

Figures

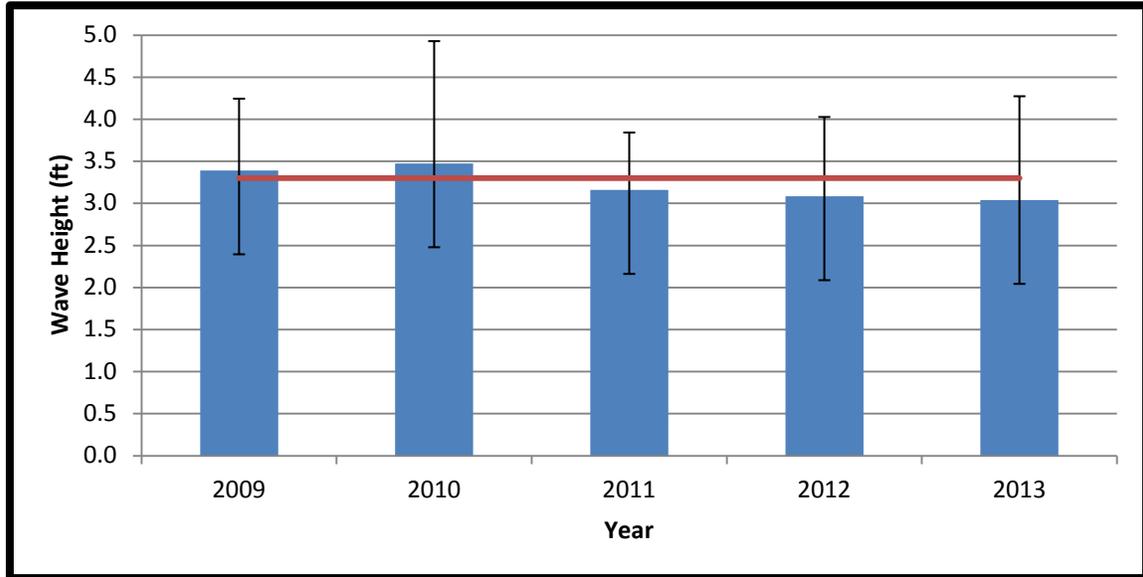


Figure 1. Annual mean wave height (feet) at the Massachusetts Bay A buoy. The red line is the 2001-2009 mean of 3.3 feet. Error bars are +/- 1 standard deviation.

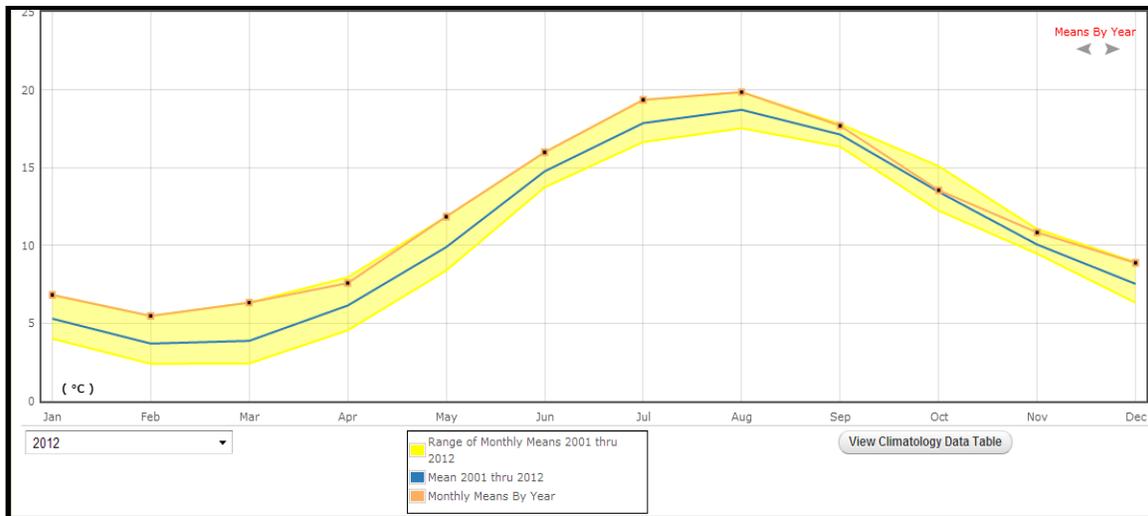


Figure 2. The monthly sea surface temperature (°C) in Massachusetts Bay 2001-2012. Yellow shading represents the range of monthly mean temperatures over the 12-year time series while the blue line is the mean. The orange dots are the monthly means for 2012. Note that all monthly averages in 2012 except that of October were the times series' maxima.

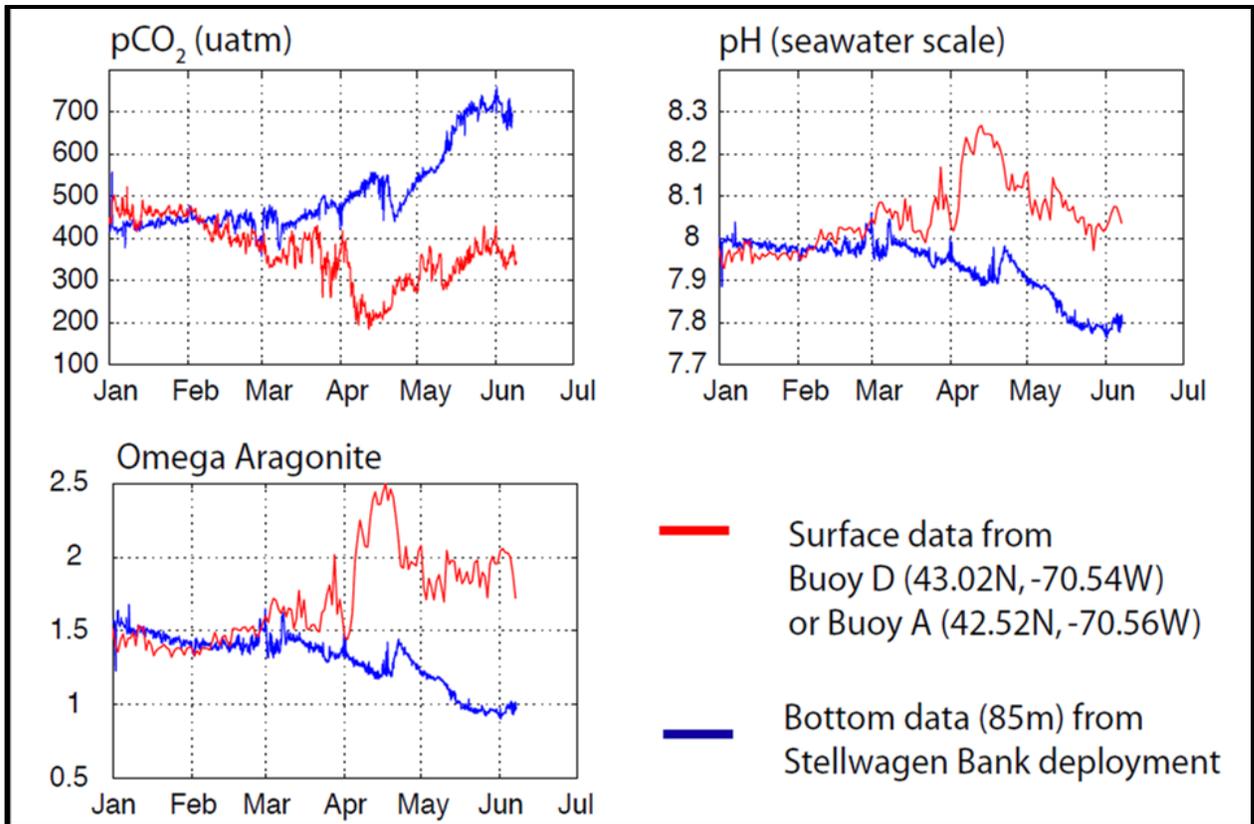


Figure 3. The partial pressure of CO₂ (microatmospheres), pH, and derived aragonite saturation (omega) at the surface (-2 m, red) and bottom (-85 m, blue) of the western Atlantic ocean. The surface measurements were recorded at the University of New Hampshire (UNH) buoy near Appledore Island.⁷¹ The bottom measurements were recorded by Stellwagen Bank National Marine Sanctuary on a buoy in Massachusetts Bay. Figure courtesy of Joe Salisbury, University of New Hampshire.

⁷¹ http://www.neracoos.org/realtime_map

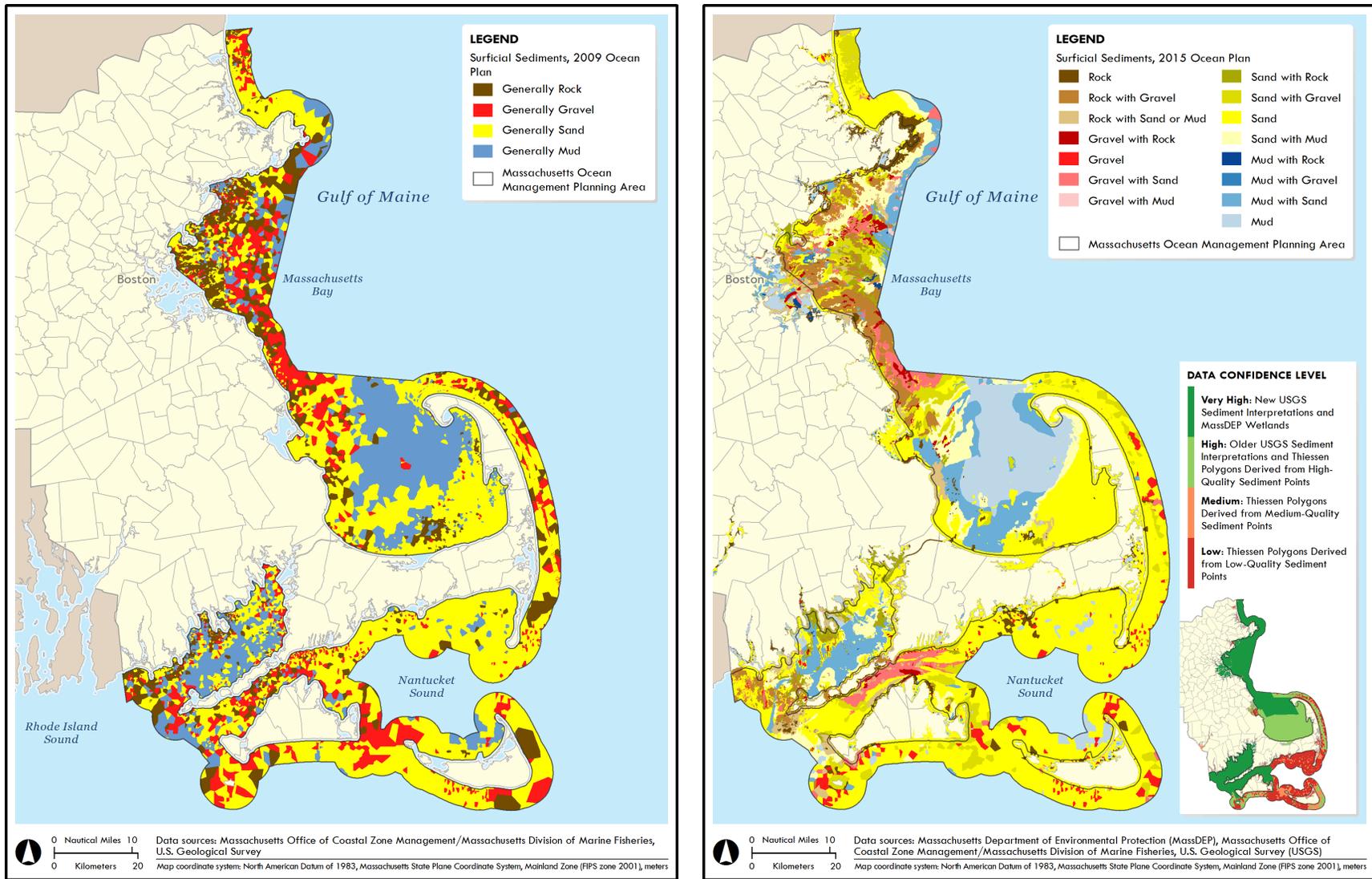


Figure 4. A comparison of the 2009 ocean plan surficial sediment map (left) to the 2015 ocean plan surficial sediment map (right). In both maps, blue represents mud, yellow represents sand, red represents gravel, and brown depicts rock. The map on the right is substantially more accurate, containing new USGS sediment interpretations and 30,000 more data points than the 2009 map.

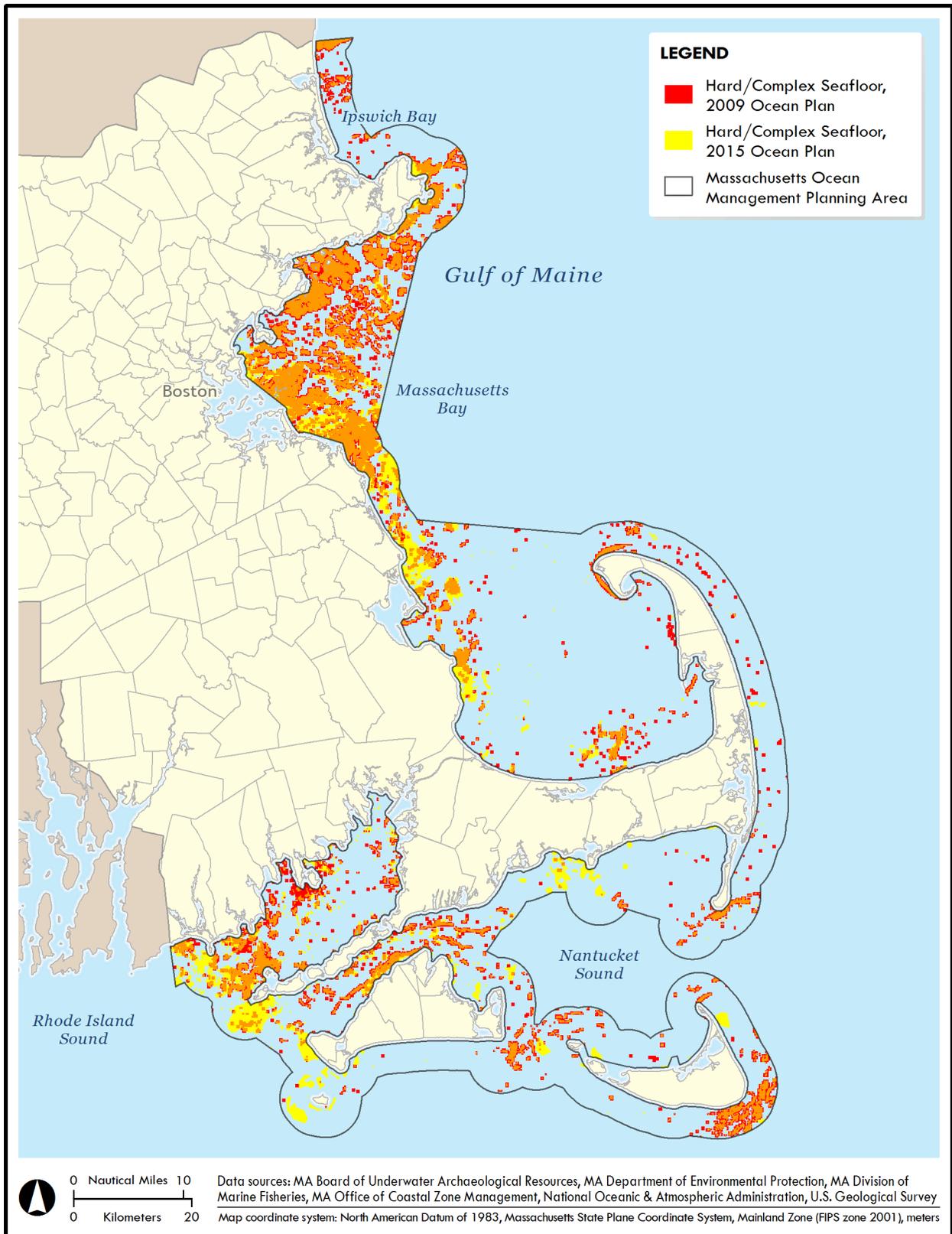


Figure 5. The 2009 hard/complex seafloor SSU resources area (red) and the revised 2015 hard/complex seafloor SSU resources area (yellow); areas common to both years in orange.

