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Spatiotemporal and Economic Analysis of Vessel Monitoring System Data within Wind Energy Areas in Greater North Atlantic

Rhode Island Department of Environmental Management

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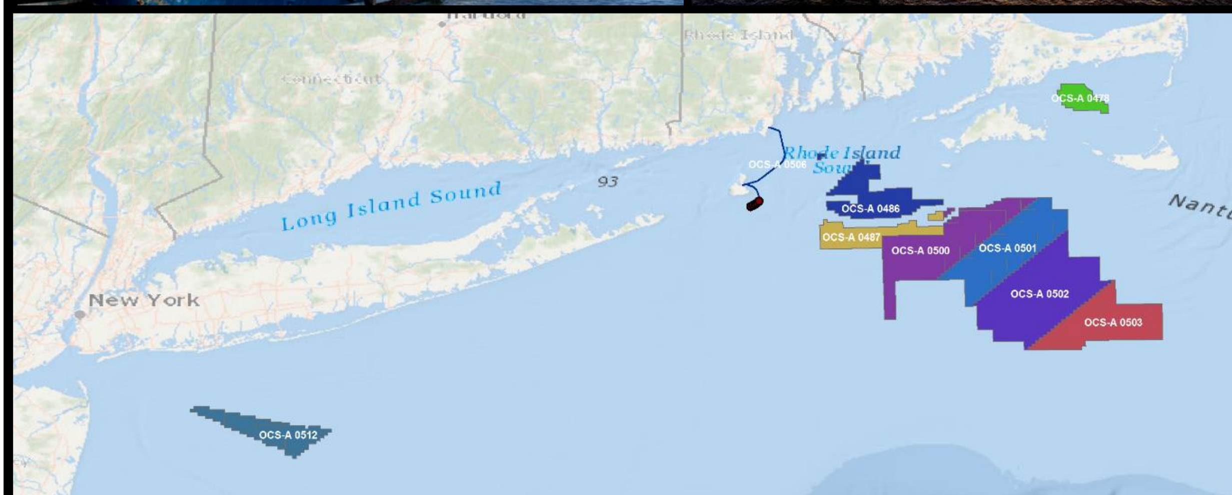

Top left: http://newenglandboating.com/new-bedford-tops-in-seafood-landings/
Top right: http://dwwind.com/project/block-island-wind-farm/
Bottom: RI DEM

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ACCSP – Atlantic Coastal Cooperative Statistics Program
AMI – area of mutual interest
ASMFC – Atlantic States Marine Fisheries Commission
BOEM – Bureau of Ocean Energy Management
Call – call for information and nominations
ConEd – Consolidated Edison
COP – construction and operations plan
CSV – comma separated values
CT DEEP - Connecticut Department of Energy and Environmental Protection, Fisheries Division
EA – environmental assessment
EEZ – exclusive economic zone
EIS – environmental impact statement
ESRI – Environmental Systems Research Institute
eVTR – electronic vessel trip report
FMP – fishery management plan
GARFO – NOAA Fisheries Greater Atlantic Regional Fisheries Office
Landings – landing data recorded through dealer reports LIPA – Long Island Power Authority
NDA – non-disclosure agreement
NEPA – National Environmental Policy Act
NMFS – National Marine Fisheries Service (now called NOAA Fisheries)
NOAA – National Oceanic and Atmospheric Administration
NOAA Fisheries – NOAA National Marine Fisheries Service (formerly NMFS)
NROC – Northeast Regional Ocean Council
NYPA – New York Power Authority
OceanSAMP – Rhode Island Ocean Special Area Management Plan
OCS – outer continental shelf
OLE – Office of Law Enforcement
RAM – random access memory
RFI – request for interest
RI DEM – Rhode Island Department of Environmental Management
RI DEM DMF – Rhode Island Department of Environmental Management, Division of Marine Fisheries
SAFIS – Standard Atlantic Fisheries Information System
SAP – site assessment plan
VMS – vessel monitoring system
VTR – vessel trip report
WEA – wind energy area

5 Executive Summary

In response to the Bureau of Ocean Energy Management's issuance of a Call for Information and Nominations (Call) of companies interested in developing the NY Call area in May 2014, Rhode Island Department of Environmental Management (RI DEM), Division of Marine Fisheries (DMF) staff started receiving input from fishermen in Rhode Island that they were concerned about the Call area being developed and its potential impacts on local and regional fisheries. The Rhode Island fishing industry anticipated that a process like the stakeholder engagement conducted through the Rhode Island Ocean Special Area Management Plan (OceanSAMP) would be used to determine other possible lease sites off other states. RI DEM held a meeting in May of 2015 with the fishing industry to discuss their concerns. Industry's main concern was that the economic values of the fisheries in the Call area presented by BOEM at public meetings held in New Jersey and New York were underestimated, and that the data used to describe fishing activity in the area were inadequate. Industry requested that RI DEM DMF staff conduct a separate analysis using Vessel Monitoring System (VMS) data. RI DEM produced a VMS study specific to the NY Wind Energy Area (WEA) and landings coming into the state of Rhode Island. This initial VMS study had limitations, so RI DEM conducted a second, more comprehensive analysis; this report outlines the second VMS analysis.

RI DEM acquired VMS data for a larger portion of the North Atlantic, as well as Vessel Trip Reports (VTRs) and landings data for New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, and New Jersey for the years of 2011 through 2016. The three datasets were linked together using Supplier Trip IDs and Vessel Permit Numbers, then raster layers of fishing densities for each fishery (by state landed, port landed, gear used, or species caught) were produced. Finally, ex-vessel values of the fishing activity within each WEA were calculated by weighting the VMS points within each fishing trip by the fishing density raster layers, selecting only the data occurring within each WEA, and summing the values. The methods are presented in great detail within this report along with the code and supplementing files to allow for other agencies to expand on this work.

The purpose of this analysis is to provide developers and managers with an additional, and more accurate source of fishing location and density information. High resolution fishing density information and corresponding economic analysis will be useful in micrositing wind turbines and developing Construction and Operations Plans (COPs) for wind farms in the North Atlantic. The products of this report should be used with other existing datasets, including the Kirkpatrick et al. (2016) study, GIS layers on the Northeast Ocean Data Portal, and anecdotal information from fishing industry participants.

The products of the analysis are 27 tables of ex-vessel values and 1,829 maps (.jpg files) and 592 rasters (.img files) of smoothed (non-confidential) fishing densities at a 0.1-degree resolution. These products have all been sorted and scrubbed of confidential-level data to comply with NOAA's Office of Law Enforcement (OLE) and Atlantic Coastal Cooperative Statistics Program (ACCSP) confidentiality rules. All non-confidential files will be provided to developers and management agencies upon request.

By ex-vessel value, the fisheries that will be most exposed to the collective WEAs within the study area are those managed by the Sea Scallop Fishery Management Plan (FMP); the Squid, Mackerel, Butterfish FMP; the Monkfish FMP; and the Northeast Multispecies FMP. The Sea Scallop fishery is estimated to have over $23 million coming from the combined WEAs over the six-year study period, while the Squid, Mackerel, Butterfish fishery is estimated to have $5.4 million caught within the WEAs in that time period. All four fisheries appear to have some intersection with multiple WEAs, though the Monkfish fishery appears to have the most spatial overlap.

6 INTRODUCTION

On September 8th, 2011, the Bureau of Ocean Energy Management (BOEM) received an unsolicited request from the New York Power Authority (NYPA), Long Island Power Authority (LIPA), and Consolidated Edison (ConEd) for a commercial lease offshore New York. BOEM is obligated to consider unsolicited request locations for possible leasing and therefore initiated the renewable energy leasing process. BOEM issued a Request for Interest (RFI) to determine whether other parties were interested in developing the Call area. In the initial leasing phases, the area is referred to as a Call area because BOEM issues a Call for Information and Nominations (Call) of other companies that may be interested in developing the area; this stage determines whether the development process will be done competitively or non-competitively. The Call was issued in May 2014. After receiving interest, BOEM initiated the competitive leasing process pursuant to the Code of Federal Regulations (CFR) (30 C.F.R. 585.211).

RI DEM DMF staff started receiving input in early 2015 from fishermen in Rhode Island that they were concerned about the Call area being developed. Rhode Island is home to two of the Atlantic Coast's largest squid processors and approximately 54% of squid on the Atlantic Coast is landed in Point Judith, Rhode Island.[1] The Rhode Island fishing industry had been through extensive stakeholder engagement meetings as part of the OceanSAMP to determine a suitable location for future offshore renewable energy projects within the Rhode Island and Massachusetts Area of Mutual Interest (AMI). Industry expected that a similar process would be used to determine other possible lease sites. Since BOEM did not hold any stakeholder meetings in Rhode Island prior to this stage in the leasing process, RI DEM DMF offered to hold a meeting in May of 2015 with the fishing industry to discuss their concerns. The primary issue raised at the public meeting was that the values of the fisheries in the Call area presented by BOEM at public meetings held in New Jersey and New York were underestimated, especially for longfin inshore squid. These numbers came from a fisheries socioeconomic report funded by BOEM (Kirkpatrick, et al., 2016). Industry felt that there was more fishing activity within the lease areas than the numbers and maps in the report described.

While the analysis conducted for the socioeconomic report was sound and the intent was to establish values of the species harvested from within WEAs coastwide, there were limitations in the location accuracy of the base fishing dataset used (vessel trip reports; VTR). Most commercial fisheries (except a few including lobster and Jonah crab) in federal waters have a VTR requirement. Therefore, this dataset is suitable for coastwide analysis. Nevertheless, a commercial fisherman is required to log a single latitude and longitude per VTR and he or she is required to fill out and submit at least one VTR per trip. Additional VTRs are required for each time the fisherman changes statistical areas (Figure 1), gear types, or mesh sizes. Therefore, only one or a few point locations are required for each fishing trip, and the location provided may not actually be indicative of where fishing actually occurred.

Due to the limitations of the VTR location data, industry requested that RI DEM DMF staff conduct a separate analysis using VMS data. In June of 2016, staff were able to acquire VMS data overlapping with the NY WEA and analyze it in conjunction with VTR data and commercial landings in Rhode Island. There were limitations to the economic portion of this analysis as well because the VMS data was specific to the

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[1] Based on landings from SAFIS for the past eleven years, Rhode Island has landed between 41% and 62% of coastwide longfin squid. Annual percent landings in Rhode Island from 2006-2016 are as follows: 62, 58, 58, 55, 50, 47, 41, 51, 55, 61, and 56%.

NY WEA. Without additional VMS data of surrounding areas, it was impossible to determine what portion of each trip occurred within the NY WEA; the use of only data within the NY WEA meant that much of each trip's location data was not included. The analysis therefore lacked any method to accurately scale the values of each trip's landings by the amount of fishing within the NY WEA. This led to an inflation of economic value by species coming from inside the NY WEA. The initial study was also limited to landings in Rhode Island. Therefore, much of the fishing activity, in terms of both location and landings values, was excluded from data products. As a result, RI DEM DMF conducted a second, more comprehensive analysis.

The second analysis is presented in this report. VMS data were acquired for a much larger portion of the ocean (Figure 2), and landings data were pulled from Rhode Island and five other states (New Hampshire, Massachusetts, Connecticut, New York, and New Jersey). This allowed for the landings values to be scaled to the amount of fishing that occurred within a WEA and for more fishing activity (landings and VMS locations) to be incorporated into the results.

There are still limitations to this more comprehensive analysis; no states south of New Jersey are included and the section of ocean for which VMS data were requested only covers a portion of the Atlantic Coast exclusive economic zone (EEZ). Future work should include VMS data from the entire Atlantic Coast and landings data from all Atlantic states (as well as all corresponding VTRs). Although there are limitations to this analysis, the location component of these products is likely the most detailed and accurate in terms of where fishing is occurring on an annual basis for a variety of fisheries. VMS data are the most accurate and highest resolution data available to answer this question. Consequently, VMS, where available, should be used in the siting of future projects, as well as in the micrositing of ongoing development projects.

6.1 Purpose

While many of the offshore wind projects in federal waters have already passed the leasing stage and are in the process of developing their Site Assessment Plans (SAPs) and COPs, there are still opportunities to discuss how each lease area will be developed. The purpose of this work is to provide developers and managers with an additional, and accurate, source of fishing location and density information. While 12 commercial sites coastwide have already been leased, higher resolution fishing density information and corresponding economic analysis will be useful in micrositing wind turbines and developing COPs for wind farms in the North Atlantic. The products of this report should be used with other existing datasets, including the Kirkpatrick et al. (2016) study, GIS layers on the Northeast Ocean Data Portal, and anecdotal information from fishing industry participants.

This information is essential at the early stages in the development process, as project COPs will be difficult to restructure once they have reached advanced stages. Accurate fishing information will also serve to streamline the Environmental Impact Statement (EIS) review of the COPs required under the National Environmental Policy Act (NEPA), or the Environmental Assessment (EA) under NEPA for new lease areas being proposed.

6.2 Data Types

It is essential to recognize the distinctions between VTR and VMS data prior to understanding the differences between the BOEM socioeconomic model (Kirkpatrick et al., 2016) and the analysis described within this report. VTRs are meant to provide information on fishing catch and effort, while VMS data are collected to determine the specific location of fishing activity.

6.2.1 Vessel Trip Reports (VTR)

All operators of NOAA Fisheries Greater Atlantic Region permitted-vessels, with the exception of those vessels that possess only a lobster permit, are required to submit a VTR for every fishing trip regardless of where the fishing occurs or what species are targeted. VTRs are required in order to provide information on when and where catch occurred, as well as effort information that is not captured elsewhere (gear specifications and length of fishing activity). Operators of all federally permitted vessels must complete a VTR prior to landing. VTRs are submitted to NOAA either through the use of paper forms or through the use of electronic VTR software (NOAA-Fisheries, Vessel Reporting, 2017).

All trips involving fishing activity (including transiting with product on board), require at least one VTR. Additional reports are necessary any time there is a change in fishing area (moving to a new statistical area; Figure 1) or fishing gear (change in gear type or a change in the mesh or ring size of the gear). Each report requires only a single latitude and longitude point to represent the area fished; the statistical area is also required. The VTR instructions require that fishermen record the haul back position where the majority of fishing occurred. Nevertheless, since new VTRs are only required when they change statistical areas or gears, multiple tows within the same statistical area using the same gear will only receive a single location coordinate that may or may not be representative of where the fishing actually occurred (NOAA-Fisheries, Vessel Reporting, 2017).

6.2.2 Vessel Monitoring System (VMS) Data

VMS is a satellite surveillance system primarily used to monitor the location and movement of commercial fishing vessels in the U.S. EEZ and treaty areas. The system uses satellite-based communications from on-board transceiver units, which certain vessels are required to carry. The transceiver units send position reports that include vessel identification, time, date, and location, and are mapped and displayed on the end user’s computer screen (NOAA-Fisheries, Vessel Monitoring System Program, 2017).

Each vessel typically sends position reports once an hour, but at increased intervals when the vessel is approaching an environmentally sensitive area. Alerts can be sent to the VMS technicians and other personnel when a particular vessel location might require additional inquiry or contact with the vessel operator (NOAA-Fisheries, Vessel Monitoring System Program, 2017).

The VMS program currently monitors more than 4,000 vessels. It is the largest national VMS fleet in the world. The system operates 24 hours a day every day with near-perfect accuracy, which is why the program is of interest to other users, including the U.S. Coast Guard, academia, and the coastal states (NOAA-Fisheries, Vessel Monitoring System Program, 2017).

VMS data is subject to strict confidentiality requirements (NOAA-Fisheries, Vessel Monitoring System Program, 2017).

6.2.3 Landings Data

Commercial landings data (sometimes called dealer reports) from the ACCSP are the compiling of state and federal landings submitted by dealers. Total pounds and dollar value are complete, but some effort information (area/gear) may be lacking in the dealer reports.

To participate in commercial fishing statistics programs, states must meet certain data submission standards set by the ACCSP. Participation requires that dealer reports include the following information: Trip start date, vessel ID, fisherman ID, dealer ID, landing date, trip number, species landed, quantity, units of measure (for quantity), disposition of catch, ex-vessel value or price, port landed, state landed, market size, and grade (ACCSP, 2012).

7 METHODS

7.1 STUDY TARGET AREAS

This report was produced by RI DEM DMF staff. Thus, the areas covered spatially are meant to encompass the locations fished by Rhode Island-based fishermen, or fishermen from other states that land in Rhode Island. The target area covers all Massachusetts WEAs (OCS-A 0500, OCS-A 0501, OCS-A 0502, and OCS-A 0503 lease areas), the Rhode Island/Massachusetts AMI (OCS-A 0486 and OCS-A 0487 lease areas), and the New York WEA (OCS-A 0512; see Figure 2). Refer to Figures 3-5 for close-up maps of the lease blocks and aliquots within each of the study WEAs. While consideration of other WEAs (i.e. the New Jersey WEA) would have been preferable, the monthly VMS datasets are very large and technological limitations restricted the area that could be processed by RI DEM DMF staff. Refer to the methods for more information on processing limitations.

7.2 DATA SOURCES

7.2.1 Vessel Monitoring System Data

Confidential-level VMS data files were obtained through a formal request to NOAA's OLE. A Non-disclosure agreement (NDA) was required in order to work with the VMS data at the raw level. The VMS data cannot be made public, viewed by the public, or otherwise accessed by anyone who has not signed an OLE NDA. Additionally, all final products must abide by the ACCSP "Rule of 3" to maintain confidentiality.

RI DEM DMF staff submitted the formal request on March 28th, 2017. The following attributes were requested for each VMS point location recorded:

- VESSEL_NAME
- LATITUDE
- LONGITUDE
- UTC DATE
- AVG_SPEED
- DECLARATIONS
- PERMIT

DEM requested data from all VMS recorded locations from January 2011 – March 2017 within the bounding coordinates below:

North: 42.151^o
South: 39.881^o
West: -74.278^o
East: -69.726^o

Refer to the Figure 2 for a visual data representation of the data request. The map was submitted to NOAA's OLE as part of the data request.

The OLE processed RI DEM DMF's request as VMS Data Request ST17-001. Data files were provided to RI DEM DMF on April 25, 2017 as a secure file download (ST17-001.zip) containing 75 html files, one file per month during the time frame requested.

7.2.2 Vessel Trip Reports

VTRs were obtained through SAFIS, the Standard Atlantic Fisheries Information System. All electronic vessel trip reports (eVTRs) submitted by fishermen go directly into SAFIS, while paper VTRs are uploaded into a NOAA VTR database by NOAA staff. The NOAA database data are pushed into SAFIS on a regular basis.

Data were pulled from SAFIS for all vessels landing in NH, MA, RI, CT, NY, or NJ between the years of 2011 and 2016. All six states' data were obtained on May 22nd, 2017. All columns of data in the SAFIS system were pulled; unnecessary information was deleted later in the process.

7.2.3 Landings Data (sometimes referred to as Dealer Reports)

Landings data for each state were pulled from the ACCSP Data Warehouse. Data were pulled from the Data Warehouse for all vessels landing in NH, MA, RI, CT, NY, or NJ between the years of 2011 and 2017. All six states' data were obtained on May 3rd, 2017. All columns of data in the system were pulled; unnecessary information was deleted later in the process.

Julia Livermore (RI DEM DMF Principal Marine Biologist) obtained access to surrounding states data by submitting a request through the ACCSP Data Warehouse that was distributed to each state's fisheries agency for review and approval. NH, MA, CT, NY, NJ, and GARFO (NOAA's Greater Atlantic Regional Fisheries Office) all approved. The Connecticut Department of Energy and Environmental Protection (CT DEEP), Fisheries Division did require the ability to review all products using CT data prior to general review of publication. CT DEEP staff approved of this report on November 21st, 2017.

7.3 Brief Methods

In short, three datasets (VMS, VTR, and landings) were obtained from their respective sources and analyzed using R (x64 version 3.3.2), RStudio (1.0.143), and Microsoft Excel. ArcGIS 10.4 was also used to create shapefiles utilized in the analysis.

The first step was to merge all three datasets into a single comprehensive dataset including a row for every VMS point in the study area that corresponds to a landing of a single species in one of the target states (NH, MA, RI, CT, NY, or NJ). This was done by connecting the VTRs to the landings by VTR number, which is recorded in both datasets. Next, the combined VTR/landings were merged to the VMS using the vessel permit number. There were challenges addressed during the merging steps that are discussed in greater detail in Appendix II Section 11.1.

The combined data were then subsetted by fishery (by species caught, gear used, state landed in, and port landed in) and mapped as a raster of fishing density by year. Since raw spatial data cannot be made public, the fishing density maps were smoothed and converted to a relative intensity map that is still useful in siting of turbines.

The raw fishing density maps by species caught were used to weight the value of fishing location points within each trip. Rather than assuming all fishing activity is equal, in order to scale the landings by the amount of fishing activity within each WEA per trip, each individual fishing point within a trip was weighted by the fishing density map for that fishery that year. Weighting the values based on fishing density places higher weights on points where the fishing density was higher. This strategy makes the assumption that fishermen target areas that are most profitable (i.e. where species abundances are higher).

It is important to point out that the first VMS analysis produced by RI DEM DMF in 2016 did not include the weighting step. This updated methodology requires that entire trips are encompassed in the VMS spatial data. Since only VMS data near the NY WEA were utilized in the first analysis, the data were not comprehensive for each trip and weighting was not possible. Hence, the first analysis includes the values of entire trips that utilized the NY WEA, rather than just the portion of fishing activity that occurred within the NY WEA. Therefore, the values of the first analysis will be different from the products described in this report, as this analysis weights the fishing points by fishing density so that the values attributed to each WEA include only fishing activity that occurred inside that WEA. Additionally, only landings in RI were included in the first analysis, while this work includes landings from six states.

Finally, to determine the value of species harvested within each WEA, the weights were applied to the landings values. Then the fishing points were spatially clipped by each of the WEAs, grouped by fishery and by year, and the weighted landings values were added together. While the true fishing densities cannot be made public, the value of each fishery (by species caught, gear used, state landed in, and port landed in) within each WEA can be tested for compliance with confidentiality rules. Each data point was tested for compliance with the ACCSP Rule of 3. Thus, the economic value of each fishery could be presented in the results if the Rule of 3 was met.

Since true fishing densities cannot be provided within this document, for any spatial area of concern identified on the relative fishing intensity maps, RI DEM DMF staff can conduct further analysis to identify the value of that specific area to each fishery. Please contact Julia Livermore (julia.livermore@dem.ri.gov; 401.423.1937) with any questions or to make a request for further analysis.

It is important to note that these data were not modeled. The fishing value data have simply been subsetted by wind area, weighted by fishing density, and grouped by fishery (gear type species landed, landing port, or landing state). The final map products have been smoothed using a 3x3 focal window, and put on a relative scale to comply with confidentiality requirements.

8 RESULTS

The products of these analysis include maps of fishing activity by year and for the whole time period (2011-2016) for fishing activity grouped by species caught/FMP, gear used, state landed in, and port landed in. As previously mentioned, only landings in the states of NH, MA, RI, CT, NY, and NJ are addressed in these analyses.

No fishing in any of the WEAs resulted in landings in New Hampshire. New Jersey, New York, Connecticut, Rhode Island, and Massachusetts all had landings coming from at least one WEA; thus, New Hampshire has been dropped from all further analysis.

Economic results tables only include rows for each port that had actual landings coming from at least one WEA. Other ports are not included in the tables; mapping of fishing activity includes fishing from ports that may not have any landings from any of the WEAs though they did have fishing in the larger study area. The following ports are omitted from the results section due to limited data not meeting the ACCSP Rule of 3: Avalon, NJ; Avalon City, NJ; Babylon, NY; Barnegat, NJ; Belmar, NJ; Brooklyn, NY; Cambridge, MA; Chilmark, MA; Cohasset, MA; Dartmouth, MA; East Haven, CT; Greenport, NY; Islip, NY; Jamestown, RI; Jersey City, NJ; Marion, MA; Mattituck, NY; Mystic, CT; Nahant, MA; Narragansett, RI; New Haven, CT; New Shoreham, RI; New York, NY; Newburyport, MA; Newington, CT; Niantic, CT; Orleans, MA; Pine Beach, NJ; Sea Isle City, NJ; Seabrook, MA; South Kingstown, RI; Wakefield (spelled incorrectly as Wakefiled in SAFIS), RI; and Westerly, RI.

The same applies for certain gear types and species landed. Fishing using harpoon, pelagic longline, and hagfish pots did occur in the study area between 2011 and 2016, but maps will not be shown and value of landings harvested within WEAs will not be disclosed due to data not meeting the ACCSP Rule of 3. The following species were all landed in at least one of the five aforementioned states (NY, NJ, NY, CT, or RI) after fishing in the study area, but the data were insufficient to pass the Rule of 3: amberjack, blood ark, barrelfish, Atlantic razor clam, Northern quahog, black drum, red drum, snowy grouper, groupers (others), hagfish, spotted hake, blueback herring, crevalle jack, mullets, Atlantic deep-sea red crab, octopus, white perch, blue runner, sculpins, black tip shark, finetooth shark, shortfin mako shark, sandbar shark, red snapper, lightning whelk, and wreckfish. It is important to point out that not passing the Rule of 3 does not necessarily mean low landings. For certain species, there are less than three dealers, fishermen, or vessels harvesting high values.

Non-confidential (smoothed and reclassified) maps were produced for the entire time period and on an annual basis for each species landed, state landed in, port landed in, and gear used. All non-confidential maps for the full time period are included in this report. In the interest of keeping this document a manageable size, for the annual maps, only maps by state fishery or for high value species, gears, and ports are shown in this report. All additional yearly maps will be provided to permitting agencies, offshore wind developers, and others upon request as .jpg and raster .img files.

It is also important to understand that there are no VMS data exclusive to the lobster or Jonah crab fisheries. The lobster and Jonah crab fisheries do not have federal requirements for VTR or VMS. VMS data for lobster and Jonah crab likely come from fishermen with lobster permits that also participate in other fisheries requiring VTRs and VMS, or lobster or Jonah crab that were caught as incidental catch in other fisheries. Hence, lobster and Jonah crab products have been omitted from this report, since fishermen that harvest exclusively lobster or Jonah crab are not covered within the VMS data.

Additionally, many fisheries did not have VMS requirements until recently. For instance, the squid fishery did not have full VMS coverage until 2016; in 2014 the fishery was at 80% coverage. Therefore, these products should be used in conjunction with other datasets like the Kirkpatrick et al. (2016) report using VTR location and landings data, as well as anecdotal information and plotter tracks provided by fishermen.

8.1 Landings Values by Fishery

For the purposes of the brief written portion of this report, only annual non-confidential values greater than $500,000 and six-year total non-confidential values greater than $1,000,000 are discussed. All other values are included in Appendix I tables.

8.1.1 Ex-vessel Values by State

8.1.1.1 Massachusetts

Massachusetts appears to be the state with the most landings coming from various WEAs. The aggregated six-year total for all landings coming from within all of the study WEAs combined is $19,039,318.01; the highest annual total was in 2011, with $5,072,995.98.78 (Table 1). All annual values for Massachusetts exceeded $2 million. The six-year total coming from the Deepwater Wind lease area is $3,299,555.48 with the highest annual totals occurring in 2015 and 2016 ($921,941.08 and $ 1,091,151.12, respectively; Table 2). The six-year total coming from the Bay State Wind lease area is $3,404,817.25, with the annual high of $1,189,168.36 in 2016 (Table 3). Six-year landings from the Vineyard Wind lease area totaled to $2,773,809.95; three years exceeded $500,000 annual totals: 2012, 2013, and 2016 ($987,431.20, $551,972.38, and $675,235.18, respectively; Table 4). Massachusetts landings coming from the Statoil lease area came to $7,893,014.35 with annual highs in 2011, 2012 and 2014 ($4,057,730.43, $1,373,540.07, and $1,356,719.10, respectively; Table 5). Massachusetts total six-year landings in the OCS-A 0502 WEA sum to $1,136,673.22 with an annual high of $540,357.03 in 2012 (Table 6). No annual values exceeded $500,000 in the OCS-A 0503 WEA for Massachusetts, or any other state (Table 7).

8.1.1.2 Rhode Island

The state with the second most landings coming from WEAs is Rhode Island. Fishing in all WEAs combined resulting in Rhode Island landings had a six-year total of $10,301,240.76 (Table 1). Rhode Island six-year totals come to $3,162,584.46 for the Deepwater Wind lease area; with large landing years occurring in 2013 ($563,106.73), 2014 ($743,139.01), and 2015 ($798.139.76; Table 2). From the Bay State Wind lease area, Rhode Island six-year landings total to $3,038,225.75, with the annual high of $1,119,799.41 in 2016 (Table 3). Rhode Island landings from the Vineyard Wind lease area over the six-year period added to $1,913,360.73, with the highest value occurring in 2016 at $1,142,581.23 (Table 4). The total value of six-year landings in Rhode Island coming from the Statoil lease area is $1,353,569.95. The largest annual value occurred in 2014 at $589,751.75 (Table 5).

8.1.1.3 New Jersey

The third most exposed state is New Jersey, with all large landings coming from the Statoil lease area. The aggregated landings from all study WEAs over the six-year study period totaled $8,217,956.38 (Table 1). Within the Statoil lease area, the six-year total comes to $8,054,350.04 with high values of $2,711,295.27

in 2011, $1,734,064.53 in 2012, $1,034,975.58 in 2013, $931,913.90 in 2014, and $1,251,437.97 in 2015 (Table 5). 98% of all study WEA landings coming into New Jersey came from the Statoil lease area.

8.1.2 Ex-vessel Values by Port

The five most economically exposed ports, in order of six-year total value coming from all study WEAs, are: New Bedford, MA ($16,481,466.81; Table 8); Point Judith, RI ($8,355,353.35); Cape May, NJ ($3,568,075.33); Point Pleasant, NJ ($2,316,064.49); and Stonington, CT ($2,470,643.45).

8.1.2.1 Fishing within Deepwater Wind Lease Area

New Bedford, MA and Point Judith, RI are the two most sensitive to the Deepwater Wind lease area with six-year totals from the lease area of $2,955,343.52 and $2,083,224.76 (Table 9). Annual values exceeding $500,000 occurred in 2014 ($623,286.25) and 2015 ($598,181.01) for Point Judith and 2015 ($877,566.42) and 2016 ($969,314.59) for New Bedford.

8.1.2.2 Fishing within Bay State Wind Lease Area

New Bedford, MA and Point Judith, RI are also the two most exposed ports to the Bay State Wind lease area. The six-year total from the Bay State Wind lease area was $2,671,175.77 for New Bedford and $2,730,666.01 for Point Judith (Table 10). Annual highs of $624,583.87 and $866,115.77 took place in 2013 and 2016 for New Bedford, while annual highs for Point Judith occurred in 2014 ($679,573.55) and 2016 ($1,076,542.94). Montauk, NY and Westport, MA also had fairly consistent landings coming from the Bay State Wind lease area.

8.1.2.3 Fishing within Vineyard Wind Lease Area

Fishing activity in the Vineyard Wind lease area appears to result in landings primarily in New Bedford, MA and Point Judith, RI as well. Total port landings over the six-year period were $2,444,609.22 for New Bedford and $1,871,044.82 for Point Judith (Table 11). New Bedford annual landings from the Vineyard Wind lease area were $884,492.00 in 2012, $513,661.67 in 2013, and $615,985.94 in 2016, while the annual high for Point Judith was $1,111,489.95 in 2016. Montauk, NY and Chatham, MA also had somewhat consistent landings from the lease area.

8.1.2.4 Fishing within Statoil Lease Area

Landings coming from the Statoil lease area were also the highest in New Bedford, MA with a six-year total of $7,468,157.94 (Table 12). Cape May, NJ had the next highest six-year total of $3,568,075.33, followed by Point Pleasant, NJ with $2,296,395.50. Annual highs coming from the Statoil lease area to New Bedford occurred in 2011 ($3,674,879.23), 2012 ($1,371,324.69), and 2014 ($1,356,719.10). For Cape May, the highest landings took place in 2011 ($1,750,250.16) and 2012 ($791,932.12). Montauk, NY and Point Judith, RI also had regular landings from the Statoil lease area.

8.1.2.5 Fishing within OCS-A 0502 and OCS-A 0503 WEAs

For the two unleased OCS lease areas, there were no ports heavily exposed, though Chatham, MA; New Bedford, MA; and Point Judith, RI all had regular fishing in the OCS-A 0502 WEA (Table 13). New Bedford and Chatham also had regular fishing in the OCS-A 0503 WEA (Table 14).

8.1.3 Ex-Vessel Values by Gear

The three gear types that resulted in the largest landings over the six-year period within all study WEAs were scallop dredge ($22,933,826.54; Table 15), bottom fish otter trawl ($12,507,276.51), and sink gill net ($3,187,319.88).

8.1.3.1 Fishing within Deepwater Wind Lease Area

Within the Deepwater Wind lease area, the six-year total landings added to $2,942,242.16 for the scallop dredge, $1,943,417.02 for the bottom fish otter trawl, and $1,494,337.08 for the sink gill net (Table 16). Highs for the scallop dredge occurred in 2015 and 2016 ($1,087,685.54 and $792,707.67, respectively). The largest annual landing for the bottom fish otter trawl was in 2014, with $566,863.81.

8.1.3.2 Fishing within Bay State Wind Lease Area

Within the Bay State Wind lease area, the bottom fish otter trawl and scallop dredge were the two gear types resulting in the highest landings, $4,177,396.52 and $1,740,229.29, respectively (Table 17). For the bottom fish otter trawl, the highest landings occurred in 2013 ($733,738.82), 2014 ($1,002,592.16), and 2016 ($1,716,350.06). Landings for the scallop dredge were greatest in 2013 ($595,947.28) and 2016 ($570,600.01).

8.1.3.3 Fishing within Vineyard Wind Lease Area

The same two gear types, bottom fish otter trawl and scallop dredge, were the most heavily used within the Vineyard Wind lease area. The six-year total for the bottom fish otter trawl was $3,200,830.60 with an annual high in 2016 of $1,981,018.41 (Table 18). The six-year total for the scallop dredge within the Vineyard Wind lease area was $1,515,208.84, with an annual high in 2012 of $860,813.02.

8.1.3.4 Fishing within Statoil Lease Area

The Statoil lease area had the same two primary gear types used within it as well. The scallop dredge was the gear type that resulted in the greatest landings, with a six-year total of $16,258,385.08 (Table 19). Annual landings for the scallop dredge exceeded $500,000 all six years: $6,773,376.44 in 2011, $3,107,844.60 in 2012, $1,476,807.03 in 2013, $2,572,517.90 in 2014, $1,700,301.74 in 2015, and $627,537.38 in 2016. Bottom fish otter trawls had landings from the Statoil lease area totaling to $1,654,224.78 over the six-year period. The annual high occurred in 2011 at $666,580.55.

8.1.3.5 Fishing within OCS-A 0502 and OCS-A 0503 WEAs

Only bottom fish otter trawls had sizable landings ($1,498,582.22 six-year total) coming from the OCS-A 0502 WEA (Table 20). Sink gill nets did have regular landings coming from the OCS-A 0502 WEA as well. No gear types resulted in large landings coming from the OCS-A 0503 WEAs, though both sink gill nets and bottom fish otter trawls did result in consistent landings (Table 21).

8.1.4 Ex-Vessel Values by Species or FMP

The fishing activity by species caught (or grouped species if in an FMP) with the greatest landings over the six-year period coming from the combined study WEAs are: Sea Scallop ($23,099,059.25; Table 22); Squid, Mackerel, Butterfish ($5,750,641.21); Monkfish ($3,009,550.45); Northeast Multispecies complex ($2,568,843.29); Northeast Small Mesh Multispecies complex ($2,295,062.91); and Summer Flounder, Scup, and Black Sea Bass ($2,108,182.07). The Sea Scallop fishery had large landings all six years with $7,158,840.06 in 2011, $4,754,007.29 in 2012, $2,866,943.16 in 2013, $3,274,401.79 in 2014, $3,055,653.56 in 2015, and $1,989,213.39 in 2016. High landings for Squid, Mackerel, and Butterfish occurred in 2011 ($693,924.54), 2013 ($761,599.50), 2014 ($557,031.95) and 2016 ($3,205,390.09). For species in the Northeast Multispecies complex, annual highs were in 2014 ($900,833.43) and 2015 ($513,093.85). Annual highs for the Monkfish FMP occurred in 2011 ($696,256.03) and 2012 ($681,262.17), while the annual high for the Northeast Small Mesh Multispecies complex was in 2016 ($733,964.39).

8.1.4.1 Fishing within Deepwater Wind Lease Area

Within the Deepwater Wind lease area, the Sea Scallop FMP, the Monkfish FMP, and the Northeast Multispecies FMP resulted in the most landings (six-year totals of $2,946.466.11, $1,267,574.46, and $1,000,580.08, respectively; Table 23). Only sea scallops had annual highs exceeding $500,000 in 2015 ($1,083,888.70) and 2016 ($786,752.88). The Northeast Small Mesh Multispecies FMP; Skate; Squid, Mackerel, Butterfish FMP; Summer Flounder, Scup, Black Sea Bass FMP, and spiny dogfish all had regular landings coming from the Deepwater Wind lease area as well.

8.1.4.2 Fishing within Bay State Wind Lease Area

The Bay State Wind lease area had similar six-year total value species: Squid, Mackerel, Butterfish FMP ($1,762,357.62; Table 24); Sea Scallop FMP ($1,753,413.84); Northeast Multispecies FMP ($1,274,611.96); and Monkfish FMP ($1,046,294.20). Annual highs for the Sea Scallop FMP were in 2013 ($604,396.34) and 2016 ($570,567.27), while the annual high for the Squid, Mackerel, Butterfish FMP occurred in 2016 ($1,494,990.24). The annual high for the Northeast Multispecies complex was in 2014 at $548,426.99. Additional species/FMPs with regular landings from the lease area were bluefish; spiny dogfish; Northeast Small Mesh Multispecies FMP; skate FMP; and the Summer Flounder, Scup, Black Sea Bass FMP.

8.1.4.3 Fishing within Vineyard Wind Lease Area

For the Vineyard Wind lease area, the species/FMPs with the largest six-year totals were the Squid, Mackerel, Butterfish FMP ($1,709,641.30; Table 25) and the Sea Scallop FMP ($1,518,387.53). The annual high for the Squid, Mackerel, Butterfish FMP was in 2016 at $1,381,315.24; the annual high for the Sea Scallop FMP was in 2012 at $860,827.35. The additional fisheries with regular landings included bluefish, spiny dogfish, the Monkfish FMP, the Northeast Multispecies FMP, and the Northeast Small Mesh Multispecies FMP.

8.1.4.4 Fishing within Statoil Lease Area

The fisheries in the Statoil lease area with the highest six-year total landings values were the Sea Scallop FMP ($16,403,030.05; Table 26) and the Squid, Mackerel, Butterfish FMP ($1,474,467.35). Annual values for the Sea Scallop FMP exceeded $500,000 all six years ($6,805,054.97 in 2011, $3,149,266.59 in 2012, $1,471,671.72 in 2013, $2,641,411.54 in 2014, $1,707,500.43 in 2015, and $628,124.80 in 2016). The annual high for the Squid, Mackerel, Butterfish FMP occurred in 2011 with $619,032.38. Fishing under other management plans with regular landings were bluefish; the Monkfish FMP; the Northeast Multispecies FMP; the Northeast Small Mesh Multispecies FMP, and the Summer Flounder, Scup, Black Sea Bass FMP.

8.1.4.5 Fishing within OCS-A 0502 and OCS-A 0503 WEAs

There were no very large value landings by species caught within either the OCS-A 0502 WEA (Table 27) or OSA-A 0503 WEA (Table 28). For the OCS-A 0502 WEA, the Monkfish FMP; Northeast Small Mesh Multispecies FMP; Squid, Mackerel, Butterfish FMP; summer flounder, black sea bass FMP; and Sea

Scallop FMP all had fairly regular landings. The Monkfish FMP was the only species/FMP that had landings from within the OCS-A 0503 WEA all six years.

Please note the interannual variability in the values of landings coming into different states and ports. This is likely due to shifts in target species' populations and spatial distributions. This is especially apparent for species like longfin inshore squid, which have a very short lift history (1-year life span), variable population sizes, and spatial distributions heavily dependent on environmental conditions.

Additionally, consider that all values presented in this report are ex-vessel values. The true value of landed seafood to local economies is usually greater than the ex-vessel value since the industry employs more than just fishermen (i.e. fuel providers, gear manufacturers, ice plants, dealers, fish processors, transportation welders, and diesel engine mechanics). One study specific to Rhode Island found that the economic contributions of Rhode Island landings to the overall economy of the state are likely 1.761 times the ex-vessel revenue (Hasbrouck, Scotti, Stent, Hasbrouck, & Gerbino, 2011).

8.2 FISHING LOCATION

While the spatial data results are summarized below and maps for all fisheries are provided within this document, it is recommended that the raster layers (.img files) be overlaid on other site-specific layers by the developers to more clearly identify the areas that may be environmentally sensitive or valuable to the fishing industry.

Most Massachusetts landings in federal waters came from north and east of Cape Cod, around Martha's Vineyard and Nantucket, south of Block Island, and along the New York Bight within the 150-ft. depth contour (Figure 6). Rhode Island federal landings came primarily from south of Martha's Vineyard and Nantucket, all around Block Island with a large chunk to southeast of the Island, in the most inshore section of the New York/New Jersey bight, and directly south of Rhode Island over 70 nm offshore (Figure 7). Connecticut landings from federal waters came primarily from south of Nantucket, west and southwest of Block Island, 70+ nm offshore south of Rhode Island and Massachusetts, and along the New York Bight within the 150-ft. depth contour (Figure 8). New York federal landings came mostly from south of Nantucket and Martha's Vineyard, southwest of Block Island (between Block Island and Long Island and south), 70+ nm offshore due south of Rhode Island, and then inshore along the New York Bight (the inner section leading into the port of NY and NJ as well as due south of Westhampton Beach, NY; Figure 9). New Jersey landings from federal waters were caught mostly in the Hudson Shelf Valley and the area due south of the center of Long Island (-73^{o} longitude), as well as between Long Island and Block Island (Figure 10).

The four highest value species/FMPs with fishing activity in the various WEAs were the Sea Scallop FMP; the Squid, Mackerel, Butterfish FMP; the Northeast Multispecies FMP; and the Monkfish FMP. For the Sea Scallop FMP, there appears to be the most activity in the Statoil lease area, primarily the southeastern half of the site (Figure 95). The heaviest scalloping occurs in OCS lease blocks 6763, 6764, 6812, 6813, 6862 and 6863, which are all only partially leased, except for 6812, which is fully leased to Statoil (Figure 5). There is also some activity just offshore the westernmost portion of the Deepwater Wind north lease area (OCS-A 0486), within OCS lease blocks 6914 and 6964, which are only partially leased (aliquots G, H, and D for 6914 and aliquots C, D, G, H, K, and L for 6964; Figure 3). Scalloping occurred most heavily within both the Statoil and Deepwater Wind lease areas in 2011 (Figures 116, 122, and 129).

The majority of Squid, Mackerel, Butterfish FMP activity occurs just south of Nantucket and Martha's Vineyard, though there is a pocket that overlaps with the northwestern section of the Statoil lease area (Figure 102). Overlap with higher densities of activity occurs in lease blocks 6655 (aliquot P), 6656 (aliquots I-P), and 6706 (aliquots B, C, D, and H; Figure 5). In 2011, the highest density of Squid, Mackerel, Butterfish FMP activity within the study area occurred within the Statoil lease area (Figures 136 and 150). In 2013 and 2014, the there was also some overlap with the northwest section of the lease area (Figures 152 and 153). In addition to the Statoil lease area, the Bay State Wind lease area (lease blocks 7072 and 7073; Figure 4) and Deepwater Wind south lease area (OCS-A 0487 lease block 6971, aliquots A-H) had medium density activity (Figure 145) in 2013.

The Monkfish FMP appears to be the species with the most fishing activity overlap the WEAs, chiefly the Deepwater Wind and Bay State Wind lease areas, as well as the Statoil lease area to a lesser degree (Figure 87). The heaviest overlapping activity occurred throughout the Deepwater Wind south lease area (OCS-A 0487 lease blocks 7064, 7114, 7067, and 7068) with one pocket in the Bay State Wind lease area (lease block 7121; Figures 3, 4, and 162). There is fishing activity within both the Deepwater Wind and Bay State lease areas in all study years (Figures 163-168). Overlap with the Statoil lease area is primarily in the southeastern portion of the lease area, but was much lower in intensity.

Finally, fishing activity corresponding to the Northeast Multispecies FMP overlapped most with the Deepwater Wind south lease area (OCS-A 0487; Figure 88). The overlapping fishing activity within the lease area (within lease blocks 7064 and 7114) occurred between 2013 and 2016 (Figures 178-181).

9 REFERENCES

ACCSP. (2012). *Atlantic Coast Fisheries Data Collection Standards.*

Hasbrouck, E. C., Scotti, J., Stent, J., Hasbrouck, E. G., & Gerbino, K. (2011). *Rhode Island Commercial Fishing and Seafood Industries - The Development of an Industry Profile.* NOAA Award #NA10NMF4720480.

Kirkpatrick, J., Benjamin, S., DePiper, G., Murphy, T., Steinback, S., & Demarest, C. (2016). *Socio-Economic Impact of Outer Continental Shelf Wind Energy Development on Fisheries in the U.S. Atlantic.* Bureau of Ocean Energy Management.

NOAA-Fisheries. (2017). *Vessel Monitoring System Program*. Retrieved from NOAA Fisheries: http://www.nmfs.noaa.gov/ole/about/our_programs/vessel_monitoring.html

NOAA-Fisheries. (2017). *Vessel Reporting*. Retrieved from Greater Atlantic Region: https://www.greateratlantic.fisheries.noaa.gov/aps/evtr/index.html

10 APPENDIX I: FIGURES AND TABLES

10.1 TABLES

10.1.1 Tables by State Landed

Table 1. Annual non-confidential landings in each study state coming from all study lease areas combined. (-) = no landings.

	2011	2012	2013	2014	2015	2016	Total
CT	$157,253.55	$283,212.91	$242,388.93	$79,161.01	$3,159.38	$209,177.67	$974,353.43
MA	$5,072,995.98	$3,725,987.67	$2,103,267.98	$2,553,440.14	$2,245,314.81	$3,340,527.39	$19,041,533.98
NJ	$2,711,295.27	$1,737,582.55	$1,051,269.88	$950,751.05	$1,304,064.43	$462,993.20	$8,217,956.38
NY	$434,231.05	$157,091.31	$255,993.38	$274,828.32	$123,619.06	$470,117.77	$1,715,880.89
RI	$949,399.33	$786,903.96	$1,856,453.33	$2,357,223.63	$1,534,597.41	$2,816,663.12	$10,301,240.76

Table 2. Annual landings in each study state coming from the Deepwater Wind lease area. NH had no landings from the lease area. (-) = no landings.

State	2011	2012	2013	2014	2015	2016	Non-Confidential Total
CT	$26,672.22	$83,713.60	$74,162.68	$2,364.77	$3,159.38	$13,858.04	$203,930.69
MA	$273,295.14	$299,707.13	$293,928.93	$419,532.08	$921,941.08	$1,091,151.12	$3,299,555.48
NJ	-	$508.25	$504.59	$500.18	$14,932.14	$3,962.77	$20,407.93
NY	$5,471.18	$1,754.67	$31,277.64	$28,835.84	$14,021.58	$43,307.80	$124,668.71
RI	$314,846.27	$344,832.26	$563,106.73	$743,139.01	$798,139.76	$398,520.43	$3,162,584.46

Table 3. Annual landings in each study state coming from the Bay State Wind lease area. NH had no landings from the lease area. (-) = no landings.

State	2011	2012	2013	2014	2015	2016	Non-Confidential Total
CT	$14,476.63	$24,812.24	$69,185.06	$3,961.76	-	$116,549.33	$228,985.01
MA	$432,258.46	$266,422.90	$677,701.14	$433,150.82	$406,115.57	$1,189,168.36	$3,404,817.25
NJ	-	$634.80	$15,789.71	$13,273.96	$15,163.83	$17,351.48	$62,213.78
NY	$1,015.62	-	$61,705.82	$111,047.55	$56,050.39	$245,570.86	$475,390.24
RI	$132,863.46	$63,579.49	$623,837.32	$699,244.04	$398,902.05	$1,119,799.41	$3,038,225.75

Table 4. Annual landings in each study state coming from the Vineyard Wind lease area. NH had no landings from the lease area. (-) = no landings.

State	2011	2012	2013	2014	2015	2016	Non-Confidential Total
CT	$35,943.23	$23,679.76	$36,764.79	$19,297.48	-	$51,530.60	$167,215.86
MA	$112,425.43	$987,431.20	$551,972.38	$199,069.54	$247,676.22	$675,235.18	$2,773,809.95
NJ	-	$3.64	-	$498.63	$19,335.96	$49,531.51	$69,369.74
NY	$3,439.51	$13,965.63	$26,489.39	$673.67	$10,819.09	$166,145.53	$221,532.81
RI	$56,401.42	$53,035.97	$159,040.67	$257,132.80	$245,168.64	$1,142,581.23	$1,913,360.73

Table 5. Annual landings in each study state coming from the Statoil lease area. NH had no landings from the lease area. (-) = no landings.

State	2011	2012	2013	2014	2015	2016	Non-Confidential Total
CT	$73,581.40	$136,500.78	$57,180.47	$52,479.53	-	$80.39	$319,822.56
MA	$4,057,730.43	$1,373,540.07	$321,090.37	$1,356,719.10	$497,233.96	$286,700.41	$7,893,014.35
NJ	$2,711,295.27	$1,734,064.53	$1,034,975.58	$931,913.90	$1,251,437.97	$390,662.79	$8,054,350.04
NY	$362,532.56	$21,046.42	$28,453.27	$119,737.05	$32,478.57	$3,083.03	$567,330.91
RI	$261,231.12	$103,638.26	$368,075.46	$589,751.75	$28,715.20	$2,158.15	$1,353,569.95

Table 6. Annual landings in each study state coming from the OCS-A 502 WEA. NH had no landings from the WEA. (-) = no landings.

State	2011	2012	2013	2014	2015	2016	Non-Confidential Total
CT	$6,580.07	$14,045.66	$2,698.52	$1,057.47	-	$9,636.36	$34,018.09
MA	$147,296.03	$540,357.03	$193,786.20	$67,393.70	$98,706.37	$89,133.90	$1,136,673.22
NJ	-	$2,371.33	-	$4,564.38	$3,194.53	$1,484.65	$11,614.89
NY	$61,517.17	$118,398.99	$106,519.60	$2,447.22	$9,577.93	$12,010.55	$310,471.47
RI	$183,751.34	$219,373.08	$142,178.01	$67,956.03	$63,671.76	$151,624.11	$828,554.33

Table 7. Annual landings in each study state coming from the OCS-A 503 WEA. NH and NJ had no landings from the WEA. (C) = confidential landings and (-) = no landings.

State	2011	2012	2013	2014	2015	2016	Non-Confidential Total
CT	-	$460.87	$2,397.41	-	-	$17,522.95	$20,381.22
MA	$49,990.49	$258,529.34	$64,788.96	$77,574.90	$73,641.61	$9,138.42	$533,663.73
NY	$255.01	$1,925.60	$1,547.66	$12,086.99	$671.50	-	$16,486.75
RI	$305.72	$2,444.90	$215.14	-	-	$1,979.79	$4,945.54

10.1.2 Tables by Port Landed

Table 8. Annual non-confidential landings in each study port coming from all study lease areas combined. (C) = confidential landings and (-) = no landings.

	2011	2012	2013	2014	2015	2016	Non-Confidential Total
Boston, MA	-	-	-	-	C	$32,236.58	$32,236.58
Cape May, NJ	$1,750,250.16	$791,932.12	$186,877.30	$398,576.69	$408,723.38	$31,715.68	$3,568,075.33
Chatham, MA	$146,371.56	$211,683.24	$83,032.36	$98,497.87	$28,363.54	$7,522.20	$575,470.77
Gloucester, MA	C	C	C	-	C	$234,769.76	$234,769.76
Hampton Bays, NY	$104,301.49	$6,616.82	$17,764.48	$15,230.94	$9,937.76	-	$153,851.49
Little Compton, RI	$159,572.79	$69,290.79	$83,869.15	C	C	C	$312,732.73
Montauk, NY	$220,297.65	$11,582.74	$203,366.45	$156,815.48	$105,497.77	$354,125.52	$1,051,685.61
New Bedford, MA	$4,377,482.50	$3,120,733.11	$1,910,689.04	$2,287,972.80	$2,014,656.48	$2,769,932.88	$16,481,466.81
New London, CT	$5,028.81	$20,178.16	$73,258.67	C	C	C	$98,465.64
Newport, RI	C	$80,816.52	$452,446.75	C	C	C	$533,263.27
Point Judith, RI	$727,569.79	$498,282.35	$1,181,008.51	$1,946,814.79	$1,327,984.27	$2,673,693.64	$8,355,353.35
Point Lookout, NY	C	$4,598.98	$2,247.82	$69,416.48	C	C	$76,263.28
Point Pleasant, NJ	$472,366.07	$240,904.40	$458,312.55	$335,735.64	$510,710.88	$298,034.95	$2,316,064.49
Stonington, CT	$486,958.56	$324,580.33	$528,401.62	$335,735.64	$496,932.35	$298,034.95	$2,470,643.45
Tiverton, RI	-	C	C	$4,287.43	C	-	$4,287.43

Table 9. Annual landings in each port (within the 6 study states) coming from the Deepwater Wind lease area. (C) = confidential landings and (-) = no landings. Total confidential landings are $630,587.86 (i.e. the sum of all C's in the table below).

Port	2011	2012	2013	2014	2015	2016	Non-Confidential Total
Atlantic City, NJ	-	C	-	-	-	-	C
Barnegat Light, NJ	-	-	-	-	C	-	C
Barnstable, MA	-	-	-	C	-	-	C
Boston, MA	-	-	-	-	C	C	C
Cape May, NJ	-	-	C	C	-	C	C
Chatham, MA	C	C	$2,739.83	C	C	-	$2,739.83
Chilmark, MA	C	-	-	-	-	-	C
Dartmouth, MA	C	-	-	-	-	-	C
Davisville, RI	-	-	-	-	C	-	C
East Haven, CT	-	-	-	-	-	C	C
Fairhaven, MA	C	-	-	-	C	-	C
Fall River, MA	-	-	-	C	-	C	C
Falmouth, MA	-	C	-	-	-	-	C
Gloucester, MA	C	C	C	C	C	C	C
Greenport, NY	C	-	-	C	-	-	C
Hampton Bays, NY	C	C	C	-	C	C	C
Jamestown, RI	-	-	C	C	C	-	C
Little Compton, RI	$159,572.79	$69,290.79	$83,869.15	C	C	C	$312,732.73
Menemsha, MA	-	-	-	-	C	-	C
Montauk, NY	$3,679.71	$1,752.12	$23,992.41	$17,583.83	$13,789.55	$37,059.02	$97,856.64
Mystic, CT	-	-	-	-	C	C	C
Nantucket, MA	-	-	-	-	C	-	C
New Bedford, MA	$262,238.32	$258,034.31	$231,092.90	$357,096.98	$877,566.42	$969,314.59	$2,955,343.52
New London, CT	C	C	$4,073.61	C	C	C	$4,073.61
New Shoreham, RI	-	-	-	C	-	-	C
Newport, RI	C	$80,816.52	$251,528.27	C	C	C	$332,344.79

North Kingstown, RI	-	-	-	-	-	C	C
Plymouth, MA	C	-	-	-	-	-	C
Point Judith, RI	$135,152.73	$165,805.42	$223,148.68	$623,286.25	$598,181.01	$337,650.67	$2,083,224.76
Point Pleasant, NJ	-	-	-	C	$13,778.53	C	$13,778.53
Portsmouth, RI	-	-	-	C	-	-	C
Providence, RI	-	-	C	-	-	-	C
Provincetown Wharf, MA	-	-	-	-	C	C	C
Shinnecock Reservation, NY	-	-	-	-	-	C	C
Stonington, CT	$14,592.49	$83,675.93	$70,089.07	C	-	C	$168,357.49
Tiverton, RI	-	C	C	$4,287.43	C	-	$4,287.43
Westport, MA	$4,169.04	C	$55,942.19	$41,693.34	C	$104,015.49	$205,820.06
Wildwood, NJ	-	-	-	-	-	C	C
Woods Hole, MA	-	C	C	C	-	-	C

Table 10. Annual landings in each port (within the 6 study states) coming from the Bay State Wind lease area. (C) = confidential landings and (-) = no landings. Total confidential landings are $651,348.38 (i.e. the sum of all C's in the table below).

Port	2011	2012	2013	2014	2015	2016	Non-Confidential Total
Atlantic City, NJ	-	C	-	-	-	-	C
Barnegat Light, NJ	-	-	-	C	-	-	C
Boston, MA	-	-	-	-	C	$32,236.58	$32,236.58
Cape May, NJ	-	-	-	-	-	C	C
Chatham, MA	C	$20,482.11	$31,153.56	C	C	C	$51,635.67
East Haven, CT	-	-	-	-	-	C	C
Fairhaven, MA	C	-	-	-	C	-	C
Fall River, MA	C	-	-	-	-	-	C
Falmouth, MA	-	C	-	-	-	-	C
Gloucester, MA	C	C	C	-	C	$234,769.76	$234,769.76
Greenport, NY	C	-	-	C	-	-	C
Hampton Bays, NY	-	-	C	-	C	C	C
Harwich Port, MA	-	-	-	C	C	-	C
Little Compton, RI	C	C	C	C	C	C	C
Menemsha, MA	-	-	-	-	C	C	C
Montauk, NY	$337.65	-	$48,118.85	$108,403.43	$55,769.05	$186,728.00	$399,356.98
Mystic, CT	-	-	-	-	-	C	-
New Bedford, MA	$334,861.50	$143,456.23	$624,583.87	$345,847.43	$356,310.97	$866,115.77	$2,671,175.77
New London, CT	C	C	$69,185.06	C	-	C	$69,185.06
Newport, RI	C	C	$188,345.76	C	C	-	$188,345.76
North Kingstown, RI	C	-	-	C	-	C	-
Point Judith, RI	$111,254.28	$40,401.57	$430,646.01	$679,573.55	$392,247.66	$1,076,542.94	$2,730,666.01
Point Pleasant, NJ	-	-	C	$5,890.46	C	C	$5,890.46
Provincetown Wharf, MA	-	-	-	C	C	-	C
Shinnecock Reservation, NY	-	-	-	-	-	C	C
Stonington, CT	C	C	-	C	-	C	C
Tiverton, RI	-	-	C	-	C	-	C
Westport, MA	$80,940.71	$29,355.44	$19,683.31	C	C	$45,042.14	$175,021.60
Woods Hole, MA	-	-	C	C	C	-	C

Table 11. Annual landings in each port (within the 6 study states) coming from the Vineyard Wind lease area. (C) = confidential landings and (-) = no landings. Total confidential landings are $451,152.08 (i.e. the sum of all C's in the table below).

Port	2011	2012	2013	2014	2015	2016	Non-Confidential Total
Barnegat Light, NJ	-	-	-	-	C	-	C
Belford, NJ	-	-	-	-	-	C	C
Boston, MA	-	-	C	-	C	C	C
Cape May, NJ	-	C	-	C	C	C	C
Chatham, MA	$65,332.05	$97,471.16	$37,237.08	$21,321.88	C	C	$221,362.17
East Haven, CT	-	-	-	-	-	C	C
Gloucester, MA	C	C	-	-	-	C	C
Hampton Bays, NY	-	-	C	-	C	C	C
Harwich Port, MA	-	-	-	-	C	C	C
Little Compton, RI	-	-	-	C	-	C	C
Montauk, NY	C	C	$24,372.87	C	$9,067.00	$118,652.10	$152,091.97
Mystic, CT	-	-	-	-	-	C	C
New Bedford, MA	$37,705.15	$884,492.00	$513,661.67	$177,570.24	$215,194.22	$615,985.94	$2,444,609.22
New London, CT	$5,028.81	C	C	C	-	C	$5,028.81
Newport, RI	-	-	C	-	-	-	C
North Kingstown, RI	C	-	-	-	-	C	C
Point Judith, RI	$54,172.29	$52,724.30	$150,418.90	$257,070.74	$245,168.64	$1,111,489.95	$1,871,044.82
Point Pleasant, NJ	-	-	-	C	C	C	C
Providence, RI	-	-	C	-	-	-	C
Provincetown Wharf, MA	C	-	-	-	C	-	C
Shinnecock Reservation, NY	-	-	-	-	-	C	C
Stonington, CT	C	-	C	-	-	C	C
Wakefiled, RI	-	C	-	-	-	-	C
Westport, MA	C	C	C	C	C	C	C

Table 12. Annual landings in each port (within the 6 study states) coming from the Statoil lease area. (C) = confidential landings and (-) = no landings. Total confidential landings are $3,403,183.75 (i.e. the sum of all C's in the table below).

Port	2011	2012	2013	2014	2015	2016	Non-Confidential Total
Atlantic City, NJ	-	-	-	C	C	-	C
Avalon, NJ	C	C	C	-	-	-	C
Barnegat Light, NJ	C	C	C	C	C	C	C
Barnstable, MA	C	-	-	-	-	-	C
Belford, NJ	C	C	C	C	C	C	C
Belmar, NJ	-	C	-	-	-	-	C
Boston, MA	-	-	-	-	C	-	C
Brielle, NJ	-	C	-	C	-	-	C
Cape May, NJ	$1,750,250.16	$791,932.12	$186,877.30	$398,576.69	$408,723.38	$31,715.68	$3,568,075.33
Fairhaven, MA	C	-	C	-	-	C	C
Fall River, MA	-	C	-	-	-	-	C
Freeport, NY	C	-	-	-	-	-	C
Gloucester, MA	-	-	-	-	-	C	C
Hampton Bays, NY	$104,301.49	$6,616.82	$17,764.48	$15,230.94	$9,937.76	-	$153,851.49
Islip, NY	C	-	-	-	-	-	C
Montauk, NY	$216,280.29	$9,830.62	$3,652.52	$30,828.22	$19,019.40	C	$279,611.05
New Bedford, MA	$3,674,879.23	$1,371,324.69	$320,027.76	$1,356,719.10	$497,041.09	$248,166.07	$7,468,157.94
New London, CT	C	$20,178.16	C	C	-	-	$20,178.16
Newport, RI	C	C	C	-	-	-	C
North Kingstown, RI	-	C	C	C	-	-	C
Point Judith, RI	$253,016.43	$22,716.38	$248,544.28	$318,928.22	$28,715.20	$2,011.25	$873,931.76
Point Lookout, NY	C	$4,598.98	$2,247.82	$69,416.48	C	C	$76,263.28
Point Pleasant, NJ	$472,366.07	$240,904.40	$458,312.55	$329,845.18	$496,932.35	$298,034.95	$2,296,395.50
Sea Isle City, NJ	-	-	-	-	C	-	C
Shinnecock Reservation, NY	C	-	C	C	C	-	C
Stonington, CT	C	C	C	$48,439.62	-	C	$48,439.62
Wildwood, NJ	C	C	C	C	C	-	C

Table 13. Annual landings in each port (within the 6 study states) coming from the OCS-A 0502 WEA. (C) = confidential landings and (-) = no landings. Total confidential landings are $$354,931.03 (i.e. the sum of all C's in the table below).

Port	2011	2012	2013	2014	2015	2016	Non-Confidential Total
Boston, MA	-	-	C	-	C	-	C
Cape May, NJ	-	C	-	C	-	-	C
Chatham, MA	$58,684.88	$69,992.04	$11,901.89	$31,659.22	$19,071.51	C	$191,309.54
Falmouth, MA	-	C	-	-	-	-	C
Gloucester, MA	-	C	C	-	-	-	C
Hampton Bays, NY	-	-	C	C	C	C	C
Harwich Port, MA	-	-	-	-	C	C	C
Little Compton, RI	-	C	-	-	-	-	C
Montauk, NY	C	C	$103,229.80	C	$7,852.77	$11,686.40	$122,768.97
Mystic, CT	-	-	-	-	-	C	C
New Bedford, MA	$67,798.30	$462,289.79	$159,477.75	$19,667.78	$63,679.63	$70,350.51	$843,263.76
New London, CT	-	C	C	C	-	C	C
Newport, RI	-	-	$12,572.72	-	-	-	$12,572.72
North Kingstown, RI	C	-	-	-	-	C	C
Point Judith, RI	$173,974.06	$216,634.68	$128,250.64	$67,956.03	$63,671.76	$145,998.83	$796,486.00
Point Lookout, NY	-	C	-	-	-	-	C
Point Pleasant, NJ	-	-	-	C	C	C	C
Providence, RI	-	-	C	-	-	-	C
Provincetown Wharf, MA	C	C	-	C	C	-	C
Shinnecock Reservation, NY	-	-	-	-	-	C	C
Stonington, CT	C	C	C	-	-	C	C
Wakefiled, RI	-	C	-	-	-	-	C
Westport, MA	C	C	C	C	-	C	C
Woods Hole, MA	-	-	C	-	C	-	C

Table 14. Annual landings in each port (within the 6 study states) coming from the OCS-A 0503 WEA. (C) = confidential landings and (-) = no landings. Total confidential landings are $368,137.10 (i.e. the sum of all C's in the table below).

Port	2011	2012	2013	2014	2015	2016	Non-Confidential Total
Chatham, MA	$22,354.63	$23,737.93	C	$45,516.77	$9,292.03	$7,522.20	$108,423.56
Fairhaven, MA	-	C	-	-	C	-	C
Hampton Bays, NY	-	-	C	-	-	-	C
Harwich Port, MA	-	-	-	-	-	C	C
Little Compton, RI	-	C	-	-	-	-	C
Montauk, NY	C	C	C	C	C	-	C
Mystic, CT	-	-	-	-	-	C	C
New Bedford, MA	C	$1,136.09	$61,845.09	$31,071.27	$4,864.15	C	$98,916.60
New London, CT	-	C	C	-	-	C	C
Point Judith, RI	C	-	C	-	-	C	C
Stonington, CT	-	C	-	-	-	-	C
Westport, MA	C	-	C	C	-	-	C

10.1.3 Tables by Gear Used

Table 15. Annual non-confidential landings caught by each gear type within all study lease areas combined. (-) = no landings.

	2011	2012	2013	2014	2015	2016	Total
DREDGE, OCEAN QUAHOG/SURF CLAM	-	C	C	C	C	C	C
DREDGE, SCALLOP	$7,131,083.28	$4,706,827.79	$2,849,921.18	$3,203,290.78	$3,051,858.46	$1,990,845.05	$22,933,826.54
GILL NET, RUNAROUND	C	-	-	-	-	-	C
GILL NET, SINK	$710,725.16	$734,124.11	$441,126.41	$487,329.78	$449,401.30	$364,613.12	$3,187,319.88
HARPOON	C	-	-	-	-	-	C
LONGLINE, BOTTOM	C	C	-	-	-	-	C
OTTER TRAWL, BOTTOM, FISH	$1,323,935.55	$834,908.32	$2,022,483.56	$2,396,943.95	$1,537,010.72	$4,391,994.41	$12,507,276.51
OTTER TRAWL, BOTTOM, SCALLOP	C	$38,694.53	C	$58,167.08	C	-	$96,861.61
OTTER TRAWL, BOTTOM, SHRIMP	-	-	-	-	-	C	C
OTTER TRAWL, MIDWATER	C	C	C	C	C	$16,153.49	$16,153.49
PAIR TRAWL, MIDWATER	C	$80,663.43	$38,879.88	C	C	$101,248.95	$220,792.26
POT, CONCH/WHELK	-	-	C	-	-	-	C
POT, FISH	-	-	C	-	-	C	C
SEINE, DANISH	-	-	-	-	C	-	C

Table 16. Annual landings caught by each gear type within the Deepwater Wind lease area. (C) = confidential landings and (-) = no landings. Total confidential landings are $274,868.67 (i.e. the sum of all C's in the table below).

Gear	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**Non-Confidential Total**
DREDGE, OCEAN QUAHOG/SURF CLAM	-	C	C	C	C	C	C
DREDGE, SCALLOP	$141,622.75	$274,007.81	$271,641.80	$374,576.59	$1,087,685.54	$792,707.67	$2,942,242.16
GILL NET, RUNAROUND	C	-	-	-	-	-	C
GILL NET, SINK	$349,005.06	$300,934.68	$271,514.48	$229,031.14	$196,435.52	$147,416.20	$1,494,337.08
LONGLINE, BOTTOM	C	C	-	-	-	-	C
OTTER TRAWL, BOTTOM, FISH	$109,488.29	$122,999.86	$335,022.52	$566,863.81	$376,647.48	$432,395.06	$1,943,417.02
OTTER TRAWL, MIDWATER	-	-	-	C	C	$16,153.49	$16,153.49
PAIR TRAWL, MIDWATER	-	C	$38,879.88	C	C	$101,248.95	$140,128.83
POT, FISH	-	-	C	-	-	C	C

Table 17. Annual landings caught by each gear type within the Bay State Wind lease area. (C) = confidential landings and (-) = no landings. Total confidential landings are $334,004.08 (i.e. the sum of all C's in the table below).

Gear	2011	2012	2013	2014	2015	2016	Non-Confidential Total
DREDGE, OCEAN QUAHOG/SURF CLAM	-	C	C	C	C	C	C
DREDGE, SCALLOP	$216,084.09	$21,614.44	$595,947.28	$115,041.91	$220,941.56	$570,600.01	$1,740,229.29
GILL NET, SINK	$205,543.55	$228,174.84	$96,138.97	$139,276.23	$160,848.18	$128,020.37	$958,002.14
OTTER TRAWL, BOTTOM, FISH	$152,116.57	$85,719.74	$733,738.82	$1,002,592.16	$486,879.17	$1,716,350.06	$4,177,396.52
OTTER TRAWL, BOTTOM, SHRIMP	-	-	-	-	-	C	C
OTTER TRAWL, MIDWATER	C	-	-	-	-	C	C
PAIR TRAWL, MIDWATER	-	-	C	-	-	C	C

Table 18. Annual landings caught by each gear type within the Vineyard Wind lease area. (C) = confidential landings and (-) = no landings. Total confidential landings are $72,019.83 (i.e. the sum of all C's in the table below).

Gear	2011	2012	2013	2014	2015	2016	Non-Confidential Total
DREDGE, OCEAN QUAHOG/SURF CLAM	-	-	-	-	-	C	C
DREDGE, SCALLOP	C	$860,813.02	$487,985.38	$123,480.82	$42,929.62	C	$1,515,208.84
GILL NET, SINK	$72,630.77	$105,557.14	$48,131.90	$21,447.60	$41,888.11	$67,574.28	$357,229.80
OTTER TRAWL, BOTTOM, FISH	$114,166.51	$109,599.42	$226,370.35	$331,493.73	$438,182.18	$1,981,018.41	$3,200,830.60
OTTER TRAWL, BOTTOM, SHRIMP	-	-	-	-	-	C	C
PAIR TRAWL, MIDWATER	C	-	C	-	-	-	C

Table 19. Annual landings caught by each gear type within the Statoil lease area. (C) = confidential landings and (-) = no landings. Total confidential landings are $97,952.98 (i.e. the sum of all C's in the table below).

Gear	2011	2012	2013	2014	2015	2016	Non-Confidential Total
DREDGE, OCEAN QUAHOG/SURF CLAM	-	-	C	C	-	-	C
DREDGE, SCALLOP	$6,773,376.44	$3,107,844.60	$1,476,807.03	$2,572,517.90	$1,700,301.74	$627,537.37	$16,258,385.08
GILL NET, SINK	C	C	-	-	C	C	C
OTTER TRAWL, BOTTOM, FISH	$666,580.55	$138,545.12	$330,454.54	$418,223.93	$96,418.33	$4,002.31	$1,654,224.78
OTTER TRAWL, BOTTOM, SCALLOP	C	$38,694.53	C	$58,167.08	C	-	$96,861.61
OTTER TRAWL, MIDWATER	-	C	C	-	-	C	C
PAIR TRAWL, MIDWATER	C	$80,663.43	C	C	C	C	$80,663.43
POT, CONCH/WHELK	-	-	C	-	-	-	C
SEINE, DANISH	-	-	-	-	C	-	C

Table 20. Annual landings caught by each gear type within the OCS-A 0502 WEA. (C) = confidential landings and (-) = no landings. Total confidential landings are $81,939.43 (i.e. the sum of all C's in the table below).

Gear	2011	2012	2013	2014	2015	2016	Non-Confidential Total
DREDGE, SCALLOP	C	$442,547.92	$17,539.69	$17,673.56	-	-	$477,761.17
GILL NET, SINK	$61,126.86	$75,674.01	$25,341.06	$46,642.20	$40,521.98	$13,743.09	$263,049.20
HARPOON	C	-	-	-	-	-	C
OTTER TRAWL, BOTTOM, FISH	$281,022.91	$374,967.16	$392,737.13	$77,770.32	$134,628.60	$237,456.10	$1,498,582.22
PAIR TRAWL, MIDWATER	-	-	C	-	-	-	C

Table 21. Annual landings caught by each gear type within the OCS-A 0503 WEA. (C) = confidential landings and (-) = no landings. Total confidential landings are $427,950.23 (i.e. the sum of all C's in the table below).

Gear	2011	2012	2013	2014	2015	2016	Non-Confidential Total
DREDGE, SCALLOP	-	C	C	C	C	-	C
GILL NET, SINK	$22,418.92	$23,783.44	C	$50,932.61	$9,707.51	$7,859.18	$114,701.66
OTTER TRAWL, BOTTOM, FISH	$560.72	$3,077.02	$4,160.20	C	$4,254.96	$20,772.47	$32,825.37
OTTER TRAWL, MIDWATER	-	-	-	-	-	C	C

10.1.4 Tables by Species Caught

Table 22. Annual non-confidential landings of each species (or grouped species in a shared FMP) caught within all study lease areas combined. (-) = no landings.

	2011	2012	2013	2014	2015	2016	Total
Bluefish FMP	$6,693.37	$8,121.51	$3,218.43	$6,359.35	$2,280.69	$3,478.80	$30,152.15
CROAKER, ATLANTIC	-	-	-	$2,482.09	C	-	$2,482.09
CUNNER	C	-	$68.02	C	C	-	$68.02
DOGFISH, SMOOTH	$1,020.97	$158.04	$890.37	$663.82	$1,689.68	$1,551.00	$5,973.88
DOGFISH, SPINY	$8,437.11	$20,242.59	$15,809.04	$10,598.19	$5,425.91	$12,902.31	$73,415.15
DORY, AMERICAN JOHN	$103.26	$342.82	$1,503.95	$0.00	$248.01	$582.51	$2,780.55
EEL, CONGER	C	C	$6.09	C	$10.29	$9.33	$25.71
FLOUNDER, FOURSPOT	C	-	-	-	$242.85	C	$242.85
Monkfish FMP	$696,256.03	$681,262.17	$445,729.48	$494,501.83	$361,940.01	$329,860.93	$3,009,550.45
Northeast Multispecies FMP	$138,888.86	$204,998.77	$345,552.67	$900,833.43	$513,093.85	$465,475.71	$2,568,843.29
Northeast Small Mesh Multispecies FMP	$334,900.19	$331,912.38	$312,918.07	$274,403.22	$306,964.66	$733,964.39	$2,295,062.91
ROBINS, SEA	C	C	C	$20.23	$1.98	-	$22.21
Sea Scallop FMP	$7,158,840.06	$4,754,007.29	$2,866,943.16	$3,274,401.79	$3,055,653.56	$1,989,213.39	$23,099,059.25
Skate FMP	$25,166.02	$24,405.57	$21,212.12	$127,248.45	$139,573.38	$82,910.67	$420,516.21
Squid Mackerel Butterfish FMP	$693,924.54	$222,463.59	$761,599.50	$557,031.95	$310,231.54	$3,205,390.09	$5,750,641.21
Summer Flounder, Scup, Black Sea Bass FMP	$132,711.86	$147,656.63	$596,011.13	$505,578.76	$356,798.75	$369,424.94	$2,108,182.07

Table 23. Annual landings of each species (or grouped species in a shared FMP) caught within the Deepwater Wind lease area. (C) = confidential landings and (-) = no landings. Total confidential landings are $236,660.77 (i.e. the sum of all C's in the table below).

Species or FMP	2011	2012	2013	2014	2015	2016	Non-Confidential Total
Bluefish FMP	$1,741.43	$1,659.49	$902.73	$1,367.18	$554.76	$427.17	$6,652.76
BONITO, ATLANTIC	C	C	C	C	C	-	C
CUNNER	C	-	$68.02	C	C	-	$68.02
DOGFISH, SMOOTH	C	C	$165.39	C	$33.39	$822.54	$1,021.32
DOGFISH, SPINY	$6,022.52	$16,469.86	$12,052.68	$8,949.04	$4,883.91	$12,626.33	$61,004.34
DORY, AMERICAN JOHN	C	$30.44	$380.41	C	C	C	$410.85
EEL, CONGER	C	C	$6.09	C	$10.29	C	$16.38
FLOUNDER, FOURSPOT	-	-	C	-	C	C	C
GROUPERS	C	-	-	-	-	-	C
HAKE, SPOTTED	-	-	-	-	C	C	C
HALIBUT, ATLANTIC	-	C	C	C	-	-	C
Monkfish FMP	$321,298.32	$239,799.05	$236,555.53	$193,511.67	$152,545.99	$123,863.90	$1,267,574.46
Northeast Multispecies FMP	$53,035.13	$93,876.42	$189,910.88	$274,121.35	$201,613.35	$188,022.95	$1,000,580.08
Northeast Small Mesh Multispecies FMP	$37,489.67	$1,238.30	$22,075.39	$117,217.35	$38,228.54	$41,077.01	$257,326.26
RAVEN, SEA	C	-	-	-	-	-	C
ROBINS, SEA	C	C	C	C	C	C	C
Sea Scallop FMP	$138,251.18	$276,570.66	$286,370.37	$374,632.33	$1,083,888.70	$786,752.88	$2,946,466.12
SHARK, SANDBAR	C	-	-	-	-	-	C
SHARK, THRESHER	-	C	-	-	-	-	C
Skate FMP	$285.69	$18,620.53	$17,669.73	$42,422.91	$49,281.43	$23,497.37	$151,777.66
Squid Mackerel Butterfish FMP	$4,744.47	$6,440.79	$45,708.28	$65,211.77	$36,526.04	$238,832.79	$397,464.14
Summer Flounder, Scup, Black Sea Bass FMP	$39,499.10	$44,900.47	$120,749.87	$104,692.35	$95,174.20	$79,108.10	$484,124.09
SWORDFISH	-	-	-	-	-	C	C
TAUTOG	C	C	C	-	C	-	C
TILEFISH, BLUELINE	C	-	-	-	-	C	C
TRIGGERFISHES	C	C	-	-	-	-	C
TUNNY, LITTLE	C	-	-	-	-	-	C

Table 24. Annual landings of each species (or grouped species in a shared FMP) caught within the Bay State Wind lease area. (C) = confidential landings and (-) = no landings. Total confidential landings are $56,697.61 (i.e. the sum of all C's in the table below).

Species or FMP	2011	2012	2013	2014	2015	2016	Non-Confidential Total
Bluefish FMP	$1,850.88	$1,178.93	$586.22	$3,152.64	$443.30	$1,054.39	$8,266.36
BONITO, ATLANTIC	-	C	-	C	C	-	C
CROAKER, ATLANTIC	-	-	-	-	-	C	C
CUNNER	-	-	-	-	C	-	C
DOGFISH, SMOOTH	C	-	$197.09	$337.11	$250.02	$359.63	$1,143.85
DOGFISH, SPINY	$699.05	$3,245.73	$3,249.53	$1,015.78	$522.47	C	$8,732.56
DORY, AMERICAN JOHN	$103.26	C	$1,123.54	C	$18.36	$171.99	$1,417.15
EEL, AMERICAN	-	-	C	-	-	-	C
EEL, CONGER	-	C	C	C	C	$9.33	$9.33
FLOUNDER, FOURSPOT	C	-	-	-	$242.85	C	$242.85
HAKE, SPOTTED	-	-	-	-	C	C	C
HALIBUT, ATLANTIC	-	C	C	C	C	-	C
Monkfish FMP	$229,048.60	$222,086.17	$131,706.77	$189,995.47	$152,882.29	$120,574.90	$1,046,294.20
Northeast Multispecies FMP	$62,312.83	$13,526.03	$118,795.99	$548,426.99	$287,174.62	$244,375.50	$1,274,611.96
Northeast Small Mesh Multispecies FMP	$27,408.20	$29,751.93	$115,638.78	$45,205.57	$39,976.76	$126,239.86	$384,221.10
ROBINS, SEA	C	C	C	$8.45	C	-	$8.45
Sea Scallop FMP	$215,533.91	$24,794.77	$604,396.34	$116,761.02	$221,360.53	$570,567.27	$1,753,413.84
Skate FMP	C	$5,785.04	$3,542.39	$61,077.98	$41,707.05	$32,070.19	$144,182.65
SPOT	-	-	-	C	-	-	C
Squid Mackerel Butterfish FMP	$9,146.52	$7,636.56	$178,368.96	$30,494.90	$41,720.44	$1,494,990.24	$1,762,357.62
Summer Flounder, Scup, Black Sea Bass FMP	$31,589.39	$29,318.04	$275,339.95	$262,752.12	$84,752.65	$84,280.35	$768,032.50
SWORDFISH	-	-	-	-	-	C	C
TAUTOG	-	-	C	-	-	-	C
TILEFISH, BLUELINE	C	-	-	-	-	C	C
TRIGGERFISHES	-	C	-	C	-	-	C
TUNNY, LITTLE	-	-	-	C	-	-	C

Table 25. Annual landings of each species (or grouped species in a shared FMP) caught within the Vineyard Wind lease area. (C) = confidential landings and (-) = no landings. Total confidential landings are $66,626.23 (i.e. the sum of all C's in the table below).

Species or FMP	2011	2012	2013	2014	2015	2016	Non-Confidential Total
Bluefish FMP	$1,198.78	$1,167.22	$141.04	$976.44	$1,053.77	$1,018.30	$5,555.55
CUNNER	-	-	-	-	C	-	C
DOGFISH, SMOOTH	-	C	$32.72	C	$269.91	$368.83	$671.46
DOGFISH, SPINY	$1,246.98	$497.84	$387.23	C	$19.53	$275.98	$2,427.56
DORY, AMERICAN JOHN	C	$312.38	C	C	$229.65	C	$542.03
EEL, CONGER	-	C	C	-	C	C	C
FLOUNDER, FOURSPOT	-	-	-	-	C	-	C
HAKE, SPOTTED	-	-	-	-	C	C	C
HALIBUT, ATLANTIC	-	C	-	C	-	C	C
Monkfish FMP	$58,722.98	$107,314.01	$44,619.60	$20,689.65	$28,286.68	$50,280.26	$309,913.18
Northeast Multispecies FMP	$8,466.66	$7,481.48	$7,843.77	$77,026.48	$23,753.66	C	$124,572.05
Northeast Small Mesh Multispecies FMP	$54,234.24	$61,117.67	$105,568.03	$95,737.31	$144,312.09	$473,309.82	$934,279.16
ROBINS, SEA	-	C	C	C	$1.98	-	$1.98
Sea Scallop FMP	C	$860,827.35	$486,967.00	$123,920.84	$42,903.90	$3,768.44	$1,518,387.53
Skate FMP	$14,797.89	C	C	$8,983.48	$18,528.79	$21,790.34	$64,100.50
SPOT	-	-	-	C	-	-	C
Squid Mackerel Butterfish FMP	$19,589.39	$21,041.07	$78,916.33	$74,834.90	$133,944.37	$1,381,315.24	$1,709,641.30
Summer Flounder, Scup, Black Sea Bass FMP	$28,642.92	$14,868.22	$29,096.05	$74,050.96	$129,630.55	$132,281.84	$408,570.54
SWORDFISH	-	-	-	-	-	C	C
TAUTOG	-	-	C	-	-	-	C
TILEFISH, BLUELINE	-	-	-	-	-	C	C

Table 26. Annual landings of each species (or grouped species in a shared FMP) caught within the Statoil lease area. (C) = confidential landings and (-) = no landings. Total confidential landings are $4,209.65 (i.e. the sum of all C's in the table below).

Species or FMP	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**Non-Confidential Total**
Bluefish FMP	$1,765.47	$169.54	$360.89	$420.44	$6.33	C	$2,722.67
BONITO, ATLANTIC	-	-	-	C	-	-	C
Coastal Migratory Pelagics FMP	C	-	-	-	-	-	C
CROAKER, ATLANTIC	-	-	-	$2,482.09	C	-	$2,482.09
DOGFISH, SMOOTH	$1,020.97	$158.04	$147.50	$248.02	$746.78	C	$2,321.31
DOGFISH, SPINY	$39.74	C	-	-	C	-	$39.74
DORY, AMERICAN JOHN	-	-	C	C	C	-	C
EEL, CONGER	-	C	C	-	-	-	C
Monkfish FMP	$9,386.08	$10,322.49	$4,580.10	$12,888.28	$6,613.04	$18,536.93	$62,326.92
Northeast Multispecies FMP	$659.02	$90,114.84	$25,483.60	C	C	$33,077.26	$149,334.72
Northeast Small Mesh Multispecies FMP	$208.74	$51.41	$531.67	$352.93	$179.37	C	$1,324.12
ROBINS, SEA	C	-	-	$11.78	C	-	$11.78
Sea Scallop FMP	$6,805,054.97	$3,149,266.59	$1,471,671.72	$2,641,411.54	$1,707,500.43	$628,124.80	$16,403,030.05
SHARK, THRESHER	-	-	-	C	-	-	C
Skate FMP	-	C	-	$6.26	$101.47	C	$107.73
Squid Mackerel Butterfish FMP	$619,032.38	$115,326.85	$300,348.77	$370,063.37	$69,641.86	$54.12	$1,474,467.35
Summer Flounder, Scup, Black Sea Bass FMP	$29,009.58	$3,313.87	$5,844.43	$21,006.45	$23,690.49	$2,844.93	$85,709.75
TAUTOG	-	C	-	-	-	-	C
TILEFISH, BLUELINE	-	-	C	C	C	-	C
TRIGGERFISHES	-	C	-	-	-	C	C
WHELK, CHANNELED	-	-	C	C	C	C	C

Table 27. Annual landings of each species (or grouped species in a shared FMP) caught within the OCS-A 0502 WEA. (C) = confidential landings and (-) = no landings. Total confidential landings are $84,982.12 (i.e. the sum of all C's in the table below).

Species or FMP	2011	2012	2013	2014	2015	2016	Non-Confidential Total
Bluefish FMP	$136.81	$3,929.86	$1,227.14	$442.65	$222.53	$978.94	$6,937.93
BONITO, ATLANTIC	-	-	-	-	C	-	C
DOGFISH, SMOOTH	C	C	$347.67	$78.69	$389.58	C	$815.94
DOGFISH, SPINY	$347.40	$29.16	$119.60	C	C	C	$496.16
DORY, AMERICAN JOHN	C	C	C	C	C	$410.52	$410.52
EEL, CONGER	-	C	-	C	C	-	C
FLOUNDER, FOURSPOT	C	-	-	-	-	-	C
HAKE, SPOTTED	-	-	-	-	-	C	C
HALIBUT, ATLANTIC	-	-	C	C	-	C	C
Monkfish FMP	$58,006.43	$80,413.30	$27,215.53	$32,298.27	$13,587.95	$9,553.30	$221,074.78
Northeast Multispecies FMP	$14,415.22	-	$3,518.43	$1,258.61	$552.22	C	$19,744.48
Northeast Small Mesh Multispecies FMP	$215,275.68	$237,009.21	$66,087.17	$15,890.06	$83,647.71	$82,315.88	$700,225.71
ROBINS, SEA	-	C	C	C	C	-	C
Sea Scallop FMP	C	$442,547.92	$17,537.73	$17,676.06	C	-	$477,761.71
Skate FMP	$7,477.64	C	C	$14,757.82	$28,288.57	$4,706.43	$55,230.46
Squid Mackerel Butterfish FMP	$41,210.78	$71,820.30	$157,144.18	$16,427.01	$24,917.17	$83,148.91	$394,668.35
Summer Flounder, Scup, Black Sea Bass FMP	$3,970.87	$55,214.51	$164,951.48	$43,076.88	$23,437.60	$68,332.52	$358,983.86

Table 28. Annual landings of each species (or grouped species in a shared FMP) caught within the OCS-A 0503 WEA. (C) = confidential landings and (-) = no landings. Total confidential landings are $434,771.13 (i.e. the sum of all C's in the table below).

Species or FMP	2011	2012	2013	2014	2015	2016	Non-Confidential Total
Bluefish FMP	C	$16.47	$0.41	-	C	C	$16.88
DOGFISH, SMOOTH	-	-	-	-	C	-	C
DOGFISH, SPINY	$81.42	-	-	$633.37	C	C	$714.79
DORY, AMERICAN JOHN	C	-	C	-	C	C	C
EEL, CONGER	-	-	-	C	-	-	C
HALIBUT, ATLANTIC	-	-	-	C	-	C	C
Monkfish FMP	$19,793.62	$21,327.15	$1,051.95	$45,118.49	$8,024.06	$7,051.64	$102,366.91
Northeast Multispecies FMP	C	-	-	-	C	C	C
Northeast Small Mesh Multispecies FMP	$283.66	$2,743.86	$3,017.03	C	$620.19	$11,021.82	$17,686.56
Sea Scallop FMP	-	C	C	C	C	-	C
Skate FMP	$2,604.80	C	C	C	$1,666.07	$846.34	$5,117.21
Squid Mackerel Butterfish FMP	$201.00	$198.02	$1,112.98	C	$3,481.66	$7,048.79	$12,042.45
Summer Flounder, Scup, Black Sea Bass FMP	C	$41.52	$29.35	C	$113.26	$2,577.20	$2,761.33

10.2 Figures

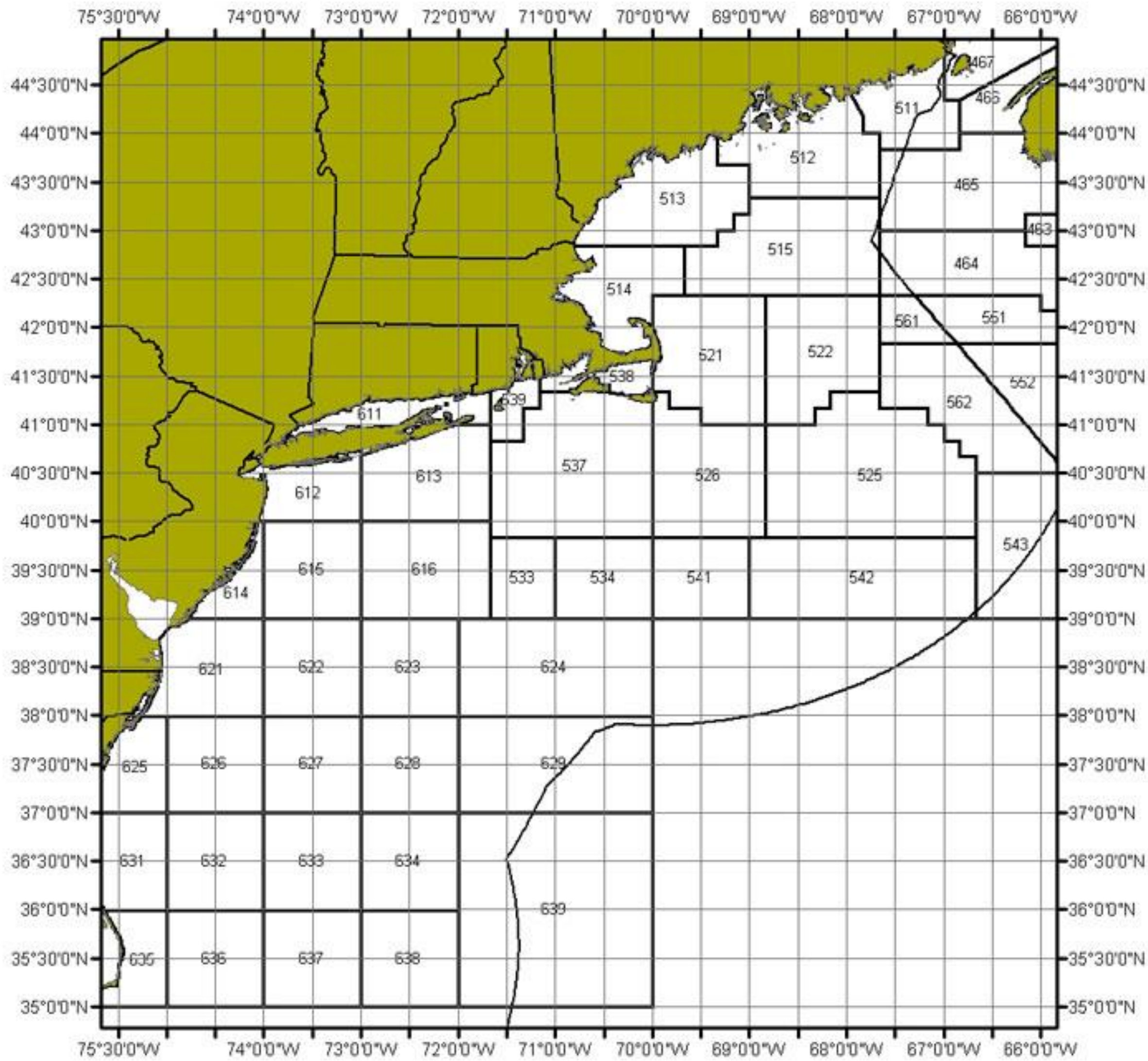

Figure 1. NOAA Fisheries Greater Atlantic Region statistical areas

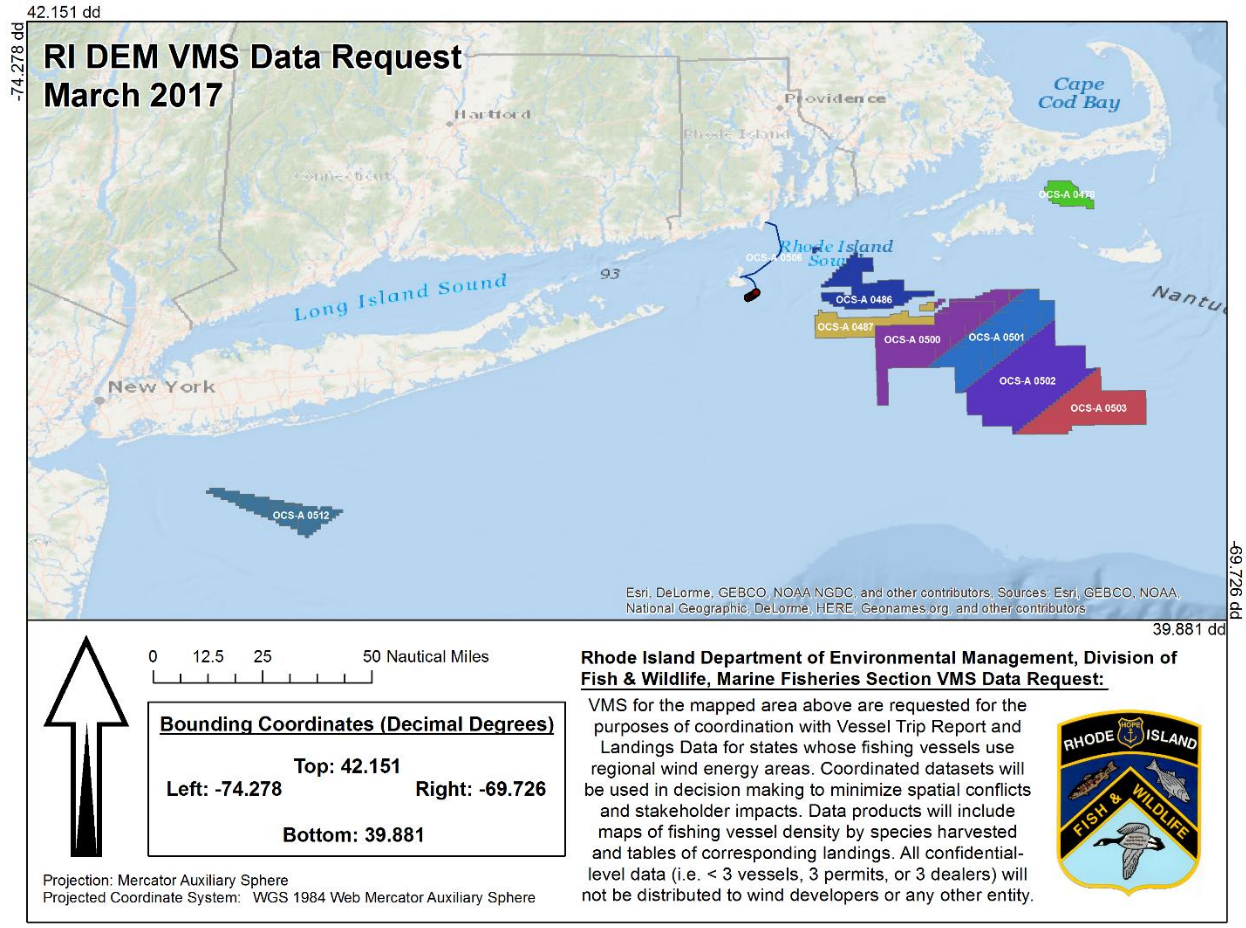

Figure 2. Map provided to NOAA’s OLE as part of DEM’s VMS data request submitted on March 28th, 2017.

