

Executive Office of Energy and Environmental Affairs
Massachusetts Office of Coastal Zone Management

TRANSPORTATION AND NAVIGATION
Work Group Report

2014 Massachusetts Ocean Management Plan Update

March 31, 2014

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SECTION ONE: WORKGROUP MEMBERSHIP

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SECTION TWO: INTRODUCTION

The Massachusetts Oceans Act of 2008 (“Act”) required the development of an Ocean Management Plan (“Plan”). The Plan, promulgated in 2009, identifies management areas within state waters and includes siting and performance standards that protect natural resources as well as commercial and recreational water-dependent uses. The Act requires the Plan to be reviewed every five years. As part of that review process, the Transportation/Navigation Workgroup convened in mid-2013 to discuss potential updates to mapped transportation and navigation uses. The workgroup focused on identifying and updating existing transportation and navigation data and trends. It should be noted that in 2009, the workgroup also reviewed infrastructure uses. For the purposes of the current Plan review and update, infrastructure has been included in the Energy and Infrastructure Workgroup.

Transportation/Navigation Workgroup Charge (2013)

- Identify any changes to spatial extent of “protected areas” identified and mapped in the 2009 Massachusetts Ocean Management Plan: special, sensitive, or unique (SSU) resource areas and concentrations of water-dependent uses.
- Identify and describe/characterize other significant or notable trends in the status or condition of resources and uses, including (a) the protected SSU resource areas and concentrations of water-dependent uses identified and mapped in the 2009 Plan and (b) the topics and categories covered in the Baseline Assessment (pertinent sections and summaries shared with workgroups).
- Identify and summarize any new science that advances the characterization of the planning area and its uses and resources, especially applied science with spatial data.

SECTION THREE: DATA RESOURCES

For the 2009 Plan, the primary source for the workgroup data layers came from the National Oceanic and Atmospheric Administration (NOAA) nautical charts. The transportation and navigation data layers used in the workgroup’s analysis included: anchorage areas, anchorage berths, areas to be avoided, ferry routes, navigational aids, pilot boarding areas, precautionary areas, prohibited areas, separation zones, and shipping lanes. Ultimately, the following data layers were included in the Plan and shown as part of the Baseline Assessment: anchorage areas and berths, ferry routes, pilot boarding areas, precautionary areas, separation zones, and shipping lanes. The Plan also included three other data layers—Automatic Identification System (AIS), Vessel Monitoring System (VMS), and recreational boating data—to map concentrated areas of water-dependent uses in the planning area.

For the current Plan review and update, the workgroup updated the baseline map with data downloaded from NOAA's Electronic Navigational Chart (ENC) Direct to Geographic Information System (GIS) viewer. These data layers include: anchorage areas, anchorage berths, precautionary areas,

separation zones, traffic lanes, and recommended routes. The ferry routes were created by the Massachusetts Department of Transportation, Office of Transportation Planning. The pilot boarding areas were produced by Applied Science Associates (ASA) and downloaded from the Northeast Ocean Data Portal. Figure 1 below shows the transportation and navigation layers which will be used in the Plan review and assessment. See Table 1 below for a comparison of these data layers to those used in the 2009 Plan.

The primary focus of the Transportation/Navigation workgroup's effort for the current Plan review and update focused on gathering new AIS, VMS, and recreational boating data. A more detailed description of these datasets and the workgroup's efforts is described below.

Automatic Identification System Vessel Density

In the 2009 Plan, AIS data were used to create a density map that showed areas of concentrated commercial vessel traffic in the planning area. The workgroup discussed the data available to update this map and the value of incorporating additional years of data. The workgroup also stated that, if available, a breakdown by vessel type would be important to include in the updated map.

To map concentrated commerce traffic for the current Plan review and update, AIS tracklines, produced by the NOAA Coastal Services Center, for 2011 and 2012 were used to create a vessel density dataset (Figure 2). In the 2009 Plan, areas where >50 vessels were recorded in 2008 were extracted to map the concentrated commerce traffic water-dependent use layer. Since the new data represent vessel density based on the length of tracklines, not counts of vessels, an equivalent of 50 vessels per year per grid cell was calculated using length. These areas of high trackline density for 2011–2012 were then extracted and mapped to update the concentrated commerce traffic water-dependent use layer (Figure 3). See Table 2 below for more information about the data analysis and for a comparison of the mapping methods used in the 2009 Plan and the current Plan review and update.

As recommended by the workgroup, AIS density by vessel type was also mapped. Figures 4, 5, 6, and 7 below show the 2011–2012 vessel density for cargo, passenger, tanker, and tug and tow vessels, respectively.

Vessel Monitoring System Data

To map concentrated commercial fishing traffic for the current Plan review and update, commercial fishing vessel density data prepared by ASA for the Northeast Regional Ocean Council were used. These data were created using VMS data from 2006–2010. ASA calculated the point density of the VMS data in the North Atlantic and standardized the data. In the 2009 Plan, areas where >25 vessels were recorded from September 1, 2007 to September 1, 2008 were extracted to map the concentrated commerce traffic water-dependent use areas. Since the new data represent standardized vessel density, the 25 vessels per year class break cannot be used. The areas mapped with >25 fishing vessels in the 2009 Plan covered 7% of the planning area, so the new data were classified into deciles and the top 10% was

extracted as the concentrated commercial fishing traffic water-dependent use layer (Figure 8). See Table 3 below for more information about mapping the concentrated commercial fishing traffic in the 2009 Plan and the current Plan review and update.

One thing to note about Figure 8 is that the areas mapped as concentrated commercial fishing traffic are likely dominated by offshore, large fishing vessels. VMS data miss many fisheries that are present in state waters. See Appendix A for a table of fisheries not covered by VMS in Massachusetts. Additional work should be done to identify corridors for commercial fishing vessels within state waters for future Plan reviews and updates.

Recreational Boating Routes

Mapped recreational boating routes were used to develop a route density dataset. The recreational boating routes include data collected from the 2010 Massachusetts Recreational Boater Survey, the 2012 Northeast Recreational Boater Survey, and the 2013 Massachusetts Marine Trades Association (MMTA) user survey (Figure 9). The 2010 Massachusetts Recreational Boater Survey was conducted by SeaPlan and partners. Survey respondents plotted over 1,000 of their boating routes in Massachusetts state waters from May to October 2010. Building off the 2010 survey, SeaPlan conducted a similar survey in 2012 for the Northeast. Boaters mapped over 1,000 routes in Massachusetts state waters between May and October 2012. In 2013, MMTA asked experienced mariners to mark charts with routes commonly used by recreational boaters in Massachusetts. Over 500 routes were mapped through this survey.

To map concentrated recreational boating activity, the line density of the 2010, 2012, and MMTA recreational boating routes in the North Atlantic was calculated. The data were classified into quartiles (Figure 10) and the top two quartiles were extracted to update the concentrated recreational boating activity water-dependent use layer (Figure 11). The top two quartiles cover 88% of the 2010 routes, 90% of the 2012 routes, and 78% of the MMTA routes, so these data capture the majority of the recreational boating routes identified in the planning area. See Table 4 below for more information about mapping the concentrated recreational boating activity in the 2009 Plan and the current Plan review and update.

