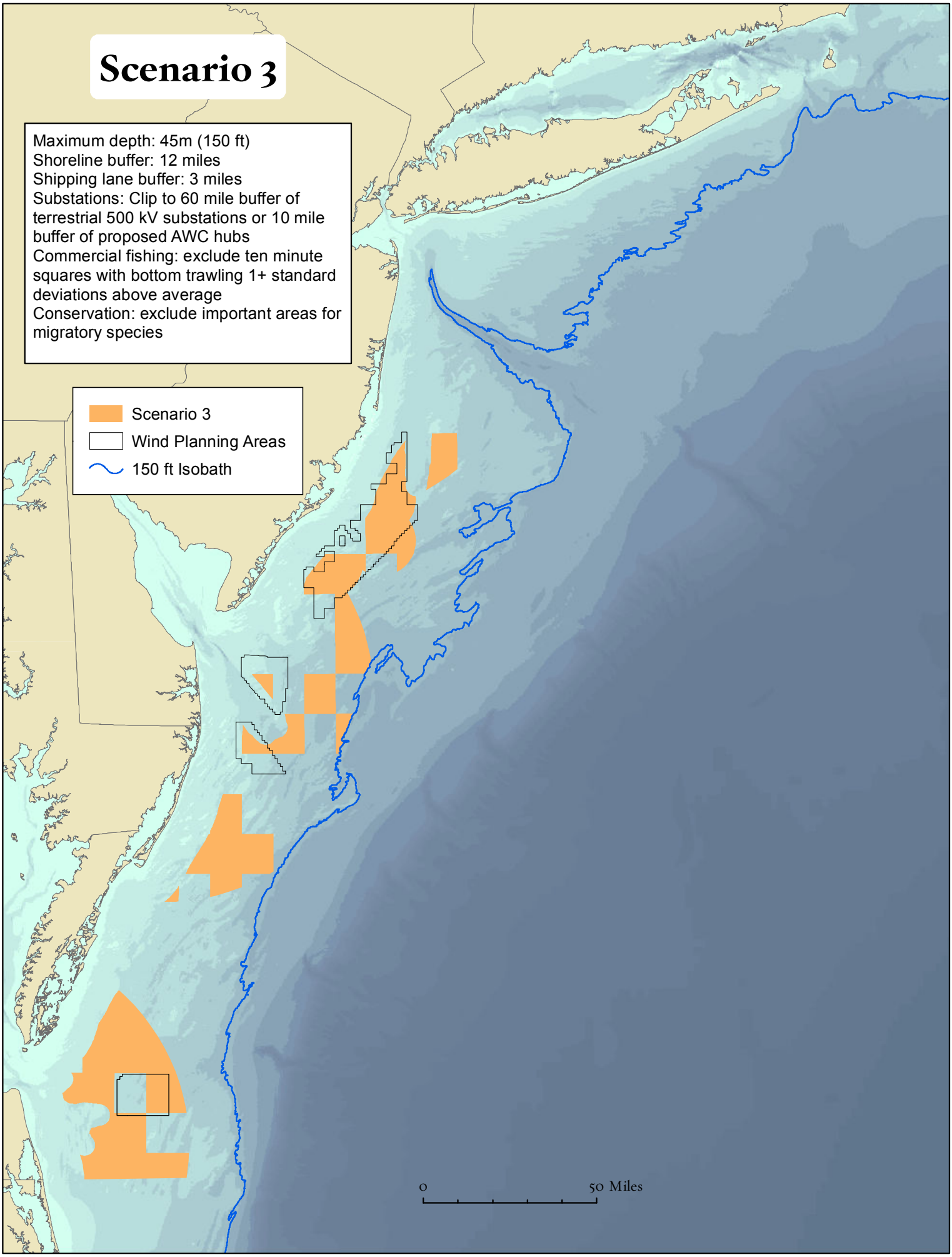
Scenario 3: This scenario is quite restrictive. The viewshed buffer is expanded to twelve miles and the "shipping lane" buffer to three miles. All bottom trawling areas with activity greater than one standard deviation higher than the regional average are excluded. Additionally, ten minute squares identified in TNC's Northwest Atlantic Marine Ecoregional Assessment (NAMERA) as having persistently high abundance of marine mammals, sea-turtles and large pelagic fishes (one or more of these groups—the "pelagic portfolio") are excluded. Areas more than 40 miles from a 500kV substation or 10 miles from the proposed Atlantic Wind Connection transmission line are also excluded.