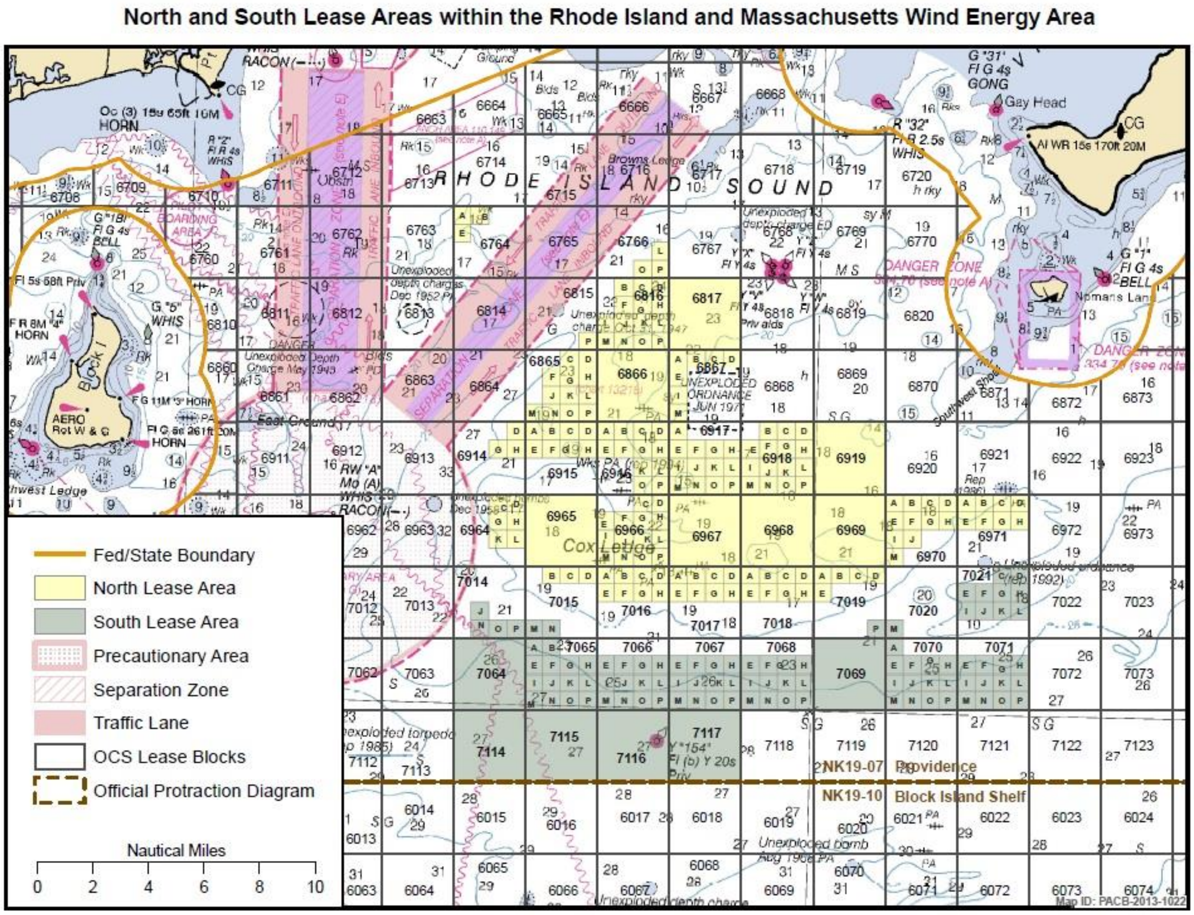

Figure 3. OCS-A-0486 and OCS-A-0487 lease areas. Both lease areas are situated within the Rhode Island and Massachusetts Area of Mutual Interest (AMI) and were leased to Deepwater Wind. Image source: BOEM (https://www.boem.gov/uploadedFiles/BOEM/Renewable_Energy_Program/State_Activities/Map%20of%20the%20Rhode%20Island%20and%20Massachusetts%20Lease%20Areas%20with%20Nautical%20Chart.pdf)

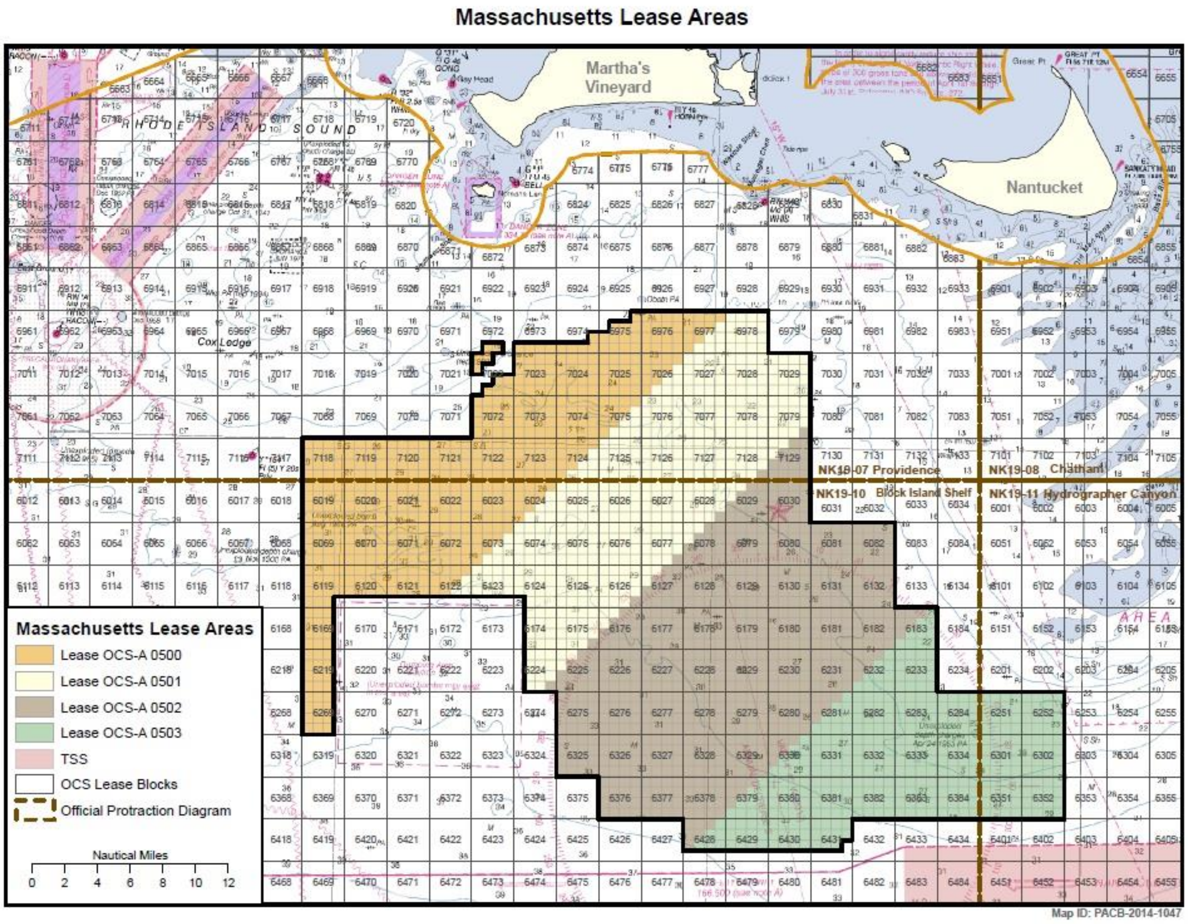

Figure 4. OCS-A-0500, OCS-A-0501, OCS-A-0502, and OCS-A-0503 lease areas. OCS-A-0500 was leased to Bay State Wind. OCS-A-0501 was leased to Vineyard Wind. Neither OCS-A-0502 nor OCS-A-0503 have been leased yet. Image source: BOEM (https://www.boem.gov/Massachusetts-Lease-Areas-with-Nautical-Chart/)

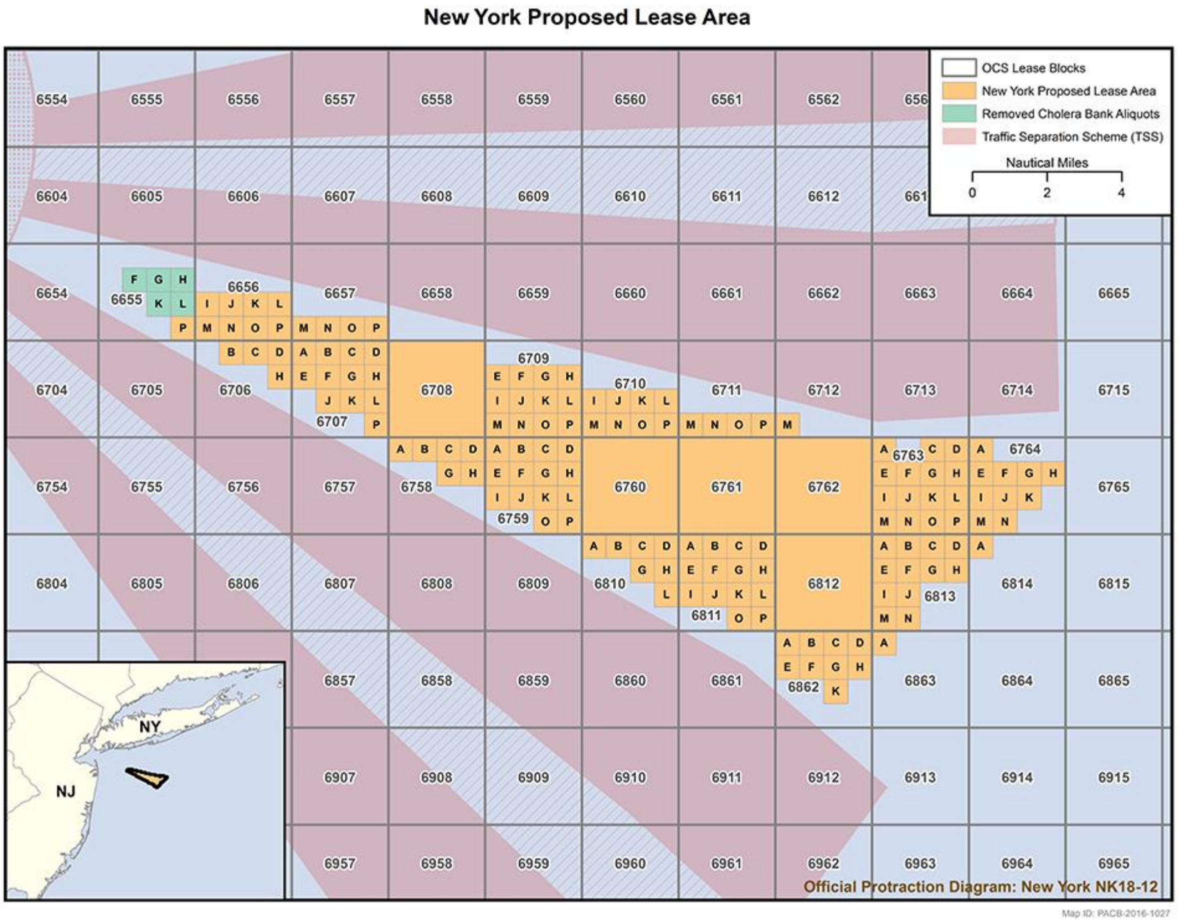

Figure 5. The OCS-A-0512 lease area, which was leased to Statoil in late 2015. Image source: BOEM (https://www.boem.gov/uploadedImages/BOEM/Renewable_Energy_Program/State_Activities/NY_Proposed_Lease_Area.jpg)

10.2.1 2011-2016 Maps by State Landed

The maps provided in this section, and all further map sections, show only relative VMS fishing densities. The data were smoothed and reclassified to show relative densities (scaled from 1-10 as equal intervals) of fishing activity to comply with confidentiality rules. Refer to the methods section for more details. The .jpg versions of these maps, as well as their corresponding GIS files are also reclassified on a scale from 1-10, with 1 meaning low and 10 meaning high.

Closeup maps (off MA-RI and South of Long Island) are on the same scales as the larger map, though the color bar may differ. The same raster layer was used to produce both the larger maps and the closeup, hence the same scale. In certain cases, the scale color bar is shifted in the closeups because the highest numbers in the raster may not show up in the close-up.

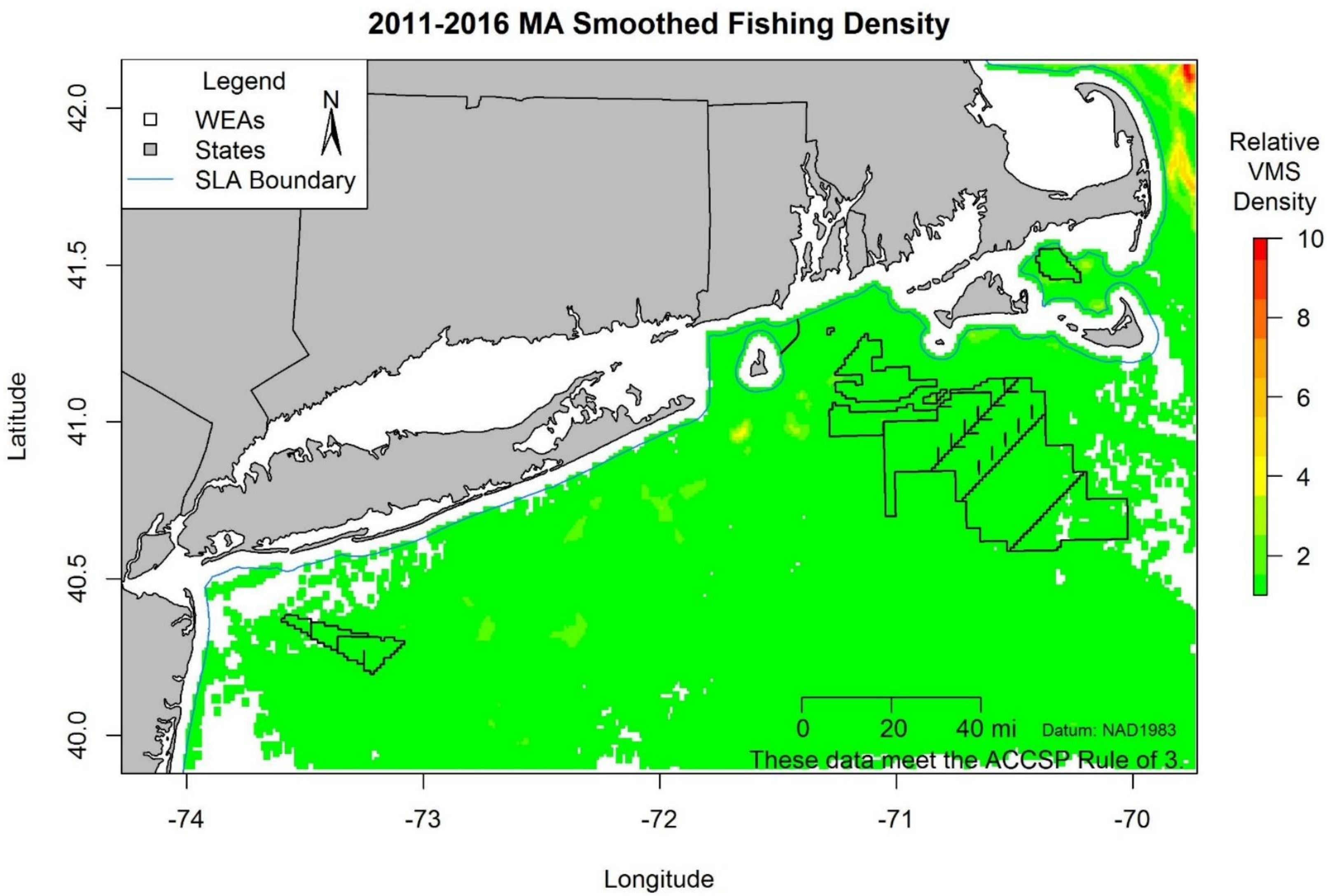

Figure 6. Smoothed federal fishing activity (all fisheries) resulting in landings in MA between 2011 and 2016

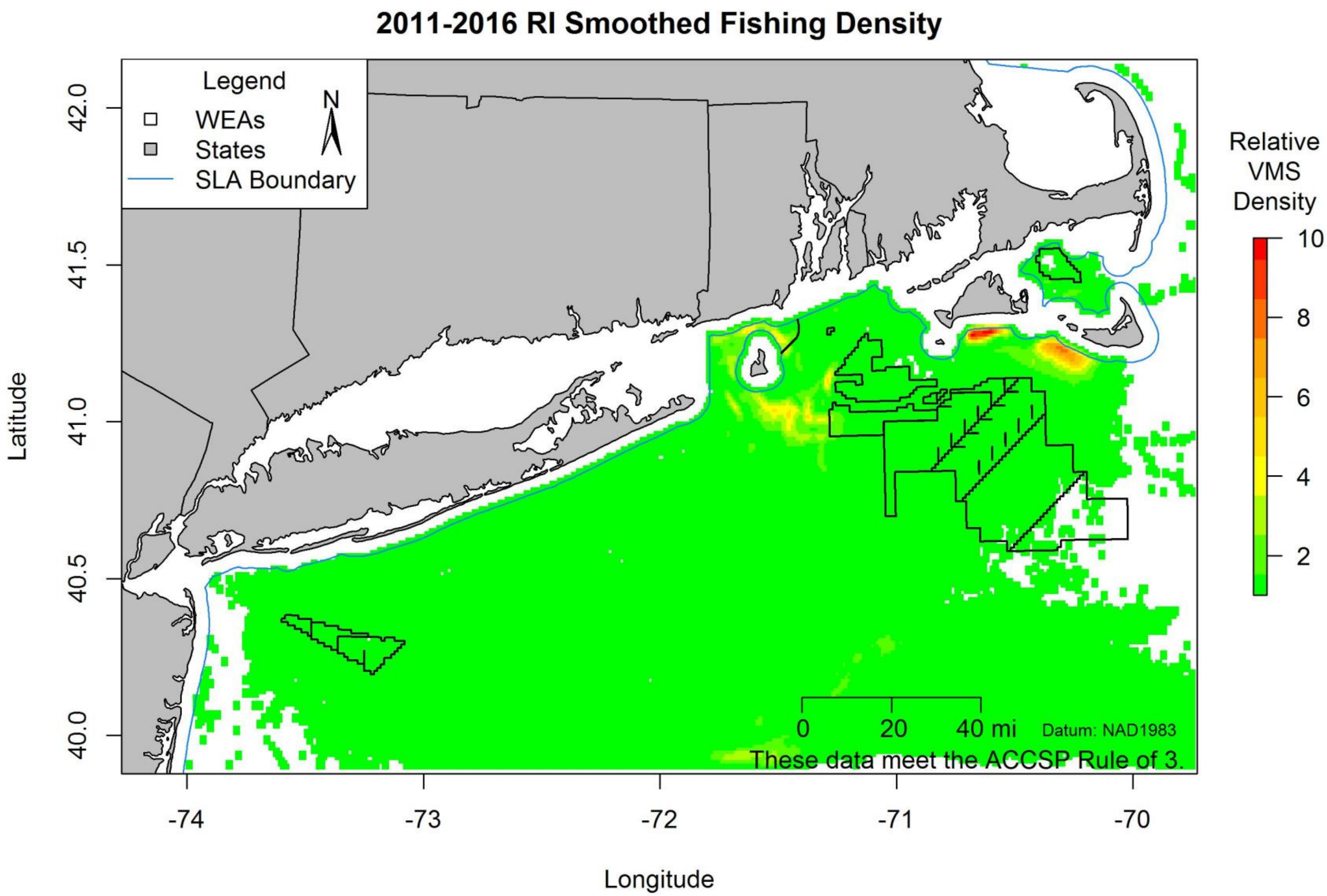

Figure 7. Smoothed federal fishing activity (all fisheries) resulting in landings in RI between 2011 and 2016

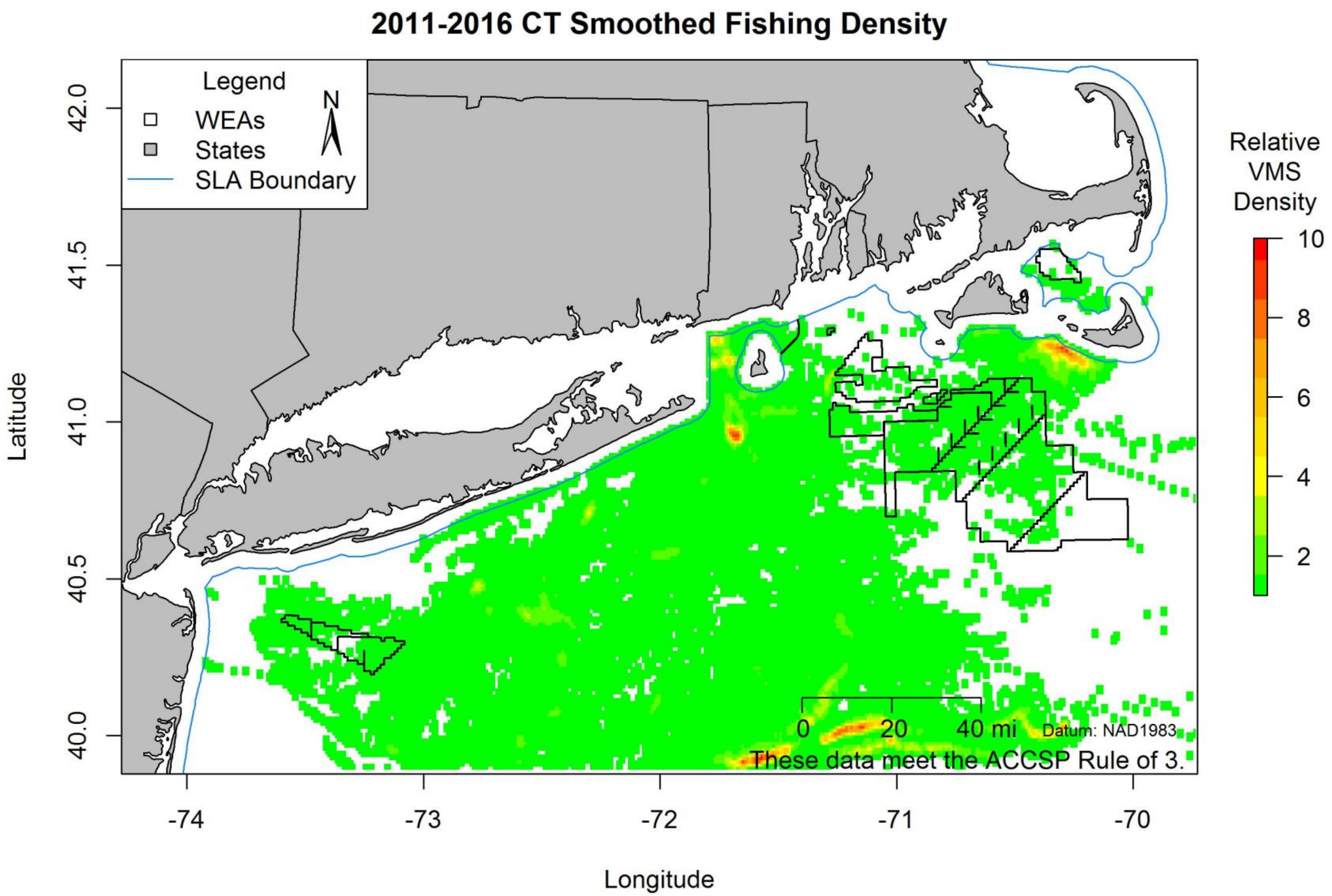

Figure 8. Smoothed federal fishing activity (all fisheries) resulting in landings in CT between 2011 and 2016

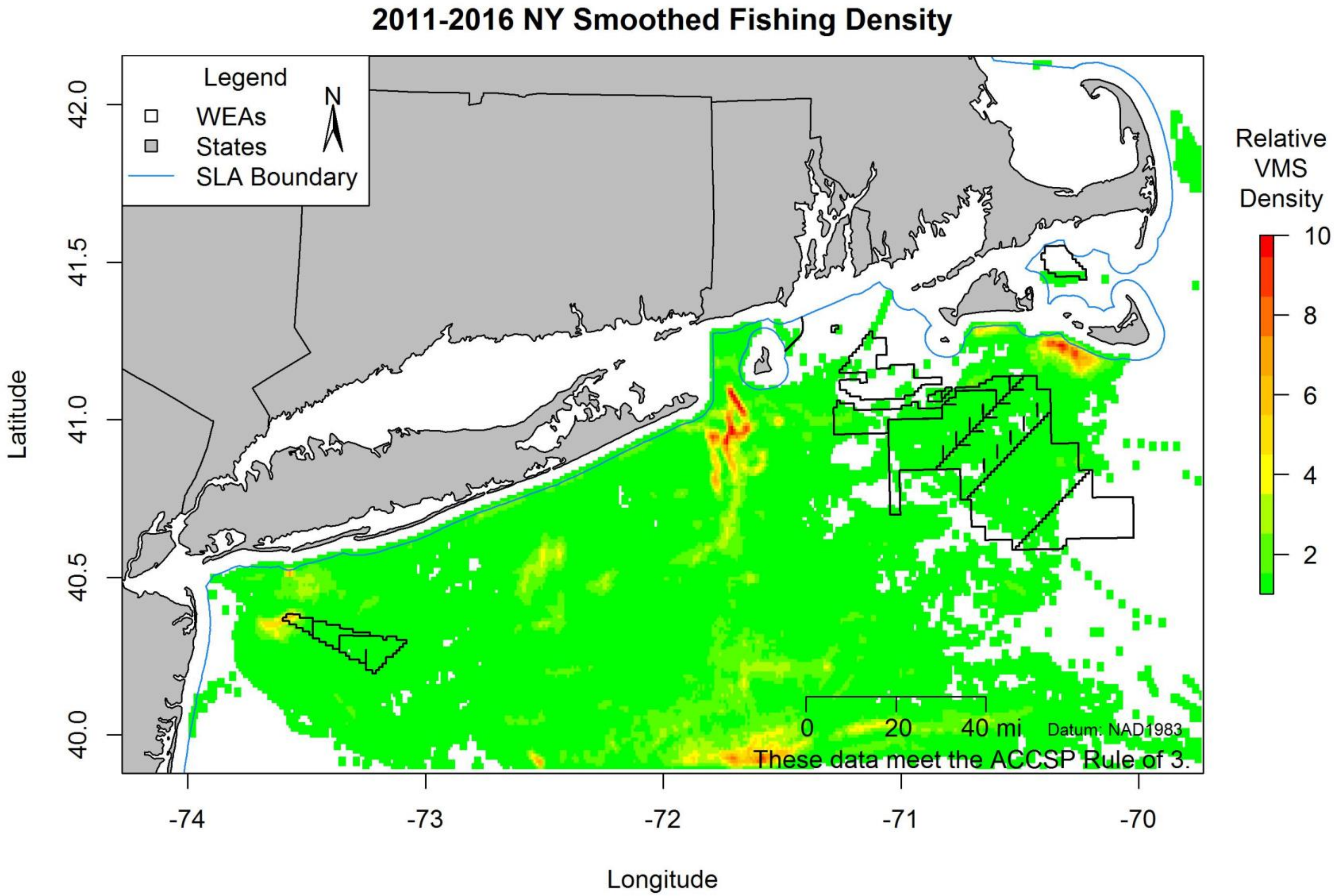

Figure 9. Smoothed federal fishing activity (all fisheries) resulting in landings in NY between 2011 and 2016

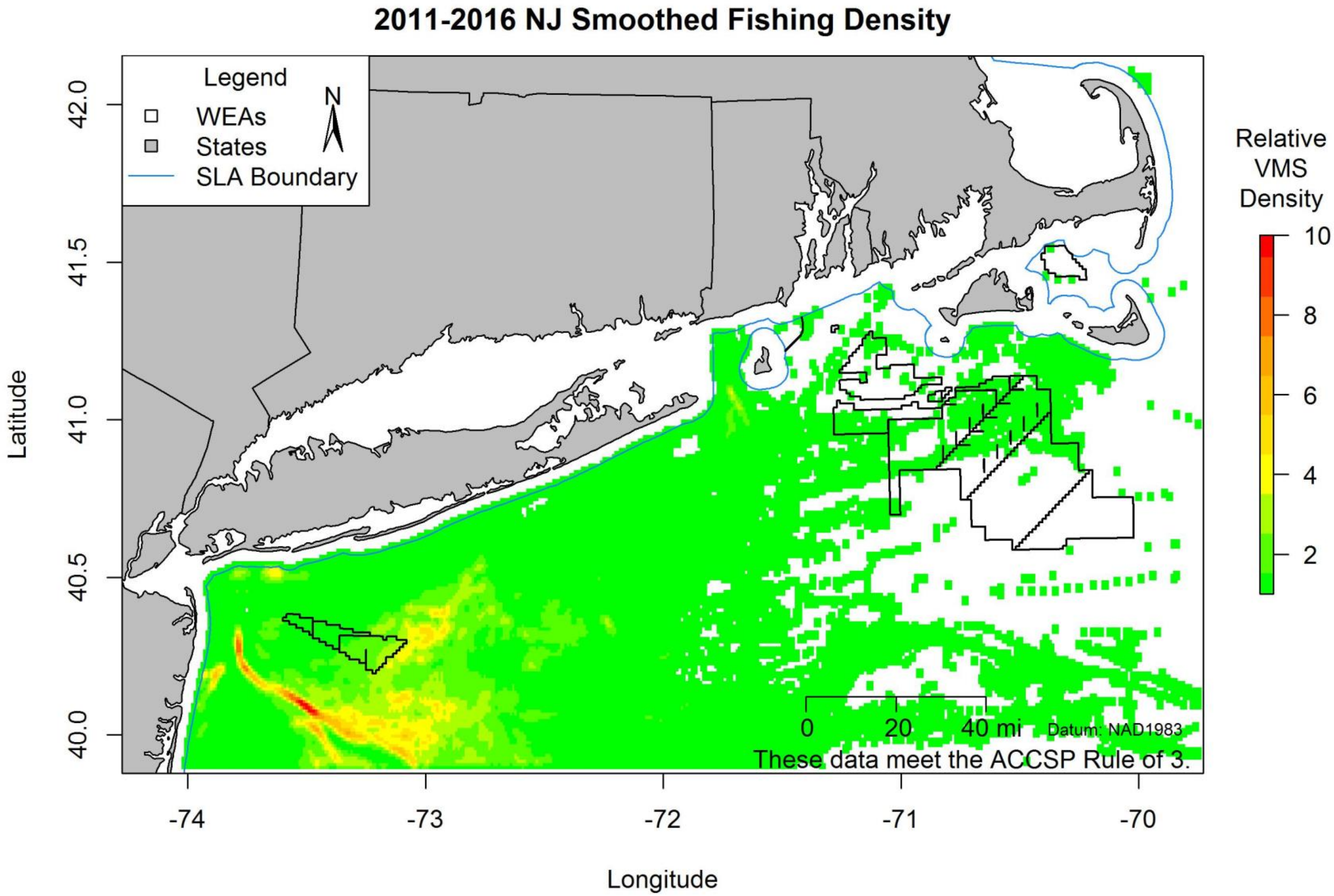

Figure 10. Smoothed federal fishing activity (all fisheries) resulting in landings in NJ between 2011 and 2016

10.2.2 2011-2016 Maps by Port Landed

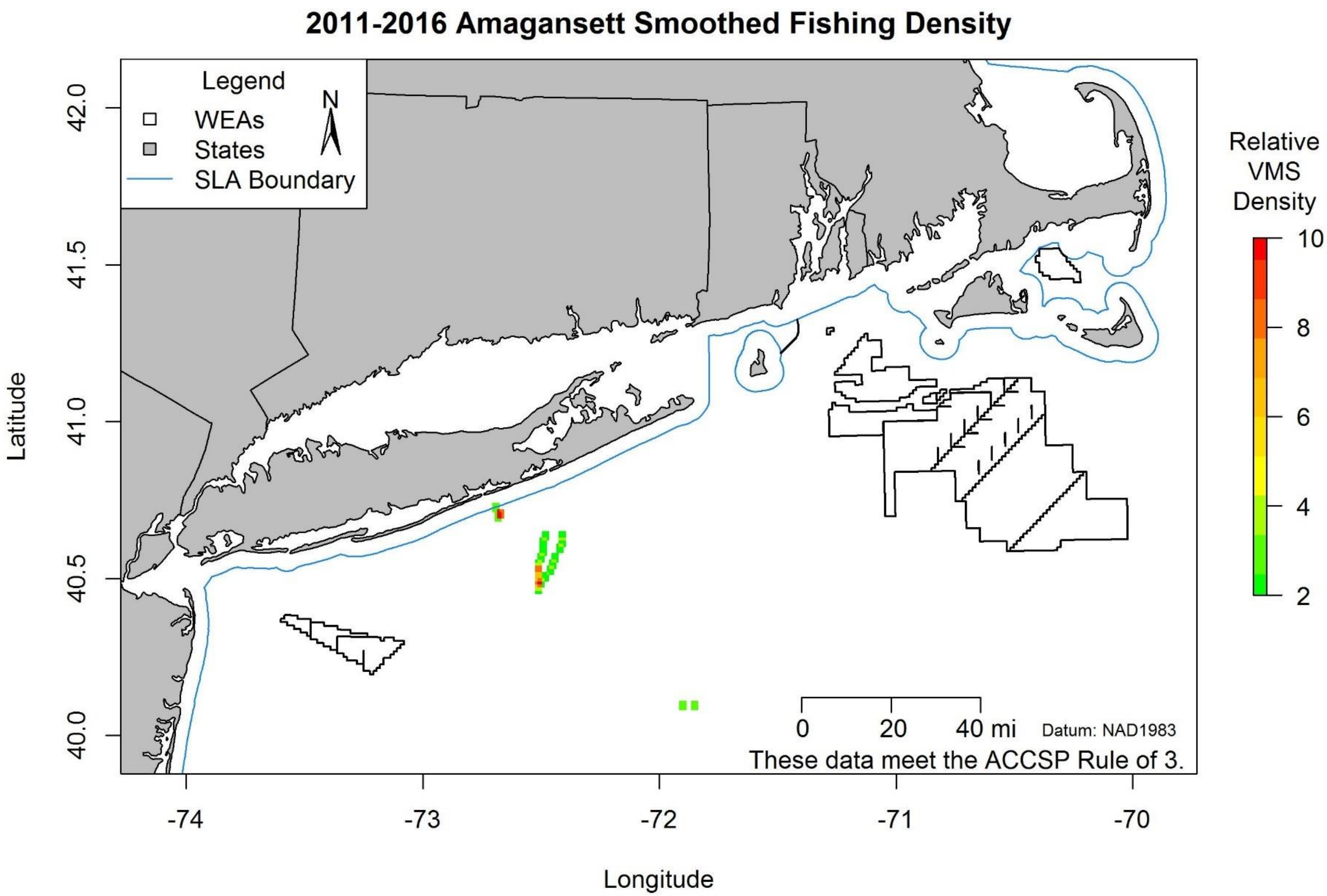

Figure 11. Smoothed federal fishing activity (all fisheries) resulting in landings in Amagansett, NY between 2011 and 2016

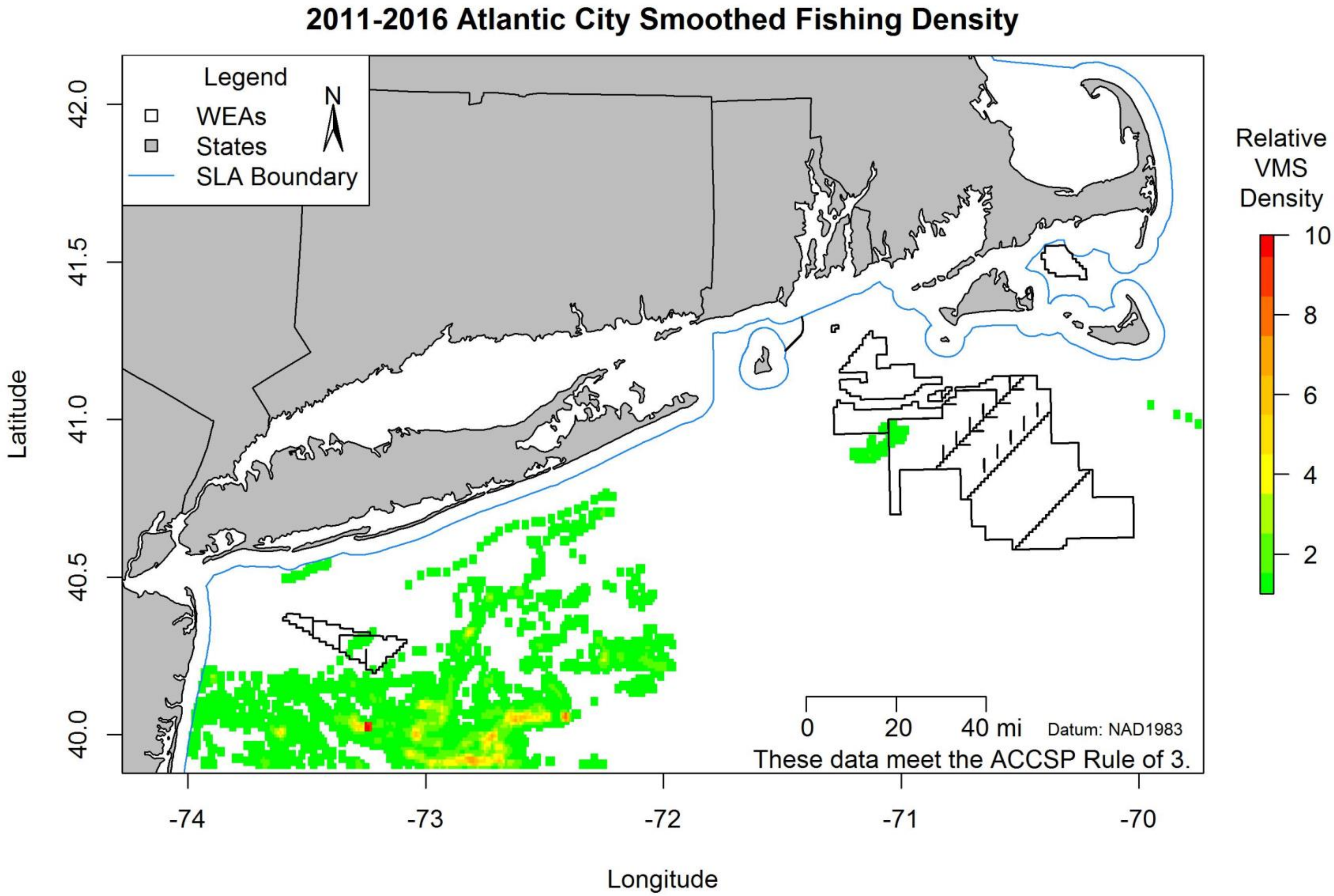

Figure 12. Smoothed federal fishing activity (all fisheries) resulting in landings in Atlantic City, NJ between 2011 and 2016

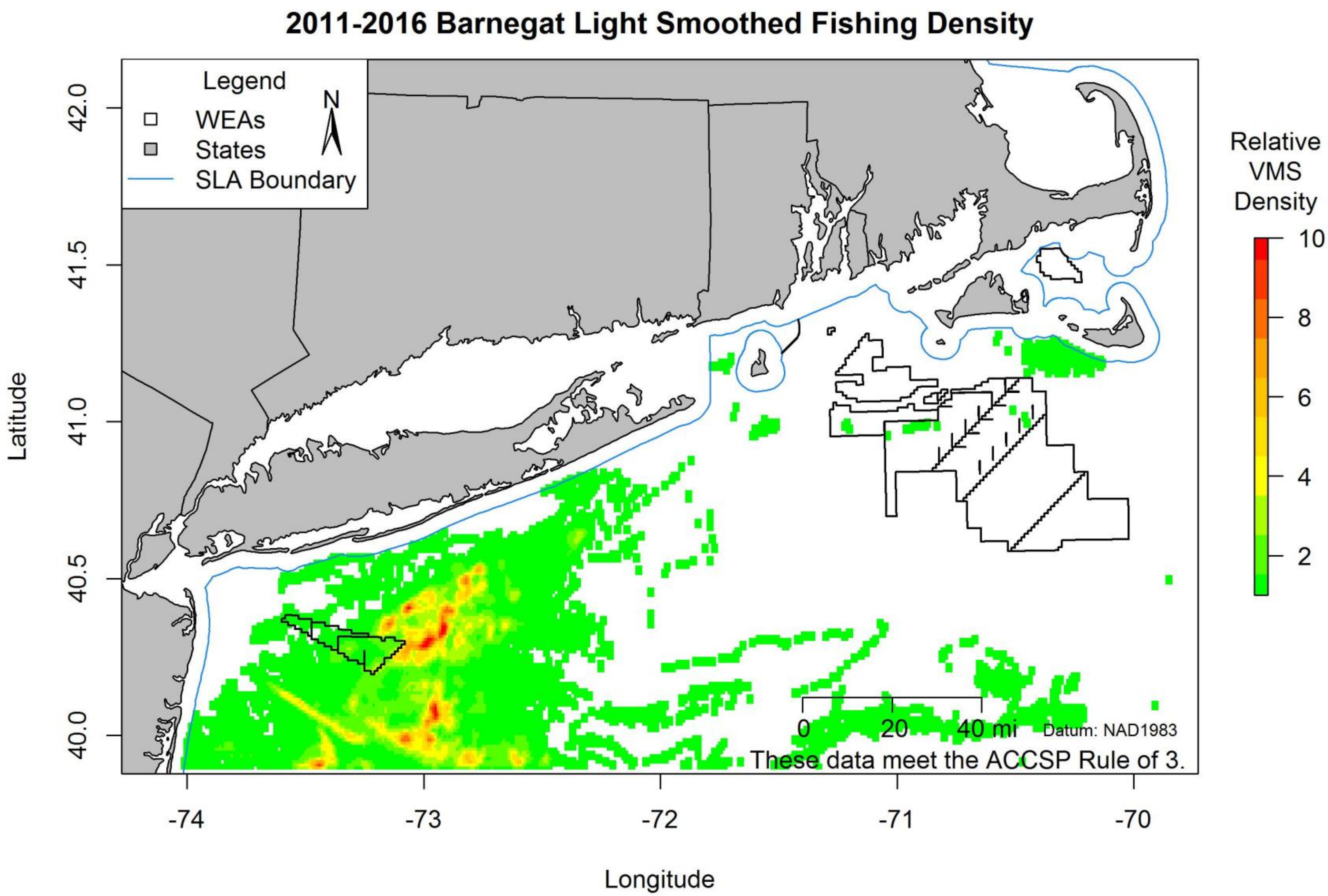

Figure 13. Smoothed federal fishing activity (all fisheries) resulting in landings in Barnegat Light, NJ between 2011 and 2016

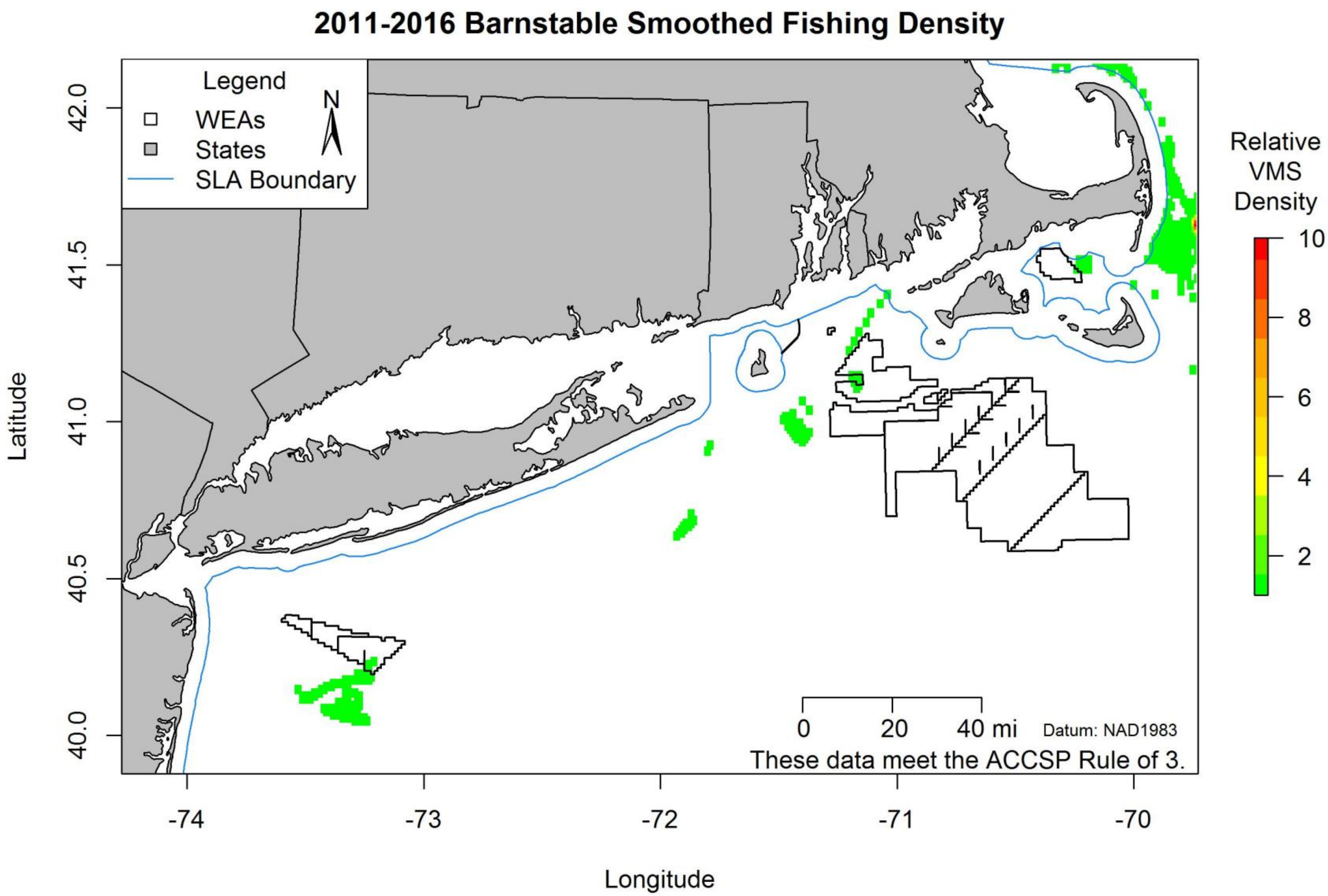

Figure 14. Smoothed federal fishing activity (all fisheries) resulting in landings in Barnstable, MA between 2011 and 2016

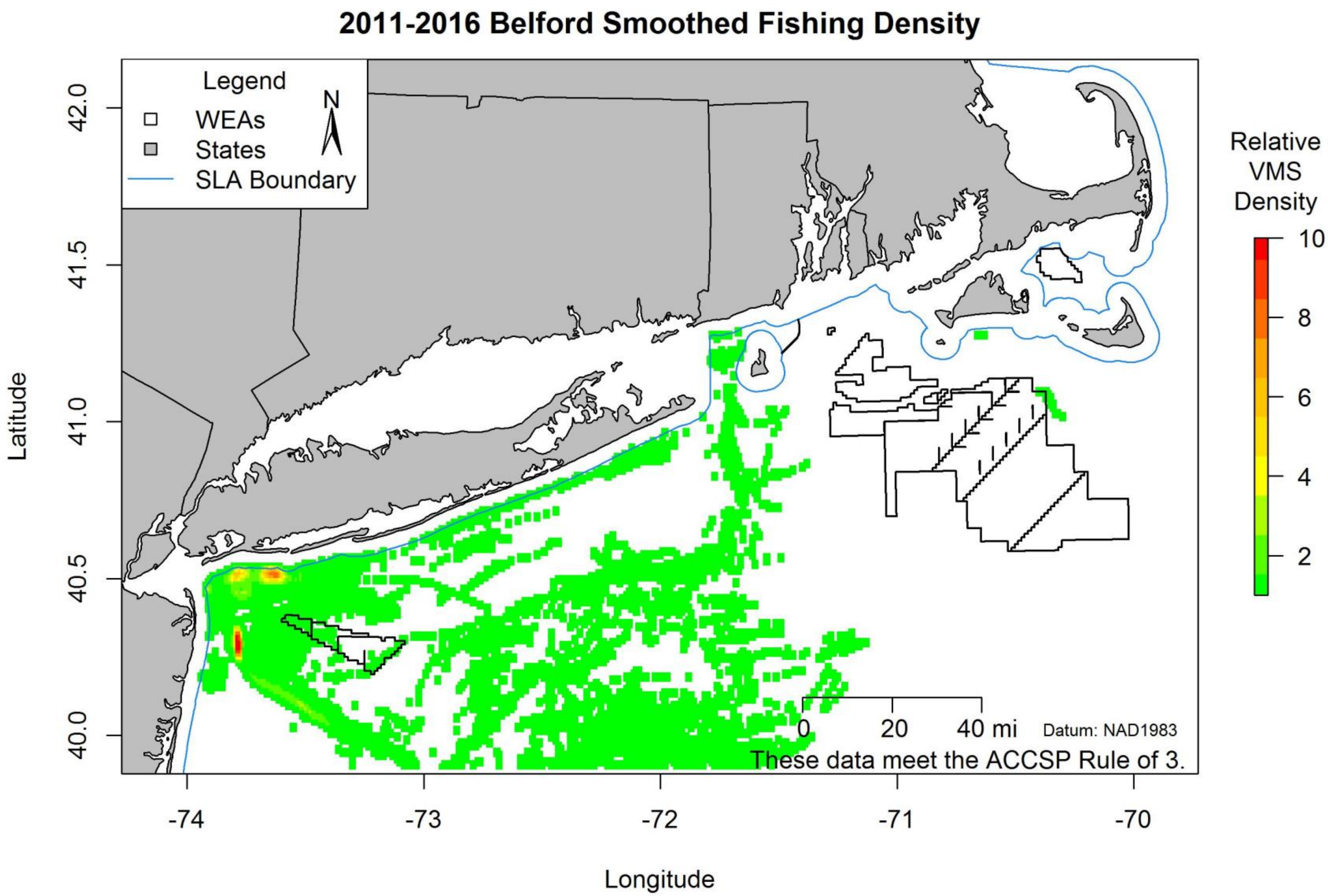

Figure 15. Smoothed federal fishing activity (all fisheries) resulting in landings in Belford, NJ between 2011 and 2016

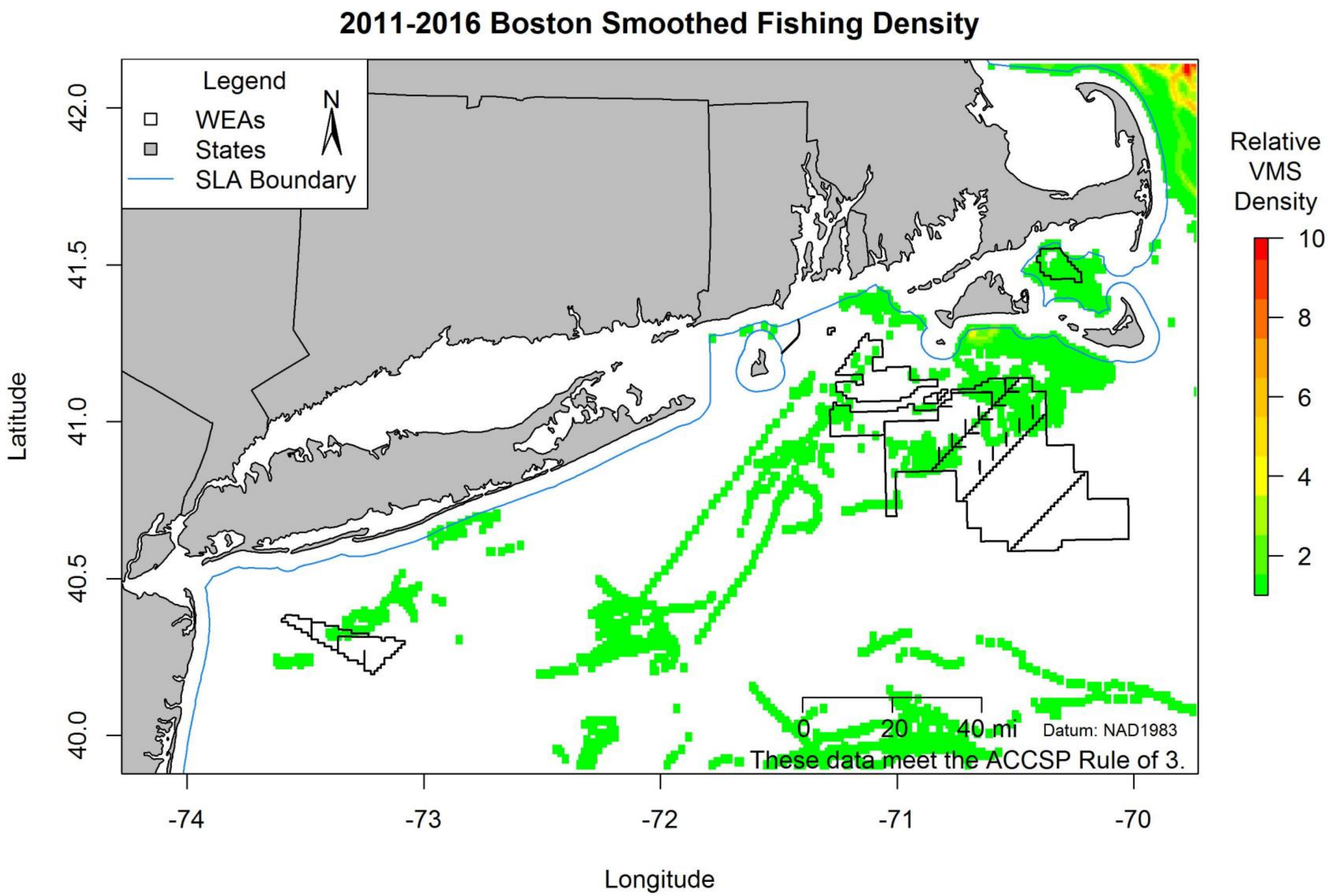

Figure 16. Smoothed federal fishing activity (all fisheries) resulting in landings in Boston, MA between 2011 and 2016

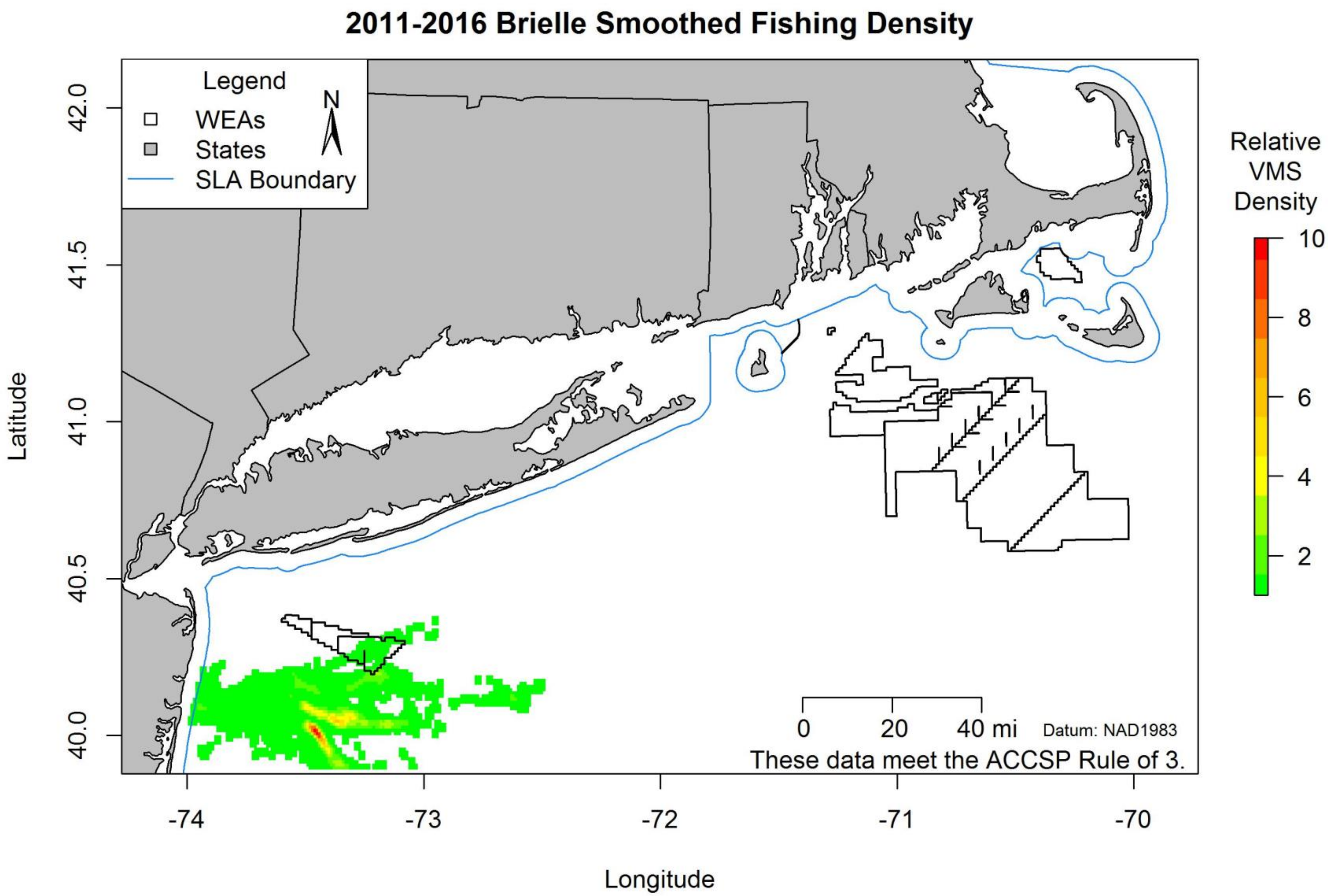

Figure 17. Smoothed federal fishing activity (all fisheries) resulting in landings in Brielle, NJ between 2011 and 2016

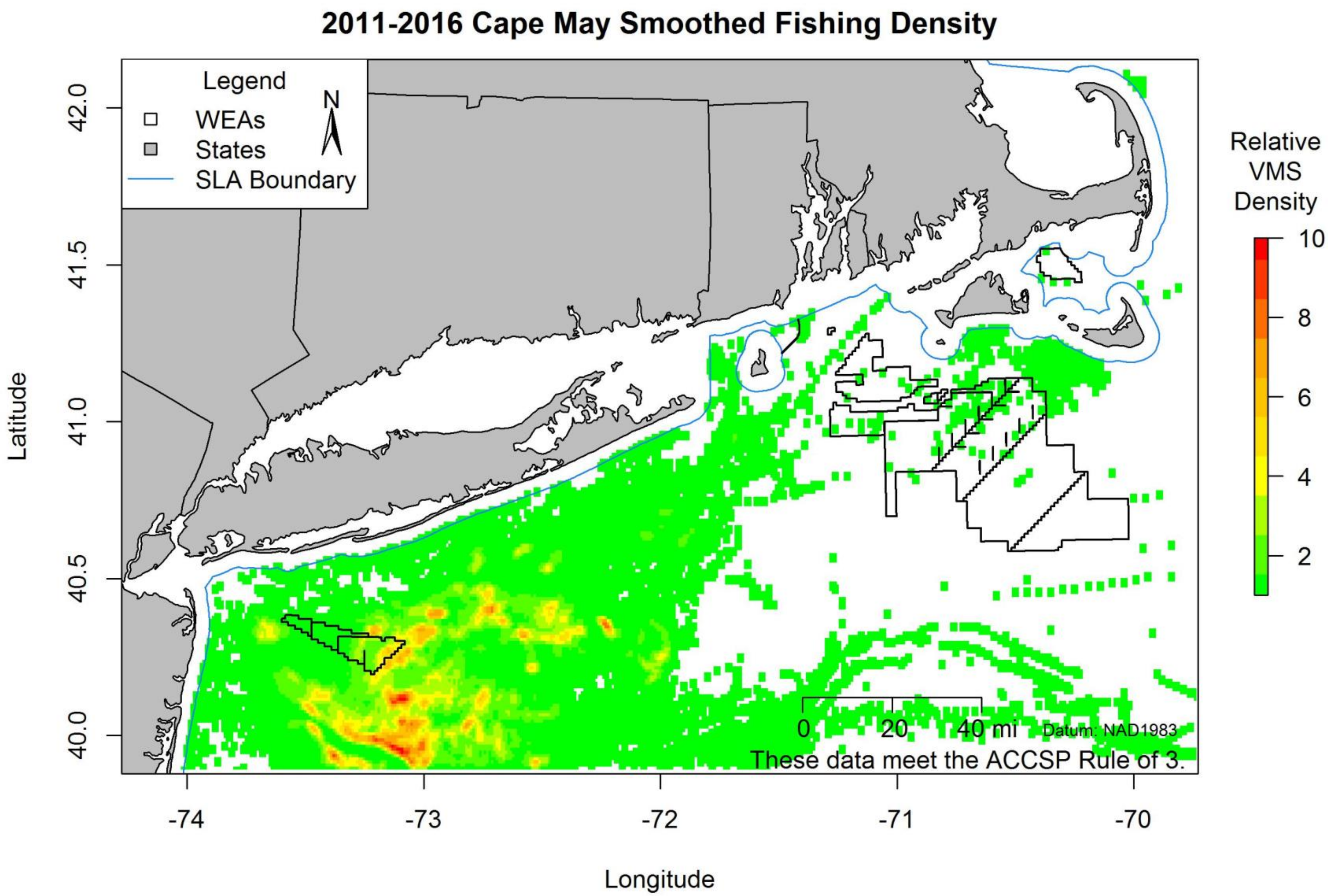

Figure 18. Smoothed federal fishing activity (all fisheries) resulting in landings in Cape May, NJ between 2011 and 2016

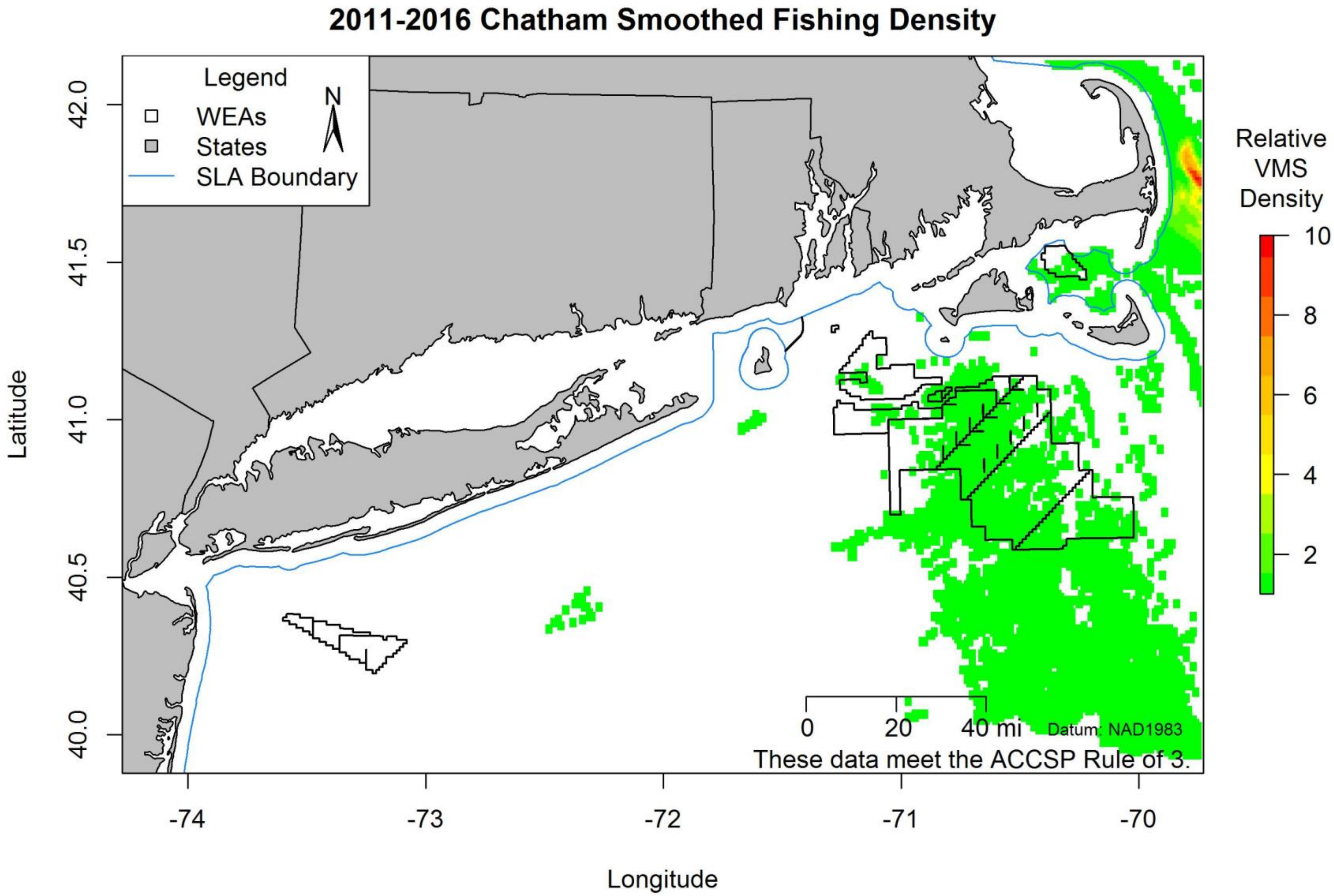

Figure 19. Smoothed federal fishing activity (all fisheries) resulting in landings in Chatham, MA between 2011 and 2016

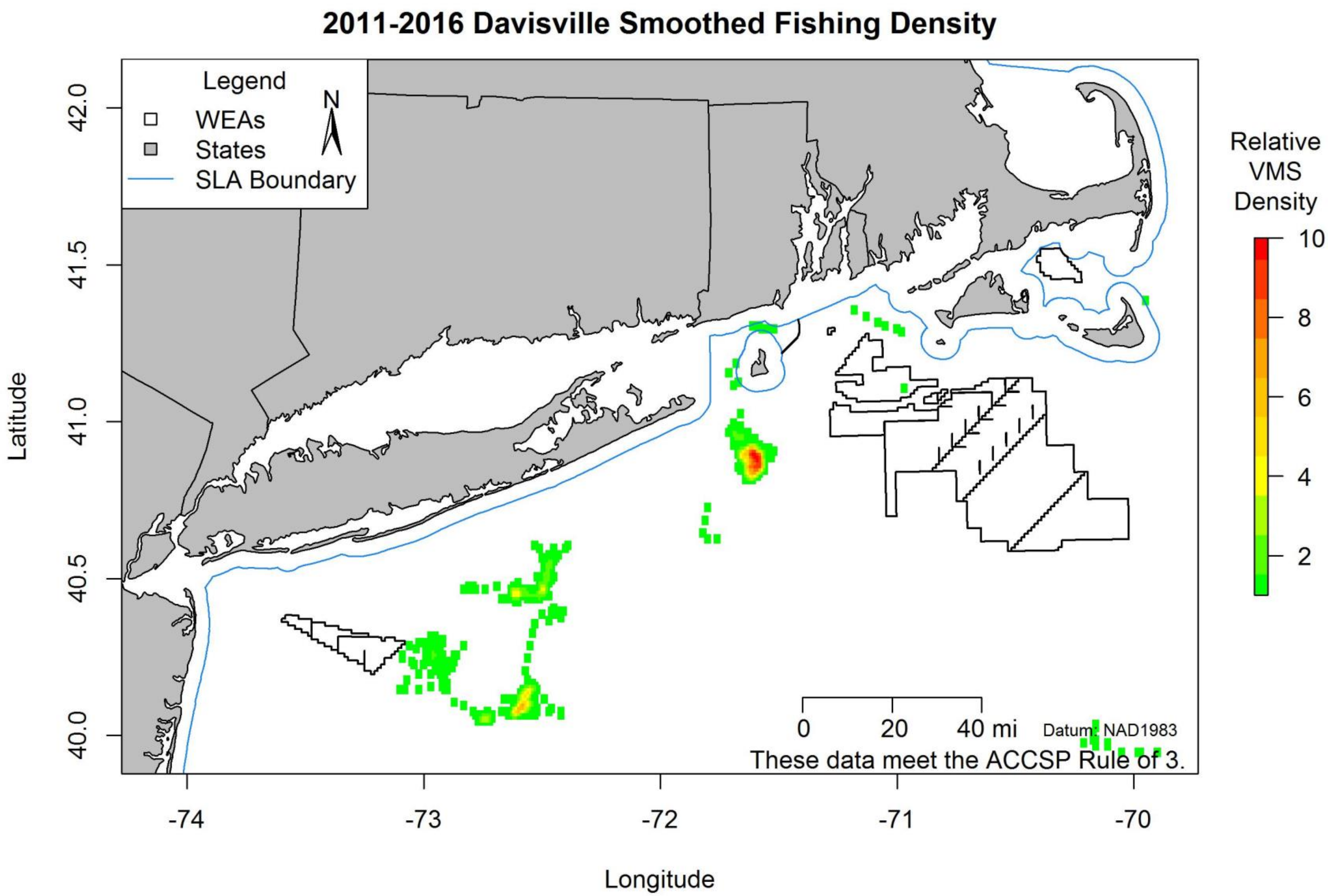

Figure 20. Smoothed federal fishing activity (all fisheries) resulting in landings in Davisville, RI between 2011 and 2016

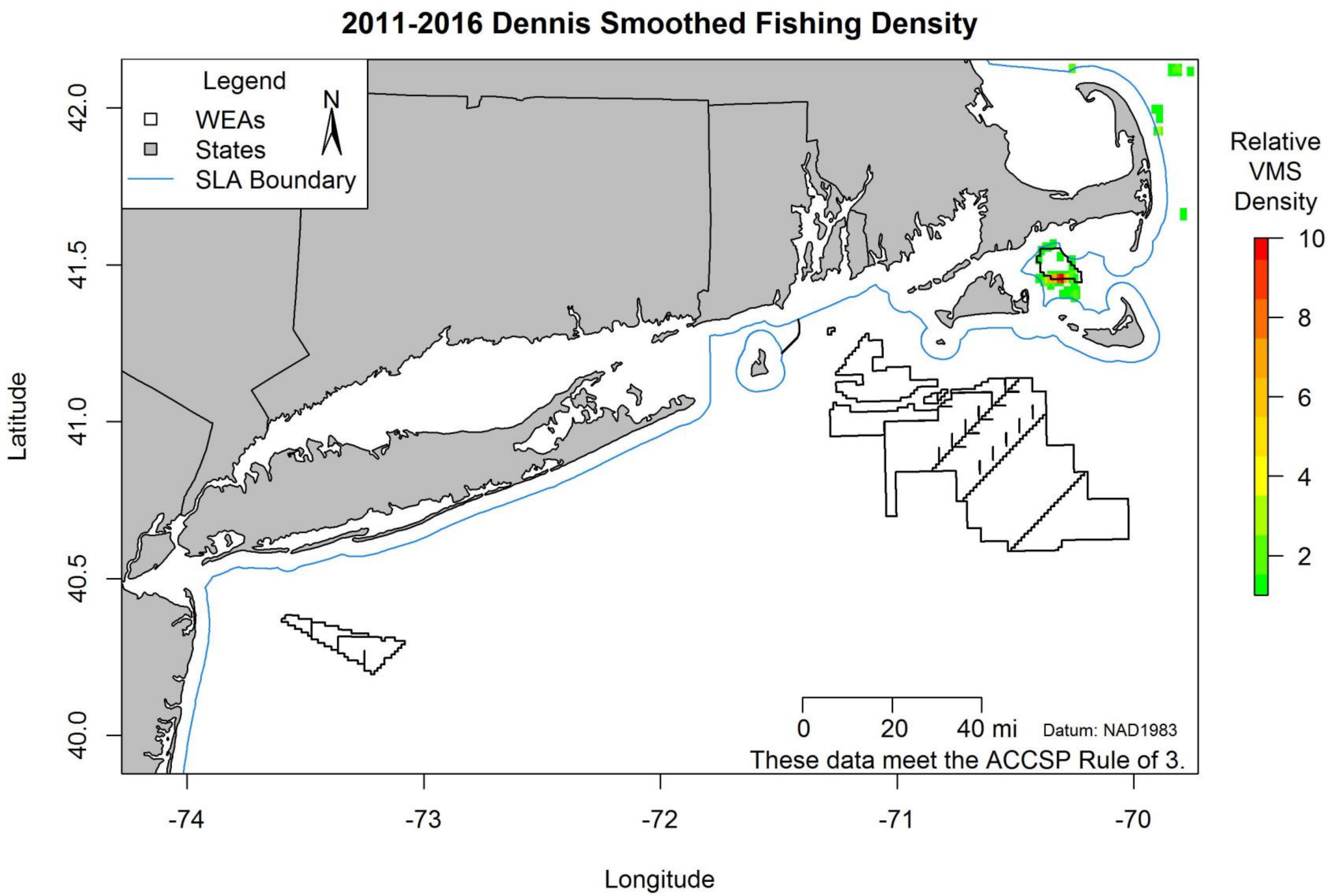

Figure 21. Smoothed federal fishing activity (all fisheries) resulting in landings in Dennis, MA between 2011 and 2016

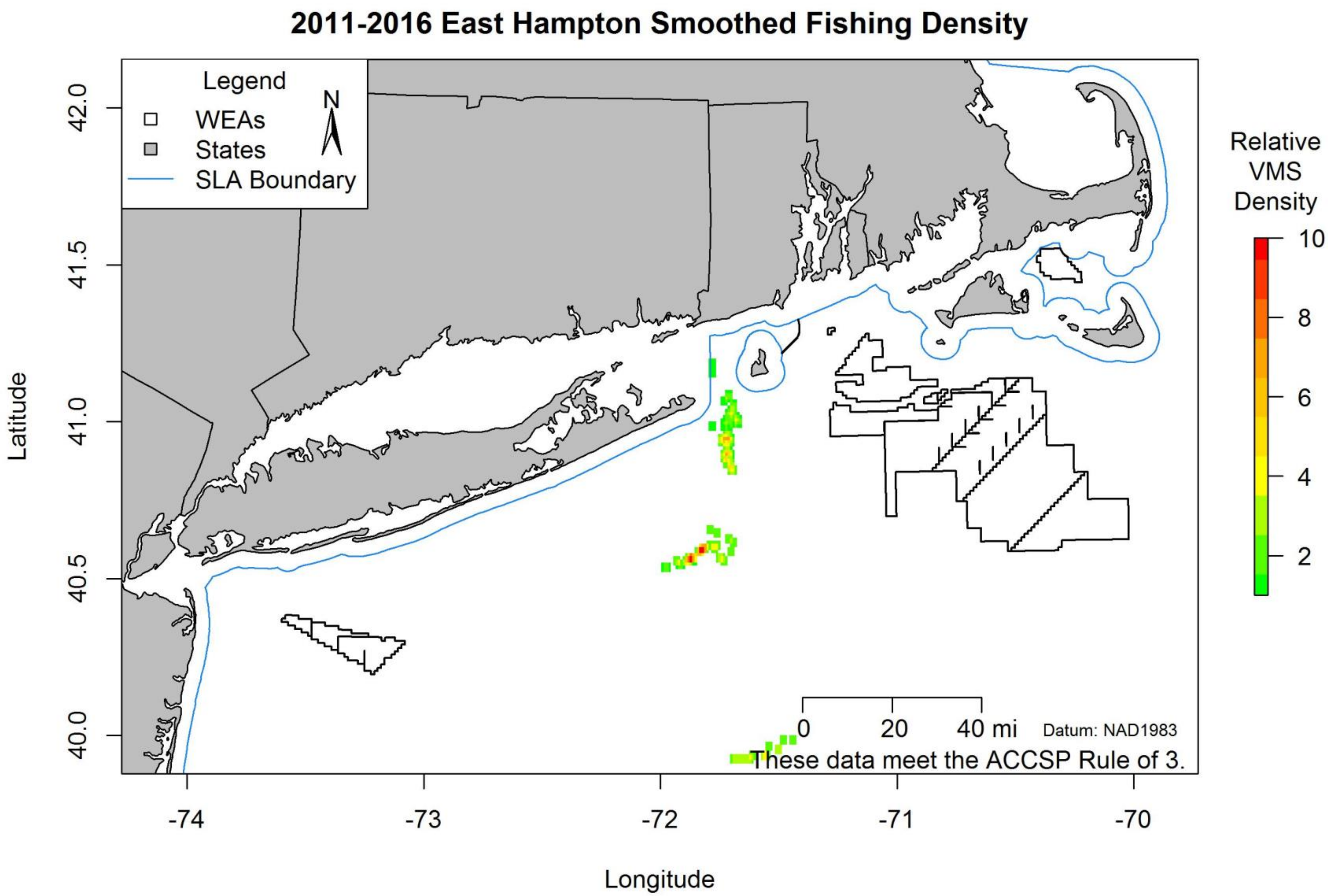

Figure 22. Smoothed federal fishing activity (all fisheries) resulting in landings in East Hampton, NY between 2011 and 2016

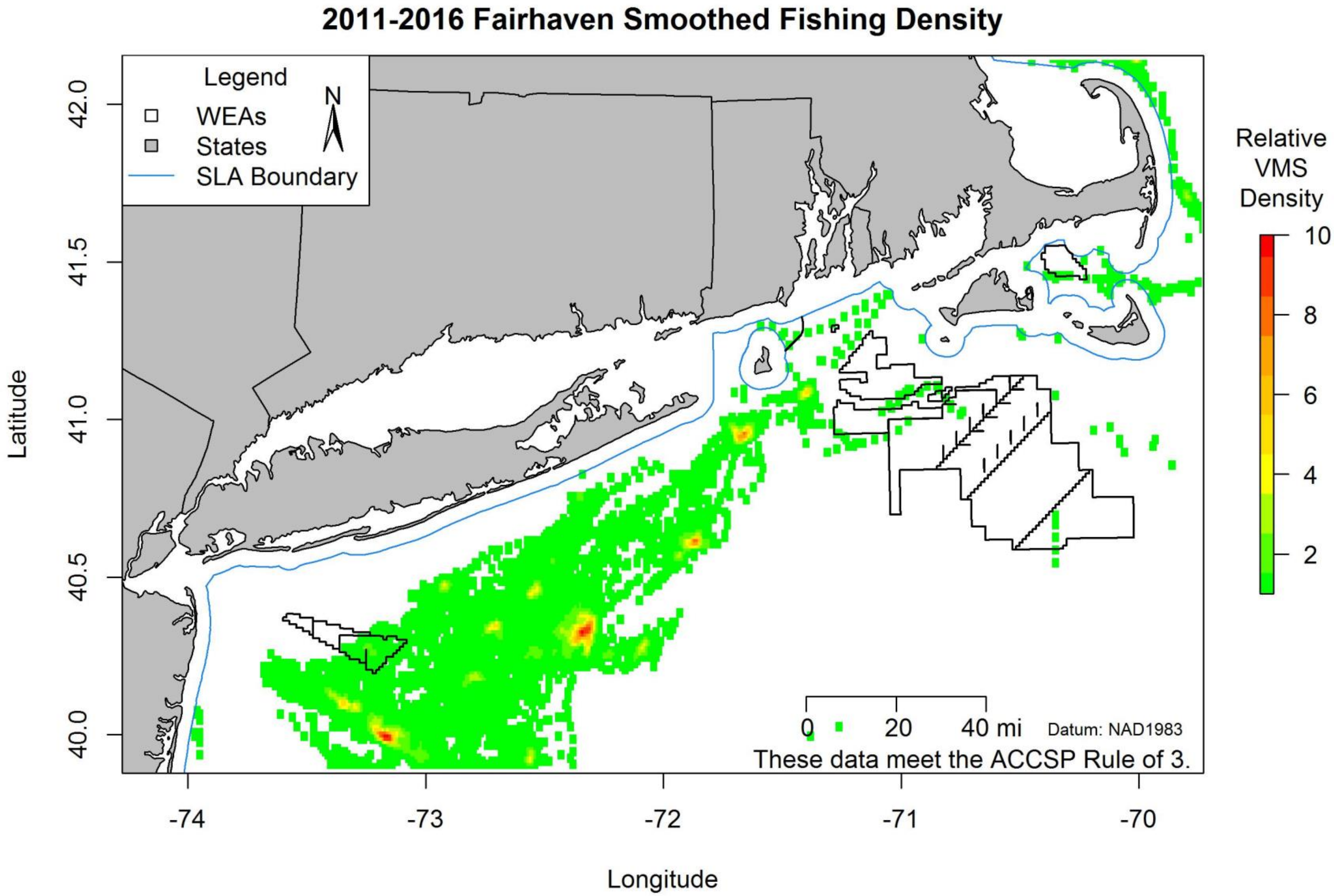

Figure 23. Smoothed federal fishing activity (all fisheries) resulting in landings in Fairhaven, MA between 2011 and 2016

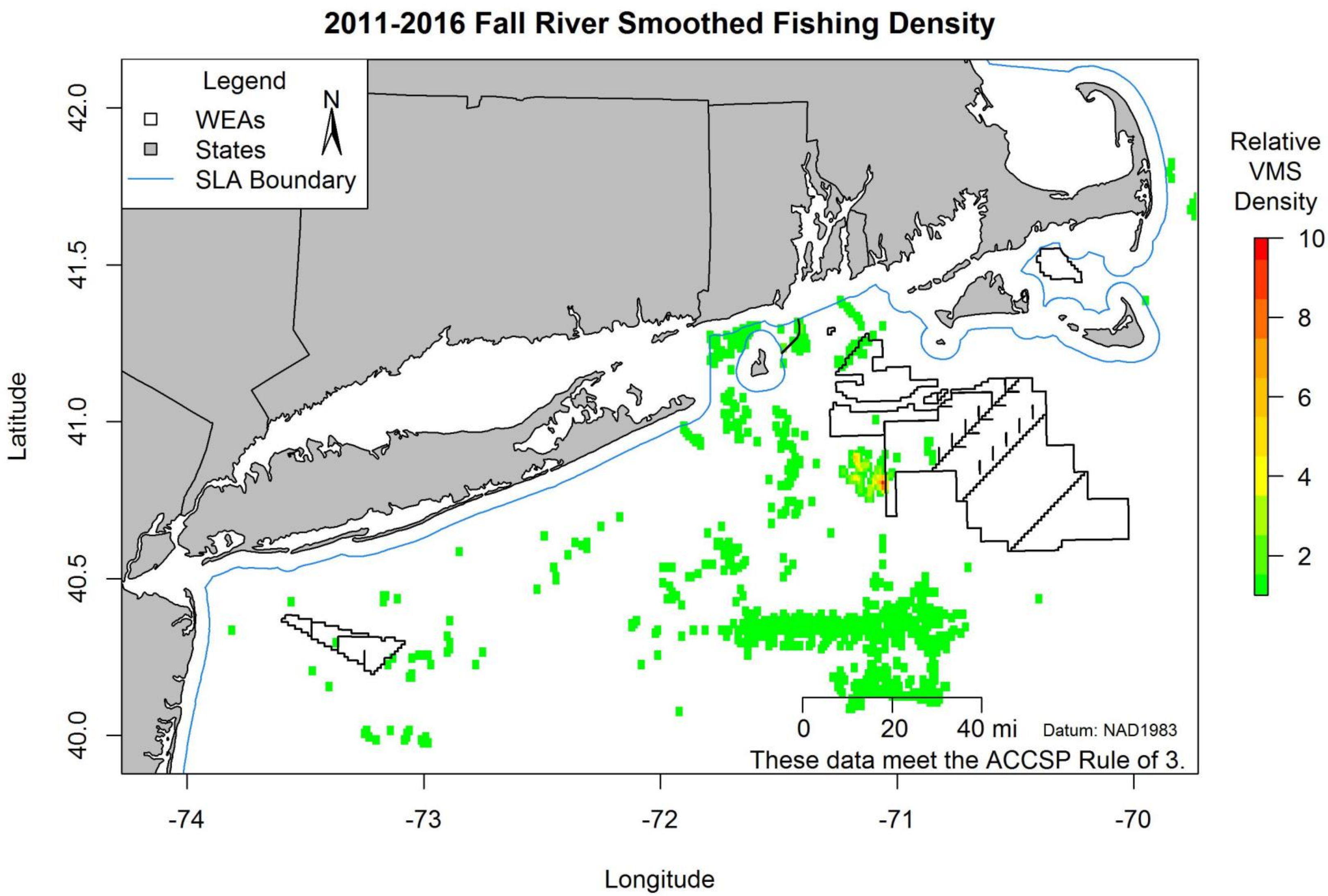

Figure 24. Smoothed federal fishing activity (all fisheries) resulting in landings in Fall River, MA between 2011 and 2016

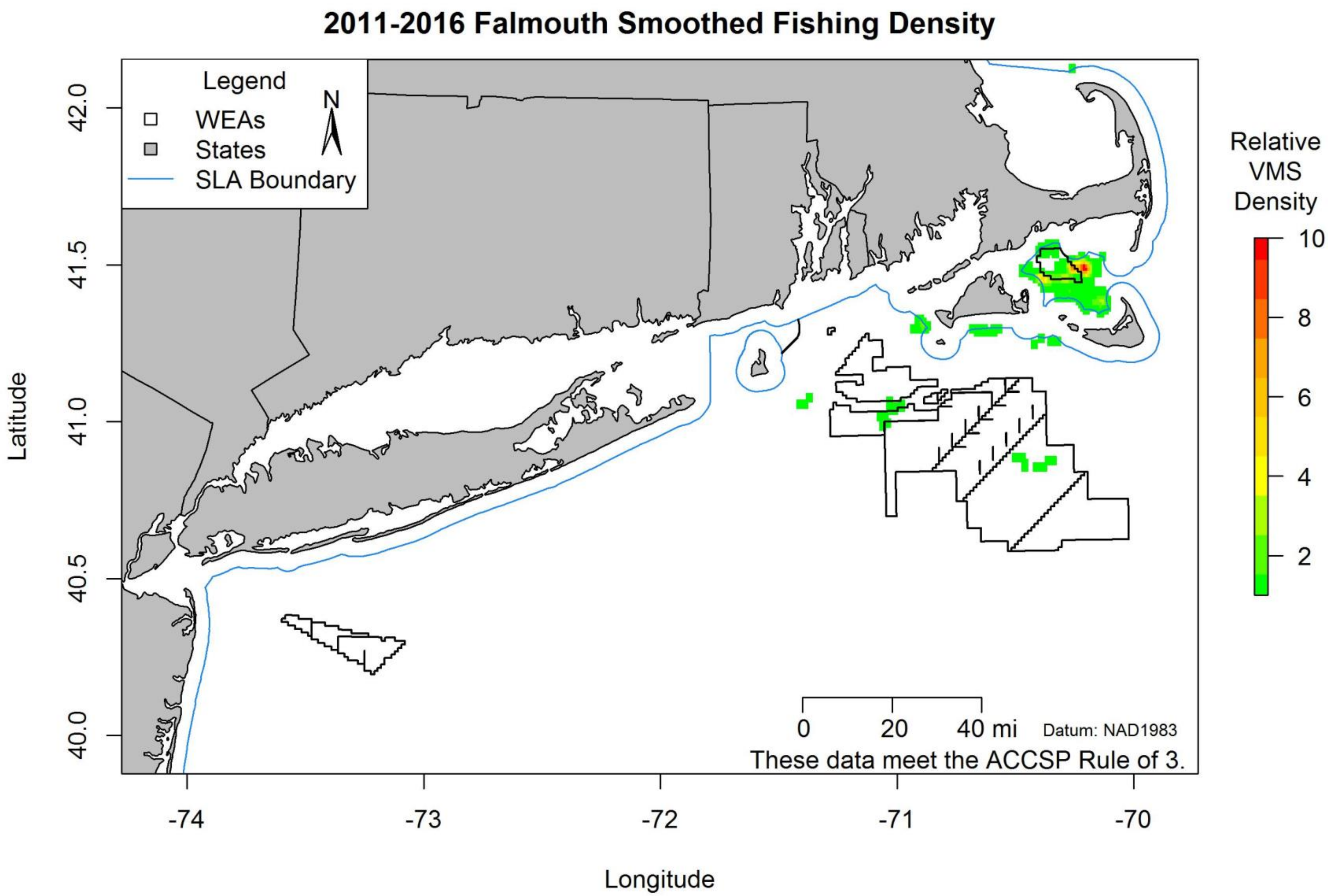

Figure 25. Smoothed federal fishing activity (all fisheries) resulting in landings in Falmouth, MA between 2011 and 2016

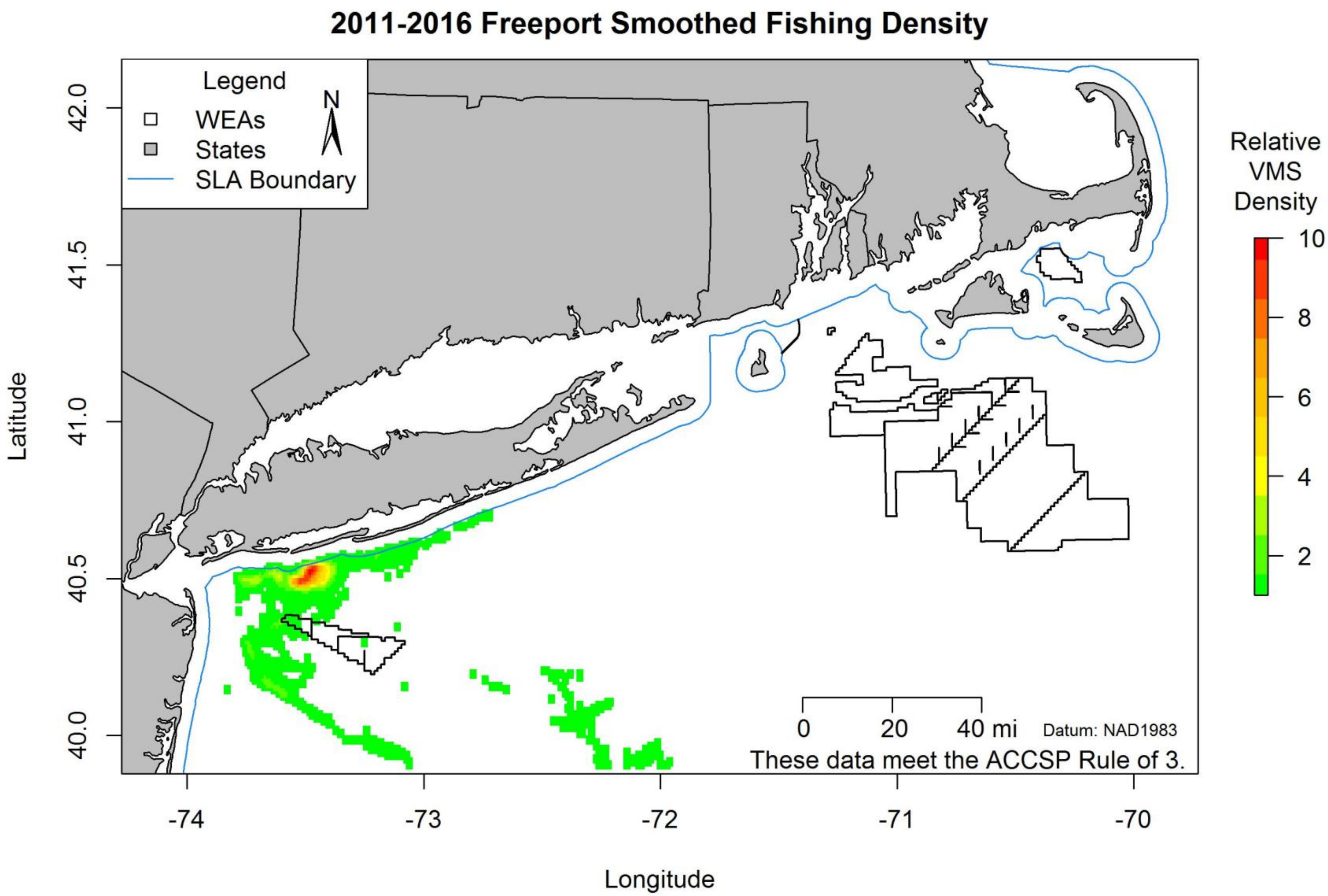

Figure 26. Smoothed federal fishing activity (all fisheries) resulting in landings in Freeport, NY between 2011 and 2016