Long-term Data Priorities

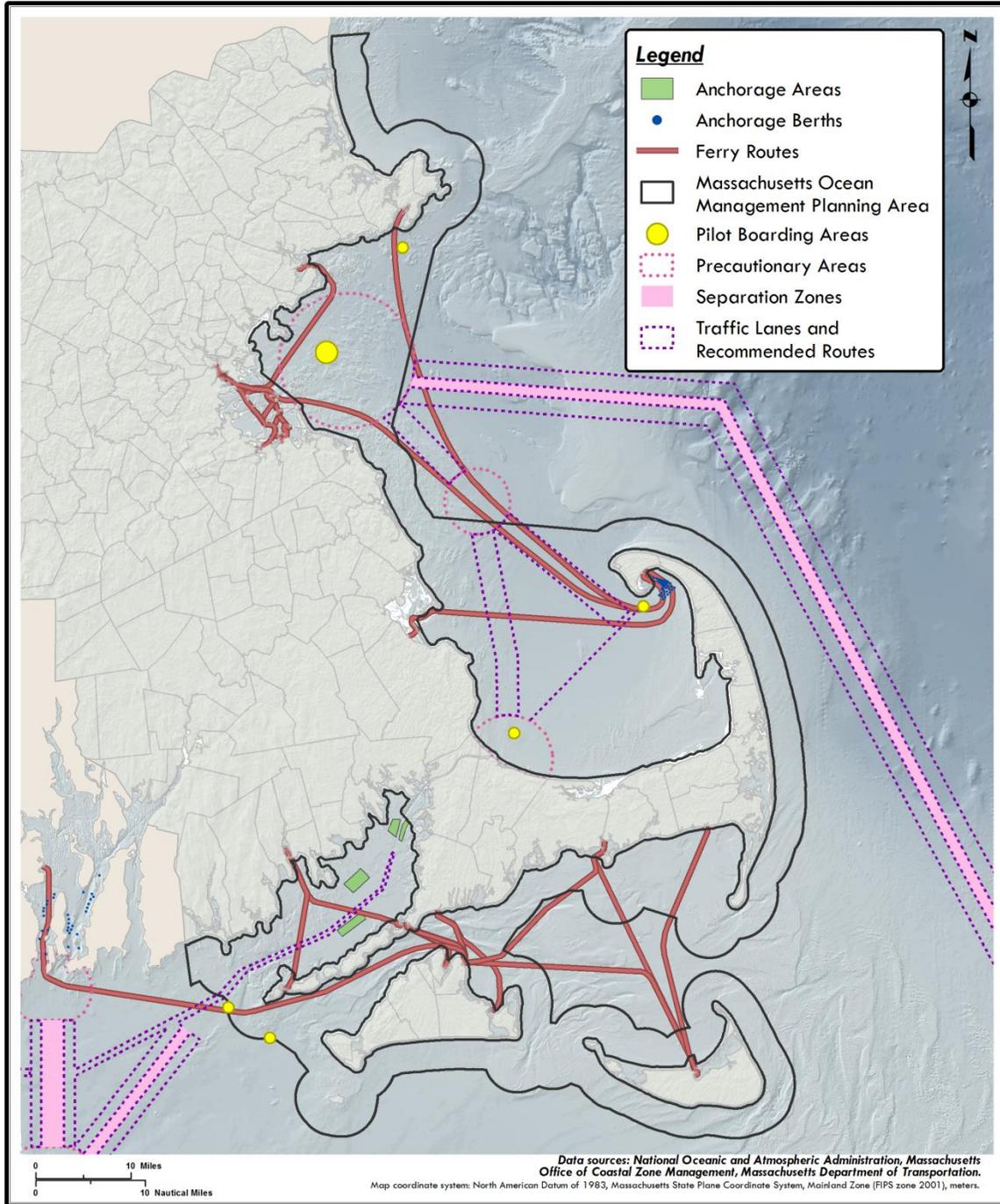
The following are long-term data priorities that were identified for future Plan reviews and updates.

- As mentioned above, VMS data do not include many fisheries that are present in Massachusetts state waters. A sensitivity test of how state-only fisheries could influence the concentrated commercial fishing traffic map (Figure 8) should be considered. Additional work should also be done to identify important in-state corridors for smaller vessels.
- The possibility of using Maritime Mobile Service Identity (MMSI) data to map recreational boaters should be investigated. Private vessels that are used for recreation only and are not required by law to carry a radio may register for a MMSI number. Recreational boaters can then transmit their MMSI

number to the Coast Guard by radio. These tracking systems are currently not widely used, but the possibility of using these data for future Plan reviews and updates should be considered.