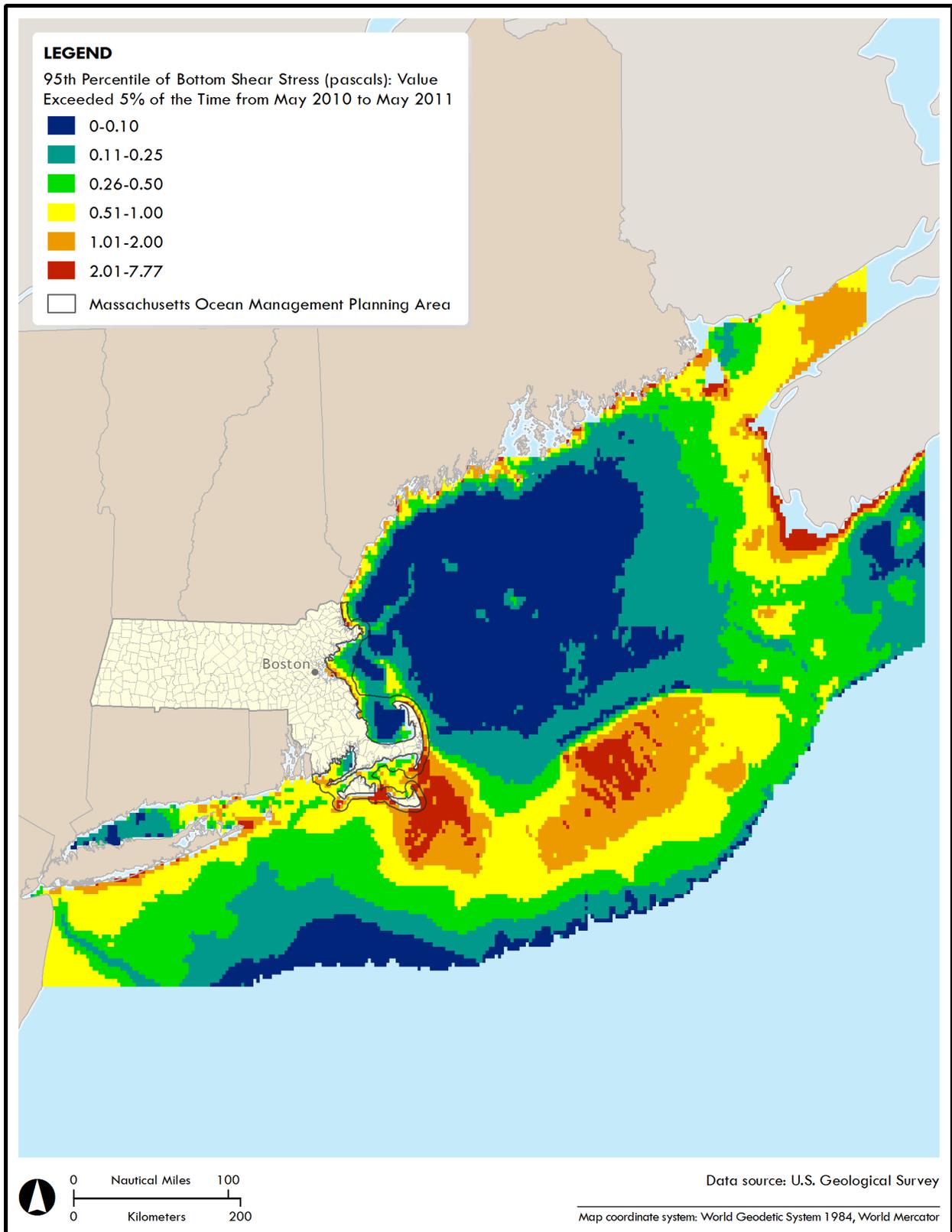


Figure 6. Annual 95th percentile (values exceeded only 5% of the time) seafloor shear stress (measured in pascals) from May 2010-May 2011.

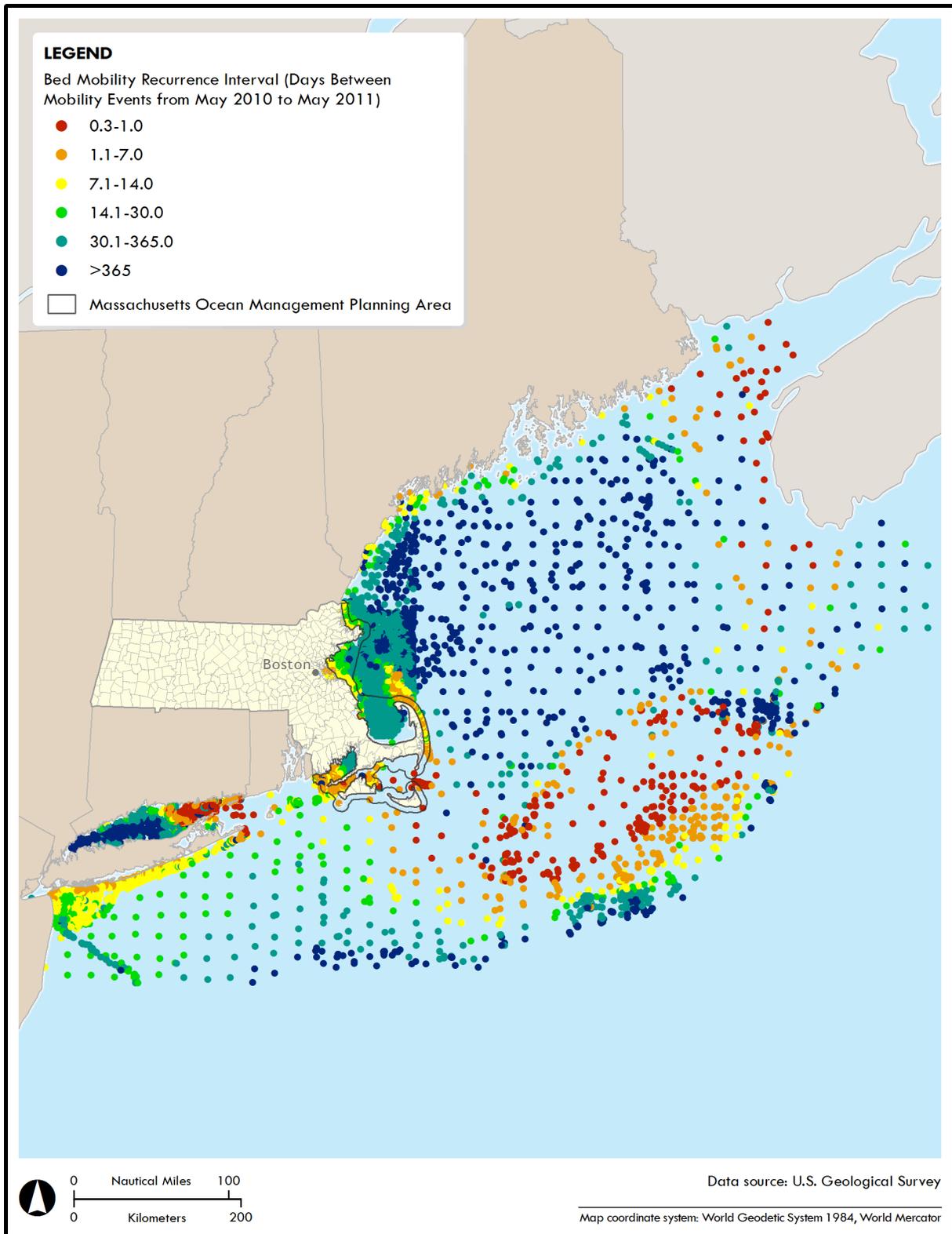


Figure 7. Days between seabed mobility events from May 2010 to May 2011. Areas represented by warmer colors (red, orange, and yellow) are less stable than areas represented by cooler colors (green, turquoise, and blue).

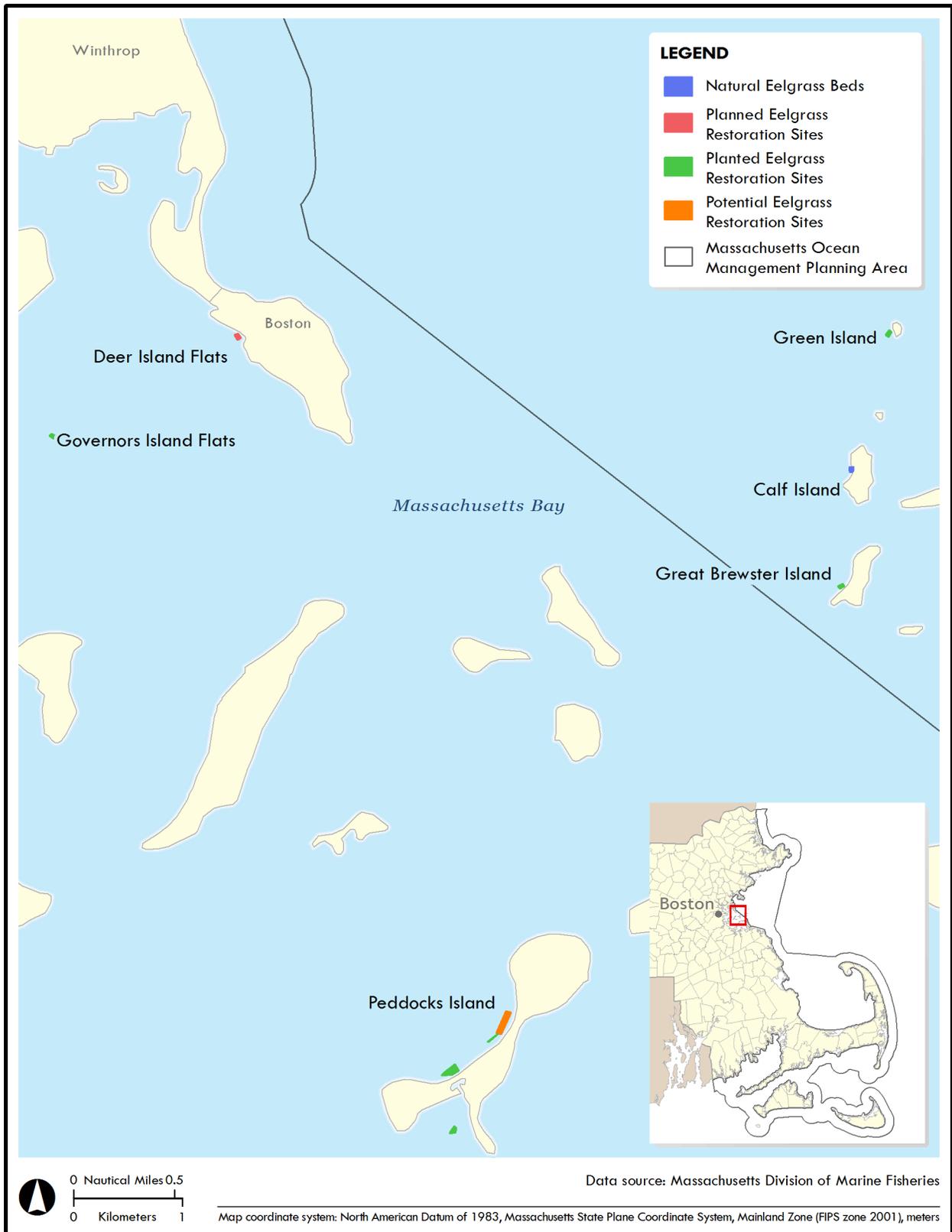


Figure 8. The location of *Marine Fisheries* eelgrass restoration sites and one recently discovered (2011) natural bed (adjacent to Calf Island) in Boston Harbor.

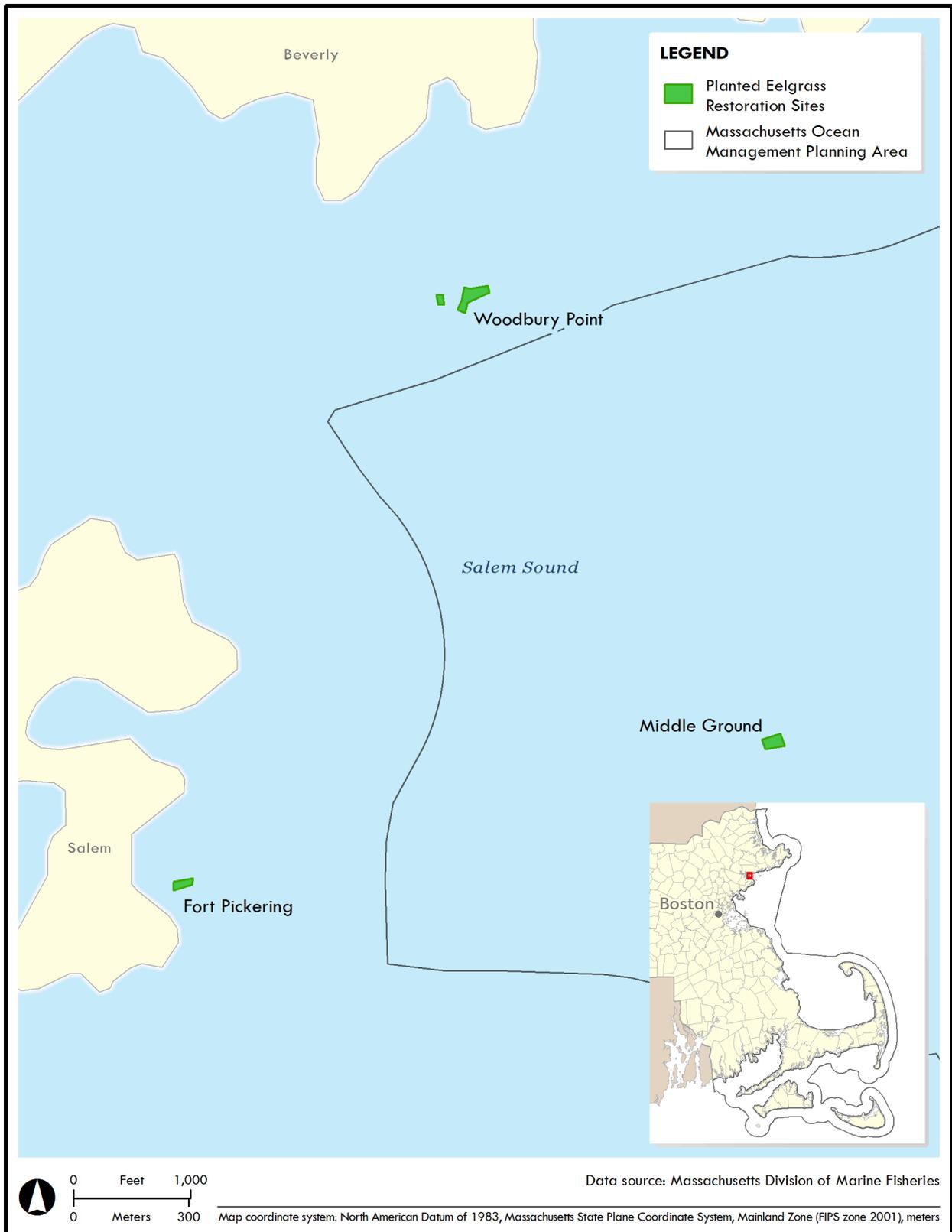


Figure 9. *Marine Fisheries* eelgrass restoration sites in Salem Sound: Woodbury Point (to the north), Middle Ground (to the southeast), and Fort Pickering (to the southwest).

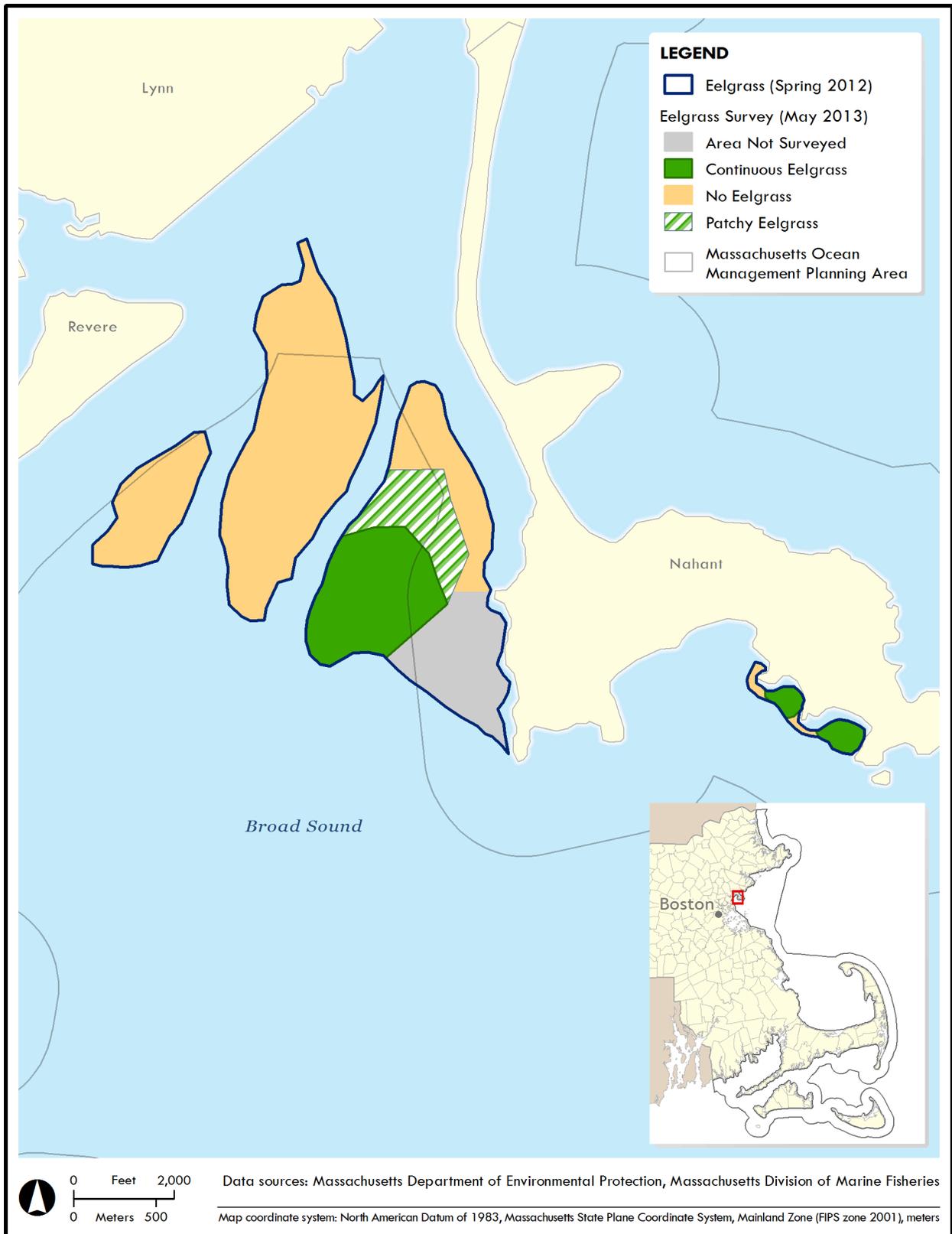


Figure 10. Change in eelgrass bed extent off of Nahant, before and after Hurricane Sandy (October 2012).