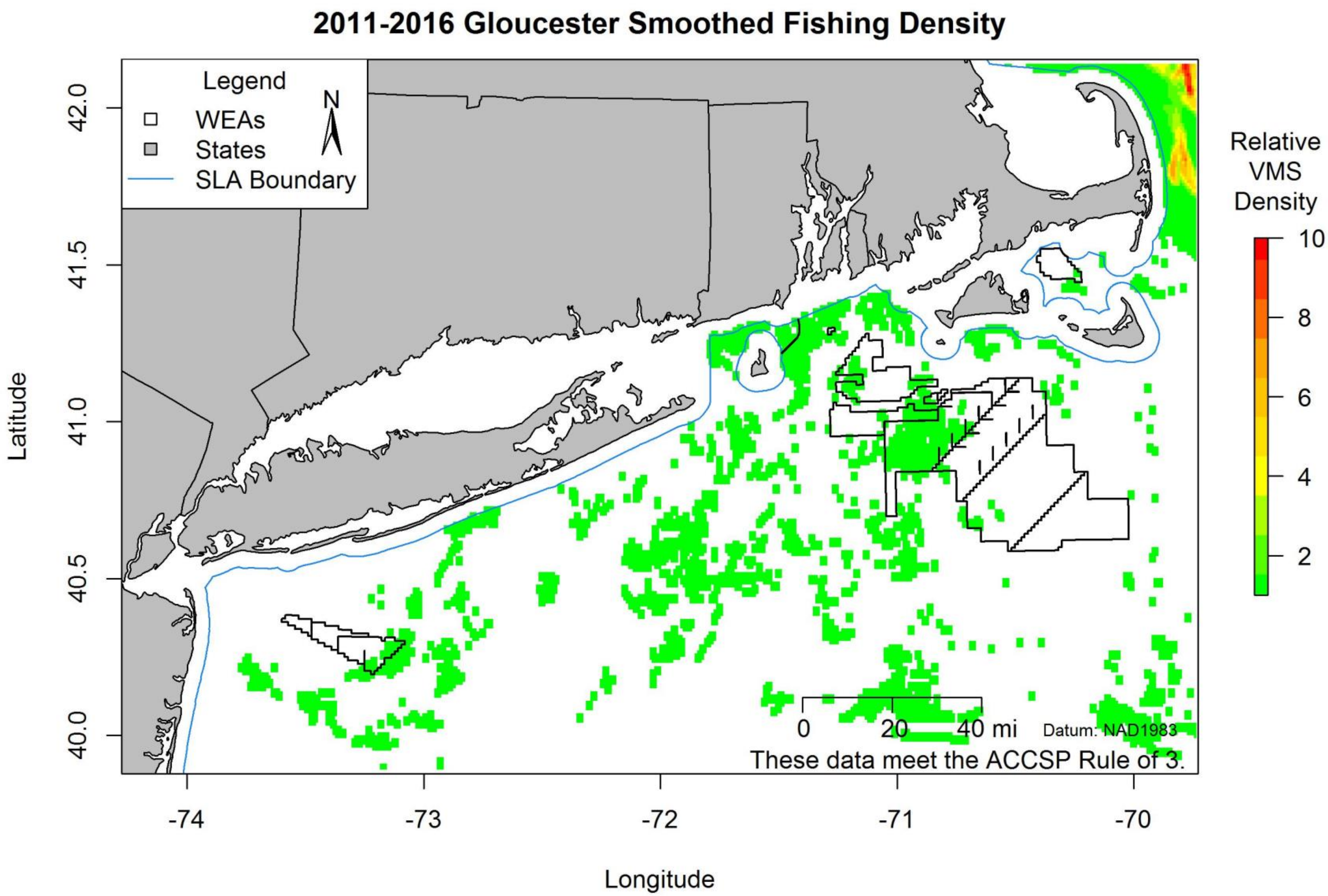

Figure 27. Smoothed federal fishing activity (all fisheries) resulting in landings in Gloucester, MA between 2011 and 2016

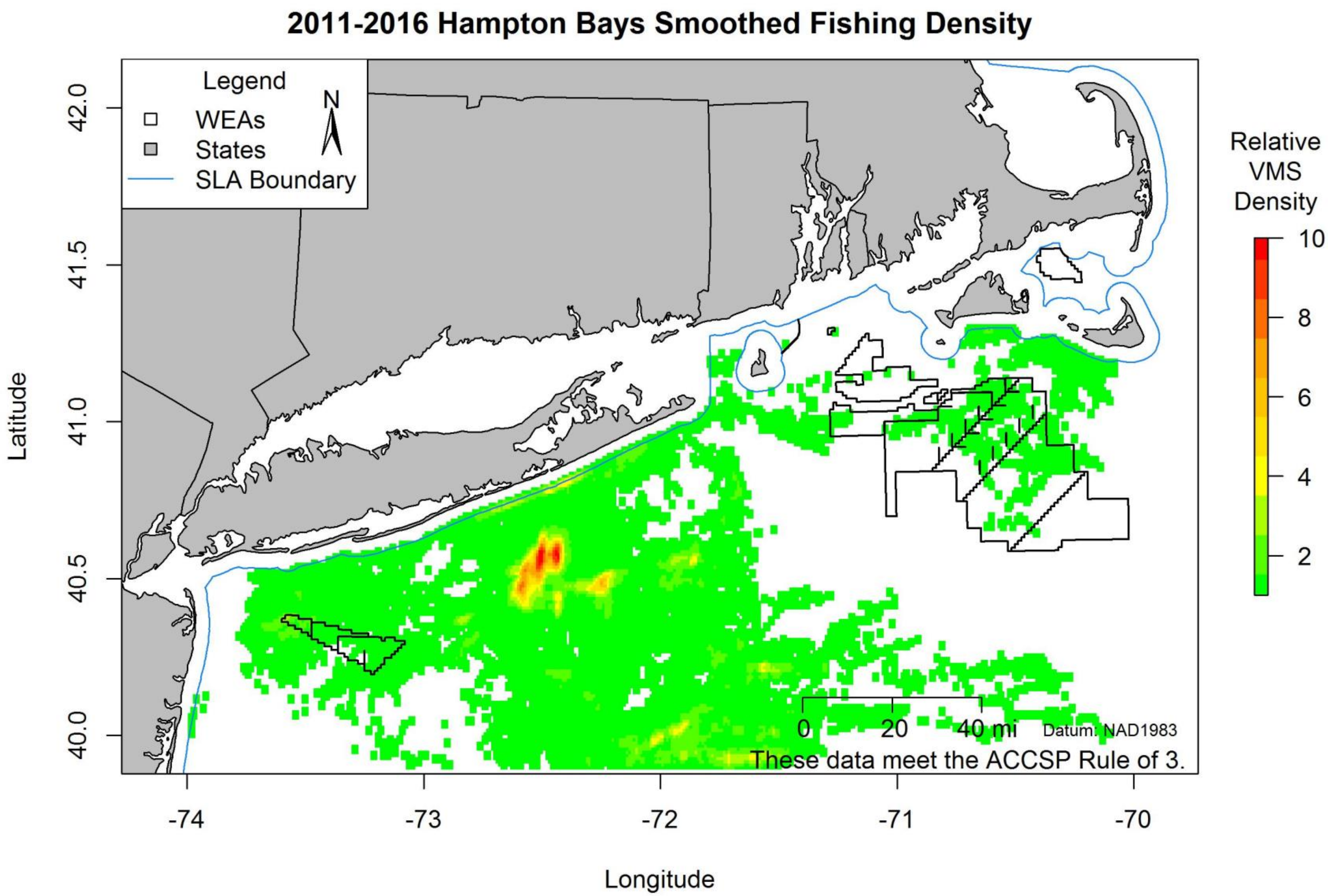

Figure 28. Smoothed federal fishing activity (all fisheries) resulting in landings in Hampton Bays, NY between 2011 and 2016

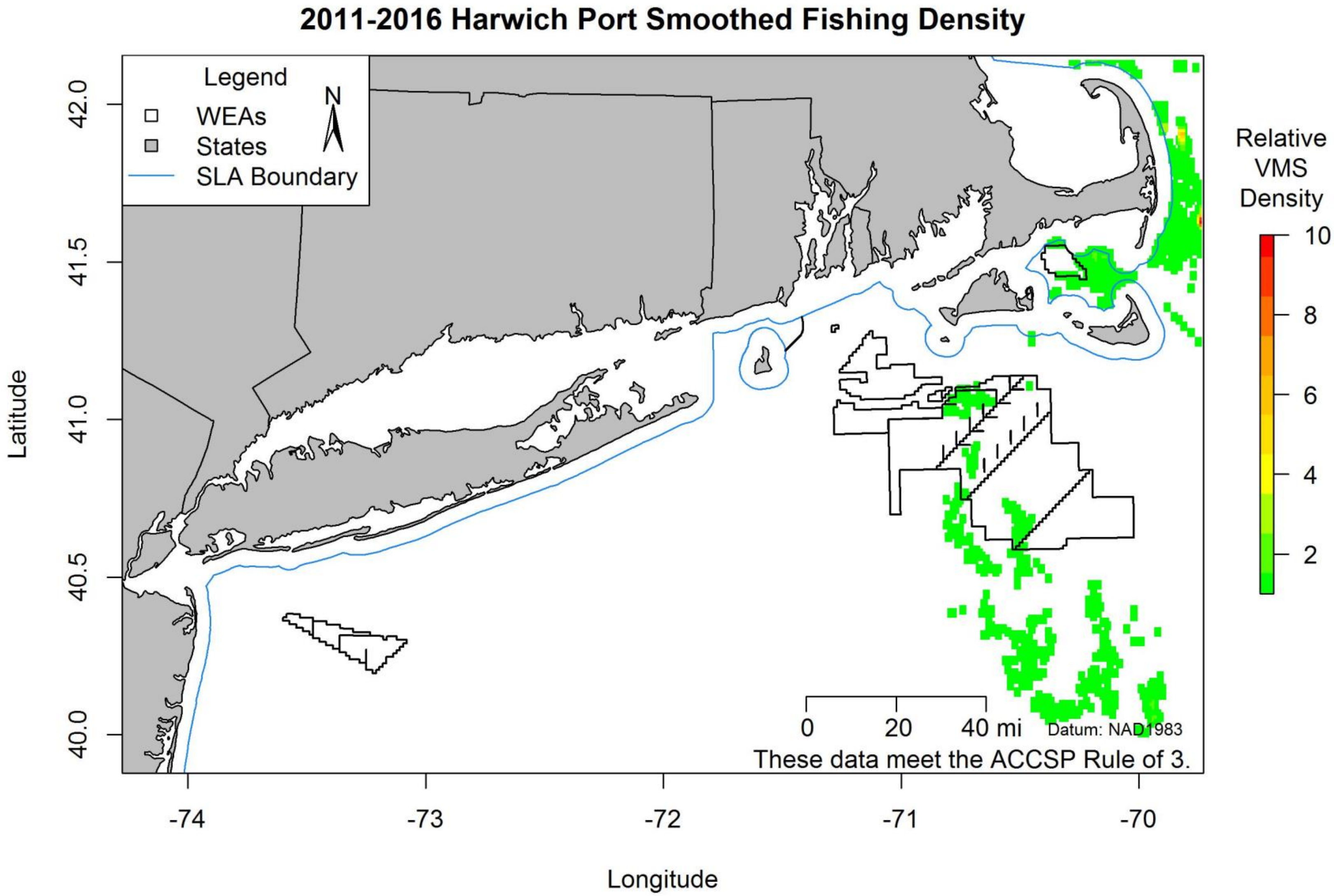

Figure 29. Smoothed federal fishing activity (all fisheries) resulting in landings in Harwich Port, MA between 2011 and 2016

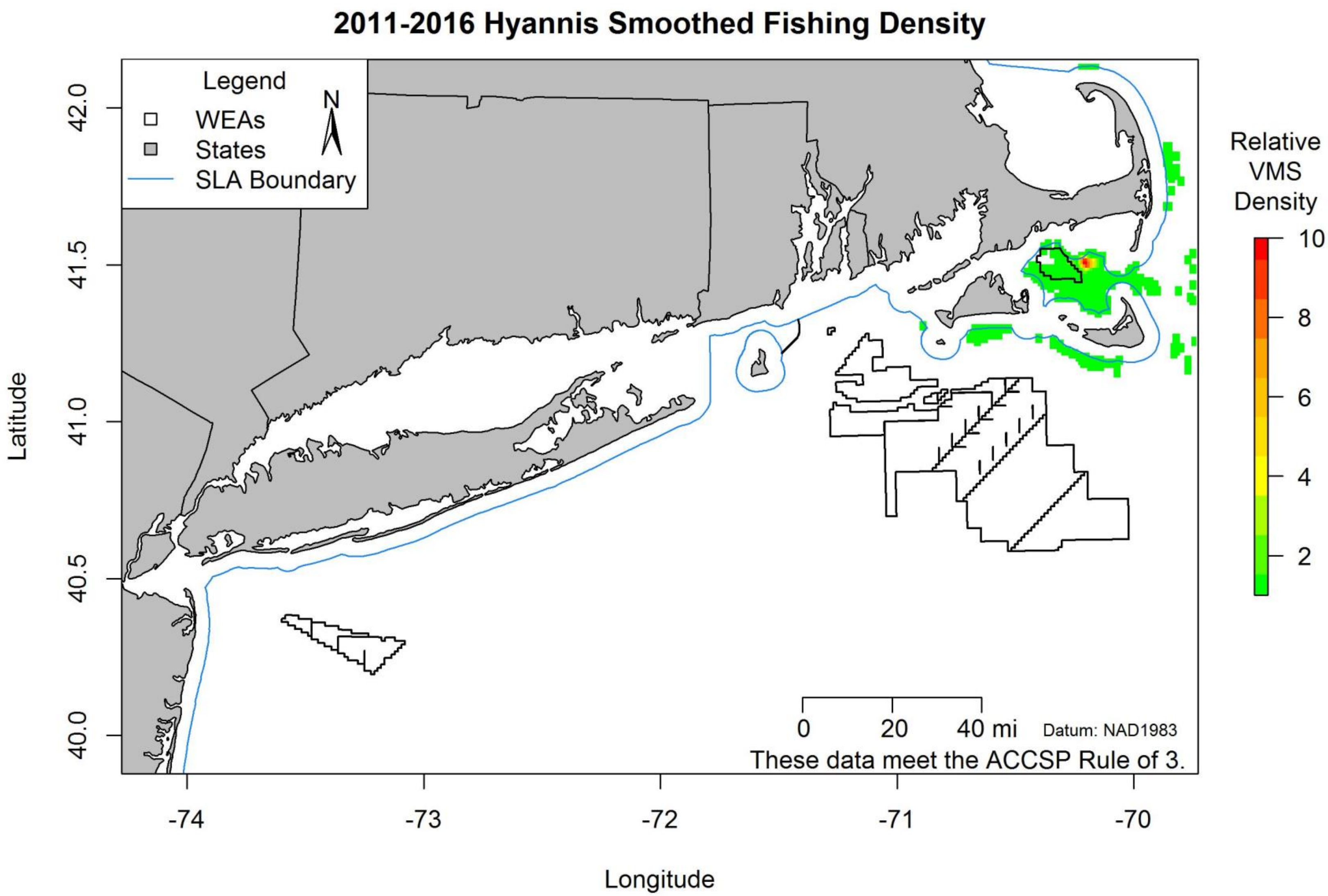

Figure 30. Smoothed federal fishing activity (all fisheries) resulting in landings in Hyannis, MA between 2011 and 2016

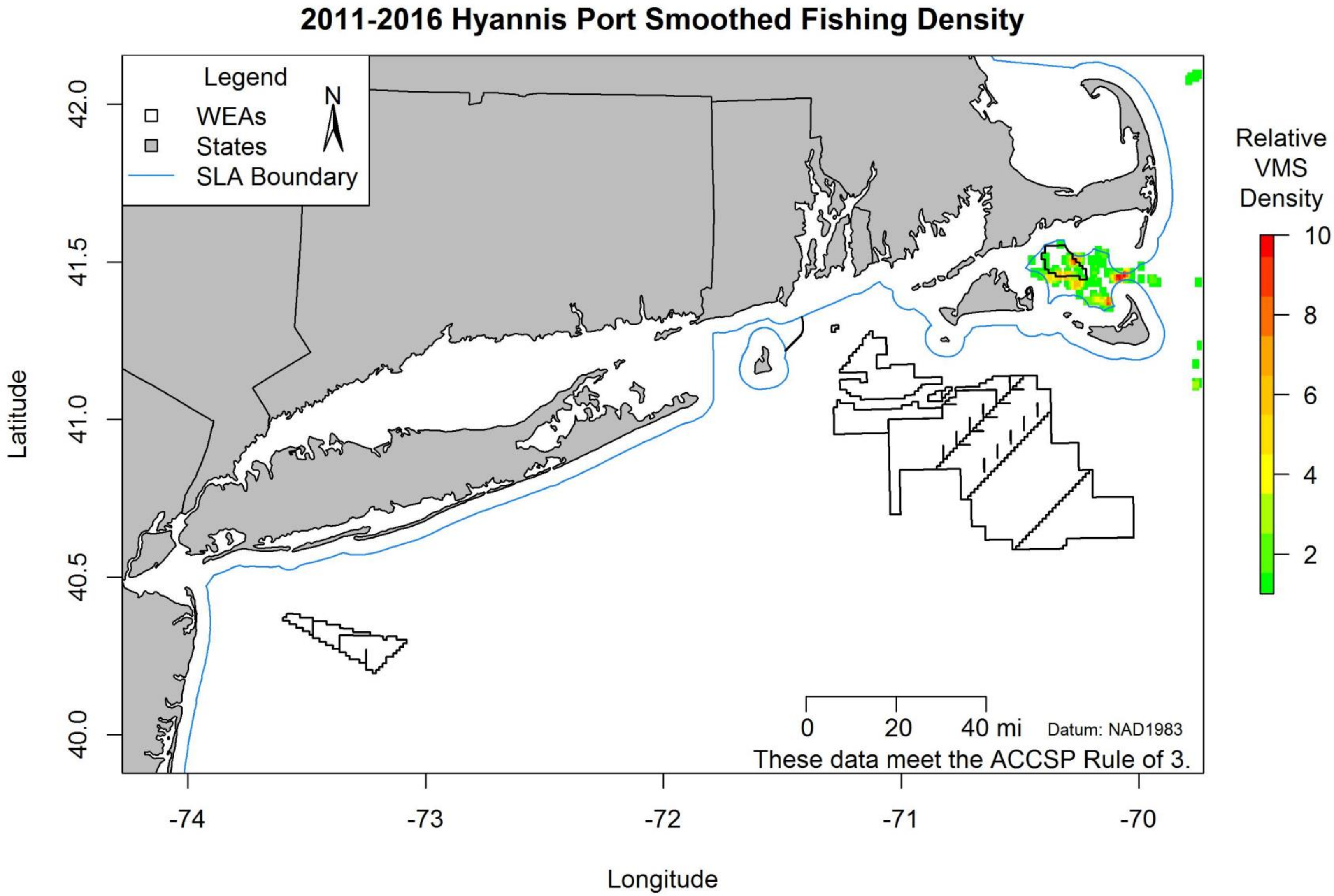

Figure 31. Smoothed federal fishing activity (all fisheries) resulting in landings in Hyannis Port, MA between 2011 and 2016

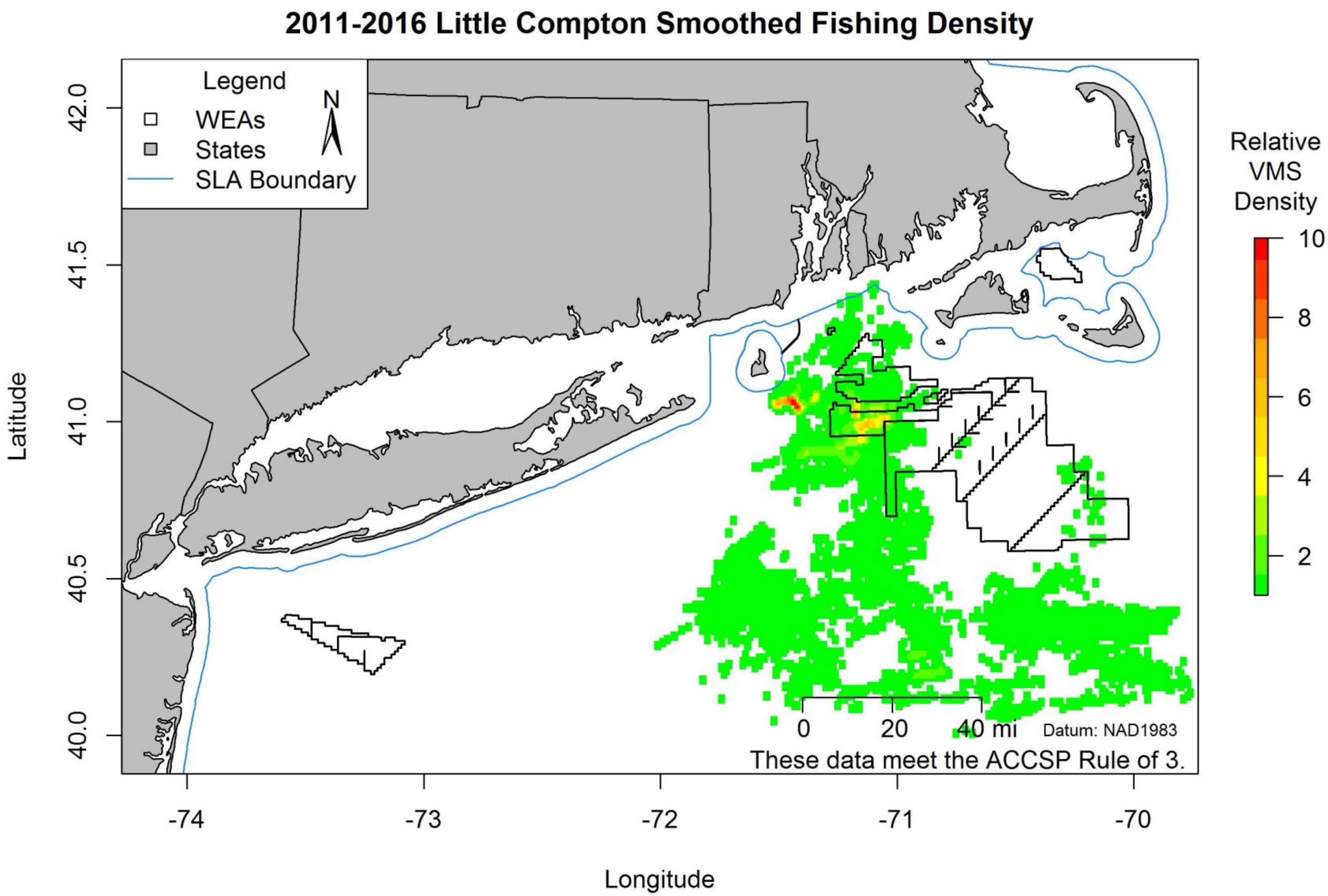

Figure 32. Smoothed federal fishing activity (all fisheries) resulting in landings in Little Compton, RI between 2011 and 2016

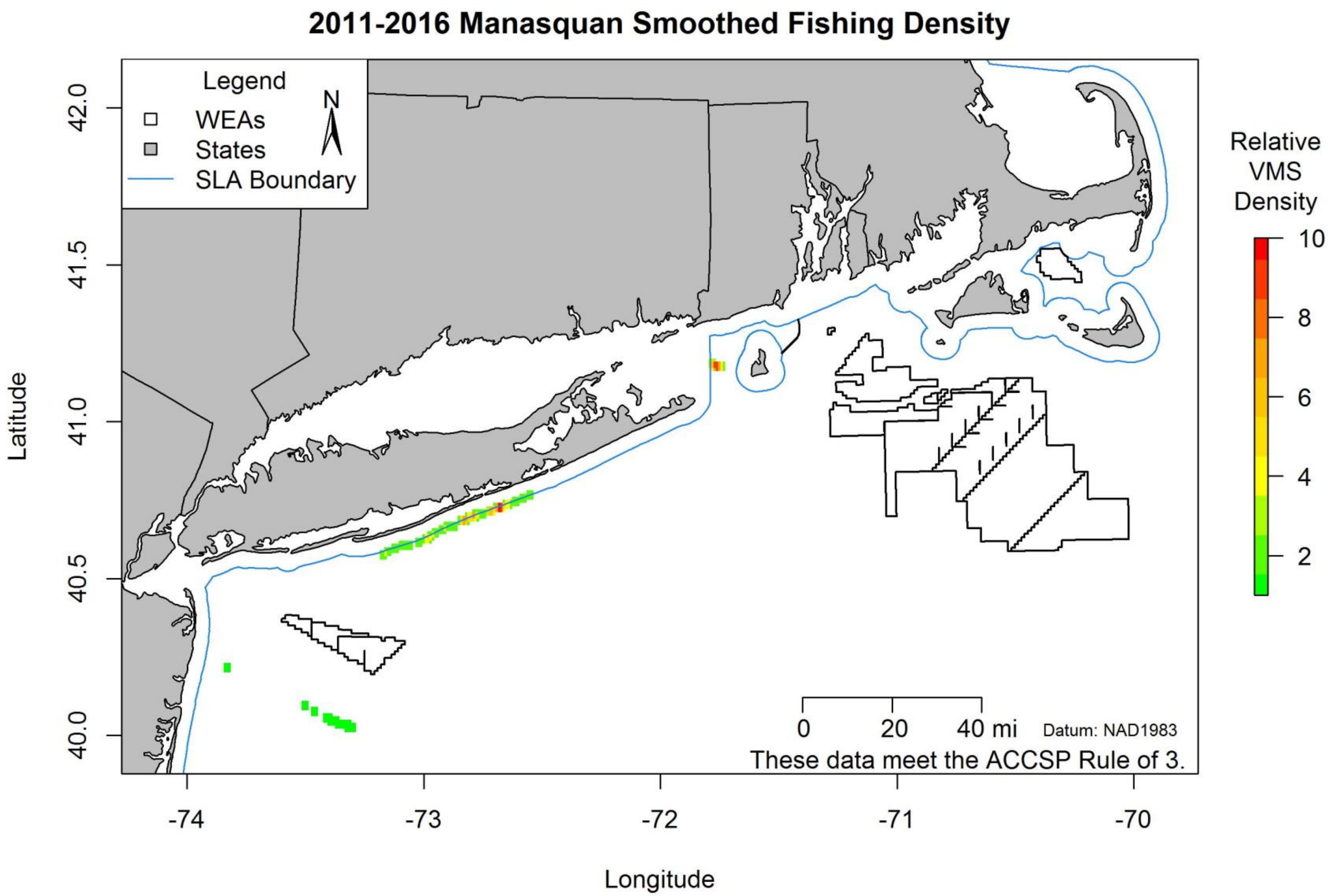

Figure 33. Smoothed federal fishing activity (all fisheries) resulting in landings in Manasquan, NJ between 2011 and 2016

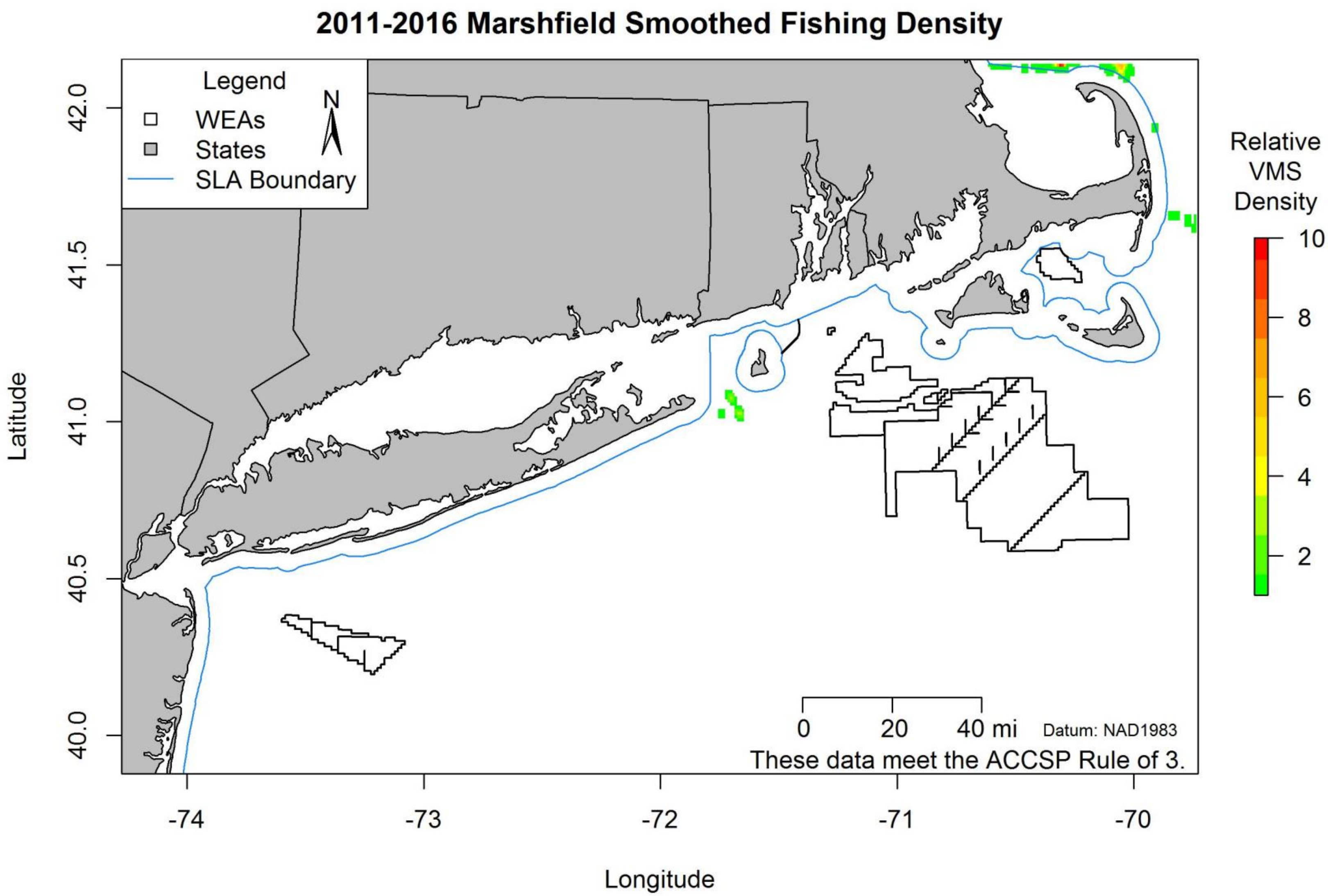

Figure 34. Smoothed federal fishing activity (all fisheries) resulting in landings in Marshfield, MA between 2011 and 2016

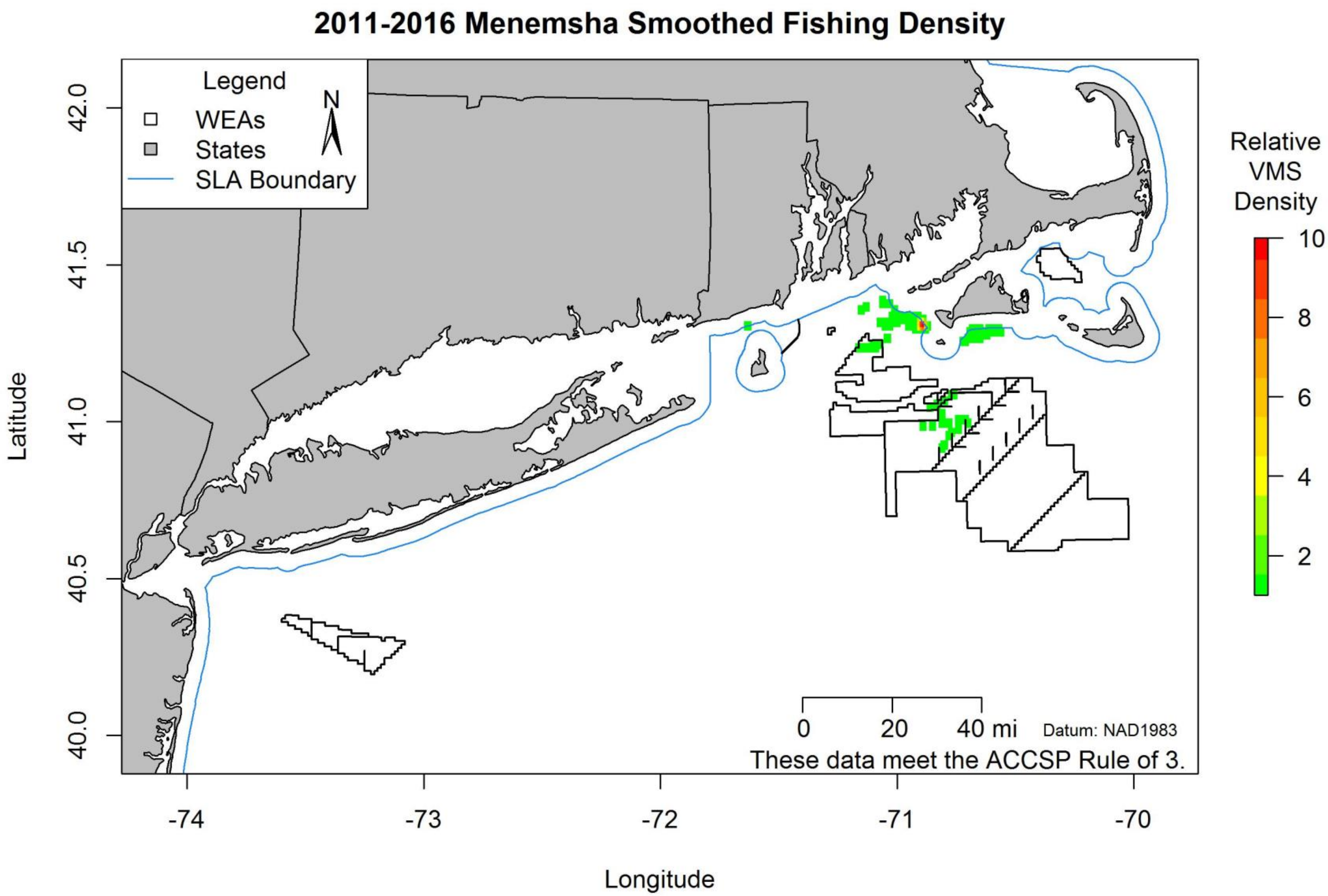

Figure 35. Smoothed federal fishing activity (all fisheries) resulting in landings in Menemsha, MA between 2011 and 2016

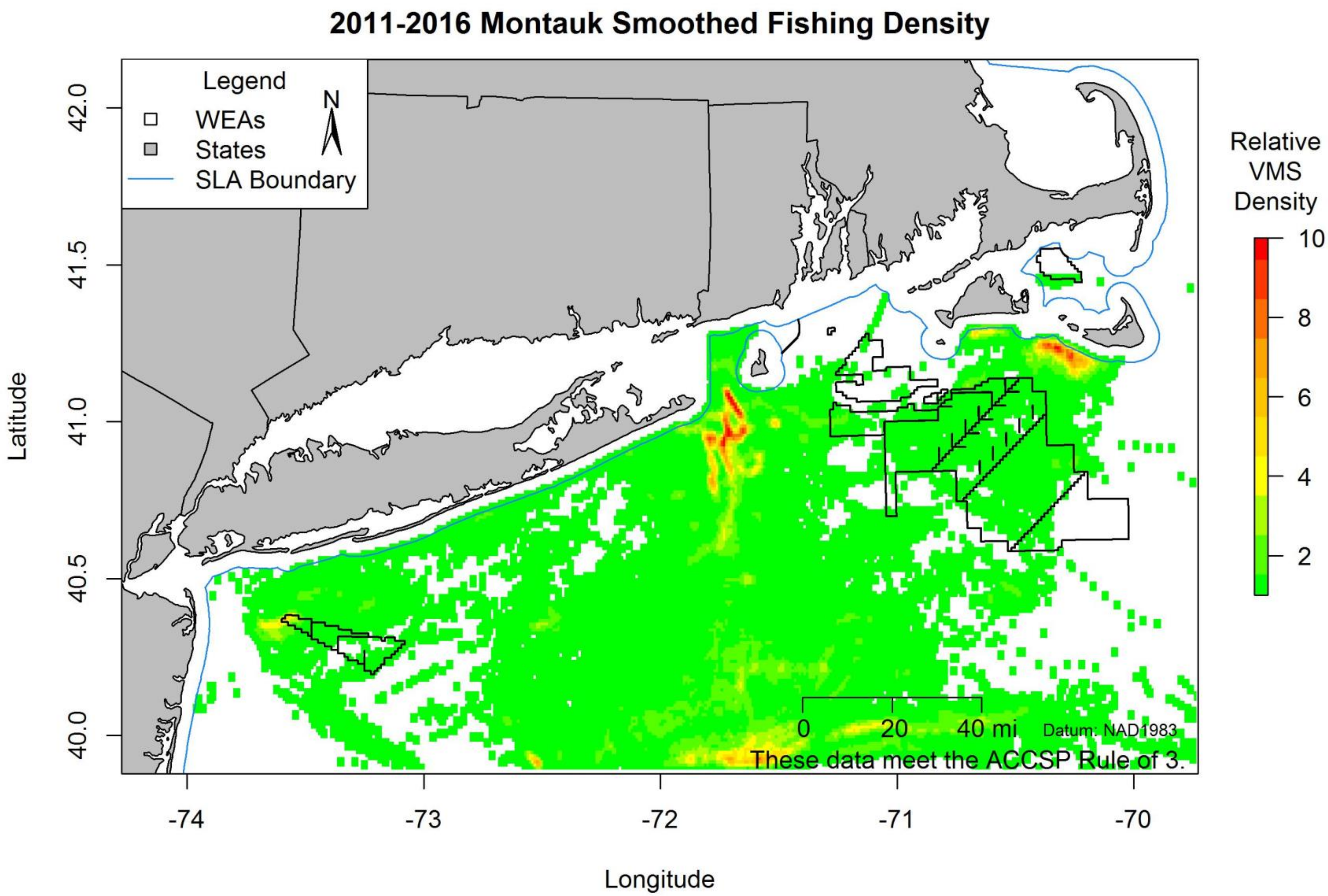

Figure 36. Smoothed federal fishing activity (all fisheries) resulting in landings in Montauk, NY between 2011 and 2016

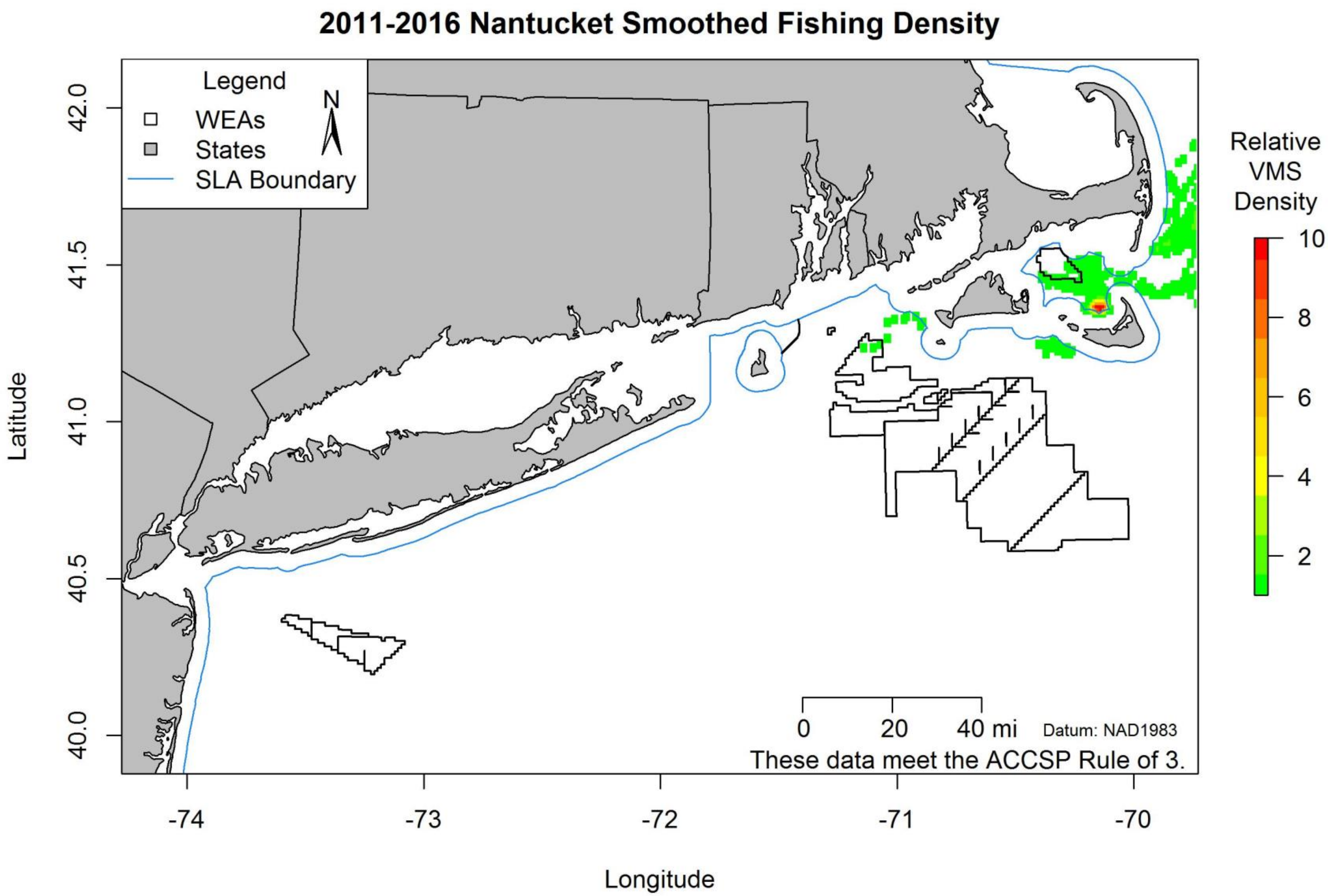

Figure 37. Smoothed federal fishing activity (all fisheries) resulting in landings in Nantucket, MA between 2011 and 2016

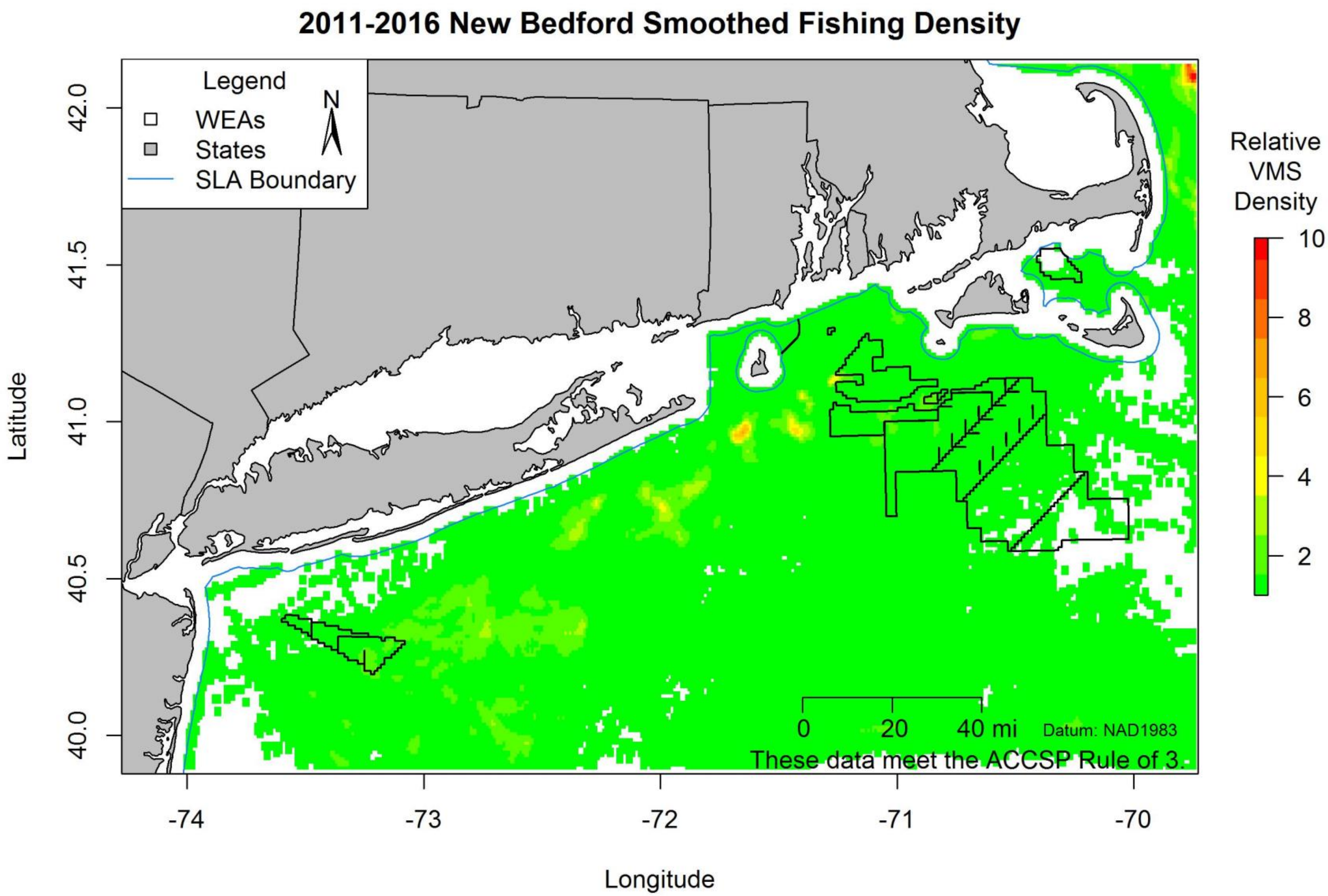

Figure 38. Smoothed federal fishing activity (all fisheries) resulting in landings in New Bedford, MA between 2011 and 2016

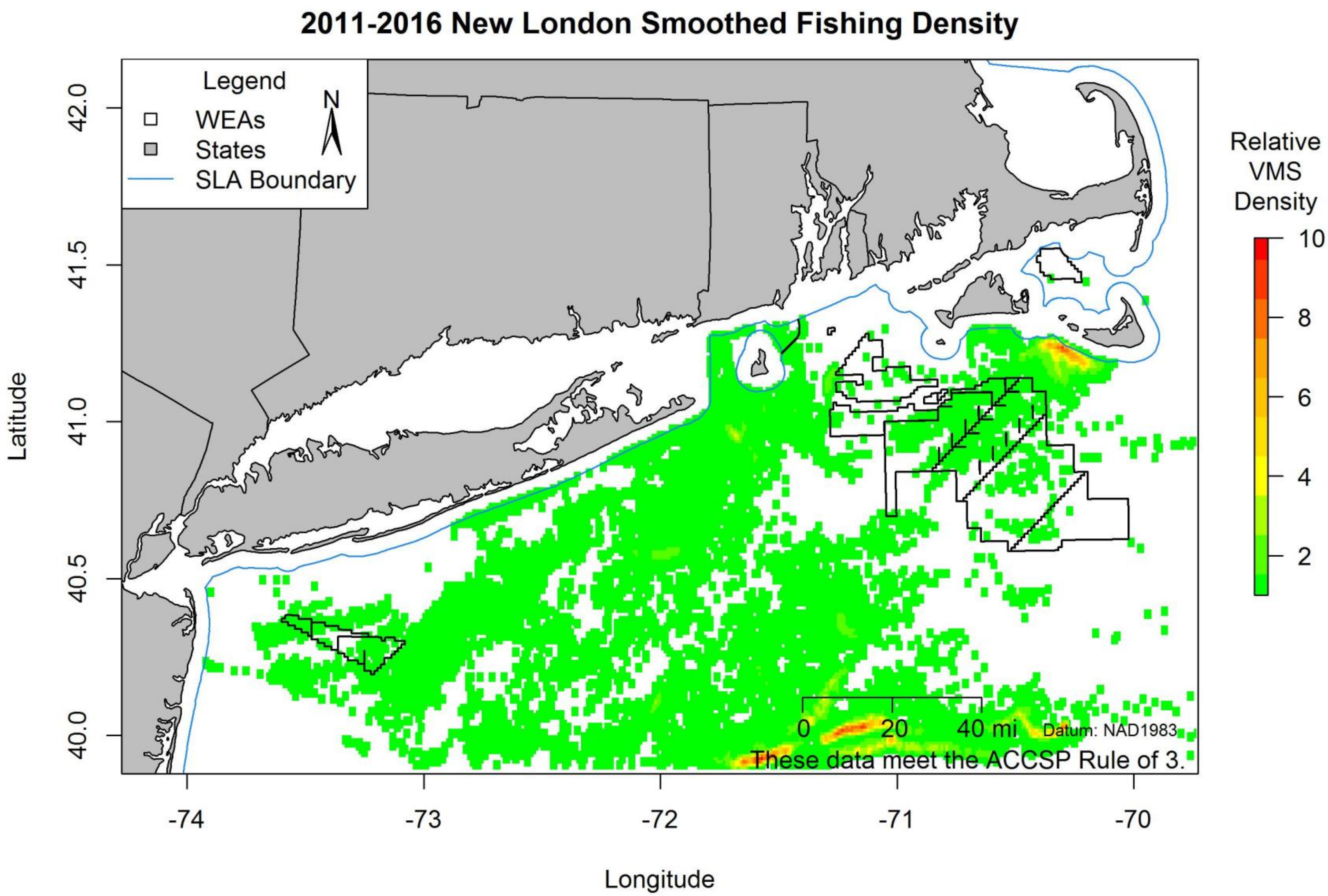

Figure 39. Smoothed federal fishing activity (all fisheries) resulting in landings in New London, CT between 2011 and 2016

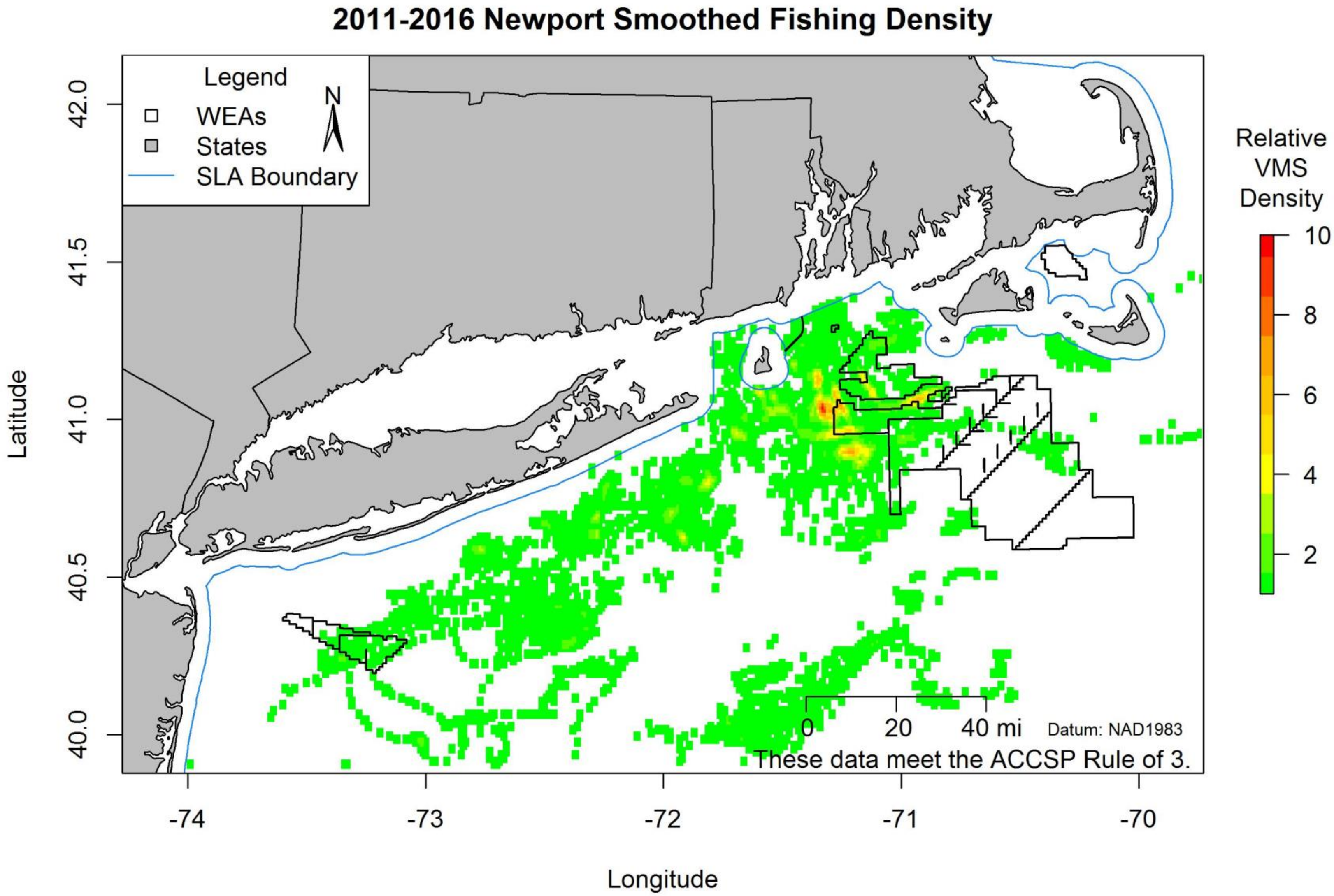

Figure 40. Smoothed federal fishing activity (all fisheries) resulting in landings in Newport, RI between 2011 and 2016

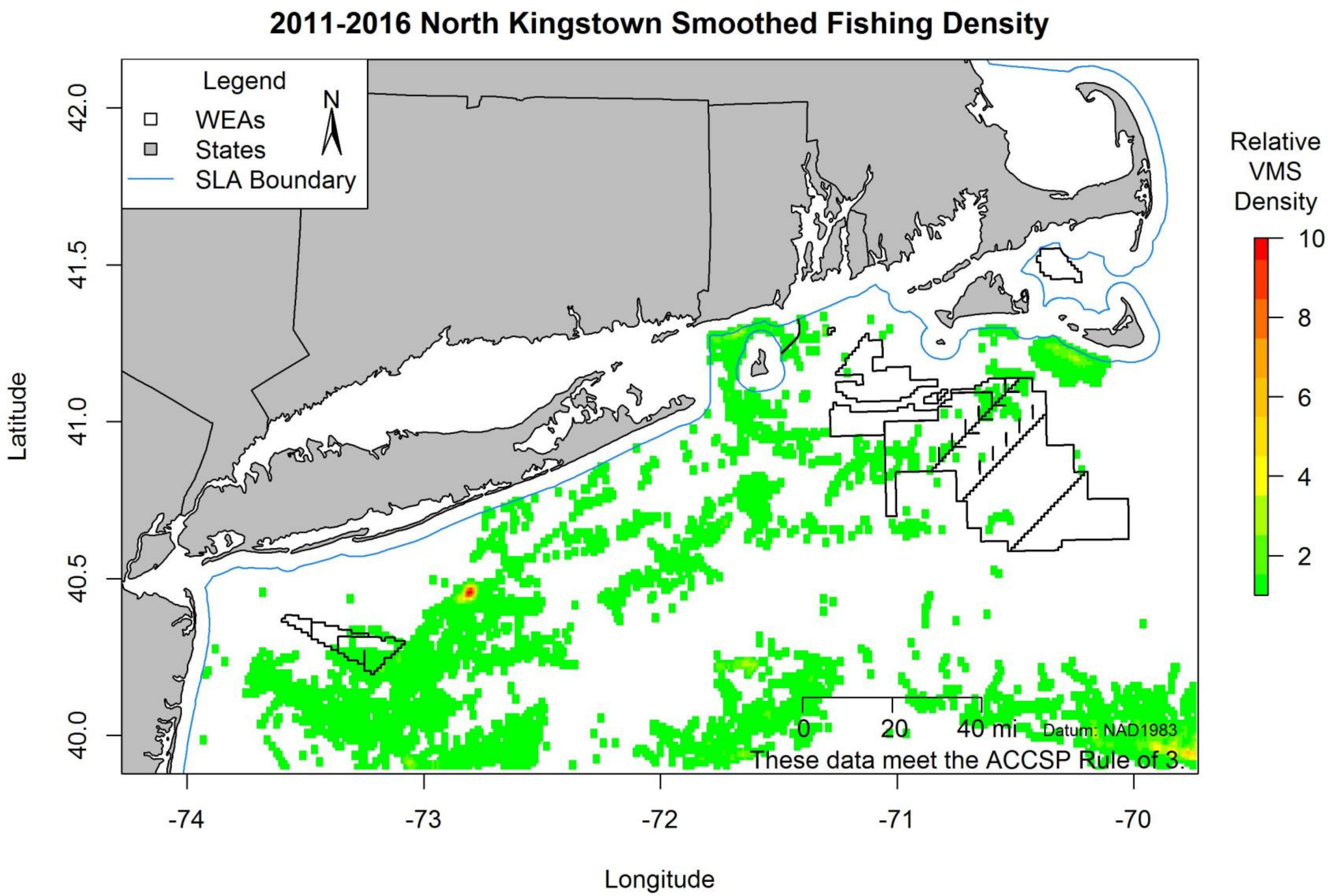

Figure 41. Smoothed federal fishing activity (all fisheries) resulting in landings in North Kingstown, RI between 2011 and 2016

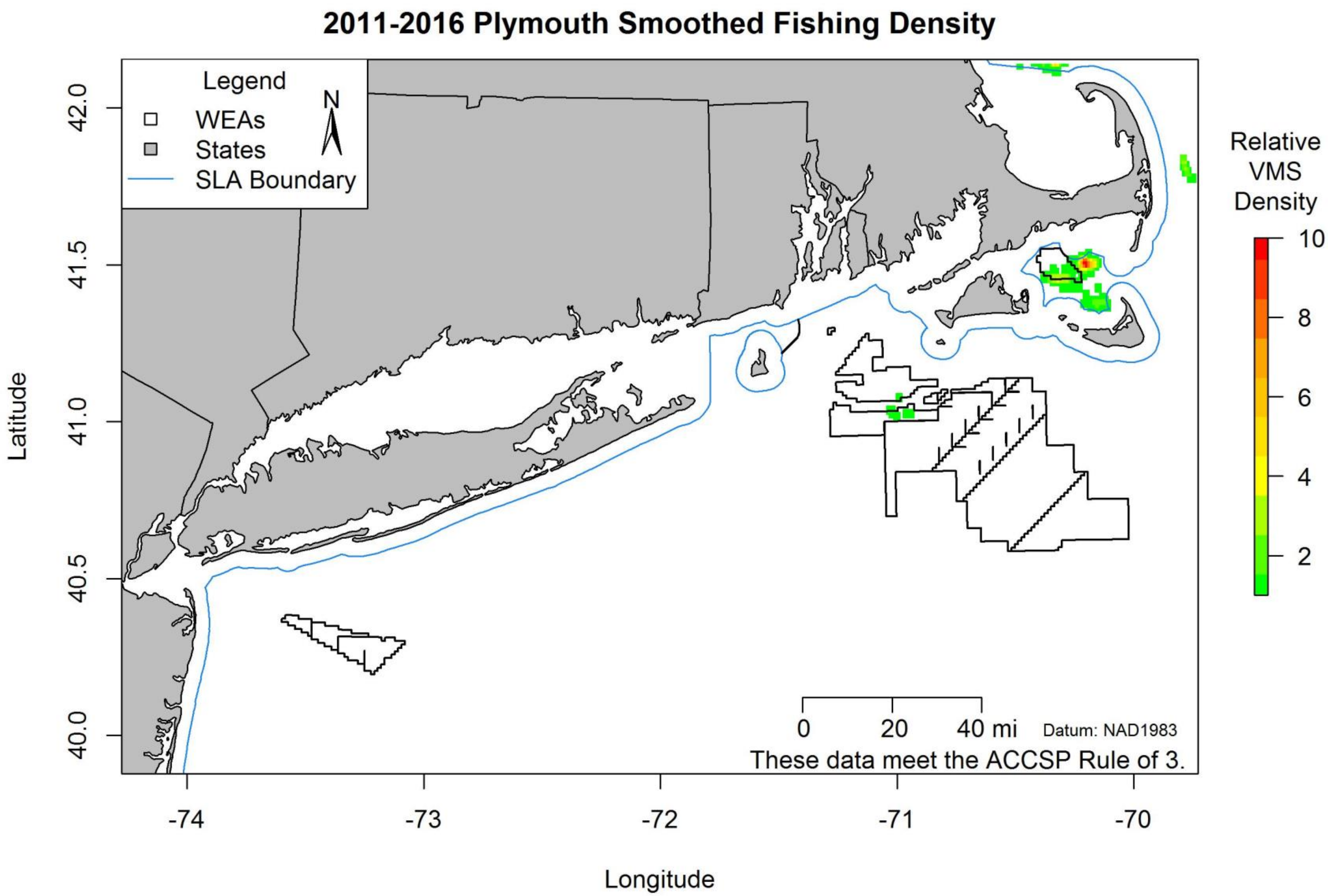

Figure 42. Smoothed federal fishing activity (all fisheries) resulting in landings in Plymouth, MA between 2011 and 2016

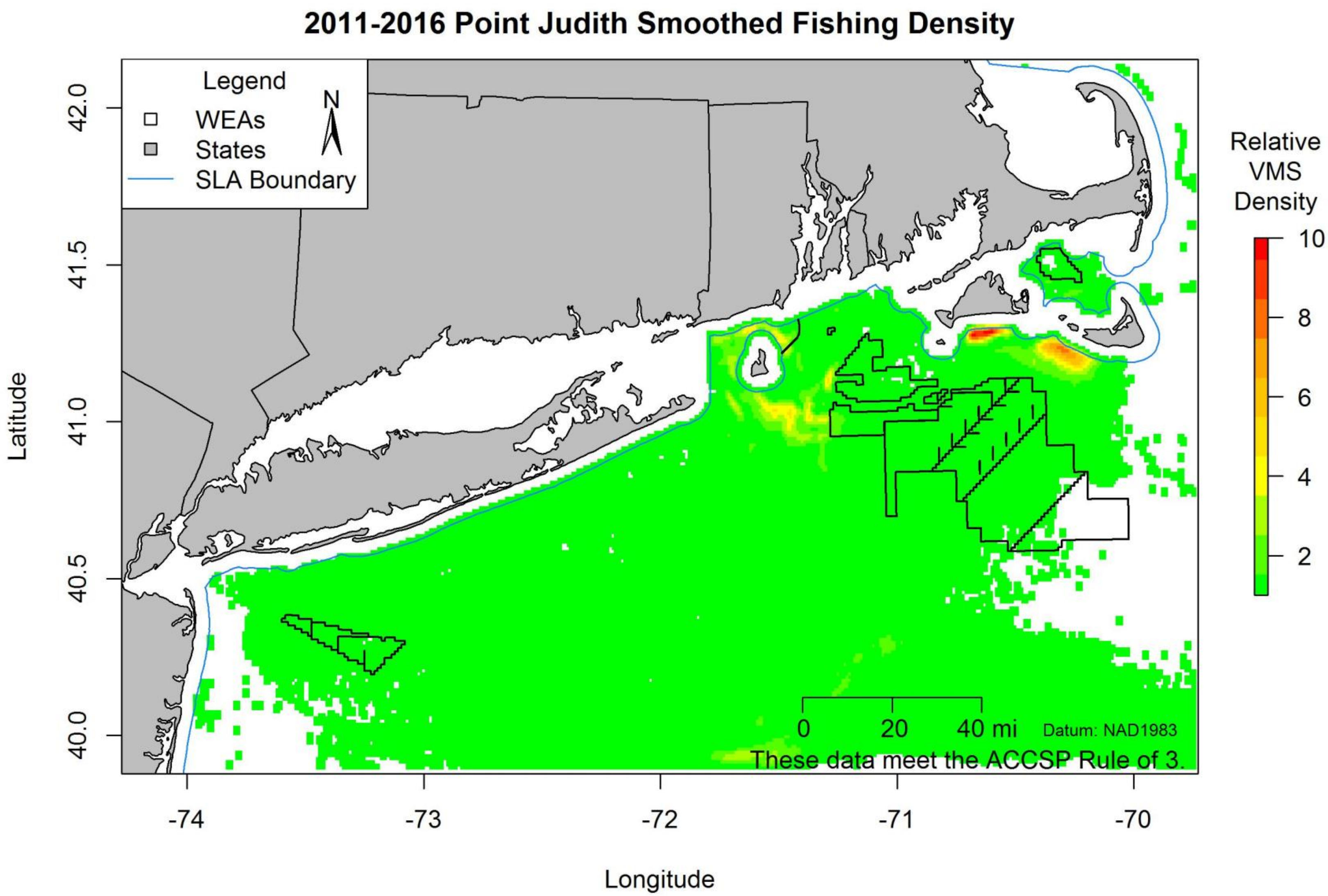

Figure 43. Smoothed federal fishing activity (all fisheries) resulting in landings in Point Judith, RI between 2011 and 2016

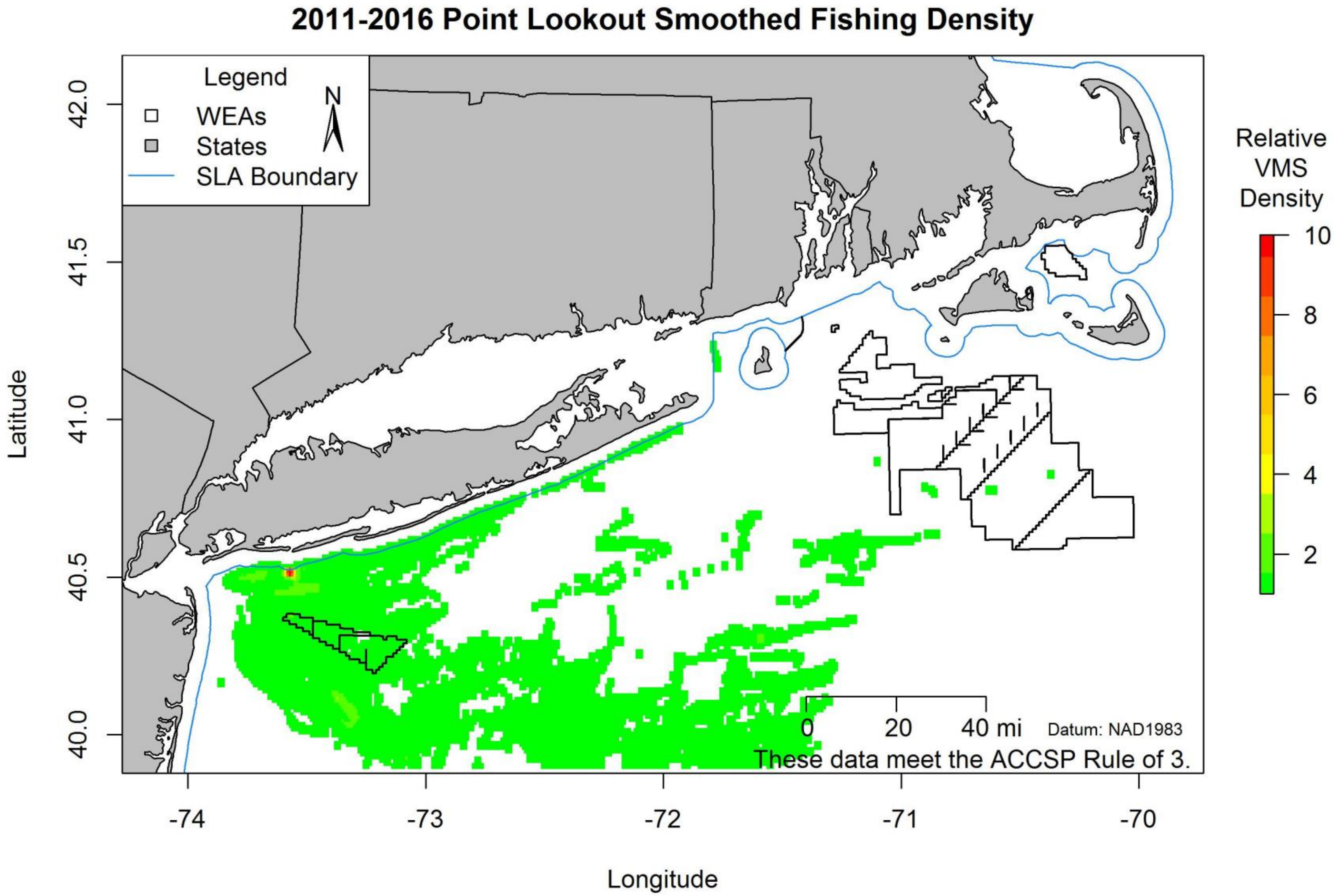

Figure 44. Smoothed federal fishing activity (all fisheries) resulting in landings in Point Lookout, NY between 2011 and 2016

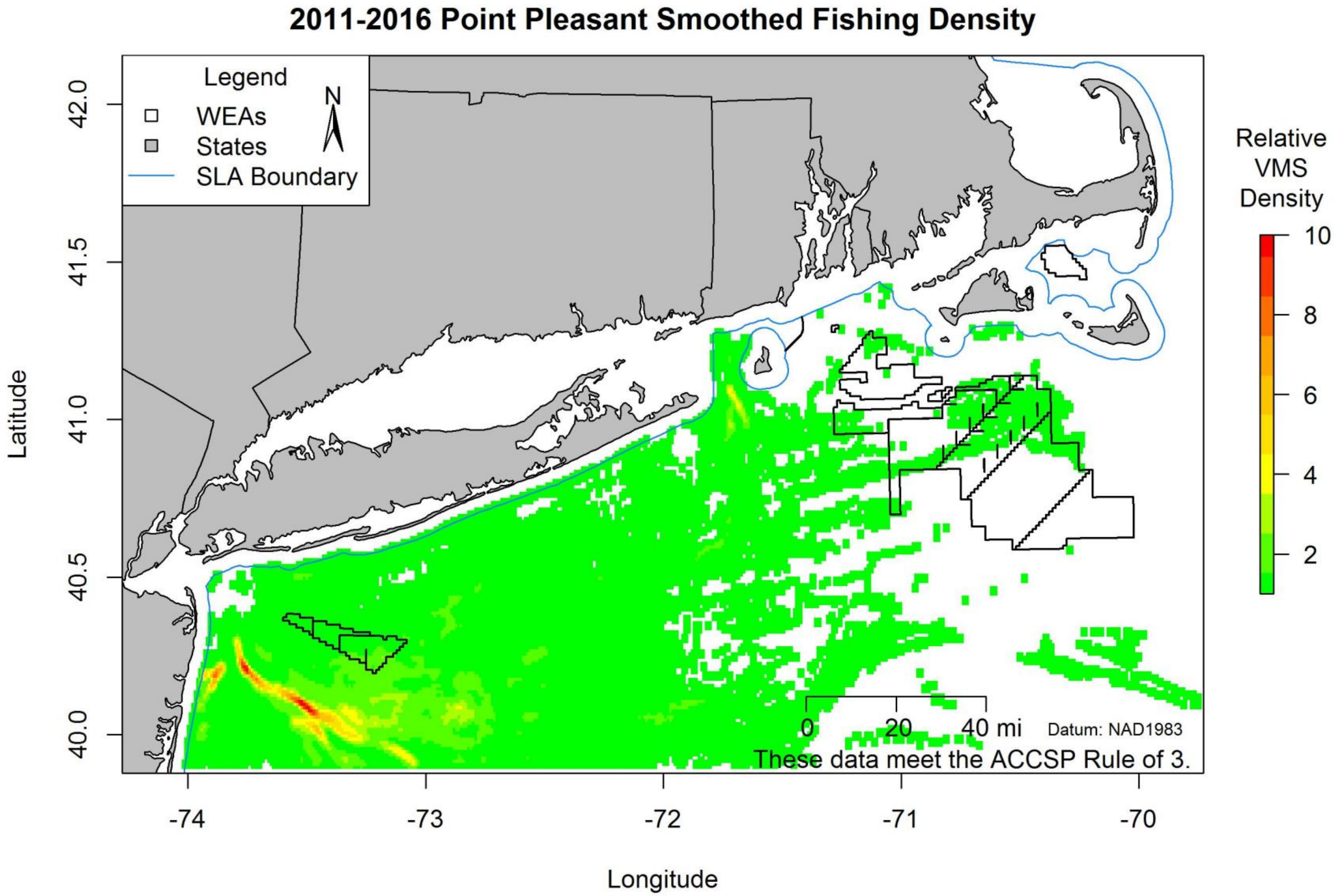

Figure 45. Smoothed federal fishing activity (all fisheries) resulting in landings in Point Pleasant, NJ between 2011 and 2016

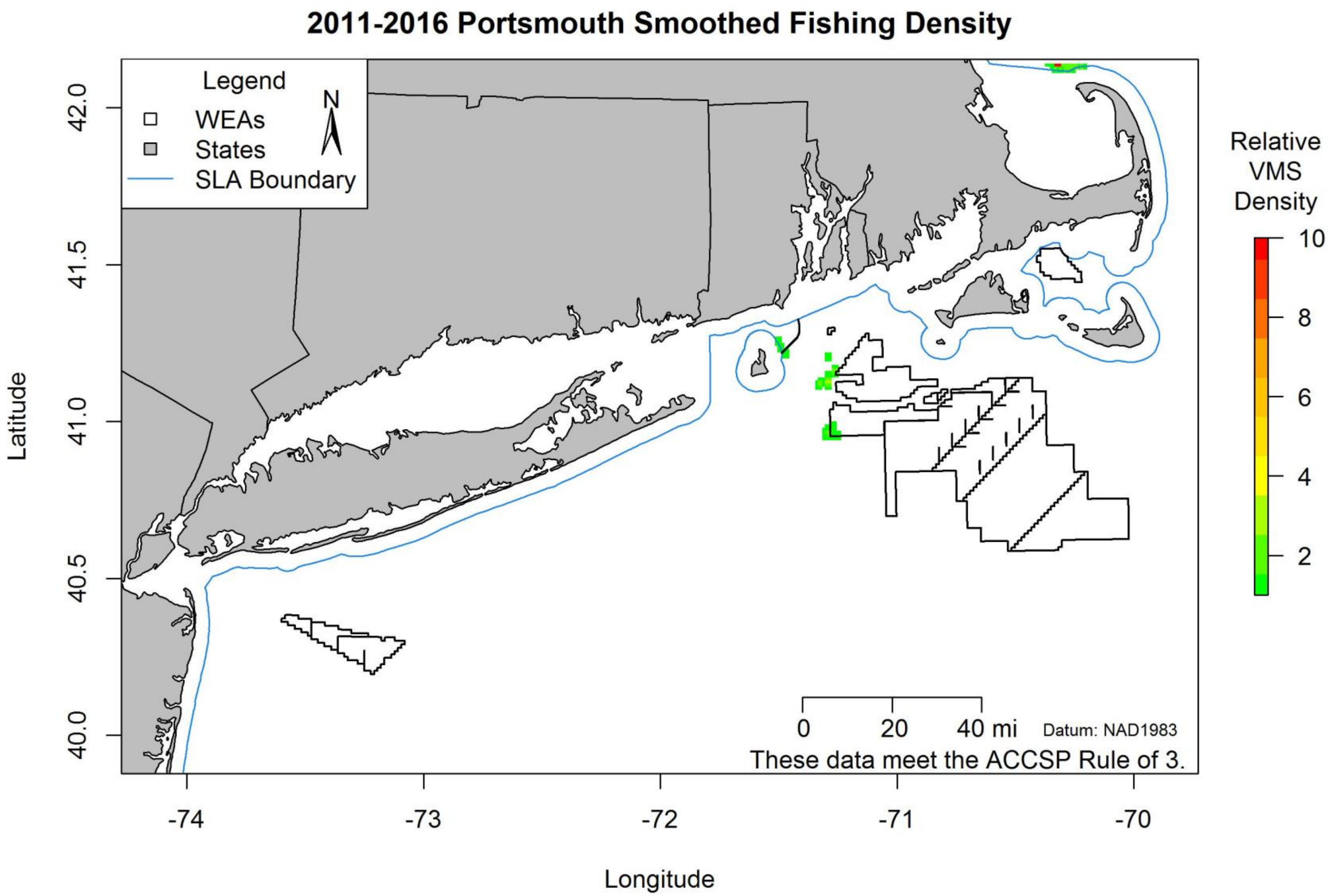

Figure 46. Smoothed federal fishing activity (all fisheries) resulting in landings in Portsmouth, NH between 2011 and 2016. None of this fishing activity occurred within any of the WEAs.

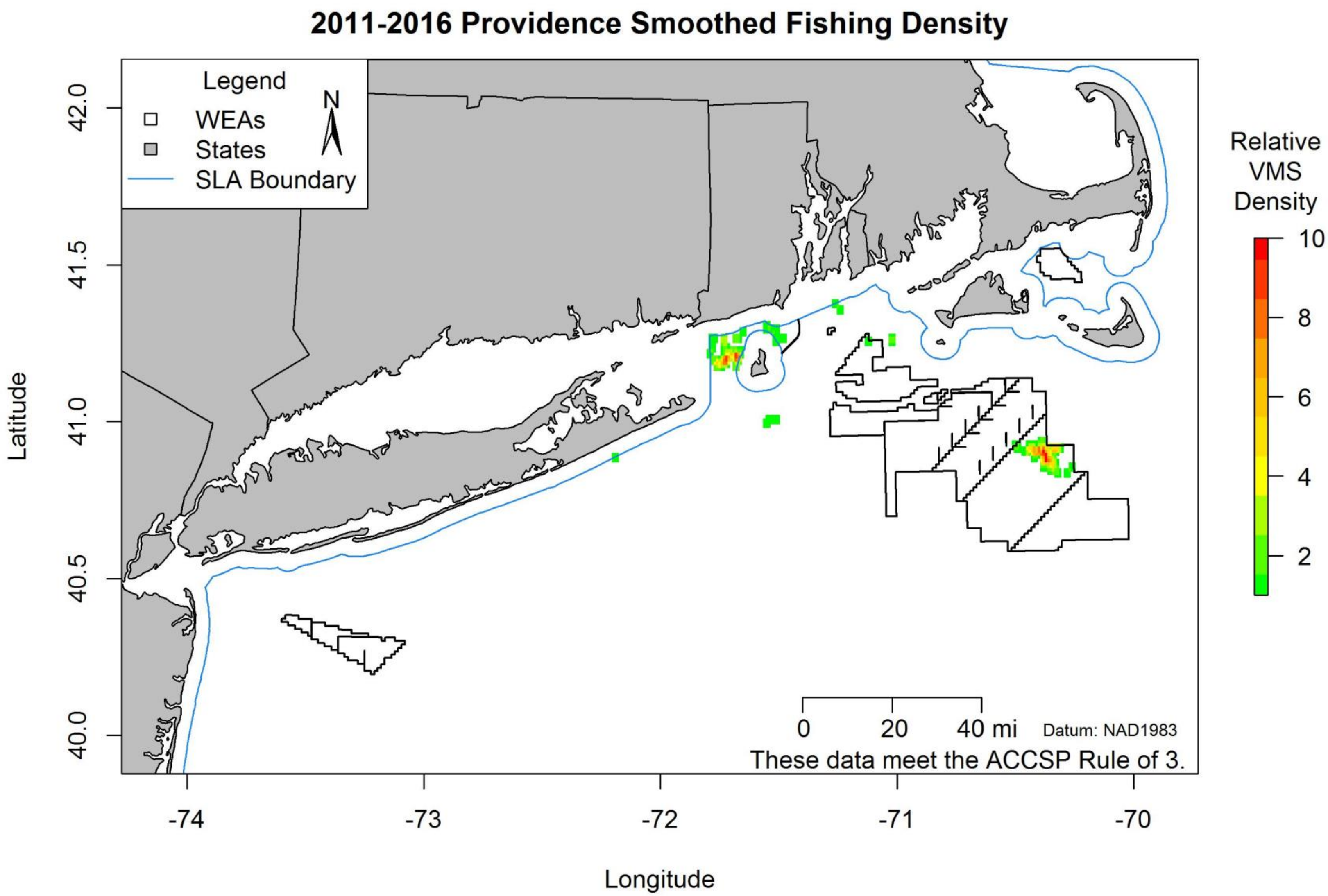

Figure 47. Smoothed federal fishing activity (all fisheries) resulting in landings in Providence, RI between 2011 and 2016

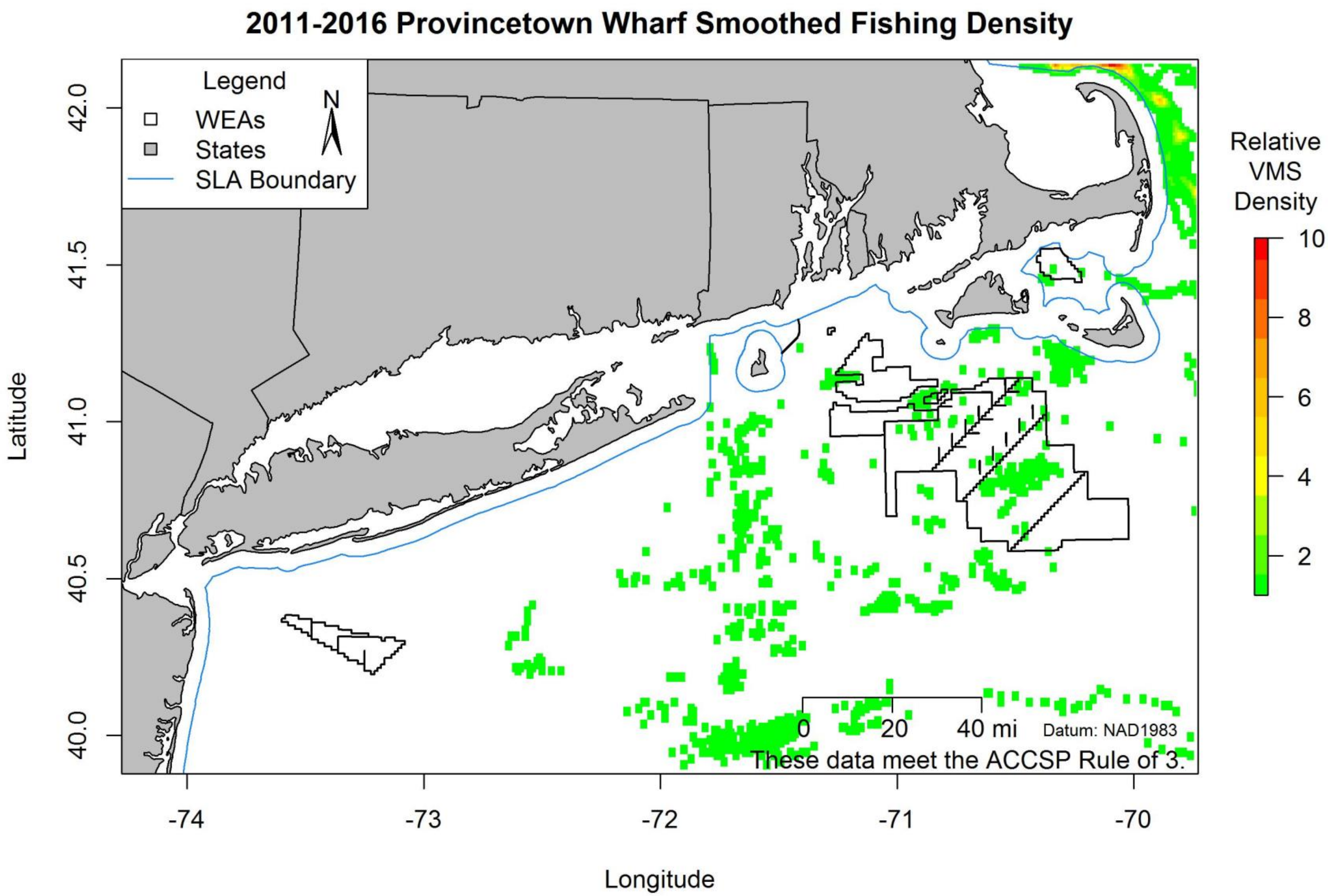

Figure 48. Smoothed federal fishing activity (all fisheries) resulting in landings in Provincetown Wharf, MA between 2011 and 2016

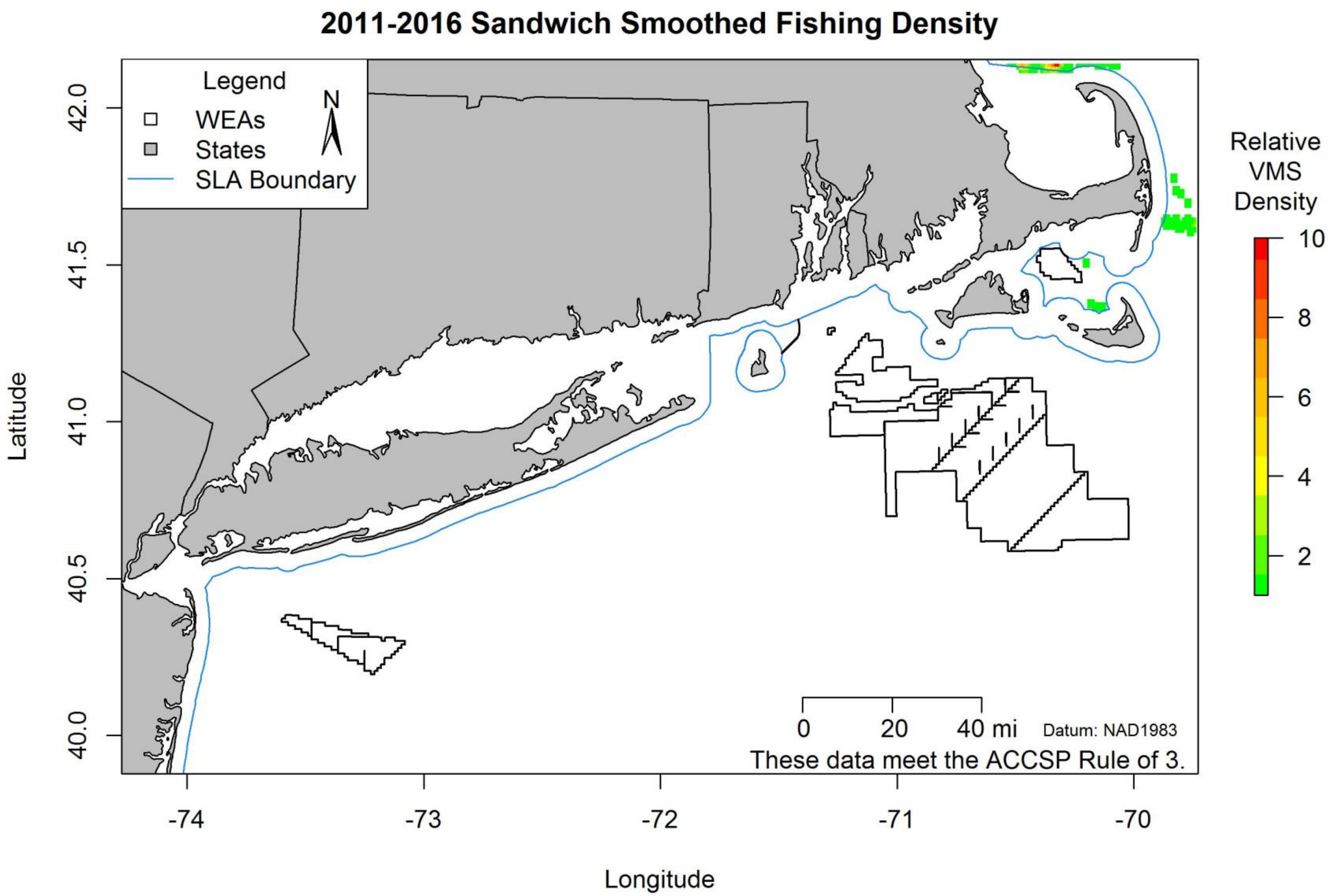

Figure 49. Smoothed federal fishing activity (all fisheries) resulting in landings in Sandwich, MA between 2011 and 2016

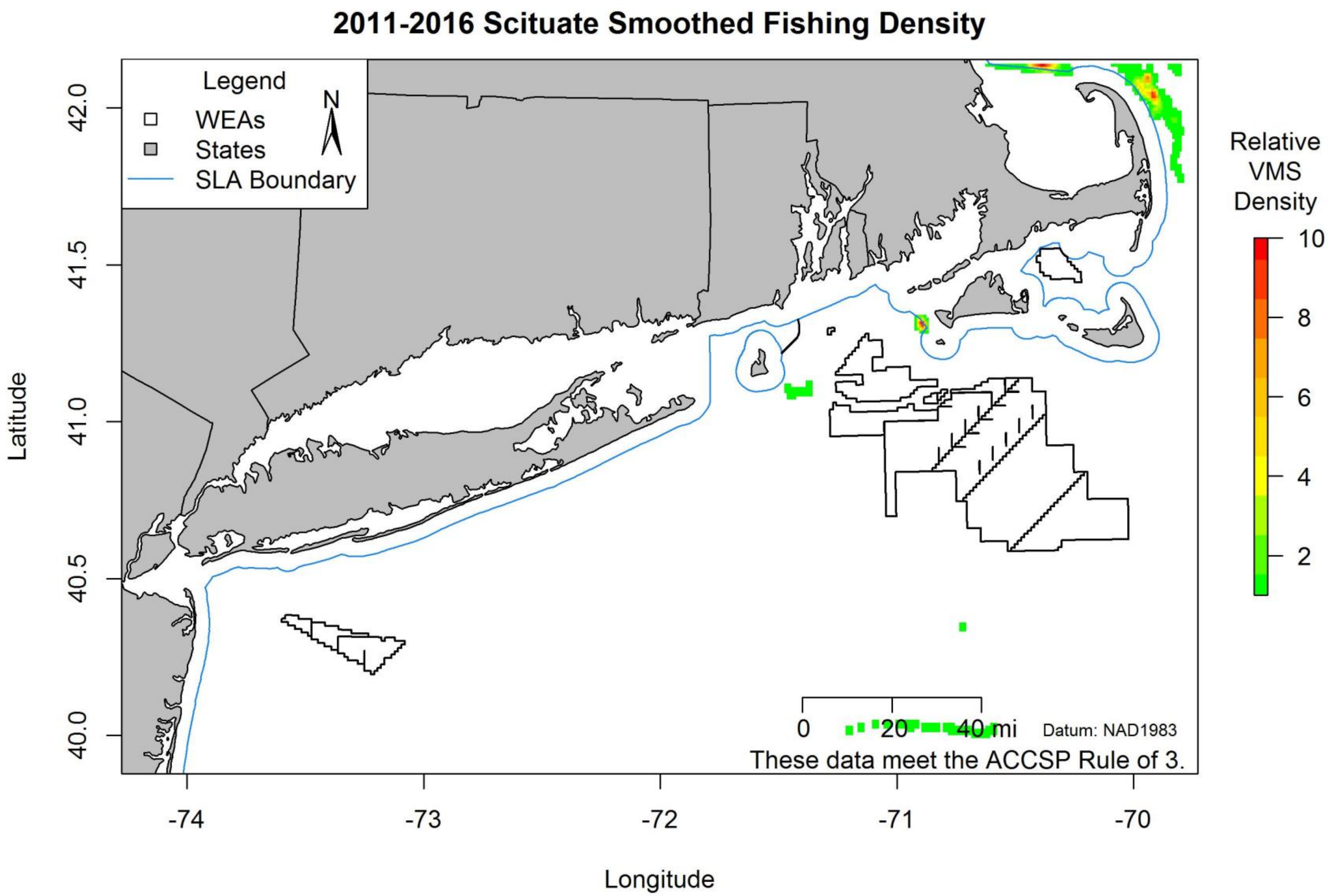

Figure 50. Smoothed federal fishing activity (all fisheries) resulting in landings in Scituate, MA between 2011 and 2016

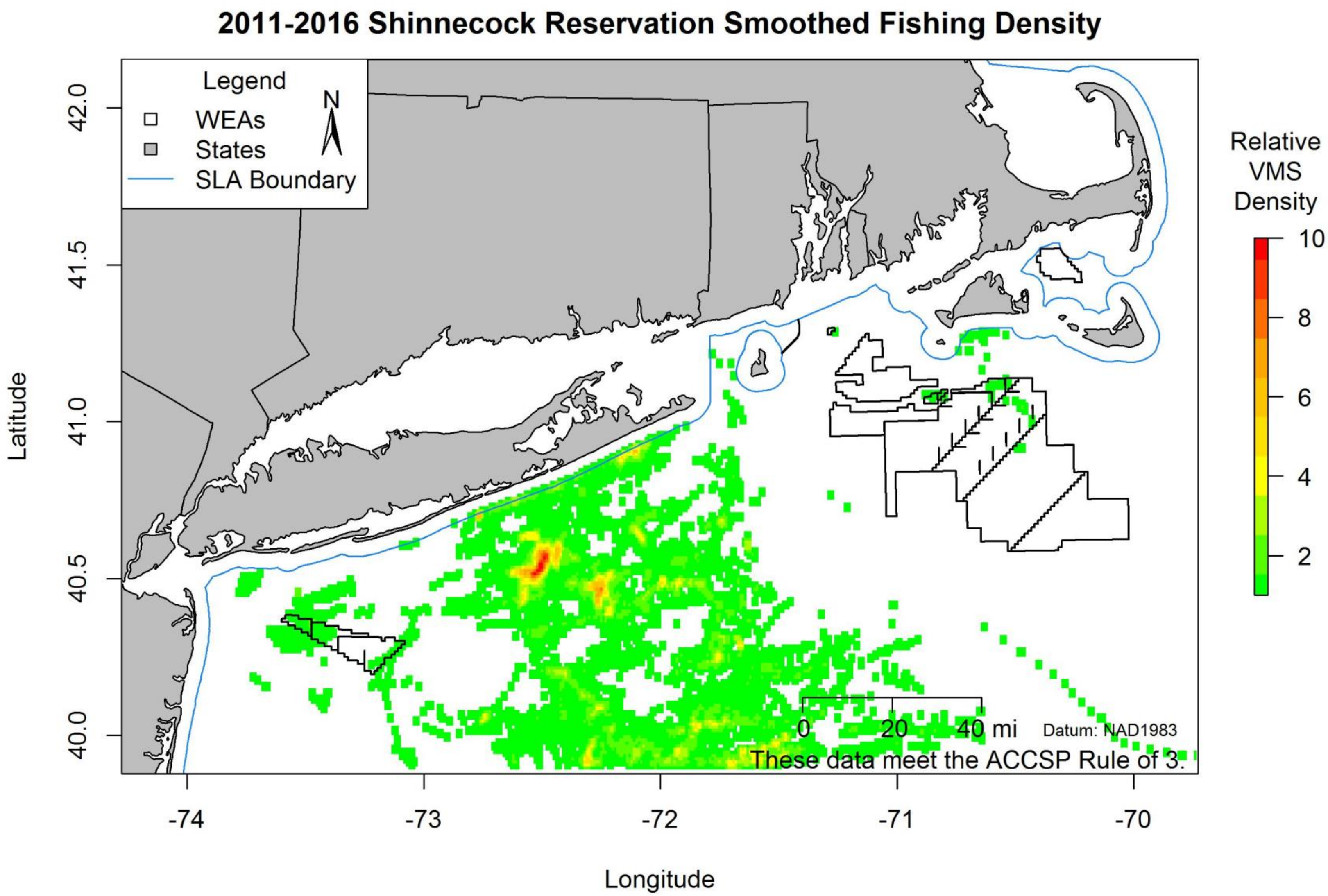

Figure 51. Smoothed federal fishing activity (all fisheries) resulting in landings in Shinnecock Reservation, NY between 2011 and 2016