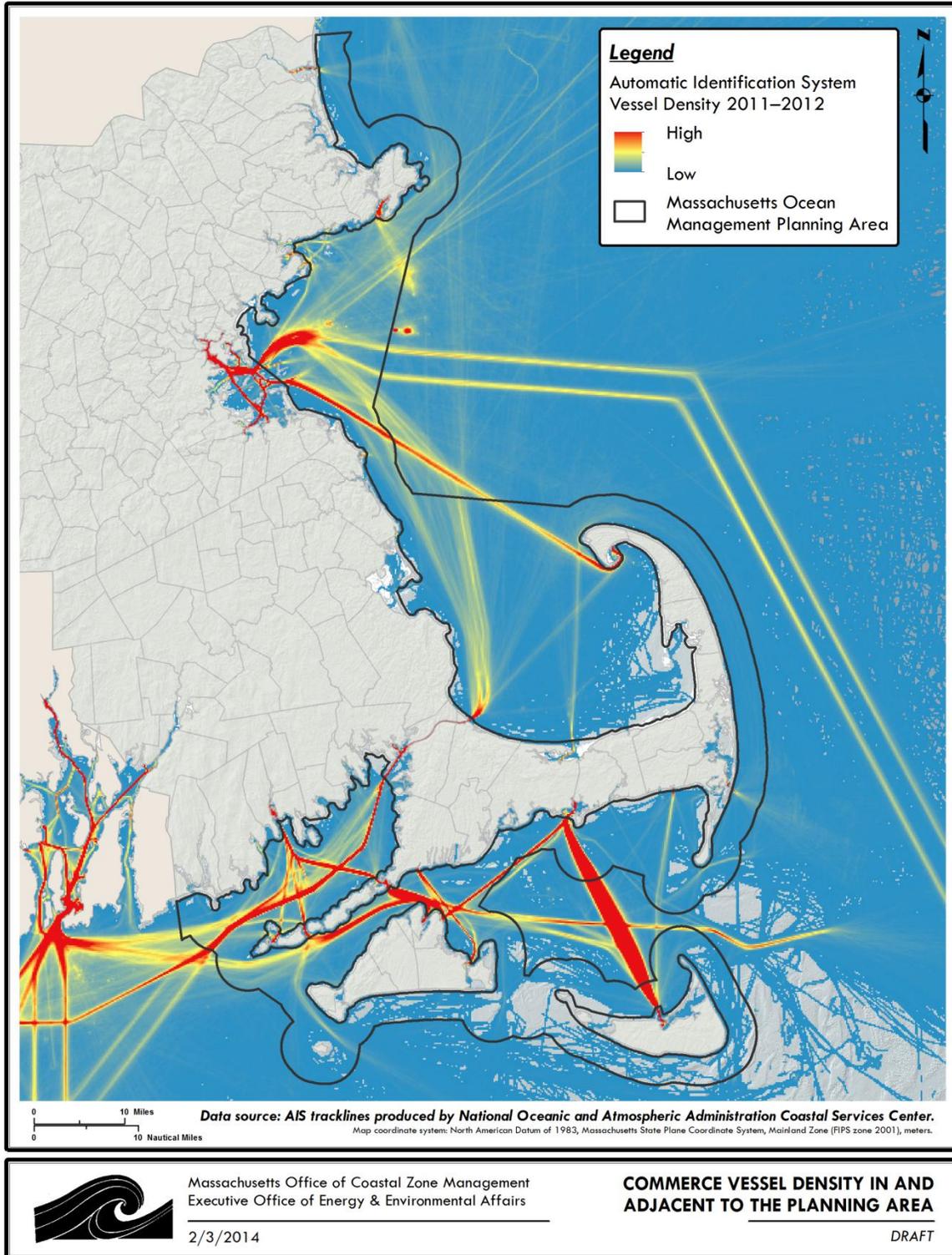
SECTION FOUR: MAP PRODUCTS

Figure 1. Transportation Routes and Navigation Uses



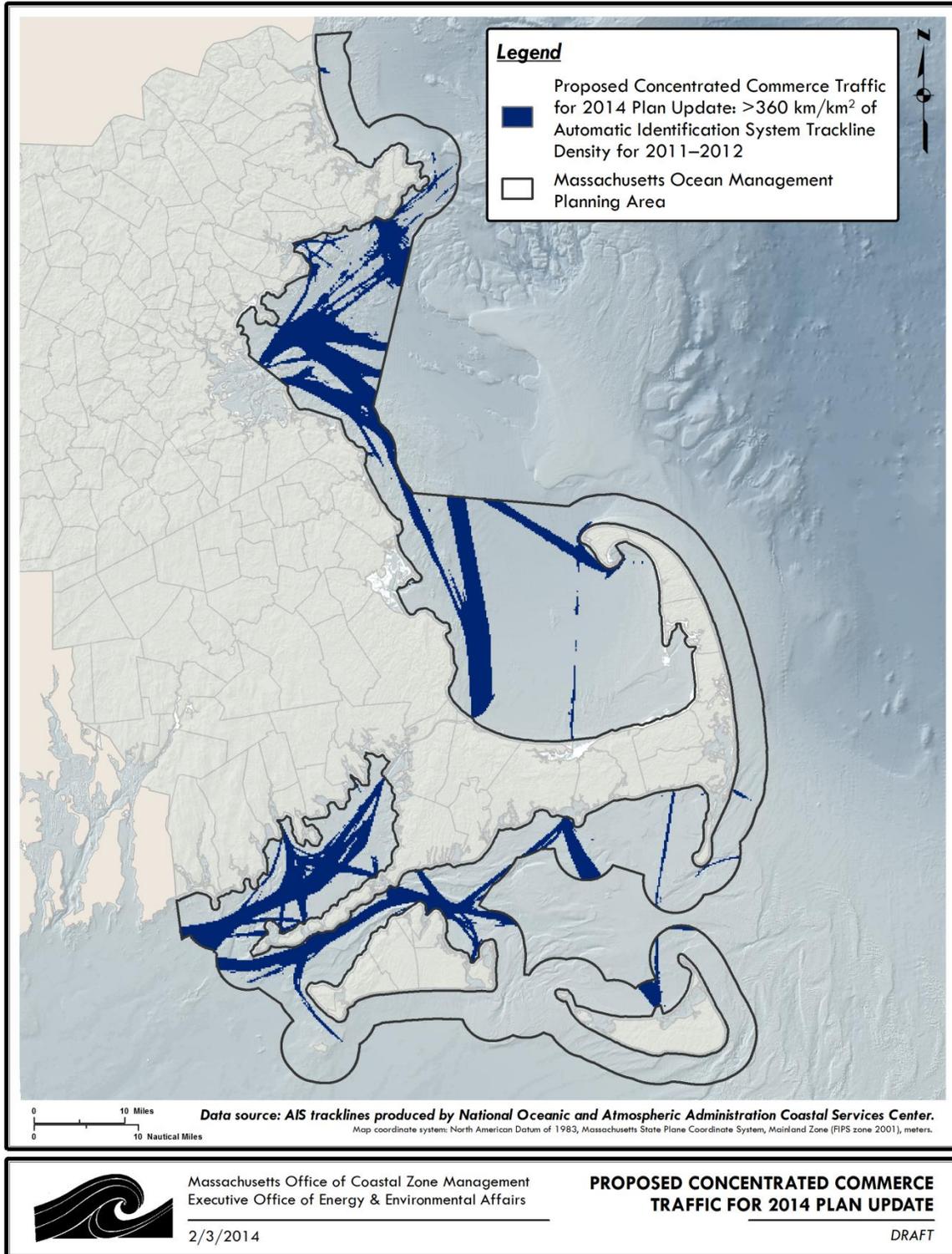
	<p>Massachusetts Office of Coastal Zone Management Executive Office of Energy & Environmental Affairs</p> <p>2/3/2014</p>	<p>TRANSPORTATION AND NAVIGATION USES IN AND ADJACENT TO PLANNING AREA</p> <p>DRAFT</p>
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Figure 2. Automatic Identification System Vessel Density for 2011–2012



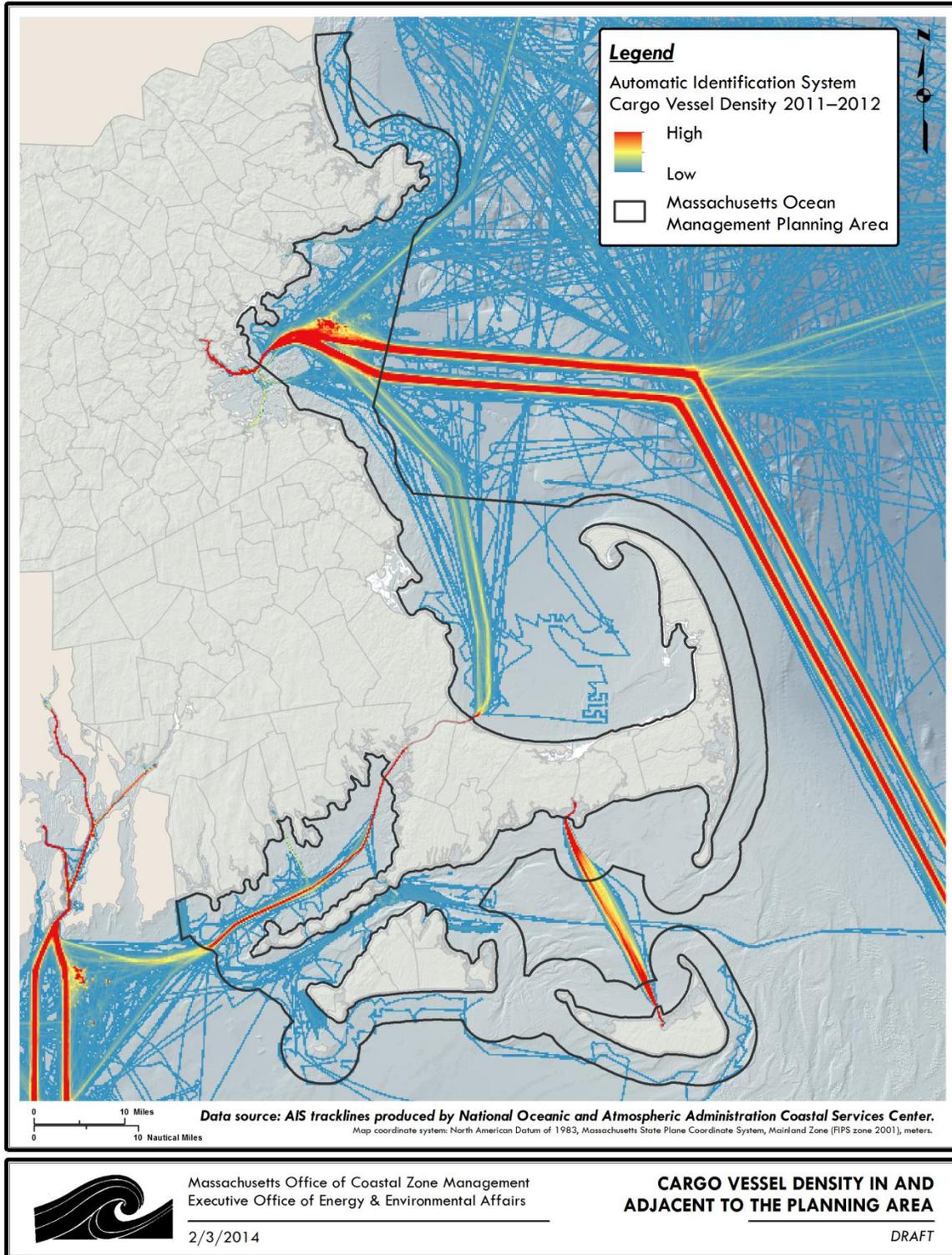
Source: Vessel density data created using vessel tracklines produced by National Oceanographic and Atmospheric Administration Coastal Services Center.

Figure 3. Proposed Concentrated Commerce Traffic Water-Dependent Use Areas for 2014 Plan Update



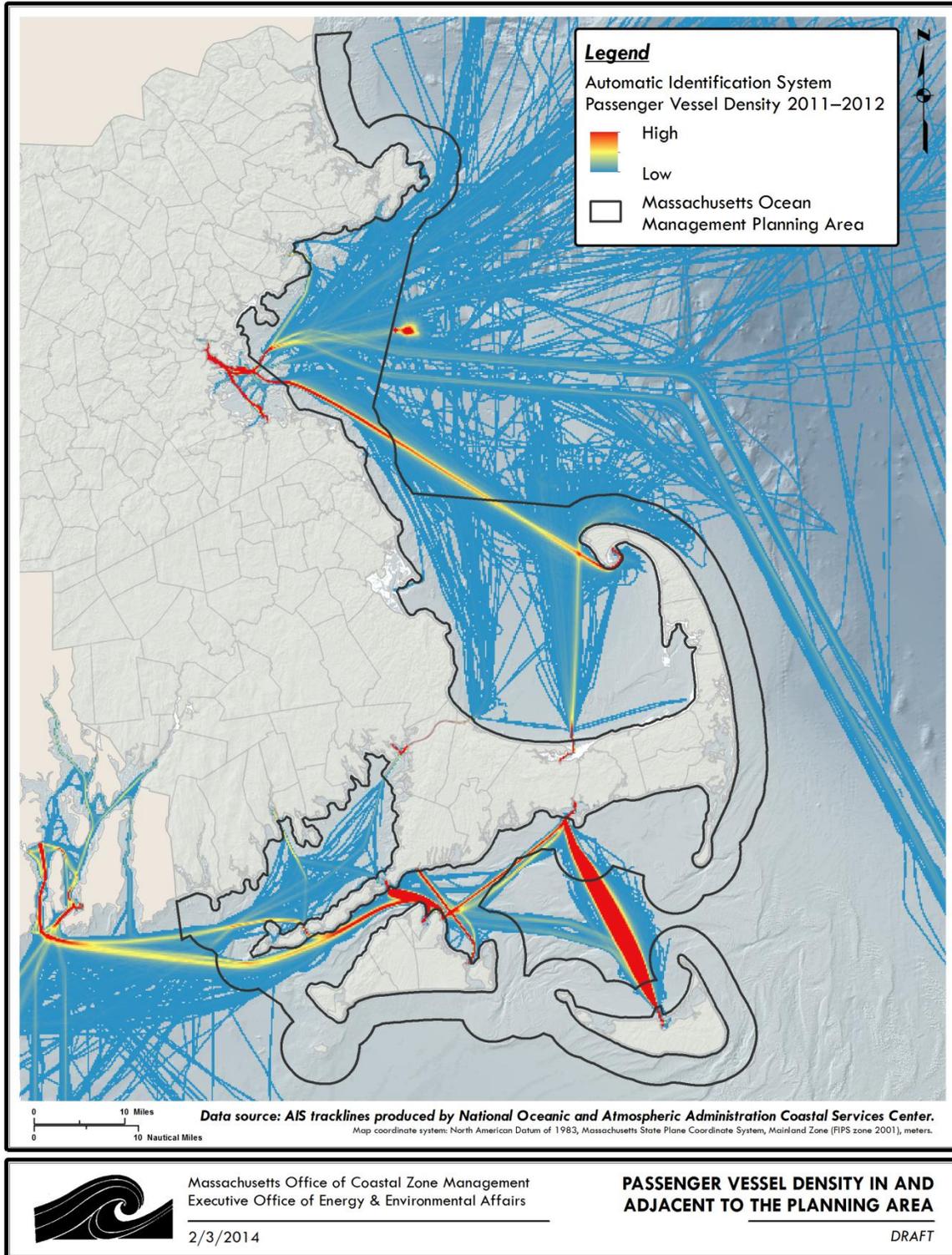
Source: Vessel density data created using vessel tracklines produced by National Oceanographic and Atmospheric Administration Coastal Services Center.