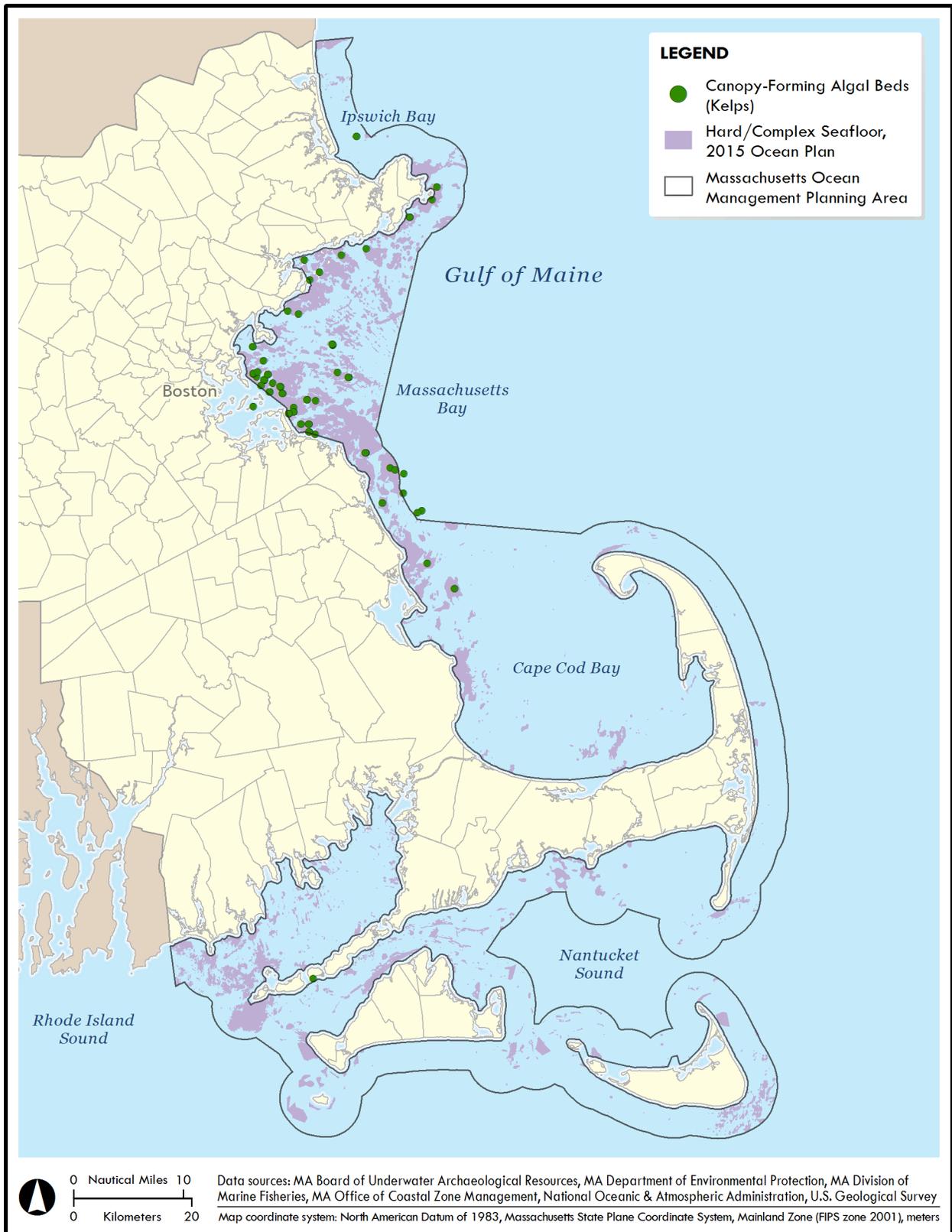


Figure 11. The location of canopy-forming algae (kelp) in Massachusetts waters as determined from opportunistic seafloor photos.

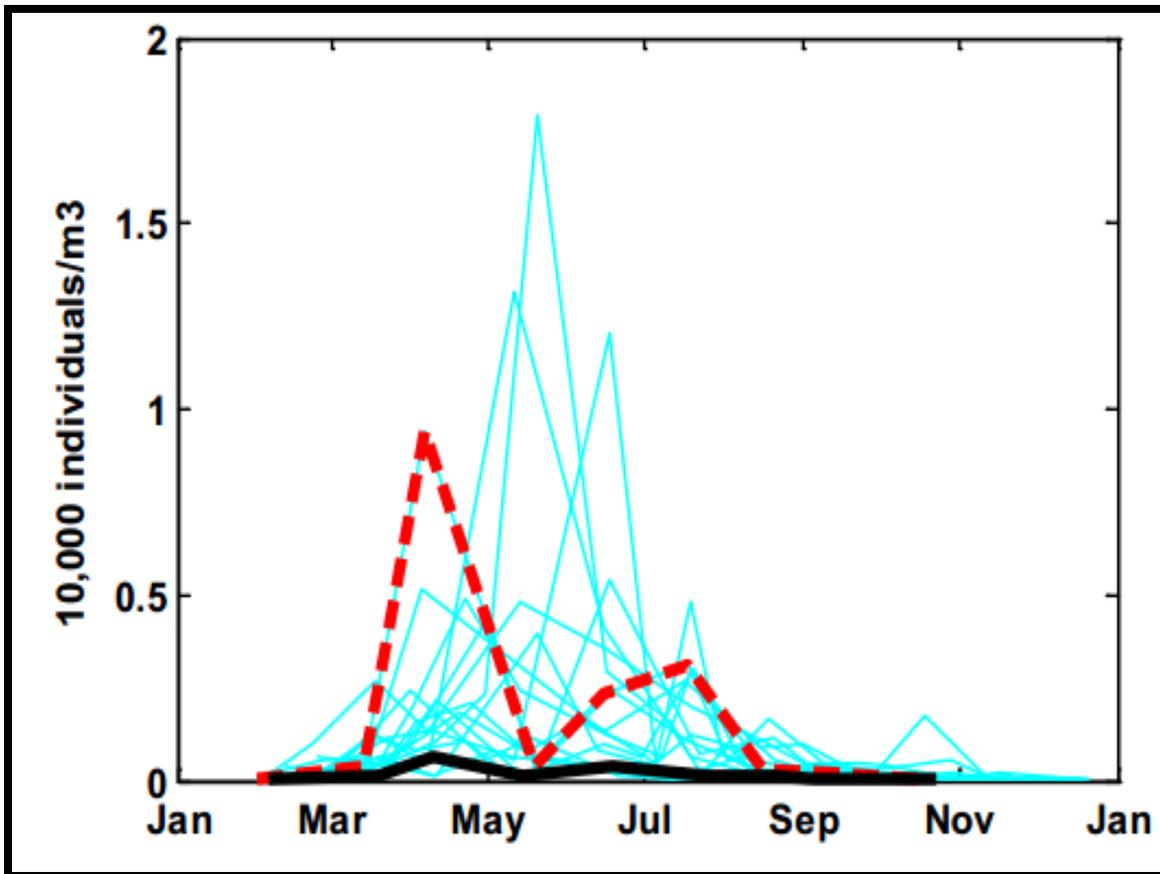


Figure 12. *Calanus finmarchicus* abundance at MWRA nearfield sampling sites in Massachusetts Bay. Blue lines represent years 1992-2010, the dashed red line is 2011, and the solid black line is 2012. Figure reproduced from MWRA ENQUAD Report 2013-14, Figure 3-20.⁷²

⁷² <http://www.mwra.state.ma.us/harbor/enquad/pdf/2013-14.pdf>

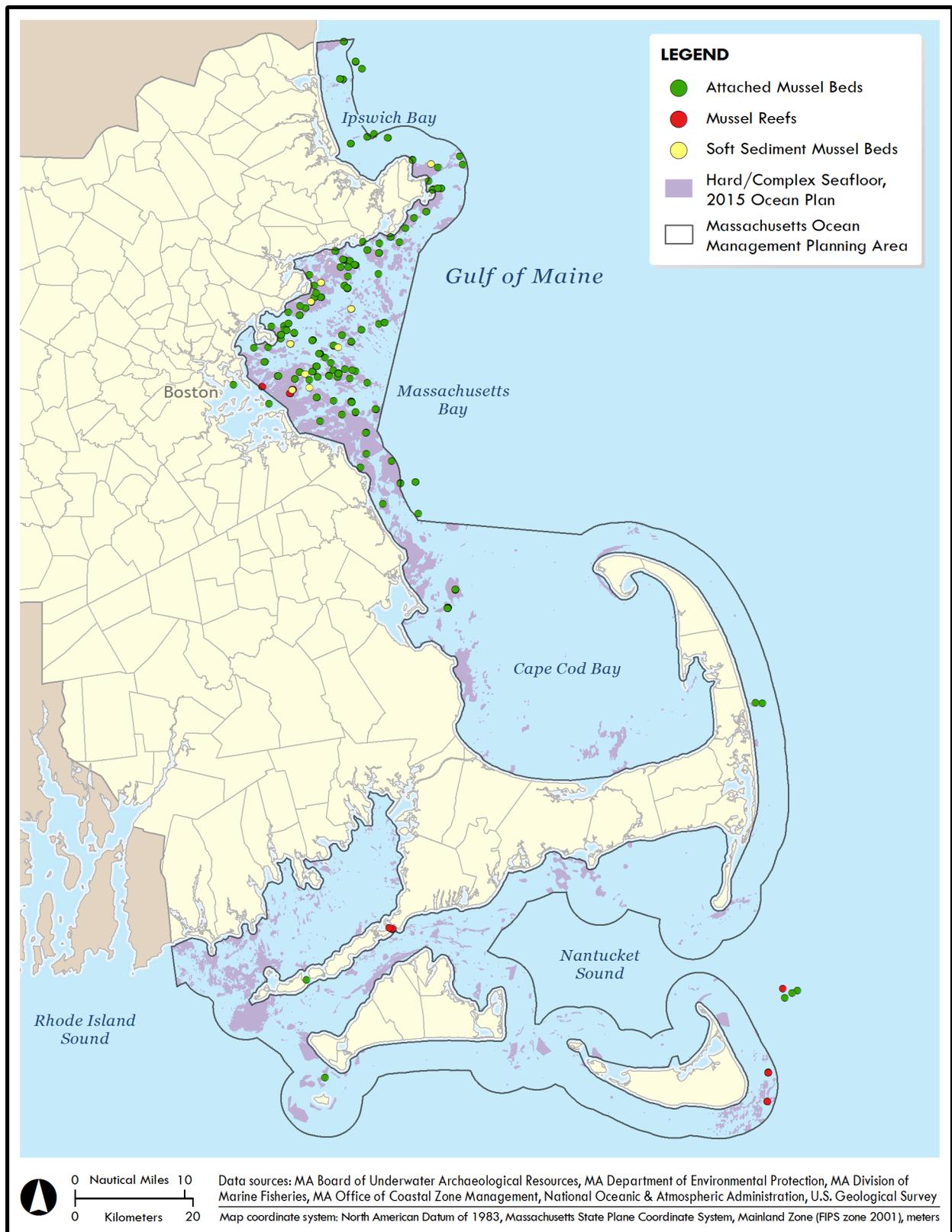


Figure 13. The location of mussel beds and reefs in Massachusetts waters as identified from opportunistic seafloor photos.

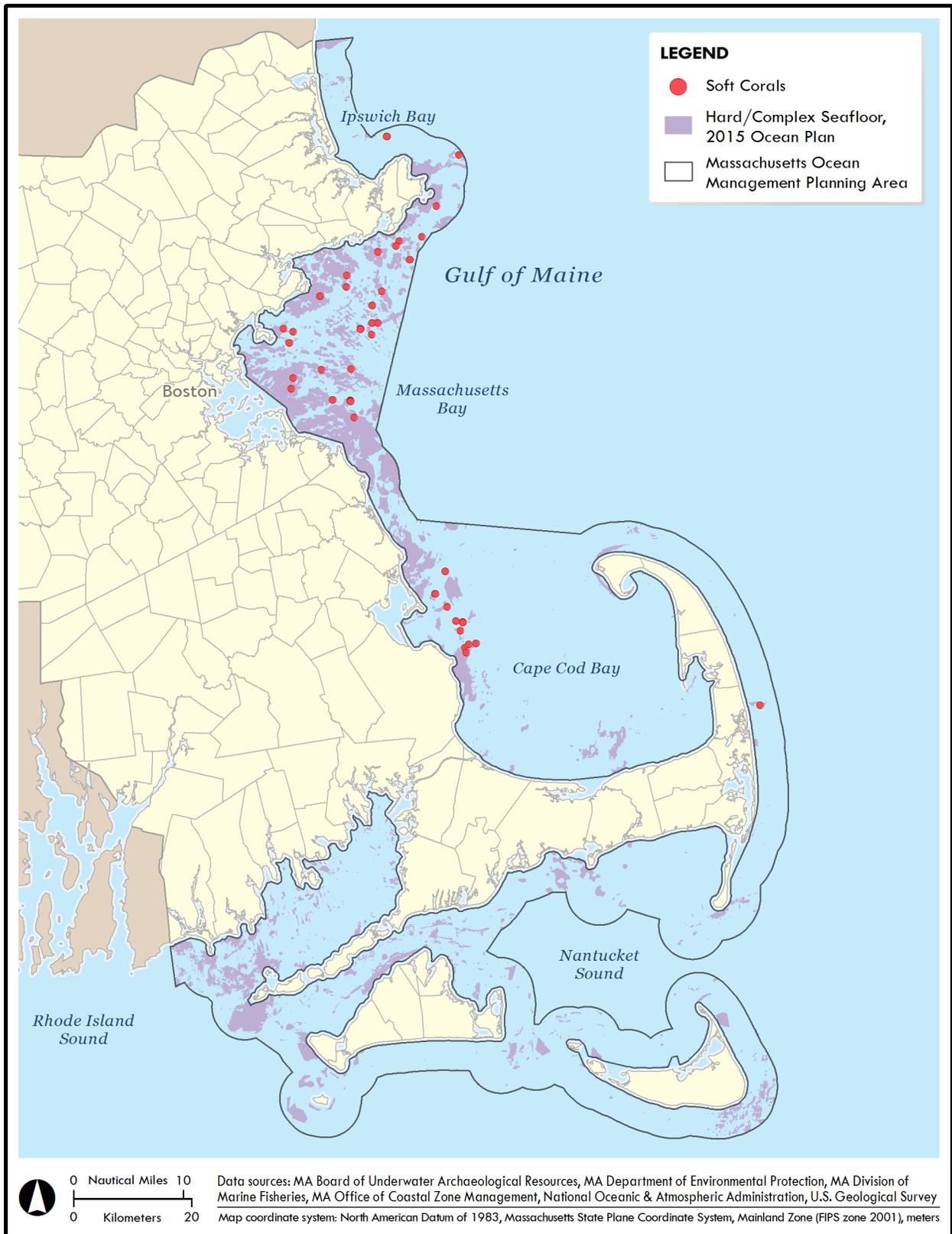


Figure 14. The location of soft corals in Massachusetts waters as identified from opportunistic seafloor photos.



Figure 15. Revised 2015 important fish resources SSU area based on *Marine Fisheries* trawl survey data from 1978-2012. The SSU mapped area did not change from 2009.