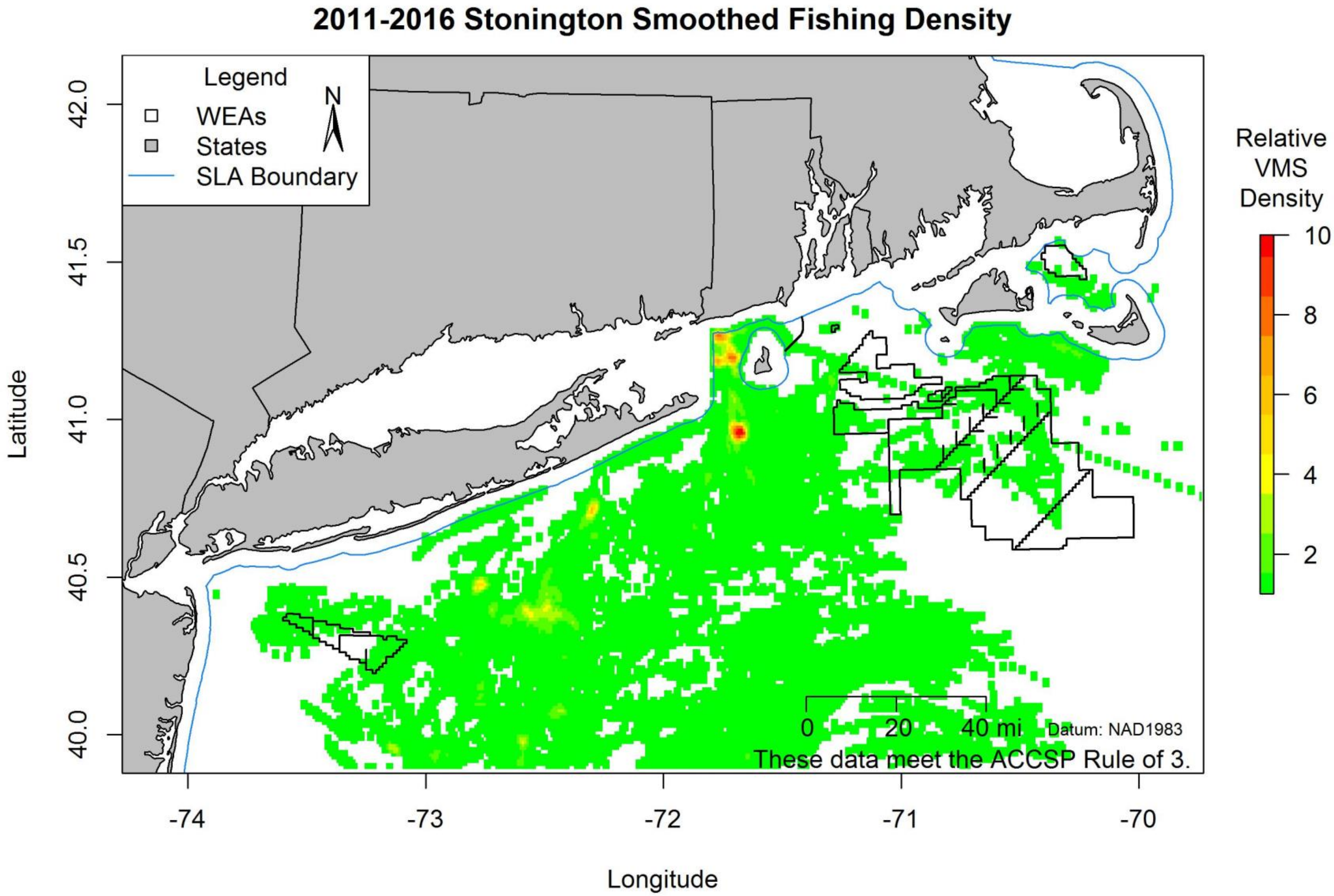

Figure 52. Smoothed federal fishing activity (all fisheries) resulting in landings in Stonington, CT between 2011 and 2016

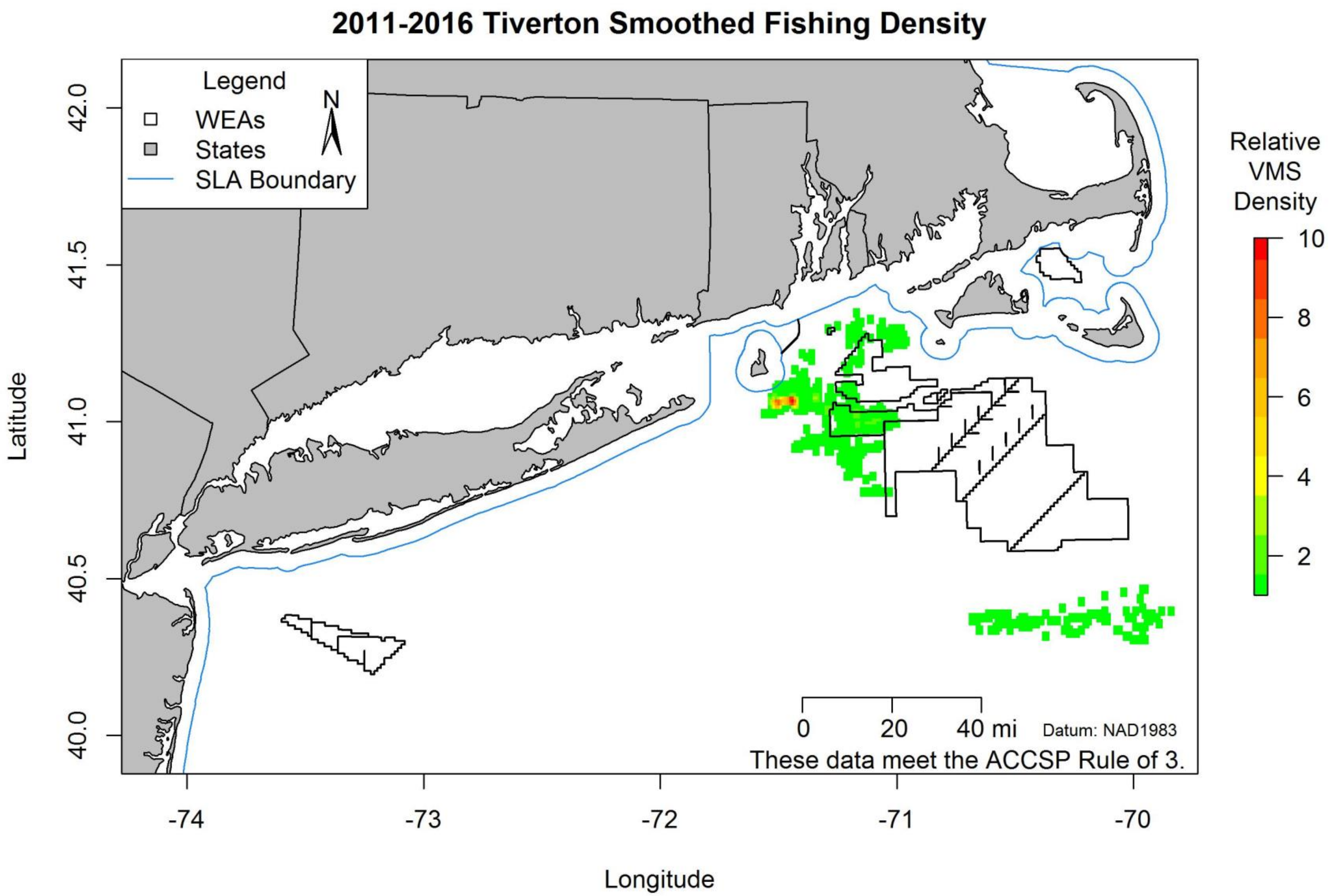

Figure 53. Smoothed federal fishing activity (all fisheries) resulting in landings in Riverton, RI between 2011 and 2016

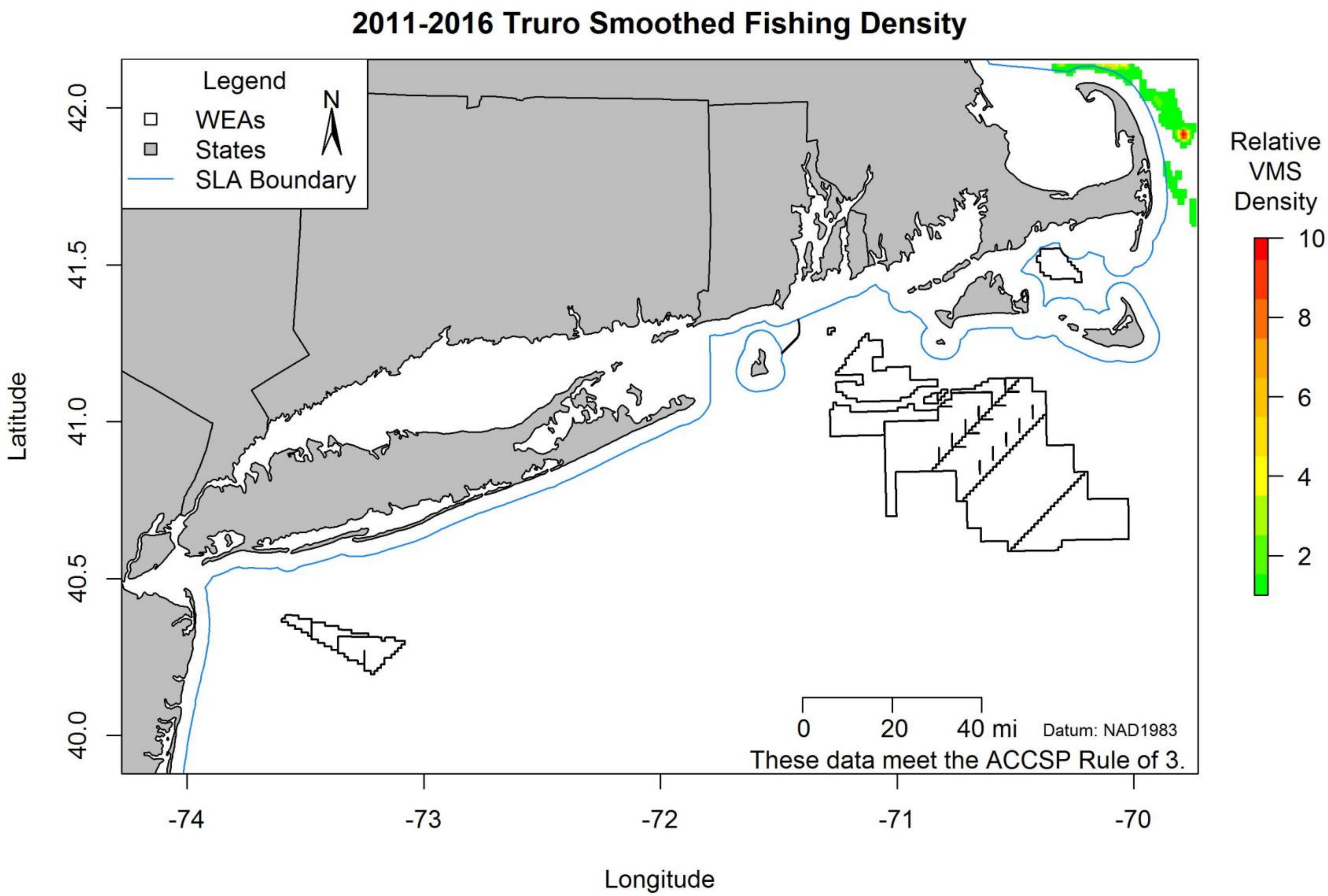

Figure 54. Smoothed federal fishing activity (all fisheries) resulting in landings in Truro, MA between 2011 and 2016

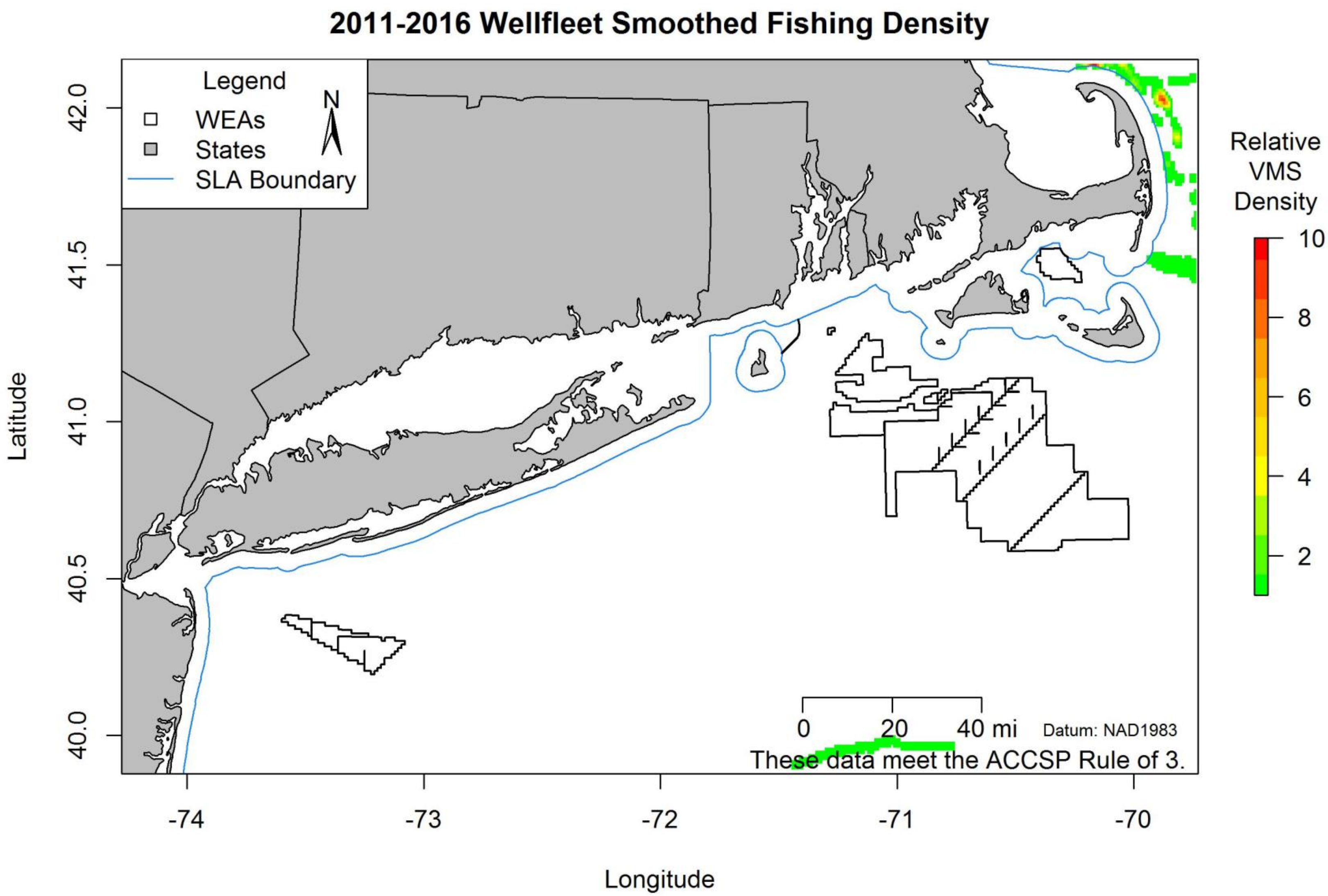

Figure 55. Smoothed federal fishing activity (all fisheries) resulting in landings in Wellfleet, MA between 2011 and 2016

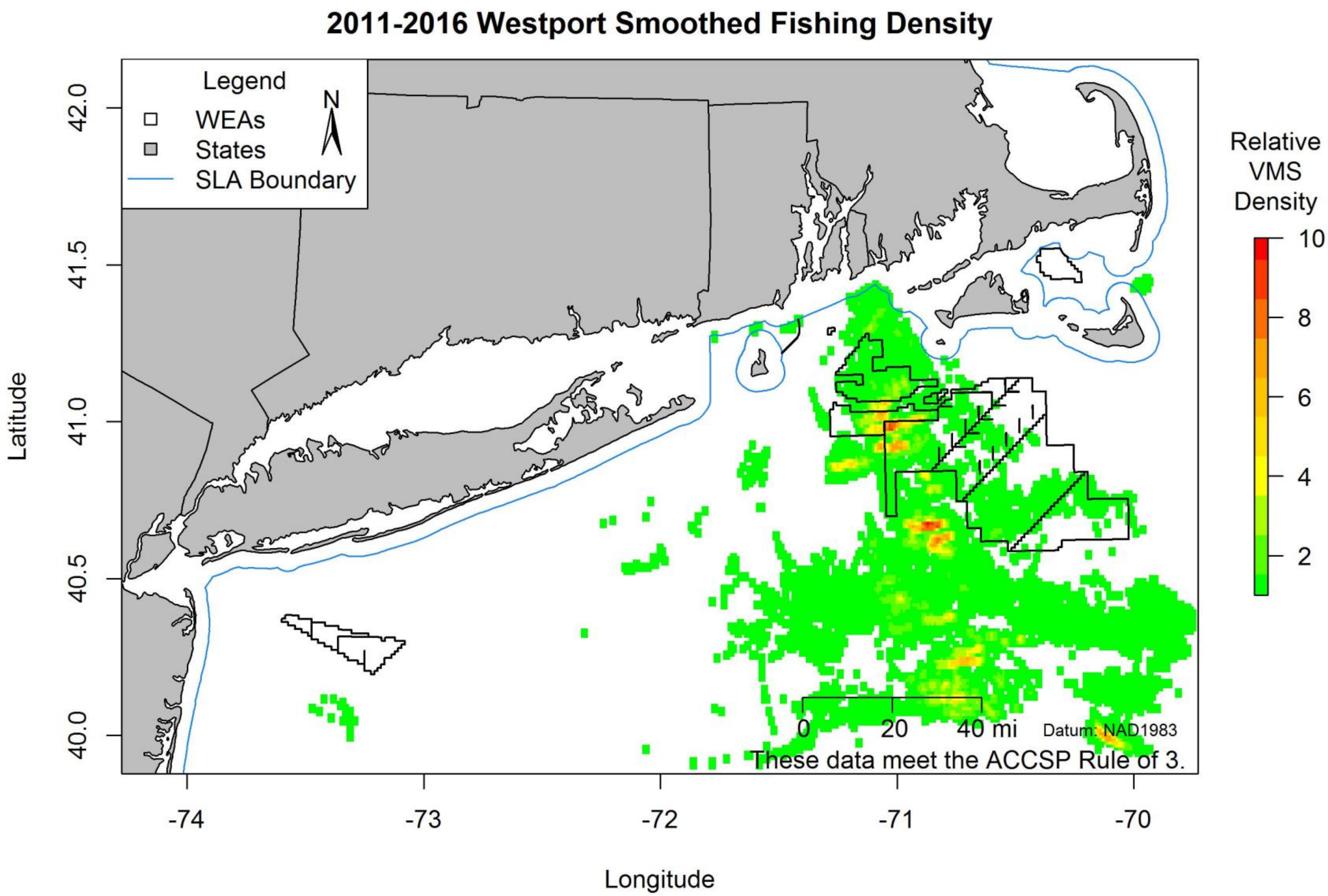

Figure 56. Smoothed federal fishing activity (all fisheries) resulting in landings in Westport, MA between 2011 and 2016

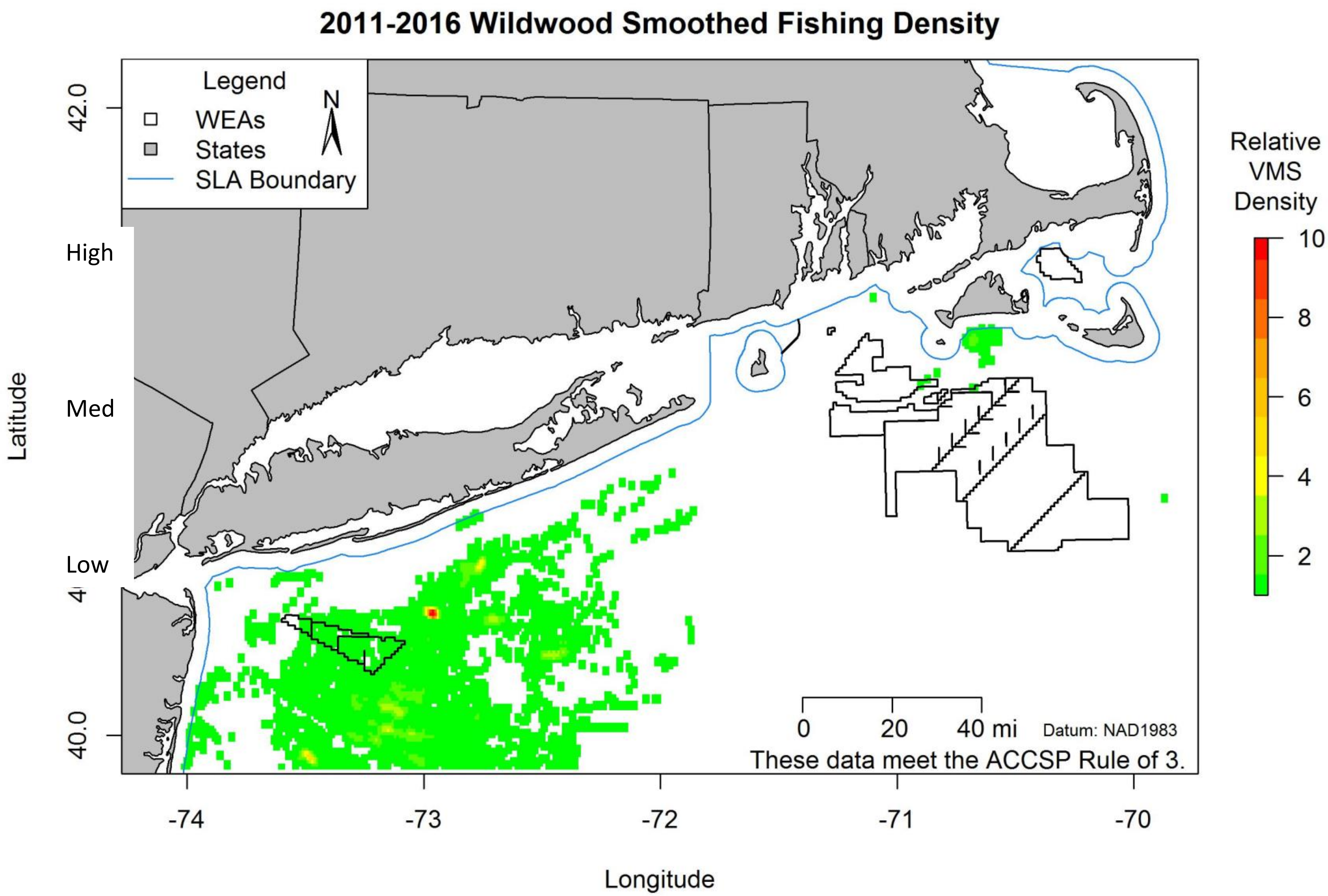

Figure 57. Smoothed federal fishing activity (all fisheries) resulting in landings in Wildwood, NJ between 2011 and 2016

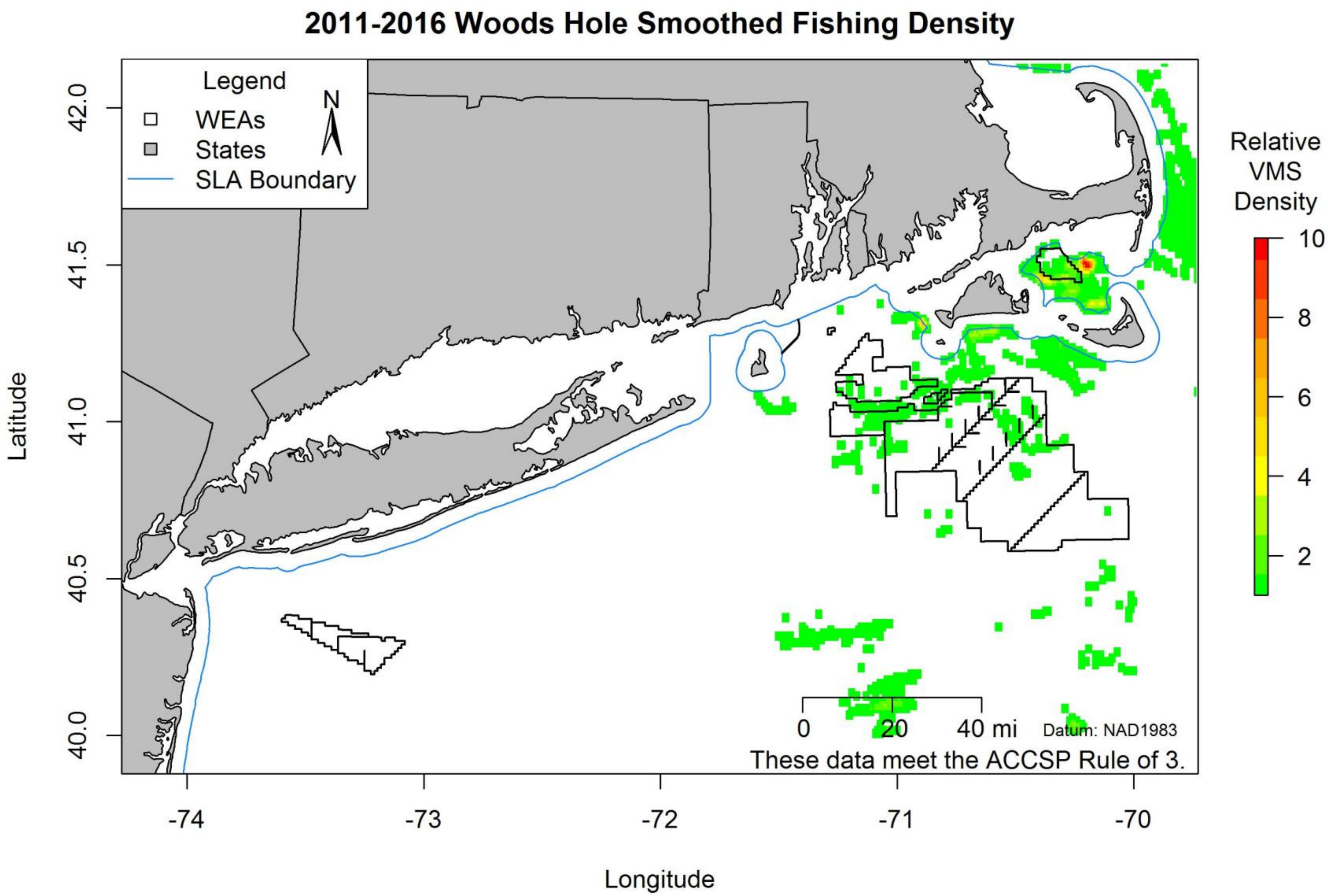

Figure 58. Smoothed federal fishing activity (all fisheries) resulting in landings in Woods Hole, MA between 2011 and 2016

10.2.3 2011-2016 Maps by Gear Used

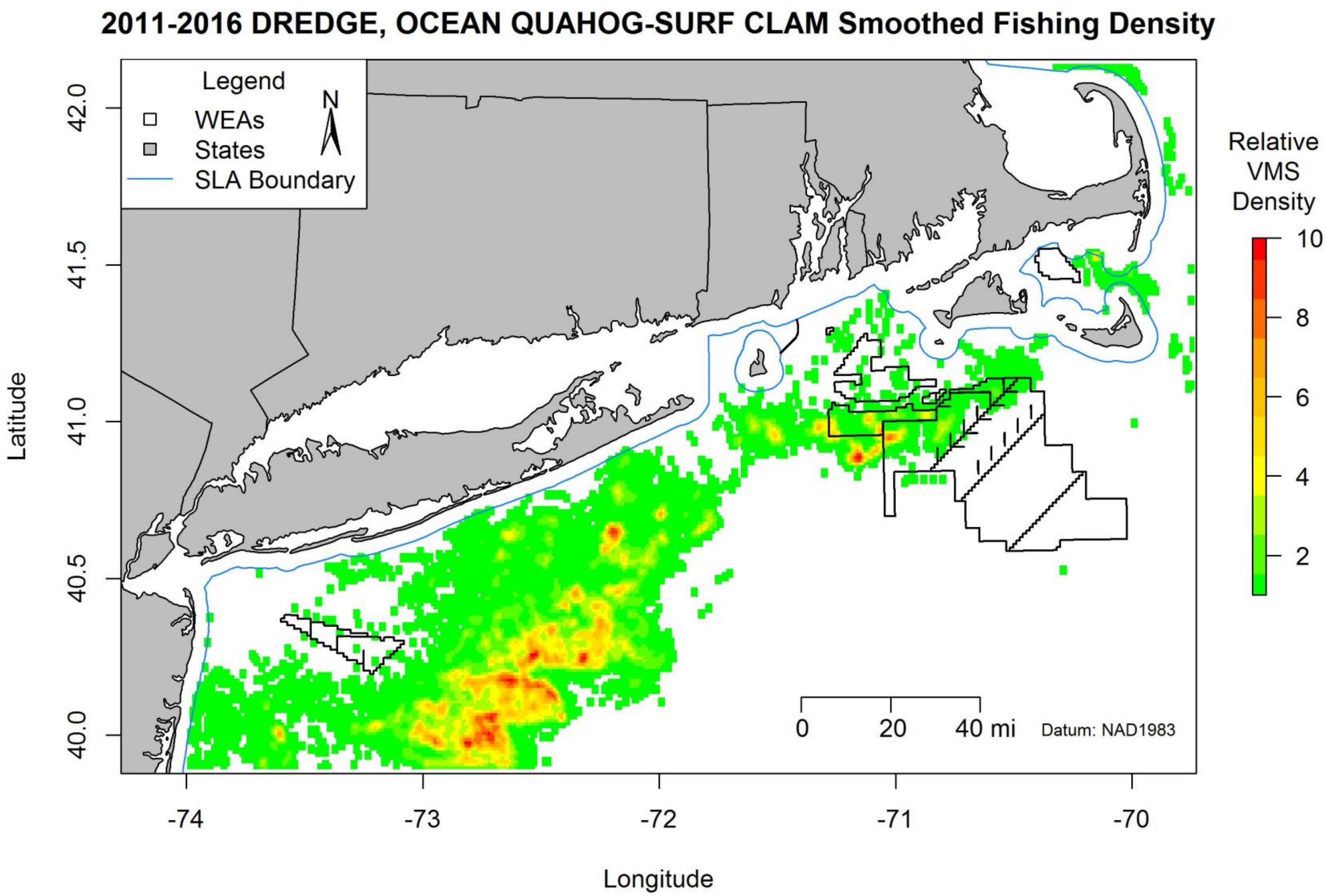

Figure 59. Smoothed federal fishing activity using an ocean quahog/surf clam dredge between 2011 and 2016

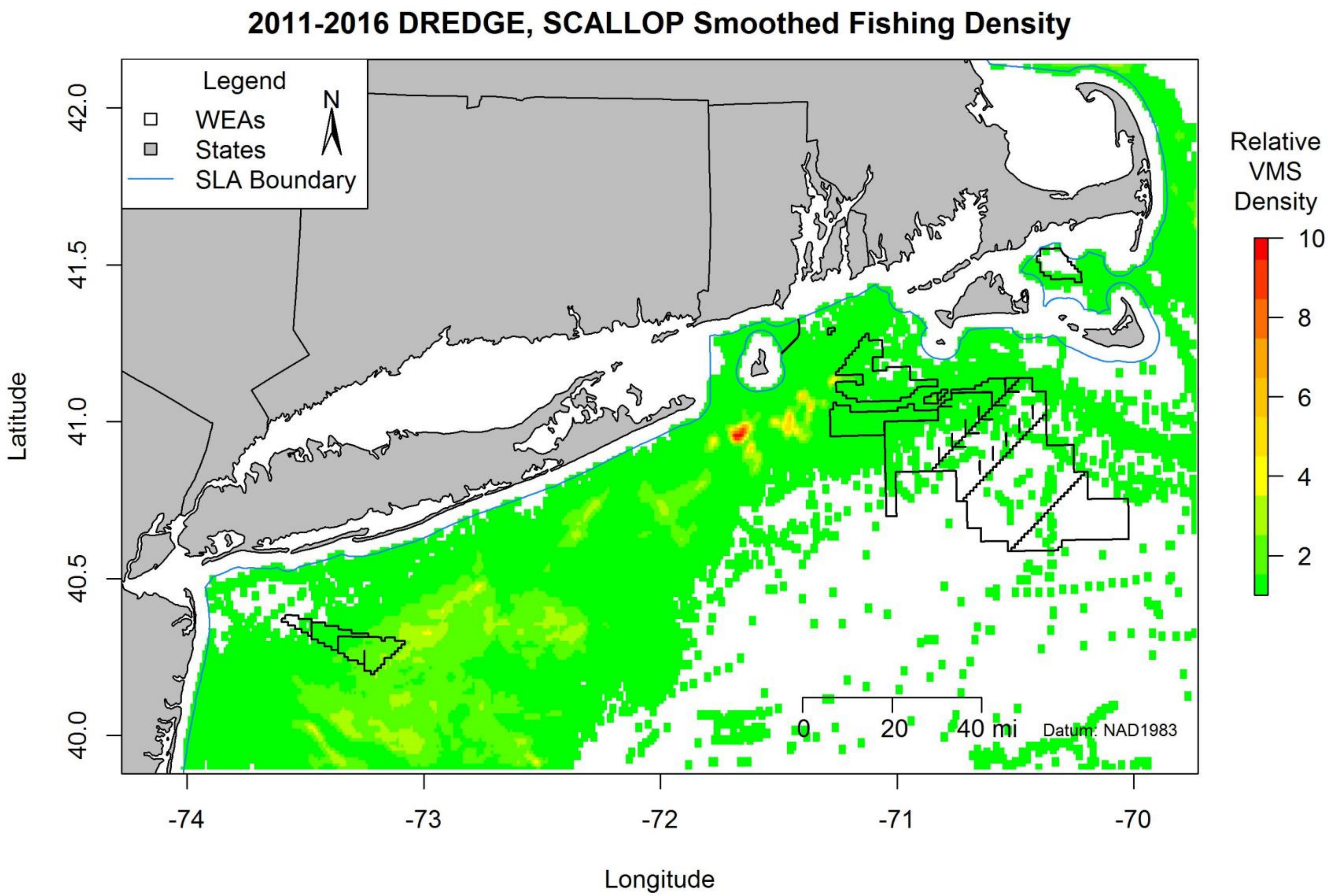

Figure 60. Smoothed federal fishing activity using a scallop dredge between 2011 and 2016

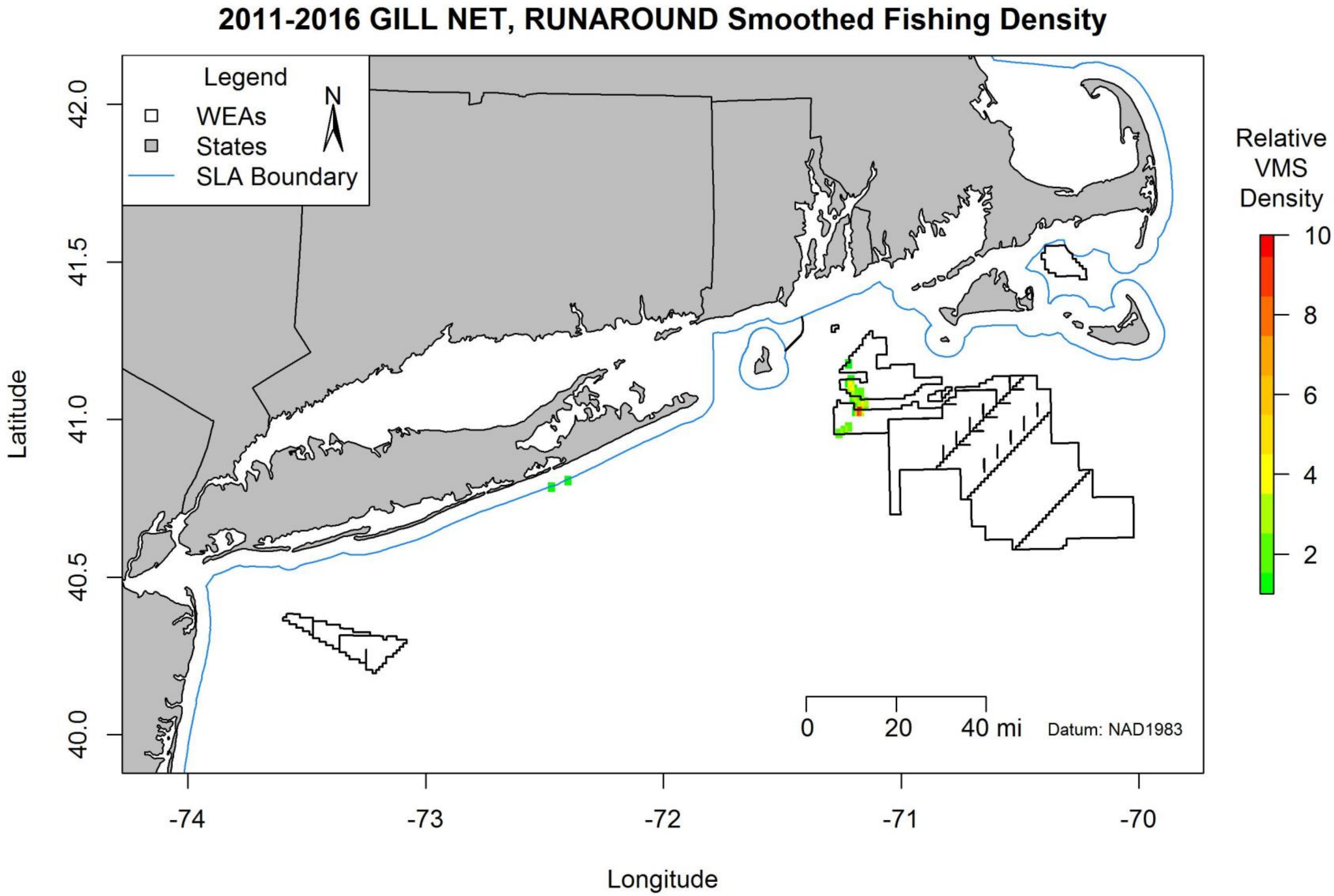

Figure 61. Smoothed federal fishing activity using a runaround gill net between 2011 and 2016

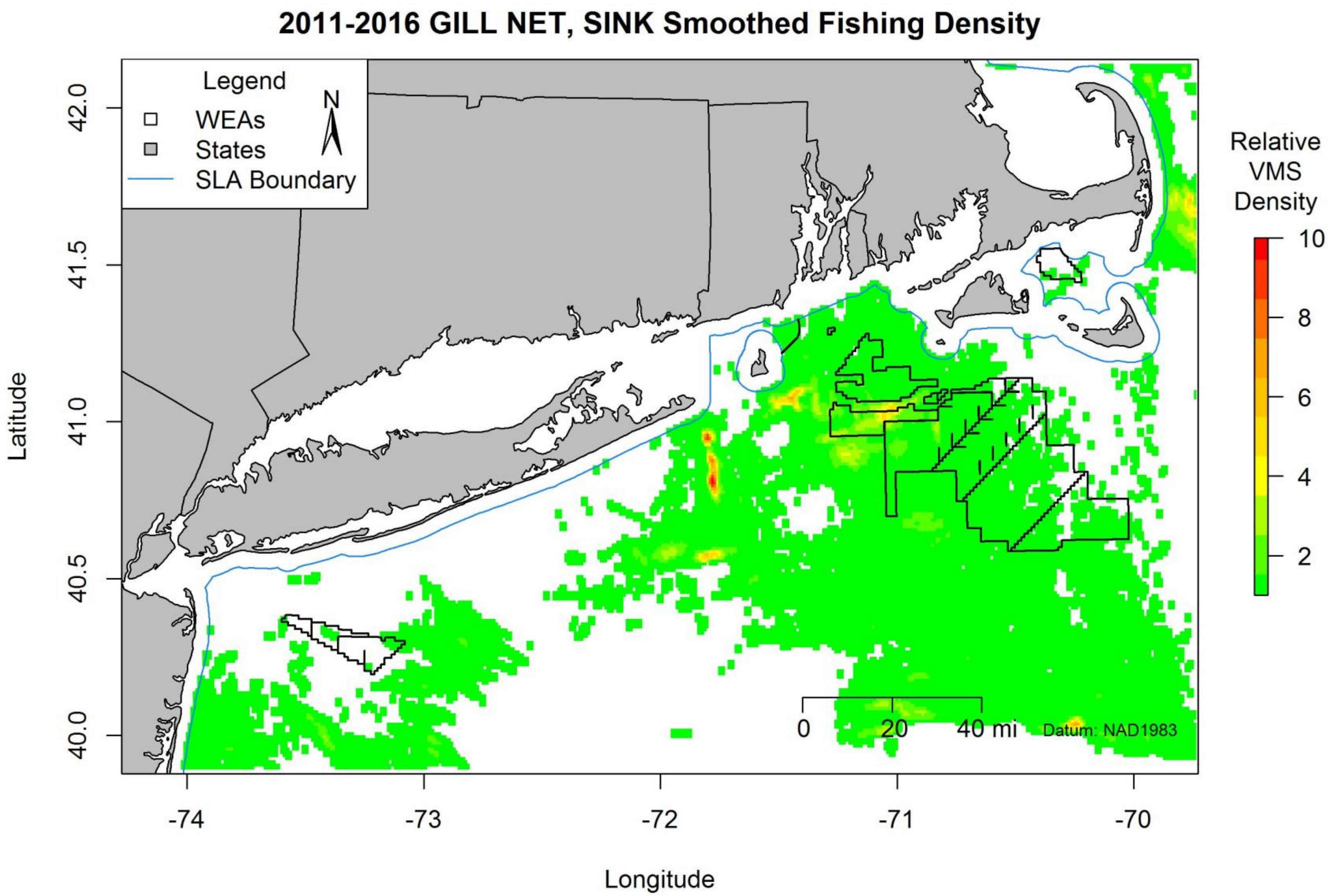

Figure 62. Smoothed federal fishing activity using a sink gill net between 2011 and 2016

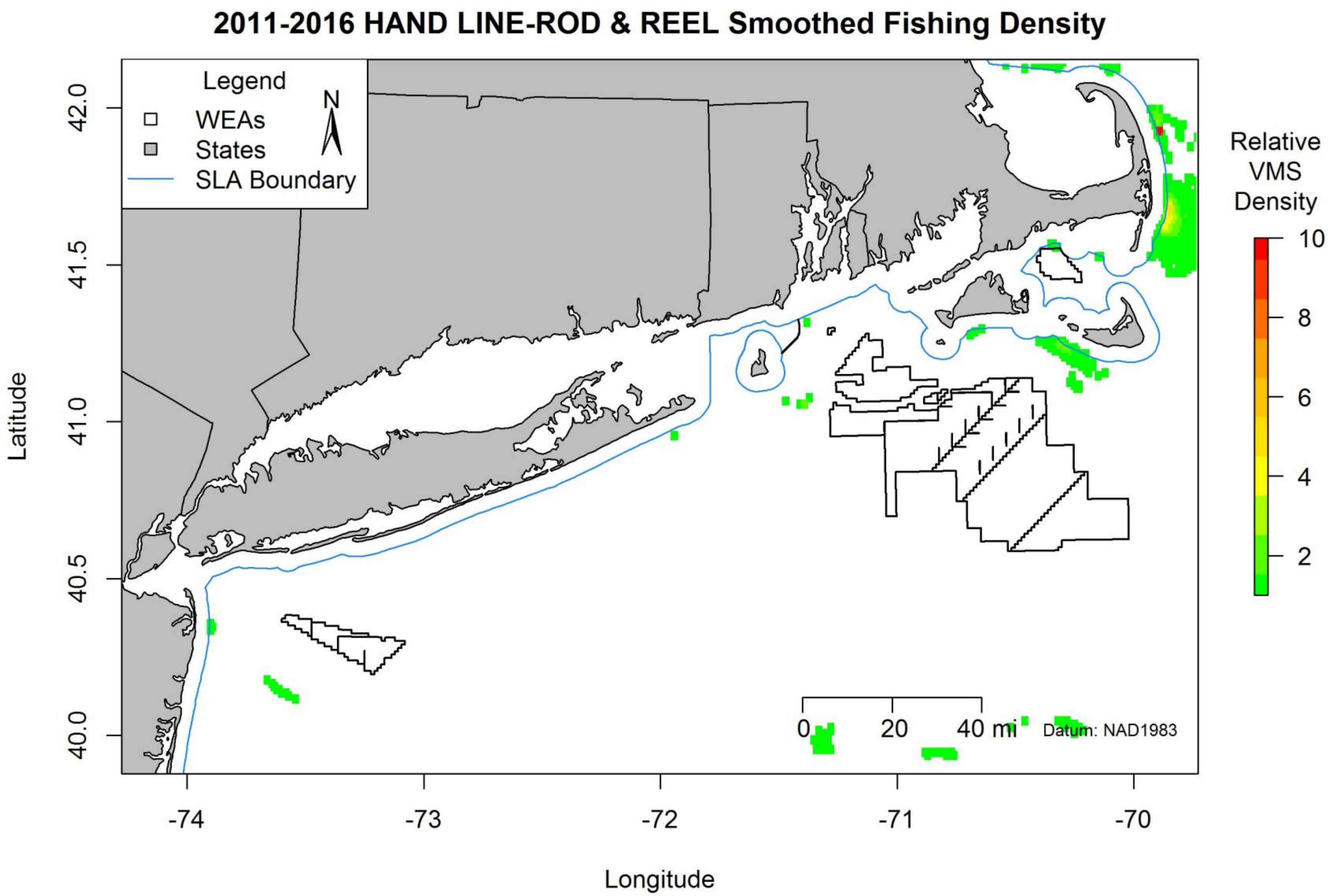

Figure 63. Smoothed federal fishing activity using hand line/rod and reel between 2011 and 2016

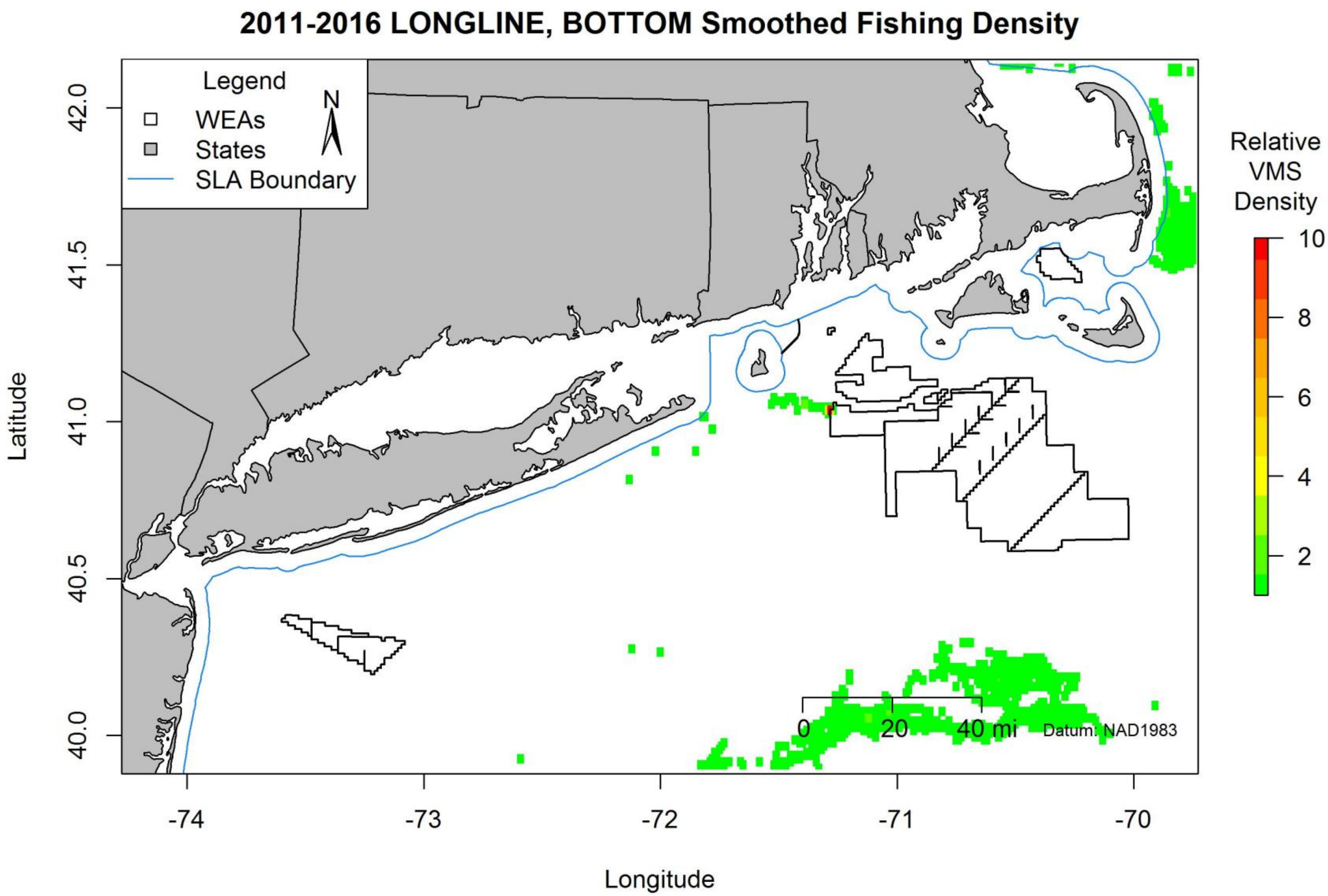

Figure 64. Smoothed federal fishing activity using a bottom longline between 2011 and 2016

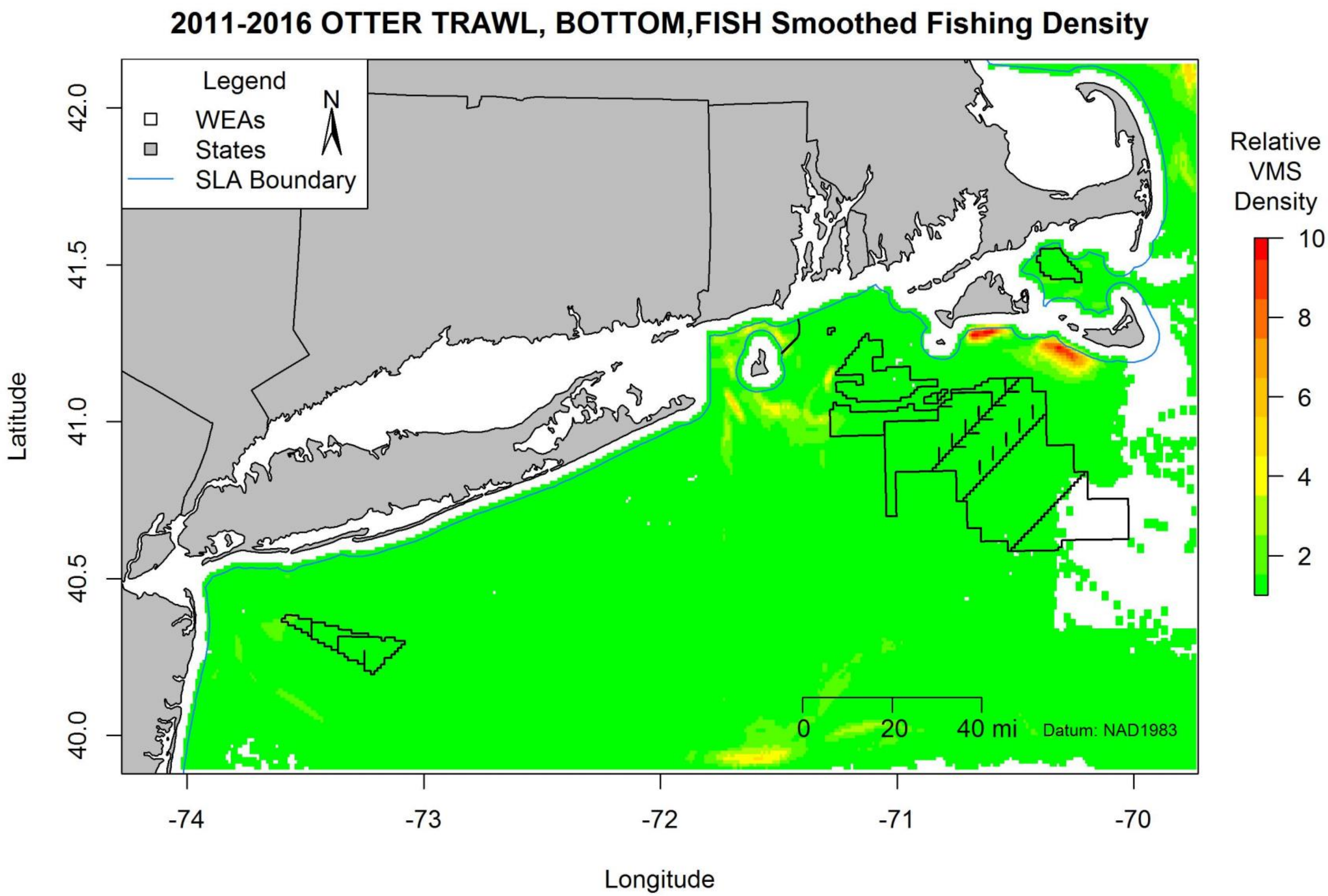

Figure 65. Smoothed federal fishing activity using a bottom fish otter trawl between 2011 and 2016

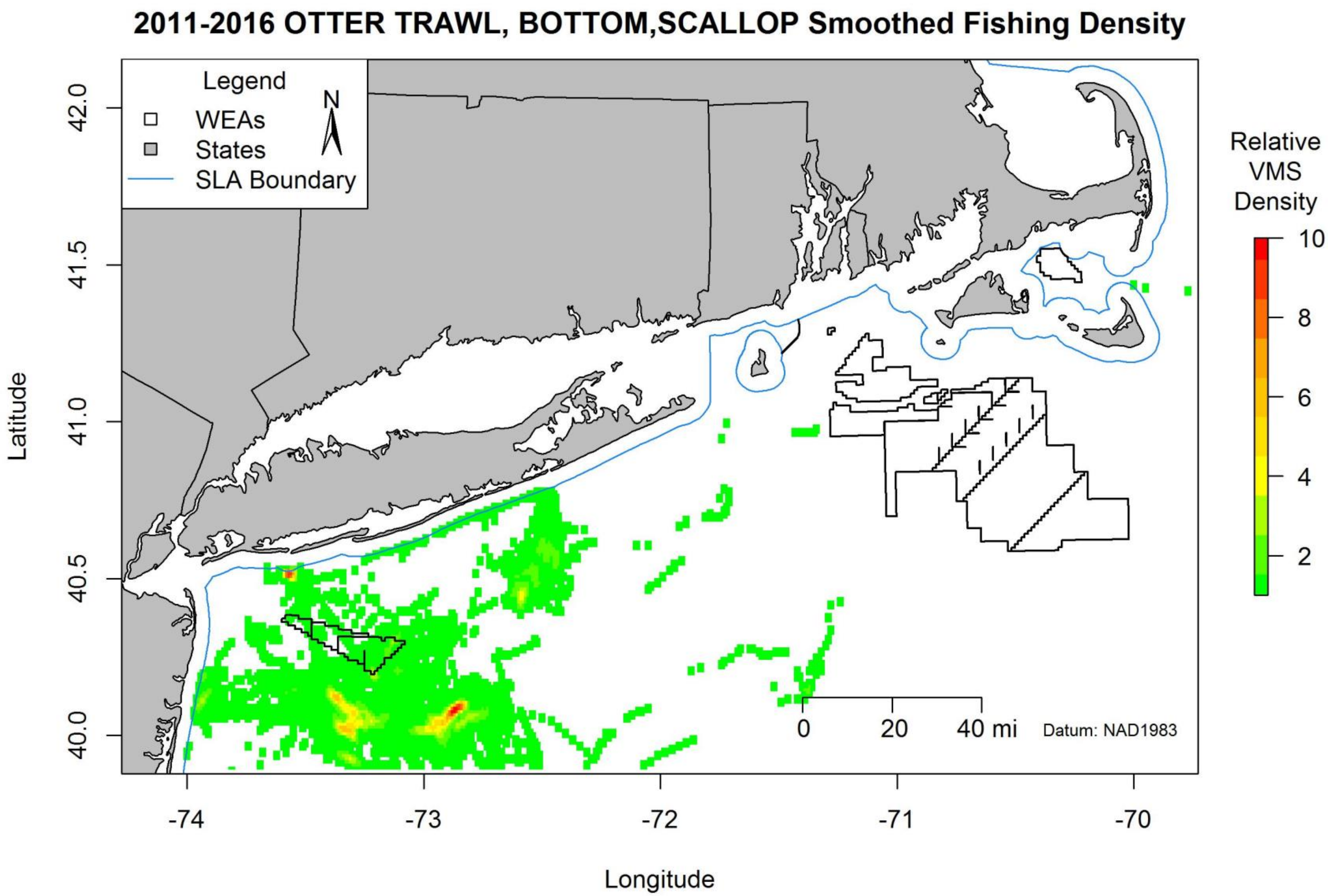

Figure 66. Smoothed federal fishing activity using a bottom scallop otter trawl between 2011 and 2016

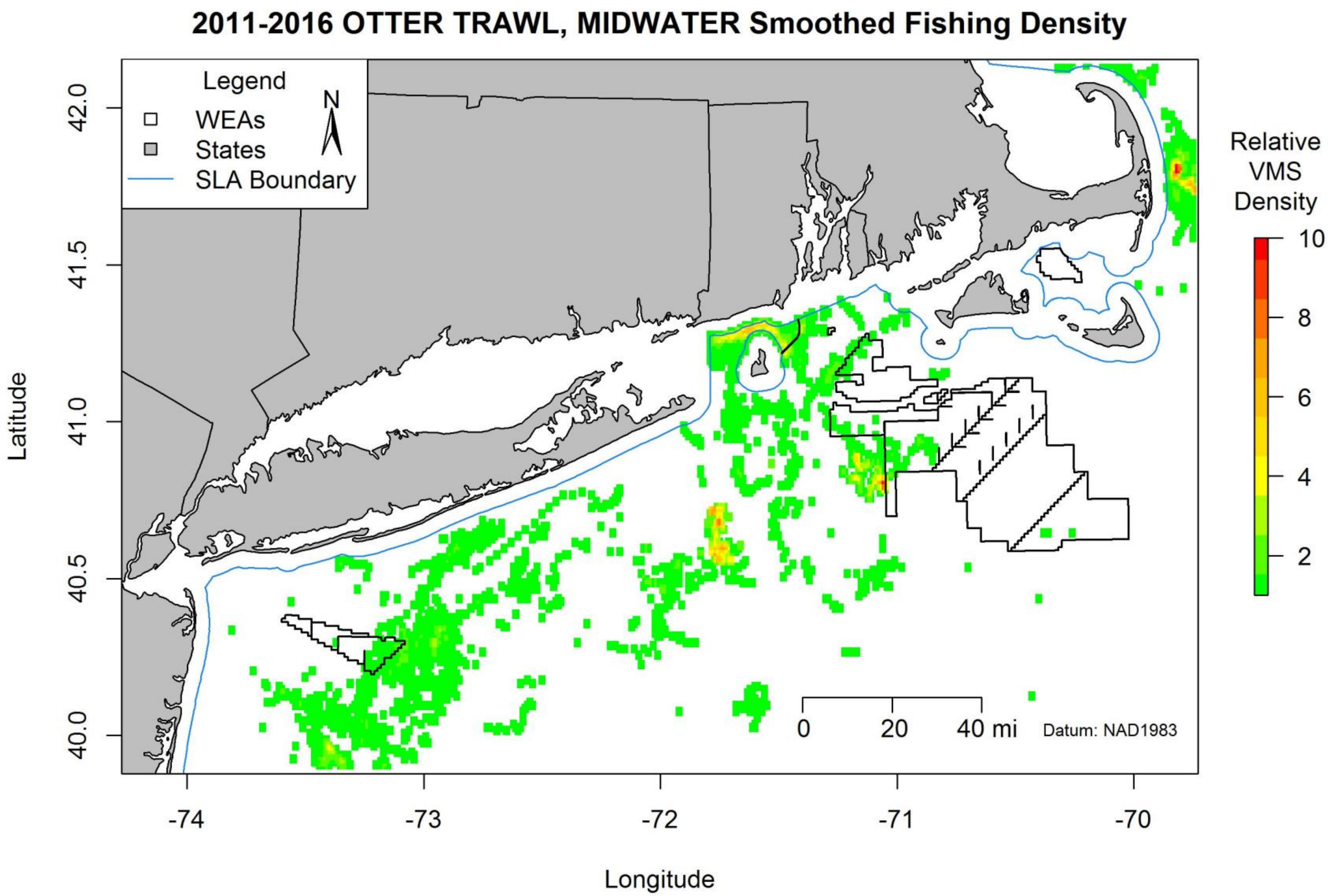

Figure 67. Smoothed federal fishing activity using a midwater otter trawl between 2011 and 2016

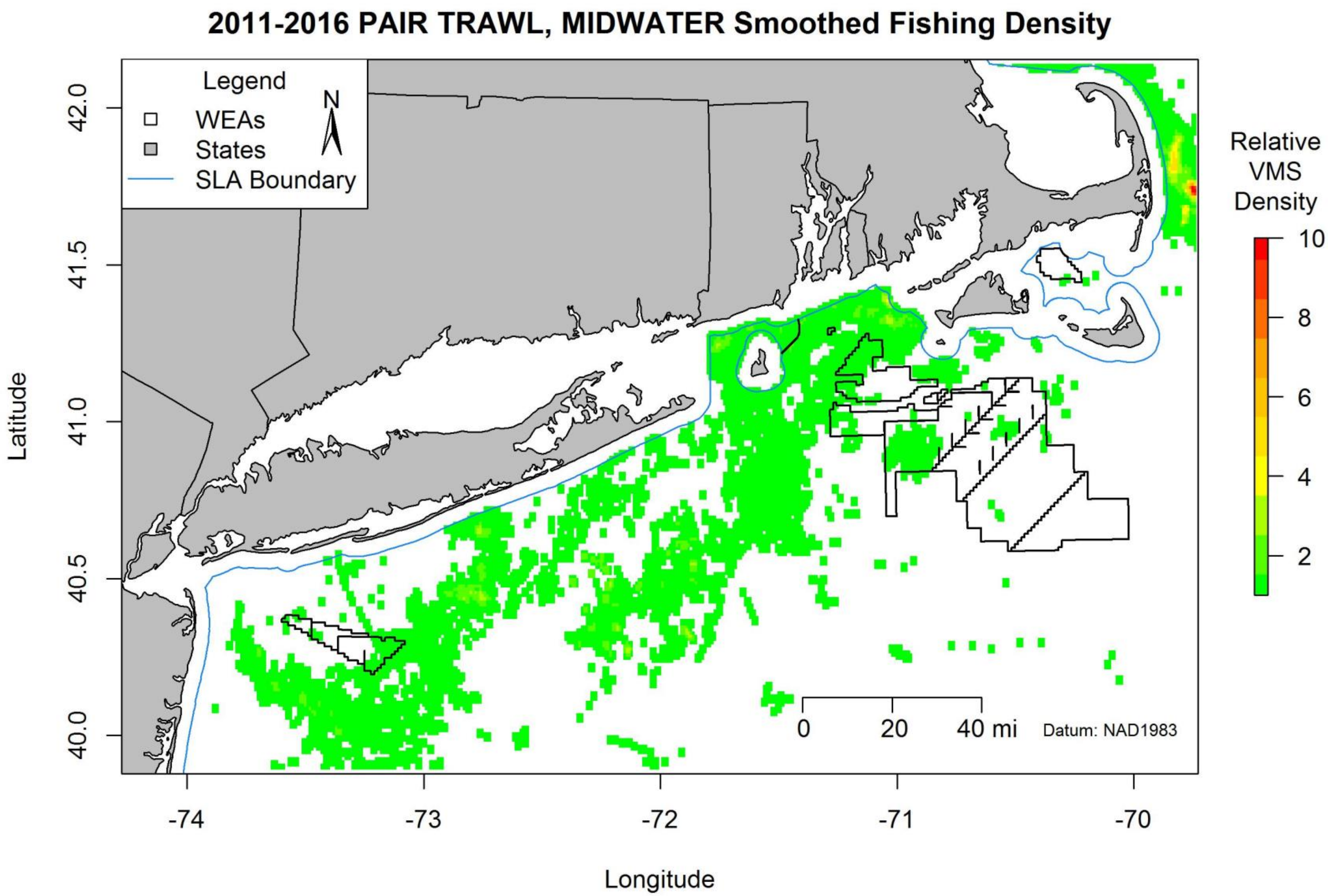

Figure 68. Smoothed federal fishing activity using a midwater pair trawl between 2011 and 2016

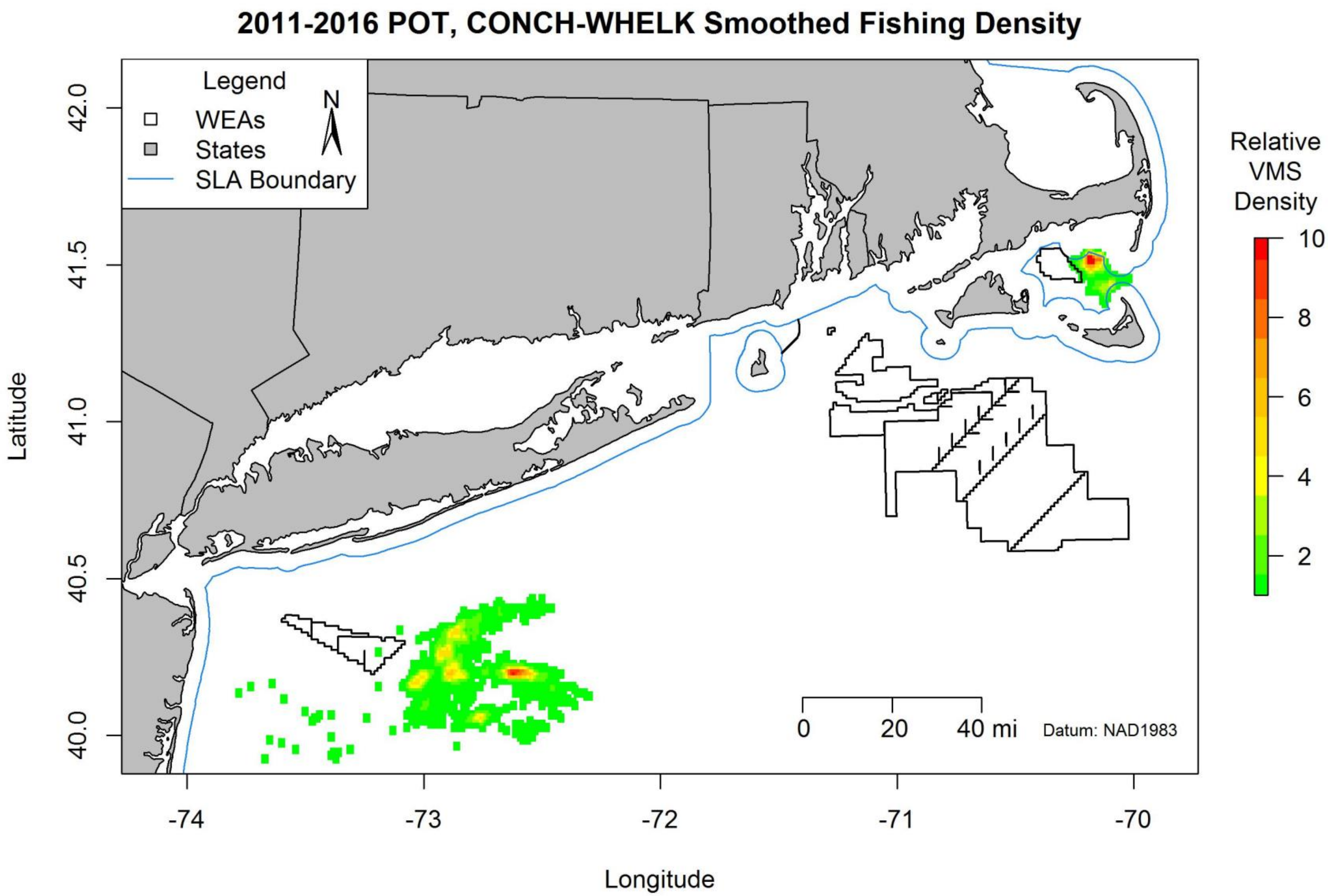

Figure 69. Smoothed federal fishing activity using conch/whelk pots between 2011 and 2016

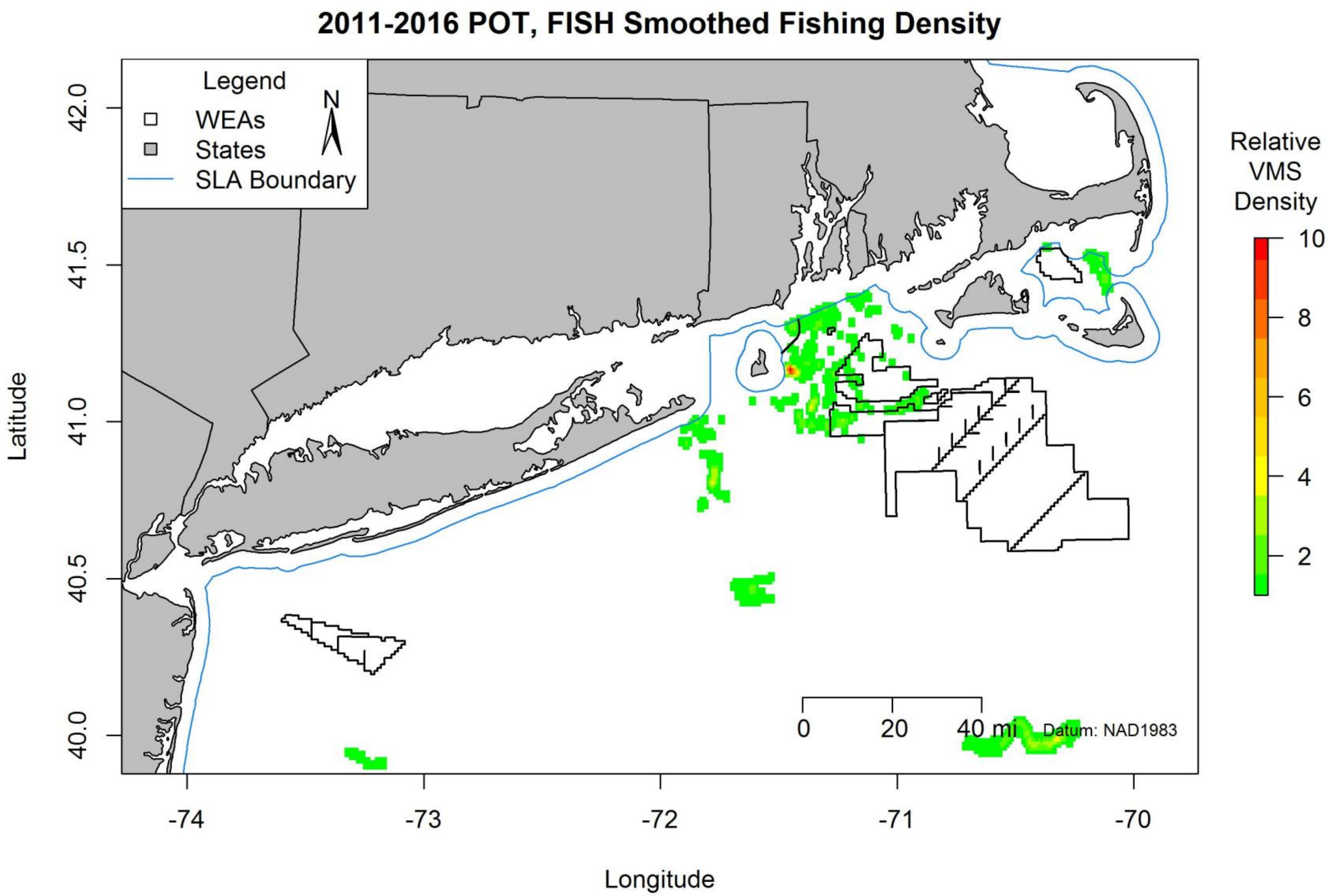

Figure 70. Smoothed federal fishing activity using fish pots between 2011 and 2016

10.2.4 2011-2016 Maps by Species Caught

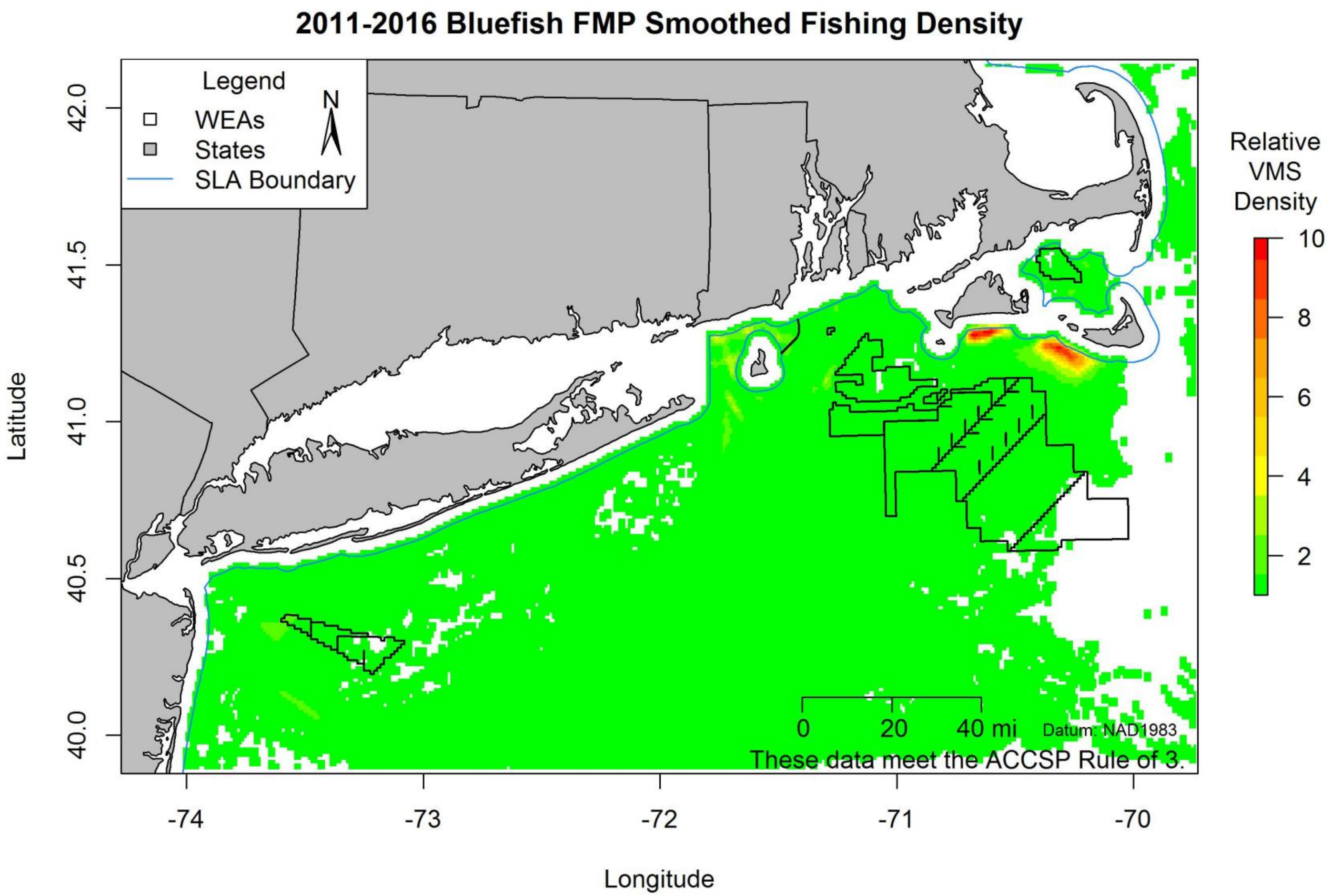

Figure 71. Smoothed federal fishing activity of all trips between 2011 and 2016 where bluefish was caught

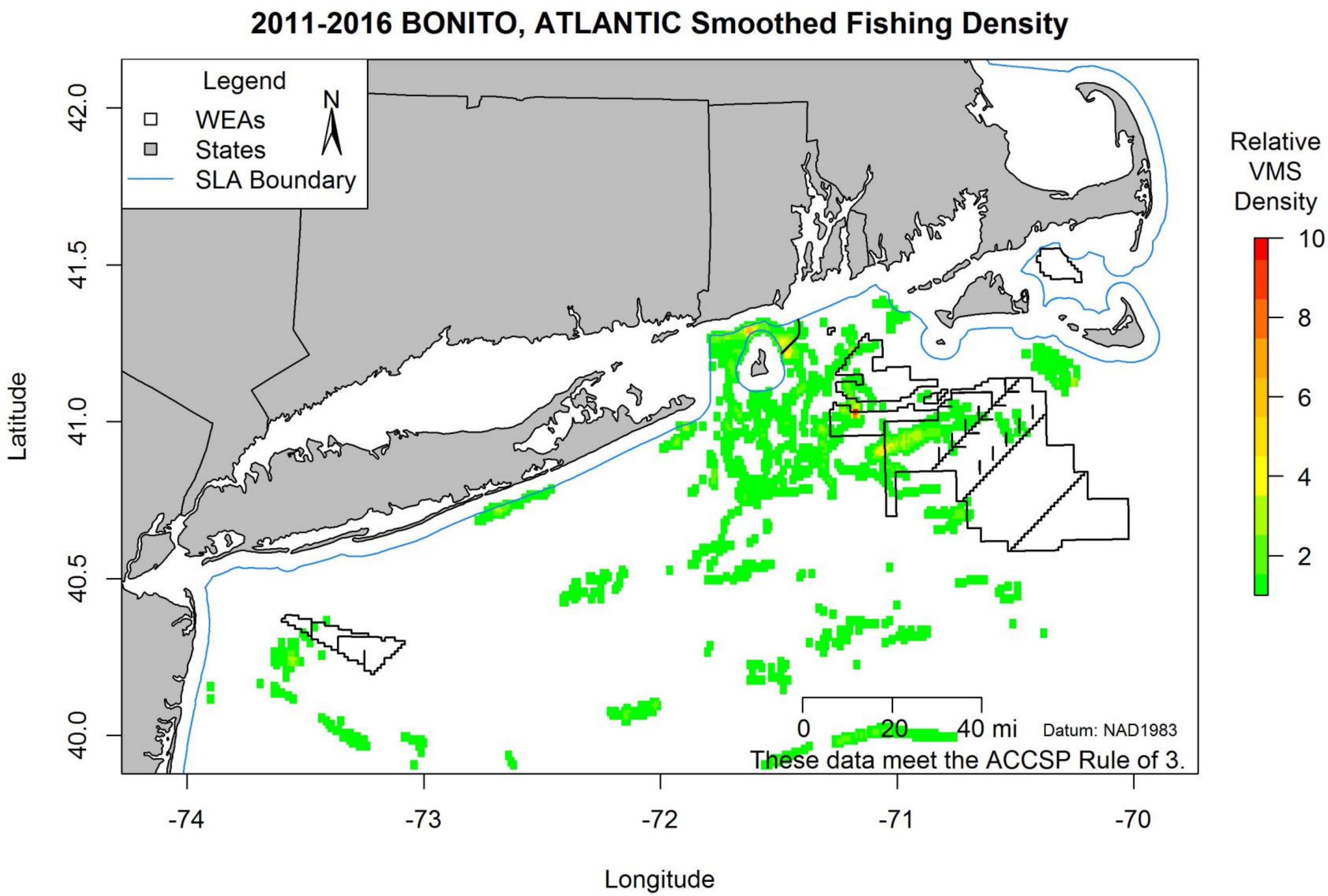

Figure 72. Smoothed federal fishing activity of all trips between 2011 and 2016 where Atlantic bonito was caught

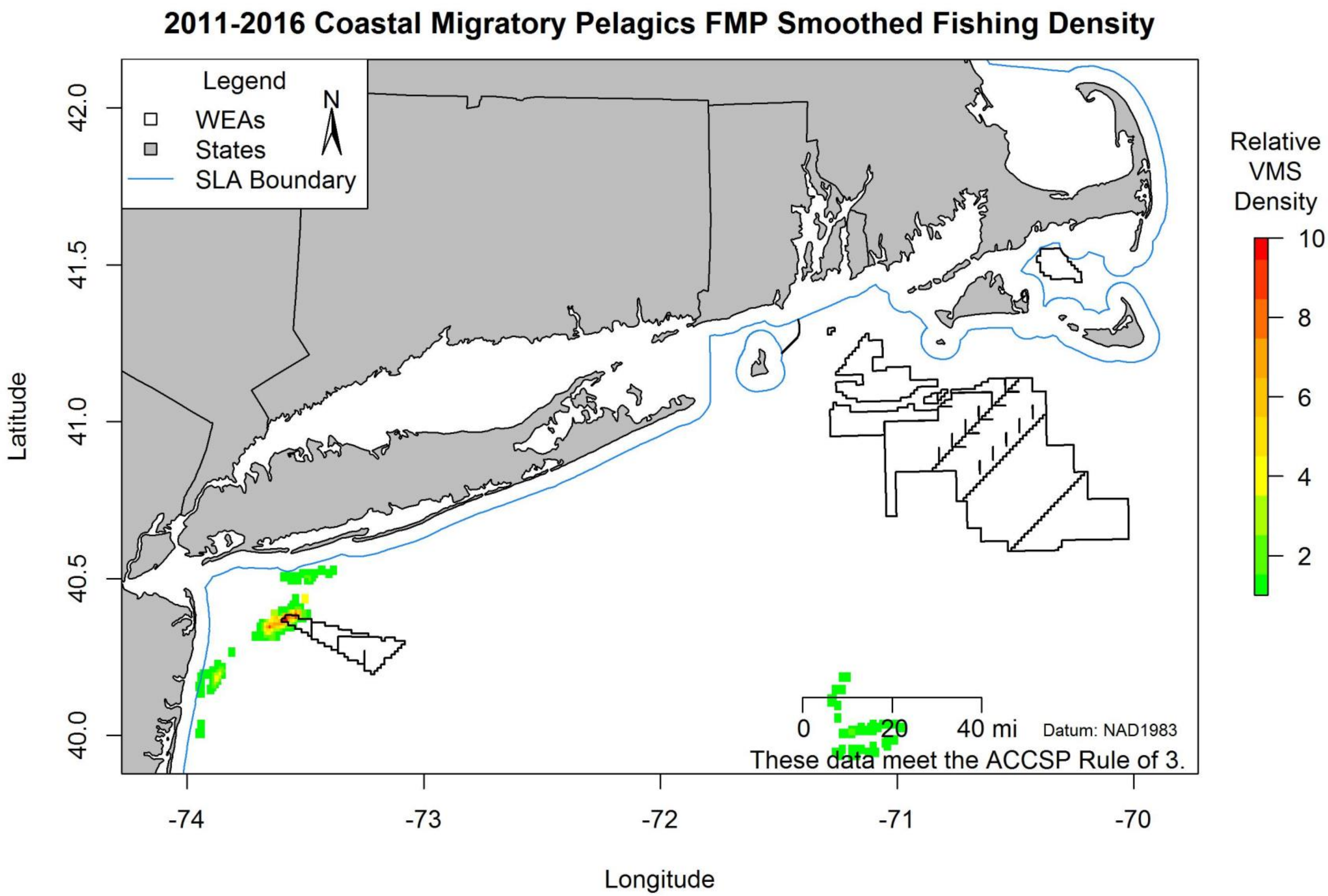

Figure 73. Smoothed federal fishing activity of all trips between 2011 and 2016 where coastal migratory pelagics (king mackerel, Spanish mackerel, and cobia) were caught

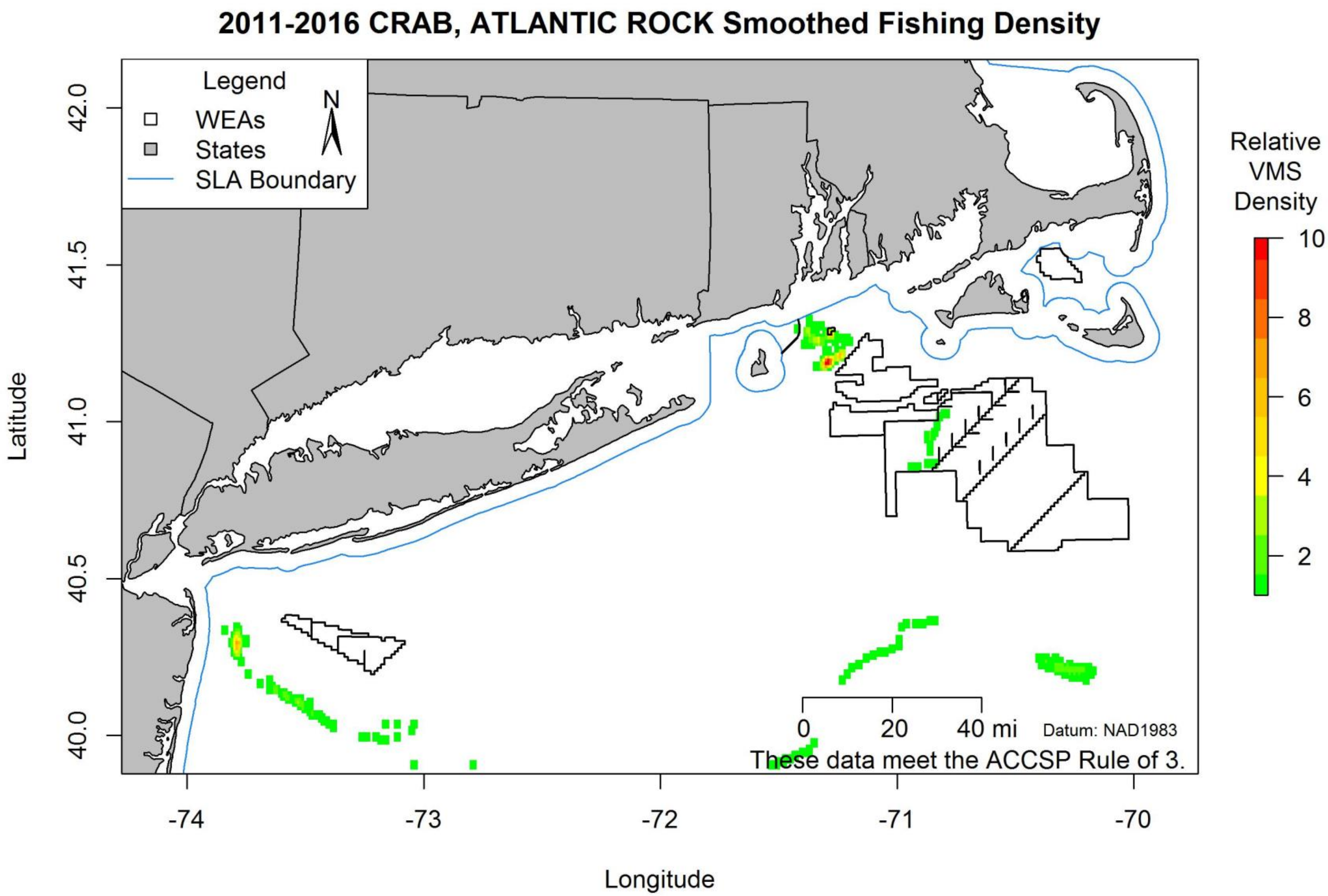

Figure 74. Smoothed federal fishing activity of all trips between 2011 and 2016 where Atlantic rock crab was caught

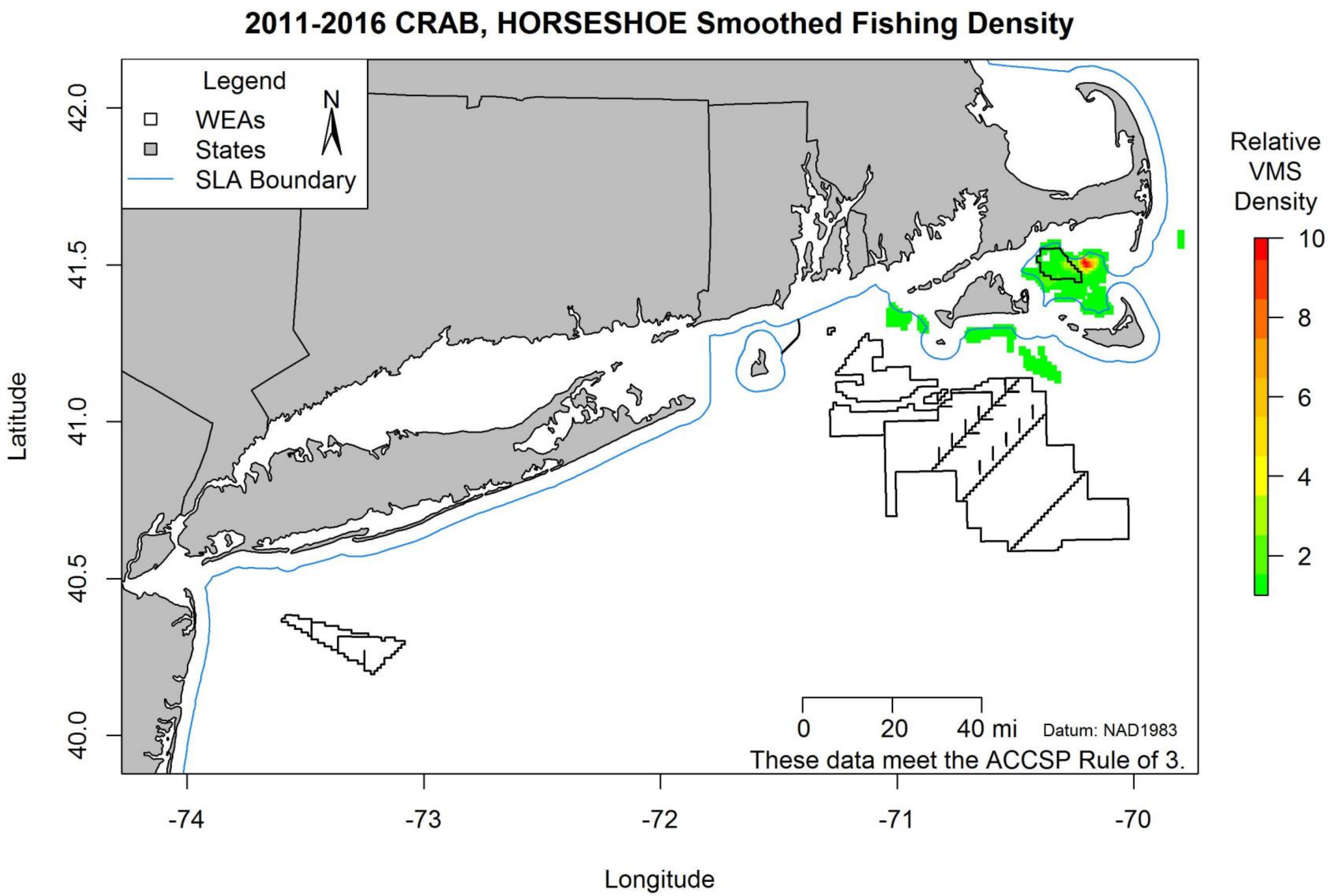

Figure 75. Smoothed federal fishing activity of all trips between 2011 and 2016 where horseshoe crab was caught

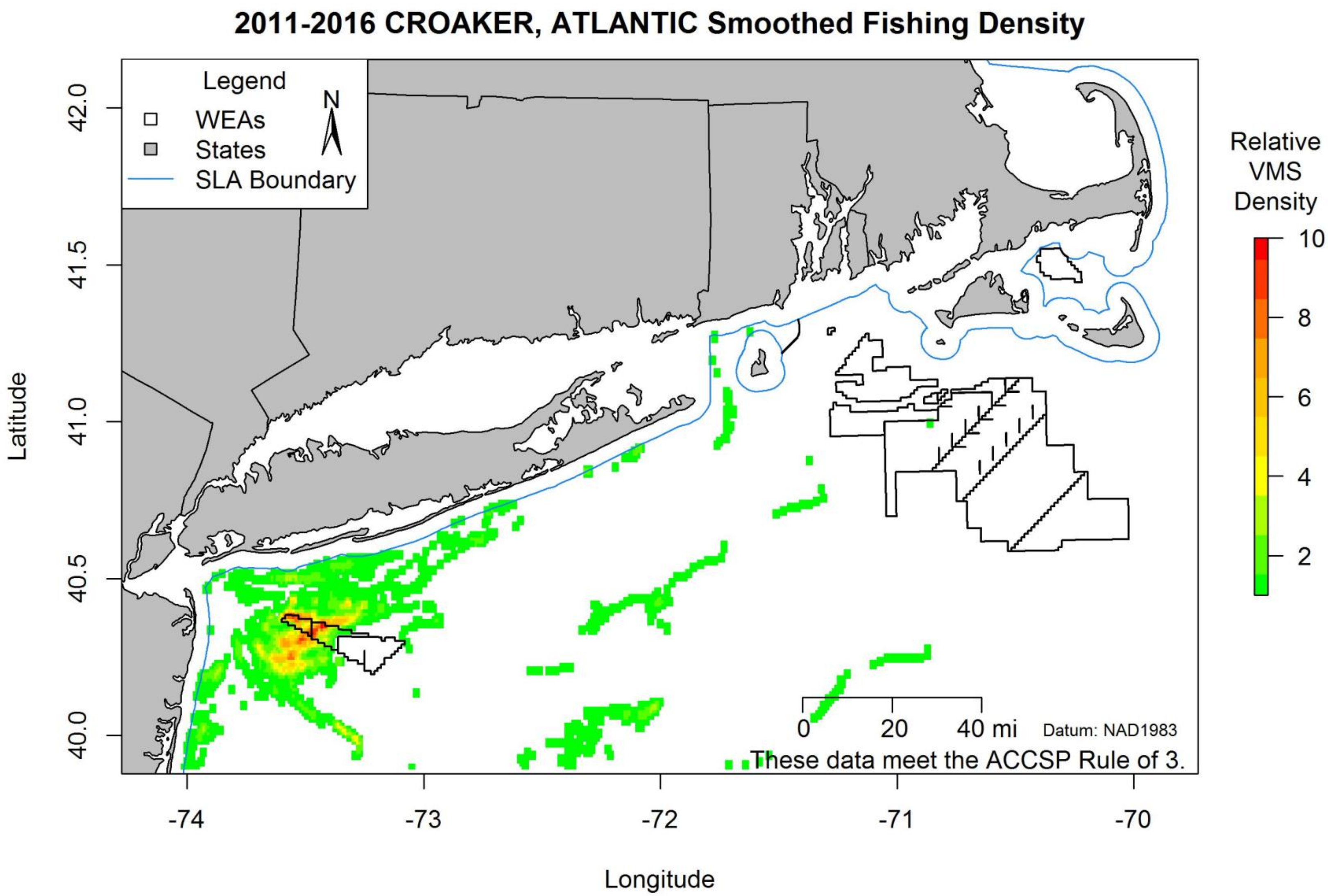

Figure 76. Smoothed federal fishing activity of all trips between 2011 and 2016 where Atlantic croaker was caught