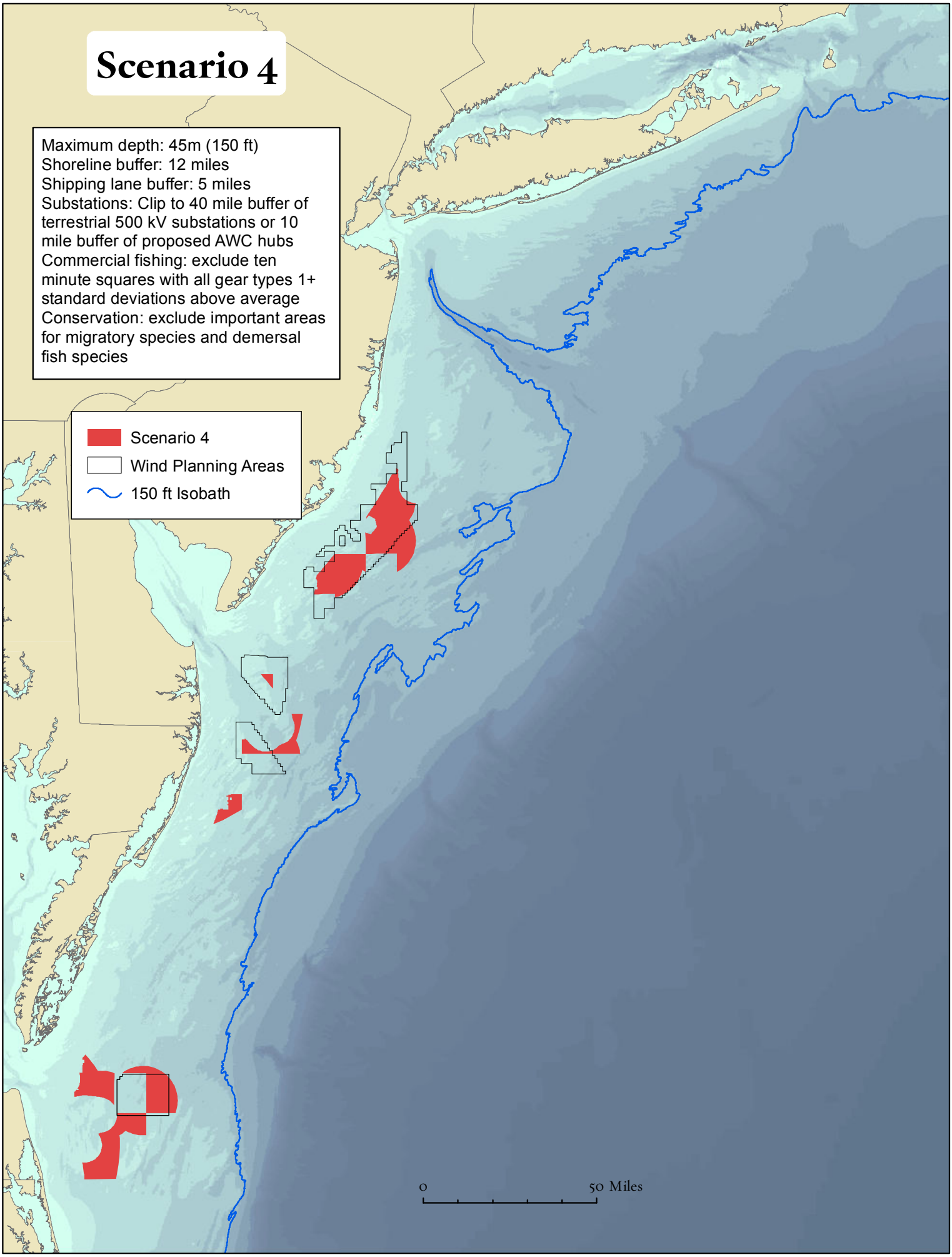
Scenario 4: This extreme scenario expands the "shipping lane" buffer to five miles and excludes all areas where commercial fishing activity for *any* gear type is one standard deviation above the regional average. Areas identified by NAMERA based on presence, abundance and persistence of demersal fish, fish community diversity, cold water corals, and hard substrates ("seafloor portfolio") were excluded along with the NAMERA migratory portfolio.