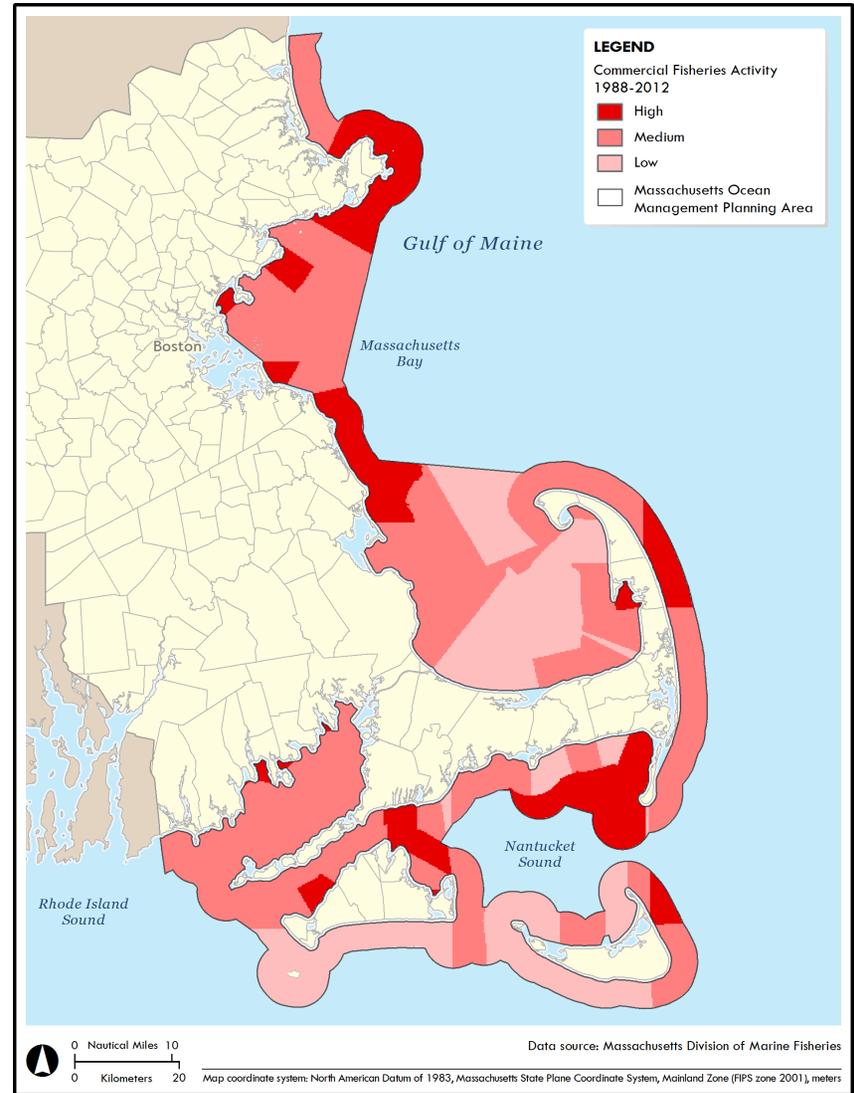
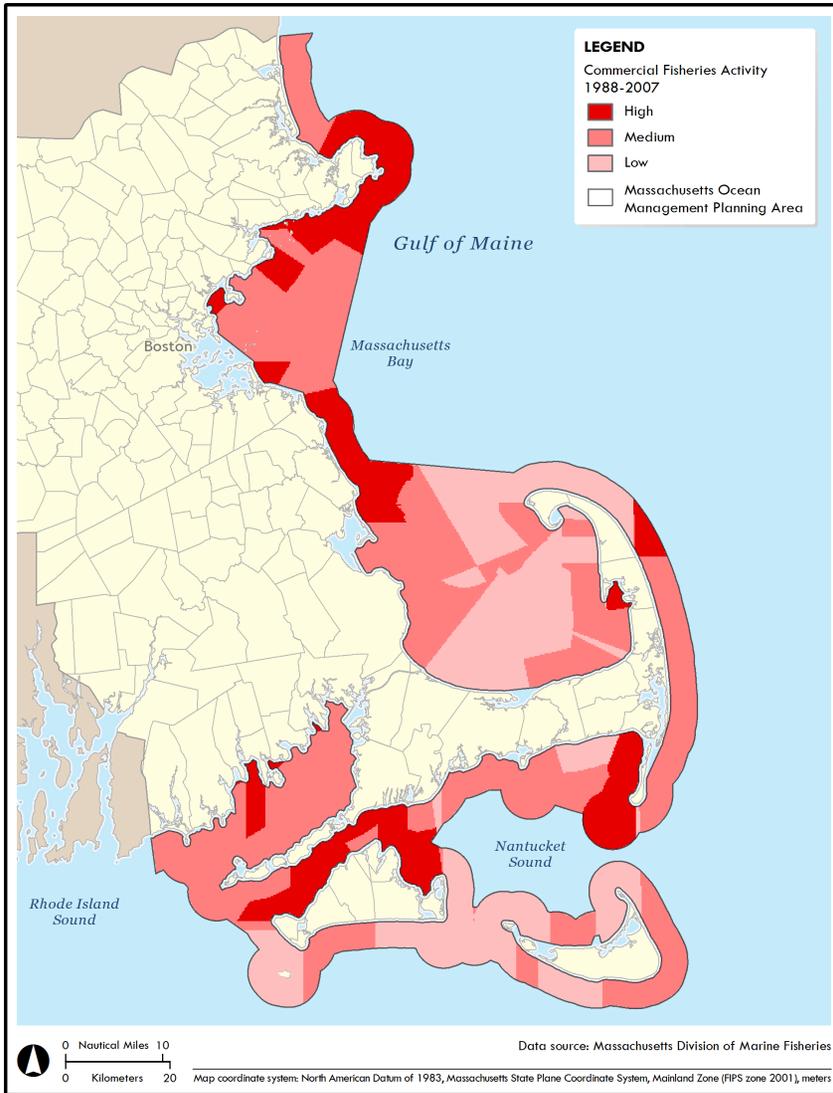


Figure 16. Commercial fishing effort and value in the 2009 ocean plan (left) and updated for the 2015 ocean plan (right). The largest changes were seen on the eastern sides of Cape Cod and Nantucket and within Nantucket Sound.

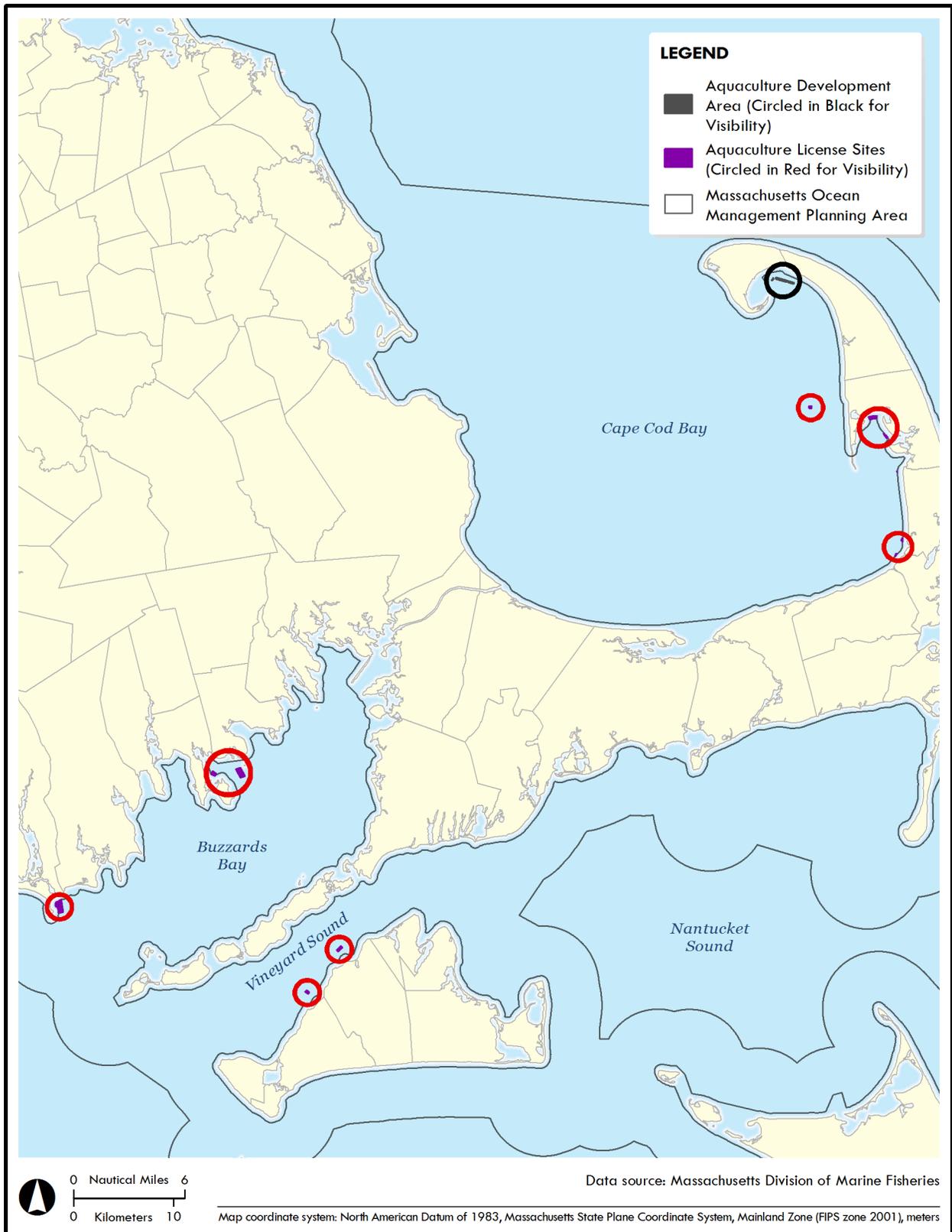


Figure 17. Aquaculture sites in the planning area; sites circled for visibility.

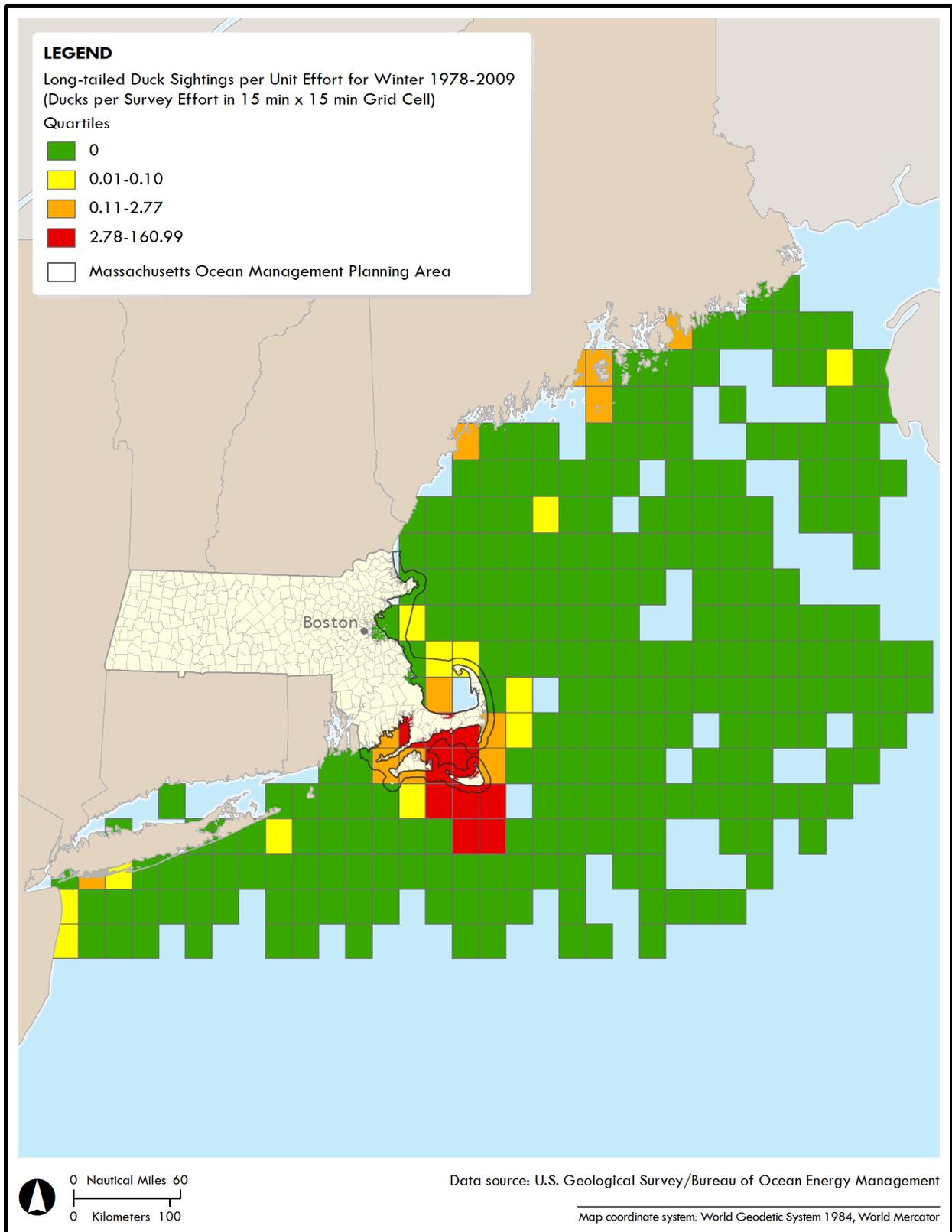


Figure 18. An example of how the USGS/BOEM Compendium of seabird studies demonstrates the importance of Massachusetts waters.

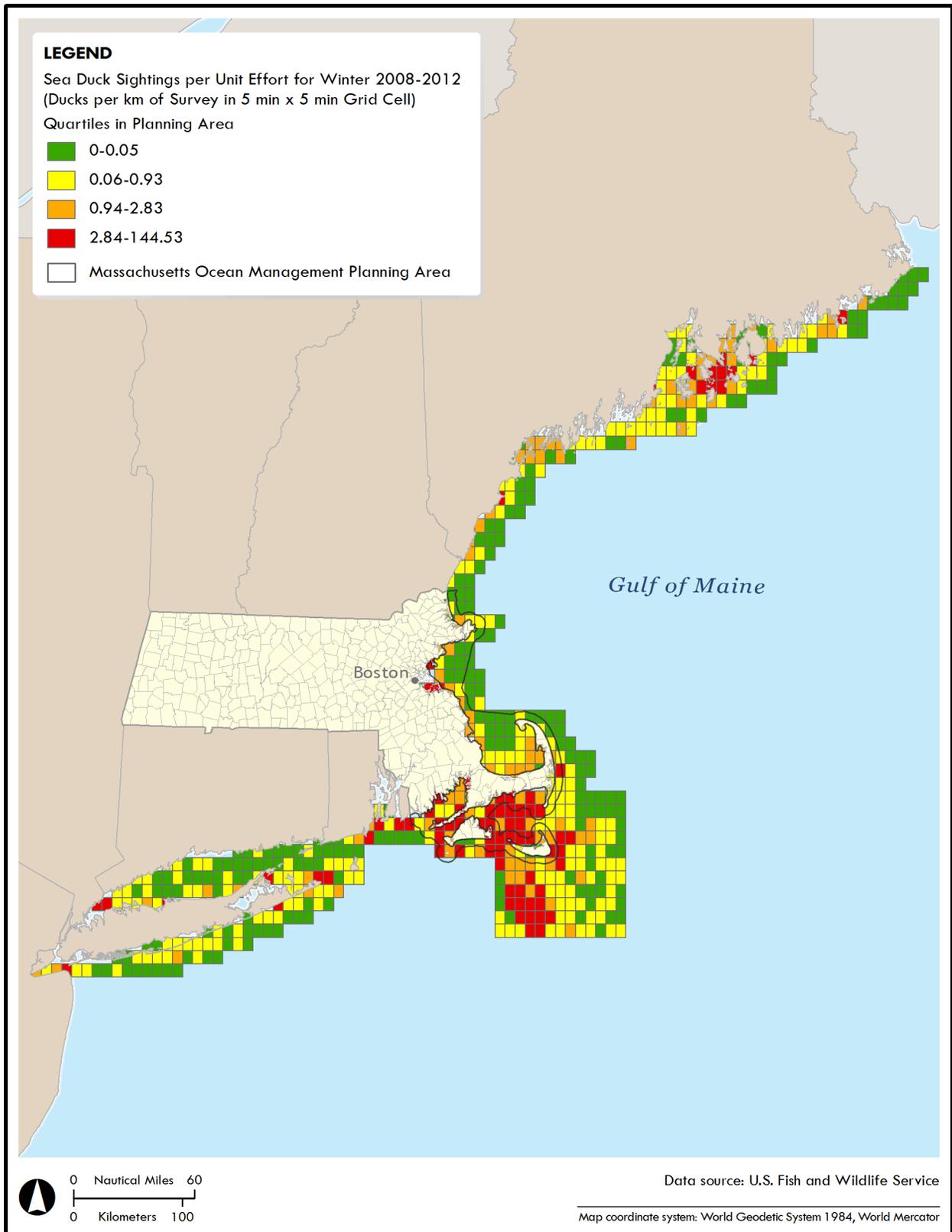


Figure 19. Combined sea duck (Long-tailed Duck, Common Eider, Surf Scoter, Black Scoter, White-winged Scoter) densities from the 2008-2012 USFWS aerial surveys.