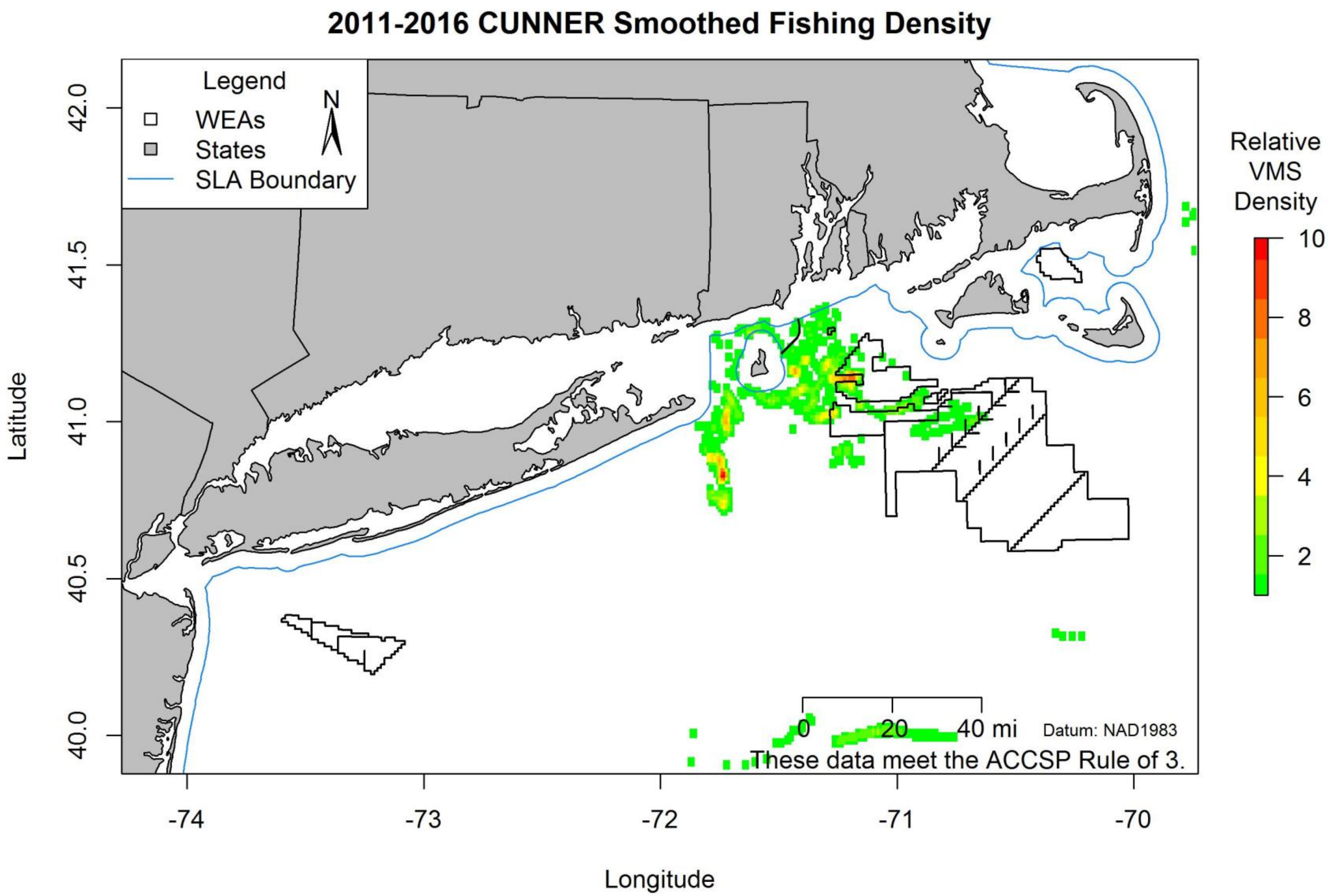

Figure 77. Smoothed federal fishing activity of all trips between 2011 and 2016 where cunner was caught

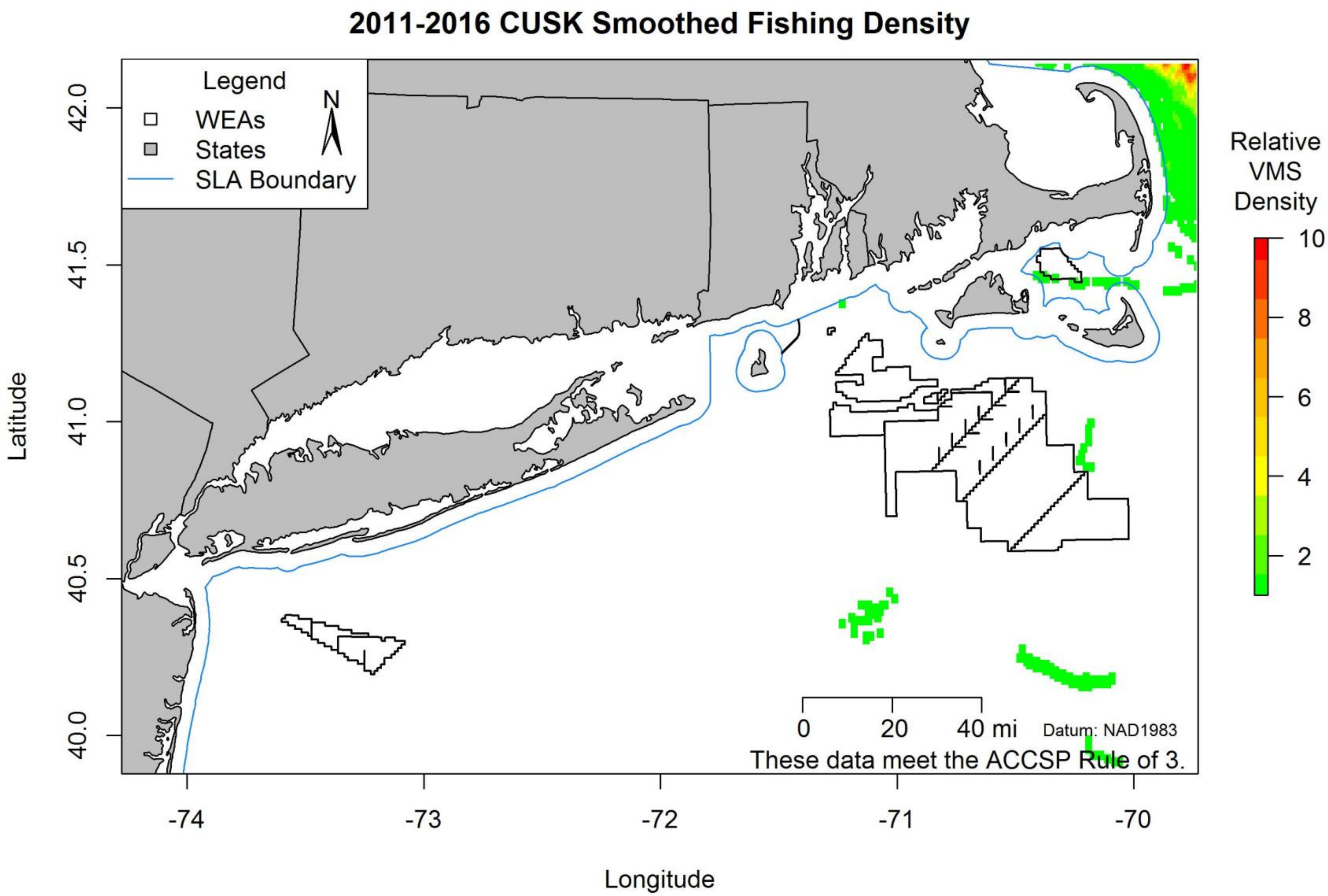

Figure 78. Smoothed federal fishing activity of all trips between 2011 and 2016 where cusk was caught

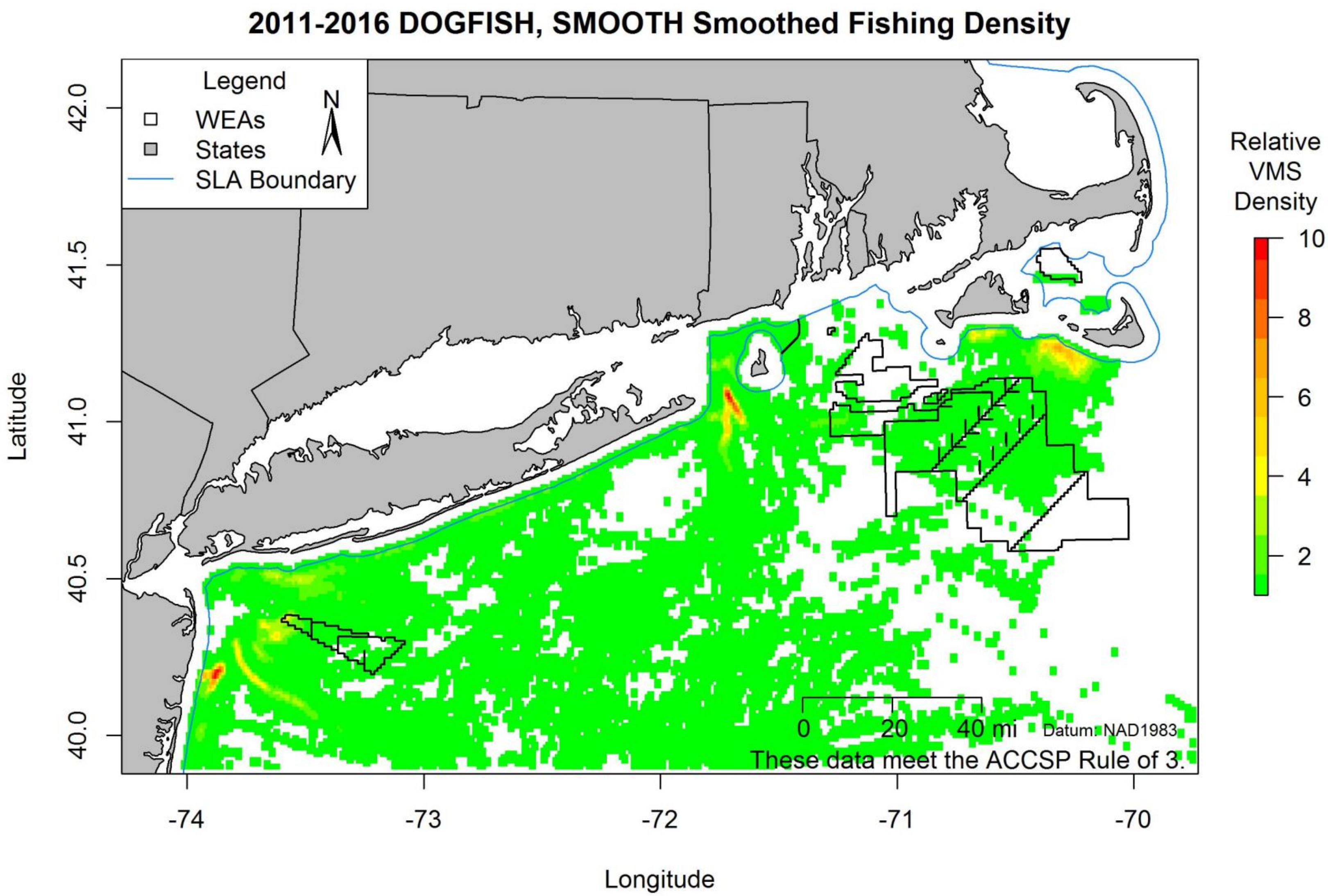

Figure 79. Smoothed federal fishing activity of all trips between 2011 and 2016 where smooth dogfish was caught

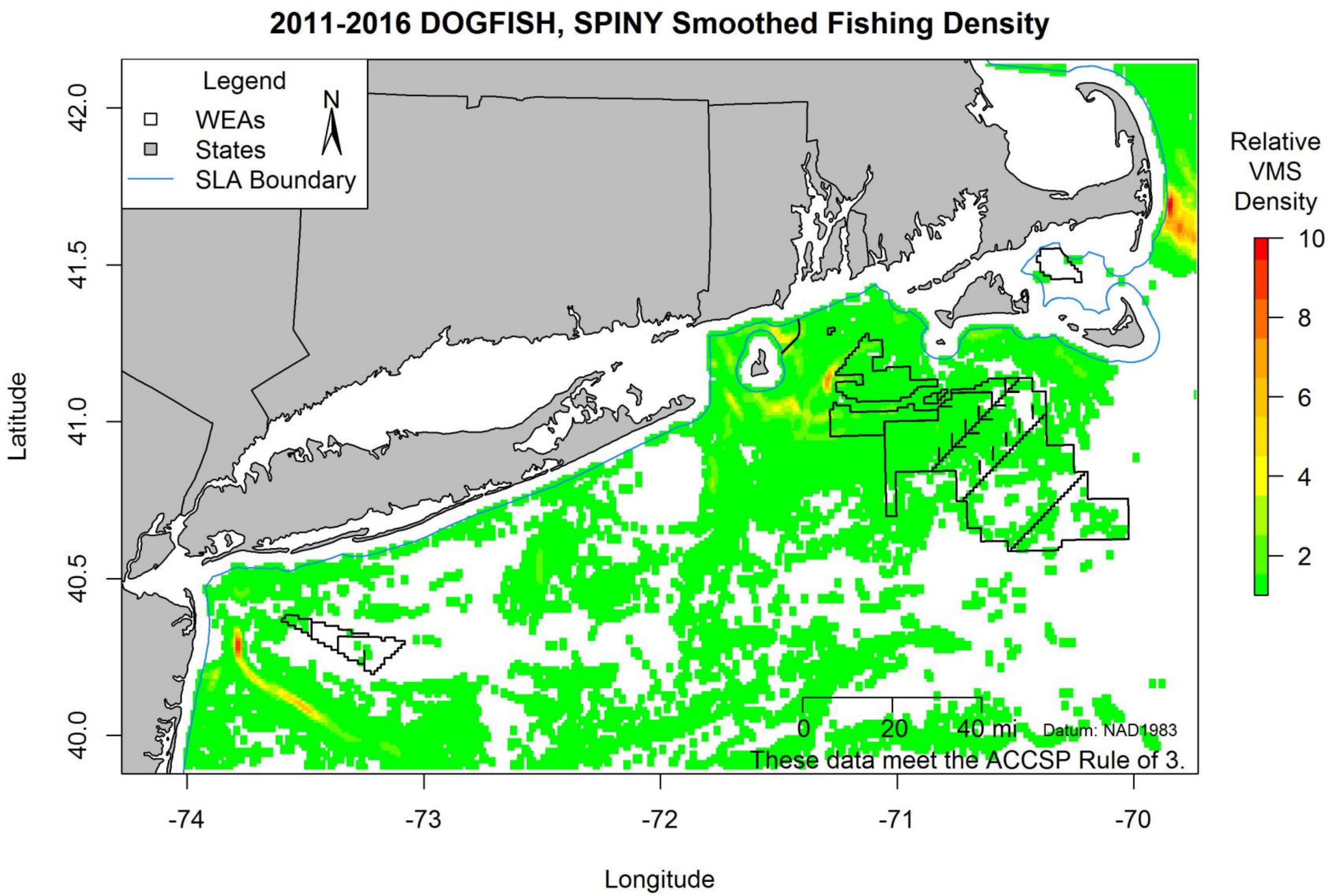

Figure 80. Smoothed federal fishing activity of all trips between 2011 and 2016 where spiny dogfish was caught

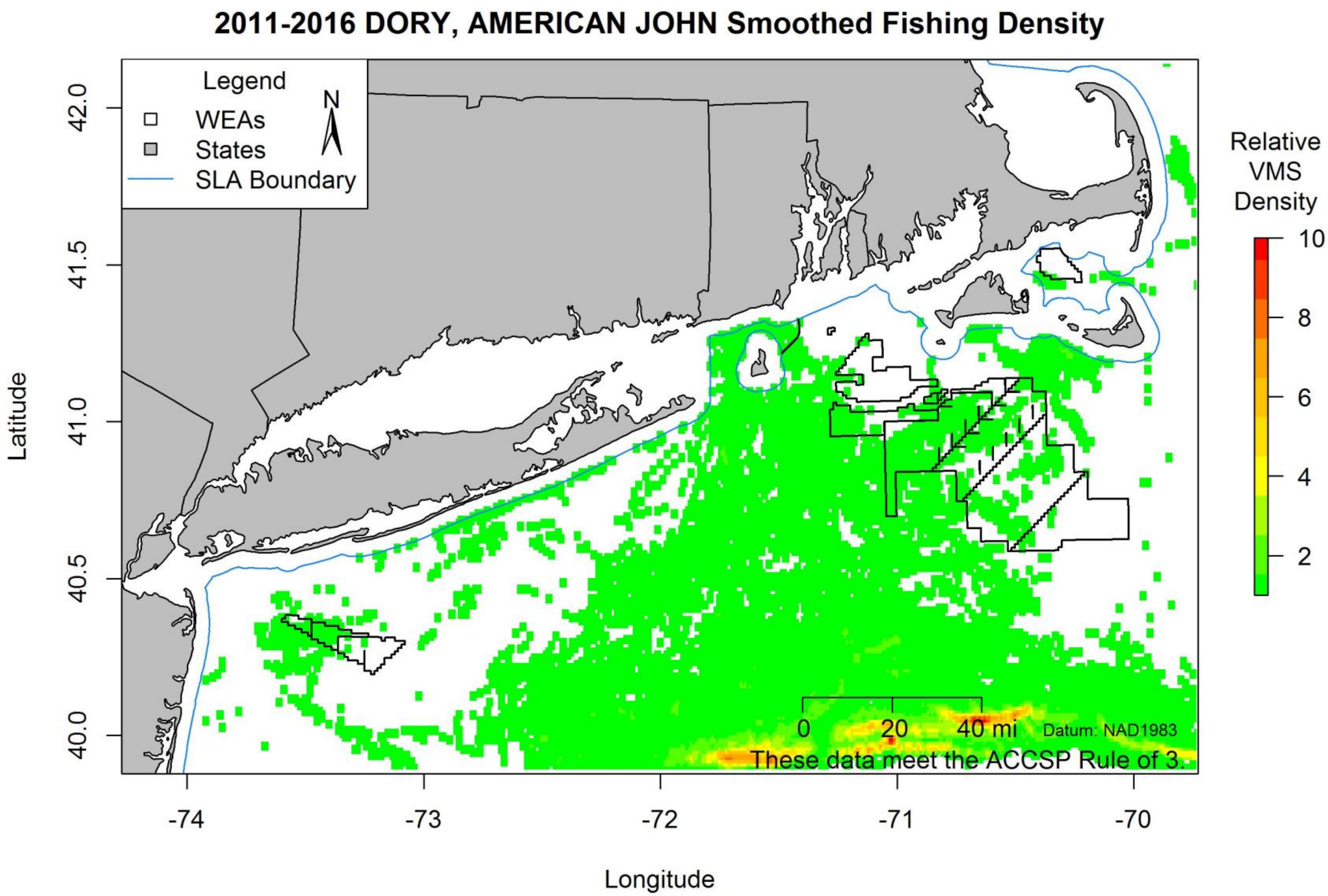

Figure 81. Smoothed federal fishing activity of all trips between 2011 and 2016 where American John Dory was caught

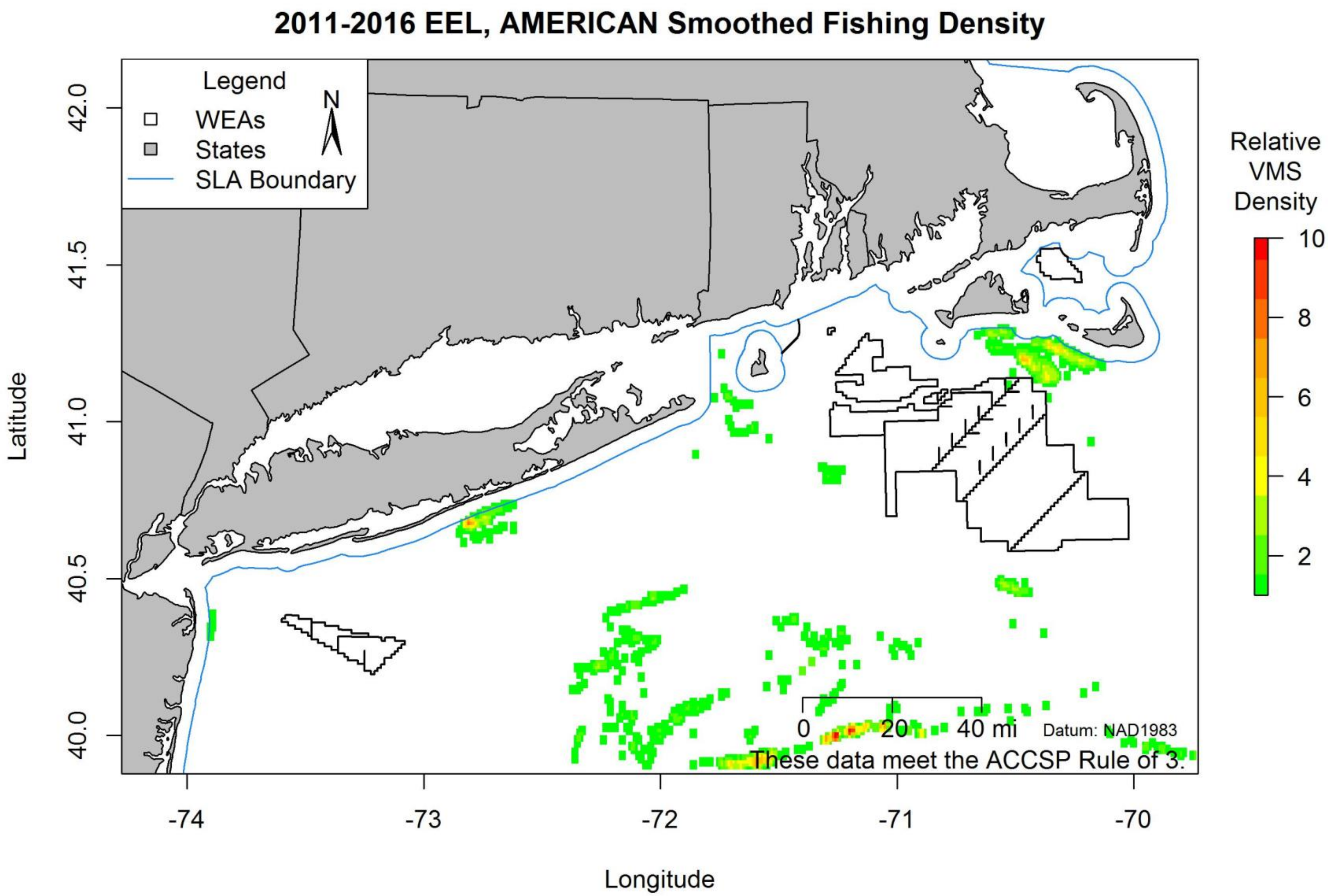

Figure 82. Smoothed federal fishing activity of all trips between 2011 and 2016 where American eel was caught

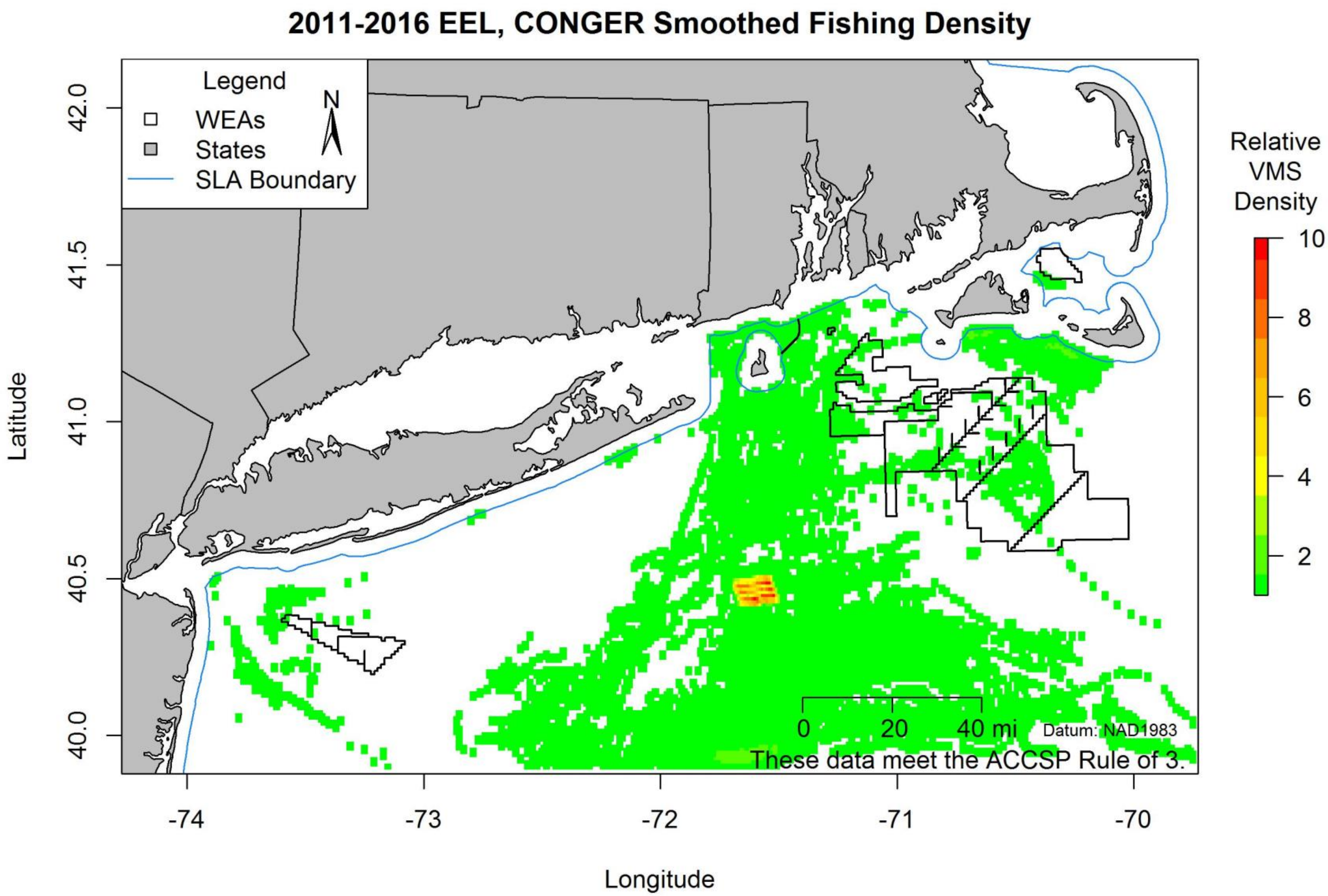

Figure 83. Smoothed federal fishing activity of all trips between 2011 and 2016 where conger eel was caught

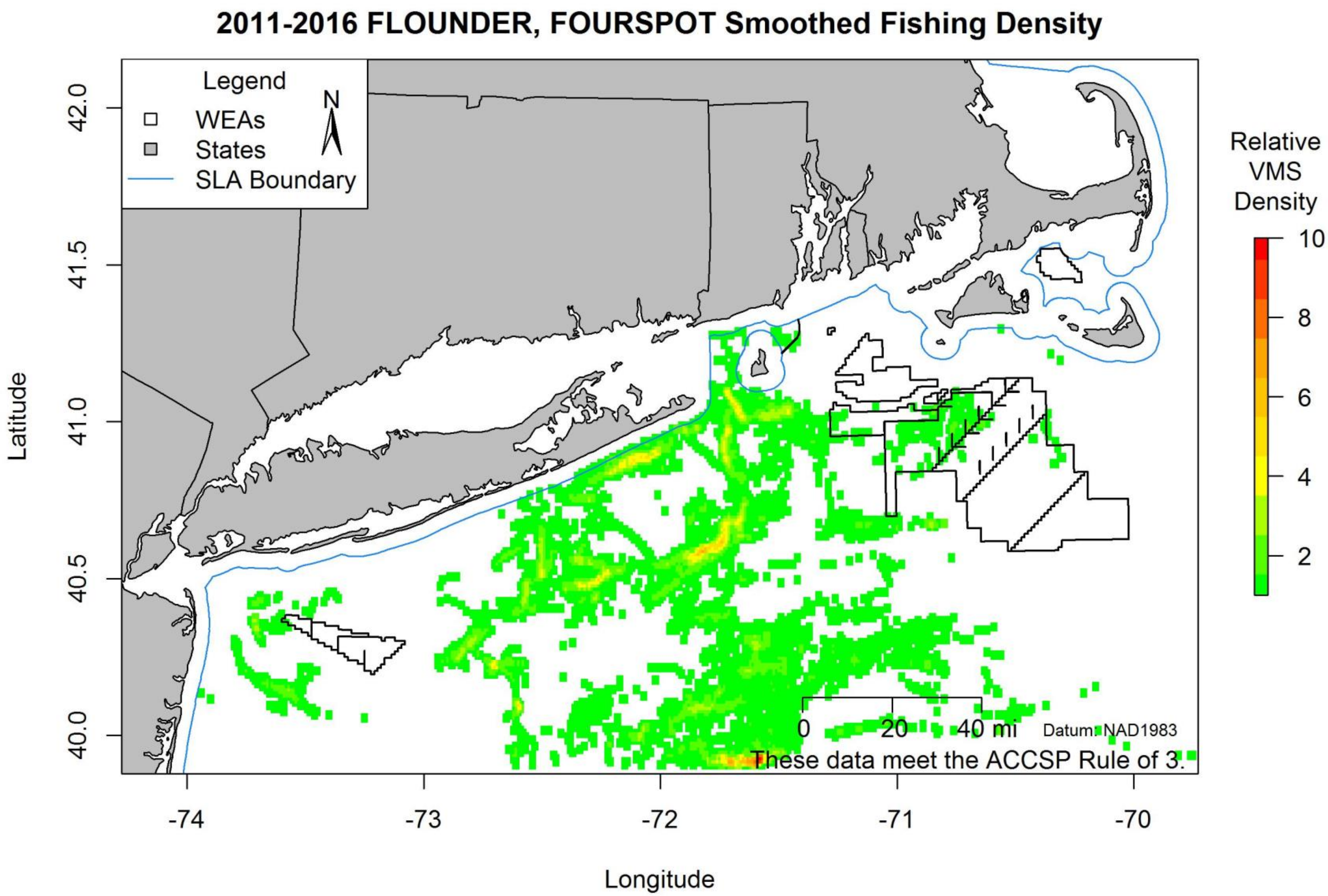

Figure 84. Smoothed federal fishing activity of all trips between 2011 and 2016 where fourspot flounder was caught

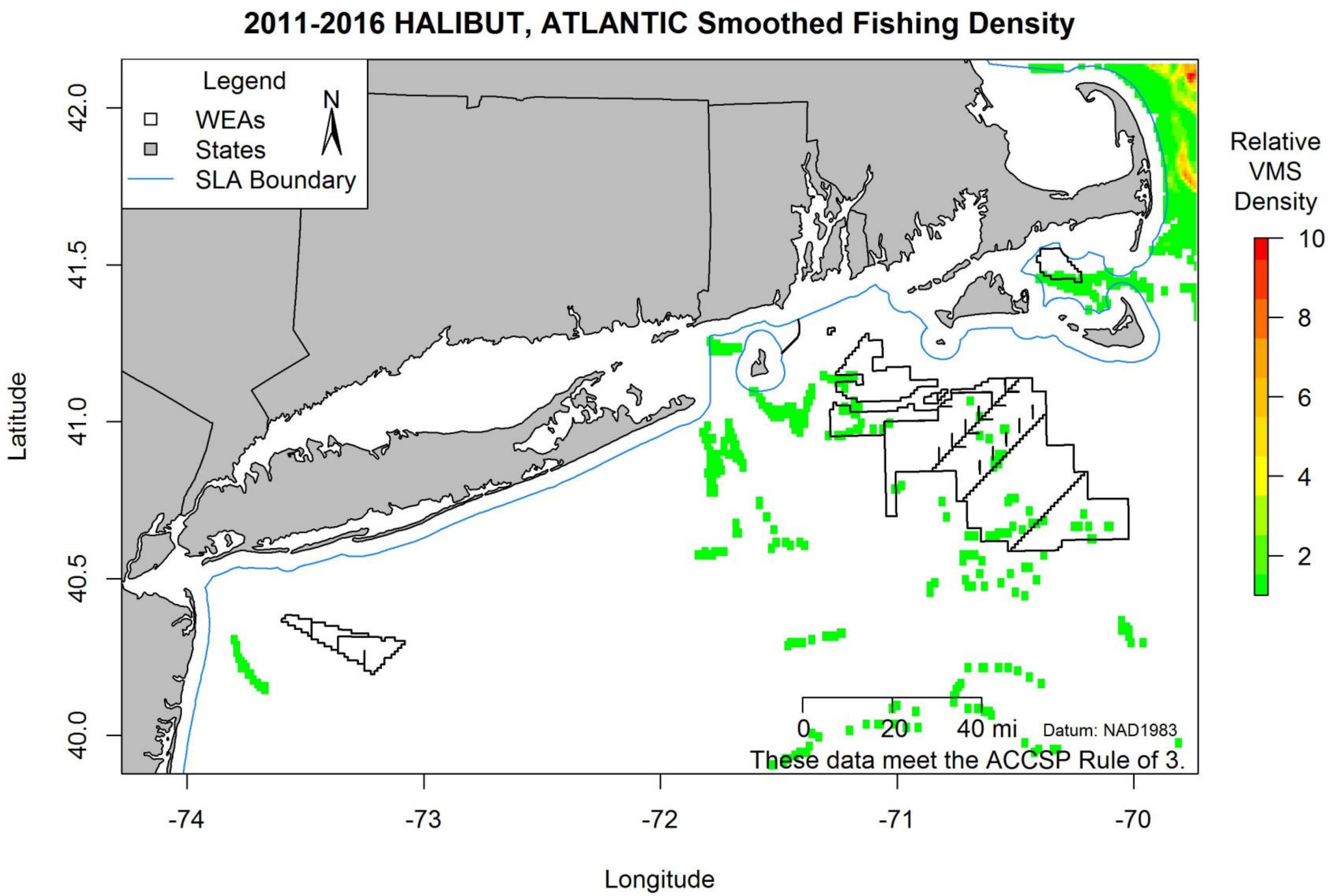

Figure 85. Smoothed federal fishing activity of all trips between 2011 and 2016 where Atlantic halibut was caught

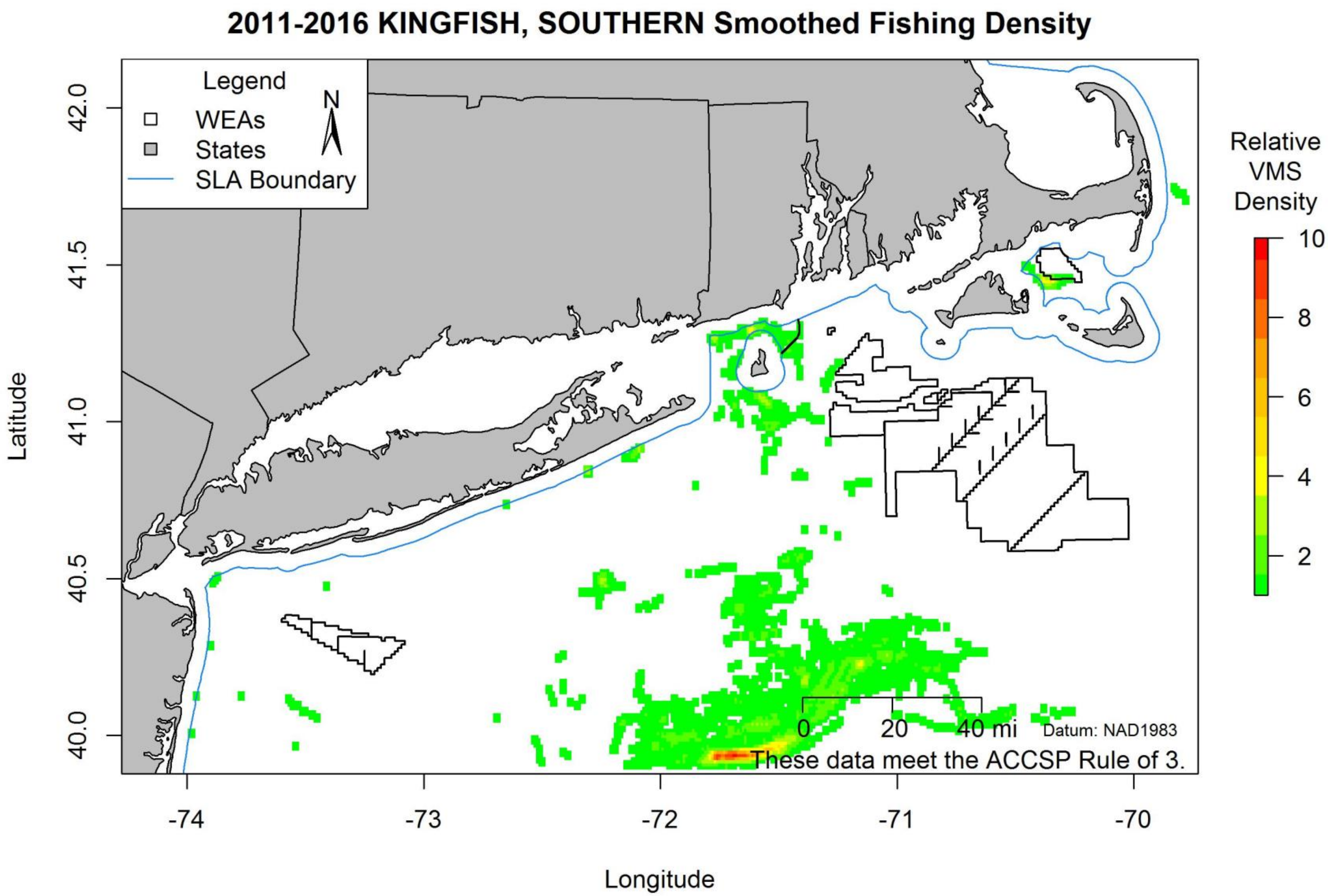

Figure 86. Smoothed federal fishing activity of all trips between 2011 and 2016 where Southern kingfish was caught

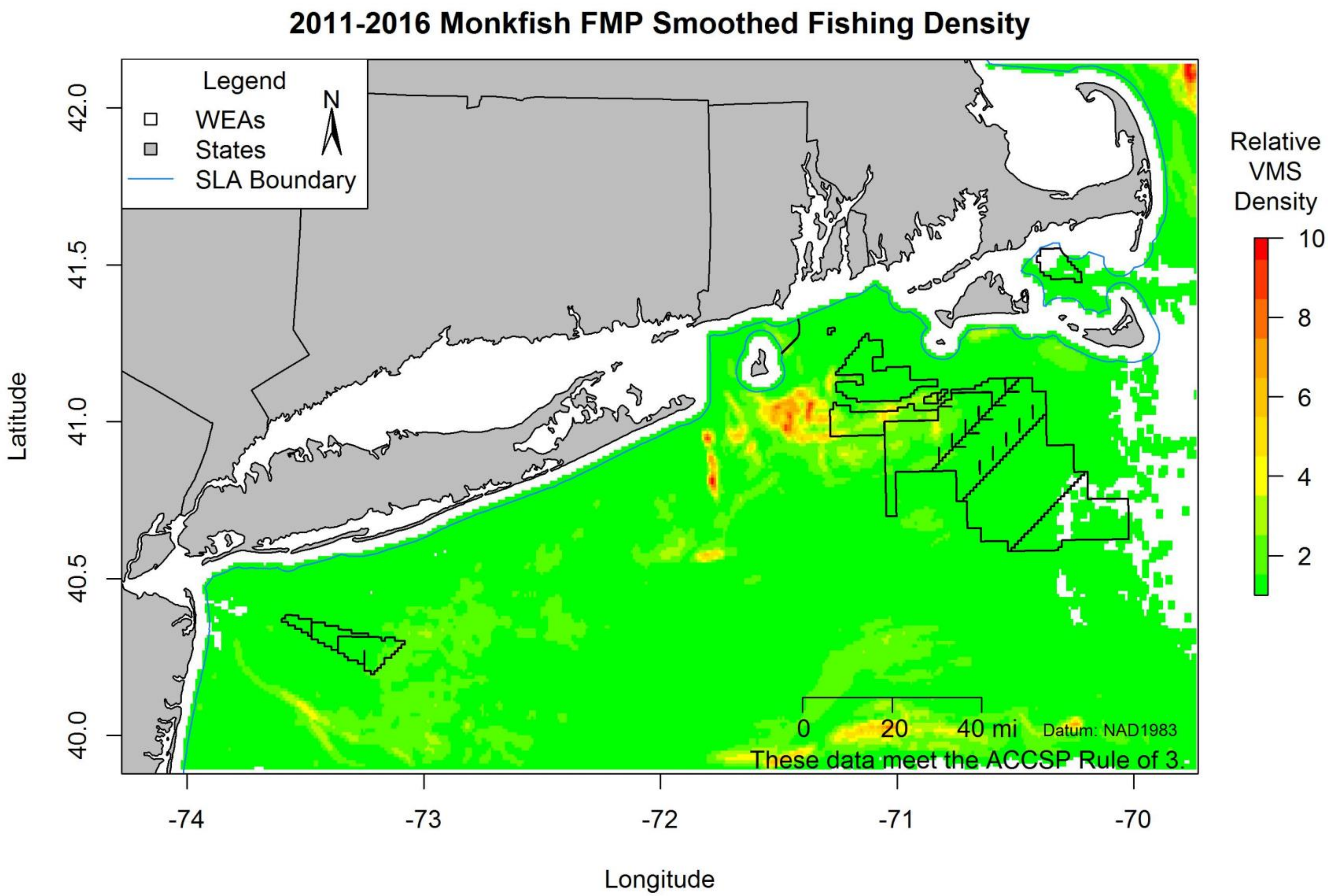

Figure 87. Smoothed federal fishing activity of all trips between 2011 and 2016 where monkfish was caught

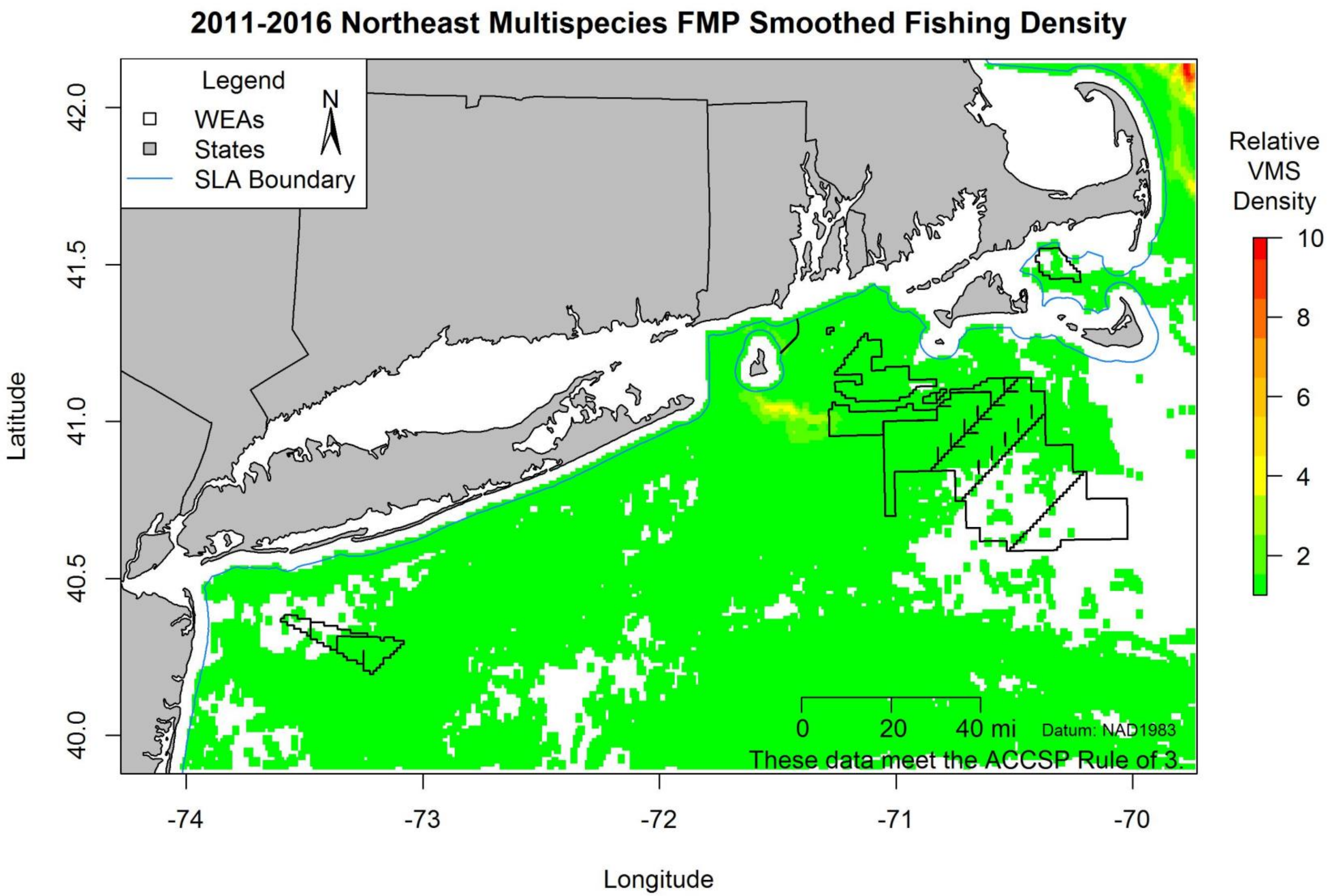

Figure 88. Smoothed federal fishing activity of all trips between 2011 and 2016 where Northeast Multispecies FMP species (American plaice, Atlantic cod, Atlantic halibut, Atlantic pollock, Atlantic wolfish - prohibited, haddock, ocean pout - prohibited, redfish, white hake, windowpane flounder - prohibited, winter flounder, witch flounder, yellowtail flounder) were caught

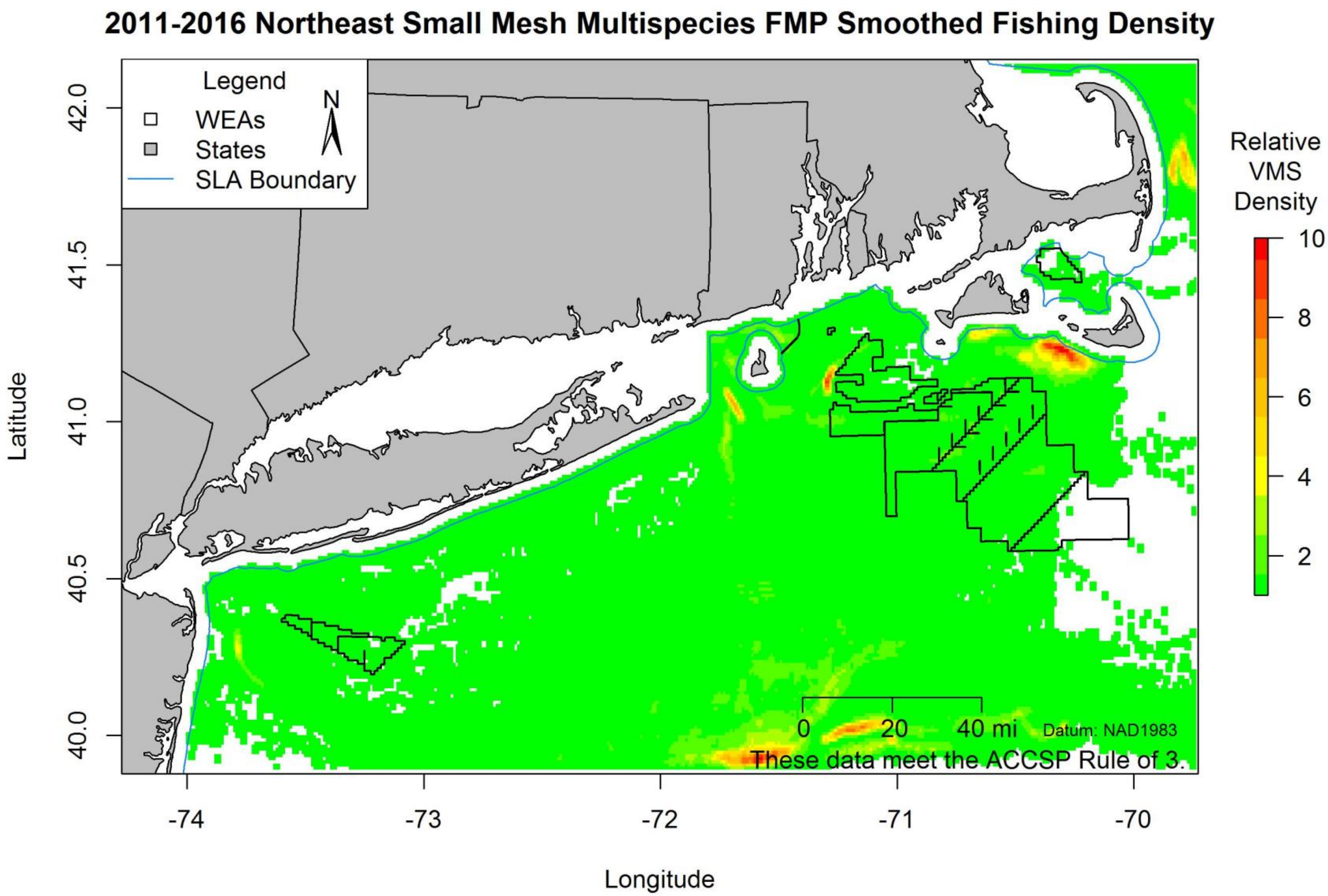

Figure 89. Smoothed federal fishing activity of all trips between 2011 and 2016 where Northeast Small Mesh Multispecies FMP species (offshore hake, red hake, and silver hake) were caught

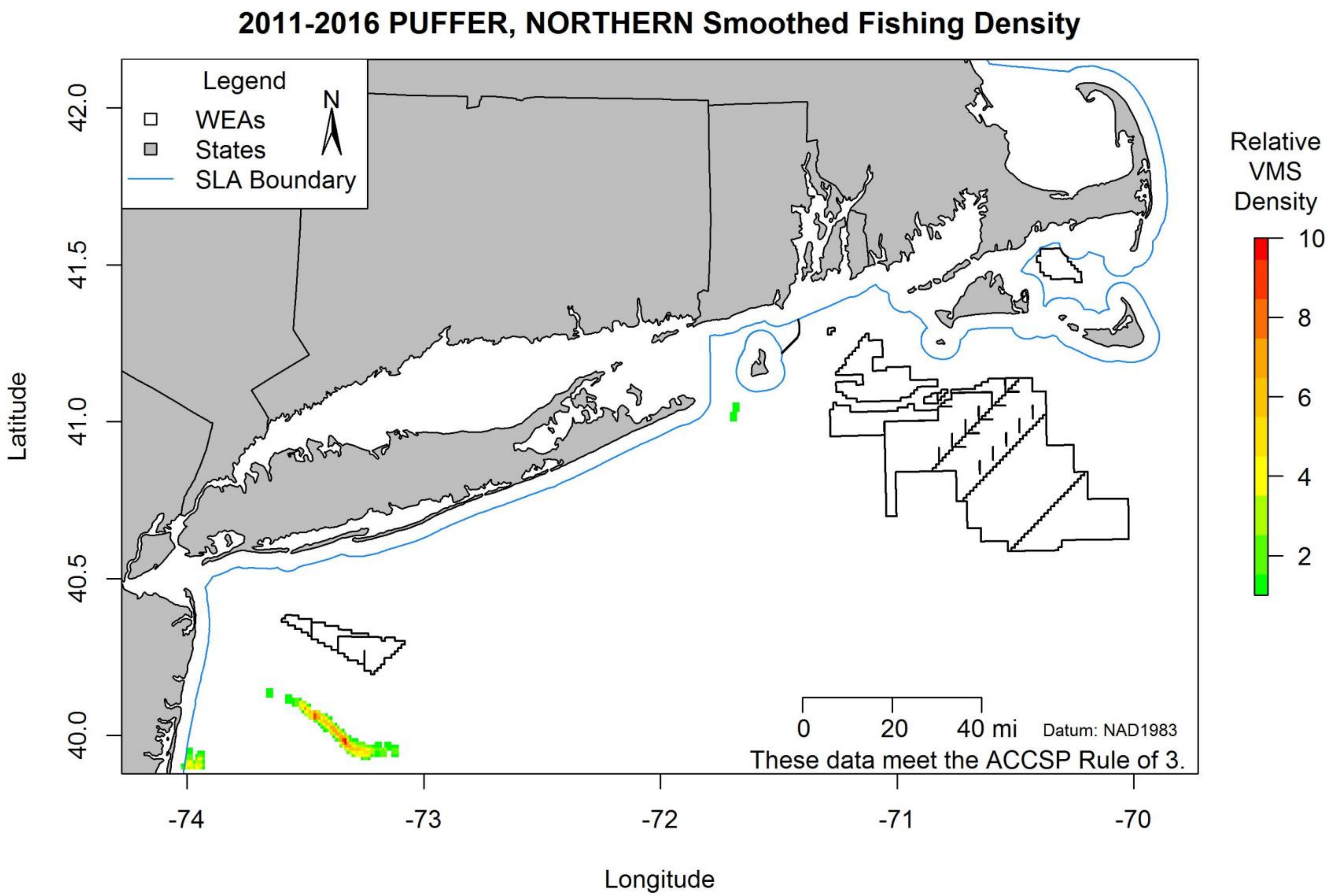

Figure 90. Smoothed federal fishing activity of all trips between 2011 and 2016 where Northern puffer was caught

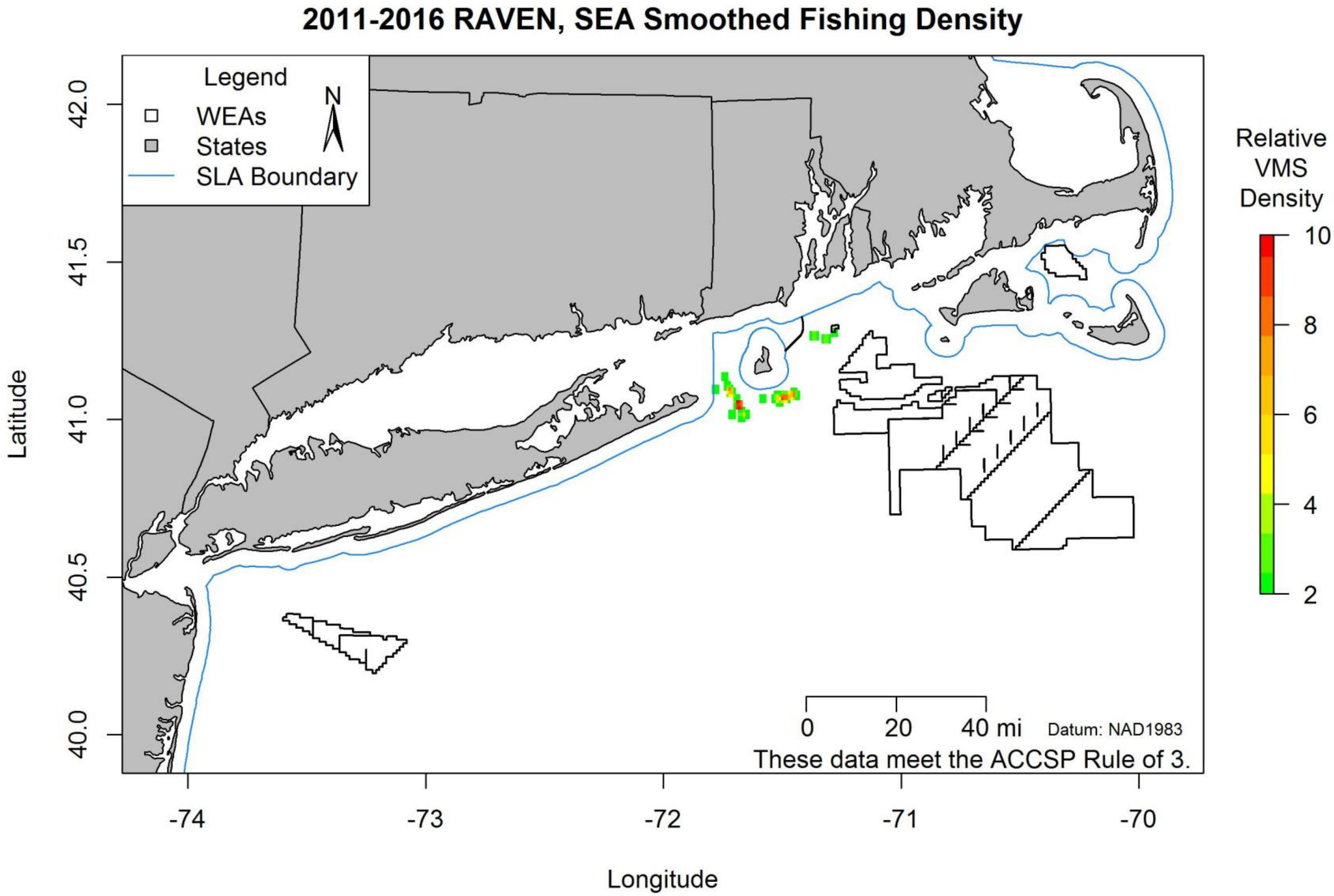

Figure 91. Smoothed federal fishing activity of all trips between 2011 and 2016 where sea raven was caught

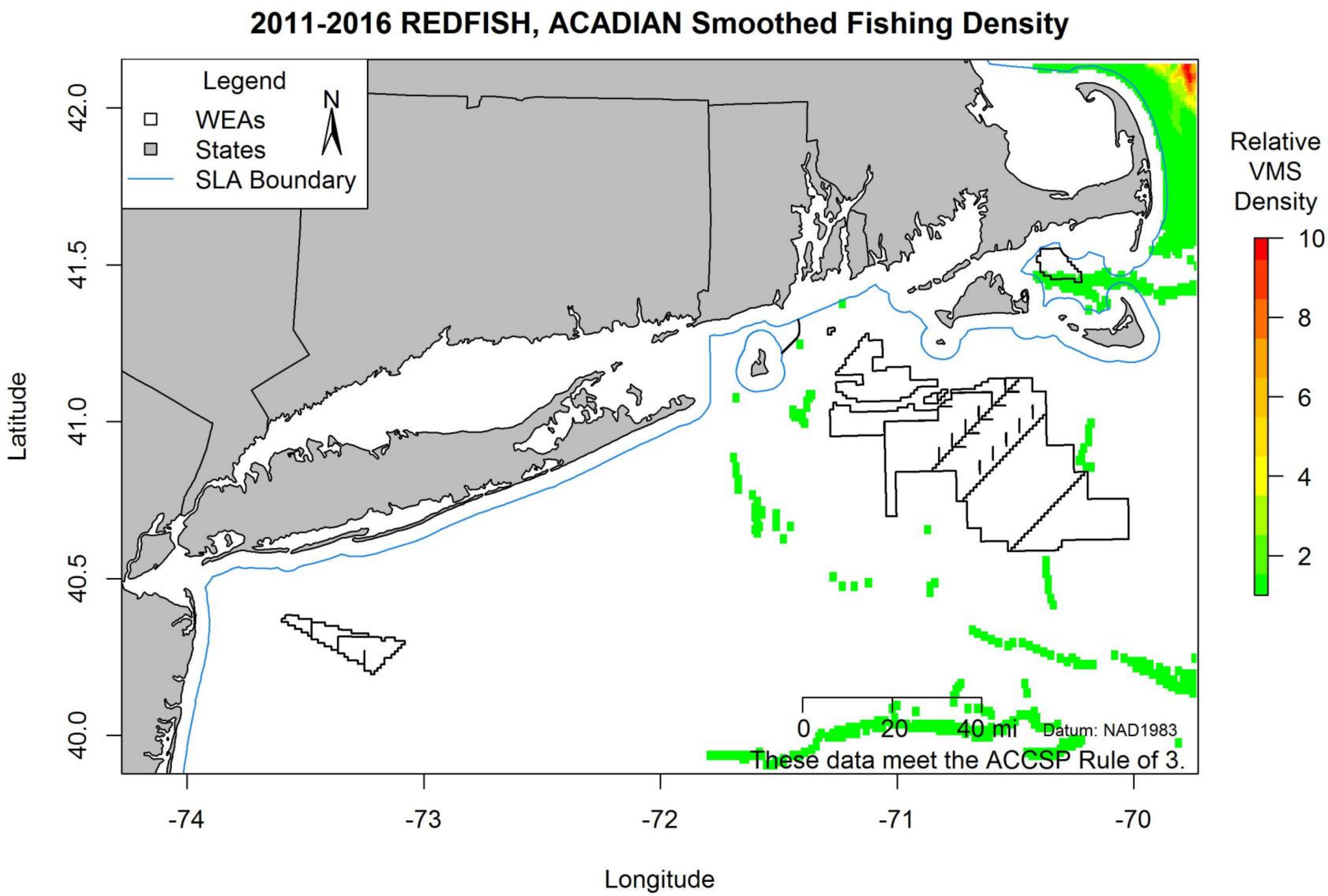

Figure 92. Smoothed federal fishing activity of all trips between 2011 and 2016 where Acadian redfish was caught

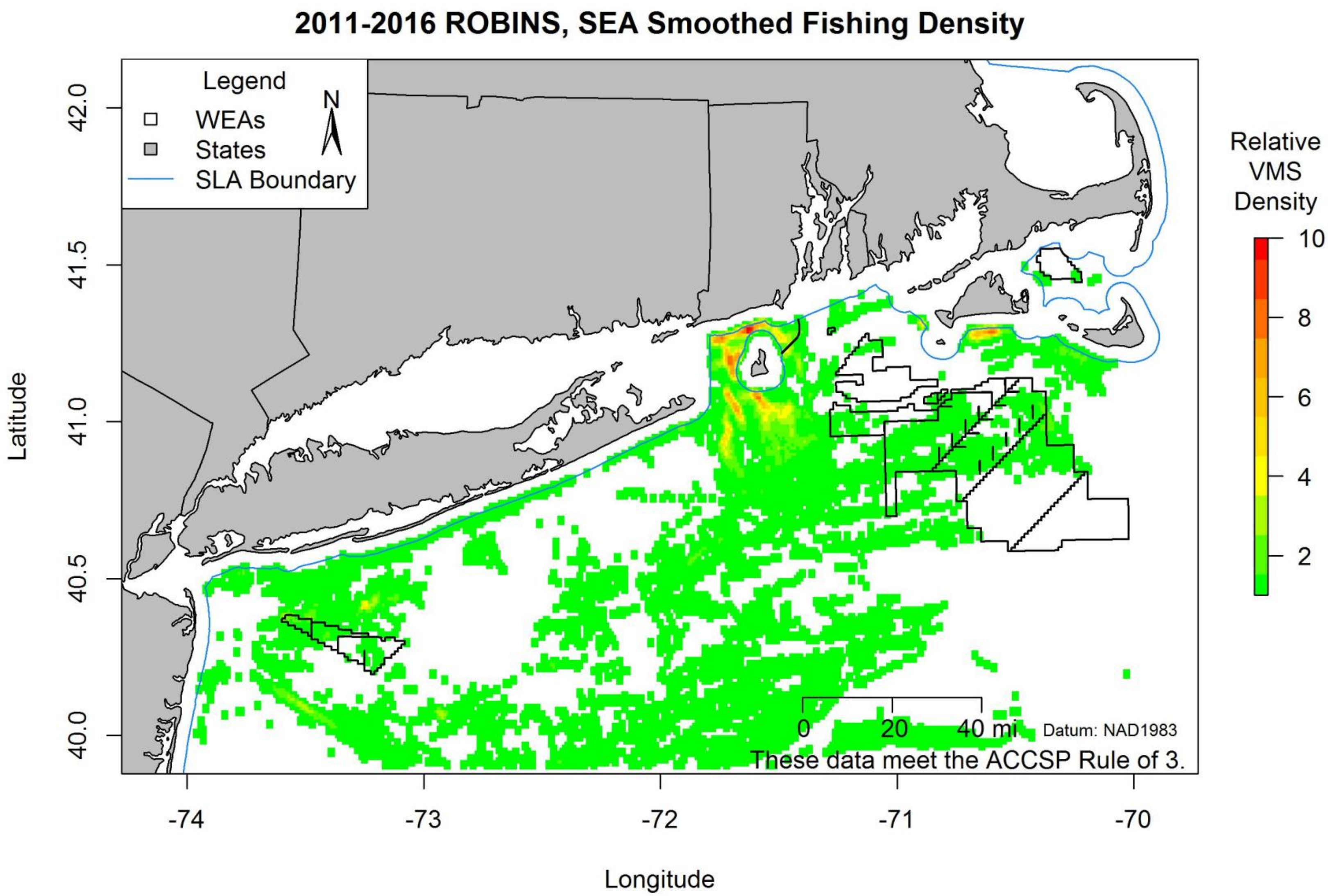

Figure 93. Smoothed federal fishing activity of all trips between 2011 and 2016 where sea robins were caught

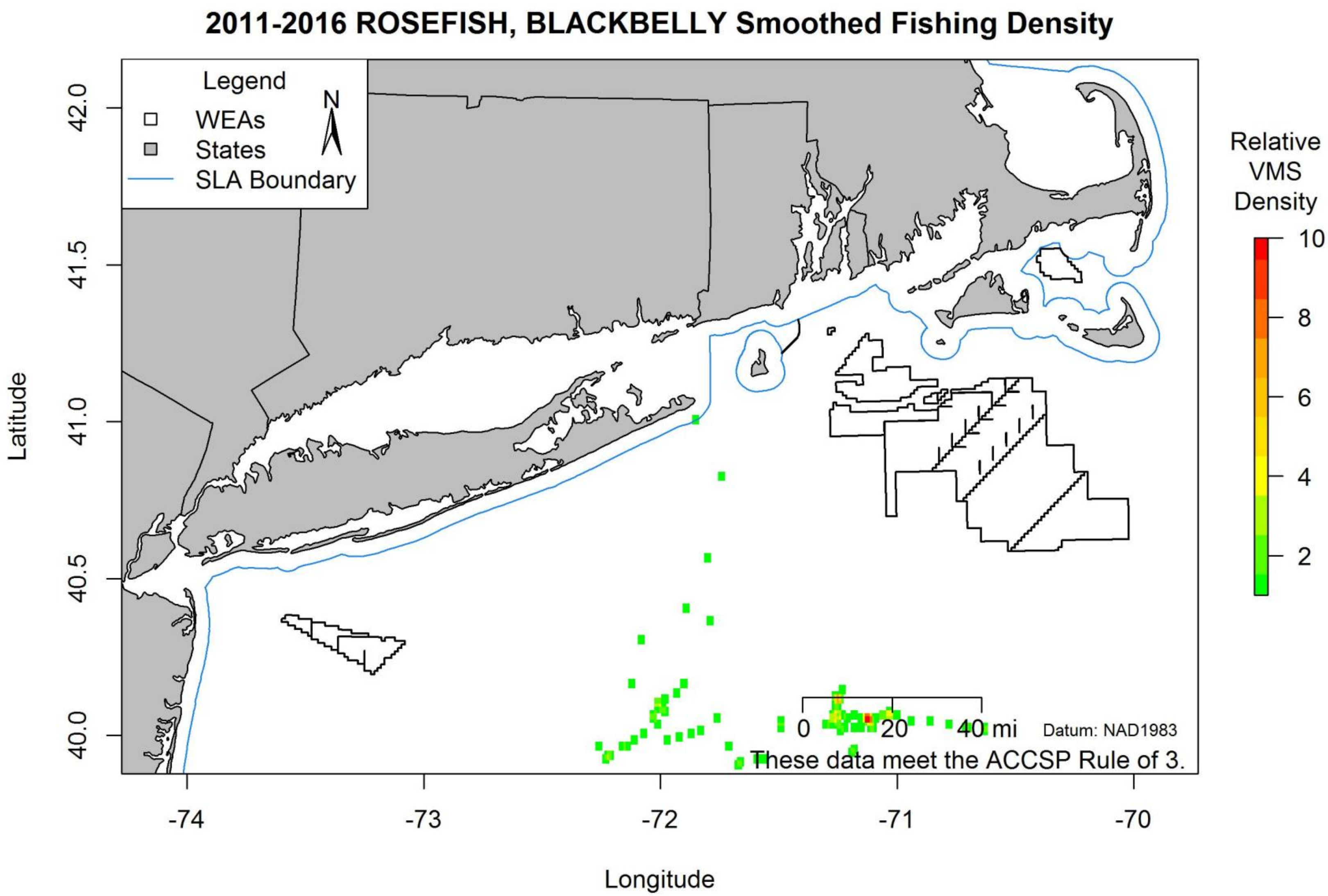

Figure 94. Smoothed federal fishing activity of all trips between 2011 and 2016 where blackbelly rosefish was caught

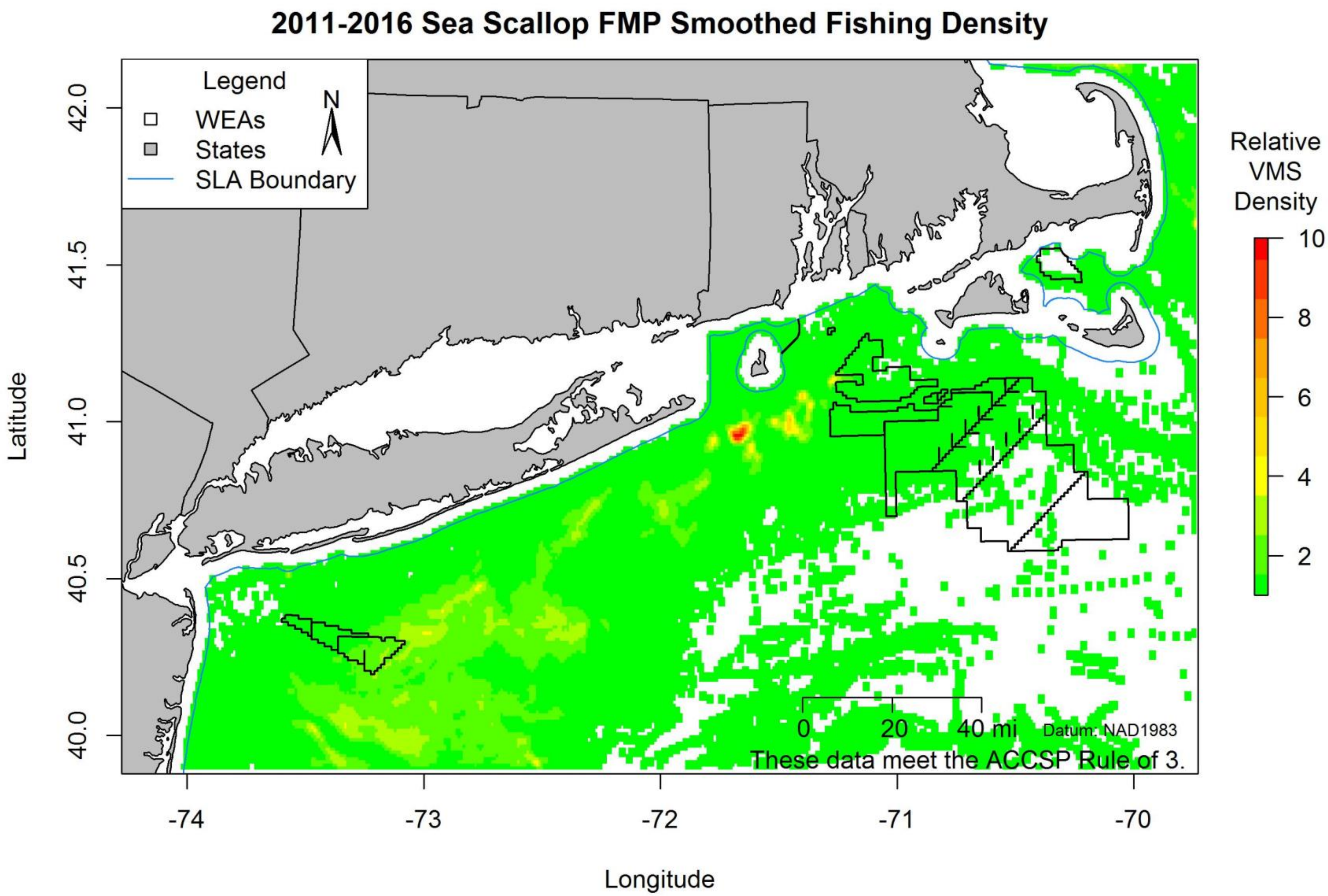

Figure 95. Smoothed federal fishing activity of all trips between 2011 and 2016 where sea scallop was caught

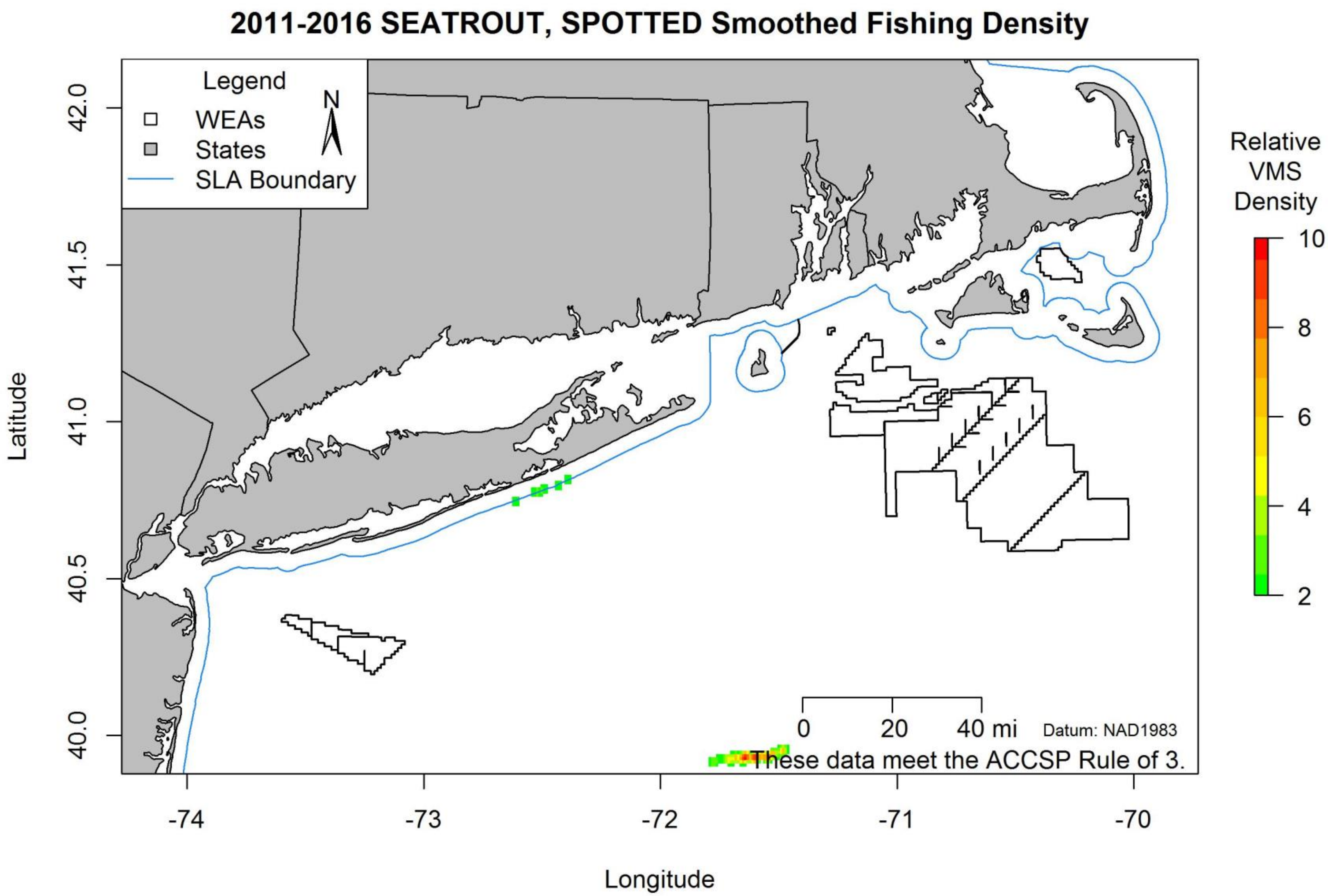

Figure 96. Smoothed federal fishing activity of all trips between 2011 and 2016 where spotted seatrout was caught

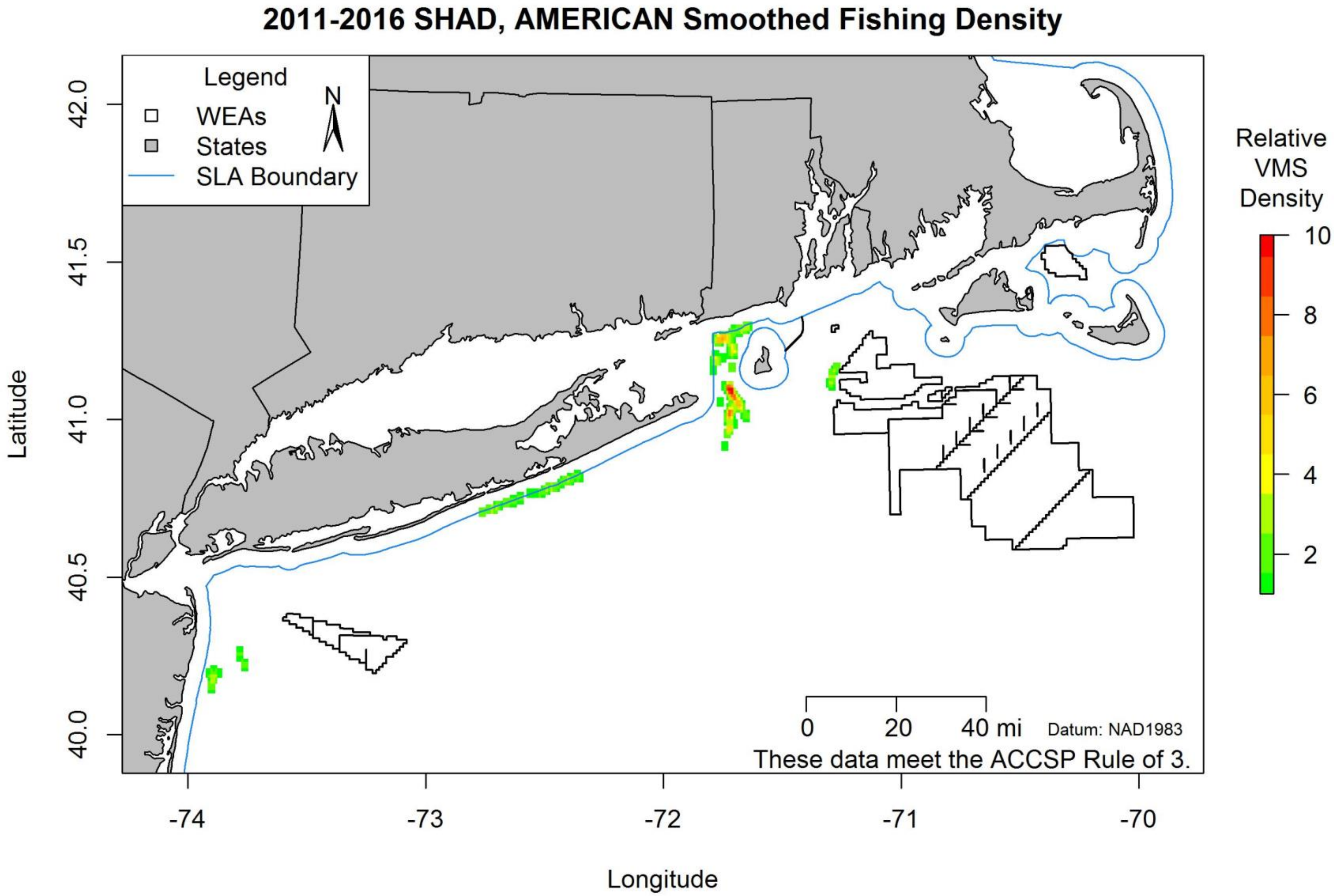

Figure 97. Smoothed federal fishing activity of all trips between 2011 and 2016 where American shad was caught

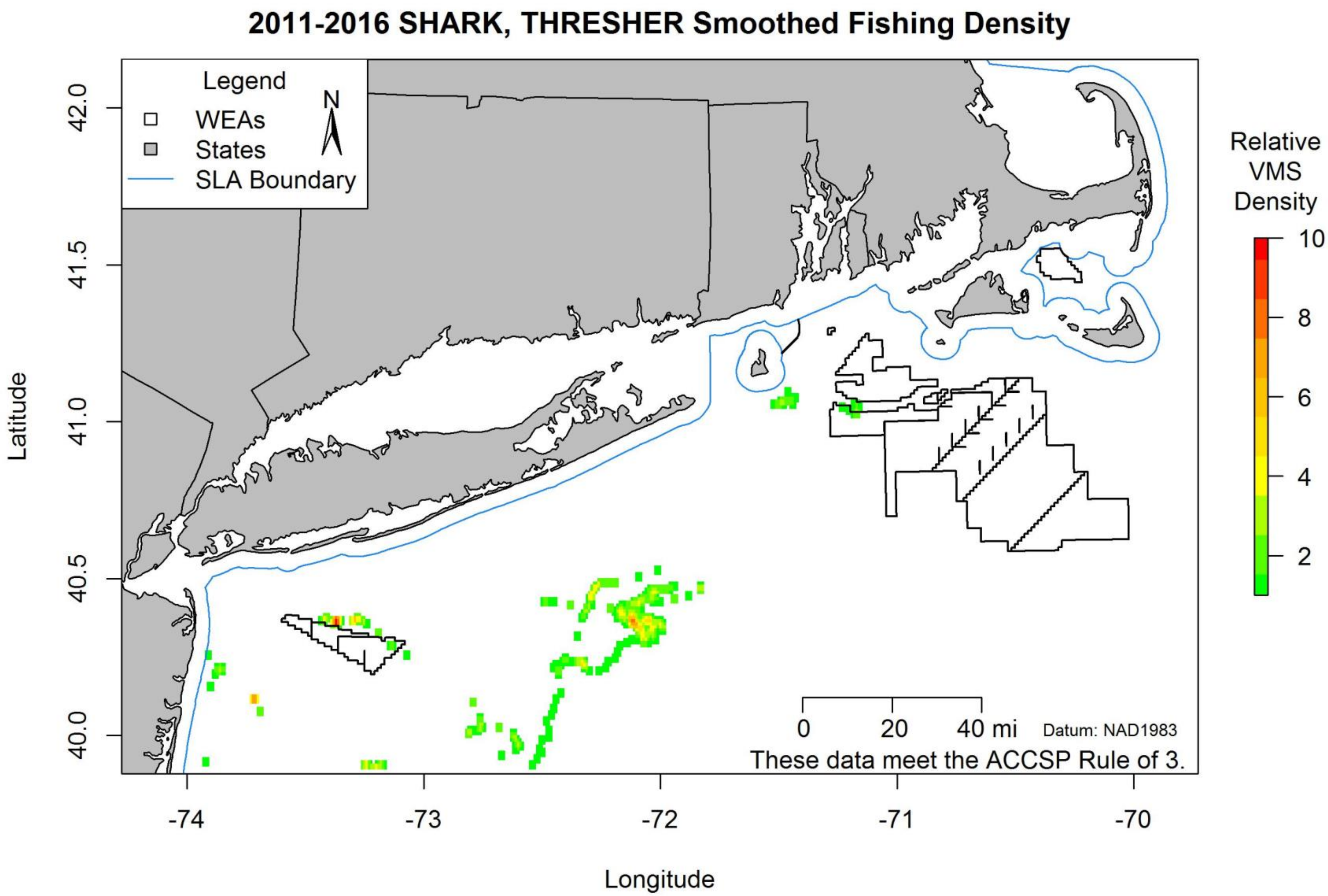

Figure 98. Smoothed federal fishing activity of all trips between 2011 and 2016 where thresher shark was caught

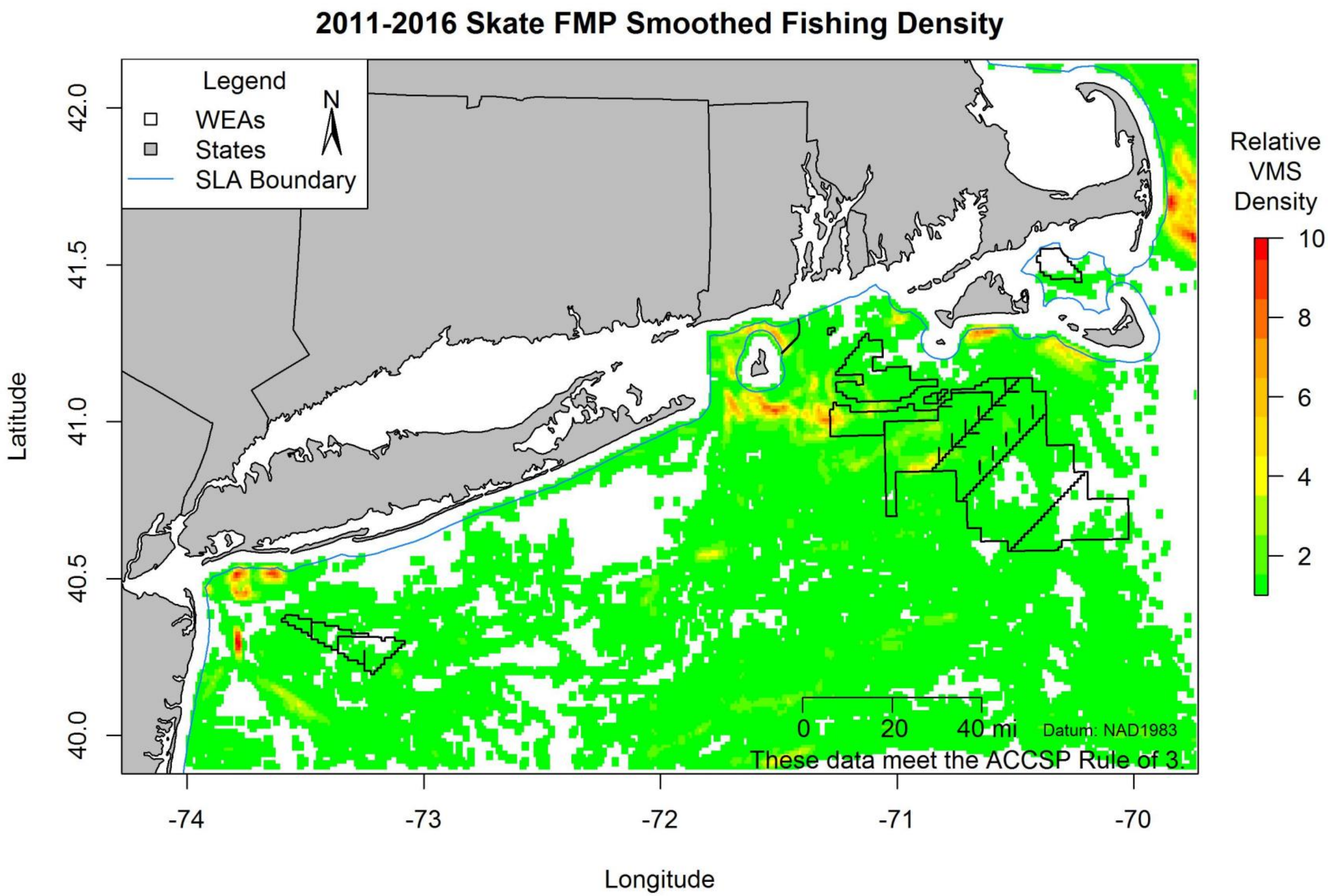

Figure 99. Smoothed federal fishing activity of all trips between 2011 and 2016 where skate FMP species (winter skate, barndoor skate – prohibited, thorny skate – prohibited, smooth skate – prohibited, little skate, clearnose skate, rosette skate) were caught

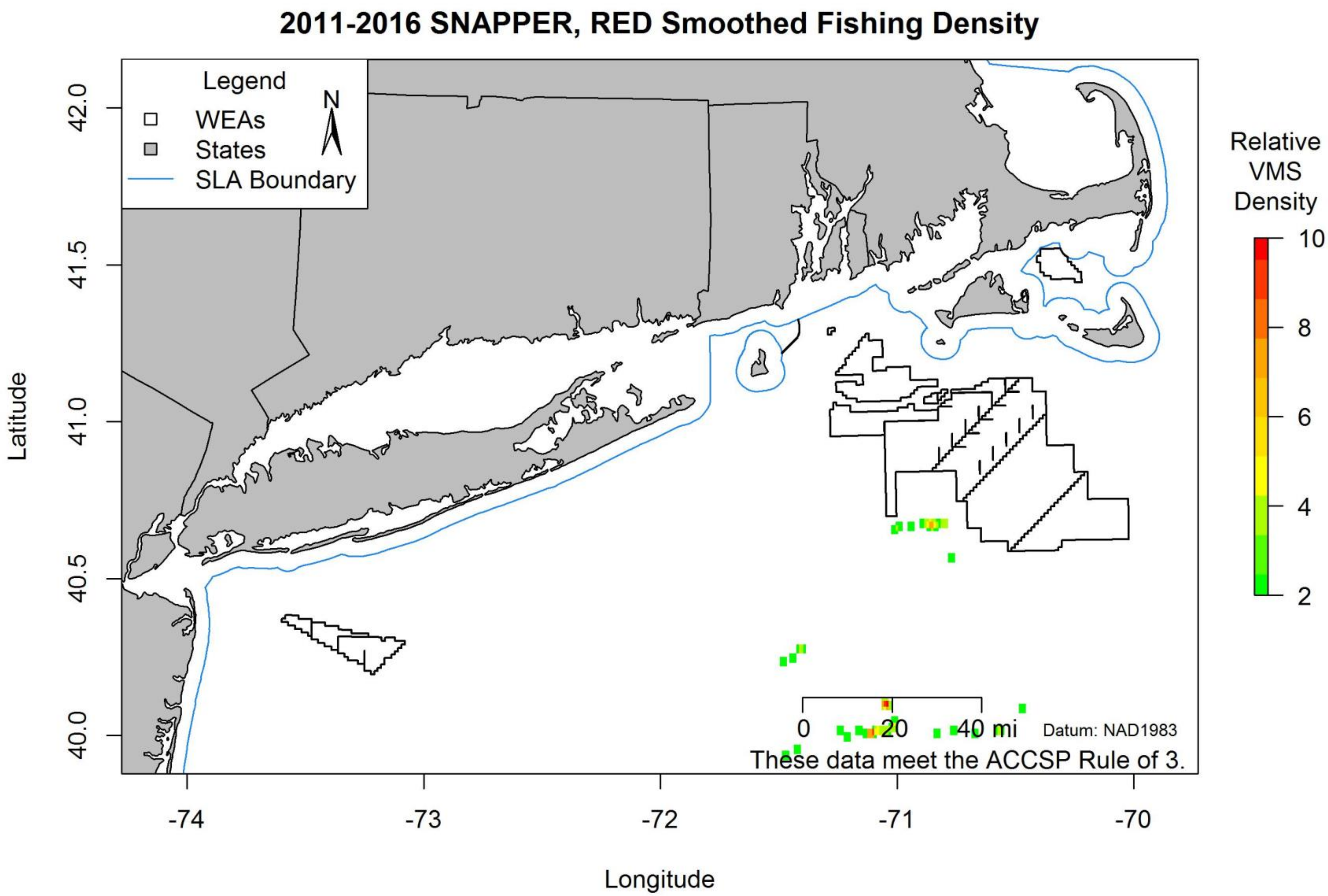

Figure 100. Smoothed federal fishing activity of all trips between 2011 and 2016 where red snapper was caught

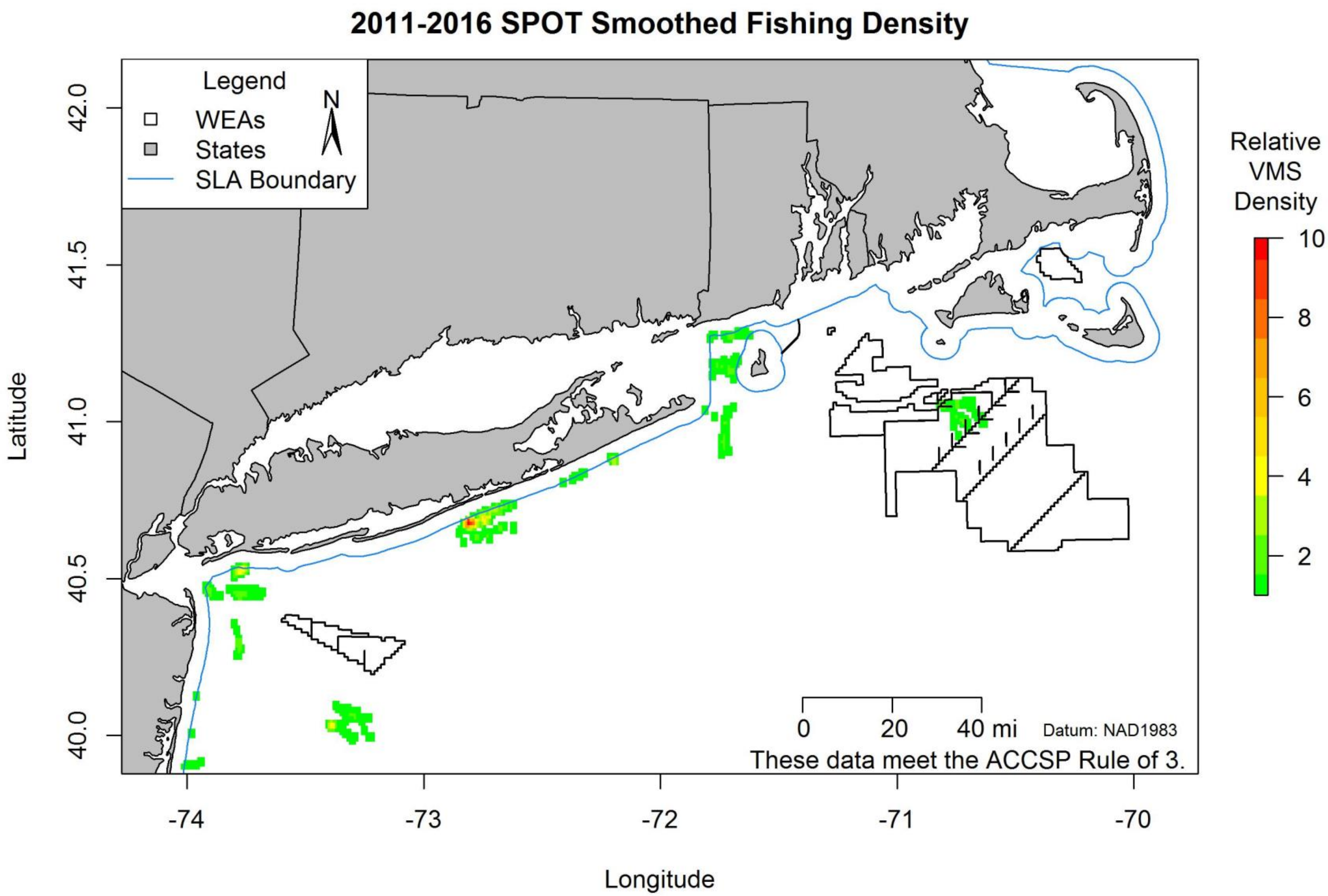

Figure 101. Smoothed federal fishing activity of all trips between 2011 and 2016 where spot was caught