Figure 4. Cargo Automatic Identification System Vessel Density for 2011–2012



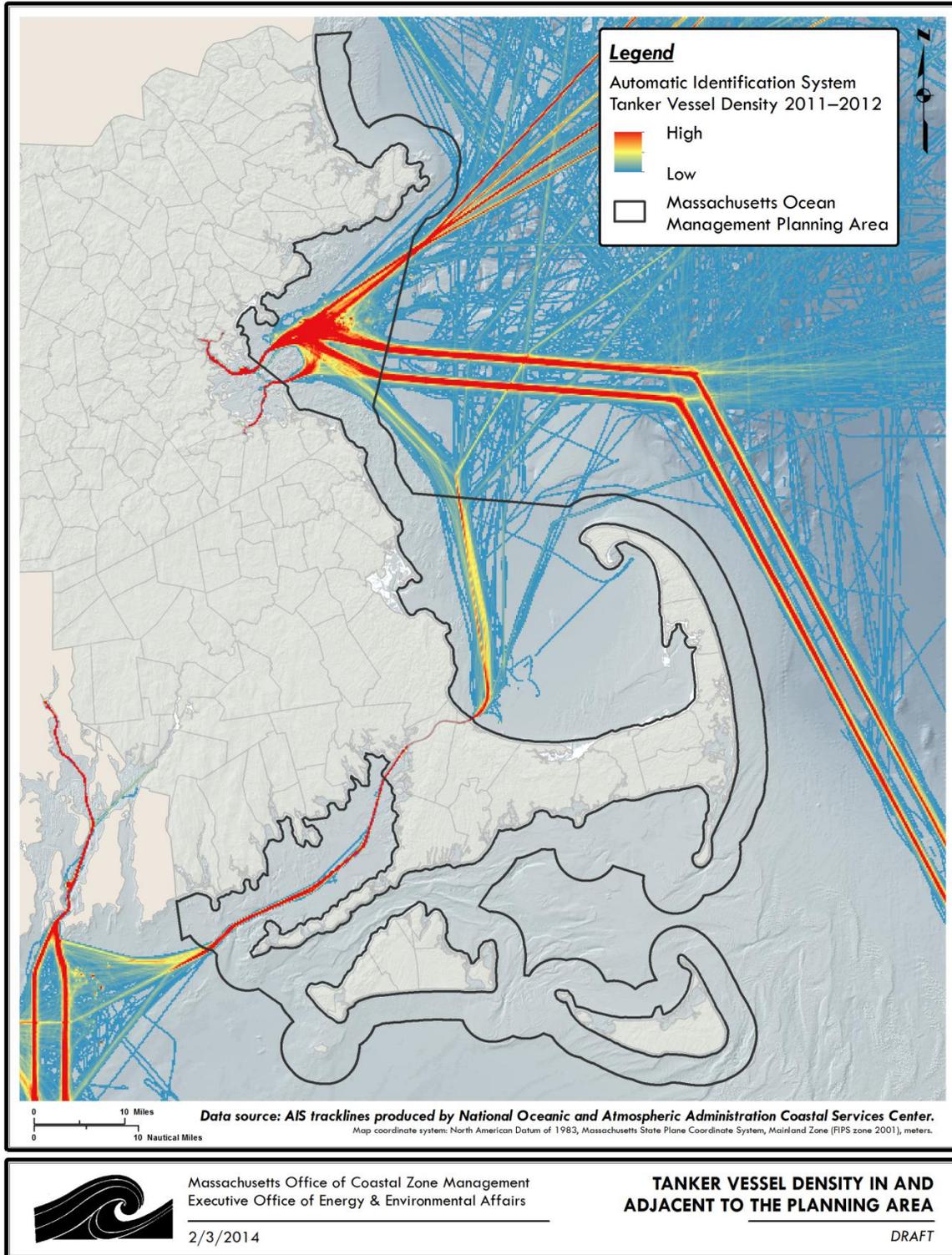
Source: Vessel density data created using vessel tracklines produced by National Oceanographic and Atmospheric Administration Coastal Services Center.

Figure 5. Passenger Automatic Identification System Vessel Density for 2011–2012



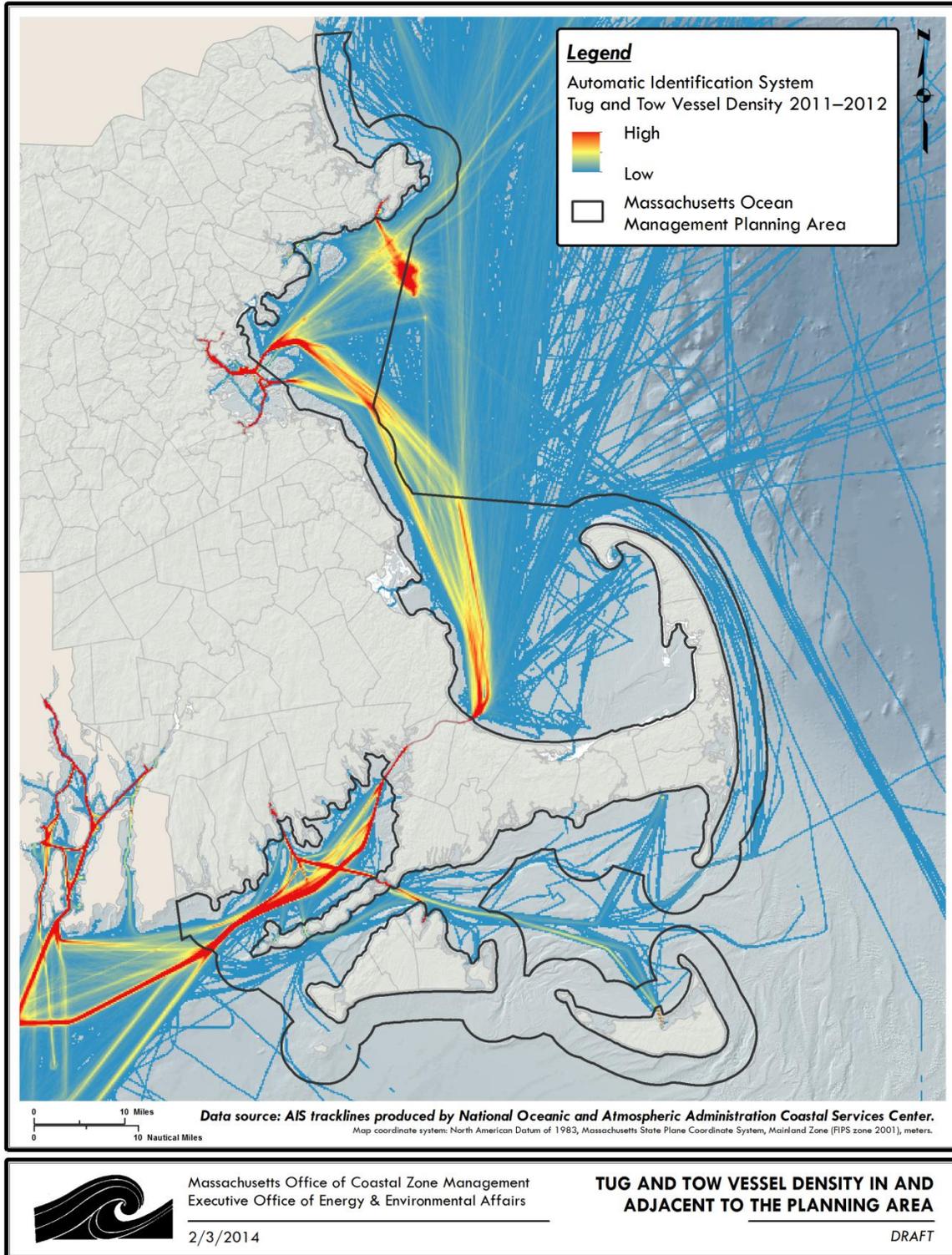
Source: Vessel density data created using vessel tracklines produced by National Oceanographic and Atmospheric Administration Coastal Services Center.