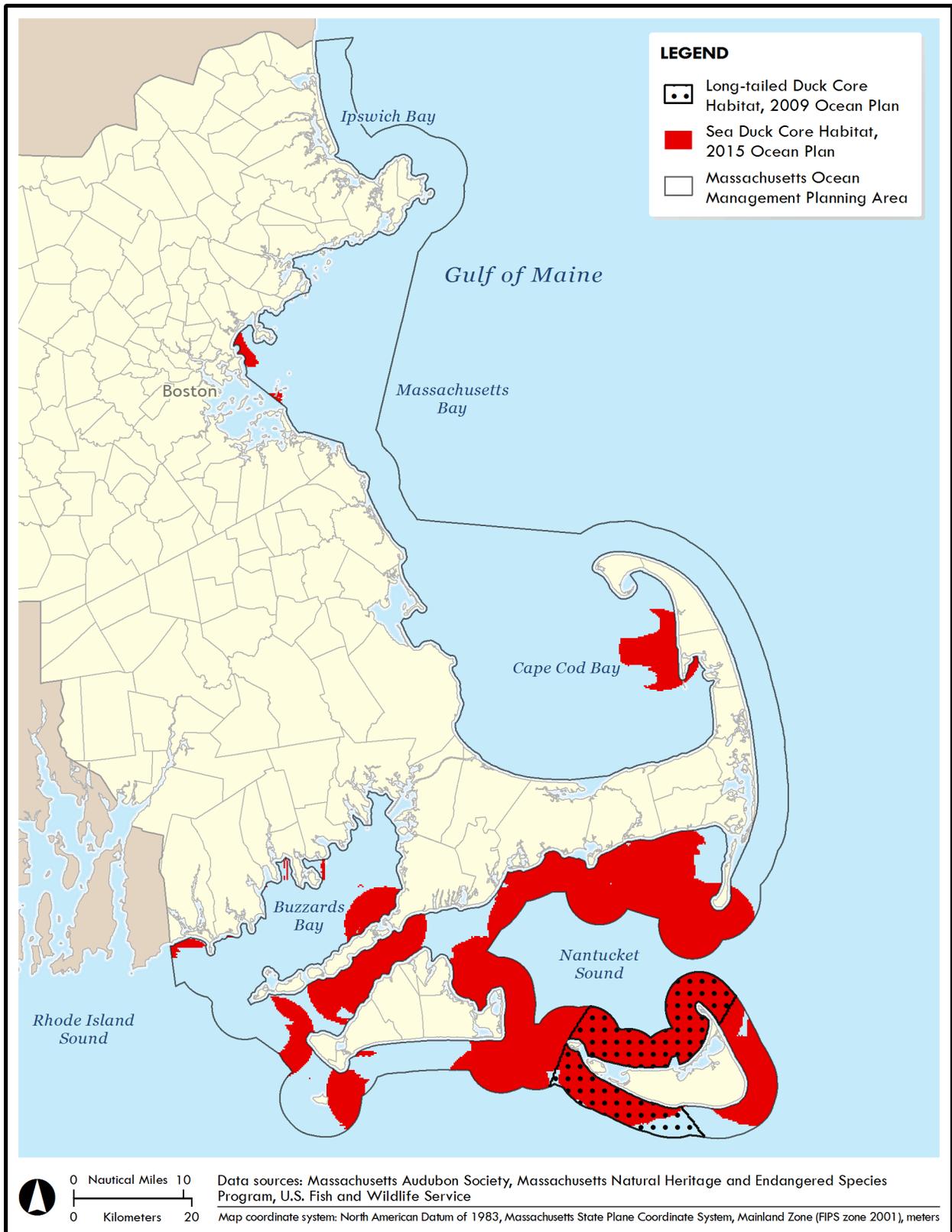


Figure 20. Sea duck core habitat SSU resource area for the 2015 ocean plan (in red) and the Long-tailed Duck core habitat SSU resource area (stippled) in the 2009 ocean plan.

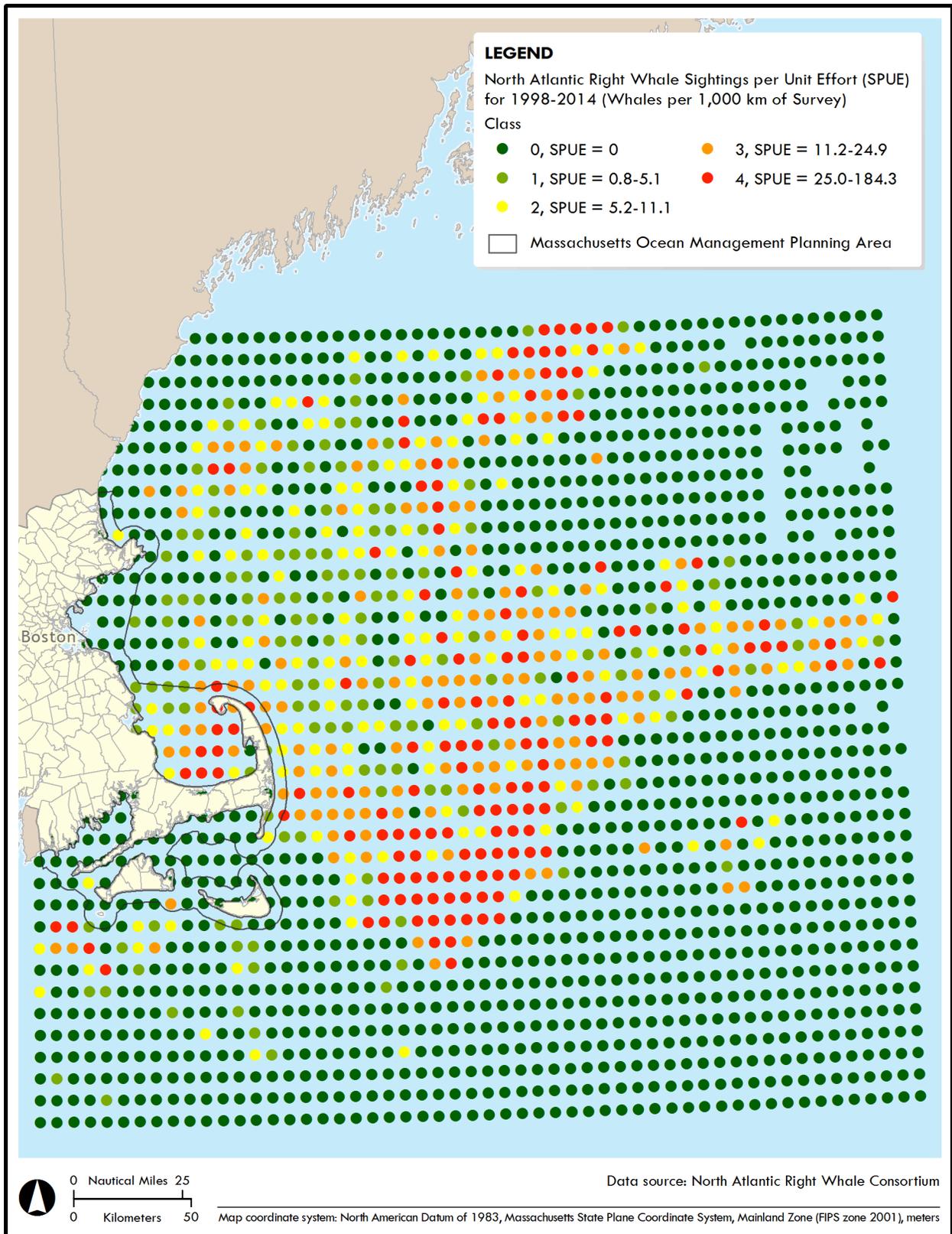


Figure 21. North Atlantic right whale sightings per unit effort for 1998-2014.

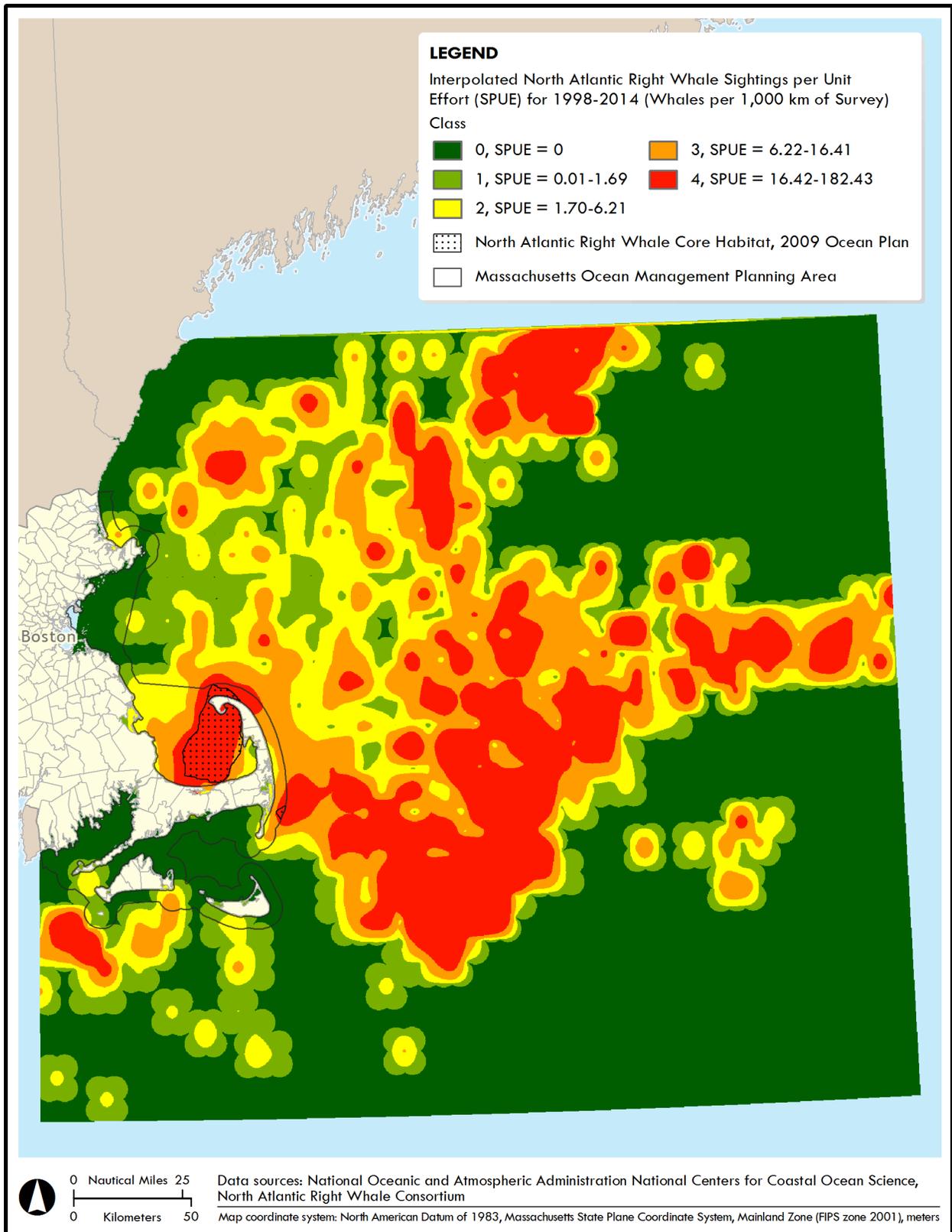


Figure 22. Interpolated North Atlantic right whale sightings per unit effort for 1998-2014 and the North Atlantic right whale core habitat SSU resource area from 2009 ocean plan (stippled).

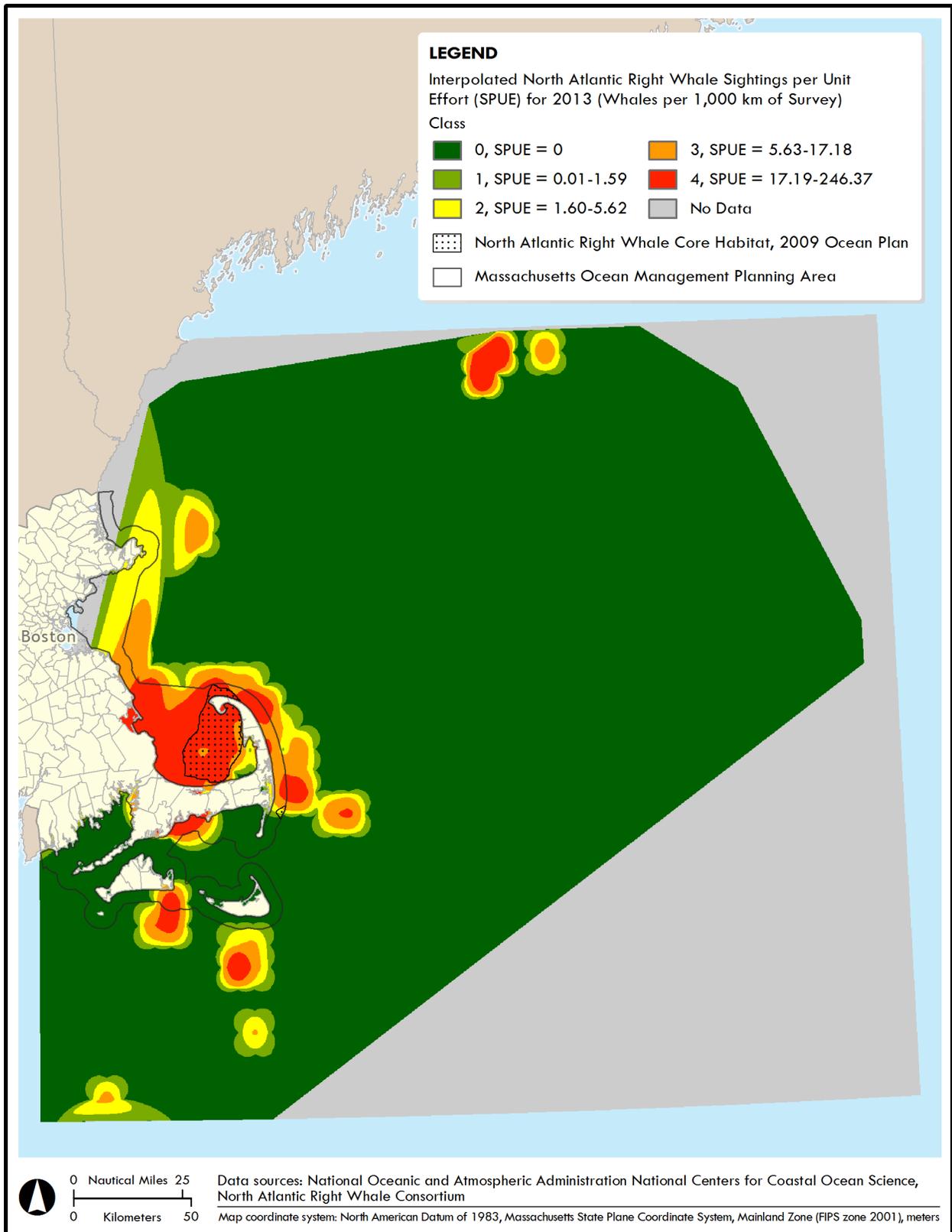


Figure 23. Interpolated North Atlantic right whale sightings per unit effort for 2013 and the North Atlantic right whale core habitat SSU resource area from 2009 ocean plan (stippled).