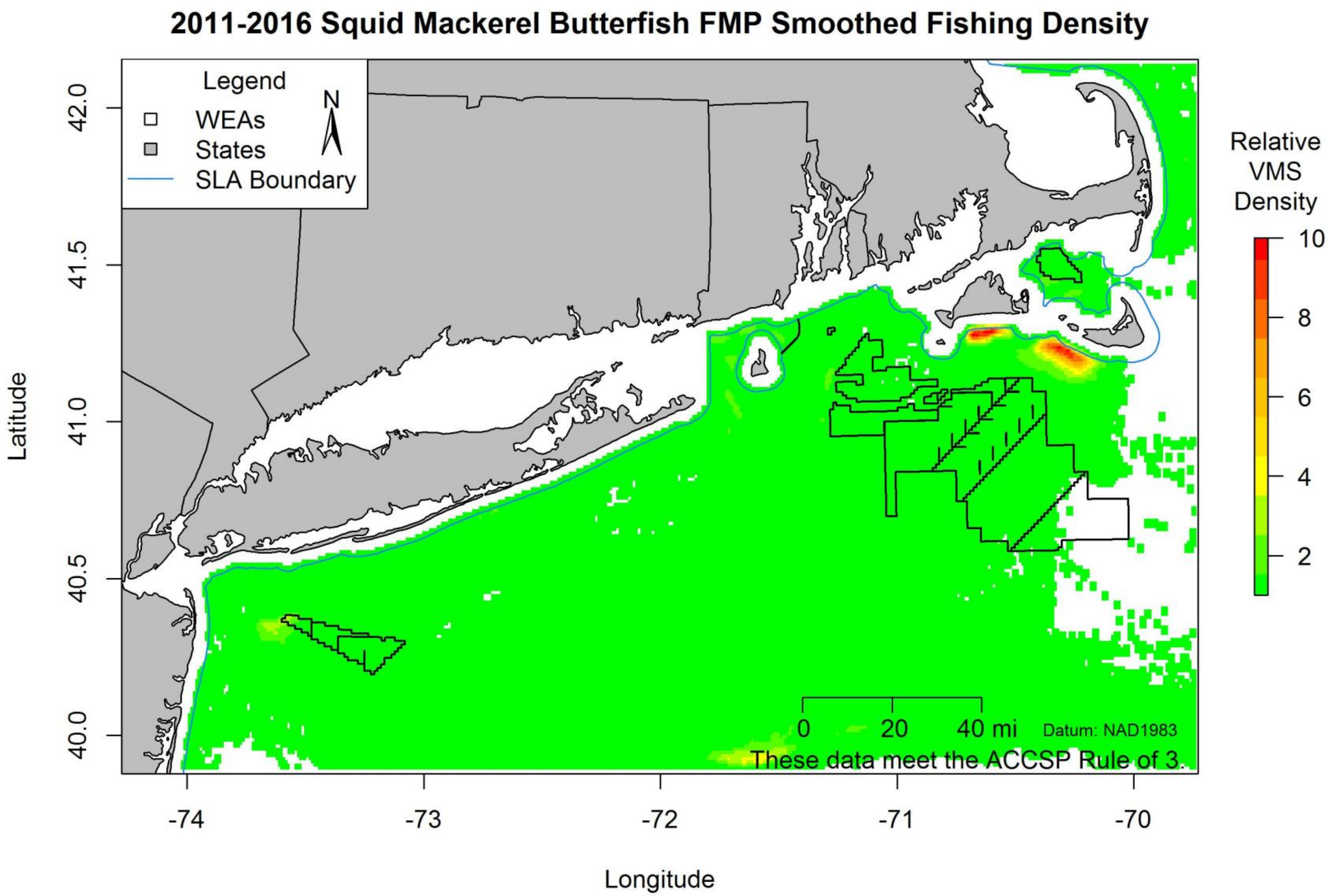

Figure 102. Smoothed federal fishing activity of all trips between 2011 and 2016 where squid, Atlantic mackerel, and butterfish were caught

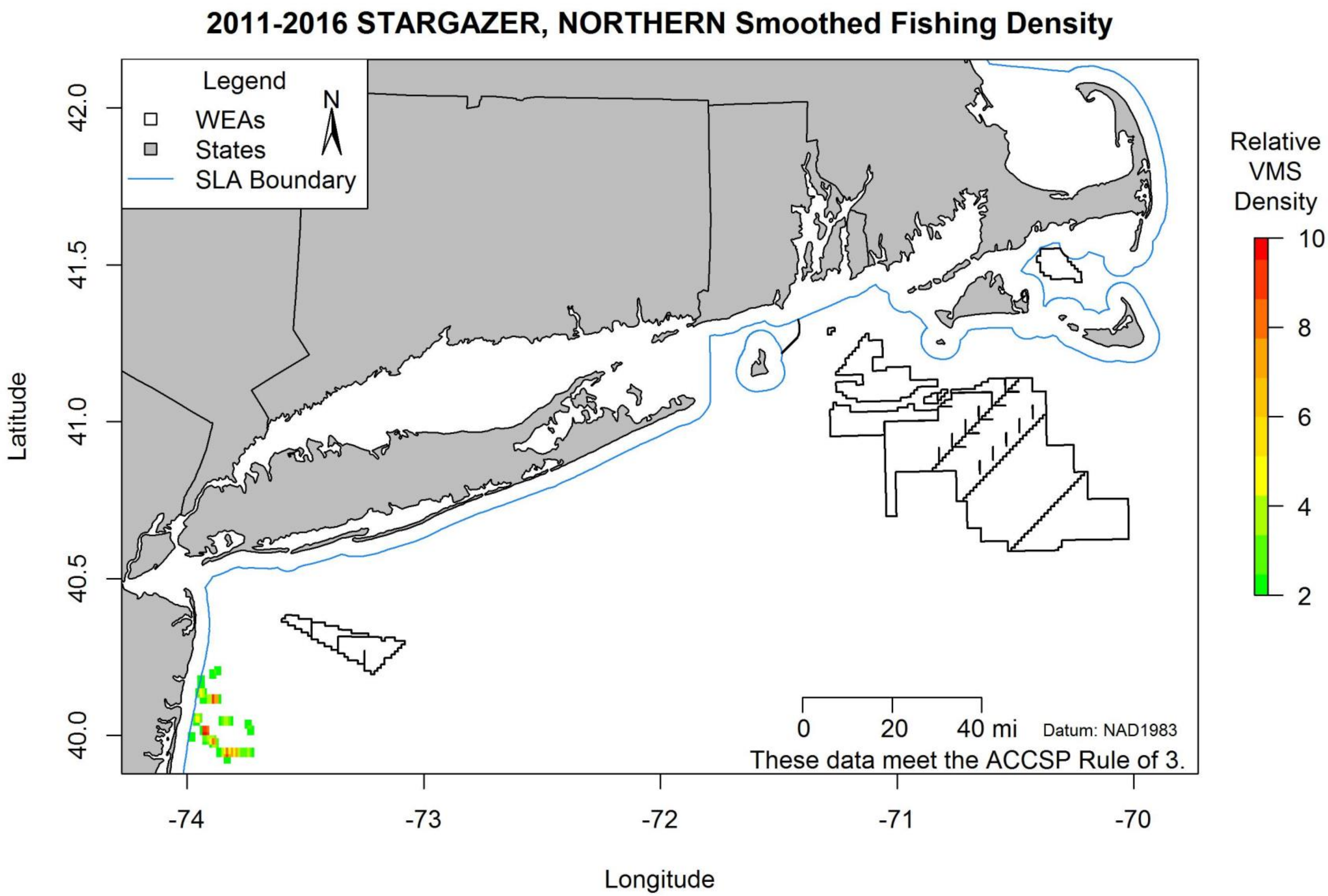

Figure 103. Smoothed federal fishing activity of all trips between 2011 and 2016 where Northern stargazer was caught

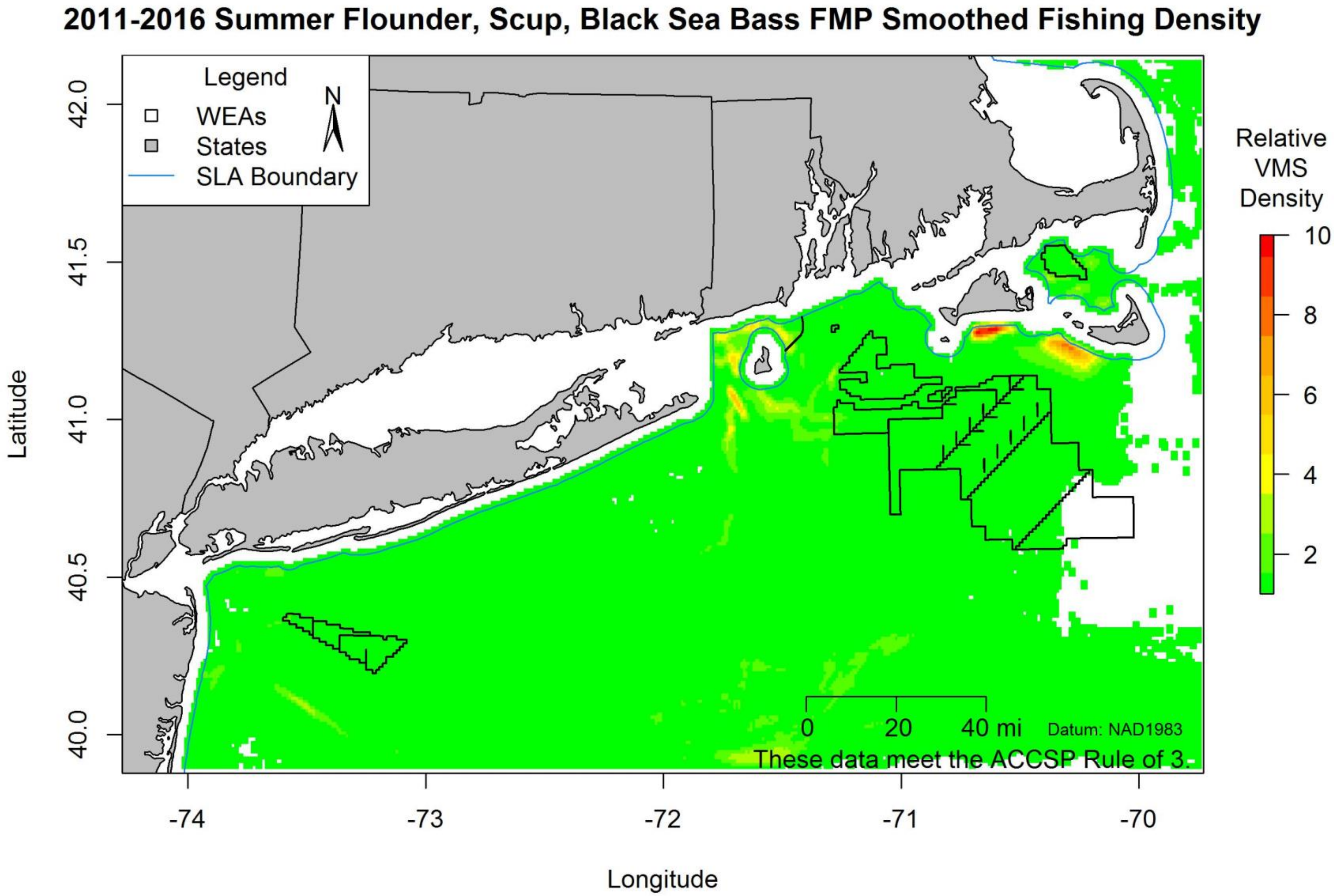

Figure 104. Smoothed federal fishing activity of all trips between 2011 and 2016 where summer flounder, scup, and black sea bass were caught

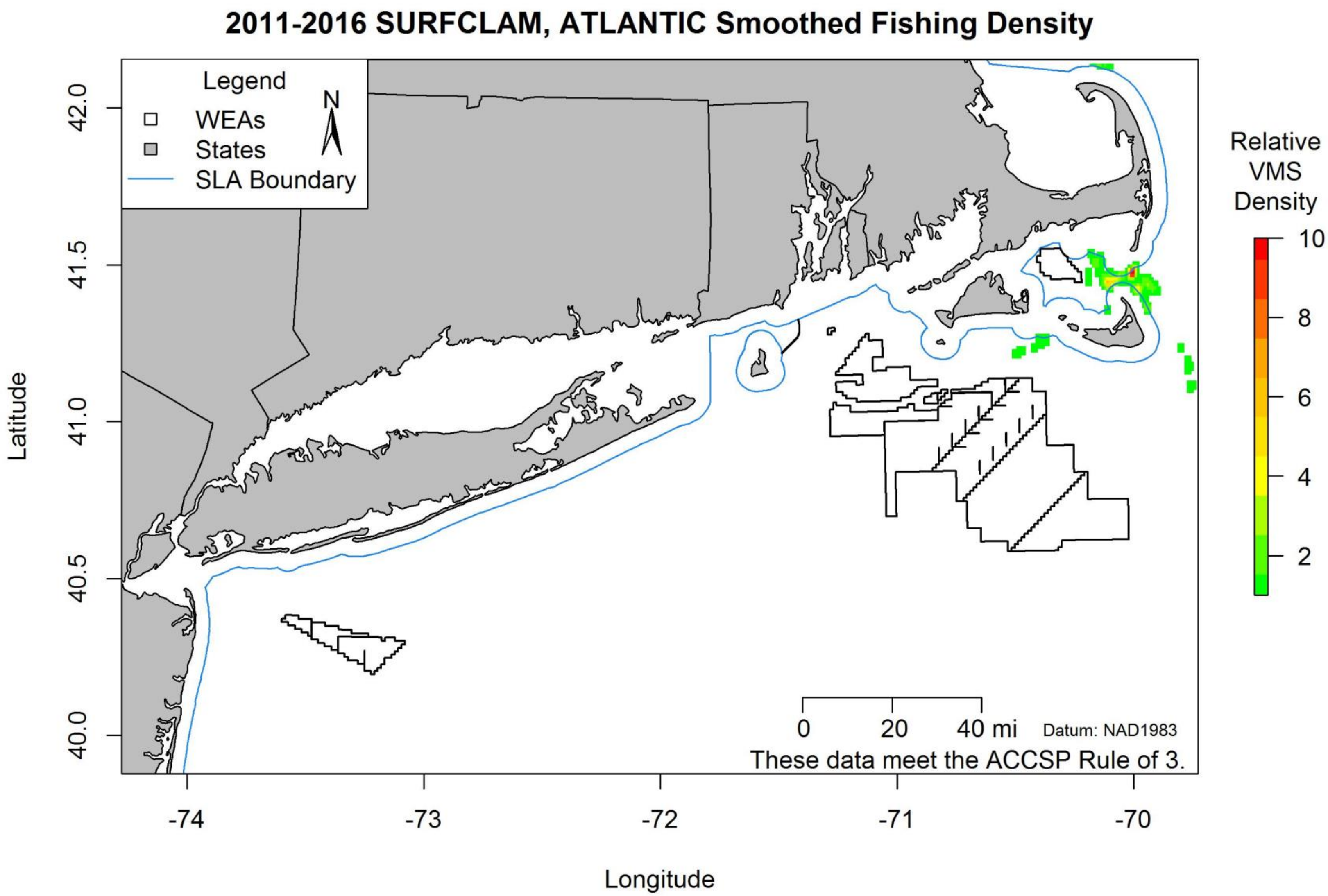

Figure 105. Smoothed federal fishing activity of all trips between 2011 and 2016 where Atlantic surfclam was caught

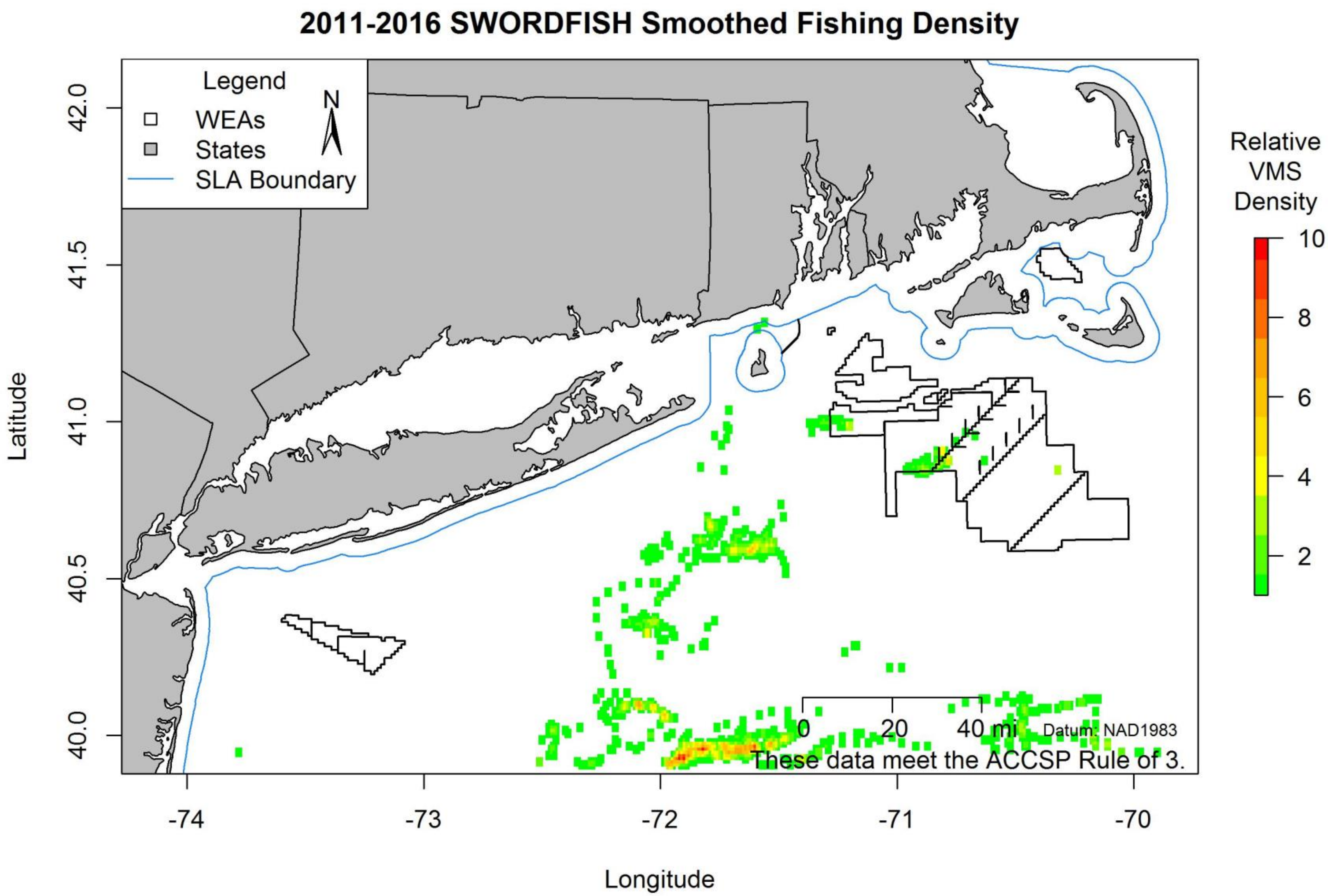

Figure 106. Smoothed federal fishing activity of all trips between 2011 and 2016 where swordfish was caught

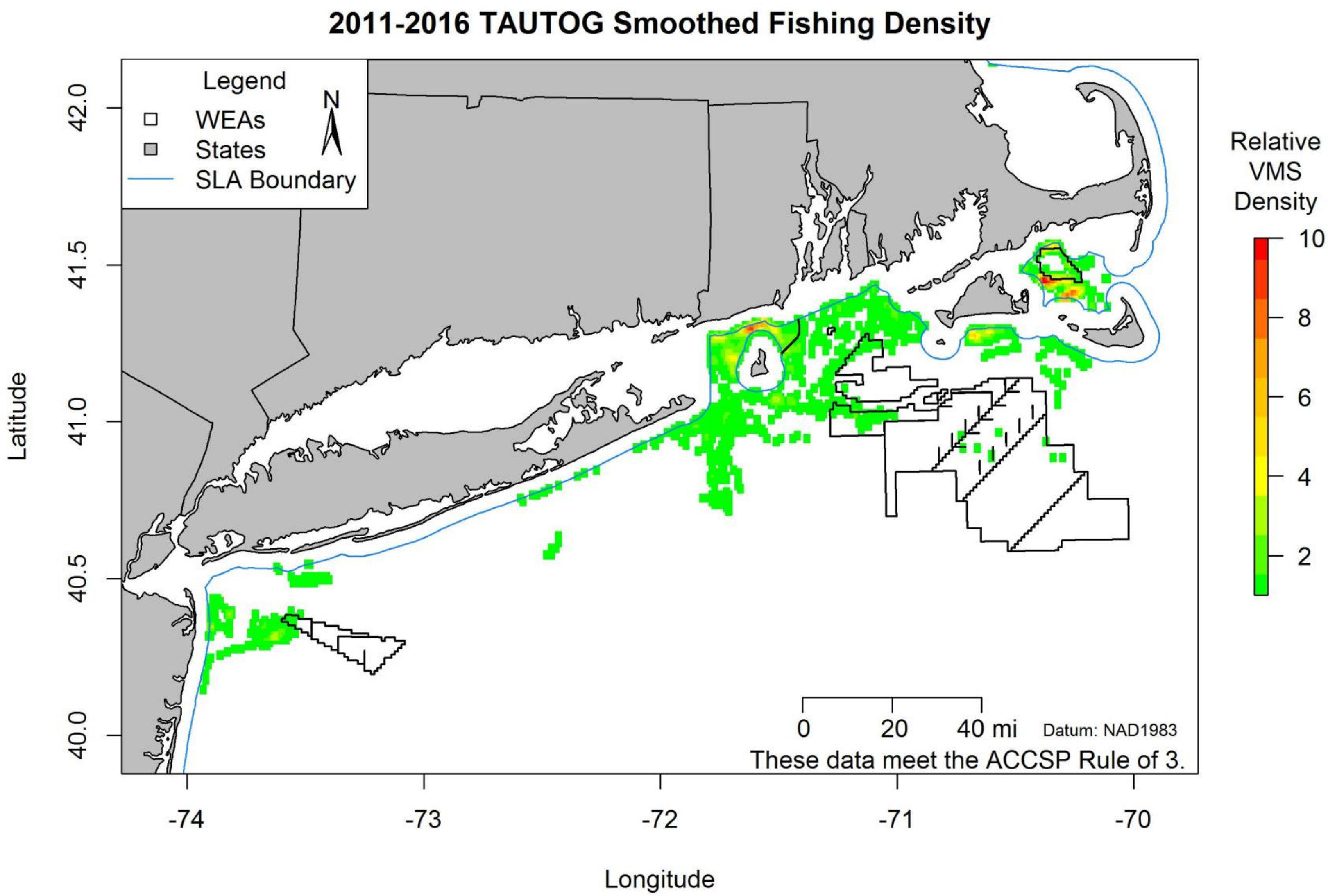

Figure 107. Smoothed federal fishing activity of all trips between 2011 and 2016 where tautog was caught

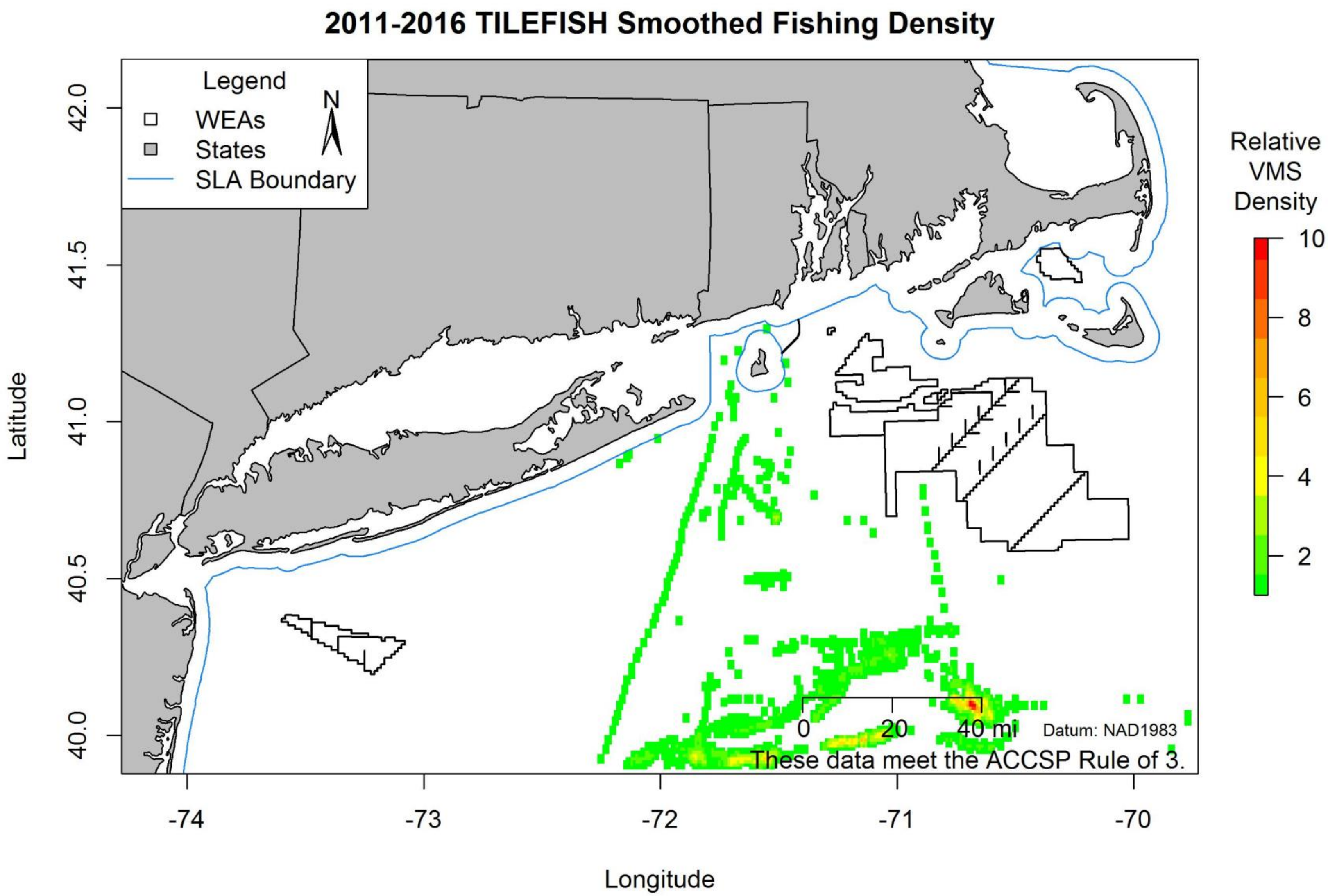

Figure 108. Smoothed federal fishing activity of all trips between 2011 and 2016 where tilefish was caught

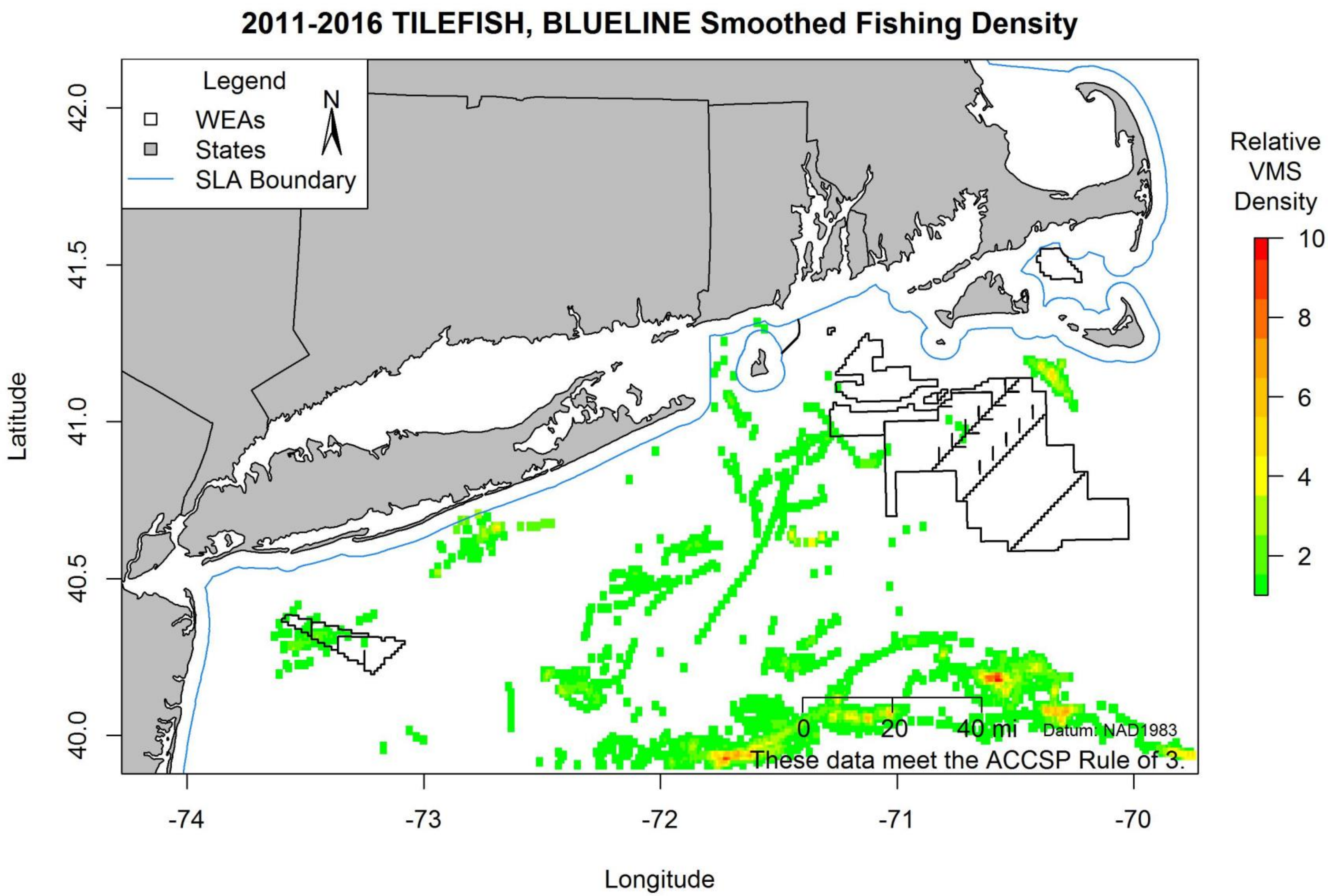

Figure 109. Smoothed federal fishing activity of all trips between 2011 and 2016 where blueline tilefish was caught

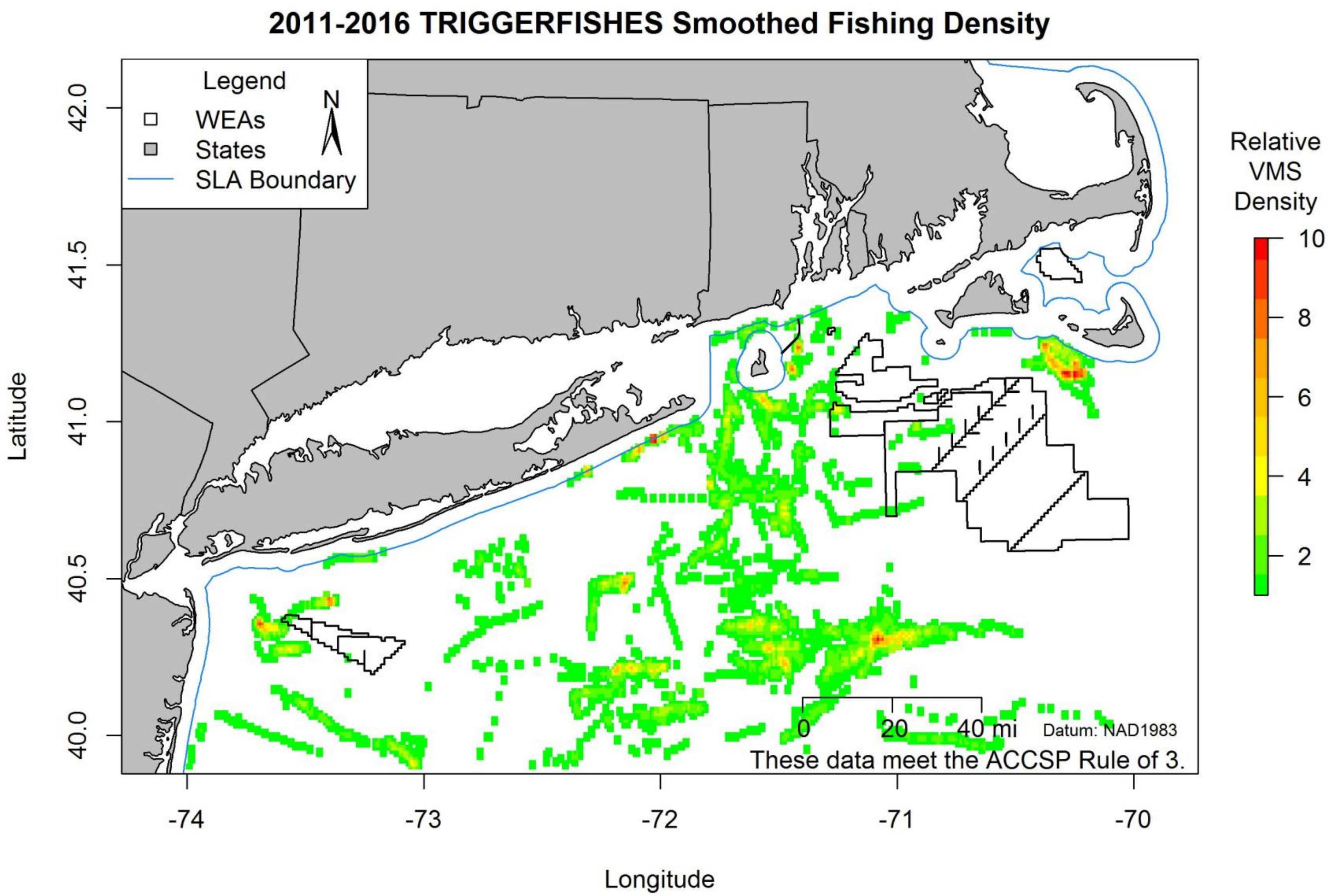

Figure 110. Smoothed federal fishing activity of all trips between 2011 and 2016 where triggerfishes were caught

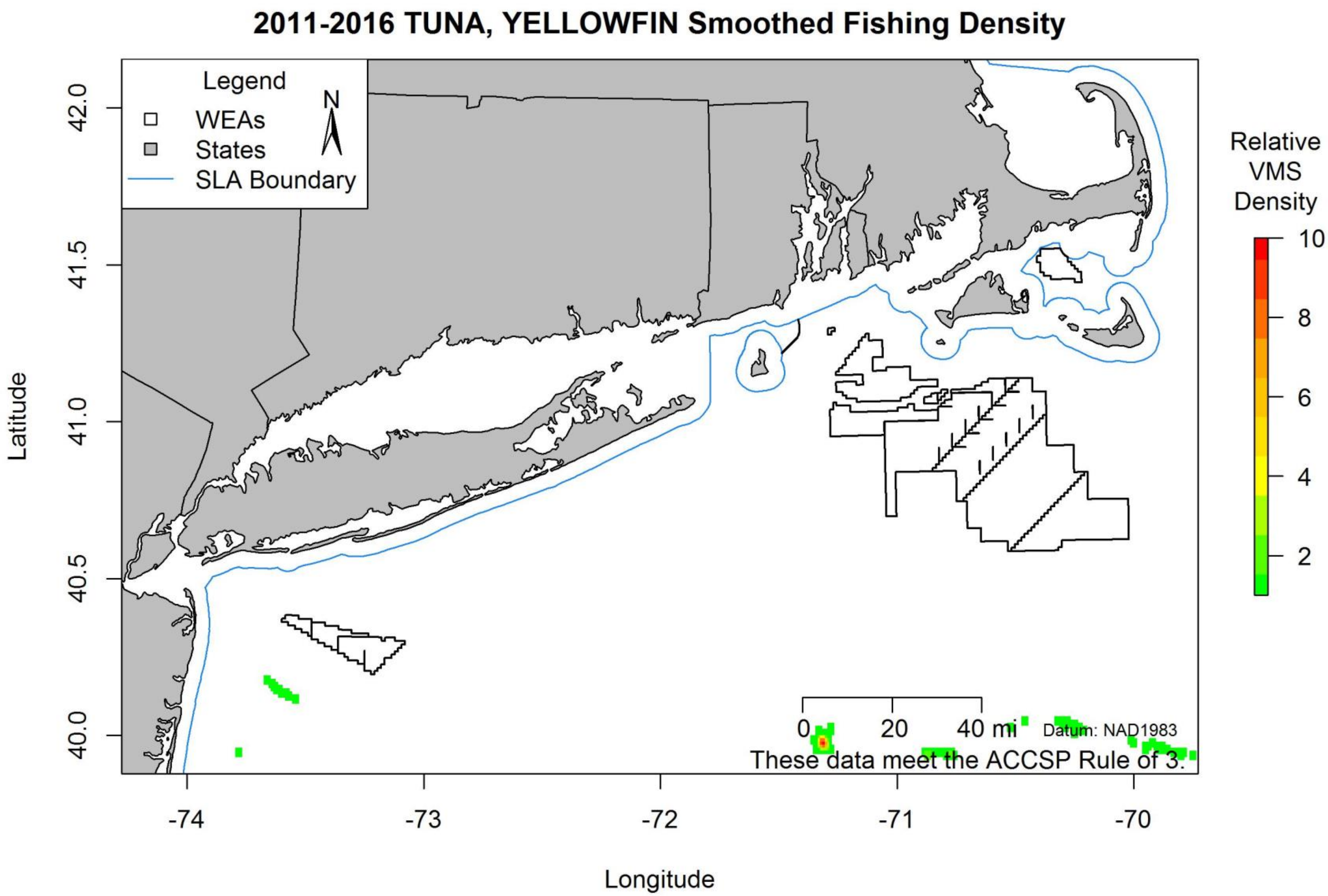

Figure 111. Smoothed federal fishing activity of all trips between 2011 and 2016 where yellowfin tuna was caught

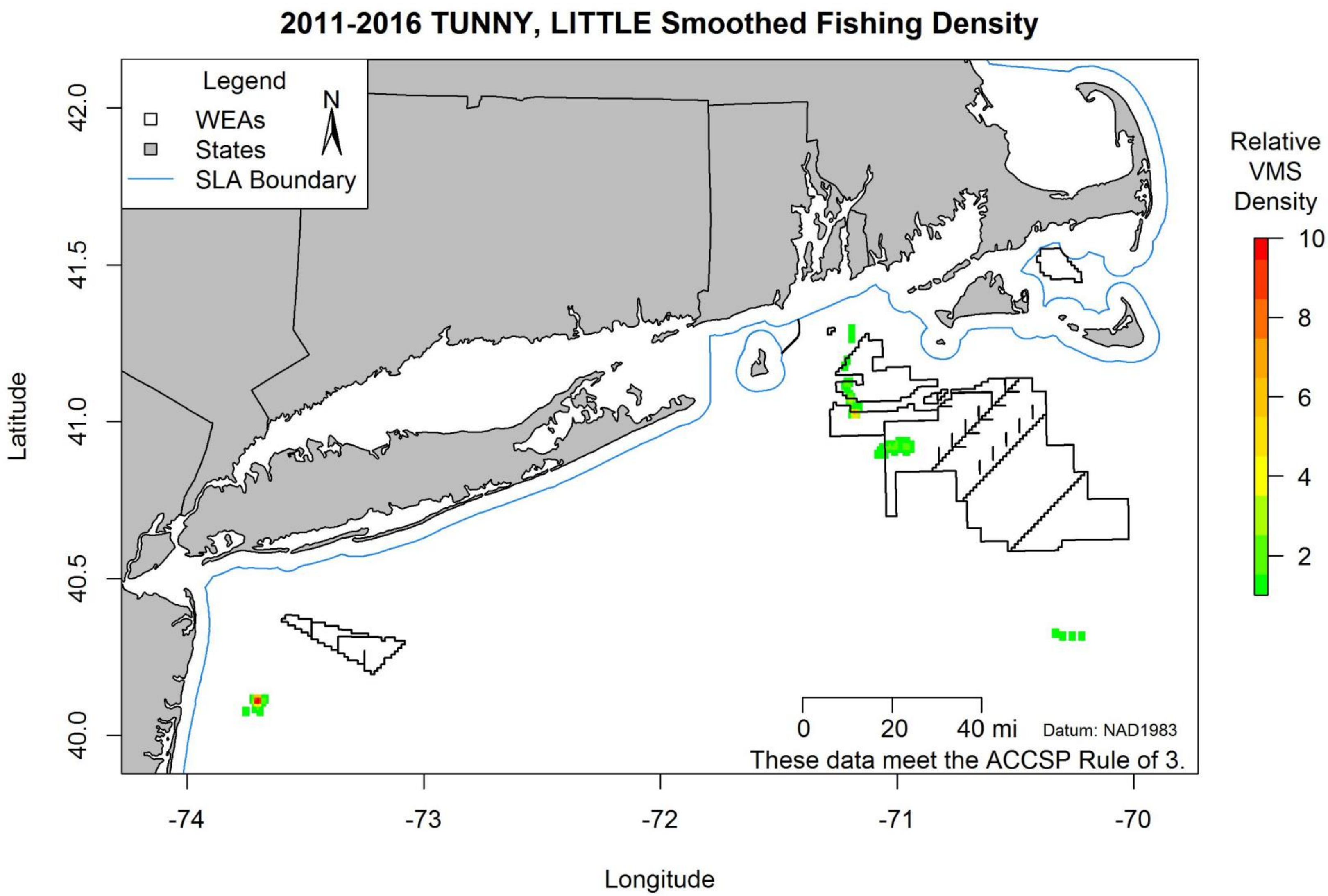

Figure 112. Smoothed federal fishing activity of all trips between 2011 and 2016 where little tunny was caught

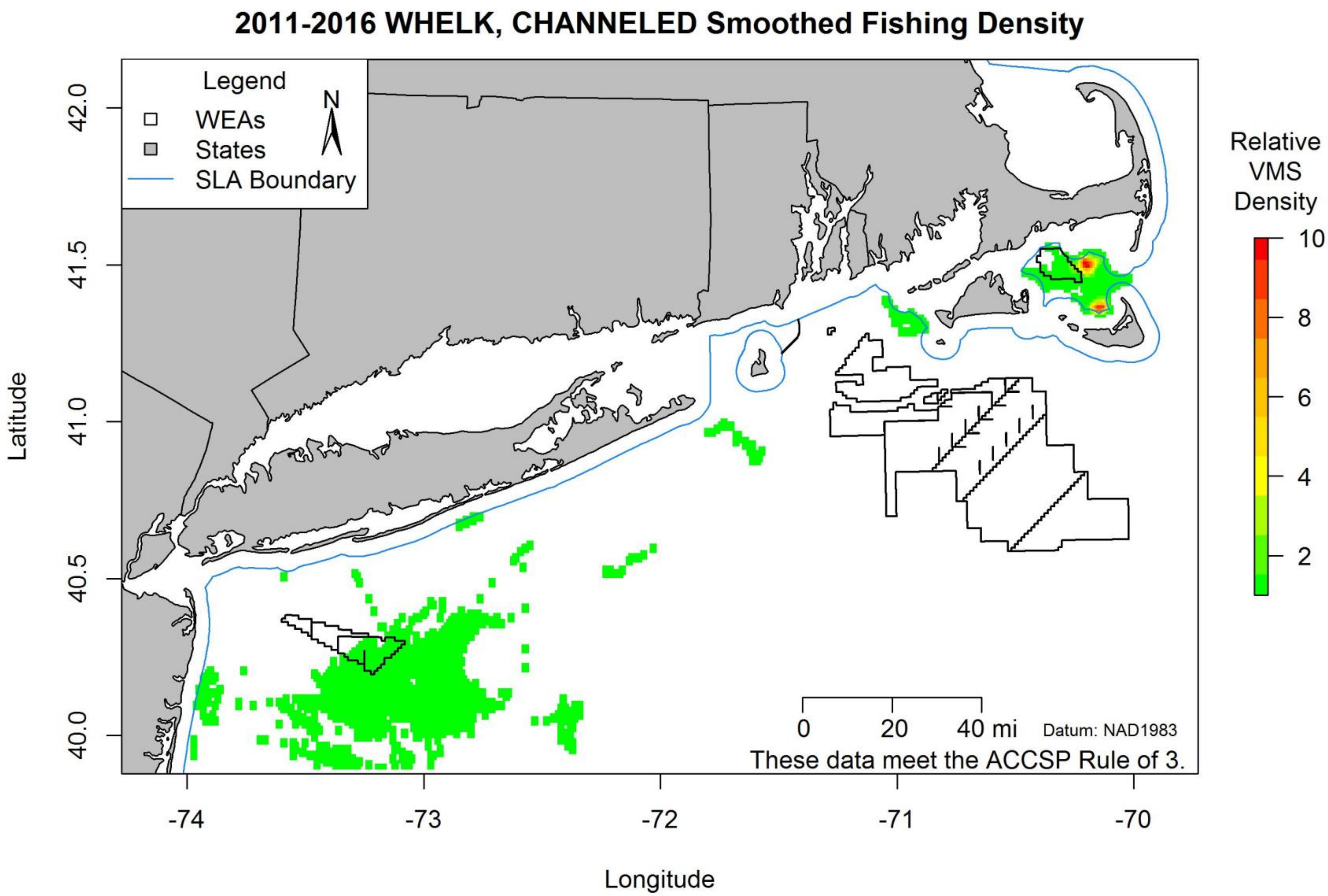

Figure 113. Smoothed federal fishing activity of all trips between 2011 and 2016 where channeled whelk was caught

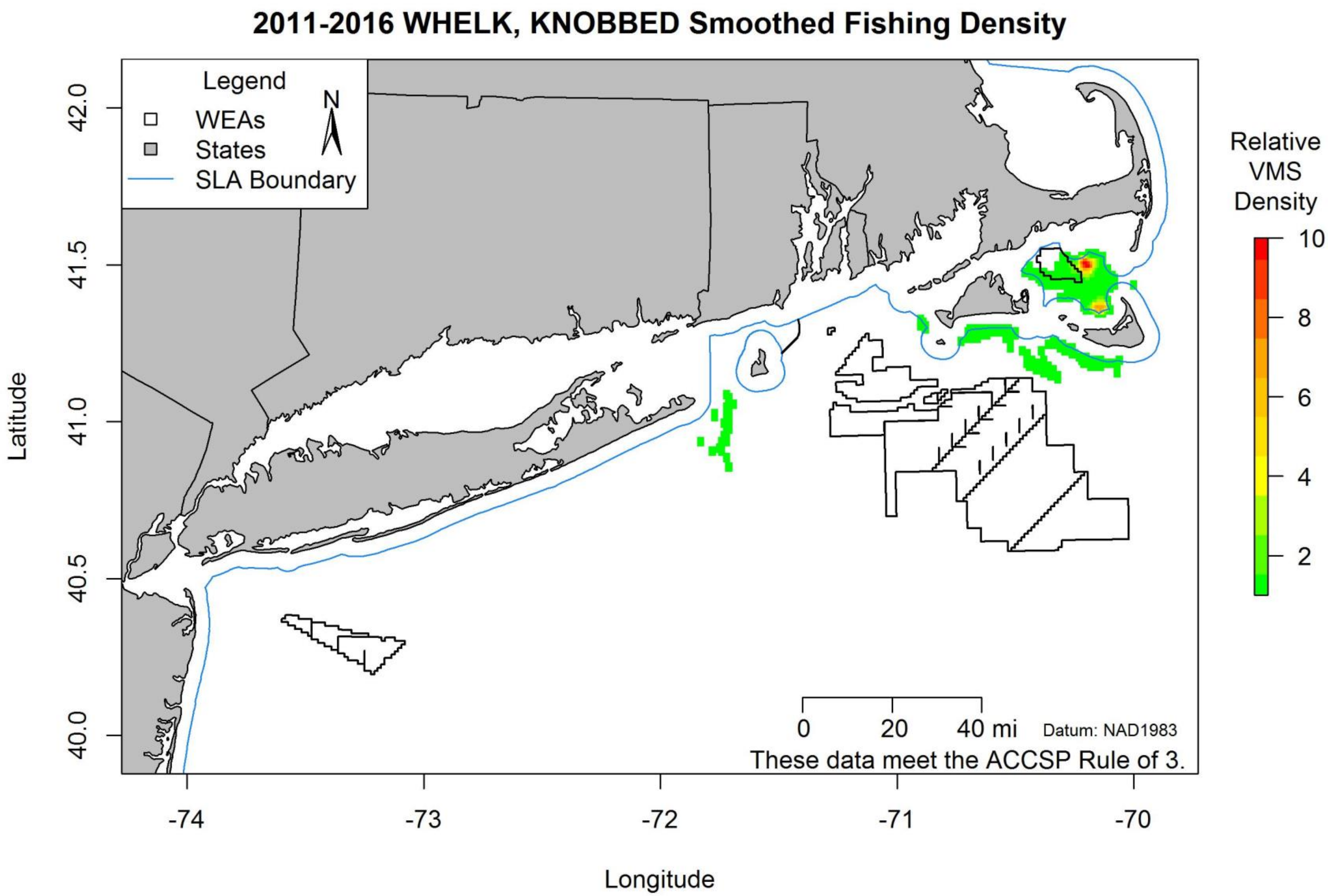

Figure 114. Smoothed federal fishing activity of all trips between 2011 and 2016 where knobbed whelk was caught

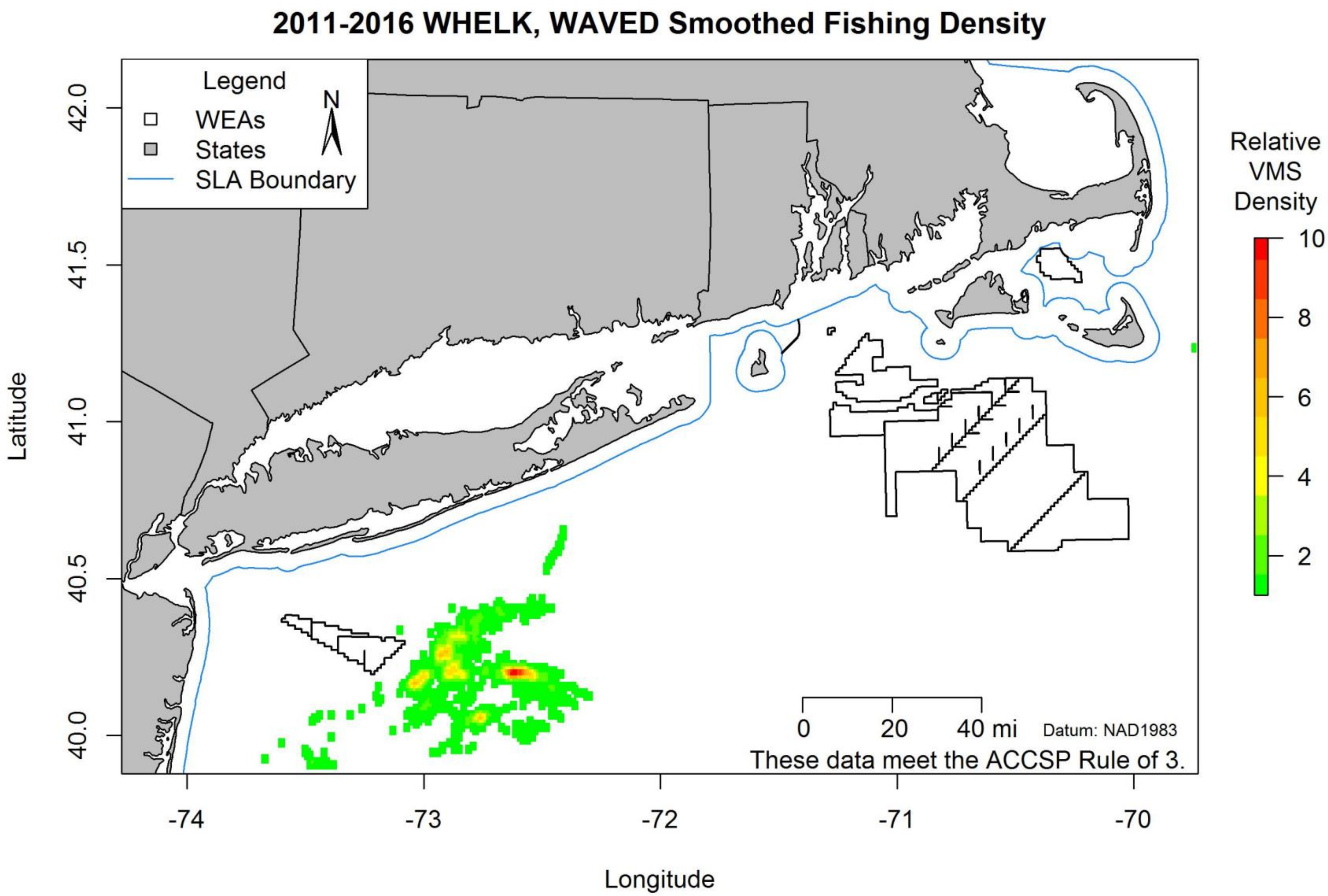

Figure 115. Smoothed federal fishing activity of all trips between 2011 and 2016 where waved whelk was caught

10.2.5 Maps for Most Exposed Species/Fisheries

Based on cumulative landings from 2011-2016 in the sates of NJ through NH, the most exposed fisheries to the combined WEAs by species are: the Sea Scallop FMP ($23,099,059.26), the Squid Mackerel Butterfish FMP ($5,447271.94), the Monkfish FMP ($3,009,550.43), and the Northeast Multispecies FMP ($2,568,483.27). These four species/FMPs each have at least $1,000,000 in a single WEA over that time period. Refer to Section 1.2 for more landings values. More site specific and annual maps of the four fisheries are provided below. Close up maps of specific sites are only shown if one of the WEAs shown has at least $1,000,000 coming from within it during the 2011-2016 time period for that specific fishery.

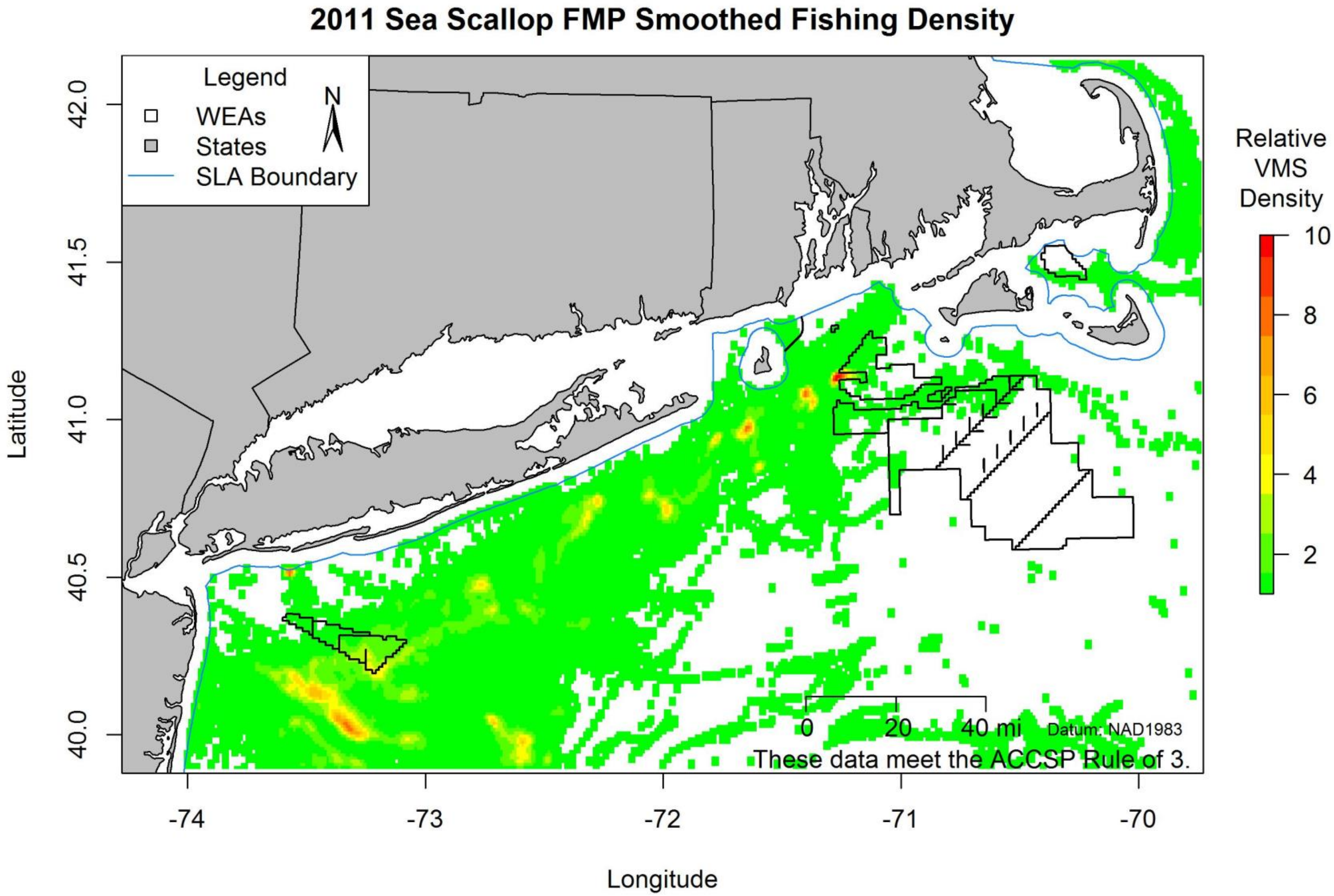

Figure 116. Smoothed federal fishing activity of all trips in 2011 where sea scallop was caught

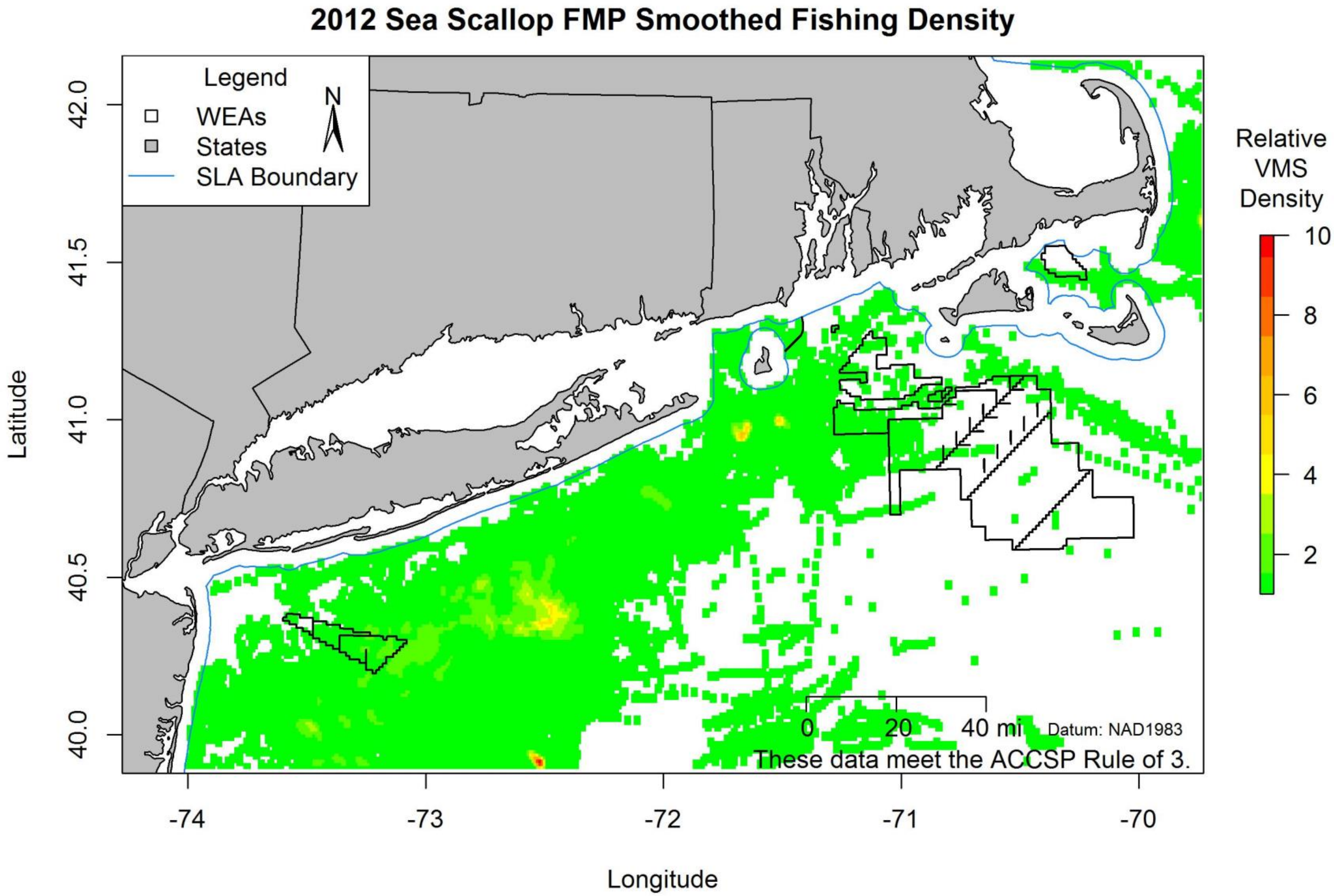

Figure 117. Smoothed federal fishing activity of all trips in 2012 where sea scallop was caught

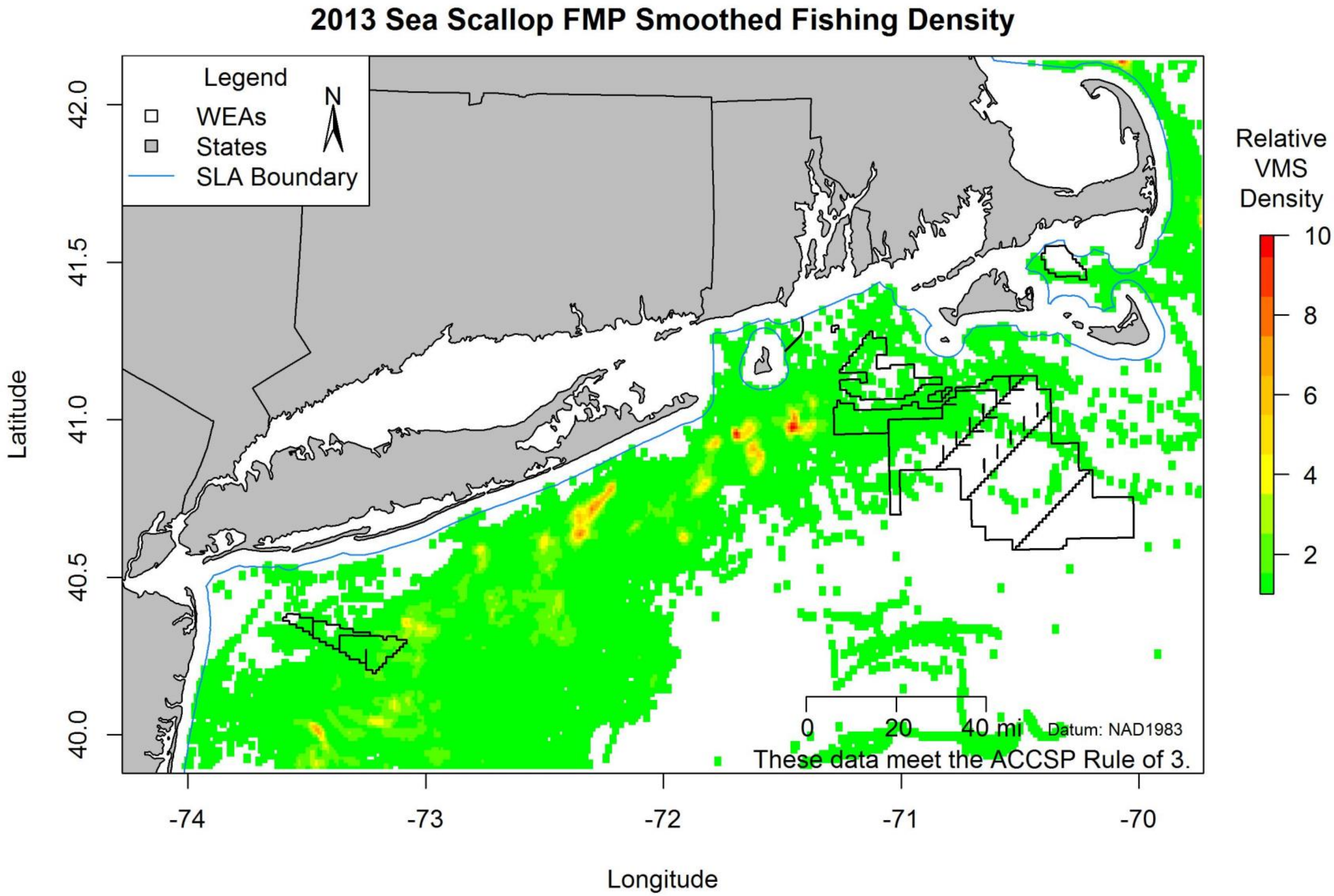

Figure 118. Smoothed federal fishing activity of all trips in 2013 where sea scallop was caught

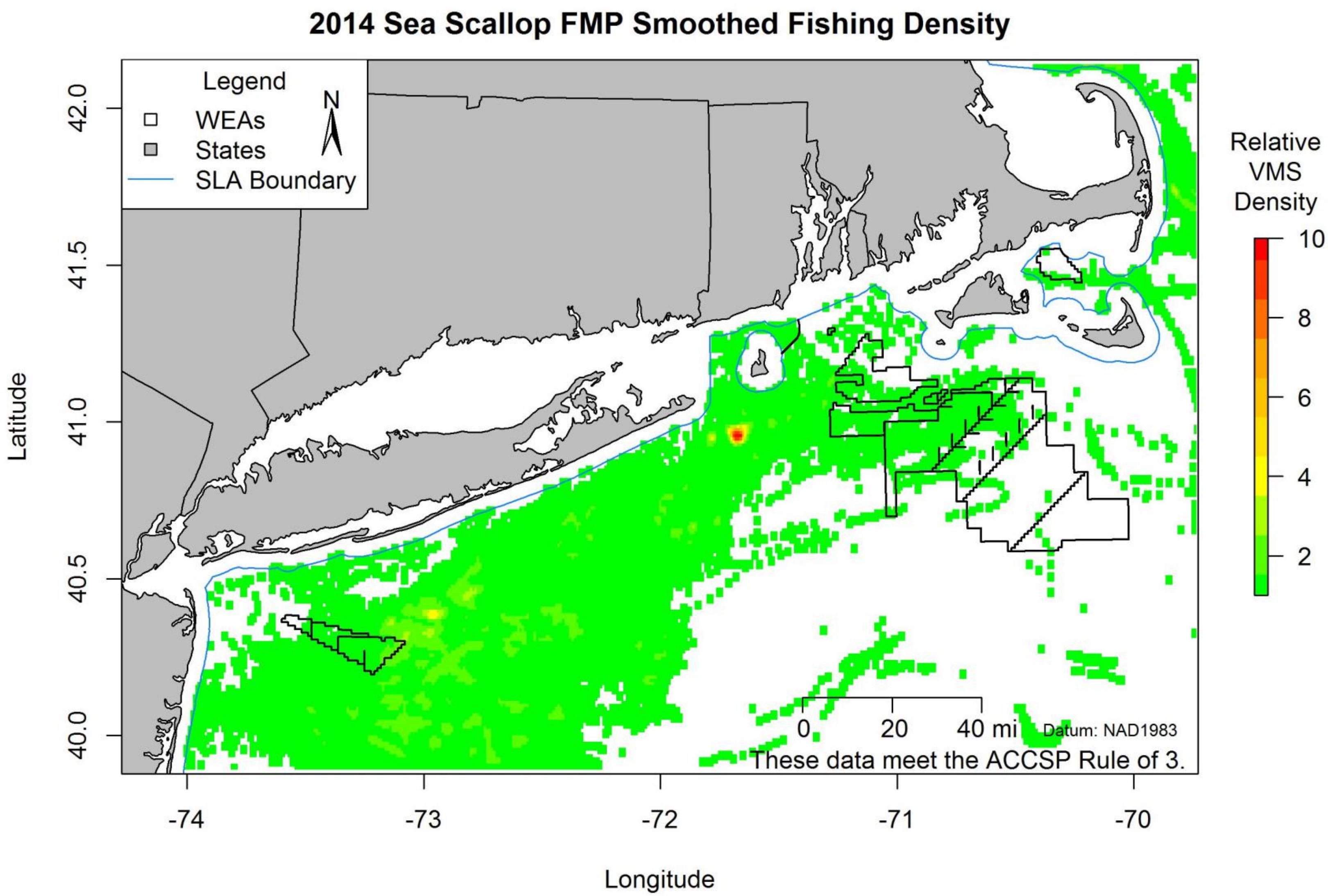

Figure 119. Smoothed federal fishing activity of all trips in 2014 where sea scallop was caught

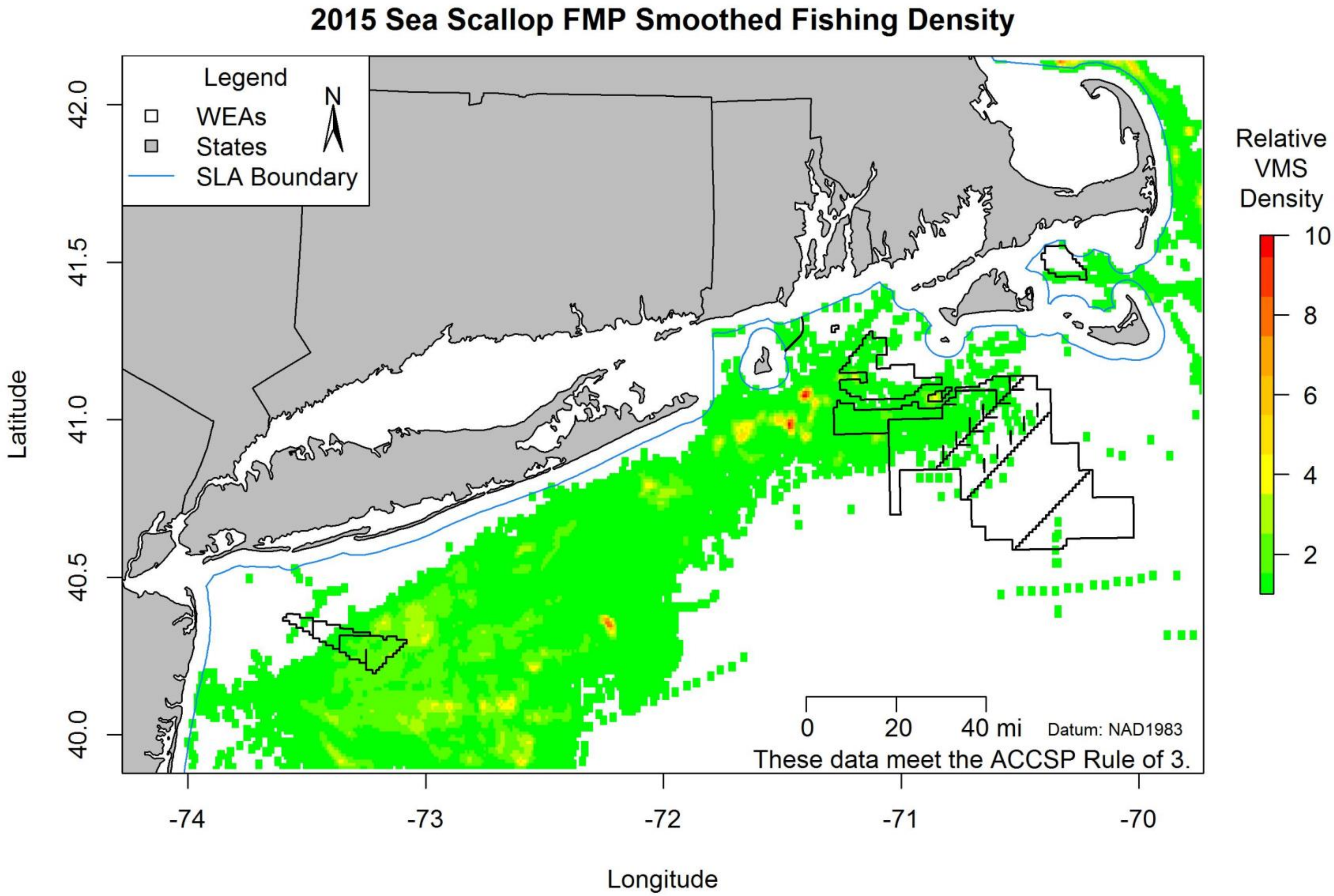

Figure 120. Smoothed federal fishing activity of all trips in 2015 where sea scallop was caught

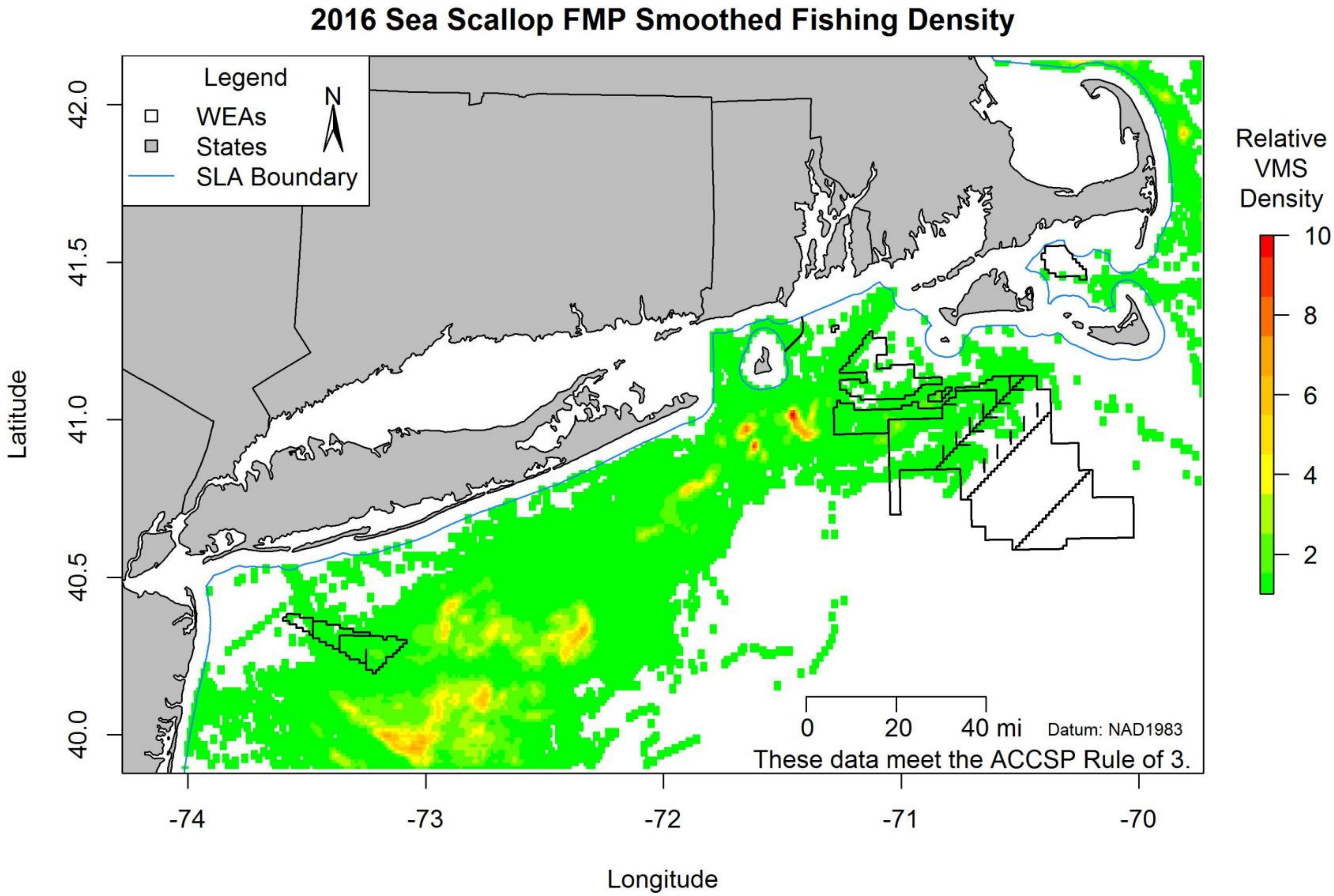

Figure 121. Smoothed federal fishing activity of all trips in 2016 where sea scallop was caught

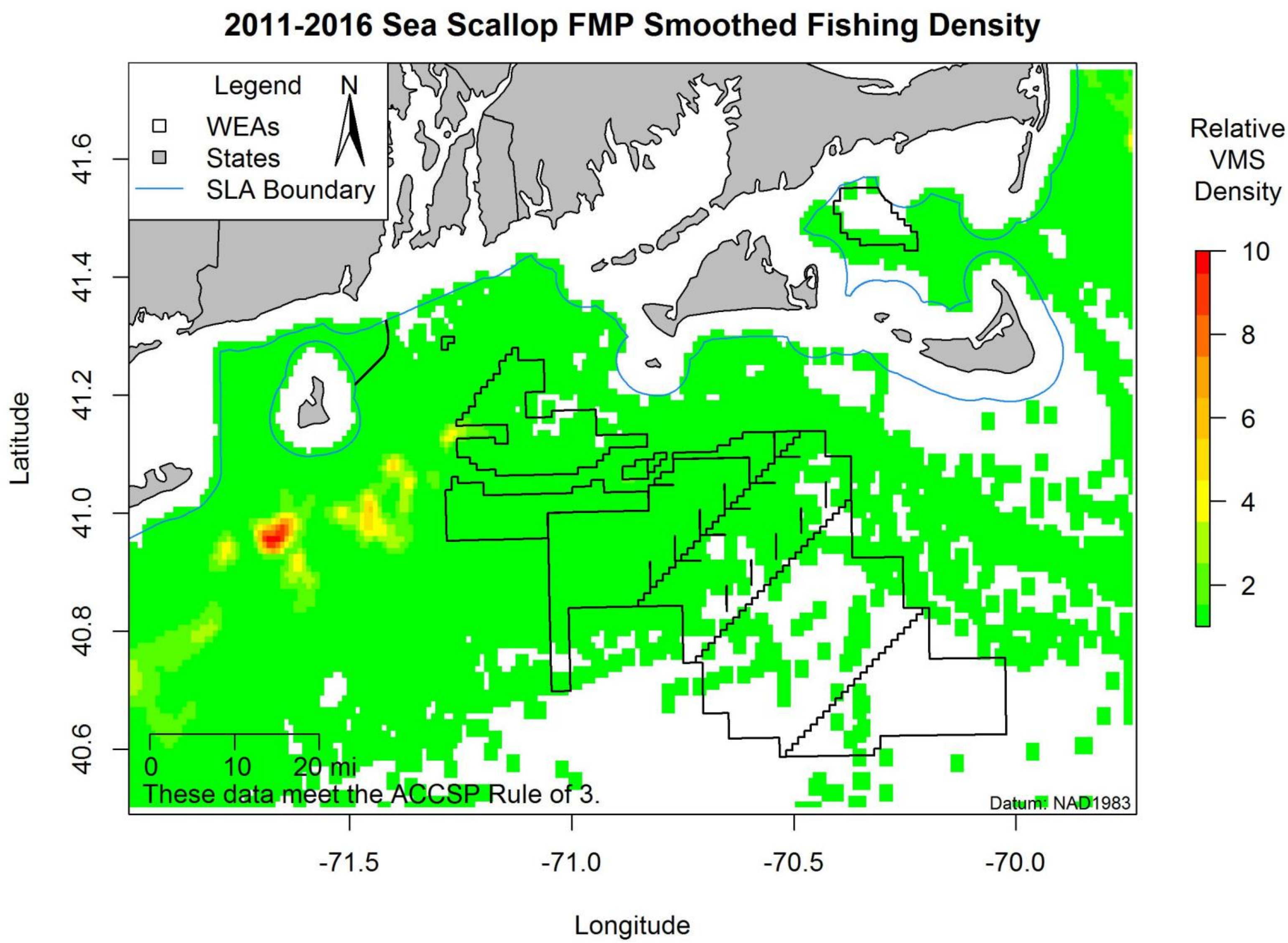

Figure 122. Smoothed federal fishing activity south of Rhode Island and Massachusetts of all trips between 2011 and 2016 where sea scallop was caught

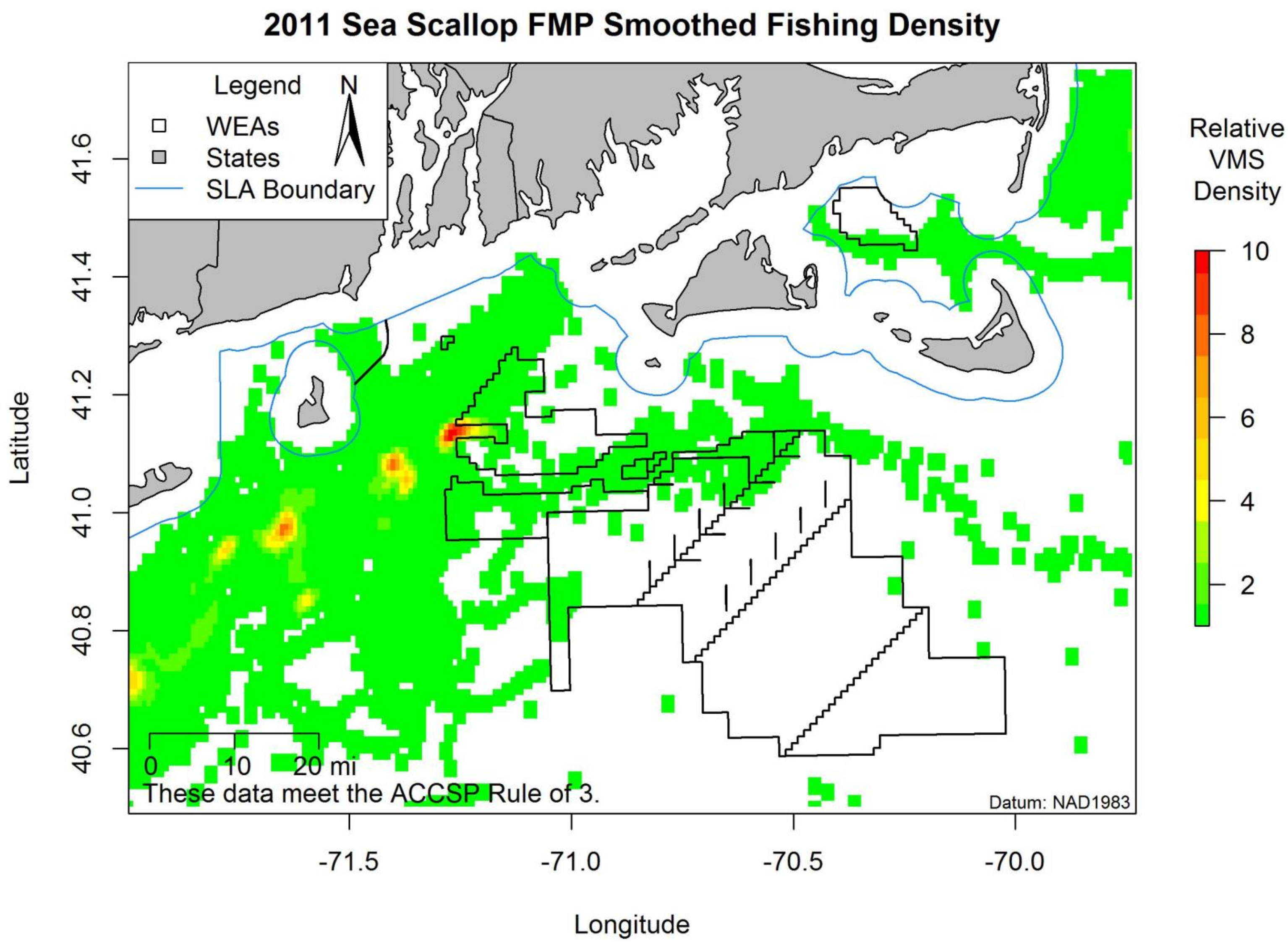

Figure 123. Smoothed federal fishing activity south of Rhode Island and Massachusetts of all trips in 2011 where sea scallop was caught

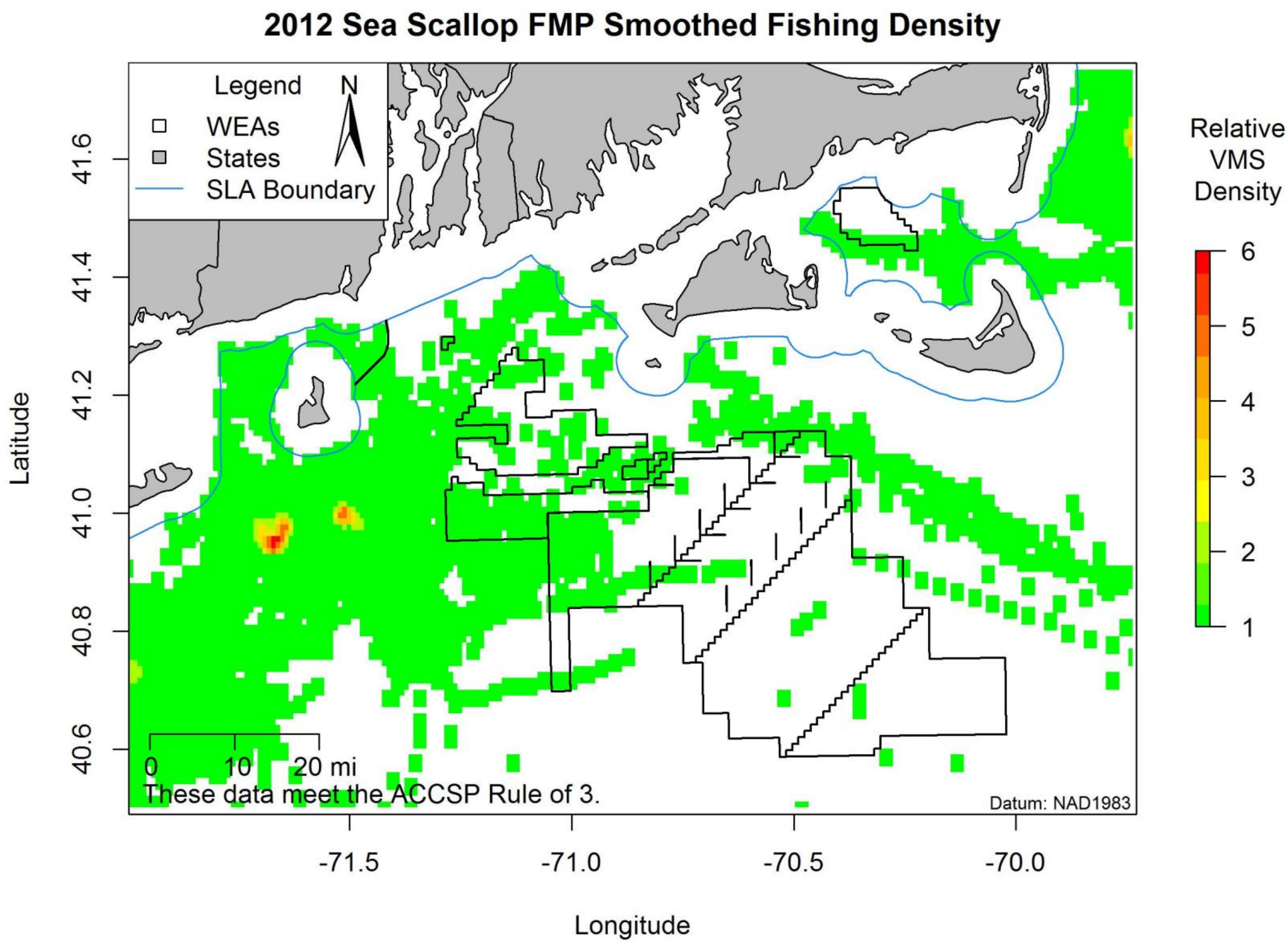

Figure 124. Smoothed federal fishing activity south of Rhode Island and Massachusetts of all trips in 2012 where sea scallop was caught

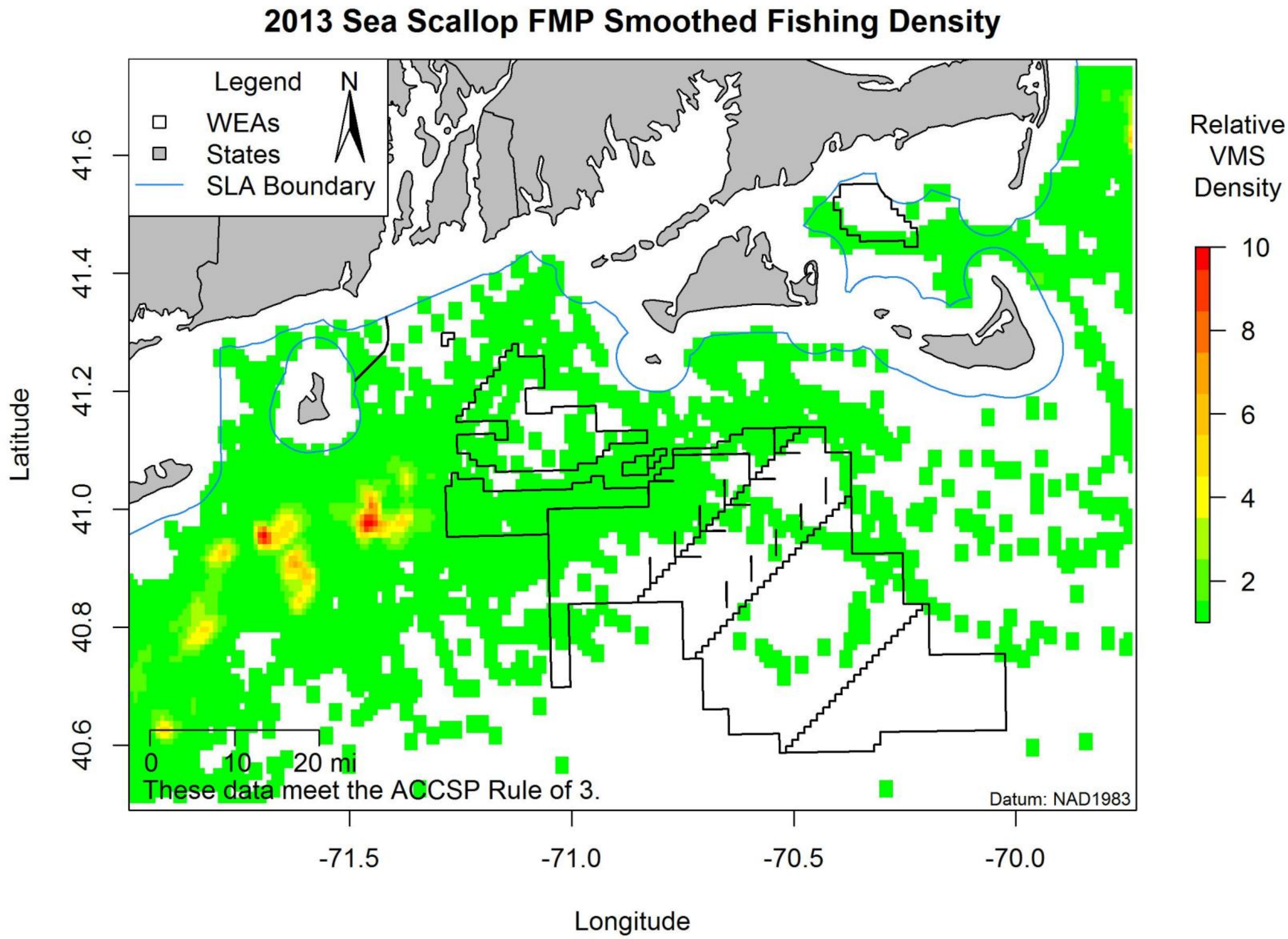

Figure 125. Smoothed federal fishing activity south of Rhode Island and Massachusetts of all trips in 2013 where sea scallop was caught

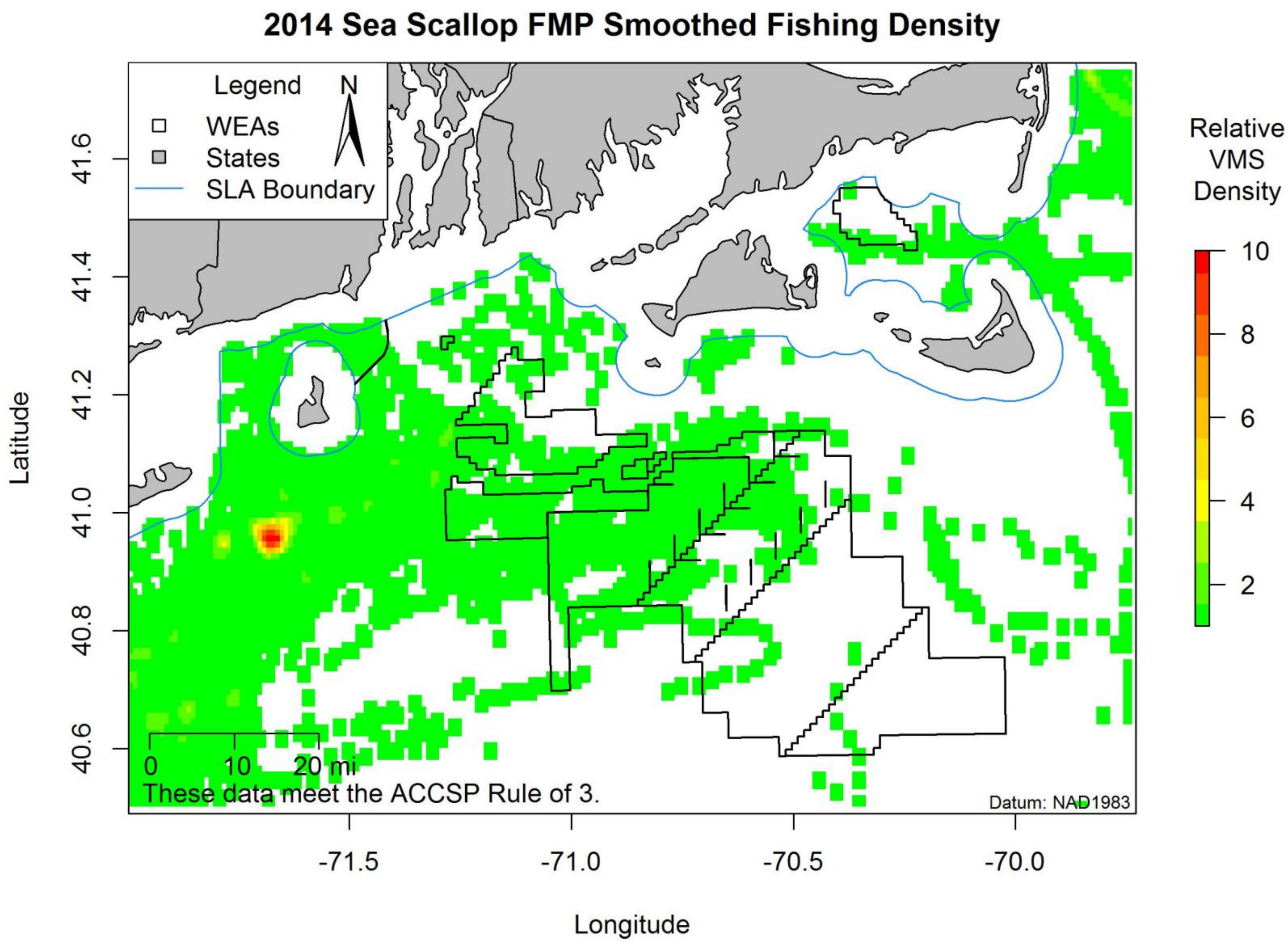

Figure 126. Smoothed federal fishing activity south of Rhode Island and Massachusetts of all trips in 2014 where sea scallop was caught