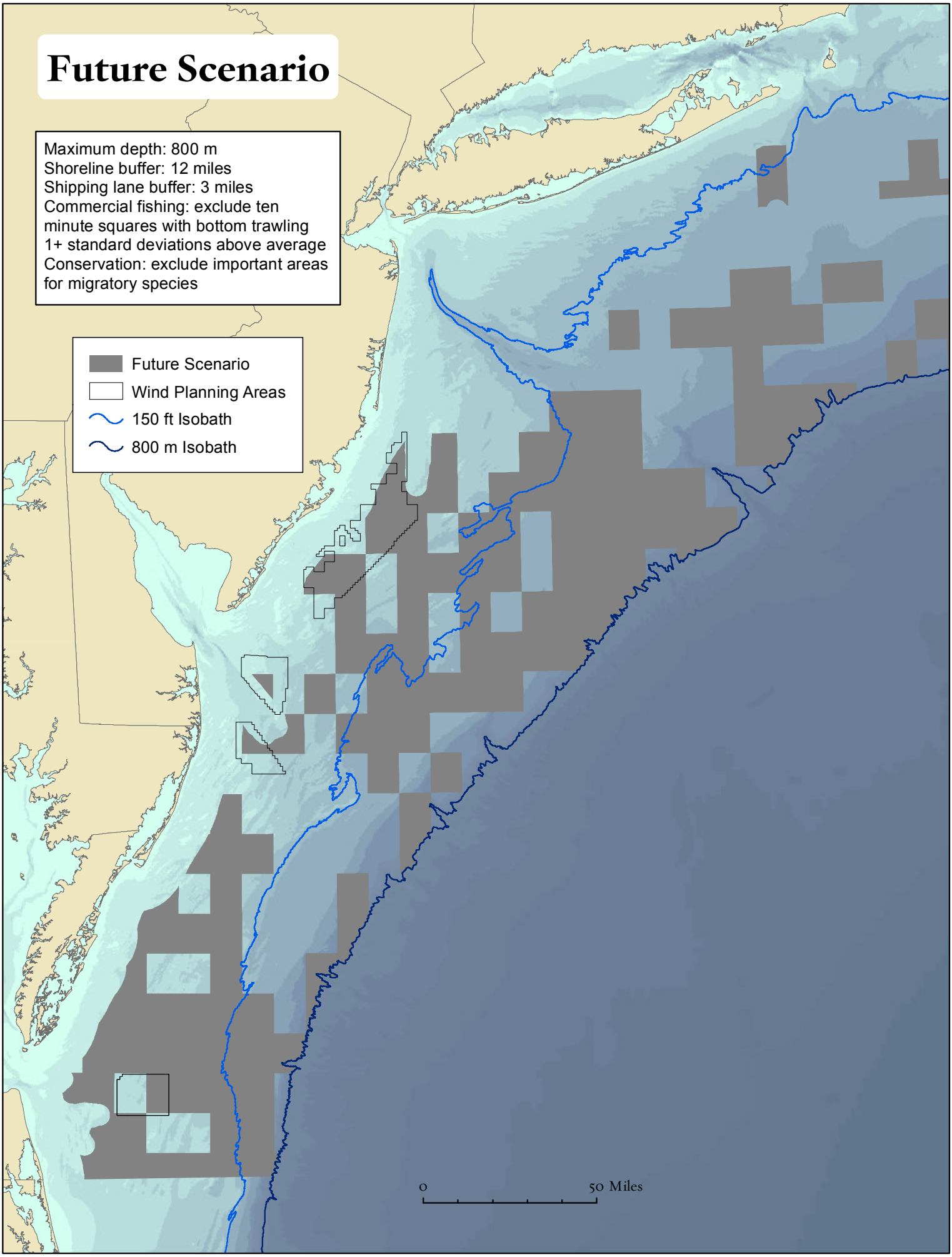
Future Scenario: This scenario considers the future potential for wind energy development using floating turbines, expanding the depth restriction seaward to 800 meters. All other exclusion criteria are identical to scenario 3, except that there are no exclusions based on proximity to 500kV substations or the proposed Atlantic Wind Connection transmission line.


Scenario 1
Maximum depth: 45m (150 ft)
Shoreline buffer: 3 miles
Shipping lane buffer: none
Scenario 1
Wind Planning Areas
150 ft Isobath
0
50 Miles


Scenario 2
Maximum depth: 45m (150 ft)
Shoreline buffer: 6 miles
Shipping lane buffer: 1 mile
Commercial fishing: exclude ten minute squares with bottom trawling 2+ standard deviations above average
Scenario 2
Wind Planning Areas
150 ft Isobath
0
50 Miles


Scenario 3
Maximum depth: 45m (150 ft)
Shoreline buffer: 12 miles
Shipping lane buffer: 3 miles
Substations: Clip to 60 mile buffer of terrestrial 500 kV substations or 10 mile buffer of proposed AWC hubs
Commercial fishing: exclude ten minute squares with bottom trawling 1+ standard deviations above average
Conservation: exclude important areas for migratory species
Scenario 3
Wind Planning Areas
150 ft Isobath
0
50 Miles


Scenario 4
Maximum depth: 45m (150 ft)
Shoreline buffer: 12 miles
Shipping lane buffer: 5 miles
Substations: Clip to 40 mile buffer of terrestrial 500 kV substations or 10 mile buffer of proposed AWC hubs
Commercial fishing: exclude ten minute squares with all gear types 1+ standard deviations above average
Conservation: exclude important areas for migratory species and demersal fish species
Scenario 4
Wind Planning Areas
150 ft Isobath
0
50 Miles


Future Scenario
Maximum depth: 800 m
Shoreline buffer: 12 miles
Shipping lane buffer: 3 miles
Commercial fishing: exclude ten minute squares with bottom trawling 1+ standard deviations above average
Conservation: exclude important areas for migratory species
Future Scenario
Wind Planning Areas
150 ft Isobath
800 m Isobath
0
50 Miles