Figure 6. Tanker Automatic Identification System Vessel Density for 2011–2012



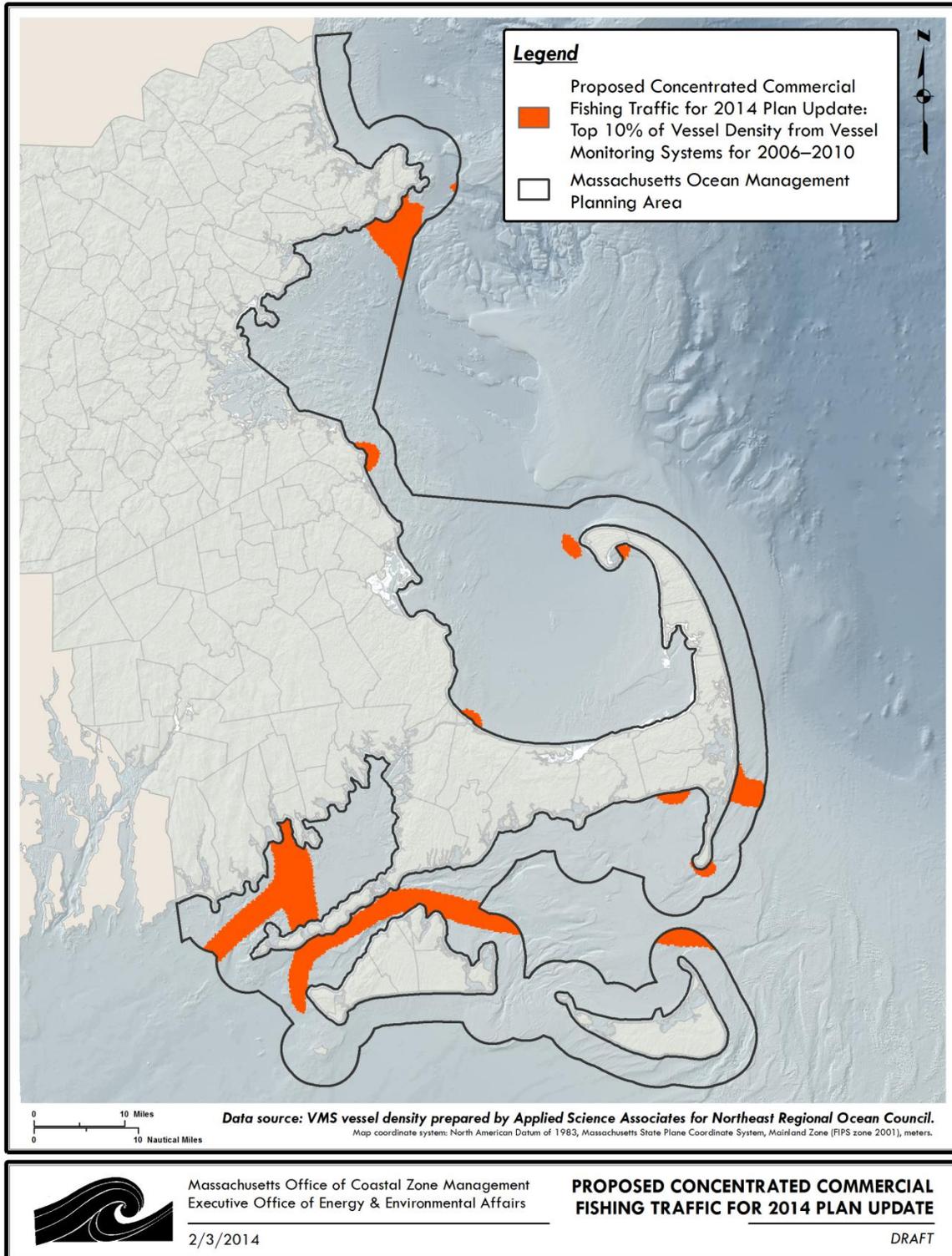
Source: Vessel density data created using vessel tracklines produced by National Oceanographic and Atmospheric Administration Coastal Services Center.

Figure 7. Tug and Tow Automatic Identification System Vessel Density for 2011–2012



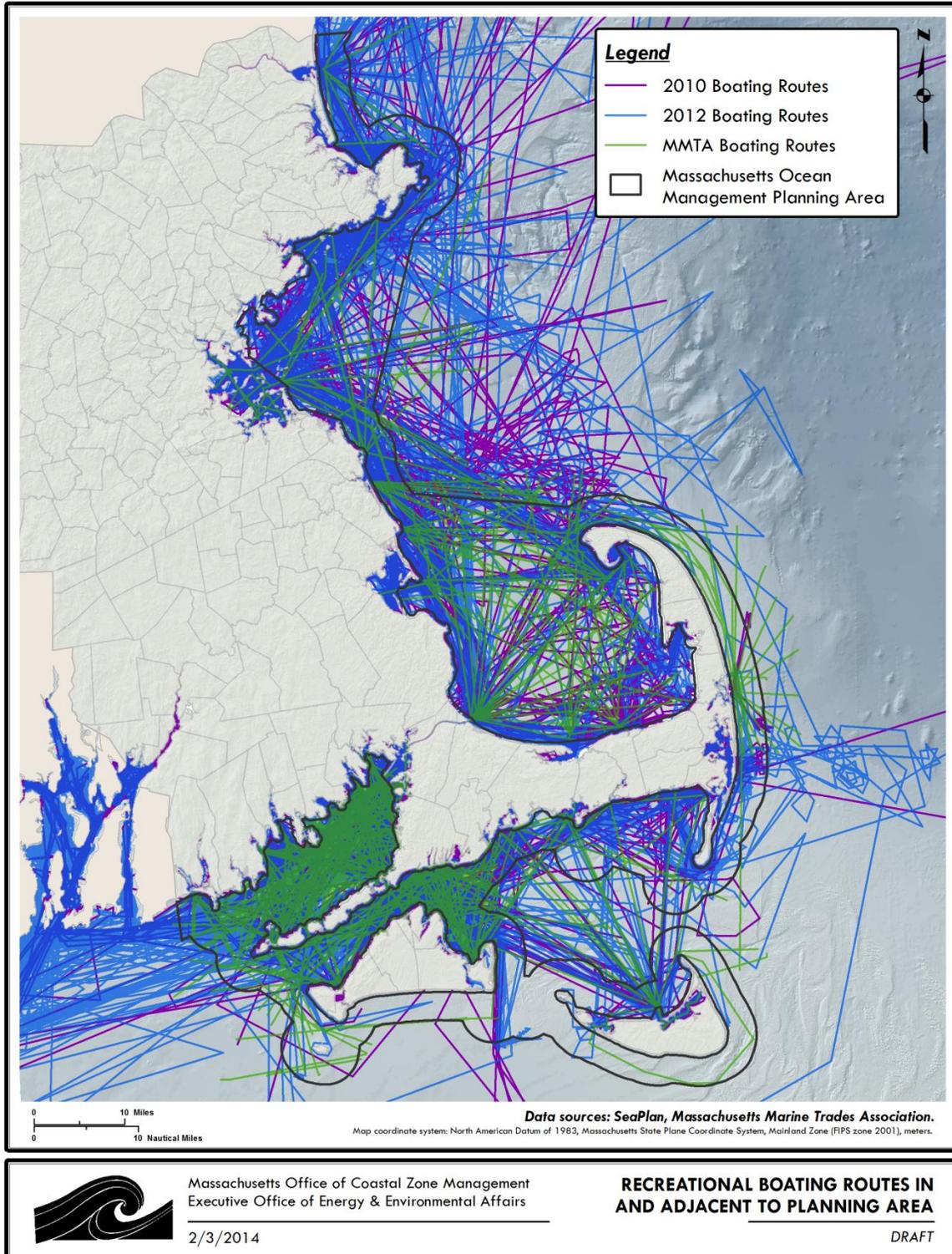
Source: Vessel density data created using vessel tracklines produced by National Oceanographic and Atmospheric Administration Coastal Services Center.