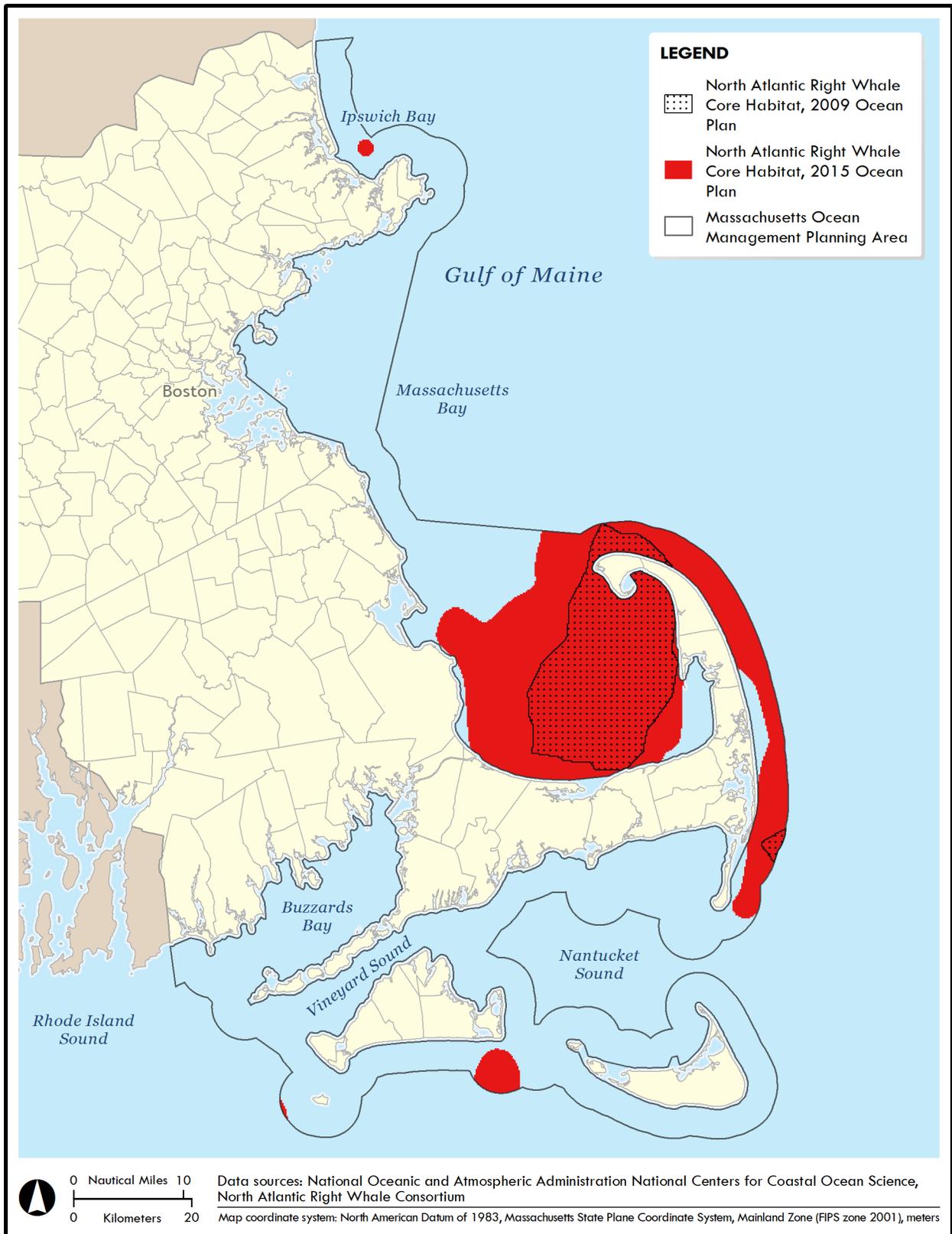


Figure 24. North Atlantic right whale core habitat SSU resource area in 2015 ocean plan (red) and North Atlantic right whale SSU resource area in the 2009 ocean plan (stippled).

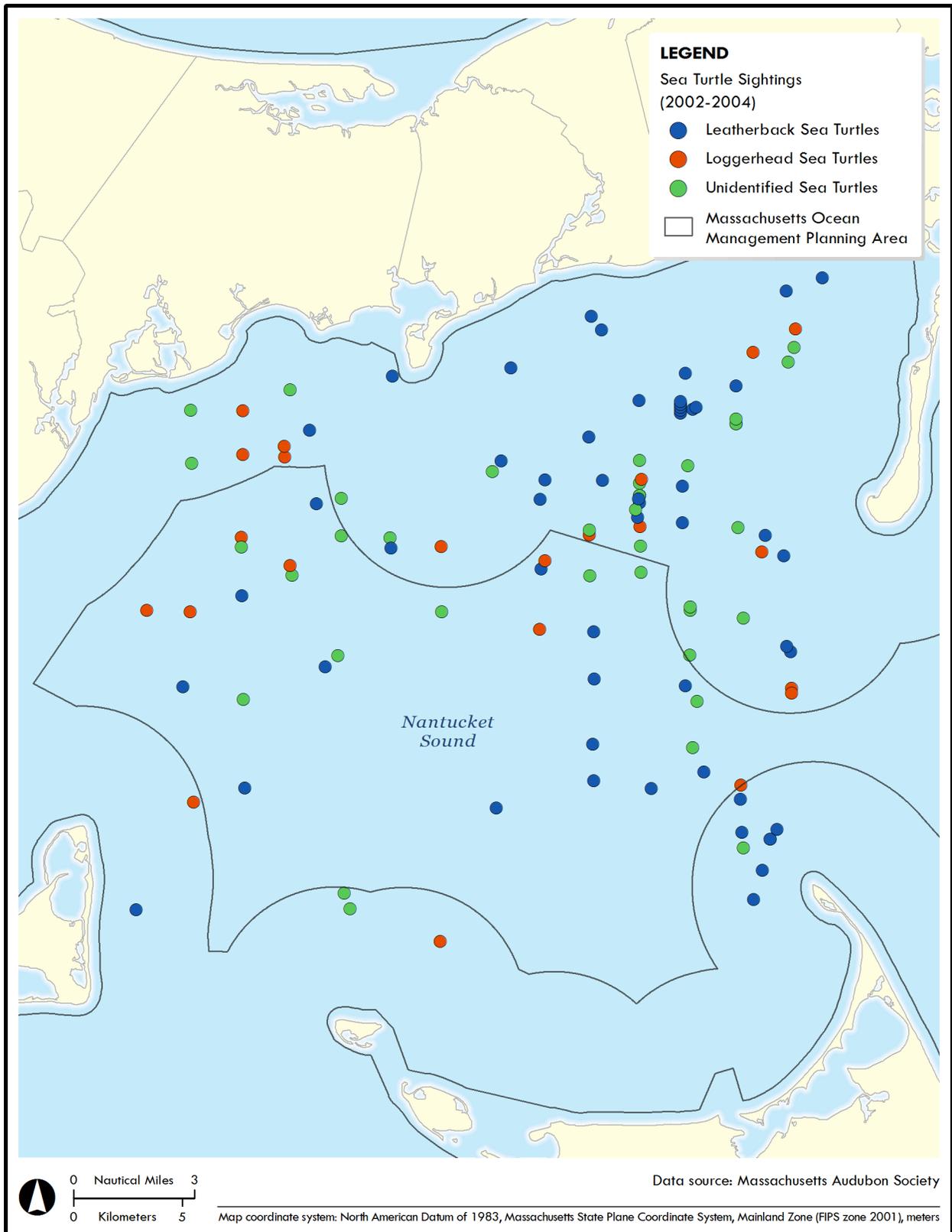


Figure 25. Mass Audubon sea turtle sightings in Nantucket Sound from aerial surveys in 2002-2004. Blue = Leatherback Turtle, Red = Loggerhead Turtle, Green = Unidentified sea turtle.

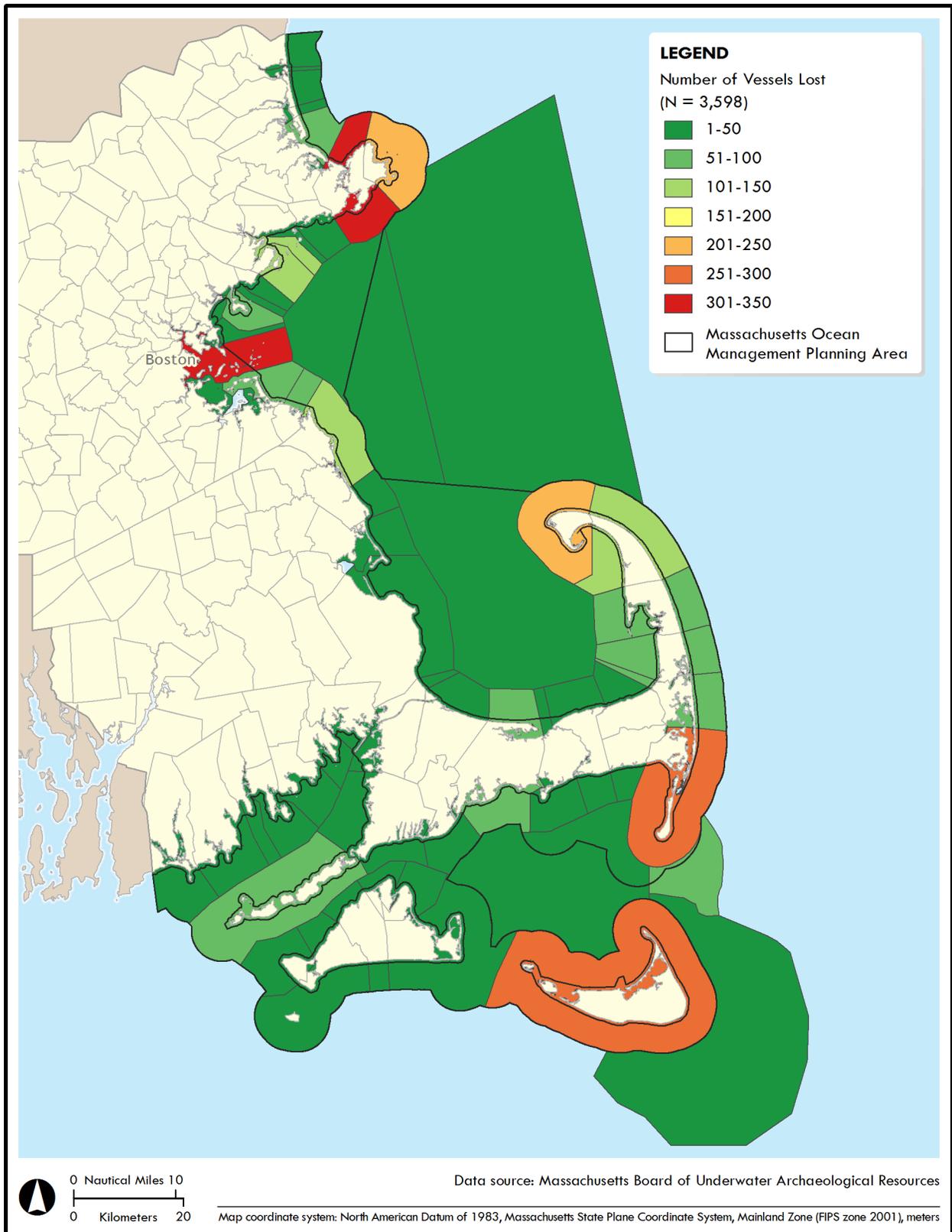


Figure 26. Sensitivity map depicting Massachusetts reported vessels lost as recorded by nearest town (1640s to present).

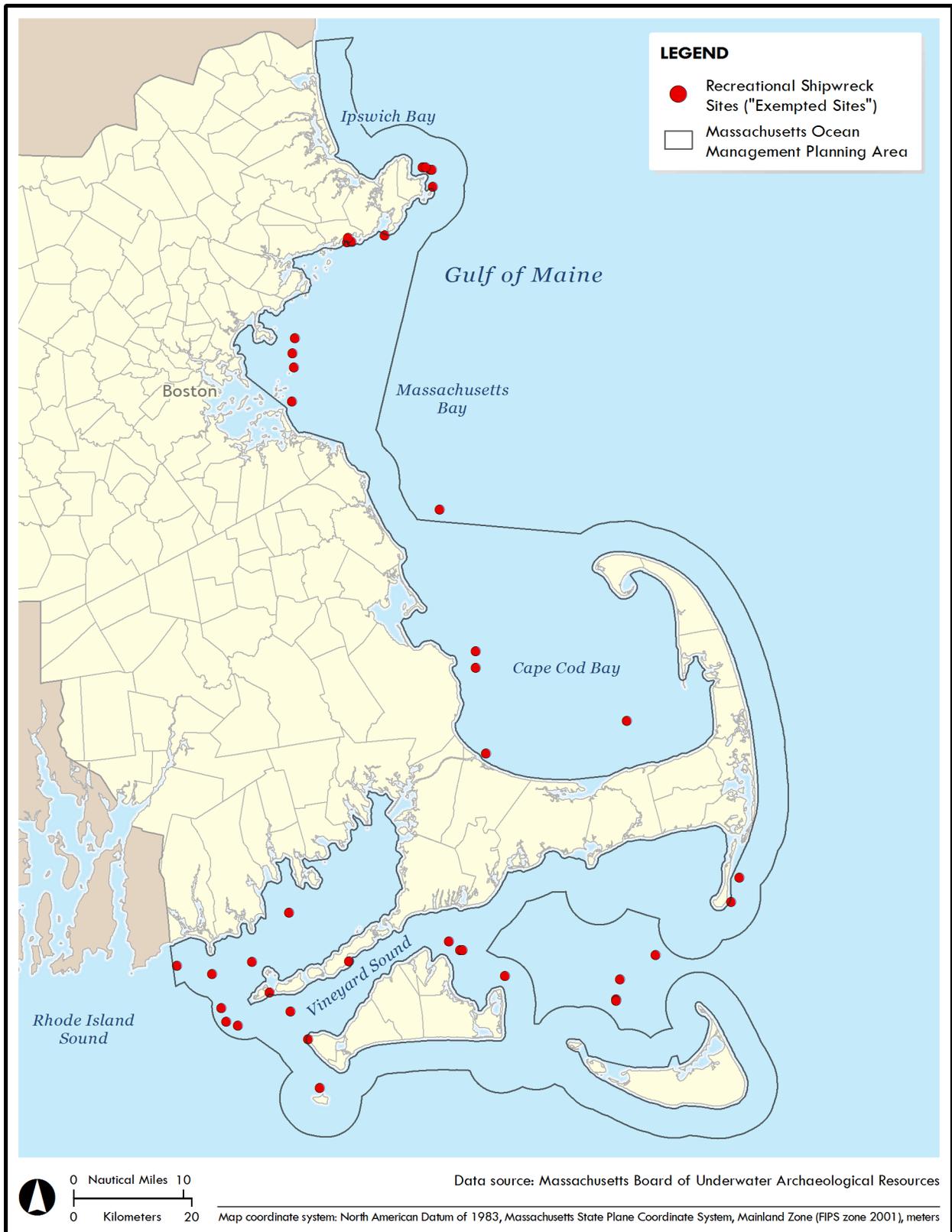


Figure 27. Shipwreck sites designated in 1985 as “Exempted Sites” for public access and use.



Figure 28. Concentrated recreational fishing water-dependent use area for the 2015 ocean plan (in green) and the 2009 ocean plan (striped).