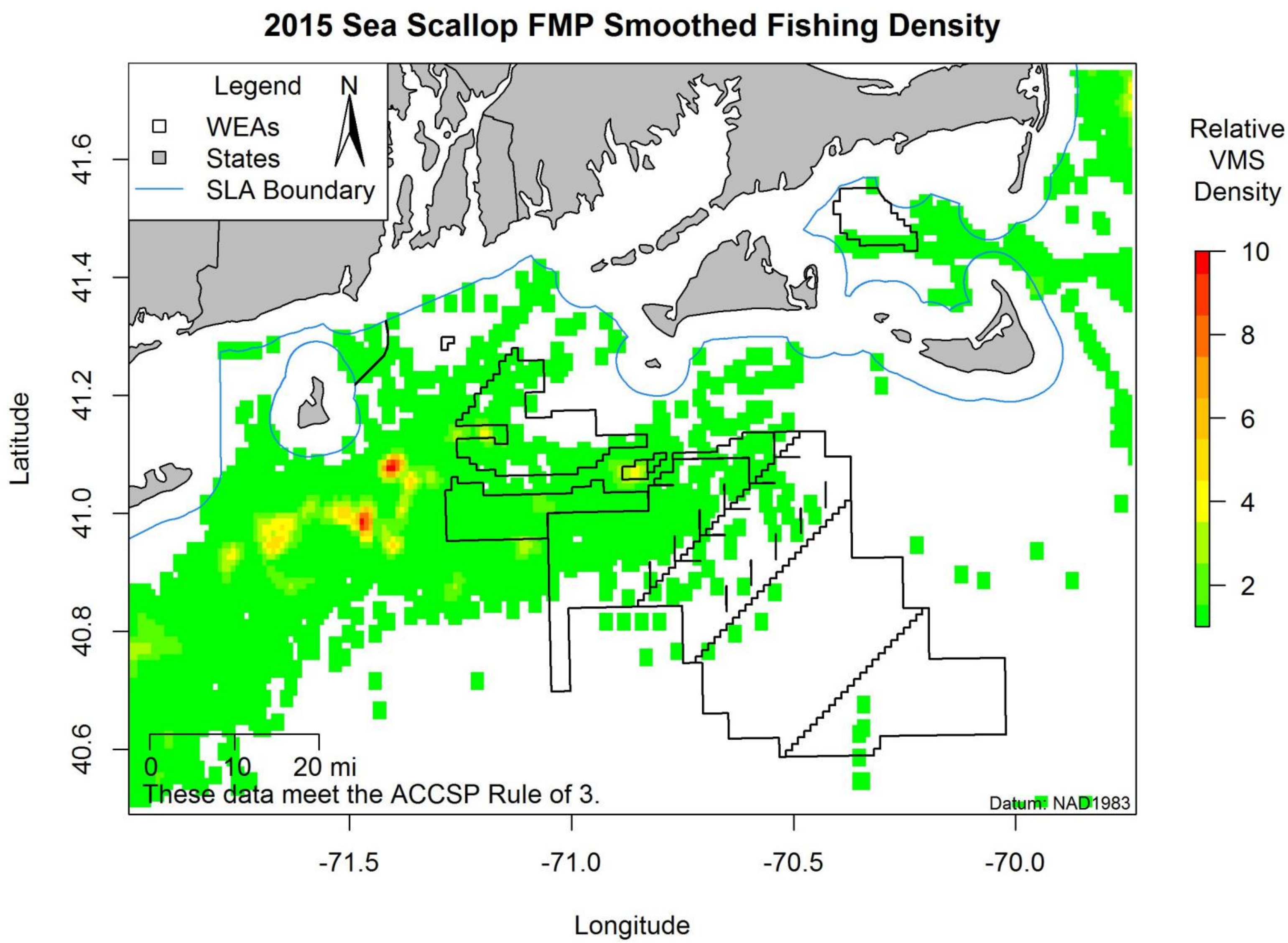

Figure 127. Smoothed federal fishing activity south of Rhode Island and Massachusetts of all trips in 2015 where sea scallop was caught

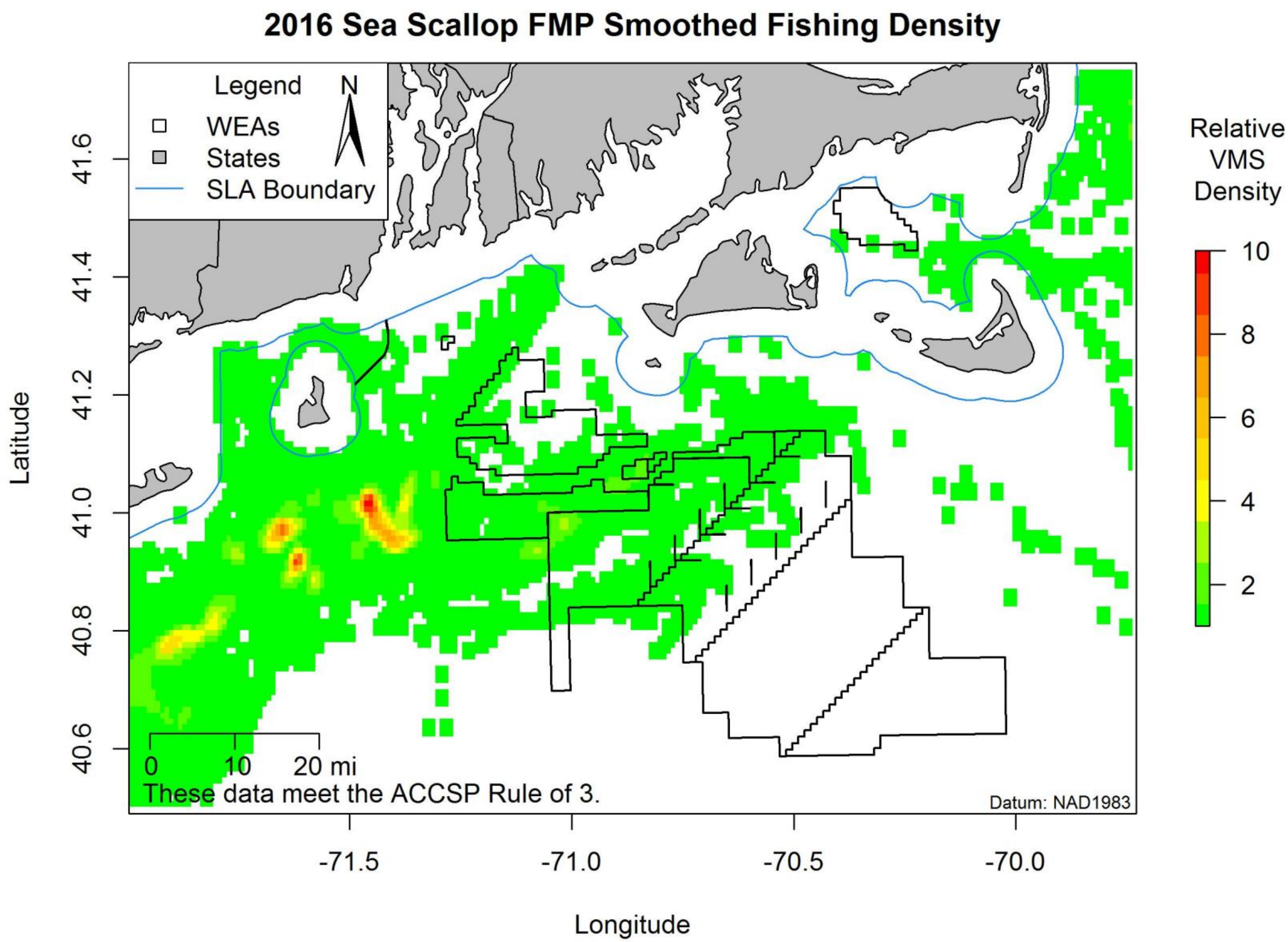

Figure 128. Smoothed federal fishing activity south of Rhode Island and Massachusetts of all trips in 2016 where sea scallop was caught

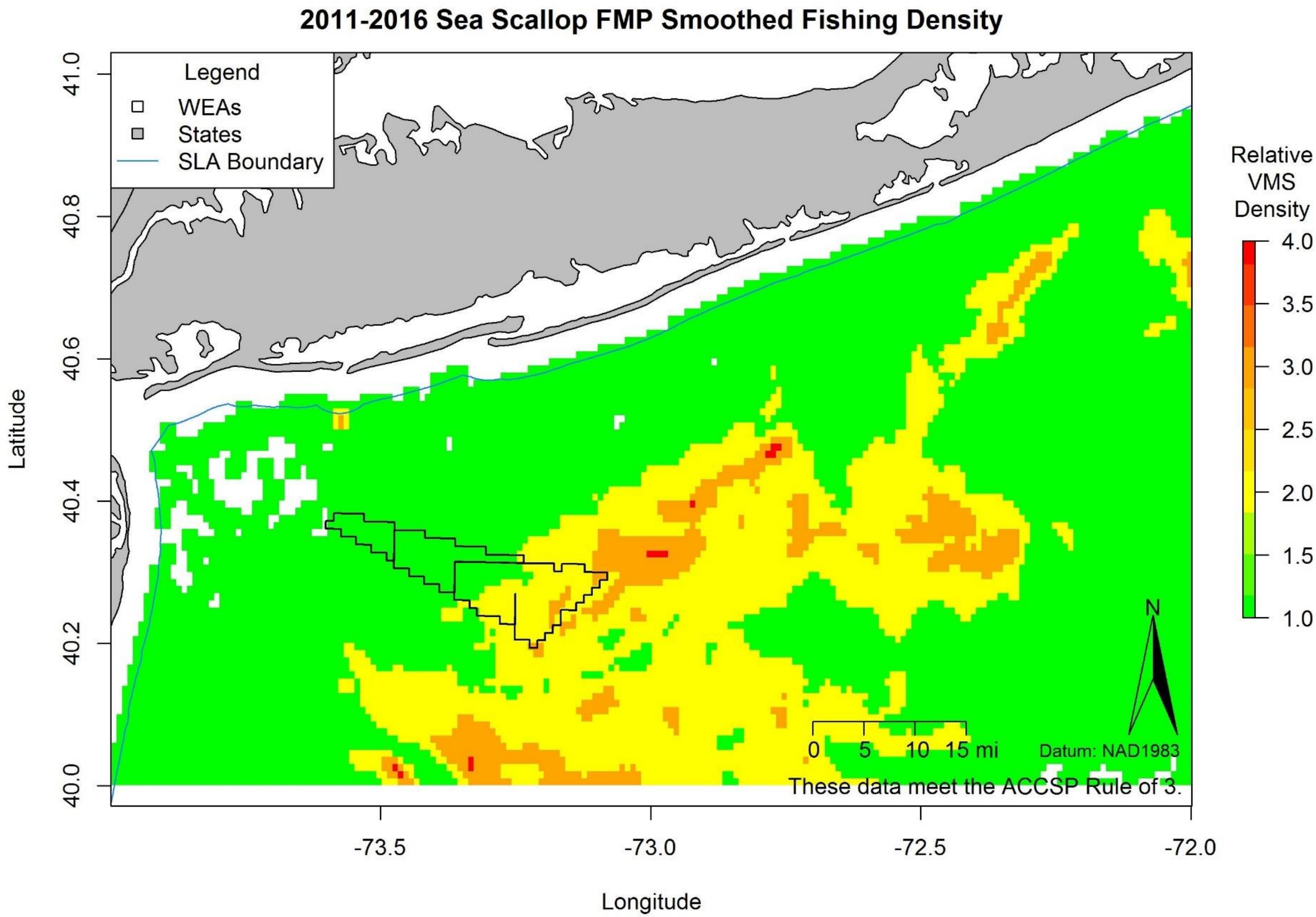

Figure 129. Smoothed federal fishing activity south of Long Island of all trips between 2011 and 2016 where sea scallop was caught

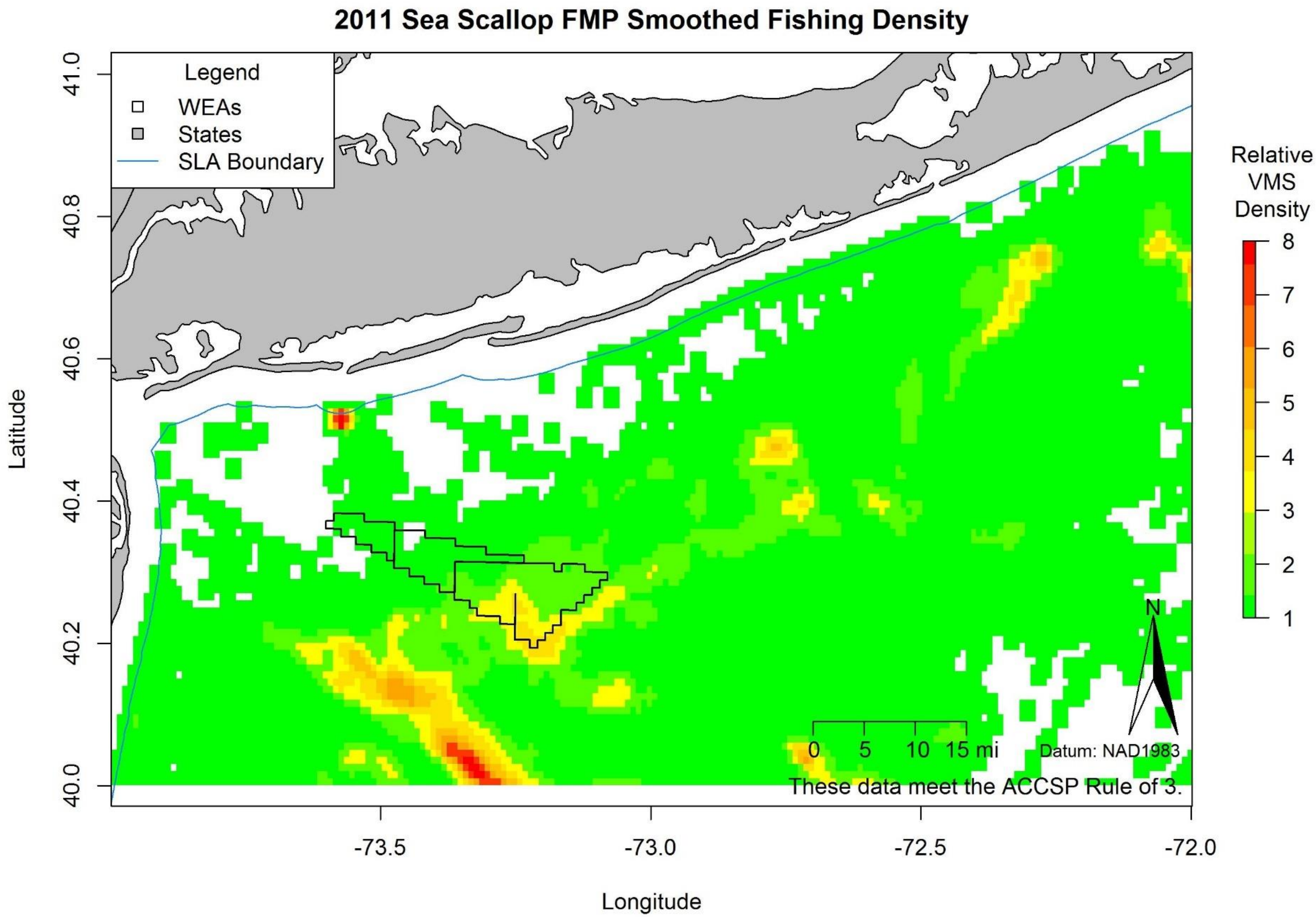

Figure 130. Smoothed federal fishing activity south of Long Island of all trips in 2011 where sea scallop was caught

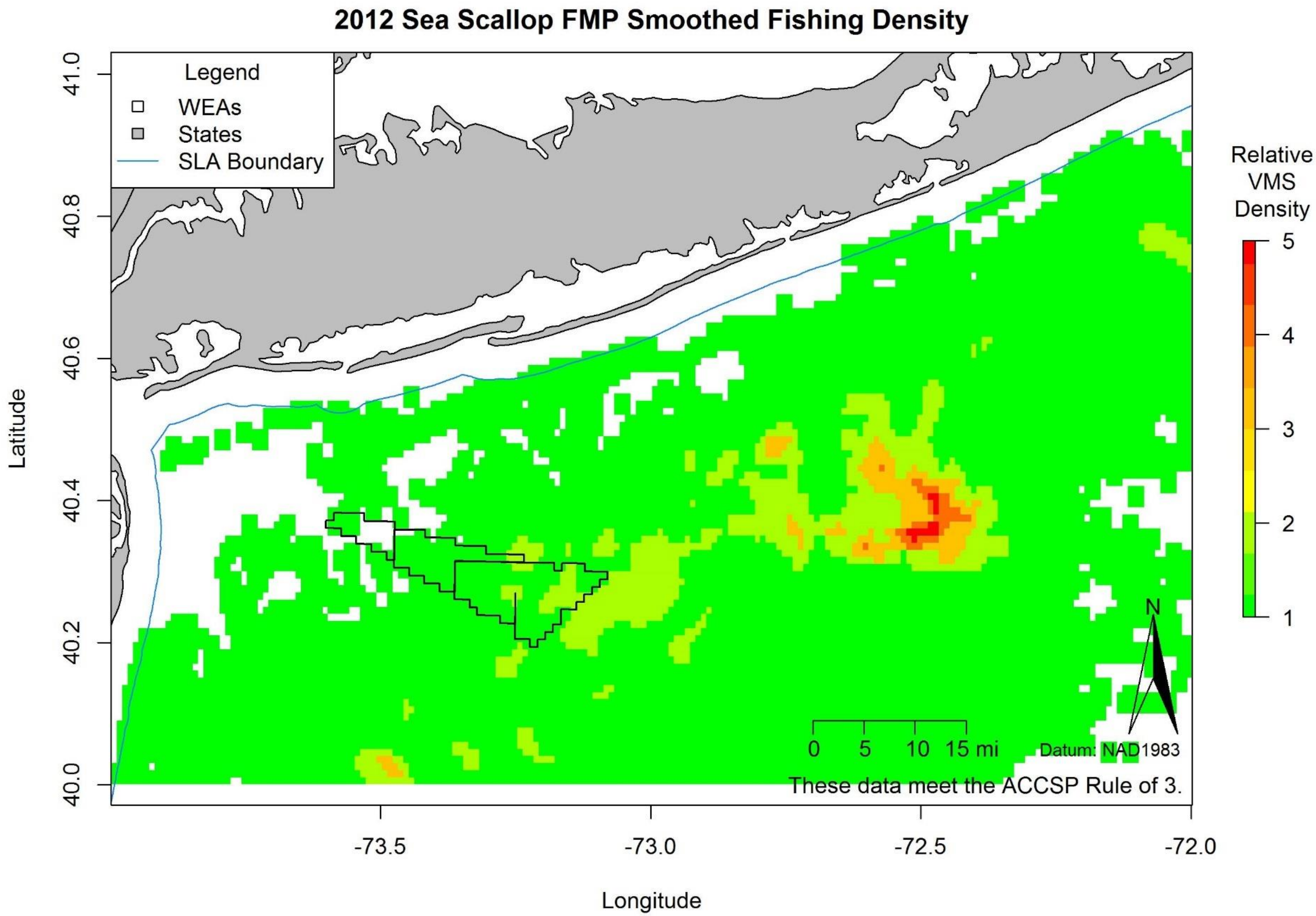

Figure 131. Smoothed federal fishing activity south of Long Island of all trips in 2012 where sea scallop was caught

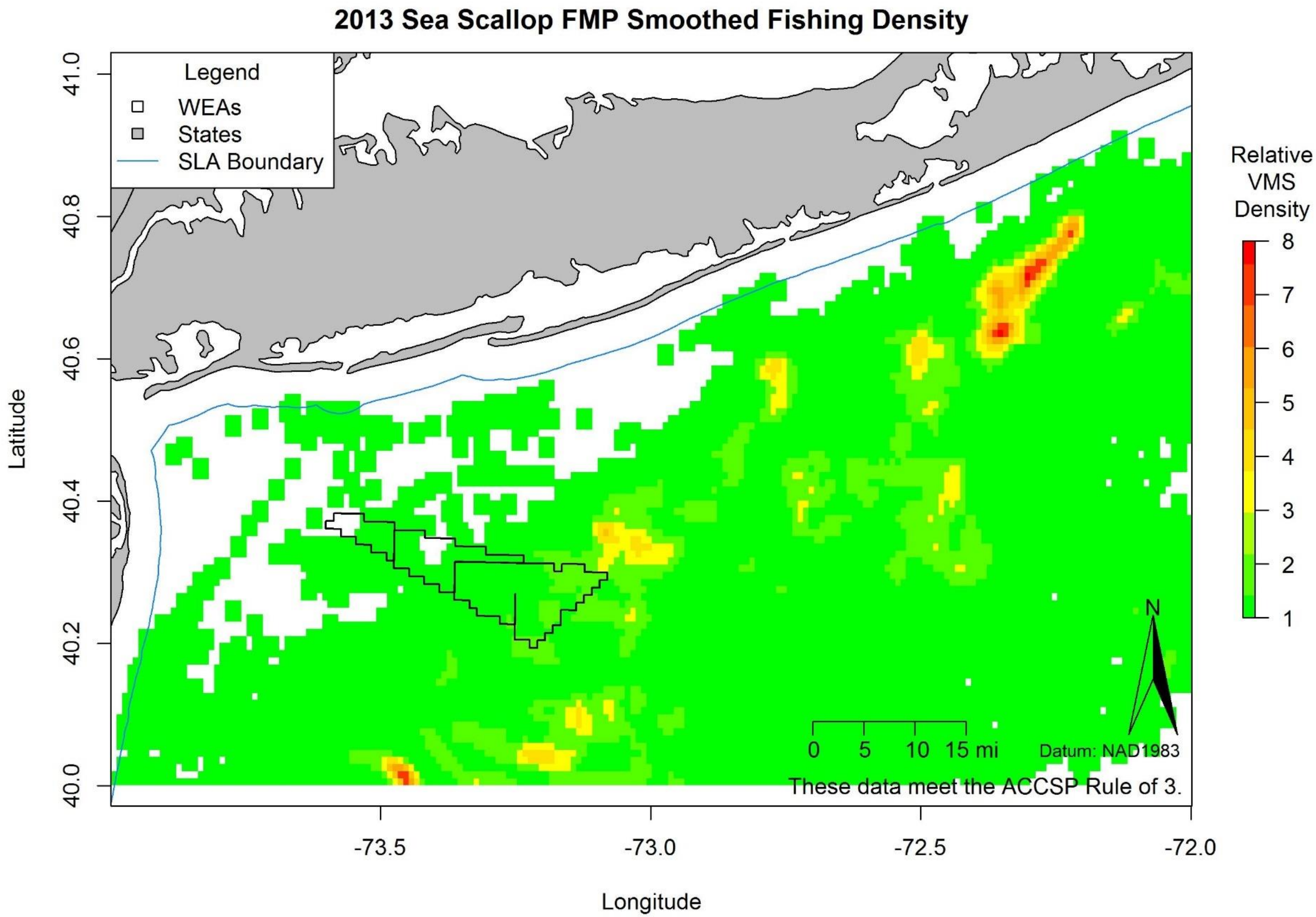

Figure 132. Smoothed federal fishing activity south of Long Island of all trips in 2013 where sea scallop was caught

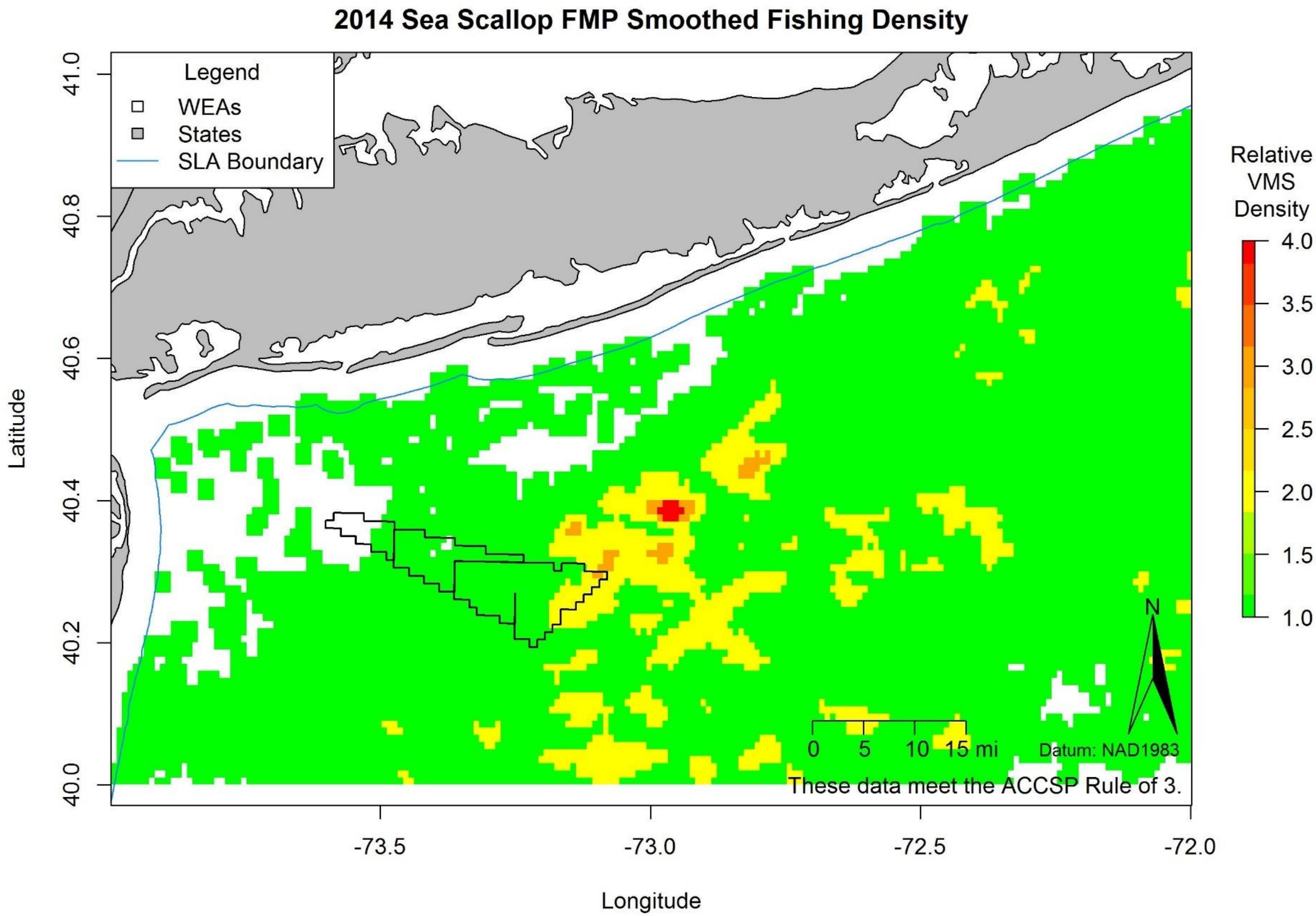

Figure 133. Smoothed federal fishing activity south of Long Island of all trips in 2014 where sea scallop was caught

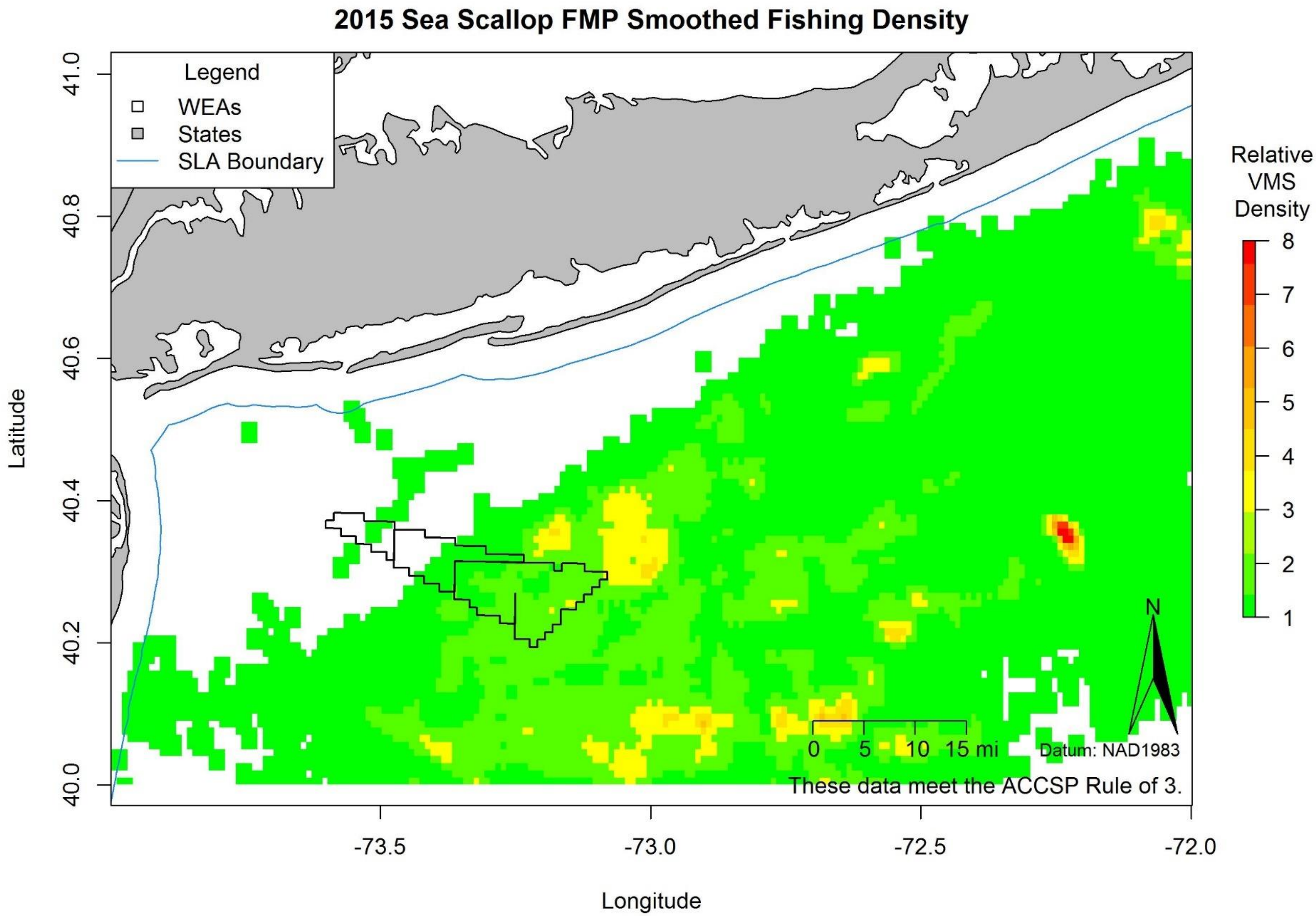

Figure 134. Smoothed federal fishing activity south of Long Island of all trips in 2015 where sea scallop was caught

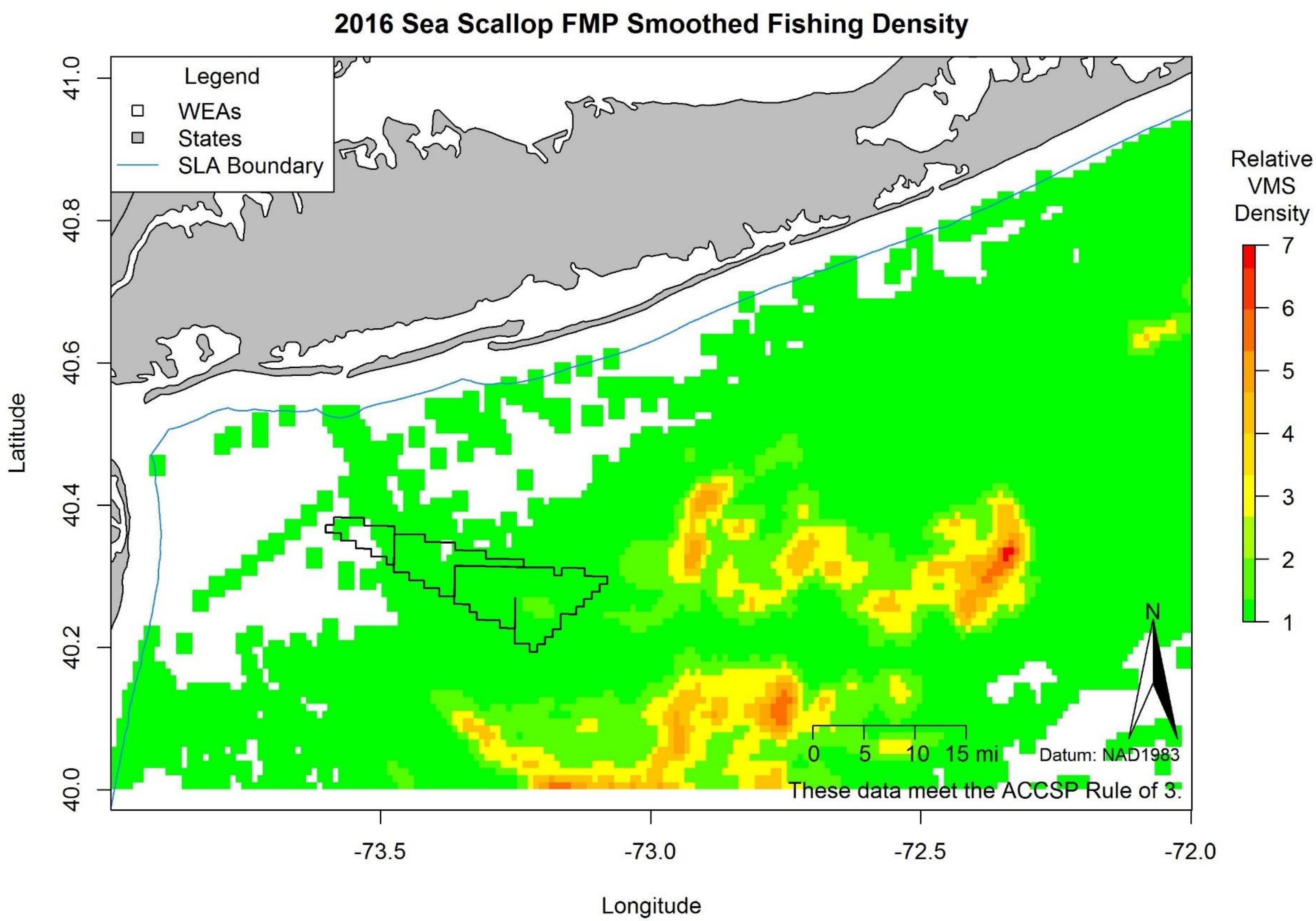

Figure 135. Smoothed federal fishing activity south of Long Island of all trips in 2016 where sea scallop was caught

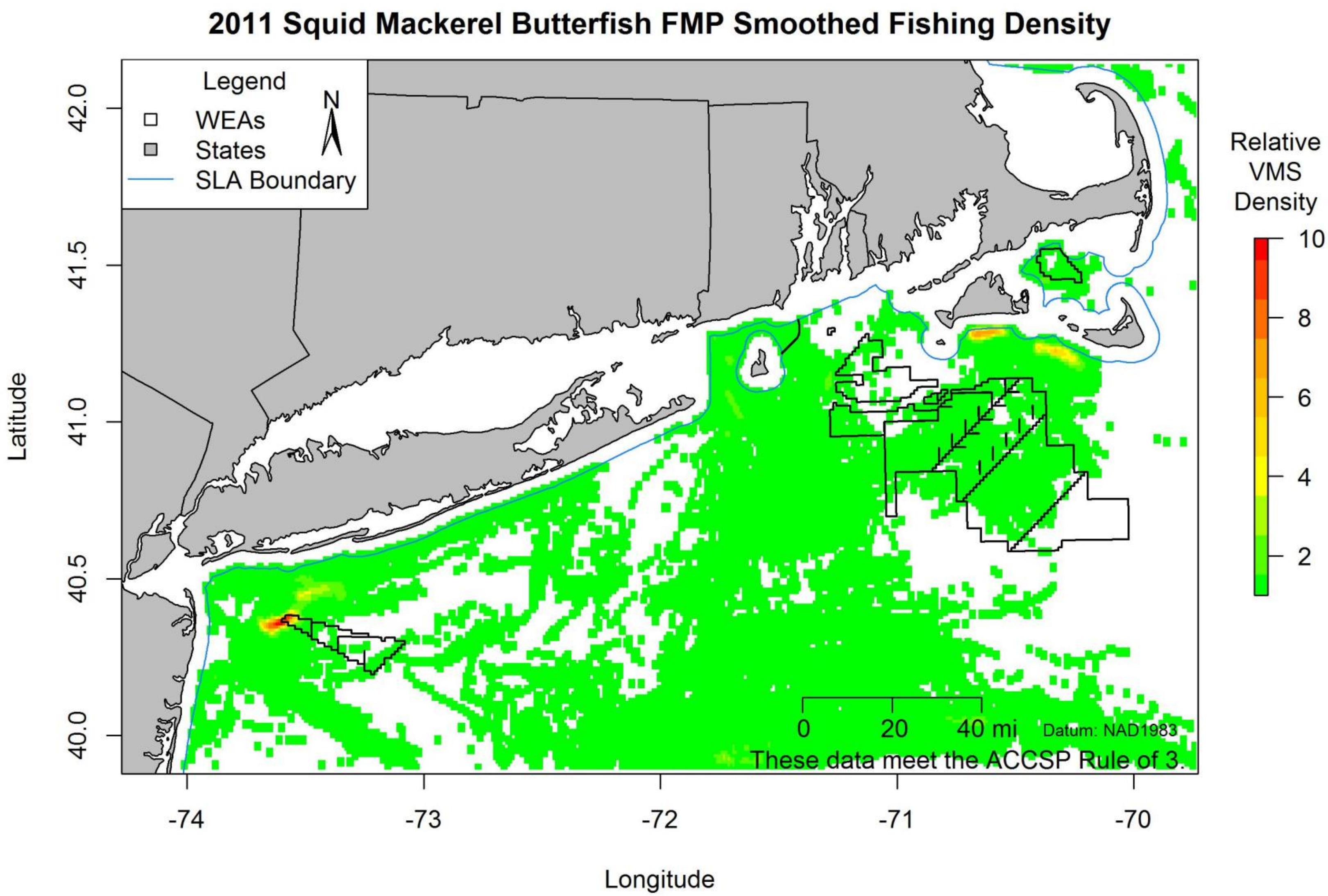

Figure 136. Smoothed federal fishing activity of all trips in 2011 where squid, Atlantic mackerel, and butterfish were caught

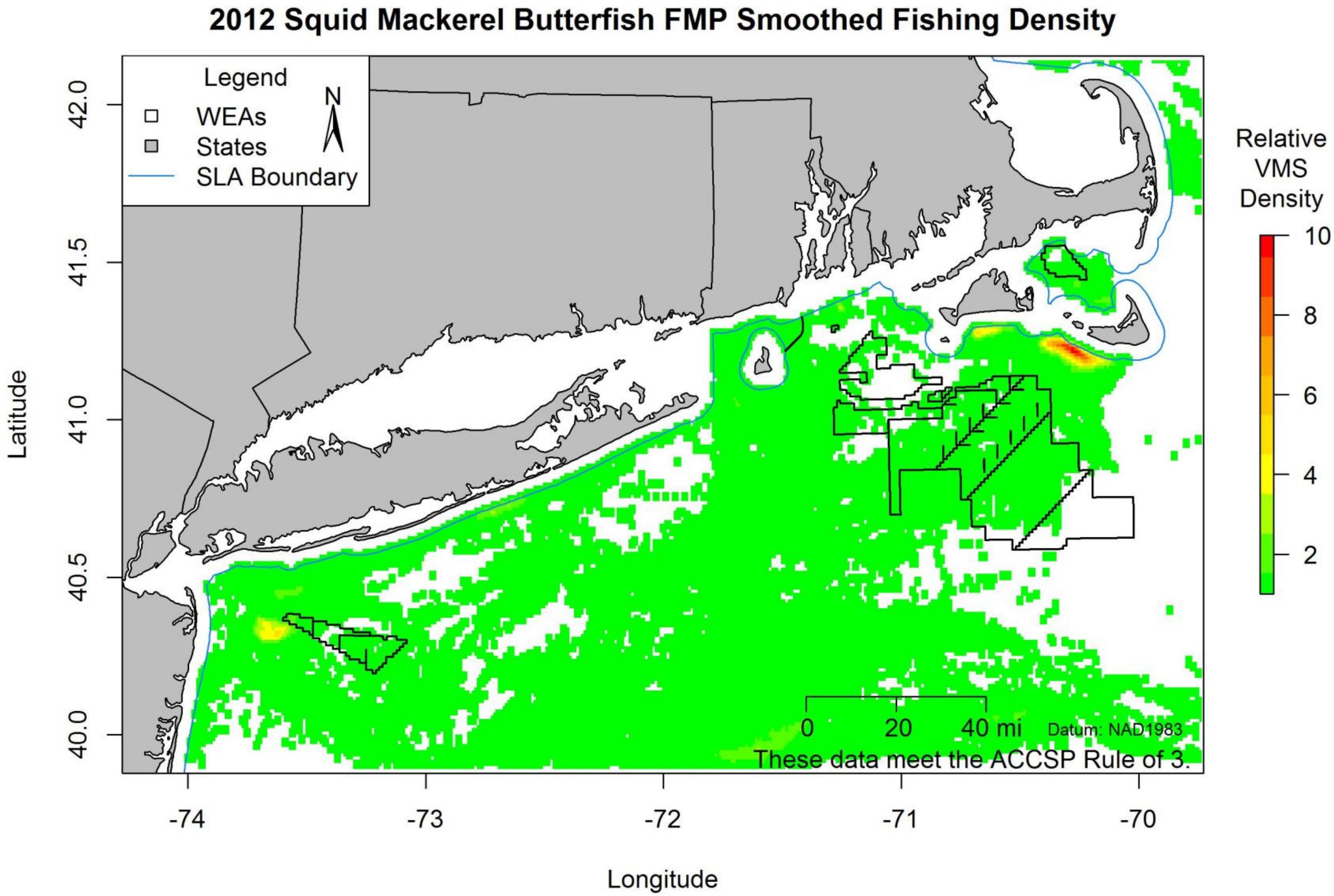

Figure 137. Smoothed federal fishing activity of all trips in 2012 where squid, Atlantic mackerel, and butterfish were caught

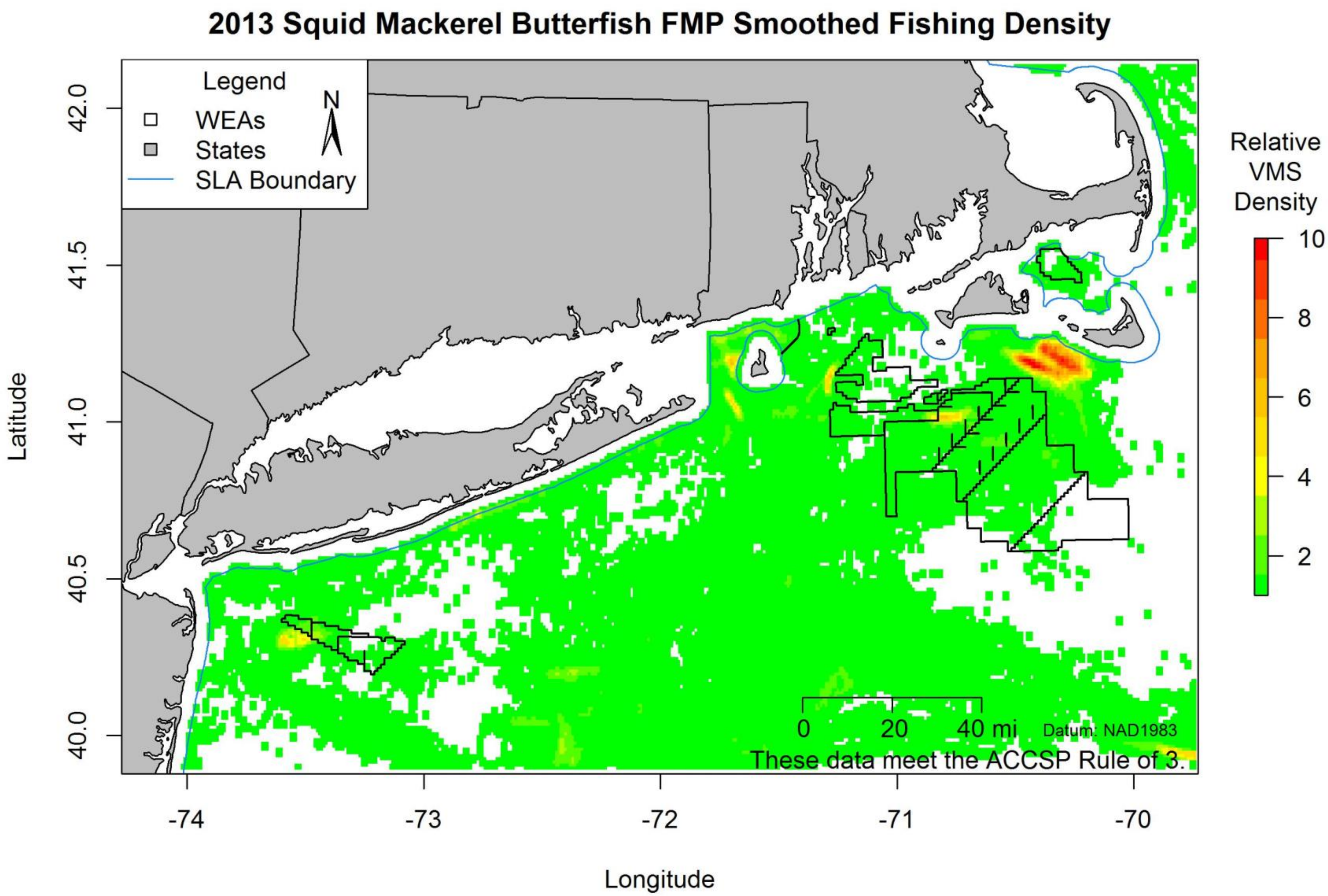

Figure 138. Smoothed federal fishing activity of all trips in 2013 where squid, Atlantic mackerel, and butterfish were caught

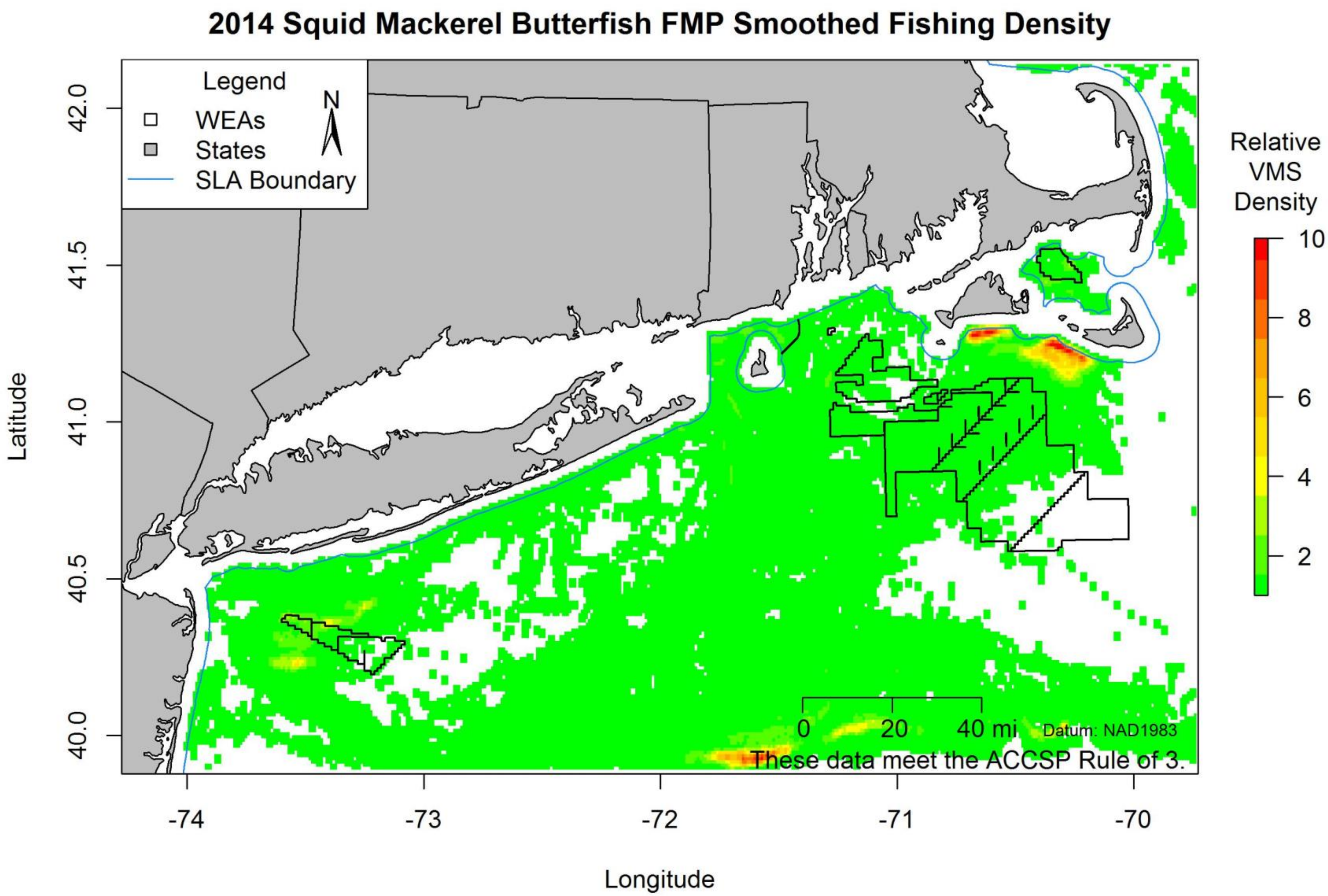

Figure 139. Smoothed federal fishing activity of all trips in 2014 where squid, Atlantic mackerel, and butterfish were caught

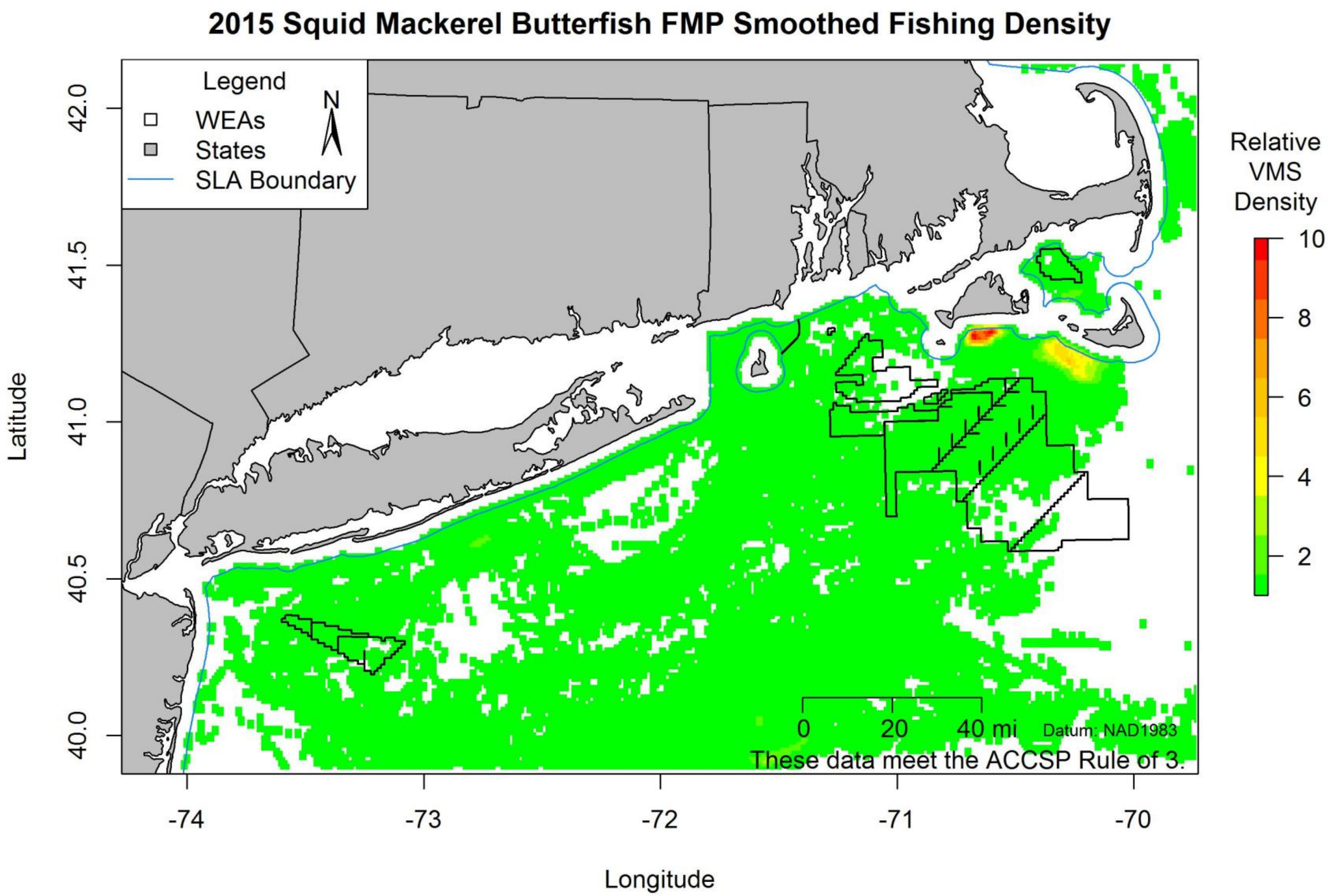

Figure 140. Smoothed federal fishing activity of all trips in 2015 where squid, Atlantic mackerel, and butterfish were caught

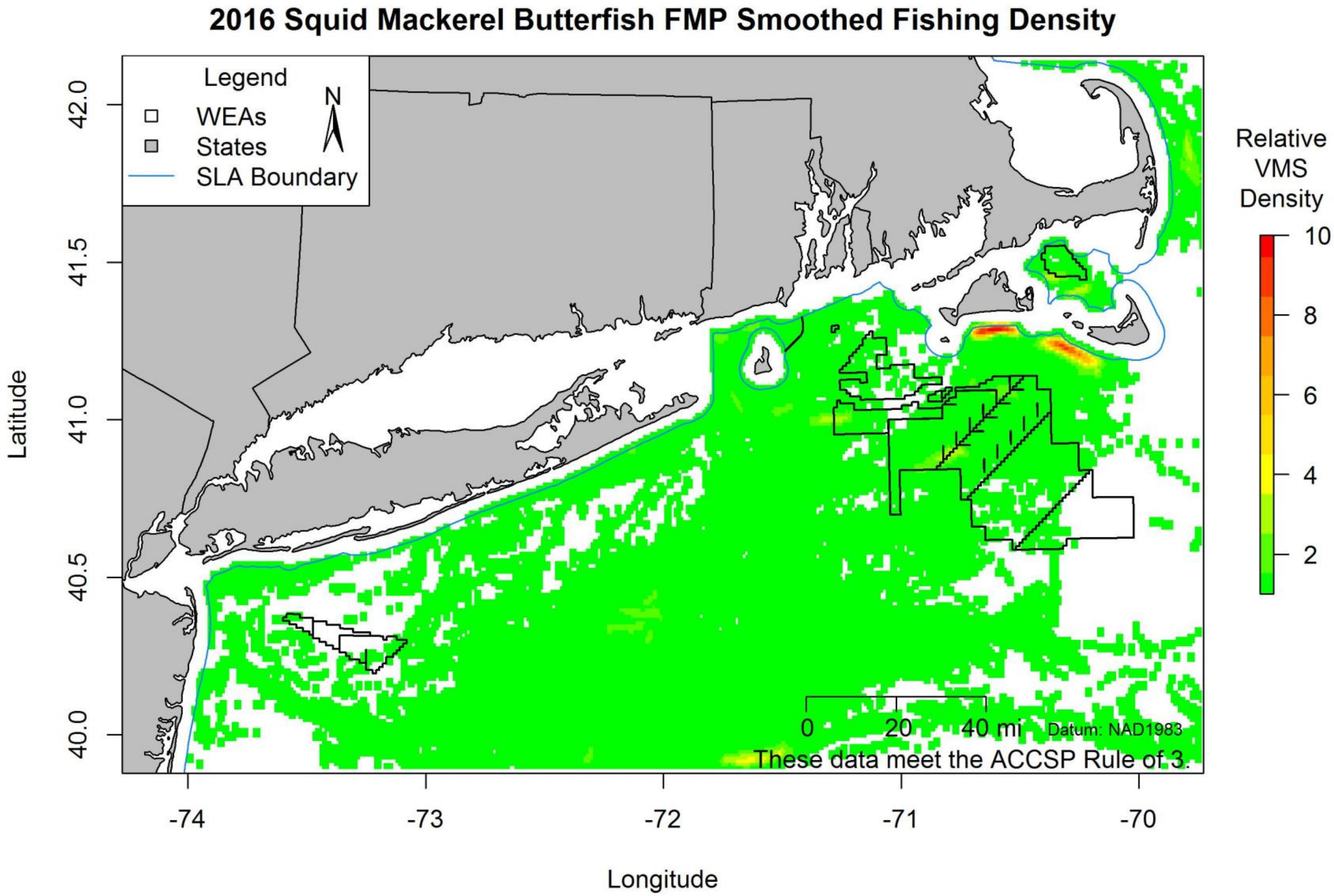

Figure 141. Smoothed federal fishing activity of all trips in 2016 where squid, Atlantic mackerel, and butterfish were caught

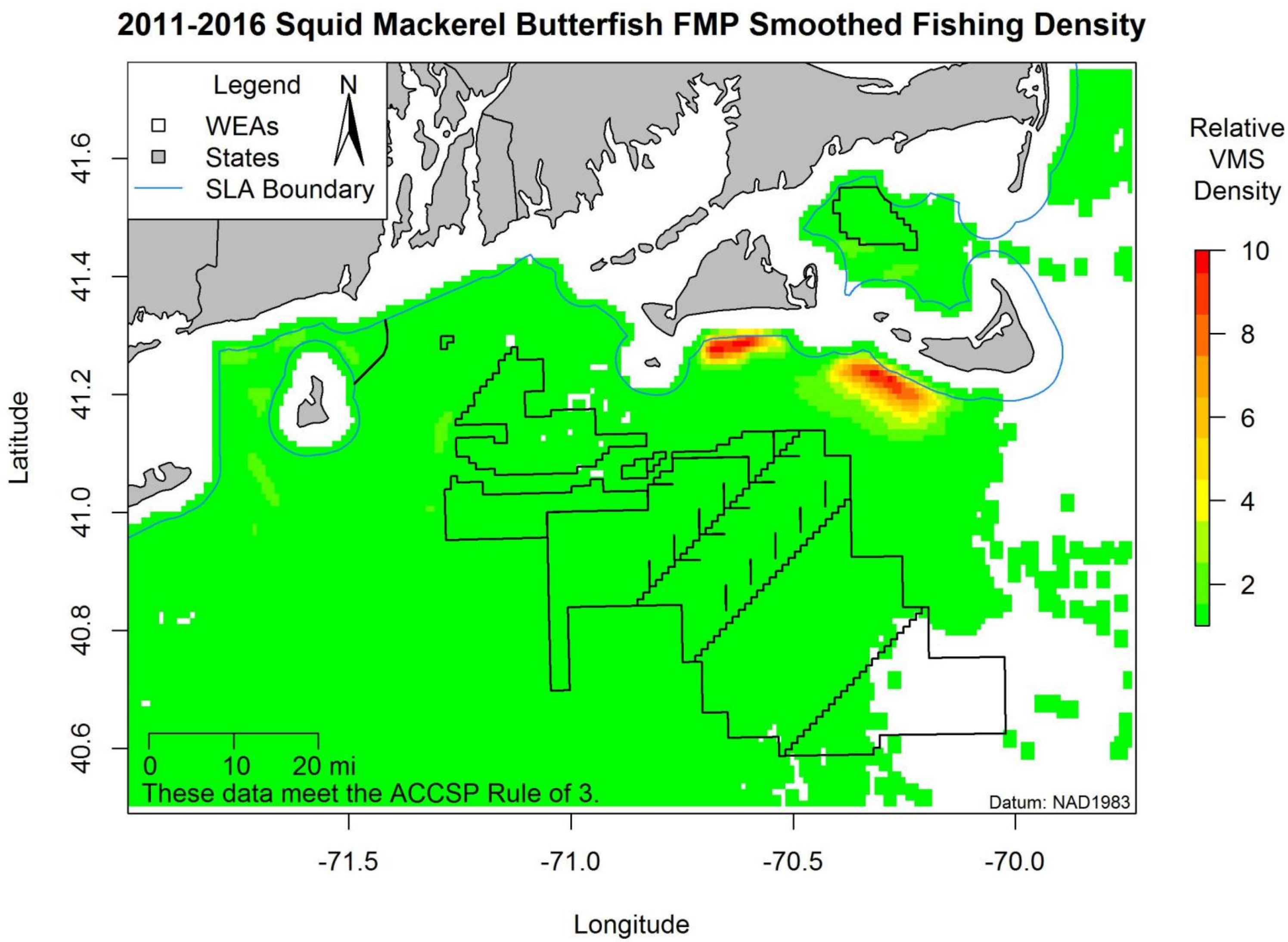

Figure 142. Smoothed federal fishing activity south of Rhode Island and Massachusetts of all trips between 2011 and 2016 where squid, Atlantic mackerel, and butterfish were caught

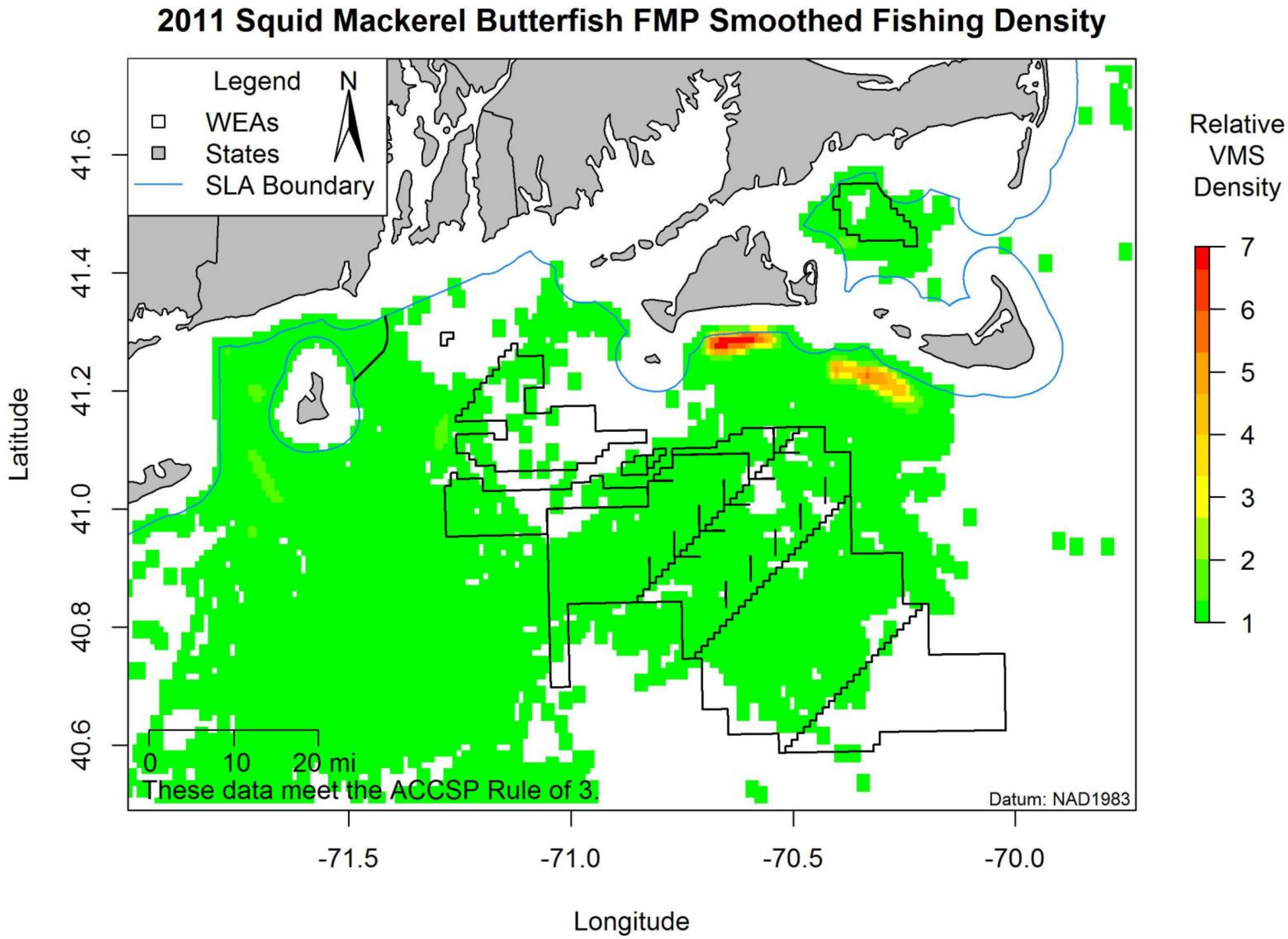

Figure 143. Smoothed federal fishing activity south of Rhode Island and Massachusetts of all trips in 2011 where squid, Atlantic mackerel, and butterfish were caught

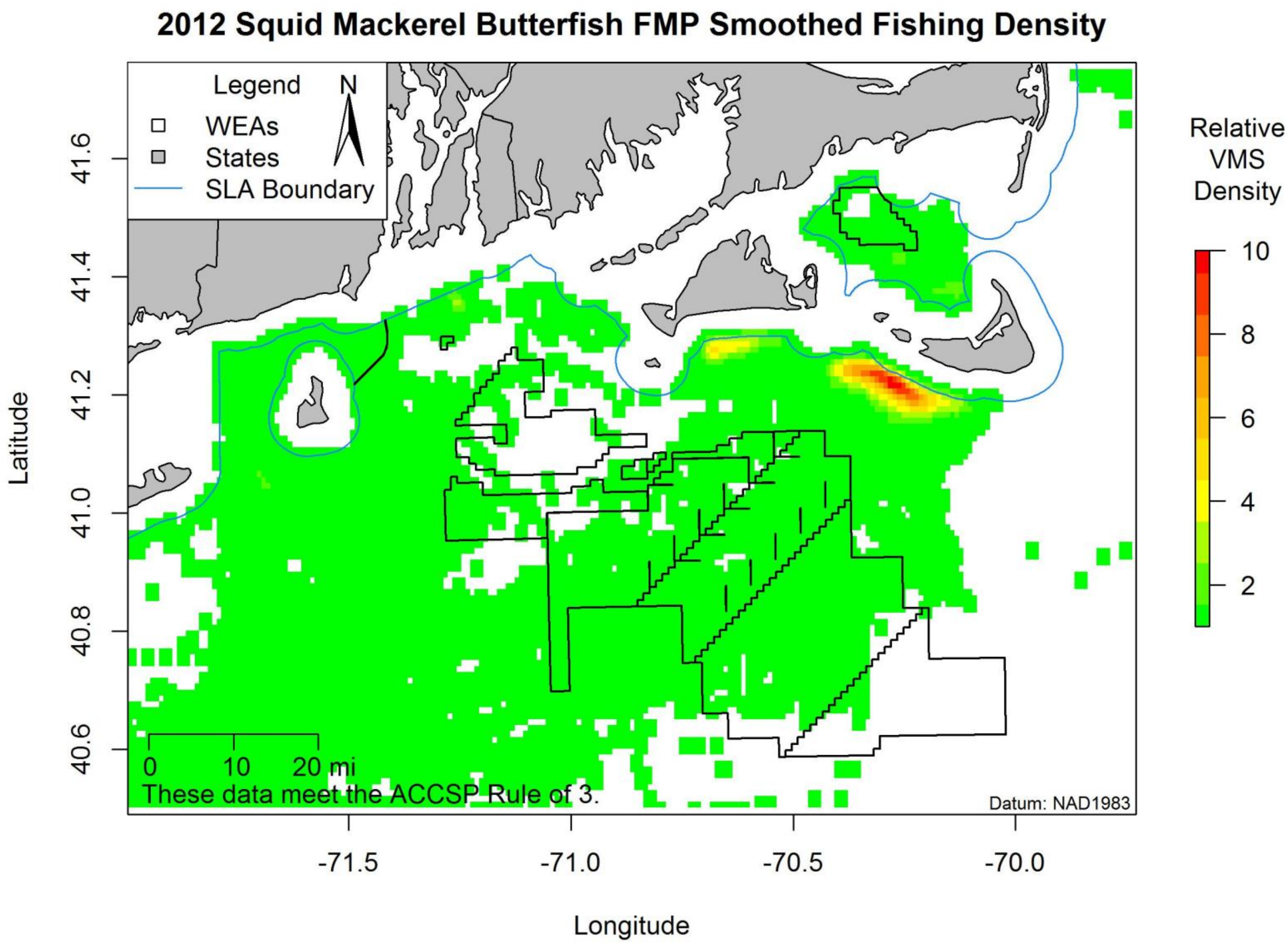

Figure 144. Smoothed federal fishing activity south of Rhode Island and Massachusetts of all trips in 2012 where squid, Atlantic mackerel, and butterfish were caught

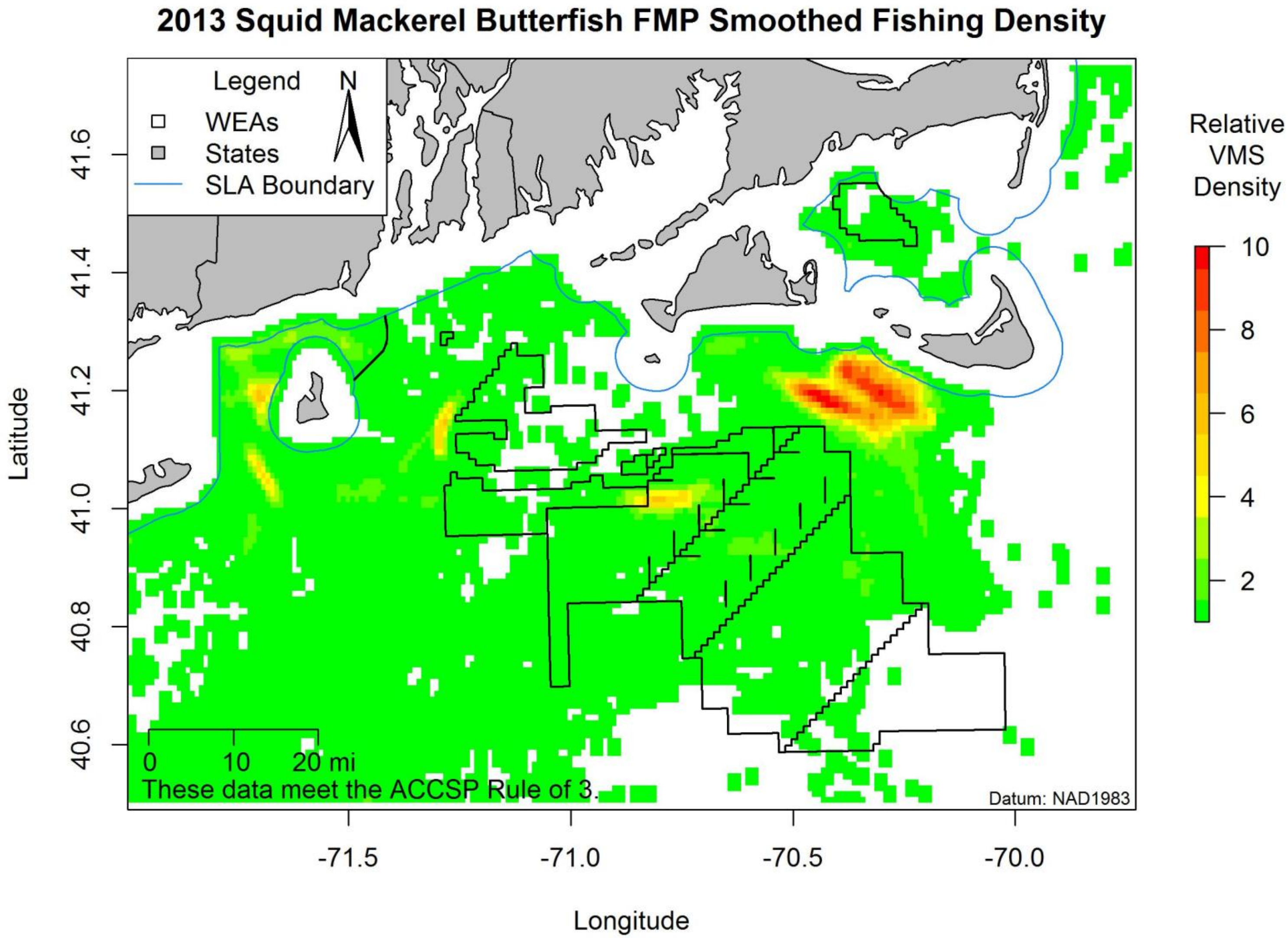

Figure 145. Smoothed federal fishing activity south of Rhode Island and Massachusetts of all trips in 2013 where squid, Atlantic mackerel, and butterfish were caught

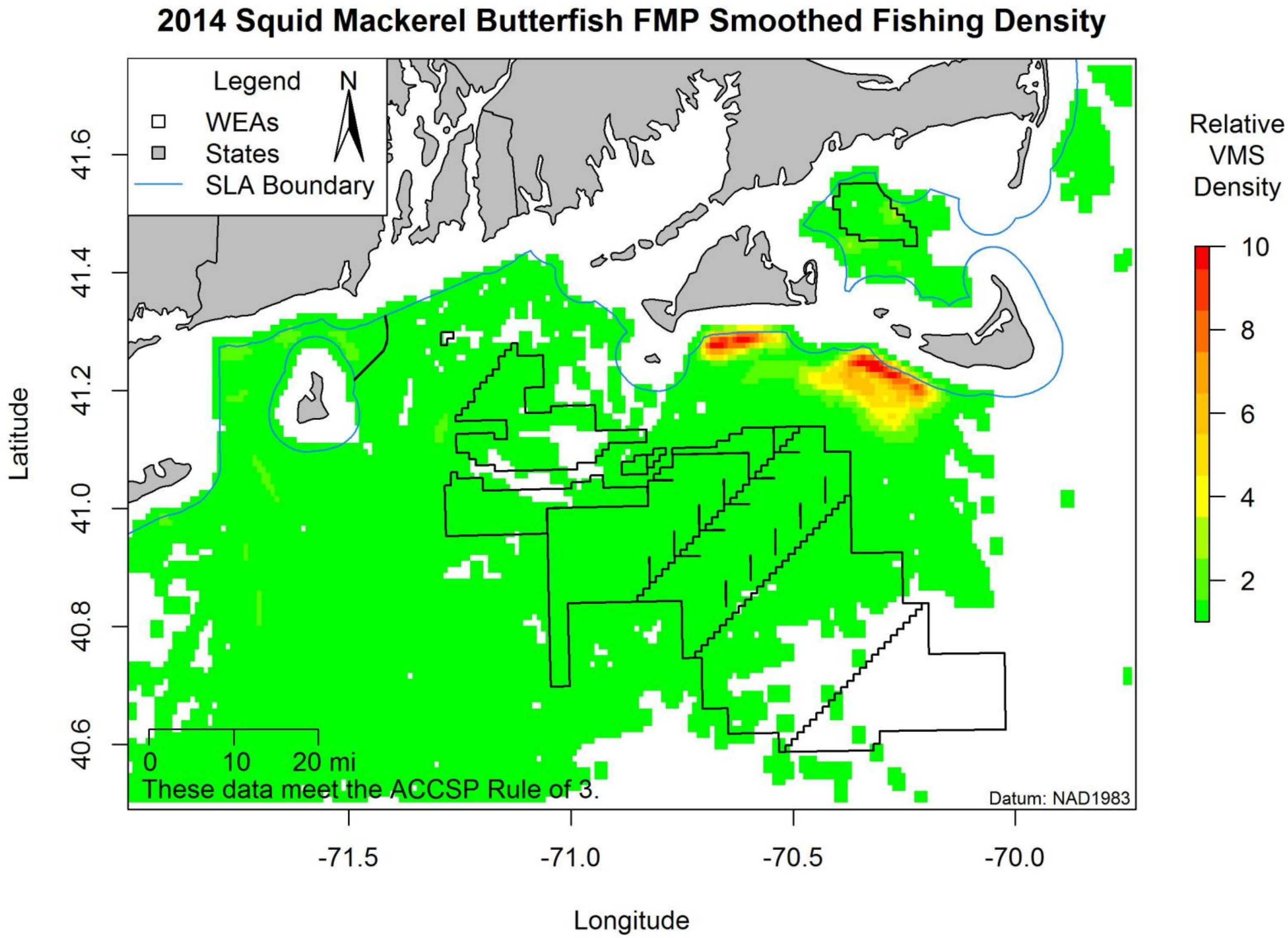

Figure 146. Smoothed federal fishing activity south of Rhode Island and Massachusetts of all trips in 2014 where squid, Atlantic mackerel, and butterfish were caught

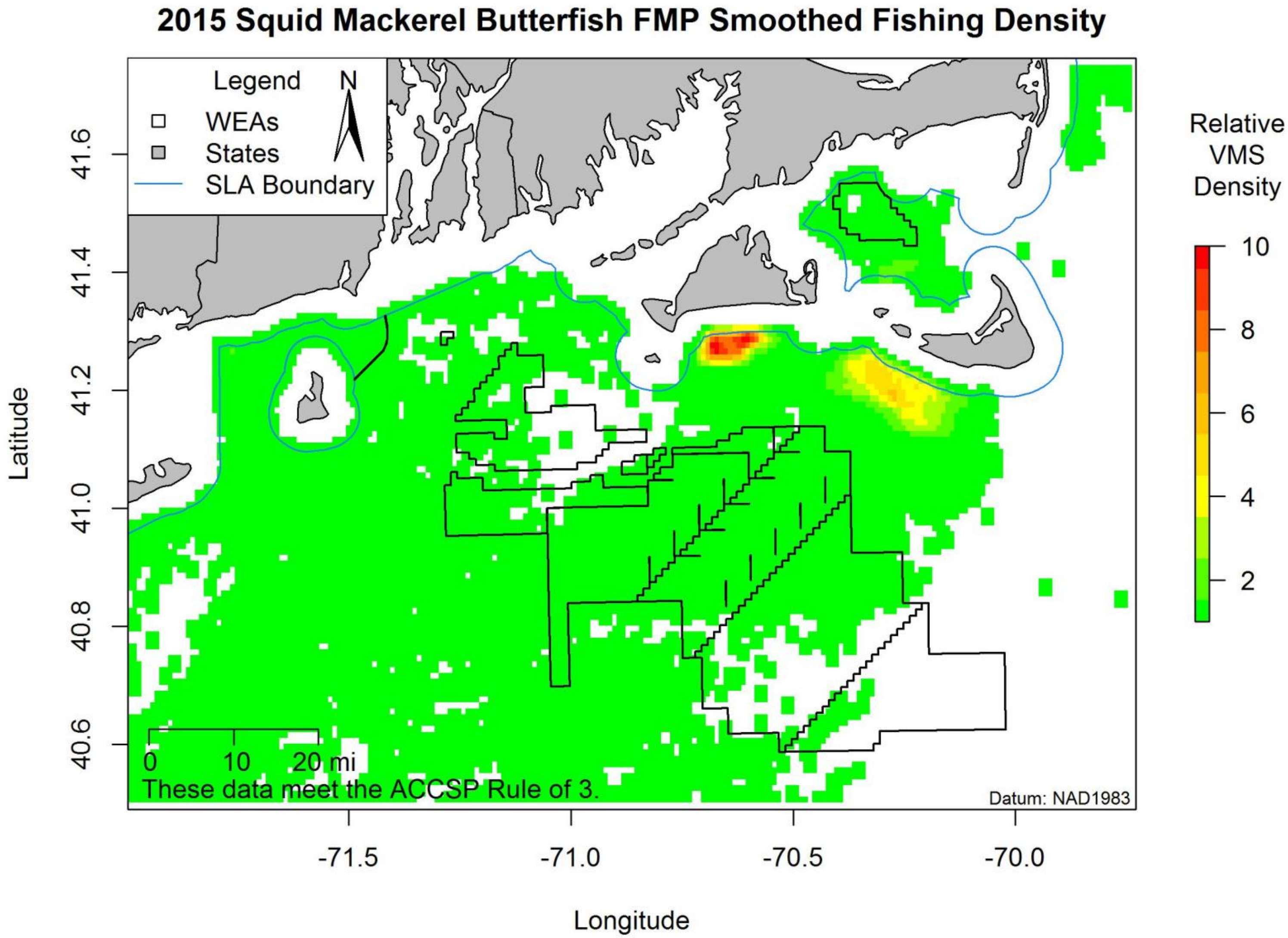

Figure 147. Smoothed federal fishing activity south of Rhode Island and Massachusetts of all trips in 2015 where squid, Atlantic mackerel, and butterfish were caught

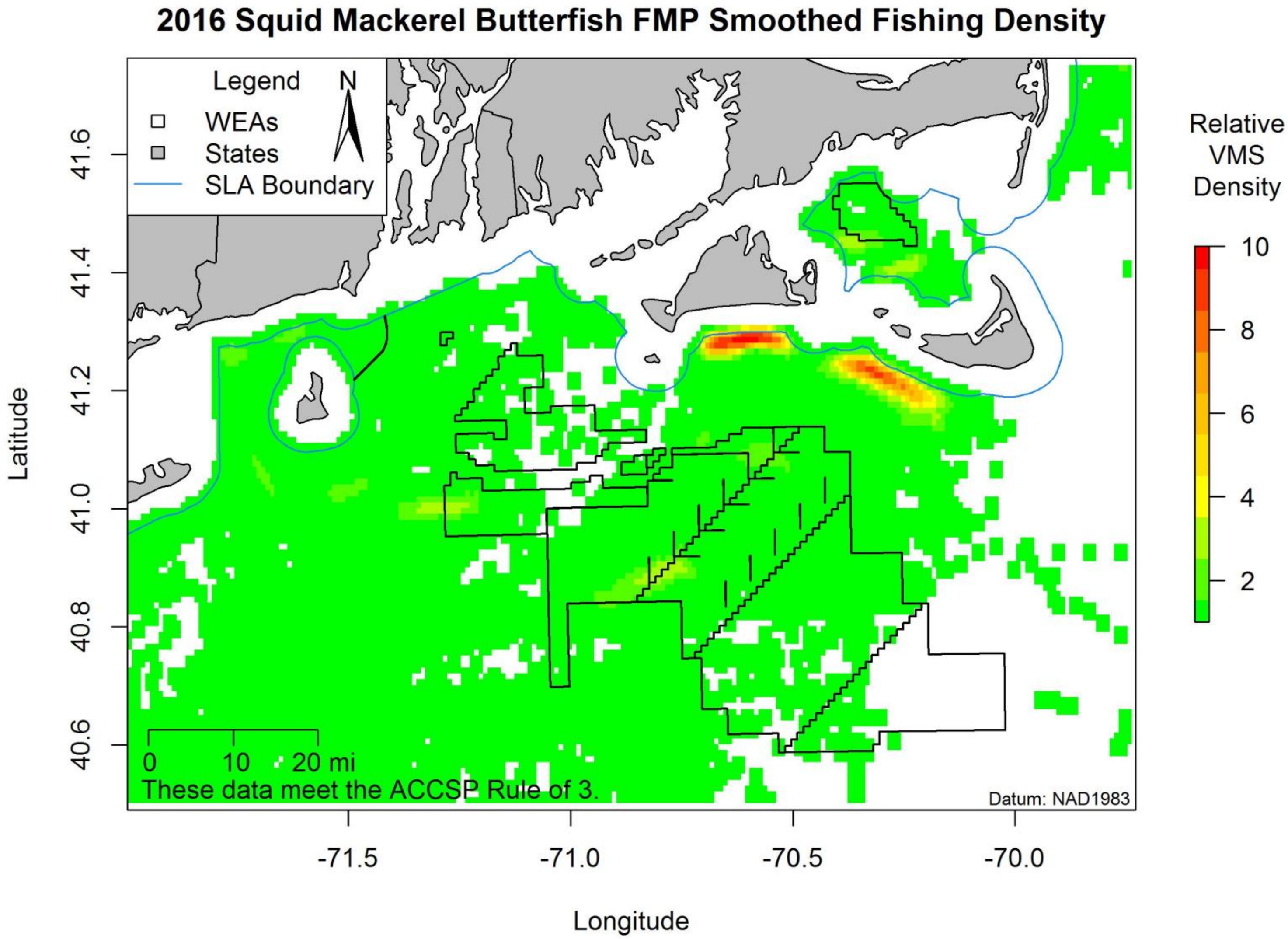

Figure 148. Smoothed federal fishing activity south of Rhode Island and Massachusetts of all trips in 2016 where squid, Atlantic mackerel, and butterfish were caught

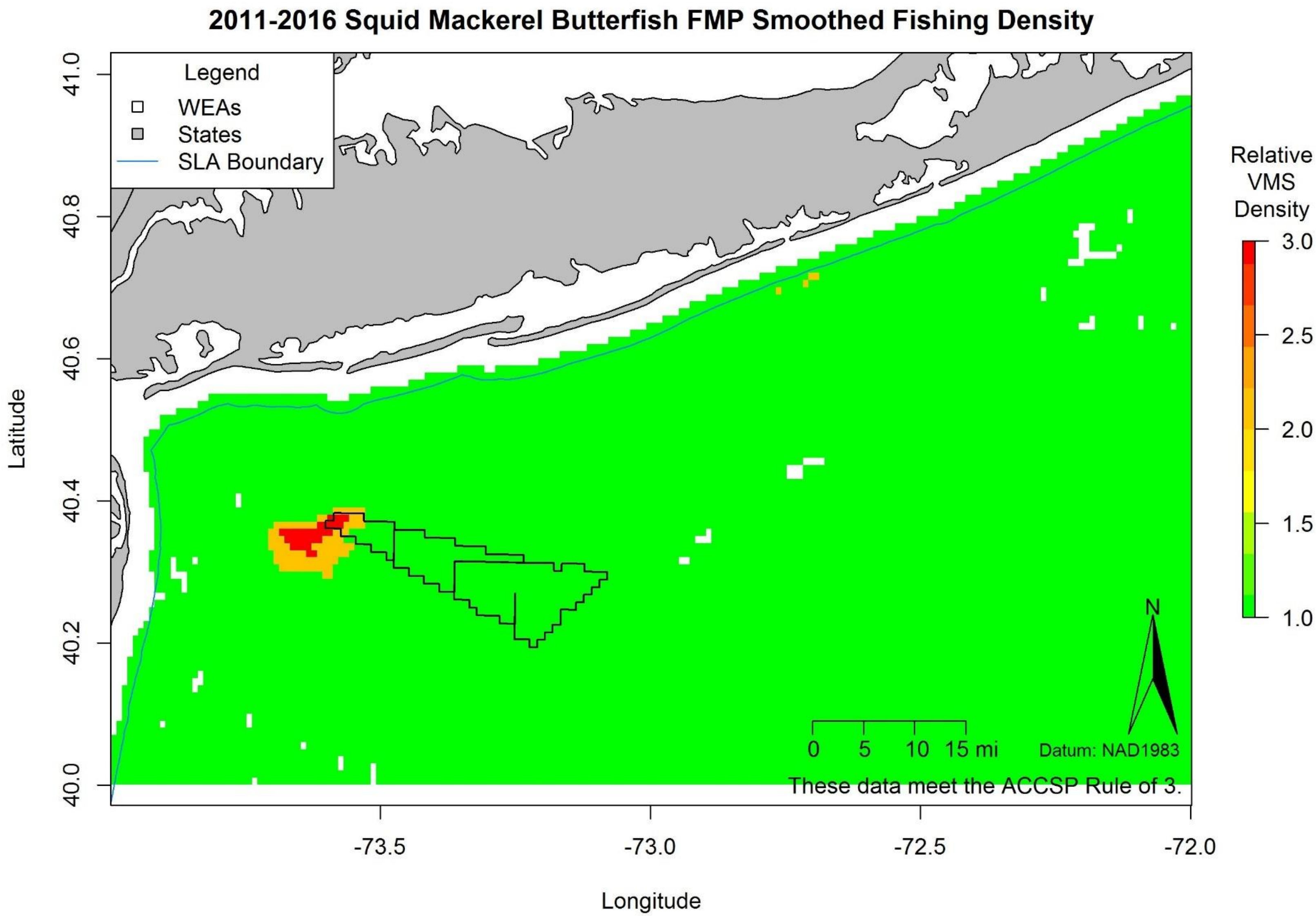

Figure 149. Smoothed federal fishing activity south of Long Island of all trips between 2011 and 2016 where squid, Atlantic mackerel, and butterfish were caught

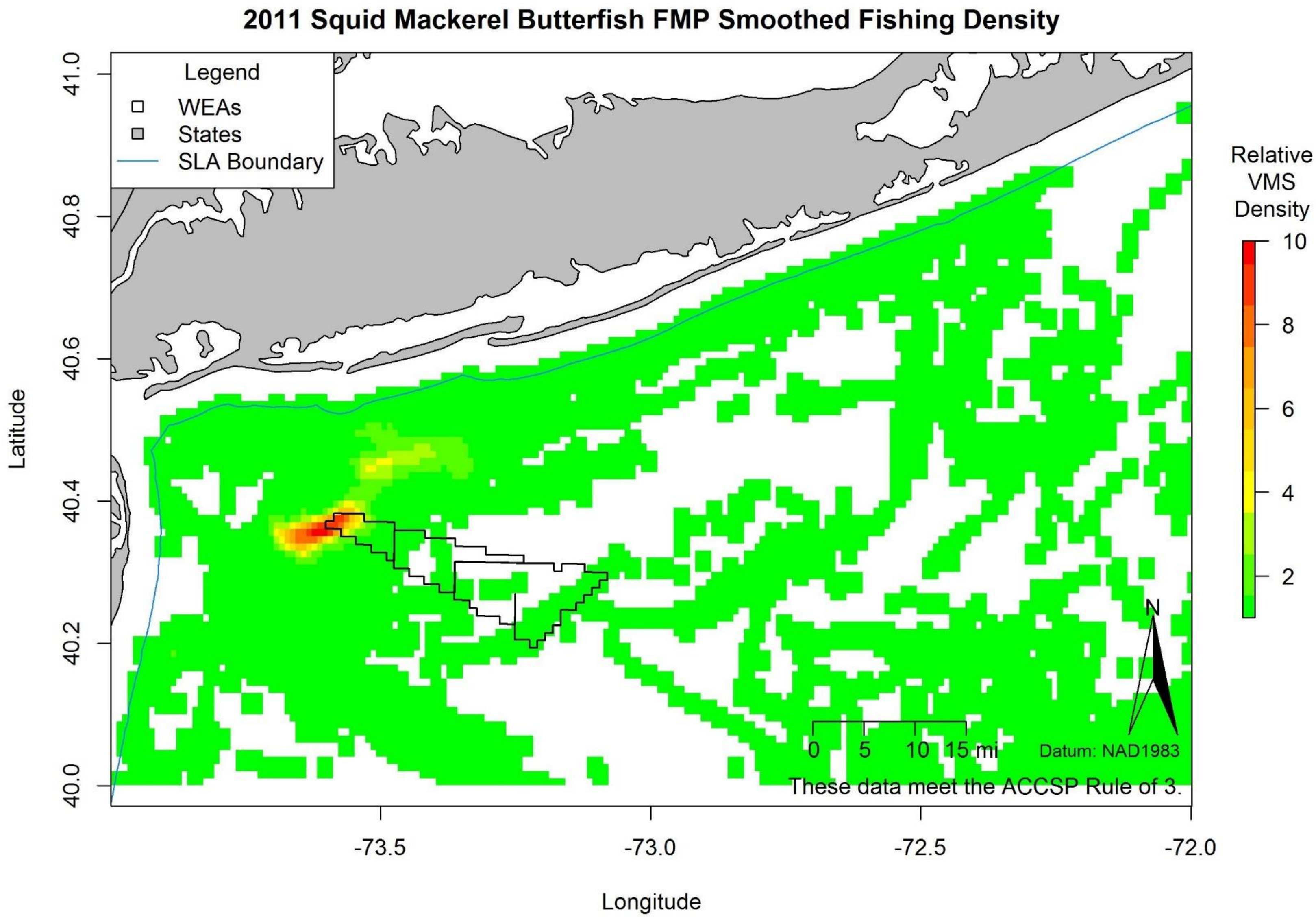

Figure 150. Smoothed federal fishing activity south of Long Island of all trips in 2011 where squid, Atlantic mackerel, and butterfish were caught

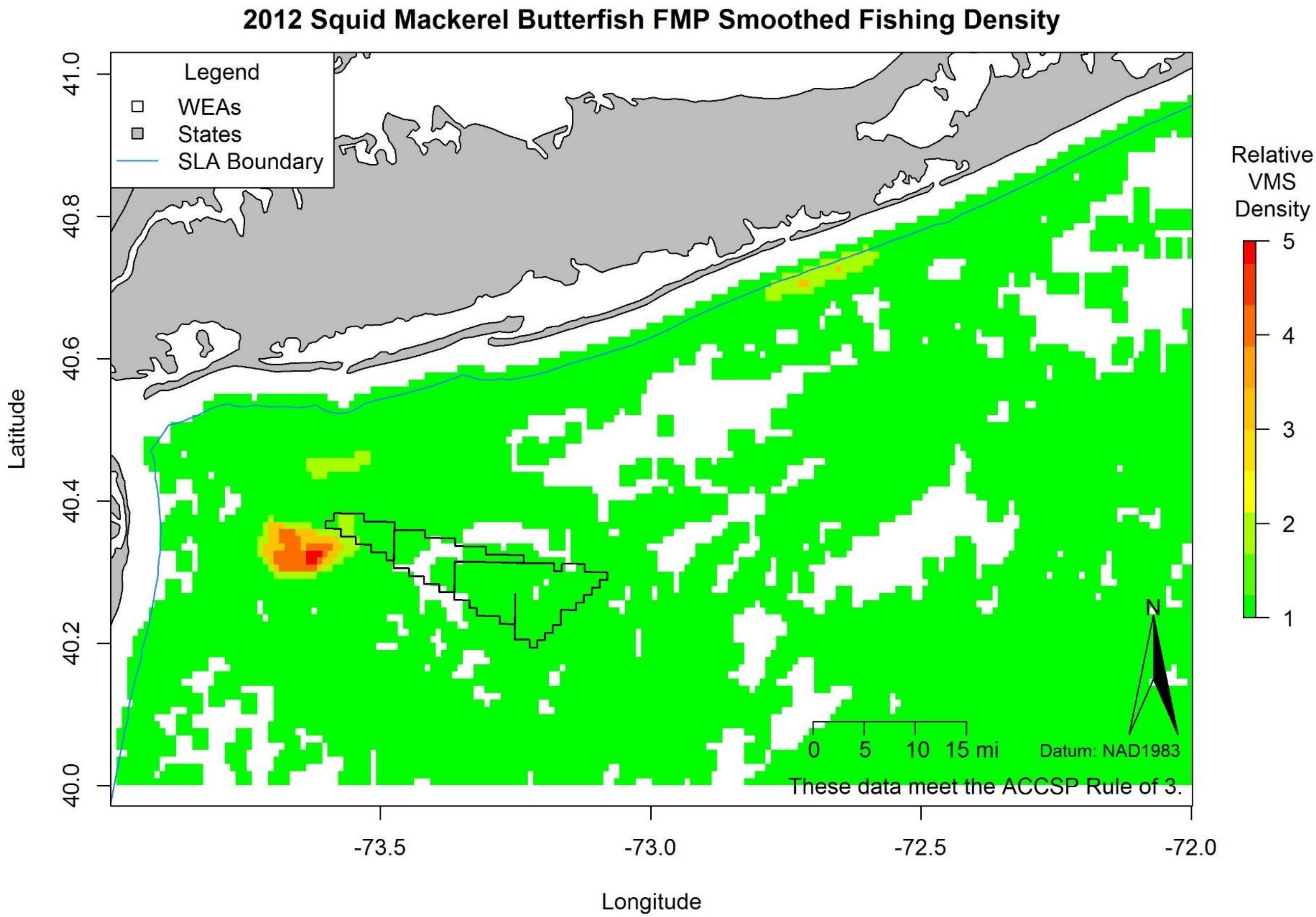

Figure 151. Smoothed federal fishing activity south of Long Island of all trips in 2012 where squid, Atlantic mackerel, and butterfish were caught