Figure 8. Proposed Concentrated Commercial Fishing Traffic Water-Dependent Use Areas for 2014 Plan Update



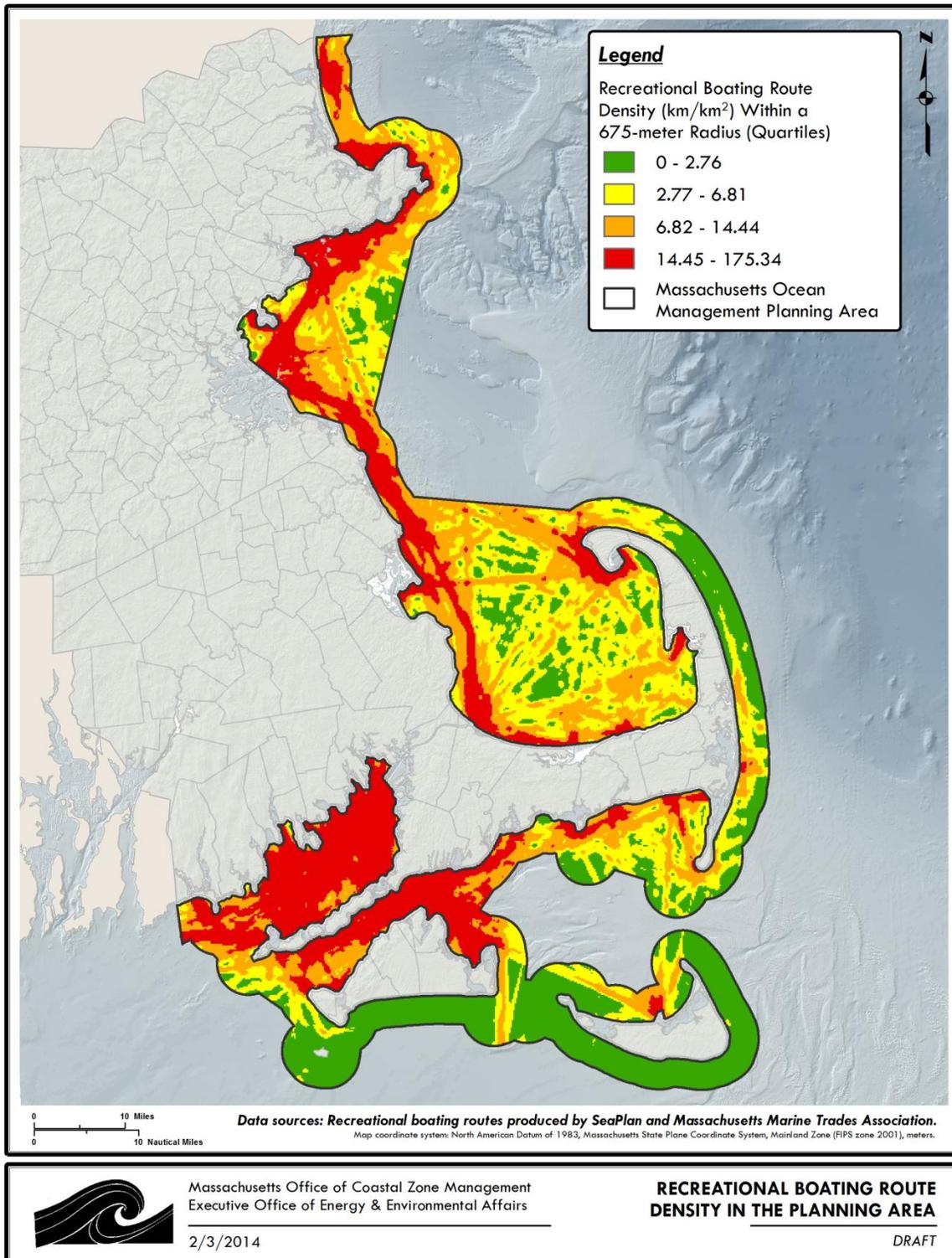
Source: Vessel density data prepared by Applied Science Associates for Northeast Regional Ocean Council.

Figure 9. Recreational Boating Routes from 2010 and 2012 SeaPlan Surveys and 2013 MMTA Survey



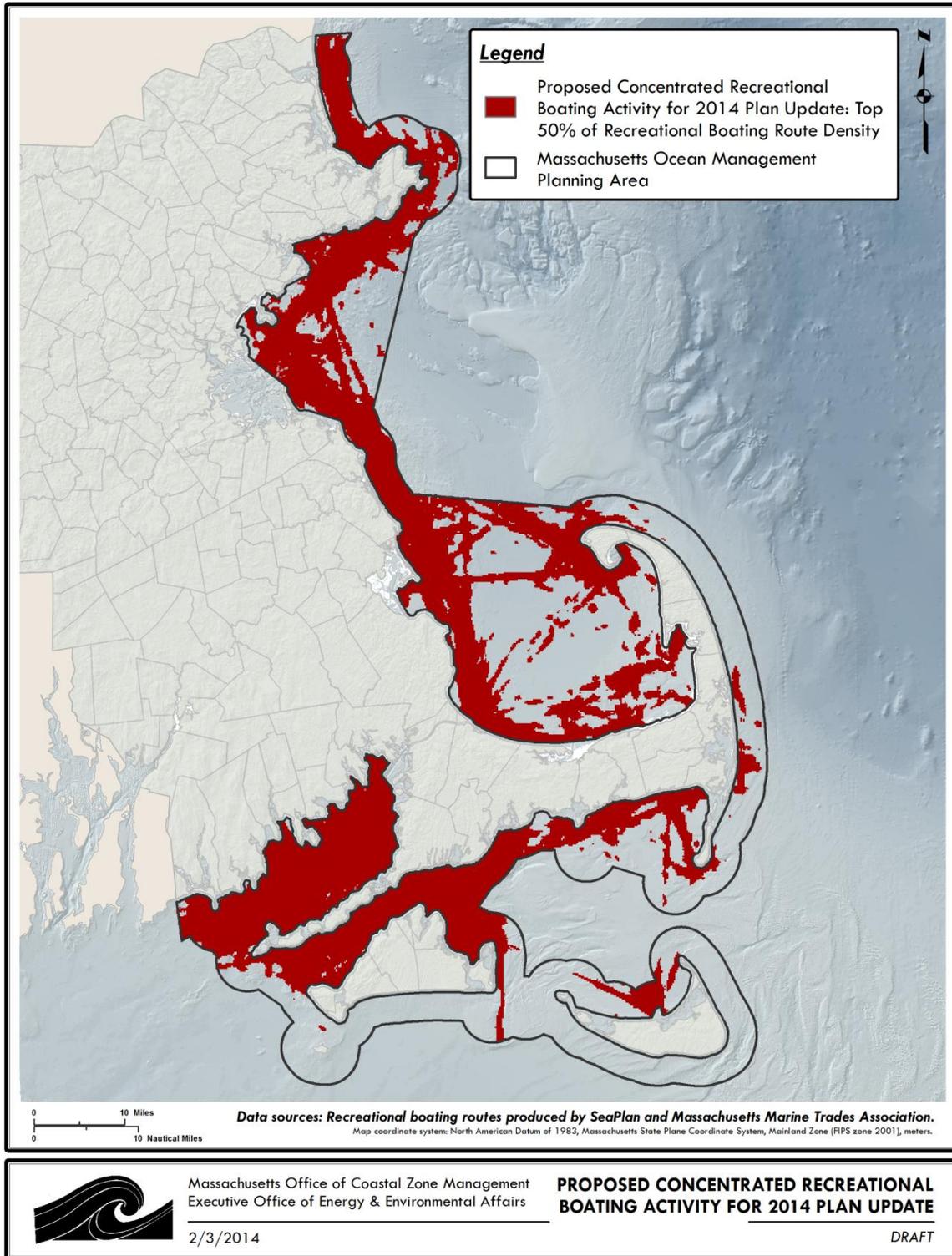
Source: SeaPlan, 2010 Massachusetts Recreational Boater Survey; SeaPlan, 2012 Northeast Recreational Boater Survey; Massachusetts Marine Trades Association, 2013 Survey.

Figure 10. Recreational Boating Route Density



Source: Recreational boating route density data created using routes from SeaPlan's 2010 Massachusetts Recreational Boater Survey, SeaPlan's 2012 Northeast Recreational Boater Survey, and Massachusetts Marine Trades Association's 2013 Survey.

Figure 11. Proposed Concentrated Recreational Boating Activity Water-Dependent Use Areas for 2014 Plan Update



Source: Density data created using routes from SeaPlan's 2010 MA Recreational Boater Survey, SeaPlan's 2012 Northeast Recreational Boater Survey, and Massachusetts Marine Trades Association's 2013 Survey.