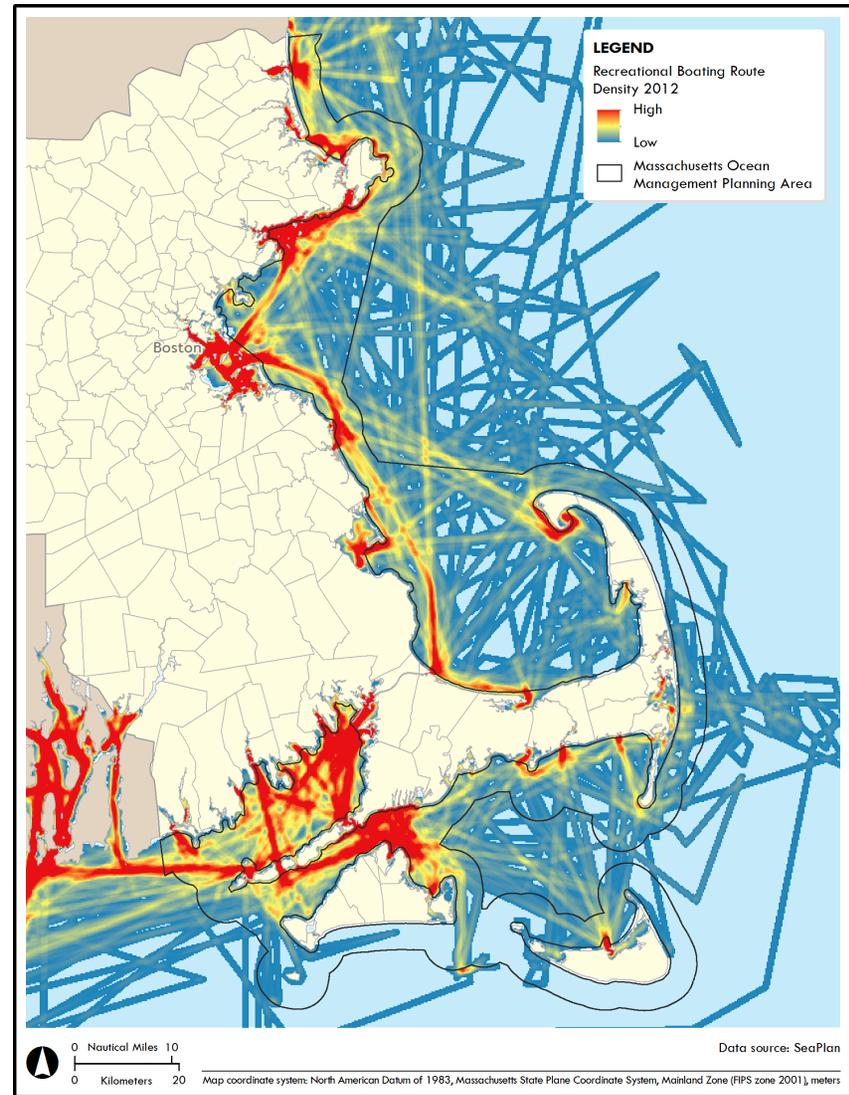
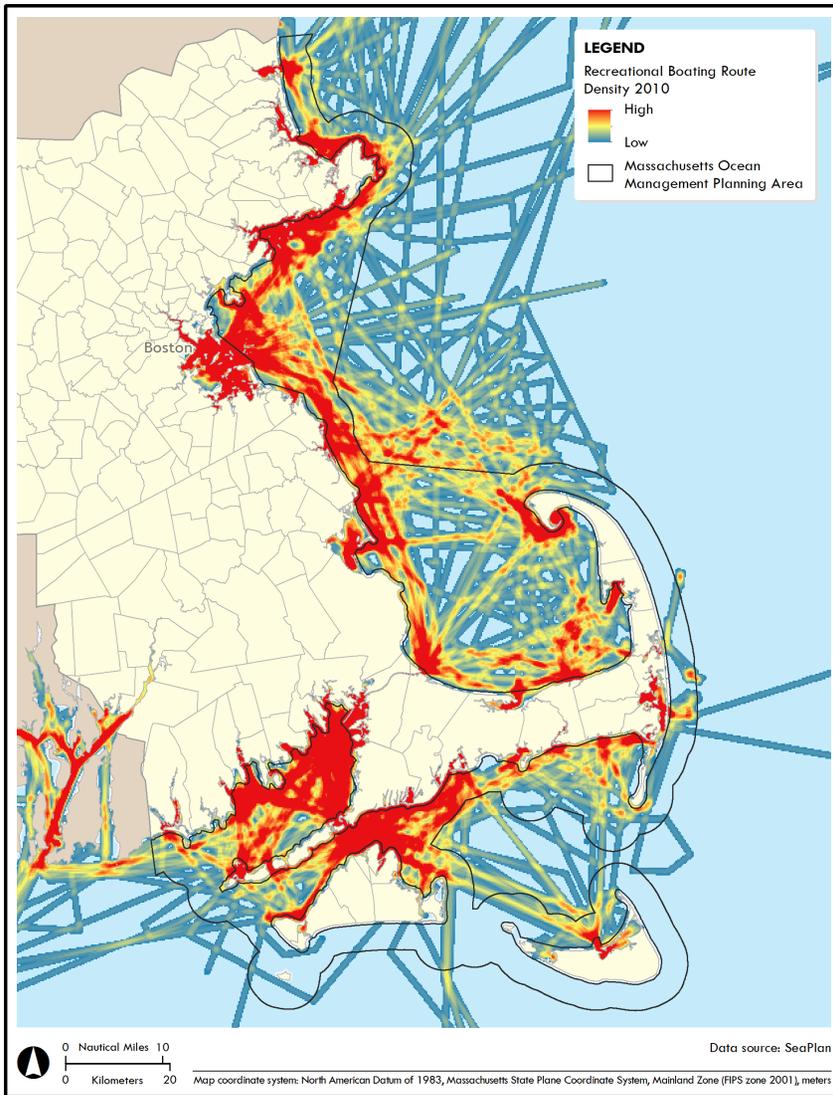


Figure 29. Recreational boating patterns resulting from the 2010 (left) and 2012 (right) recreational boating surveys conducted by SeaPlan.



Figure 30. Concentrated recreational boating for the 2015 ocean plan.

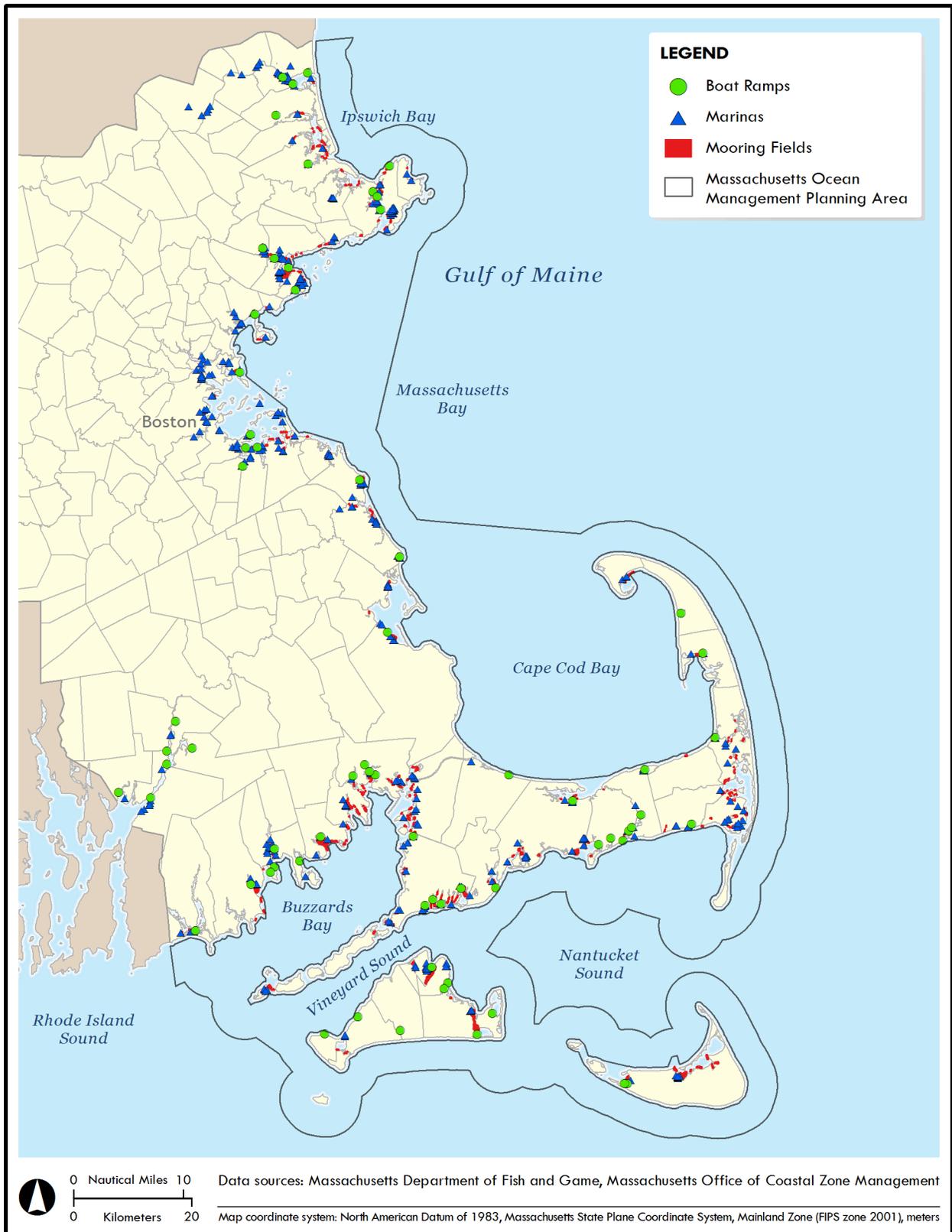


Figure 31. Coastal boat ramps, marinas, and mooring fields in Massachusetts.



Figure 32. Marine public and semi-public beaches in Massachusetts.



Figure 33. Wildlife viewing locations reported by recreational boaters in 2012.

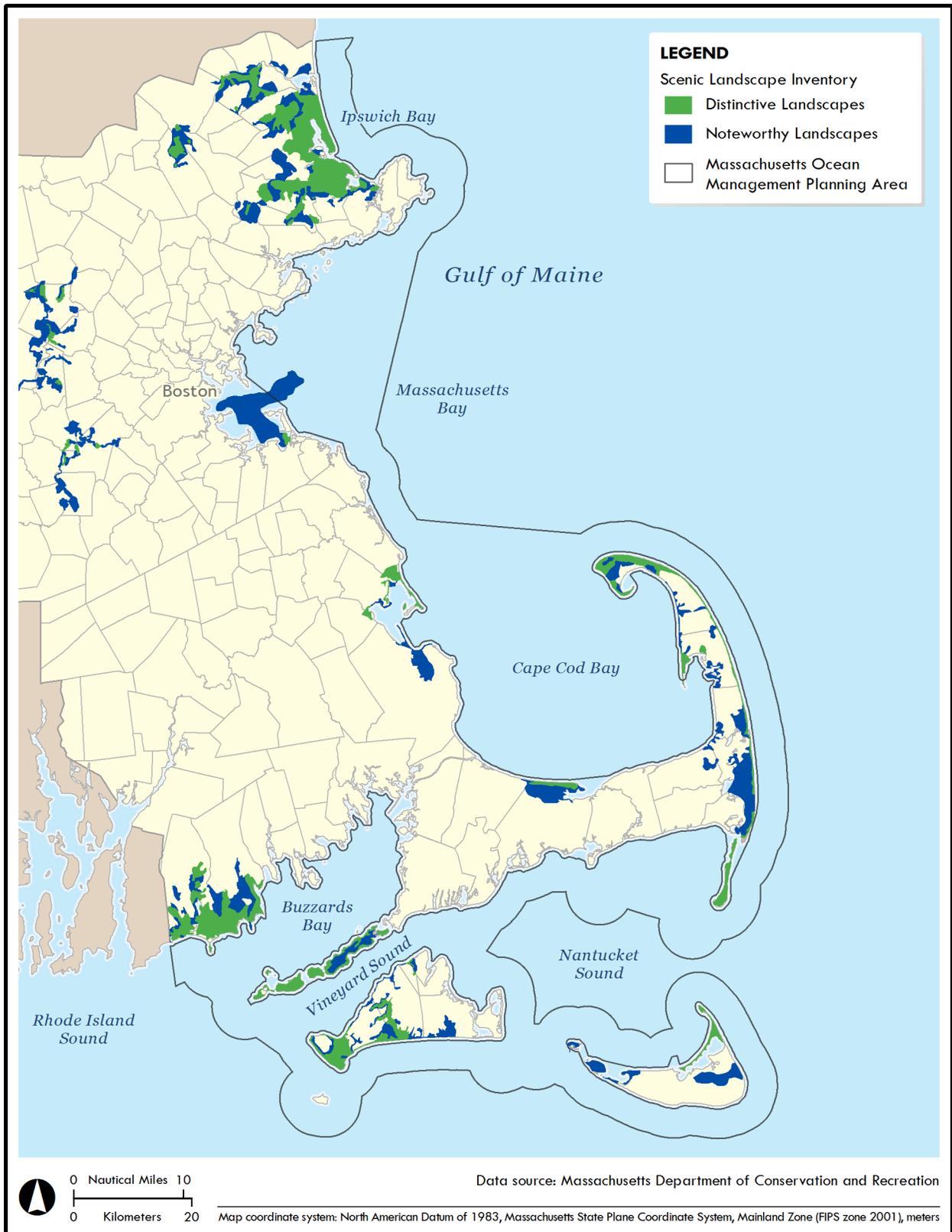


Figure 34. Scenic landscape inventory 2012. Distinctive areas have the highest scenic quality, while noteworthy landscapes are of a lesser, but important, visual quality.



Figure 35. National Register of Historic Places in coastal Massachusetts.

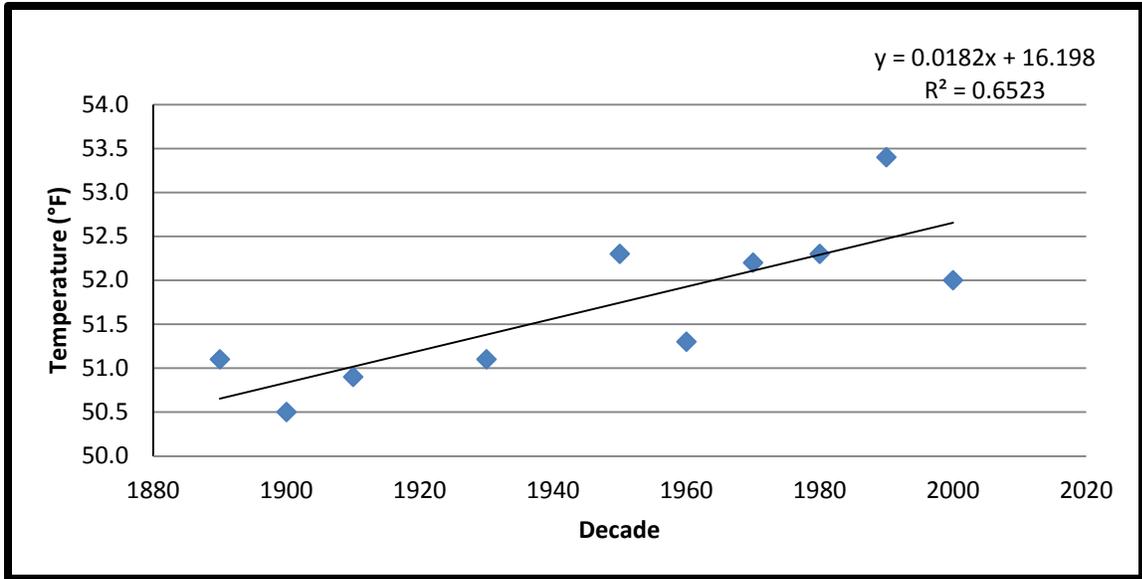


Figure 36. Decadal mean sea surface temperature at Woods Hole, Massachusetts, from the 1880s to the 2000s.

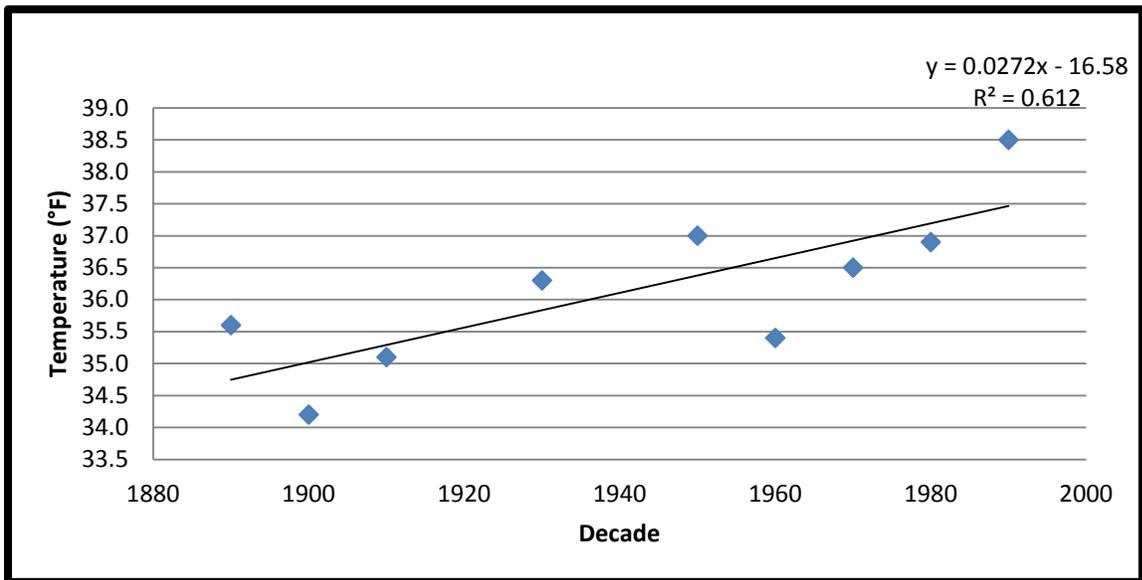


Figure 37. Winter (December-February) decadal mean sea surface temperature at Woods Hole, Massachusetts, from the 1880s to the 2000s.

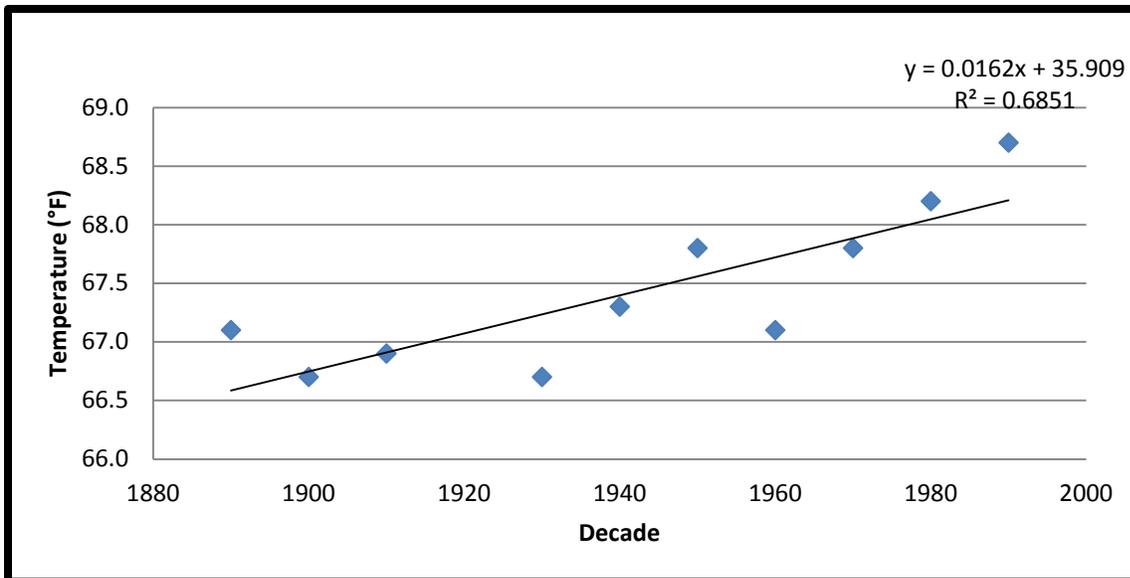


Figure 38. Summer (June-August) decadal mean sea surface temperature at Woods Hole, Massachusetts, from the 1880s to the 2000s.