SECTION FIVE: TABLES COMPARING DATA SOURCES AND ANALYSES FOR THE 2009 PLAN TO THE PROPOSED 2014 PLAN

Table 1. Mapping Additional Transportation and Navigation Uses: Comparison of 2009 Ocean Plan to Proposed 2014 Ocean Plan.

	2009 Ocean Plan	Proposal for 2014 Ocean Plan
Data Source	<p><i>Anchorage Areas:</i> Downloaded from National Oceanic and Atmospheric Administration's (NOAA) Electronic Navigational Chart (ENC) Direct to Geographic Information System (GIS) [NOAA ENC Direct to GIS] on May 21, 2009.</p> <p><i>Anchorage Berths:</i> Digitized off of NOAA nautical charts by Photo Science for the Massachusetts Office of Coastal Zone Management (CZM) in 2006.</p> <p><i>Ferry Routes:</i> Created by Massachusetts Department of Transportation (MassDOT). The data were last updated in December 2008.</p> <p><i>Pilot Boarding Areas:</i> Mapped by CZM in 2009 using center coordinates of five pilot boarding areas provided by representatives from state pilot associations (Boston Harbor Pilot Association and Northeast Pilots Association).</p> <p><i>Precautionary Areas:</i> Downloaded from NOAA ENC Direct to GIS on May 21, 2009.</p> <p><i>Separation Zones:</i> Digitized off of NOAA nautical charts by CZM in 2009.</p> <p><i>Traffic Lanes and Recommended Routes:</i> Digitized off of NOAA nautical charts by CZM in 2009.</p>	<p><i>Anchorage Areas:</i> Downloaded from NOAA ENC Direct to GIS on June 17, 2013.</p> <p><i>Anchorage Berths:</i> Downloaded from NOAA ENC Direct to GIS on June 17, 2013.</p> <p><i>Ferry Routes:</i> Created by MassDOT. The data were last updated in January 2012.</p> <p><i>Pilot Boarding Areas:</i> Created by Applied Science Associates and downloaded from the Northeast Ocean Data Portal. Four of the six pilot boarding areas in Massachusetts state waters were mapped using information from the U.S. Coast Pilot. The two remaining pilot boarding areas were derived from CZM's pilot boarding areas dataset. The data were last updated January 18, 2013.</p> <p><i>Precautionary Areas:</i> Downloaded from NOAA ENC Direct to GIS on June 17, 2013.</p> <p><i>Separation Zones:</i> Downloaded from NOAA ENC Direct to GIS on June 17, 2013.</p> <p><i>Traffic Lanes and Recommended Routes:</i> Downloaded and merged traffic lanes, recommended tracks, and recommended two-way routes from NOAA ENC Direct to GIS on June 17, 2013.</p>
Data Description	<p>These layers show the extent of various transportation uses in the planning area. These data were mapped and used in the Baseline Assessment (contained in Volume 2 of the 2009 Plan).</p>	<p>These layers show the extent of various transportation uses in the planning area. These data will be used in the Baseline Assessment Five-Year Review.</p>

Table 1. Continued.

	2009 Ocean Plan	Proposal for 2014 Ocean Plan
Data Extent	In and adjacent to Massachusetts state waters.	In and adjacent to Massachusetts state waters.
Data Adjustment and Pre-processing	<p><i>Anchorage Areas:</i> Extracted and mapped four of the anchorage areas (C, D, L, and M). Based on feedback from the Transportation/Navigation Workgroup, the other anchorage areas in the planning area were removed from the analysis because they receive virtually no commercial traffic.</p> <p><i>Anchorage Berths:</i> None.</p> <p><i>Ferry Routes:</i> Buffered by a 200-meter radius to convert from lines to polygons.</p> <p><i>Pilot Boarding Areas:</i> Based on recommendations from the Transportation/Navigation Workgroup, the Boston Harbor pilot boarding area was buffered by a one-nautical mile radius and the remaining four pilot boarding areas were buffered by a 0.5-nautical mile radius to convert the data from points to polygons.</p> <p><i>Precautionary Areas:</i> None.</p> <p><i>Separation Zones:</i> None.</p> <p><i>Traffic Lanes and Recommended Routes:</i> None.</p>	<p><i>Anchorage Areas:</i> Based on feedback from the Transportation/Navigation Workgroup in 2009, four of the anchorage areas (C, D, L, and M) were extracted and mapped.</p> <p><i>Anchorage Berths:</i> None.</p> <p><i>Ferry Routes:</i> None. In 2009, all point and line features were converted to polygons so that all the data could be merged to create a suitability map. This step is not necessary for the 2014 Plan.</p> <p><i>Pilot Boarding Areas:</i> Based on recommendations from the Transportation/Navigation Workgroup in 2009, the Boston Harbor pilot boarding area was buffered by a one-nautical mile radius and the remaining five pilot boarding areas were buffered by a 0.5-nautical mile radius to convert the data from points to polygons.</p> <p><i>Precautionary Areas:</i> None.</p> <p><i>Separation Zones:</i> None.</p> <p><i>Traffic Lanes and Recommended Routes:</i> None.</p>
Data Analysis	None.	None.
Data Classification	Not applicable. The data were not classified.	Not applicable. The data were not classified.
Selection of Water-Dependent Use Area	Not applicable. These data are not mapped as water-dependent use areas.	Not applicable. These data are not mapped as water-dependent use areas.

Table 2. Concentrated Commerce Traffic Mapping, as Indicated by Automatic Identification System (AIS) Data: Comparison of 2009 Ocean Plan to Proposed 2014 Ocean Plan.

	2009 Ocean Plan	Proposal for 2014 Ocean Plan
Data Source	Raw AIS data for 2008 were provided courtesy of Stellwagen Bank National Marine Sanctuary. Applied Science Associates (ASA) analyzed the raw AIS data to create a raster grid of vessel density.	Vessel tracklines were produced by National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center (CSC). The tracklines were created using raw AIS data from 2011 and 2012.
Data Description	Number of vessels over 300 tons recorded in 2008 in a 250x250-meter grid cell.	Trackline density (km/km ²) of vessels over 300 tons recorded in 2011–2012 within a 177-meter radius of a 250x250-meter grid cell.
Data Extent	Rectangular extent of the Massachusetts ocean management planning area.	North Atlantic from Virginia to Maine.
Data Adjustment and Pre-processing	None.	None.
Data Analysis	ASA analyzed the data to create a raster grid of the number of vessels in 2008 in a 250x250-meter grid cell. Vessels were counted as they passed through the cells of a regular grid covering the coastal region. Each vessel was counted once as it entered a grid cell and was not counted again unless it had been at least half an hour since it was last in a particular grid cell. This allows ships which repeatedly follow the same course over a month to be counted properly, while only counting a vessel once even though it may be recorded several times as it passes through a particular cell. One problem with this method is that if a ship is moored or on station for a long time it causes a spike in the result, so these moored vessels were removed from the dataset.	The Transportation/Navigation Workgroup recommended analyzing two or more years of data, so AIS tracklines from 2011 and 2012 were analyzed by the Massachusetts Office of Coastal Zone Management (CZM). The line density of the 2011 and 2012 tracklines that fall within a 177-meter radius of each 250x250-meter grid cell in the North Atlantic was calculated. The 250x250-meter cell size was selected to be consistent with the grid used in the 2009 Plan. The radius was selected by calculating the radius of the smallest circle that would completely contain a grid cell. In other words, the 177-meter radius was chosen to match the length of half the diagonal of a grid cell (rounded to the nearest meter).

Table 2. Continued.

	2009 Ocean Plan	Proposal for 2014 Ocean Plan
Data Classification	The data were divided into two classes by CZM: 1) ≤50 vessels in a 250x250-meter grid cell, and 2) >50 vessels in a 250x250-meter grid cell. This class break was based on best professional judgment.	<p>CZM followed the example of the 2009 Plan and used an equivalent class break of 50 vessels per year per grid cell (i.e., 100 vessels per grid cell since two years of data were used). Since these data represent vessel density based on the length of tracklines, not counts of vessels, an equivalent to the 100 vessels class break was calculated using length. As a conservative estimate, 354 meters, which is the length of the diameter of the circle used to calculate the line density, was used as an approximation of one vessel. Therefore, 50 vessels per year per grid cell is approximately equal to 360 km/km² of trackline density for two years of data using the following equation:</p> $\frac{50 \text{ vessels} \times 0.354 \text{ km [1 vessel's trackline length]} \times 2 \text{ years}}{\pi \times 0.177^2 \text{ km [area of circle]}}$ <p>Thus, the data were divided into two classes: 1) ≤360 km/km² of vessel density in a 177-meter radius of a 250x250-meter grid cell, and 2) >360 km/km² of vessel density in a 177-meter radius of a 250x250-meter grid cell.</p>
Selection of Water-Dependent Use Area	Areas where >50 vessels were recorded in 2008 in a 250x250-meter grid cell. CZM extracted grid cells where >50 vessels were recorded and hand digitized polygons around these grid cells to simplify and smooth the data.	Areas where >360 km/km ² of trackline density were recorded in 2011–2012 in a 177-meter radius of a 250x250-meter grid cell.

Table 3. Concentrated Commercial Fishing Traffic Mapping, as Indicated by Vessel Monitoring System (VMS) Data: Comparison of 2009 Ocean Plan to Proposed 2014 Ocean Plan.

	2009 Ocean Plan	Proposal for 2014 Ocean Plan
Data Source	The raw data were provided courtesy of National Marine Fisheries Service (NMFS) Northeast Regional Office. Applied Science Associates (ASA) analyzed the raw data to create a raster grid of fishing vessel density.	The commercial fishing vessel density data were prepared by ASA for the Northeast Regional Ocean Council using VMS data from 2006–2010.
Data Description	Number of fishing vessels from September 1, 2007 to September 1, 2008 in a 250x250-meter grid cell.	Standardized commercial fishing vessel density for 2006–2010 within a 3-kilometer radius of a 250x250-meter grid cell.
Data Extent	Rectangular extent of the Massachusetts ocean management planning area.	North Atlantic from Connecticut to Maine.
Data Adjustment and Pre-processing	ASA removed bad data points.	ASA removed points that represented individual and identifiable vessel positions to preserve privacy.
Data Analysis	ASA analyzed the data to create a raster grid of the number of fishing vessels from September 1, 2007 to September 1, 2008 in a 250x250-meter grid cell. Vessels were counted as they passed through the cells of a regular grid covering the coastal region. Each vessel was counted once as it entered a grid cell and was not counted again unless it had been at least one hour since it was last in a particular grid cell. This allows ships which repeatedly follow the same course over time to be counted properly, while only counting a vessel once even though it may be recorded several times as it passes through a particular cell. This method highlights both heavy traffic through an area as well as areas where vessels stop to catch fish.	ASA analyzed the VMS data to create a standardized raster grid of the commercial fishing vessel density. First, the point density of the VMS data from 2006–2010 within a 3-kilometer radius of each 250x250-meter grid cell in the North Atlantic was calculated. Next, all zero values were set to null. Finally, the log-transformed z-score of each grid cell was calculated to standardize the values. In the final dataset, values of 0 indicate average fishing vessel density, while values between -1 and 1 indicate density within one standard deviation of the mean.
Data Classification	The data were divided into two classes by the Massachusetts Office of Coastal Zone Management (CZM): 1) ≤ 25 fishing vessels in a 250x250-meter grid cell, and 2) > 25 vessels in a 250x250-meter grid cell. This class break was based on best professional judgment.	Since these data represent standardized vessel density, the 25 vessels class break used in the 2009 Plan cannot be used. In the 2009 Plan, the areas with > 25 fishing vessels covered 7% of the planning area. As an approximation of this, CZM classified the standardized vessel density data in the planning area into deciles so that the top 10% can be extracted as the concentrated water-dependent use areas.
Selection of Water-Dependent Use Area	Areas where > 25 fishing vessels were recorded in a 250x250-meter grid cell. CZM extracted grid cells where > 25 vessels were recorded and hand digitized polygons around these grid cells to simplify and smooth the data.	Top 10% of standardized commercial fishing vessel density.

Table 4. Concentrated Recreational Boating Activity Mapping: Comparison of 2009 Ocean Plan to Proposed 2014 Ocean Plan.

	2009 Ocean Plan	Proposal for 2014 Ocean Plan
Data Source	Recreational boating areas and routes identified by the Massachusetts Marine Trades Association (MMTA).	Recreational boating routes from the following three sources were used by the Massachusetts Office of Coastal Zone Management (CZM) to develop a route density dataset: 1) The 2010 Massachusetts Recreational Boater Survey conducted by SeaPlan and partners. Survey respondents plotted over 1,000 of their boating routes in Massachusetts state waters from May to October 2010. 2) The 2012 Northeast Recreational Boater Survey conducted by SeaPlan and partners. Building off the 2010 survey, SeaPlan conducted a similar survey in 2012 for the Northeast. Boaters mapped over 1,000 routes in Massachusetts state waters between May and October 2012. 3) A 2013 survey of experienced mariners by MMTA. Mariners marked charts with routes commonly used by recreational boaters in Massachusetts. Over 500 routes were mapped through this survey.
Data Description	MMTA asked experienced mariners to mark charts with areas regularly used for recreational boating, including pleasure boating, recreational fishing, races, and transit navigation routes, within the planning area.	Recreational boating route density (km/km ²) within a 675-meter radius of a 250x250-meter grid cell.
Data Extent	In and adjacent to Massachusetts state waters.	In and adjacent to Massachusetts state waters.
Data Adjustment and Pre-processing	None.	CZM removed any portions of routes that were over land.
Data Analysis	CZM clipped the recreational boating areas to the Massachusetts ocean management planning area.	CZM created a raster grid of the line density of the 2010, 2012, and 2013 recreational boating routes that fall within a 675-meter radius of each 250x250-meter grid cell in the North Atlantic. The 250x250-meter cell size was selected to be consistent with the grid used in the 2009 Plan. The radius was selected based on the accuracy of the chart basemap used in the mapping tool for the 2010 and 2012 surveys, which is ±675 meters.
Data Classification	Not applicable. The data were not classified.	CZM classified the data into quartiles using class breaks derived from the data in the planning area only. Quartiles were chosen because they were used to determine important areas for other resources and uses in the Plan. Finding the class breaks using only data within the planning area was selected because the planning area is the area of interest for this analysis.
Selection of Water-Dependent Use Area	All recreational boating areas (clipped to the planning area) and transit navigation routes were mapped.	Top two quartiles of route density.

APPENDIX A: FISHERIES NOT COVERED BY THE VESSEL MONITORING SYSTEM IN MASSACHUSETTS¹

Fisheries that occur in Massachusetts waters	VMS data in state waters?
Sea herring	Federal vessels only
Ocean quahog, surfclam	Federal vessels only
Scallops (dredge and diving)	Federal vessels only
Monkfish	Federal vessels only
Northeast multispecies/coastal access permit (large mesh groundfish; includes trawls, gillnets, hook and line)	Federal vessels only
Highly migratory species (tuna, sharks, swordfish; hook and line and purse seines)	Federal vessels only
Small mesh multispecies	Federal vessels only
Fish weir	Locations are known
Aquaculture	Locations are known
American eel	No VMS (river codes reported)
Pots (conch, lobster, black sea bass)	No VMS
Atlantic mackerel, squid, butterfish	No VMS
Summer flounder, scup, black sea bass	No VMS
Northern shrimp	No VMS*
White perch	No VMS
Smelt	No VMS
Bay scallop	No VMS
Other shellfish (razor clams, oysters, seaworms)	No VMS
Atlantic bluefish	No VMS
Horseshoe crab	No VMS
Inshore net	No VMS
Striped bass	No VMS
Surface gillnet	No VMS
Green crabs	No VMS
Sea urchin (dredge and diving)	No VMS
Menhaden	No VMS
Sand eels	No VMS
Skate	No VMS*
Cusk	No VMS*
Spiny dogfish	No VMS*
Tautog	No VMS
Recreational fishing	No VMS

* A vessel that has a federal permit in a fishery that requires VMS (e.g., Monkfish, northeast multispecies, scallop) can also have state endorsements for other fisheries. In such a case, the vessel reports to the VMS system even when it is fishing under the state endorsement. However, it would be difficult or impossible to discern from the VMS data which fishery the individual was participating in other than what was declared on the VMS as required for the federal permit (the declaration codes can only accommodate the fisheries required to report under VMS). Federally permitted vessels fishing in state waters must comply with their federal permit and/or more restrictive state regulations. The fisheries that this is most problematic for (cusk, skate, dogfish, and shrimp) are indicated with an asterisk. There is also a directed spiny dogfish fishery in state waters in October and November that federal groundfish boats do not participate in. Since fishermen also report Vessel Trip Report (VTRs) with their catches, theoretically VMS tracks could be linked up to catch information. Since the VTR contains landings from an entire trip, when that trip spans multiple areas, including state and federal waters, it would be impossible to pinpoint where in the VMS track the landings actually occurred.

Tilefish excluded since fishery occurs outside of state waters; salmon, river herring, shad excluded since they are not commercial fisheries at this time.

¹ This table is from the Draft Massachusetts Ocean Plan Fisheries Work Group Report #2.