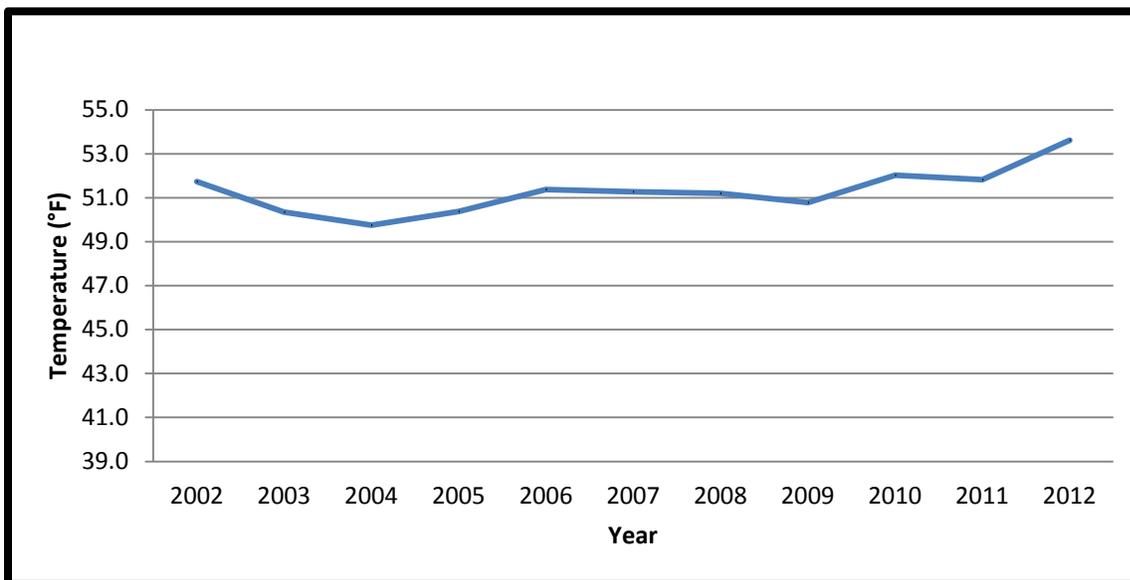


Figure 39. Annual average sea surface temperature at the Massachusetts A01 buoy from 2002-2012.

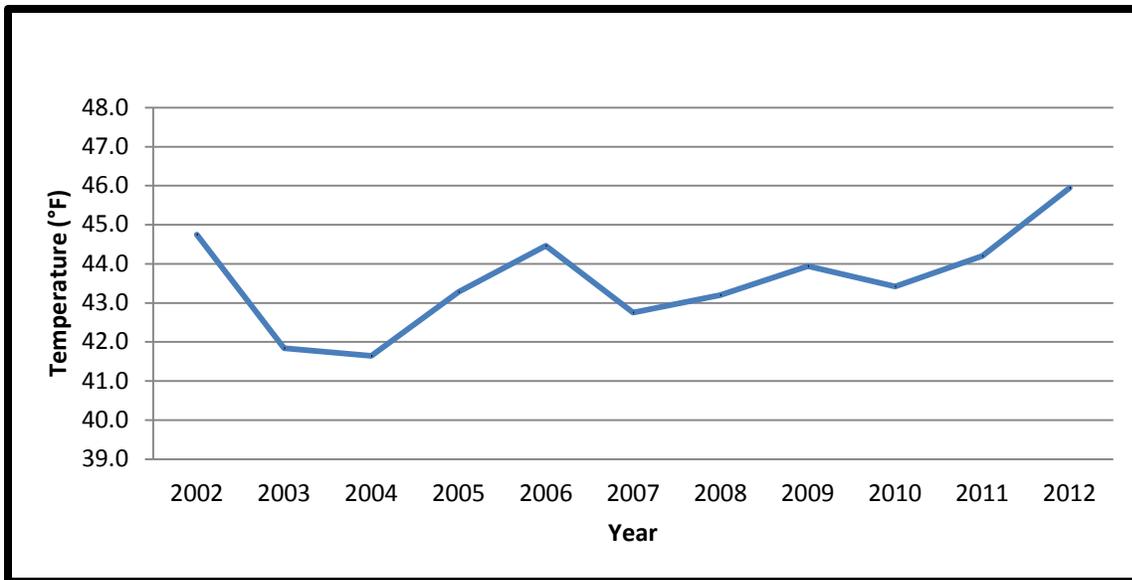


Figure 40. Annual average sea bottom (50 m depth) temperature at the Massachusetts A01 buoy from 2002-2012.

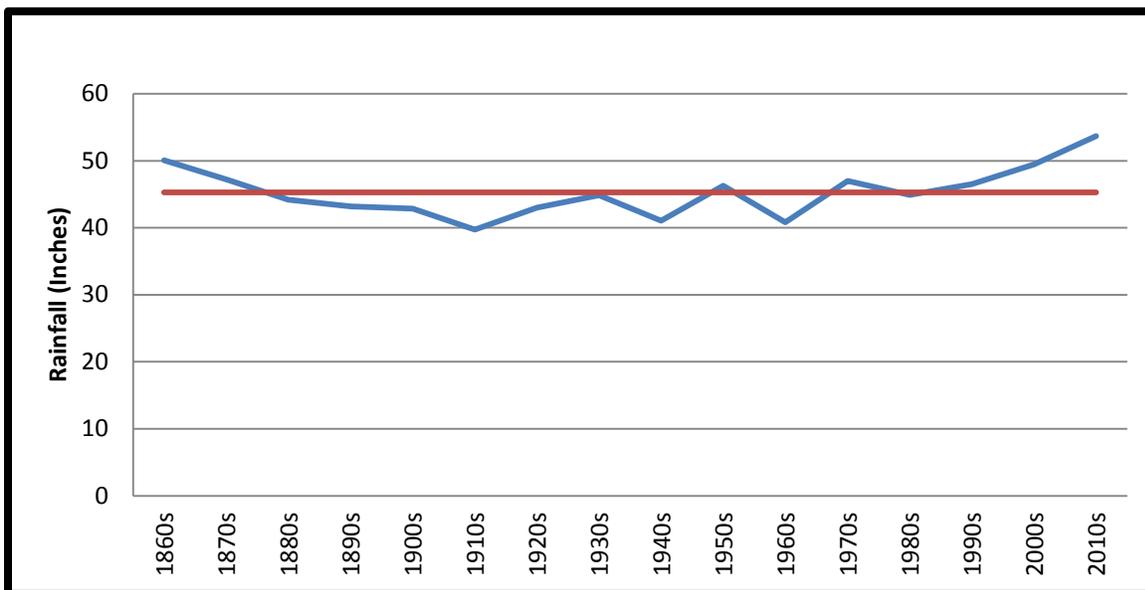


Figure 41. Decadal average rainfall in coastal Massachusetts watersheds from the 1860s to 2000s. The straight red line is the long-term average of 45 inches.

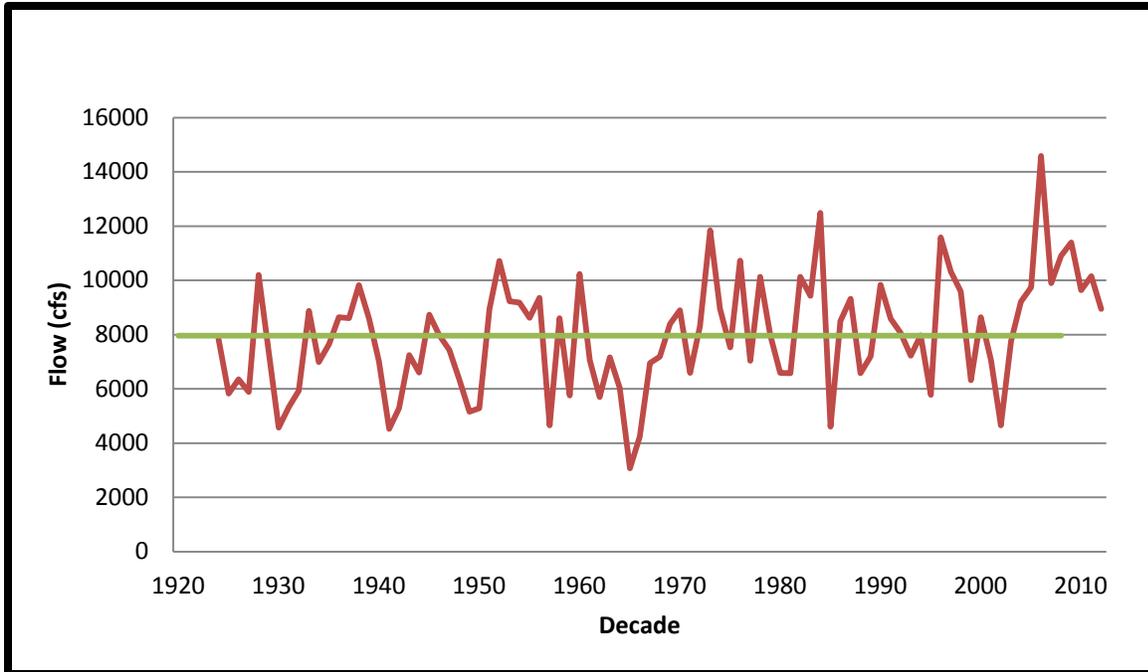


Figure 42. Merrimack River annual average flow in cubic feet per second (cfs) from 1924-2012 at USGS gauge 01100500. The straight green line is the long-term average flow of 7,959 cfs.

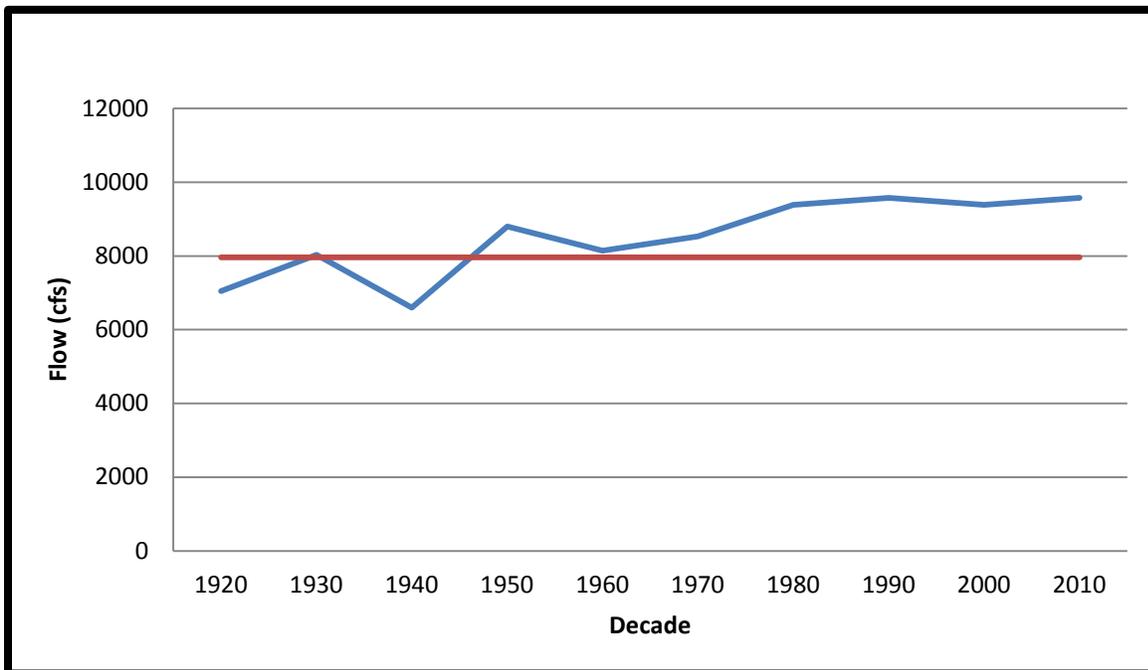


Figure 43. Merrimack River decadal average flow in cubic feet per second (cfs) from the 1920s to the 2000s at USGS gauge 01100500. The straight red line is the long-term average flow of 7,959 cfs.

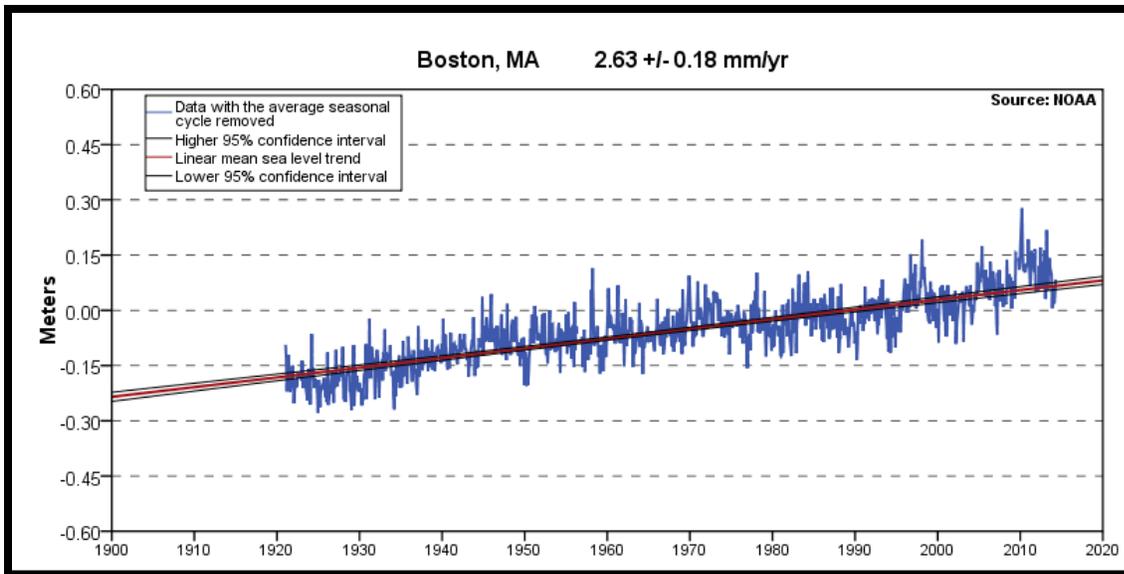


Figure 44. Long-term mean sea level data for NOAA Boston tide gauge station with linear trend and confidence interval.⁷³

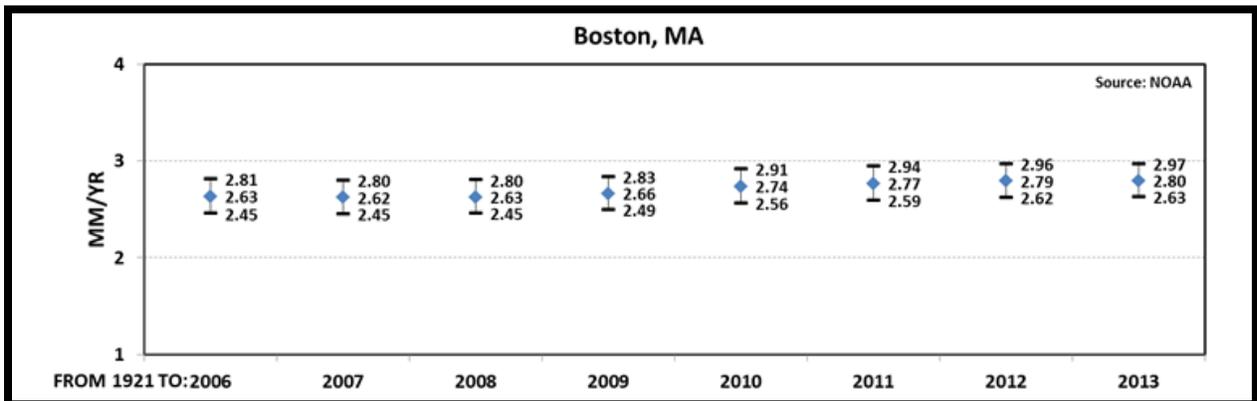


Figure 45. Mean sea level rates (blue diamonds) and 95% confidence intervals (in millimeters per year) calculated from 1921 to recent years (2006-2013) at the NOAA Boston tide gauge station. Values are the trend of the entire data period up to that year.

⁷³ http://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?stnid=8443970