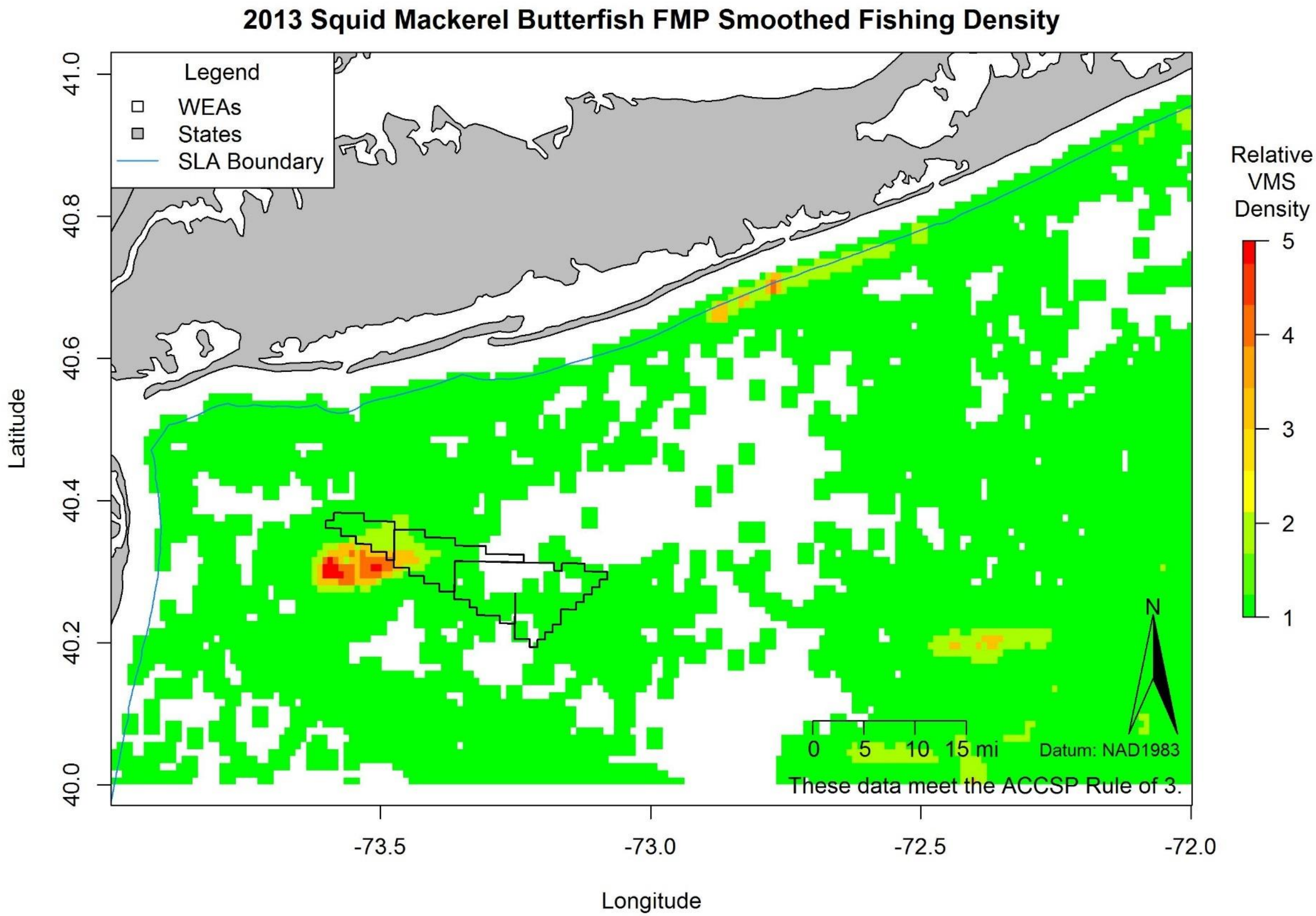

Figure 152. Smoothed federal fishing activity south of Long Island of all trips in 2013 where squid, Atlantic mackerel, and butterfish were caught

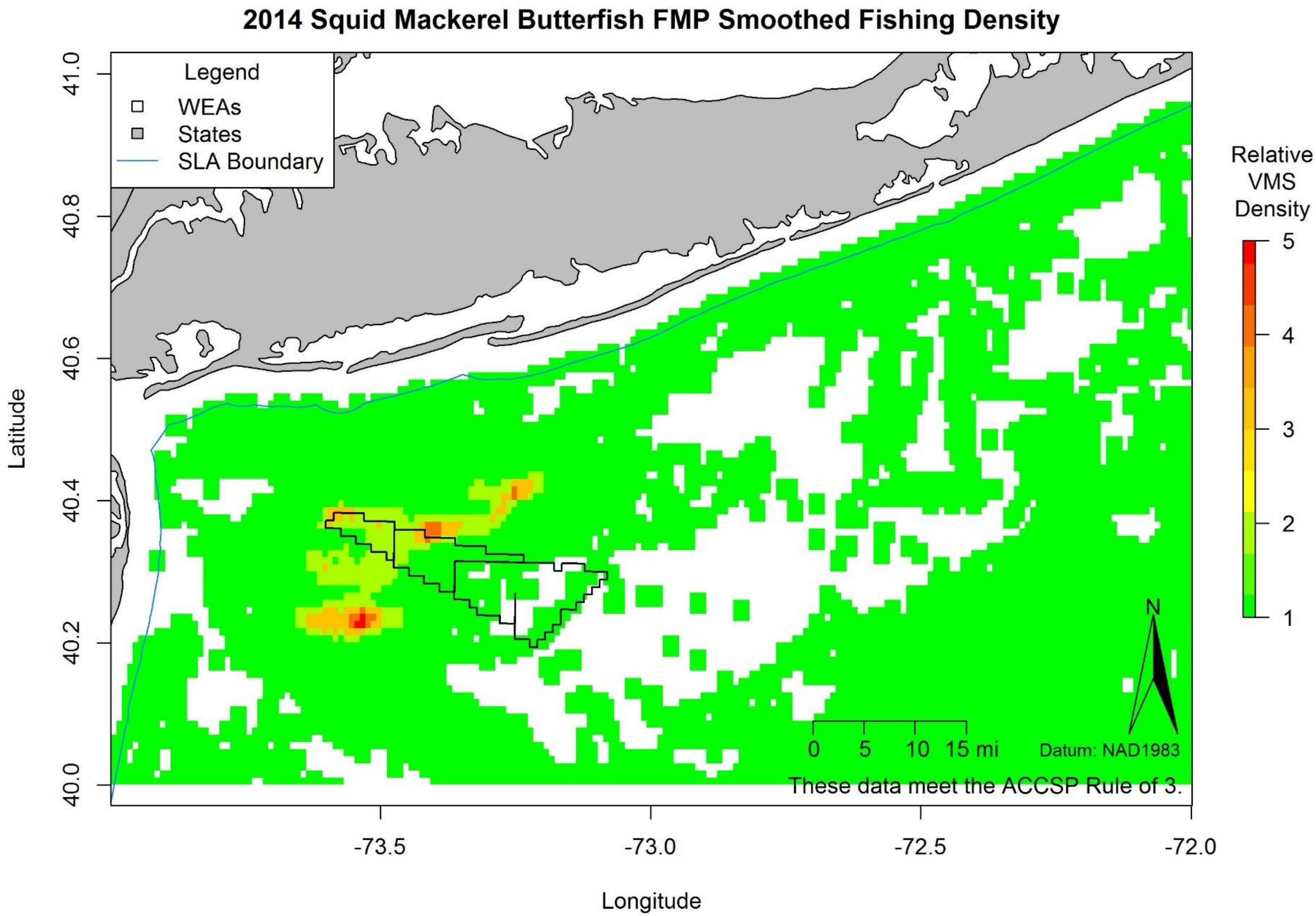

Figure 153. Smoothed federal fishing activity south of Long Island of all trips in 2014 where squid, Atlantic mackerel, and butterfish were caught

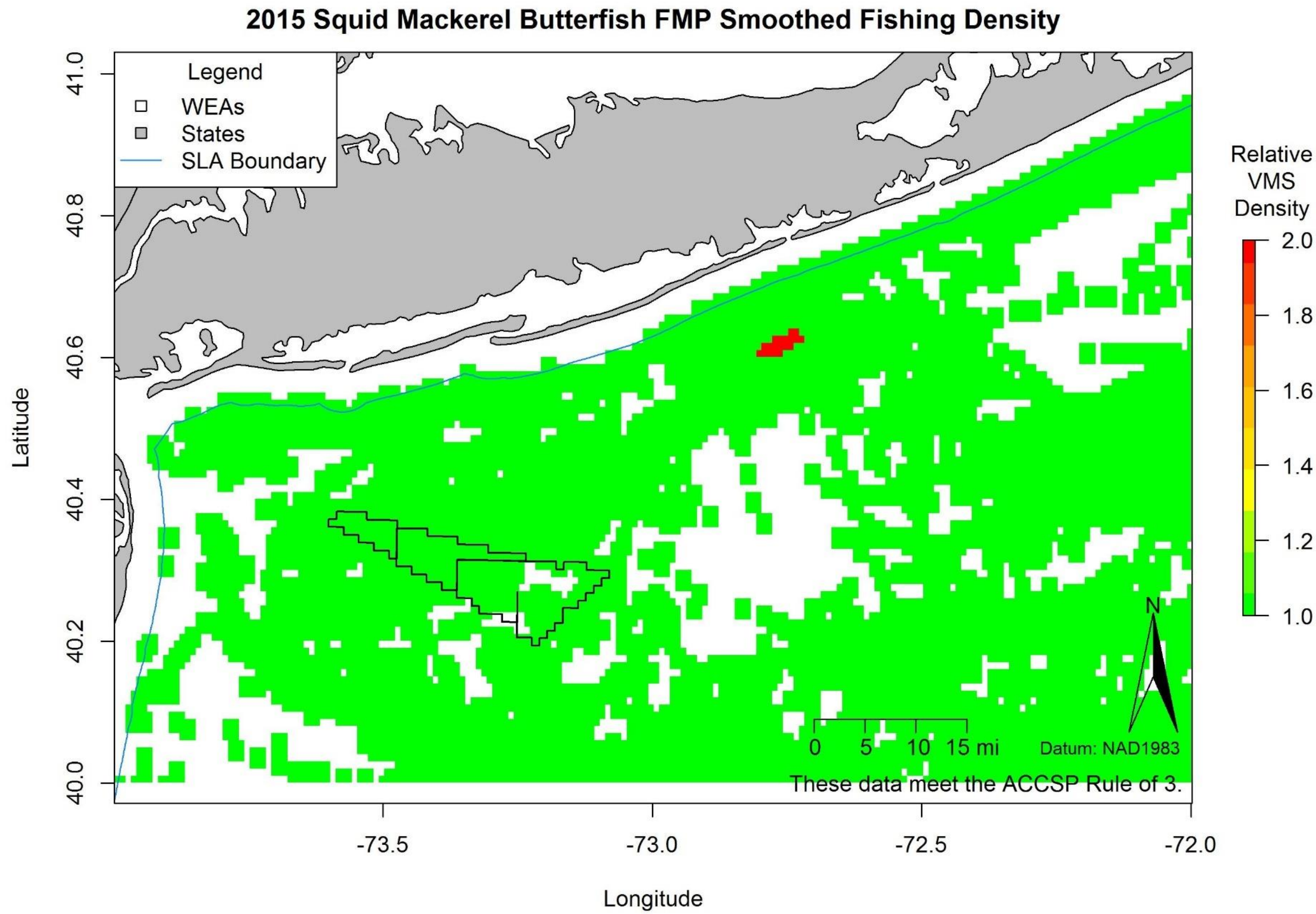

Figure 154. Smoothed federal fishing activity south of Long Island of all trips in 2015 where squid, Atlantic mackerel, and butterfish were caught

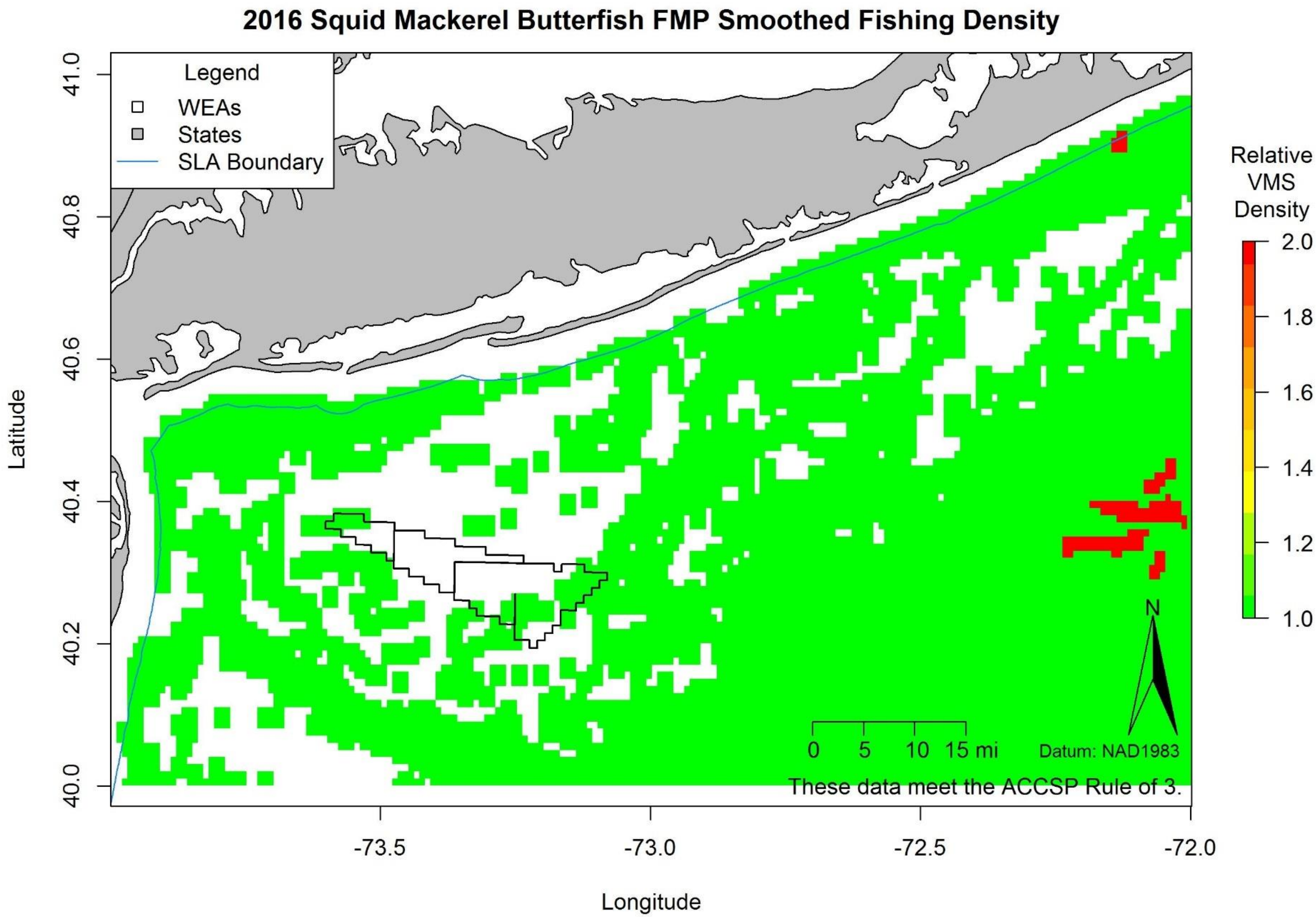

Figure 155. Smoothed federal fishing activity south of Long Island of all trips in 2016 where squid, Atlantic mackerel, and butterfish were caught

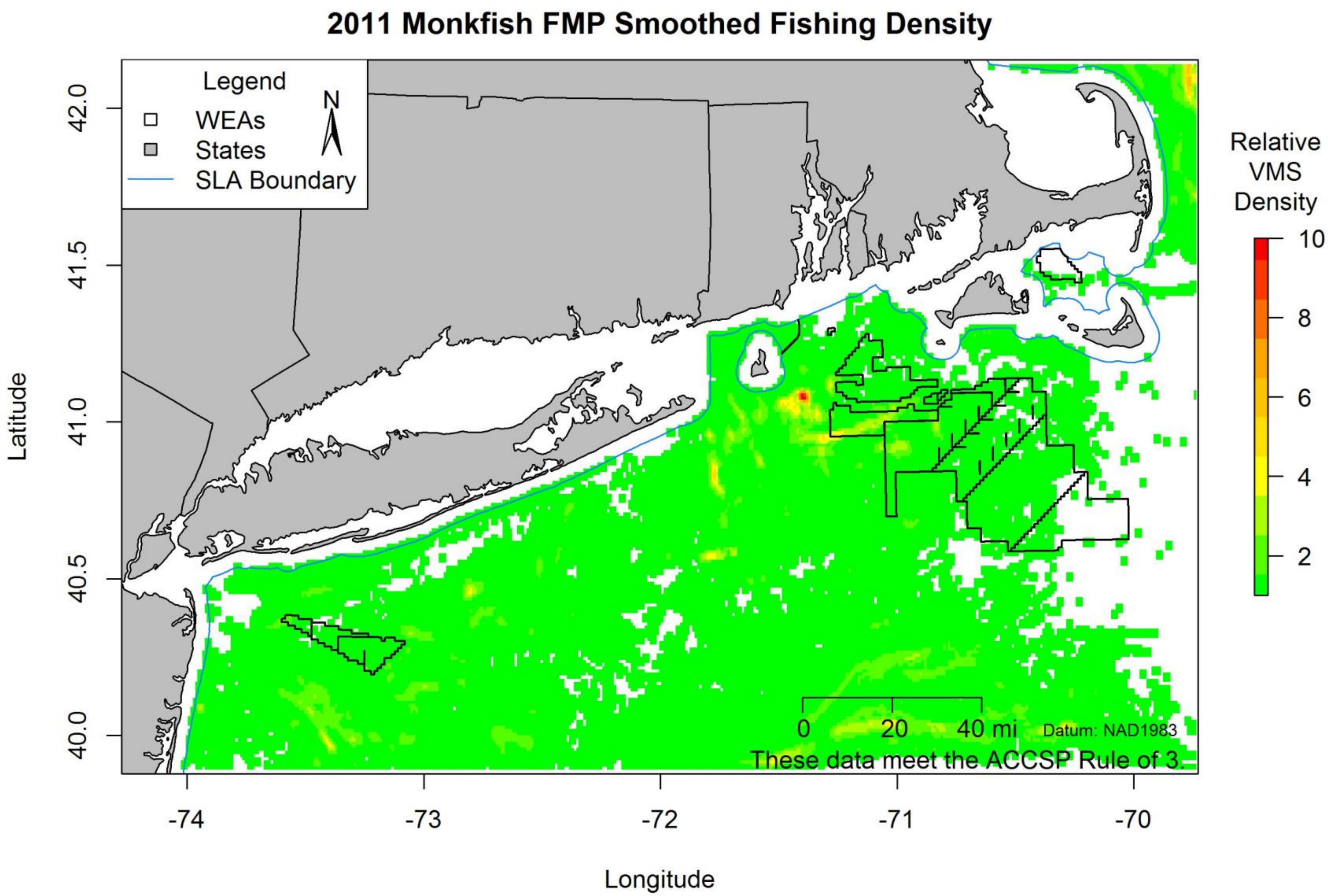

Figure 156. Smoothed federal fishing activity of all trips in 2011 where monkfish was caught

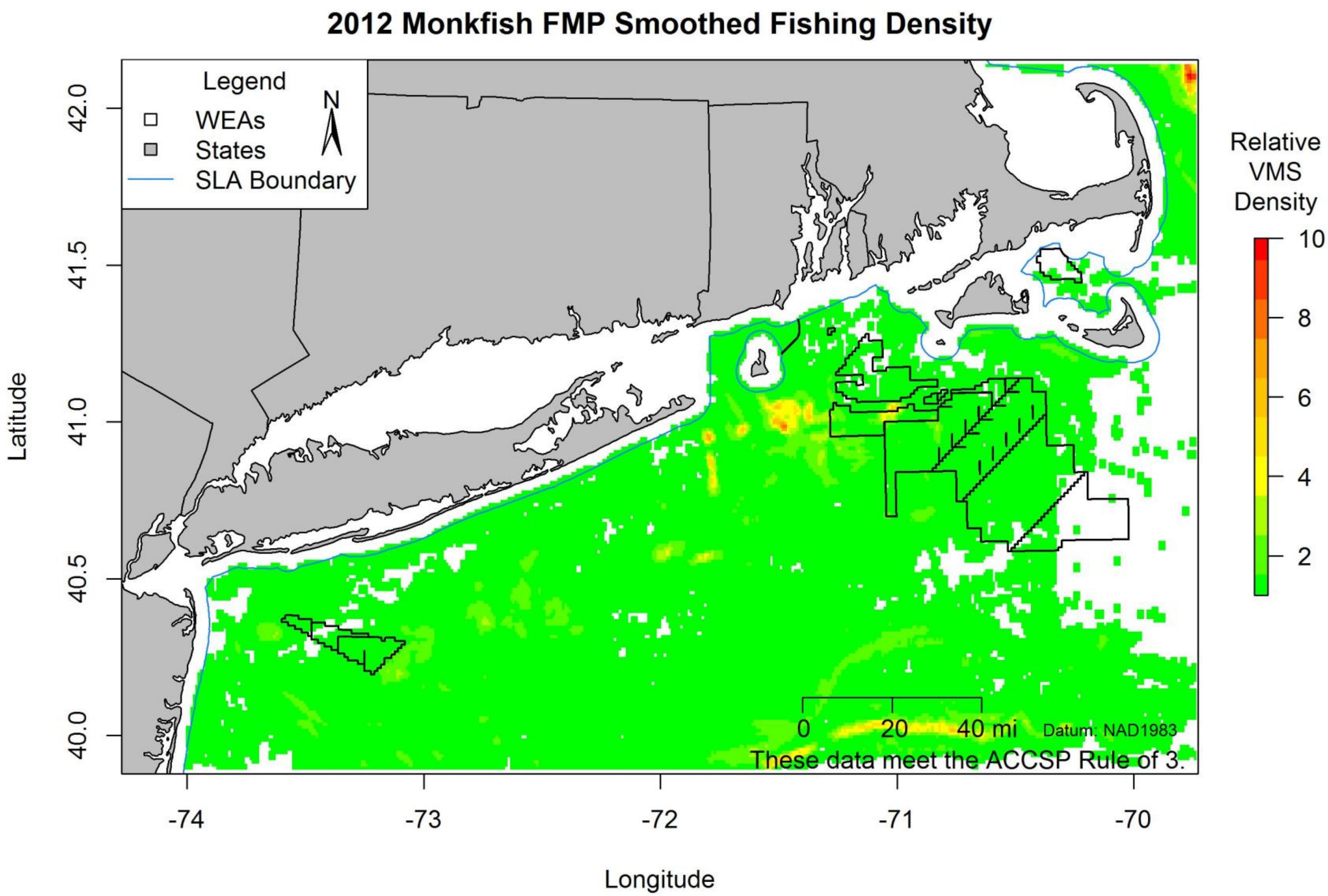

Figure 157. Smoothed federal fishing activity of all trips in 2012 where monkfish was caught

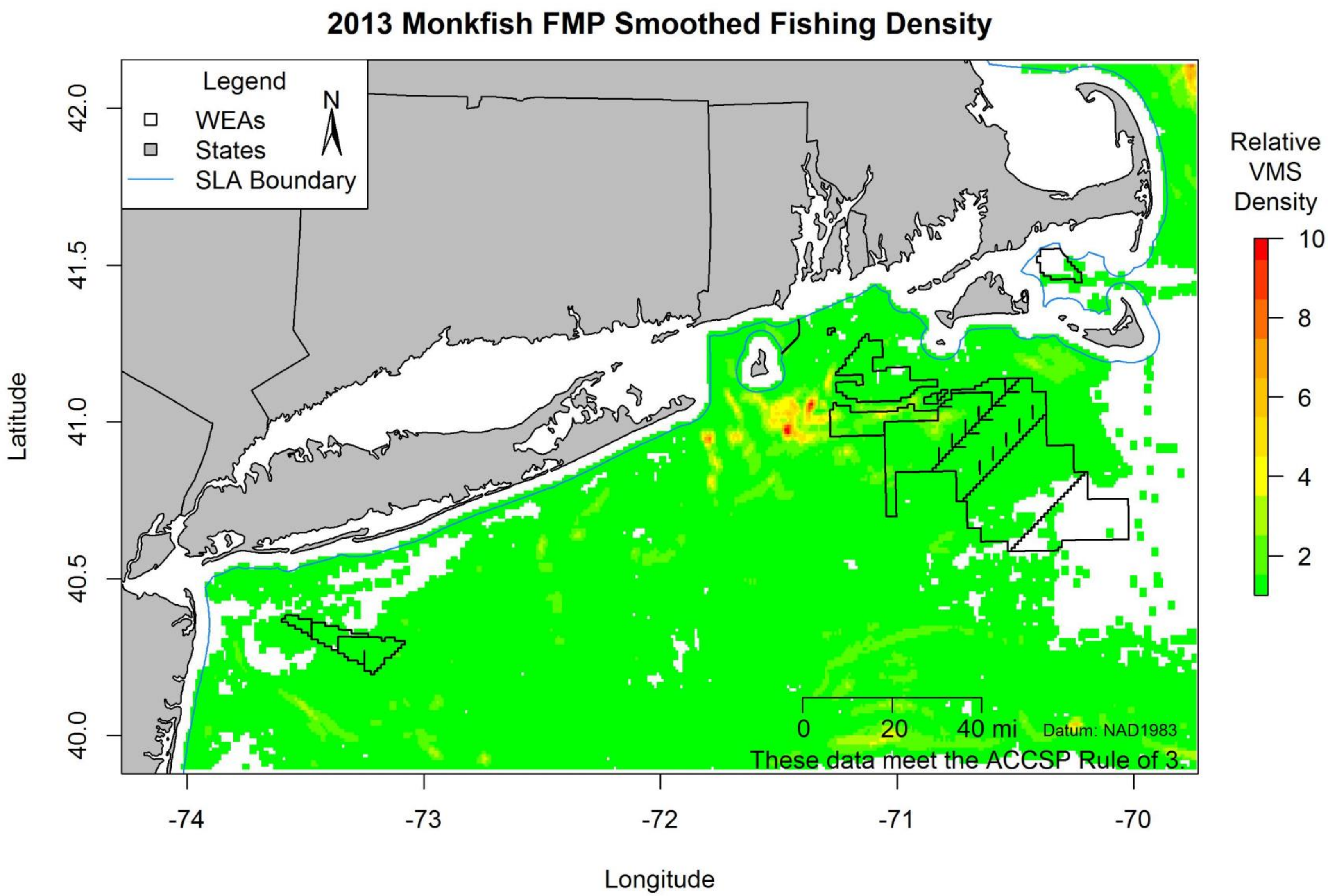

Figure 158. Smoothed federal fishing activity of all trips in 2013 where monkfish was caught

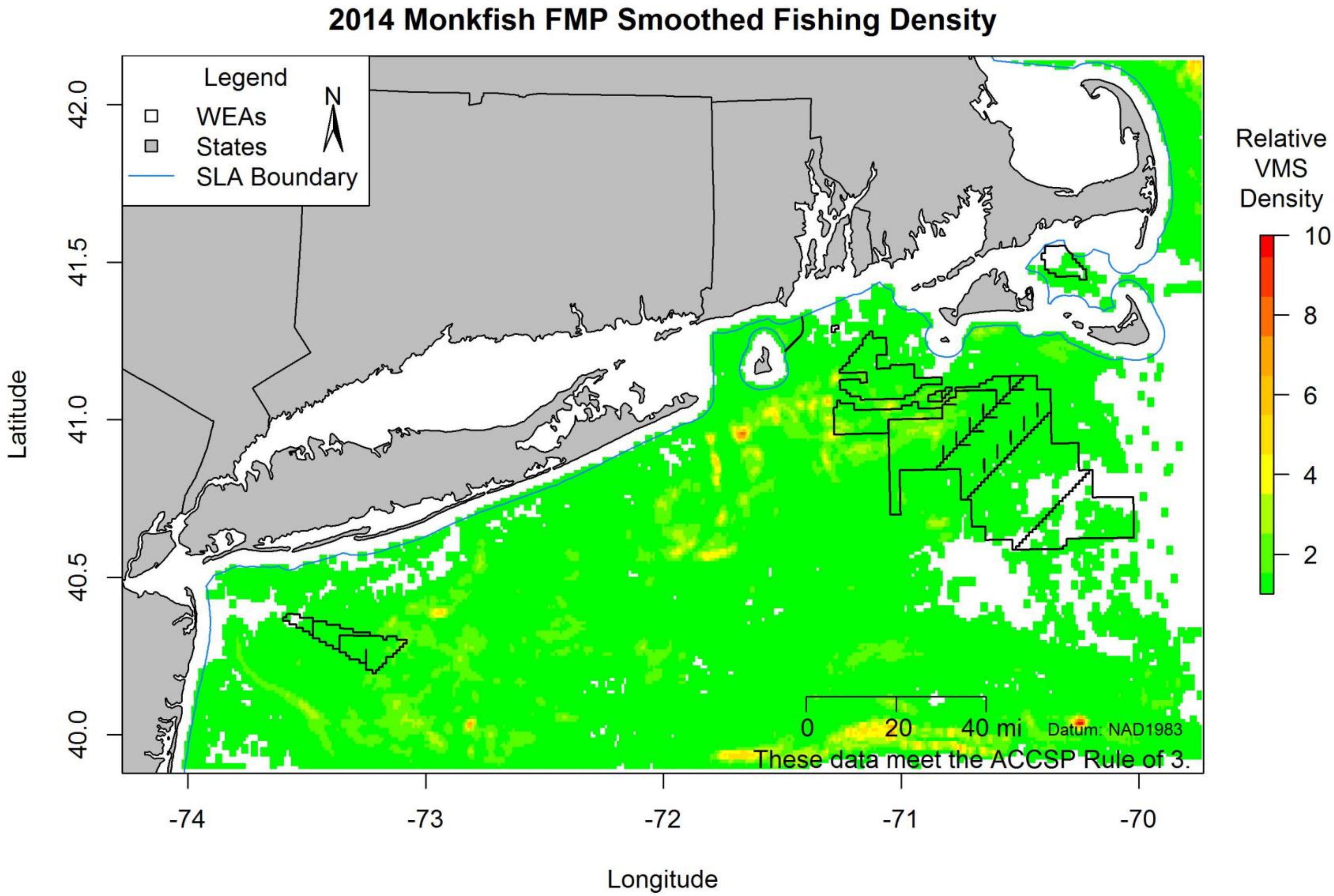

Figure 159. Smoothed federal fishing activity of all trips in 2014 where monkfish was caught

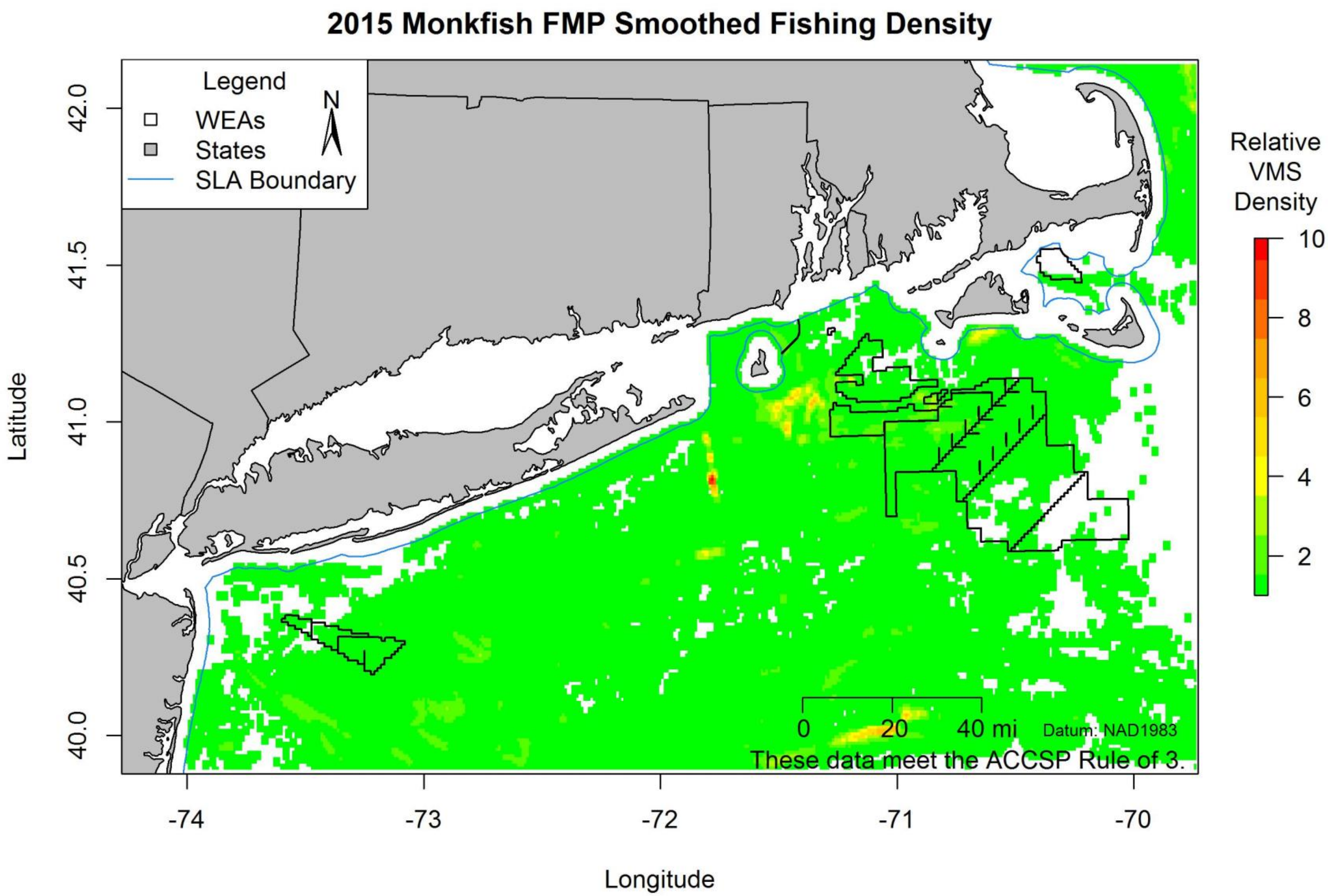

Figure 160. Smoothed federal fishing activity of all trips in 2015 where monkfish was caught

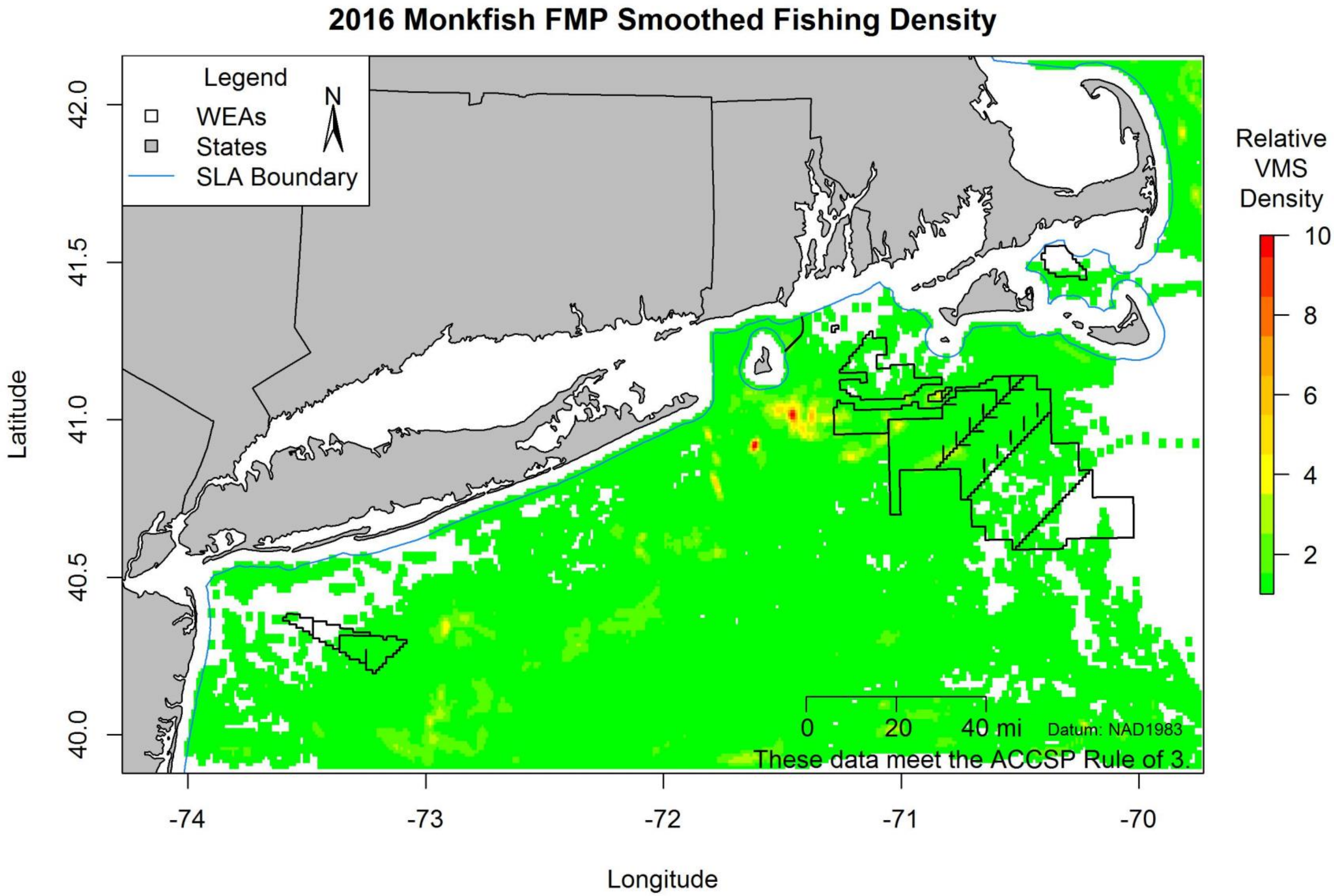

Figure 161. Smoothed federal fishing activity of all trips in 2016 where monkfish was caught

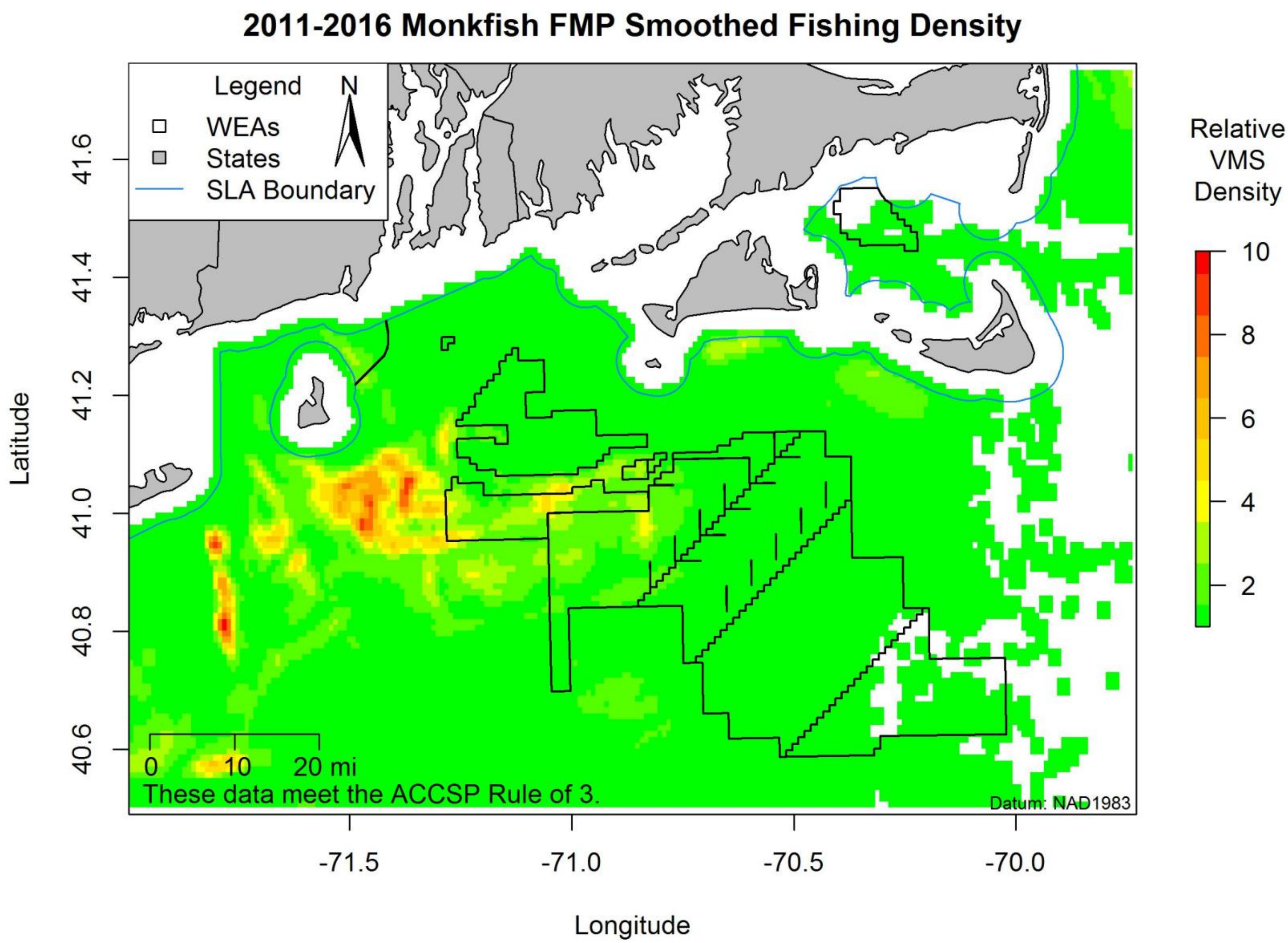

Figure 162. Smoothed federal fishing activity south of Rhode Island and Massachusetts of all trips between 2011 and 2016 where monkfish was caught

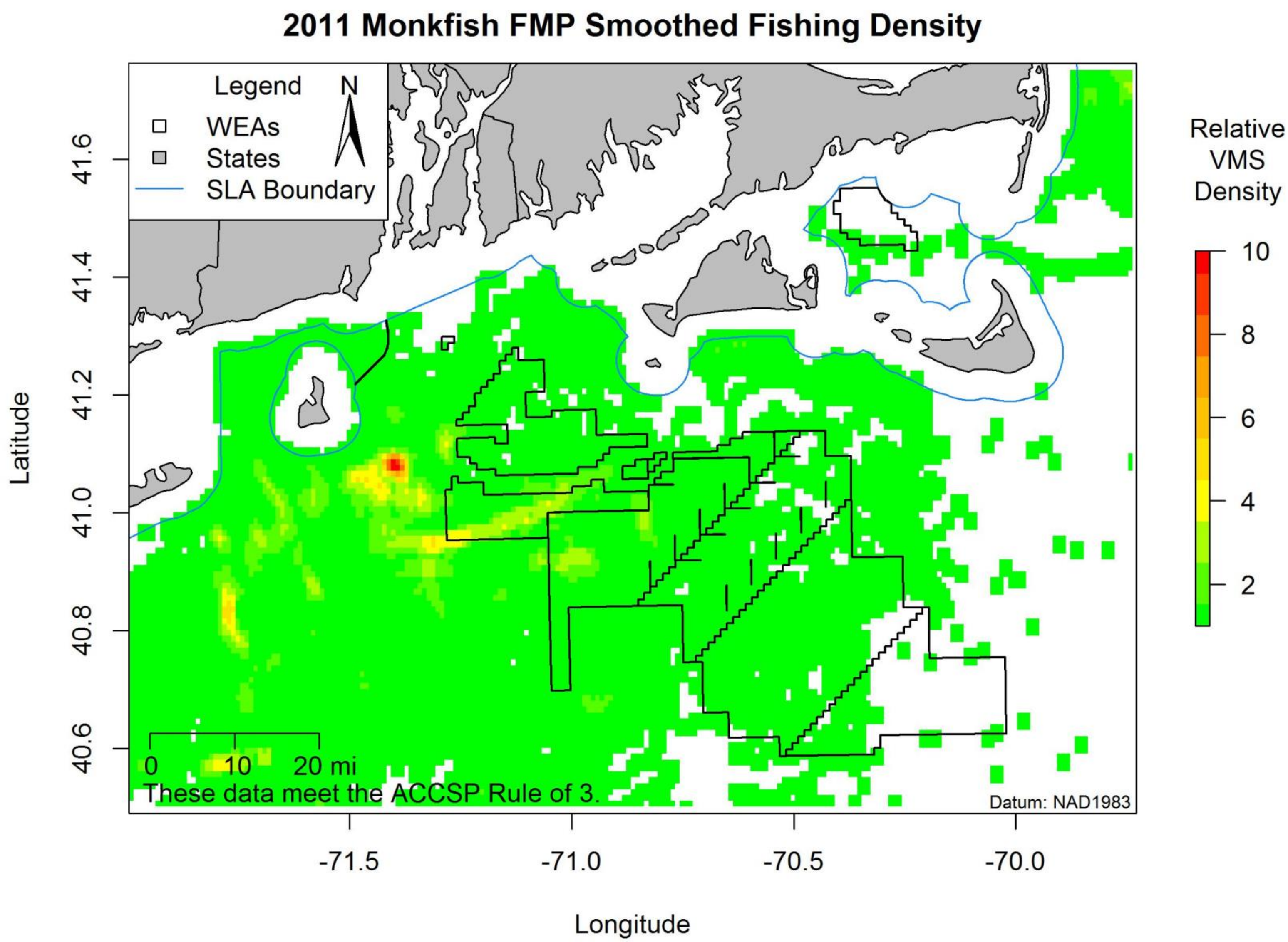

Figure 163. Smoothed federal fishing activity south of Rhode Island and Massachusetts of all trips in 2011 where monkfish was caught

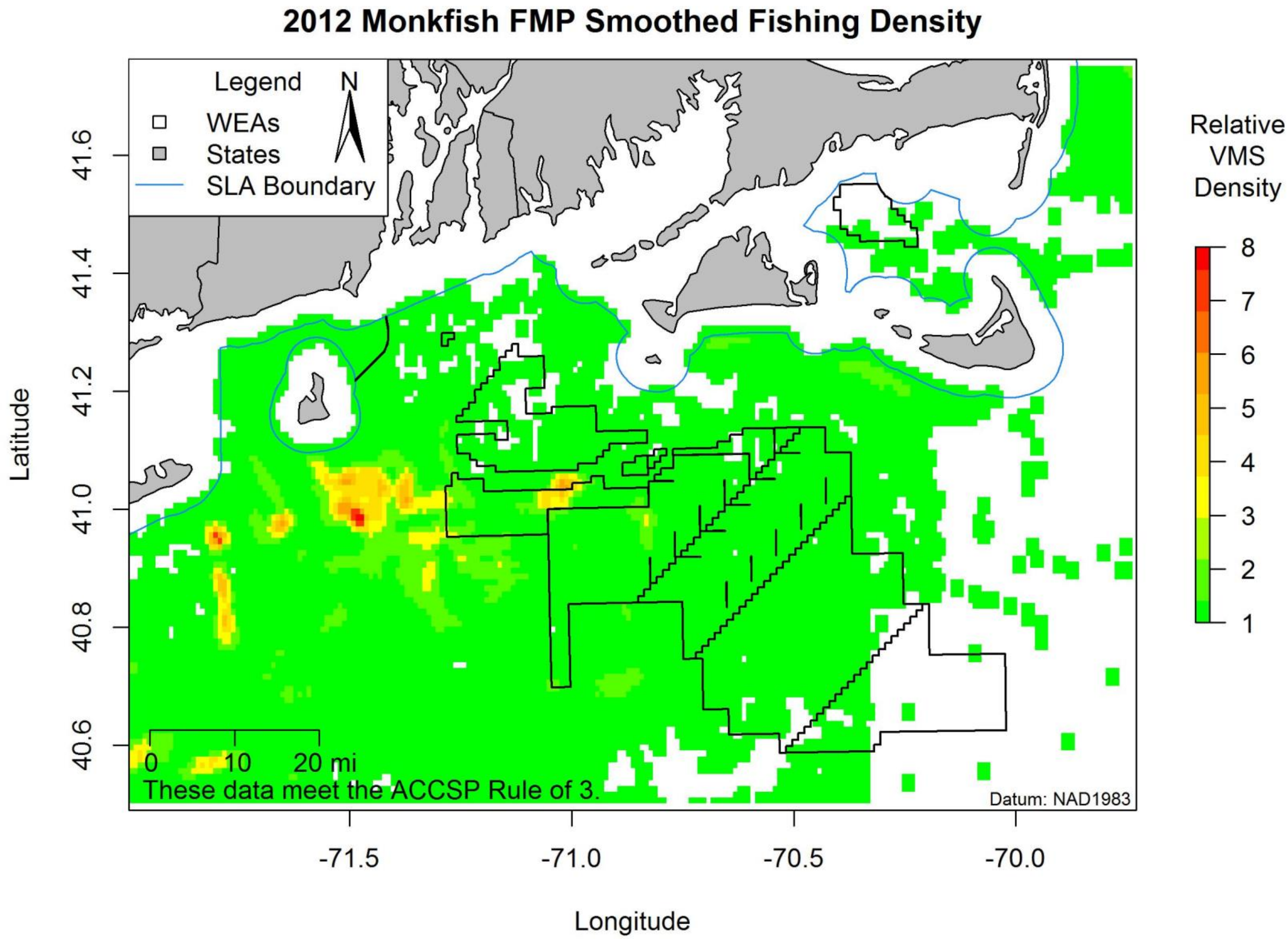

Figure 164. Smoothed federal fishing activity south of Rhode Island and Massachusetts of all trips in 2012 where monkfish was caught

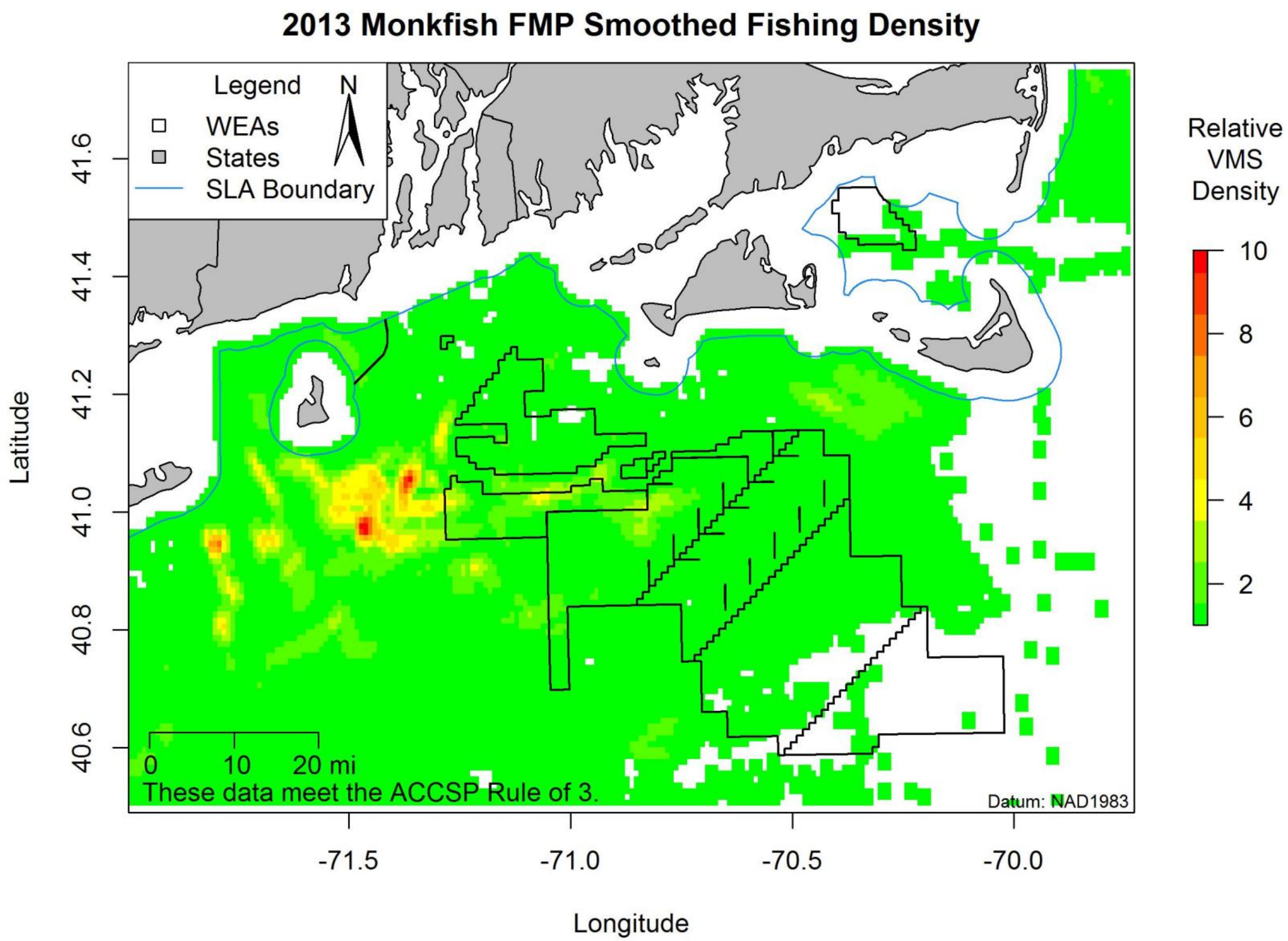

Figure 165. Smoothed federal fishing activity south of Rhode Island and Massachusetts of all trips in 2013 where monkfish was caught

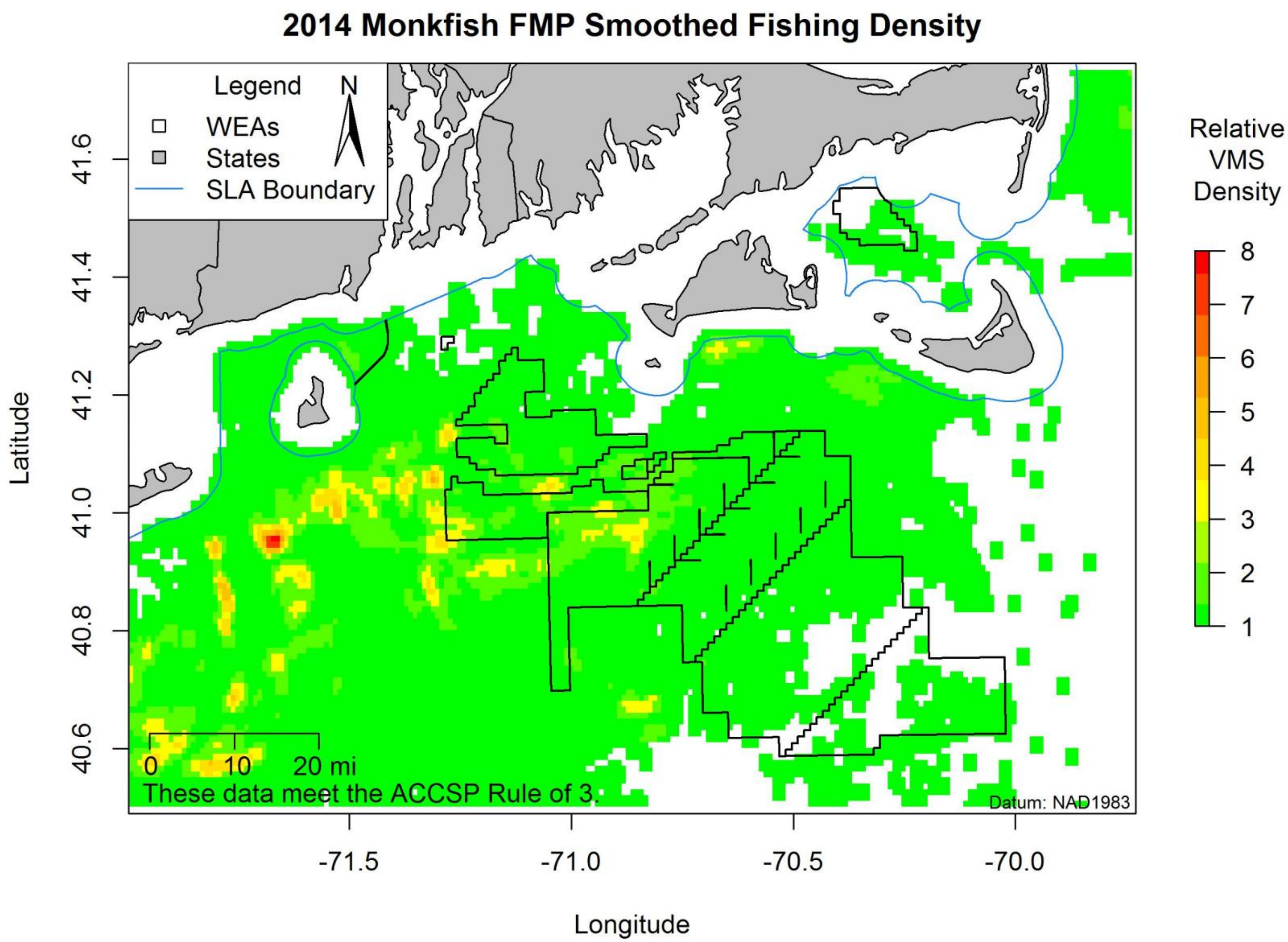

Figure 166. Smoothed federal fishing activity south of Rhode Island and Massachusetts of all trips in 2014 where monkfish was caught

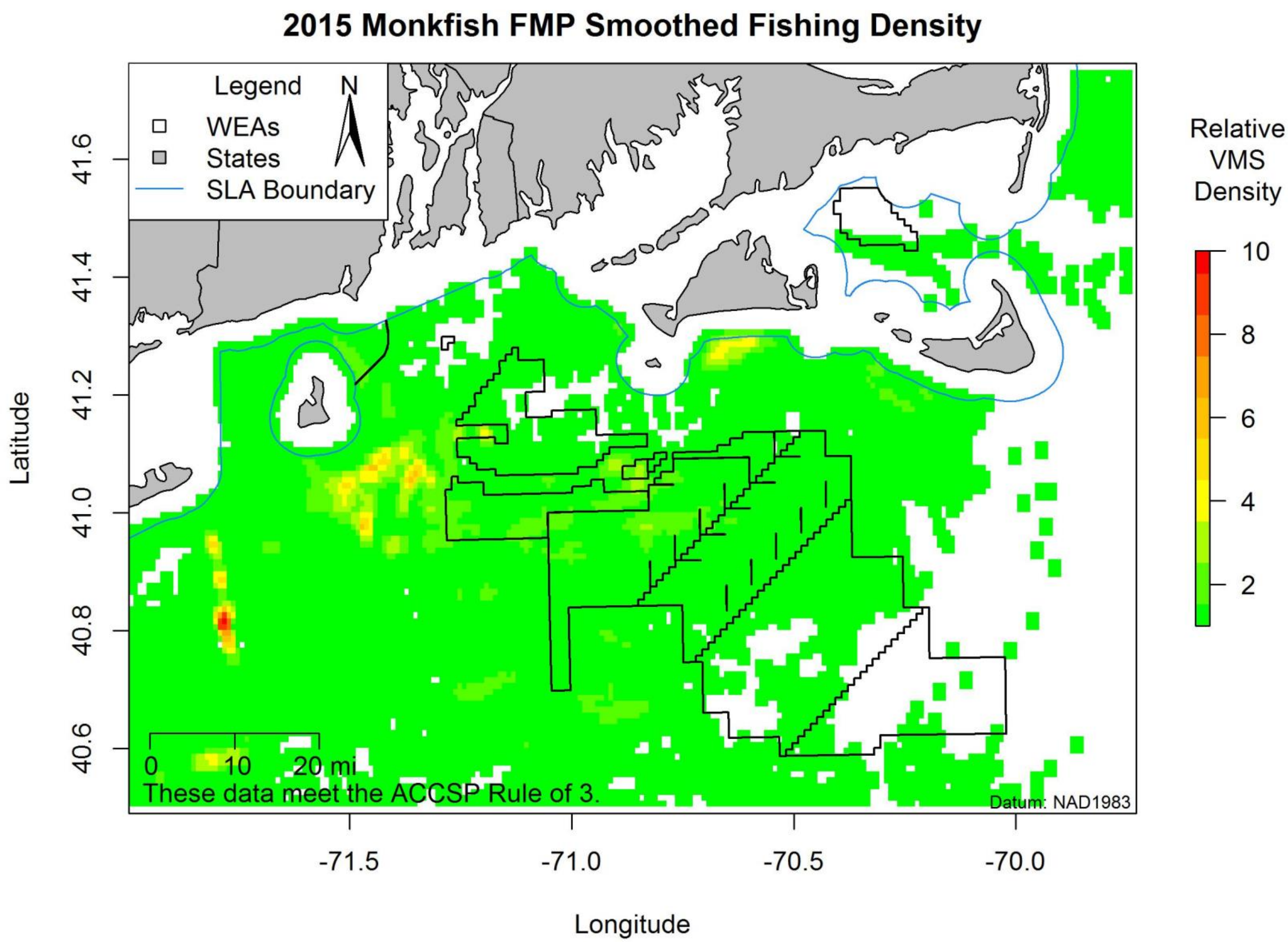

Figure 167. Smoothed federal fishing activity south of Rhode Island and Massachusetts of all trips in 2015 where monkfish was caught

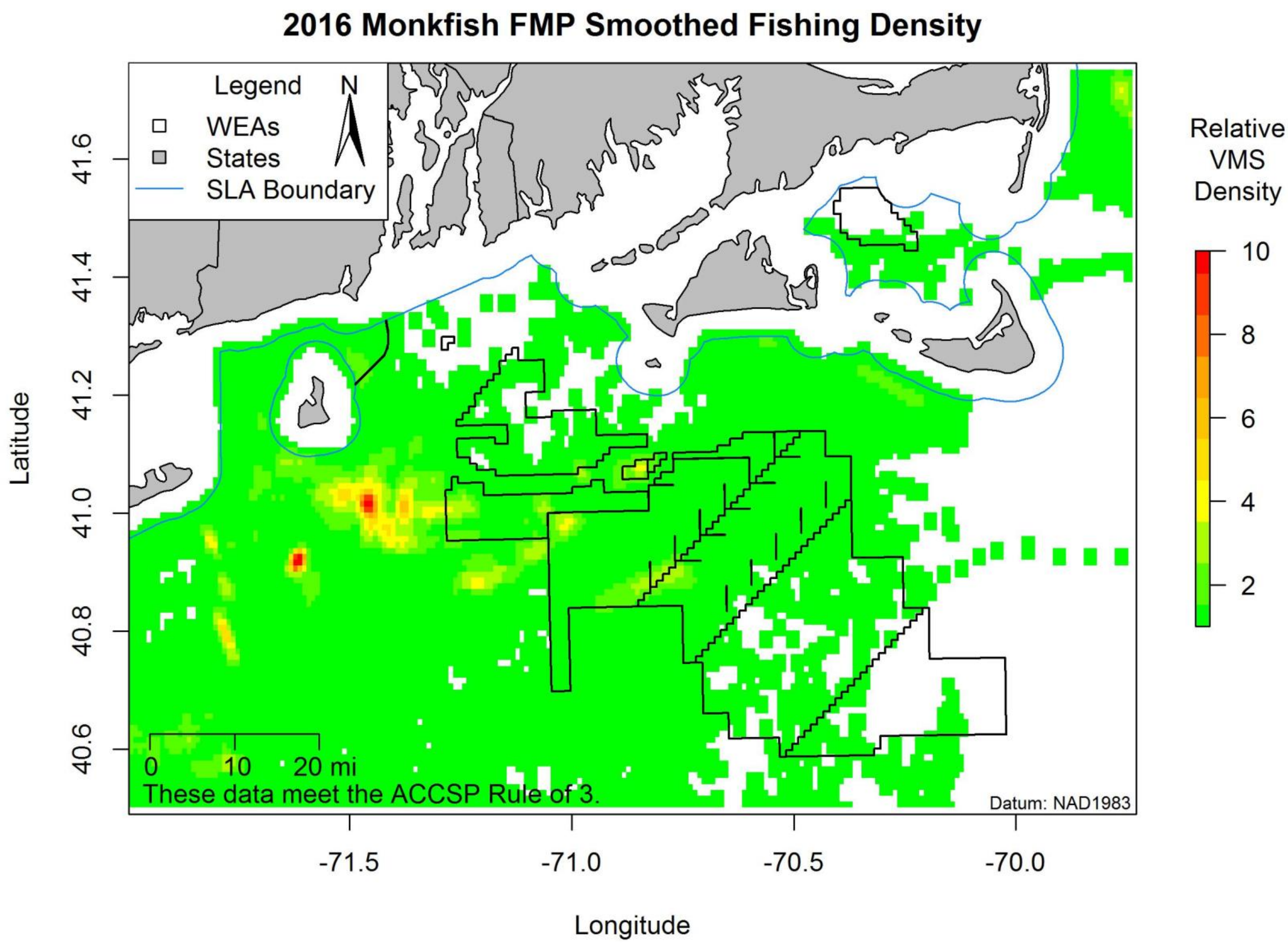

Figure 168. Smoothed federal fishing activity south of Rhode Island and Massachusetts of all trips in 2016 where monkfish was caught

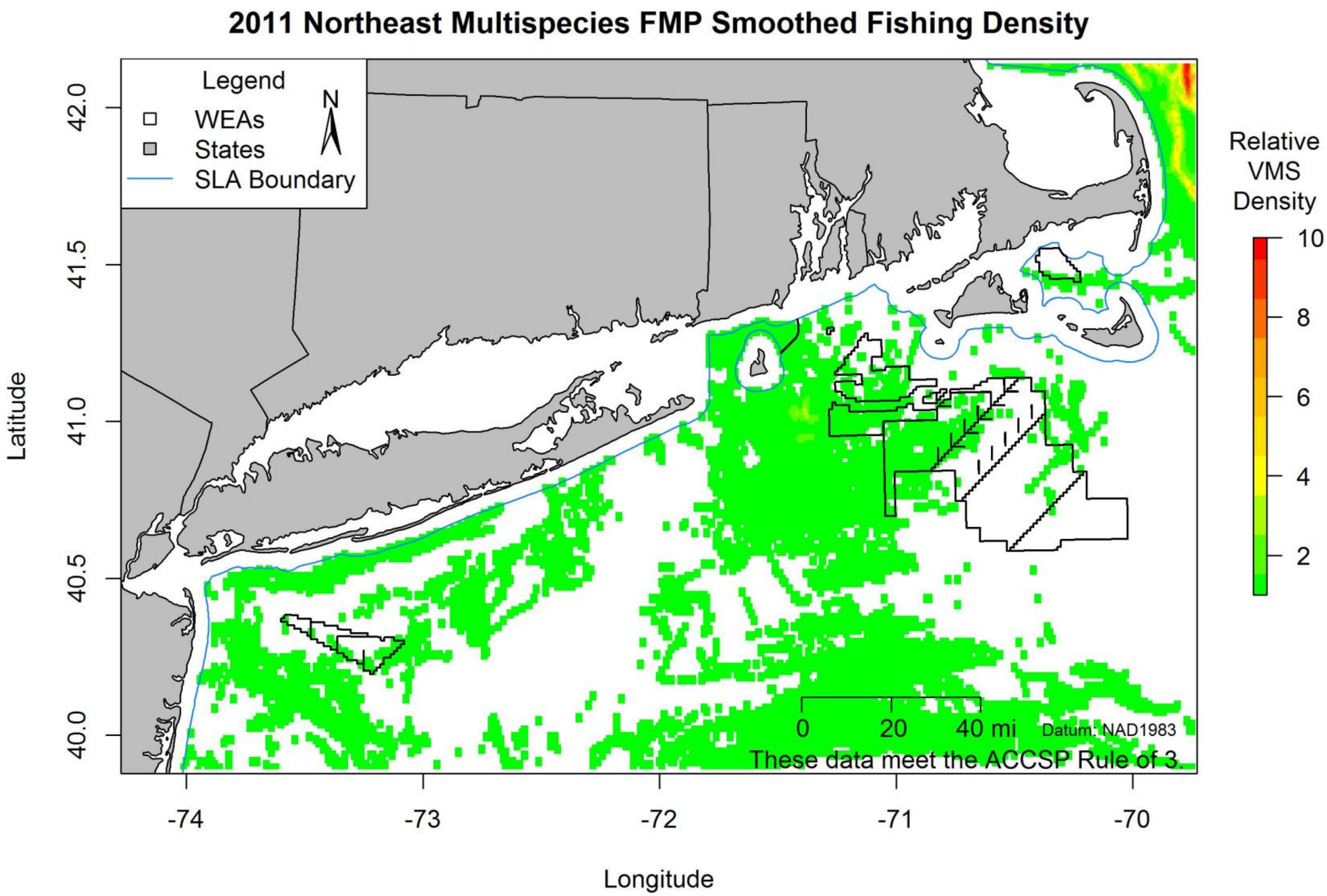

Figure 169. Smoothed federal fishing activity of all trips in 2011 where Northeast Multispecies FMP species (American plaice, Atlantic cod, Atlantic halibut, Atlantic pollock, Atlantic wolfish - prohibited, haddock, ocean pout - prohibited, redfish, white hake, windowpane flounder - prohibited, winter flounder, witch flounder, yellowtail flounder) were caught

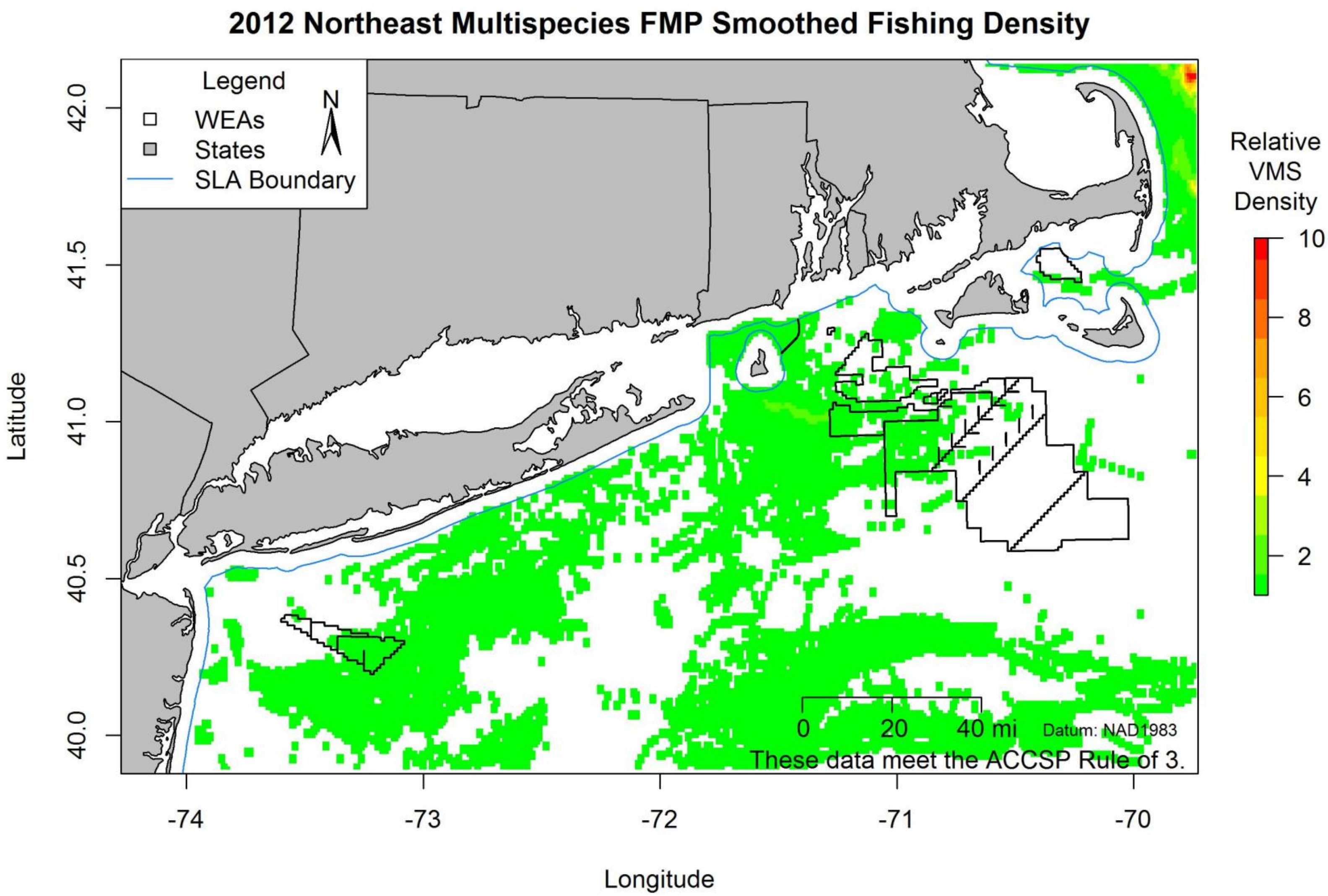

Figure 170. Smoothed federal fishing activity of all trips in 2012 where Northeast Multispecies FMP species (American plaice, Atlantic cod, Atlantic halibut, Atlantic pollock, Atlantic wolfish - prohibited, haddock, ocean pout - prohibited, redfish, white hake, windowpane flounder - prohibited, winter flounder, witch flounder, yellowtail flounder) were caught

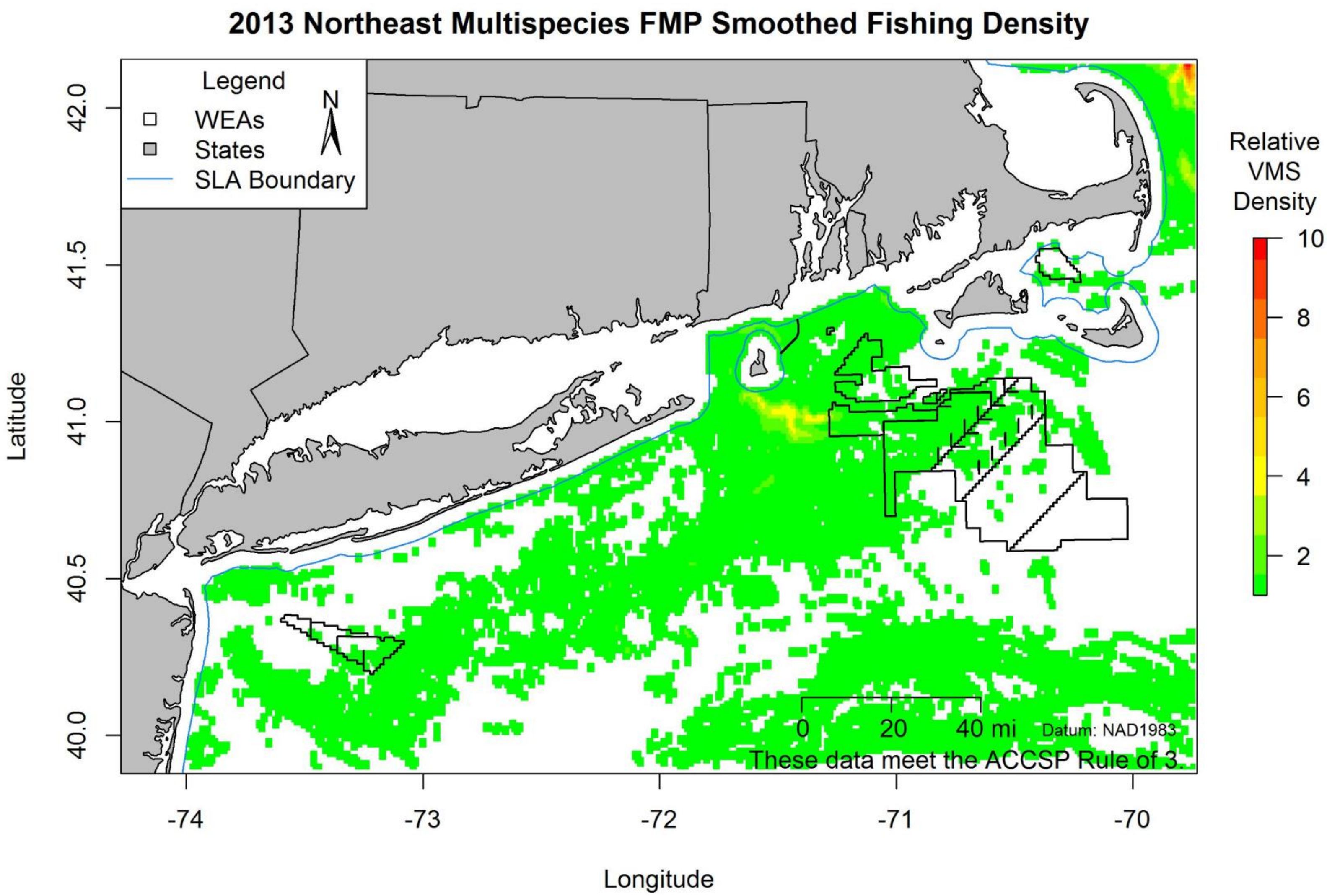

Figure 171. Smoothed federal fishing activity of all trips in 2013 where Northeast Multispecies FMP species (American plaice, Atlantic cod, Atlantic halibut, Atlantic pollock, Atlantic wolfish - prohibited, haddock, ocean pout - prohibited, redfish, white hake, windowpane flounder - prohibited, winter flounder, witch flounder, yellowtail flounder) were caught

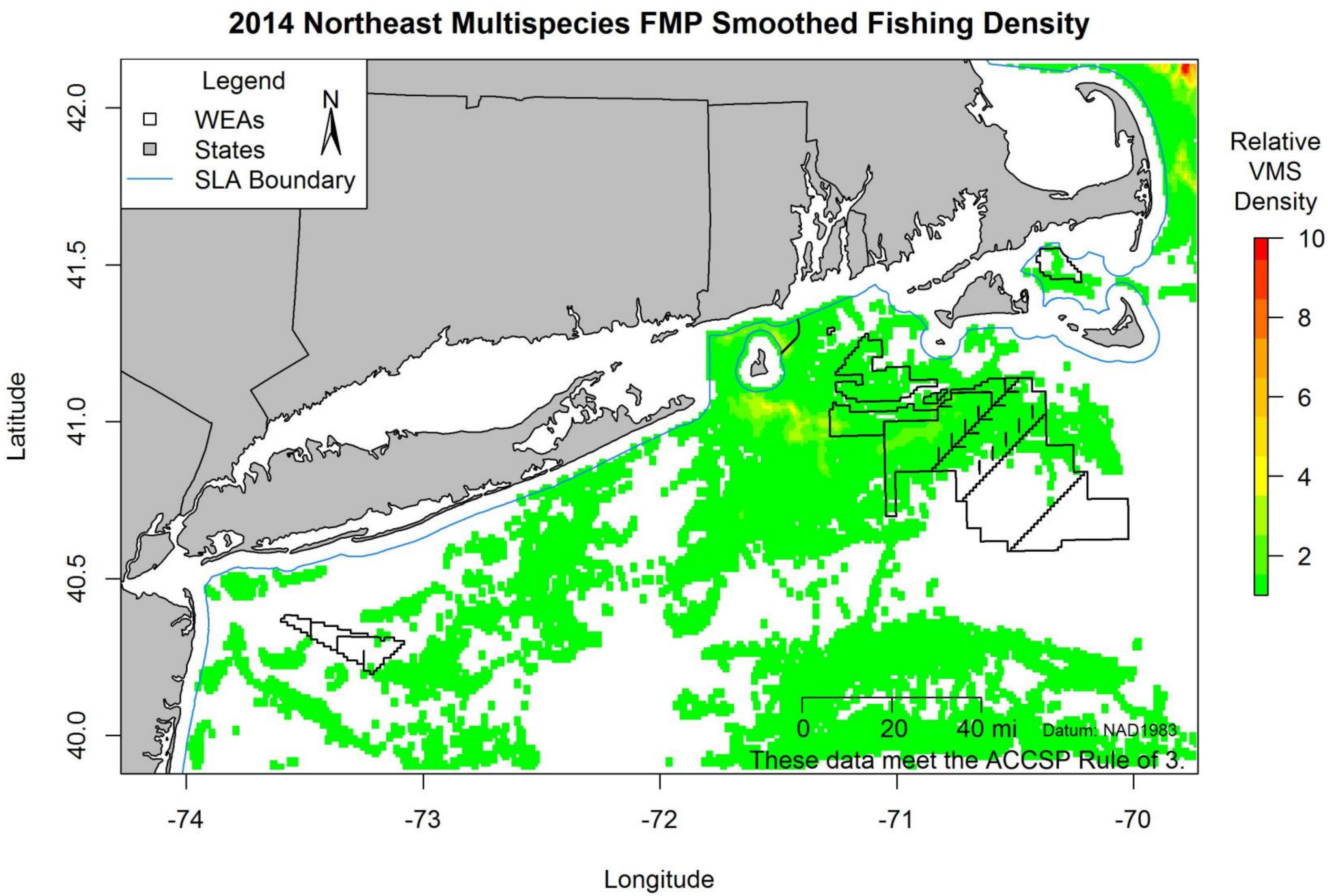

Figure 172. Smoothed federal fishing activity of all trips in 2014 where Northeast Multispecies FMP species (American plaice, Atlantic cod, Atlantic halibut, Atlantic pollock, Atlantic wolfish - prohibited, haddock, ocean pout - prohibited, redfish, white hake, windowpane flounder - prohibited, winter flounder, witch flounder, yellowtail flounder) were caught

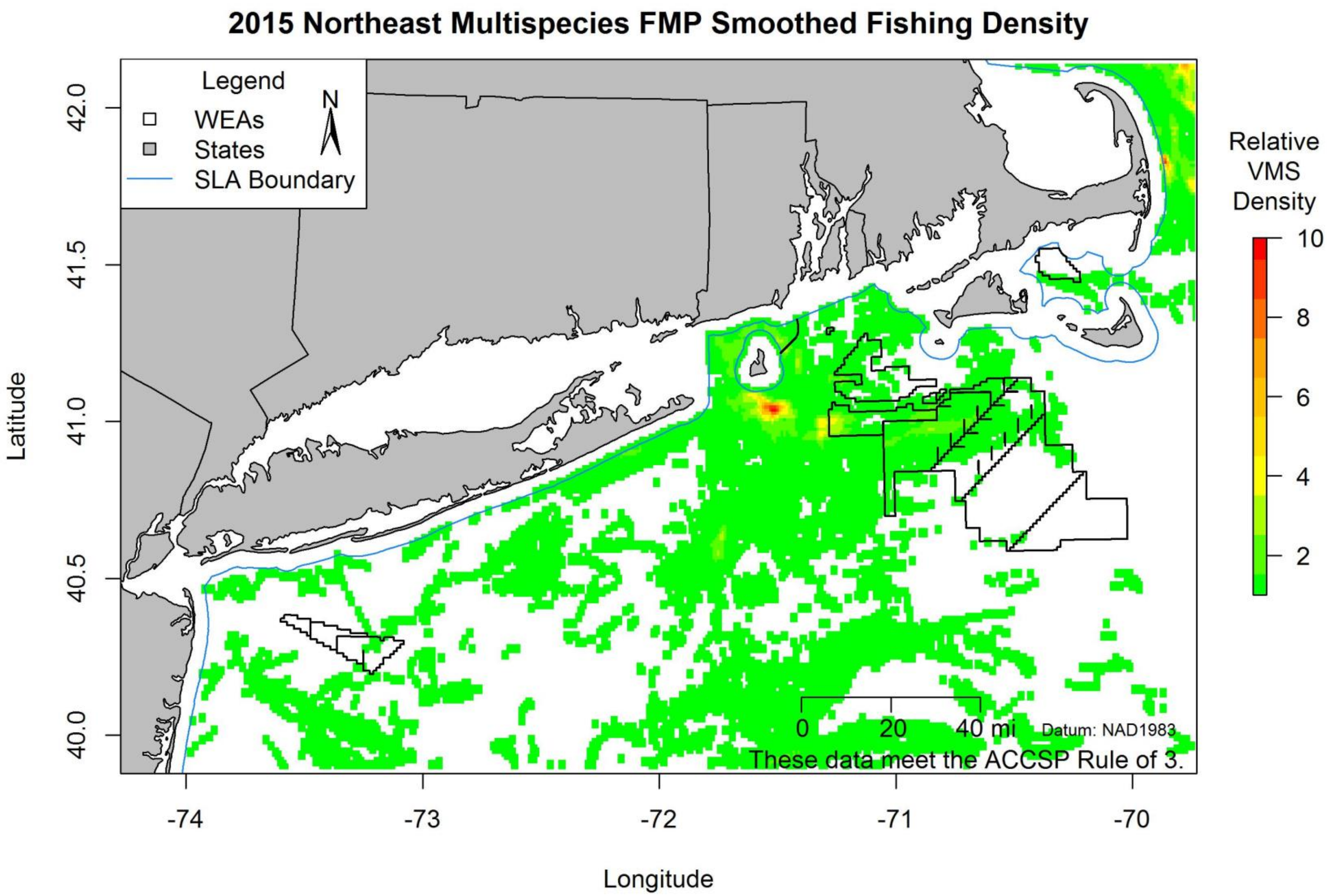

Figure 173. Smoothed federal fishing activity of all trips in 2015 where Northeast Multispecies FMP species (American plaice, Atlantic cod, Atlantic halibut, Atlantic pollock, Atlantic wolfish - prohibited, haddock, ocean pout - prohibited, redfish, white hake, windowpane flounder - prohibited, winter flounder, witch flounder, yellowtail flounder) were caught

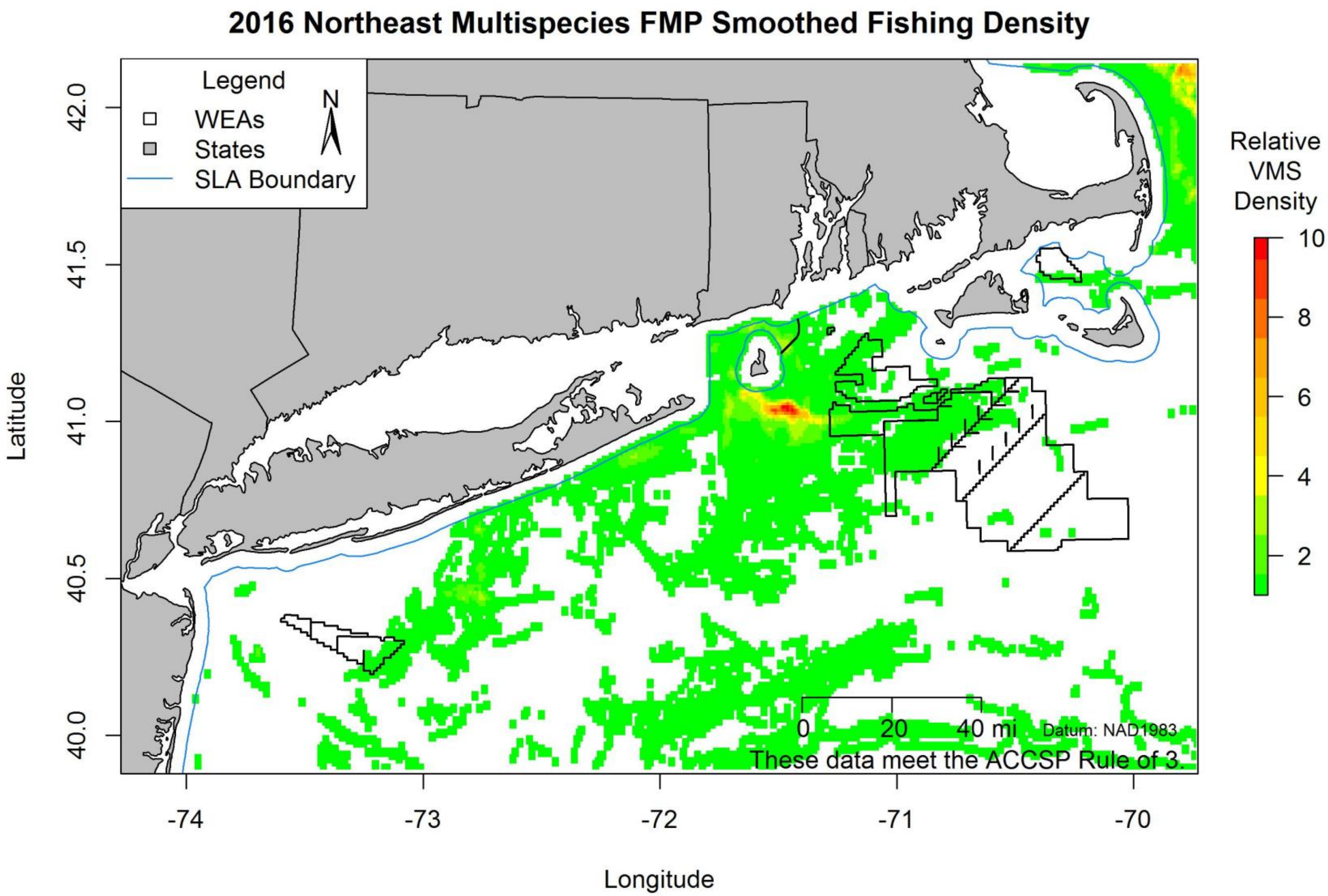

Figure 174. Smoothed federal fishing activity of all trips in 2016 where Northeast Multispecies FMP species (American plaice, Atlantic cod, Atlantic halibut, Atlantic pollock, Atlantic wolfish - prohibited, haddock, ocean pout - prohibited, redfish, white hake, windowpane flounder - prohibited, winter flounder, witch flounder, yellowtail flounder) were caught

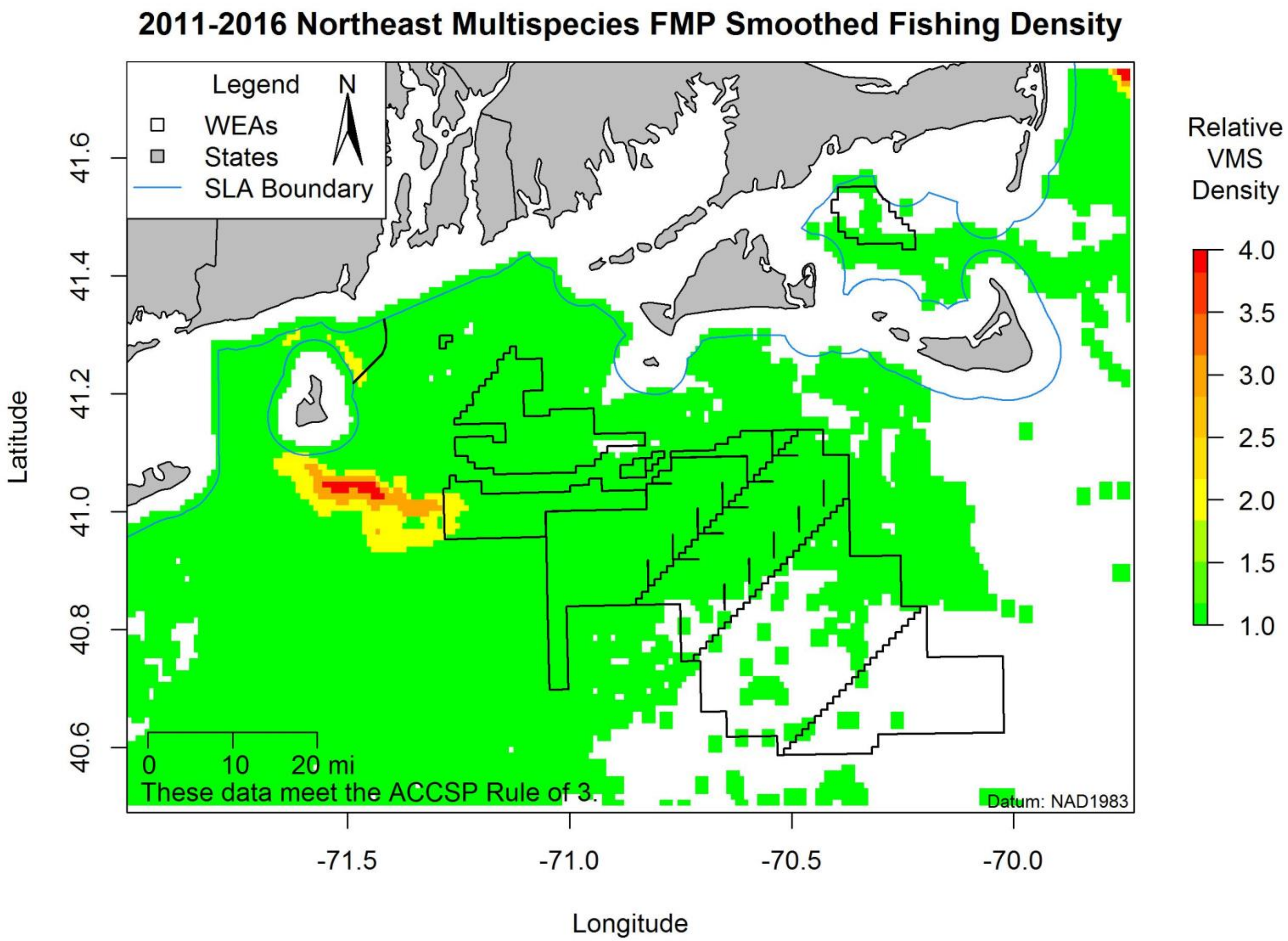

Figure 175. Smoothed federal fishing activity south of Rhode Island and Massachusetts of all trips between 2011 and 2016 where Northeast Multispecies FMP species (American plaice, Atlantic cod, Atlantic halibut, Atlantic pollock, Atlantic wolfish - prohibited, haddock, ocean pout - prohibited, redfish, white hake, windowpane flounder - prohibited, winter flounder, witch flounder, yellowtail flounder) were caught

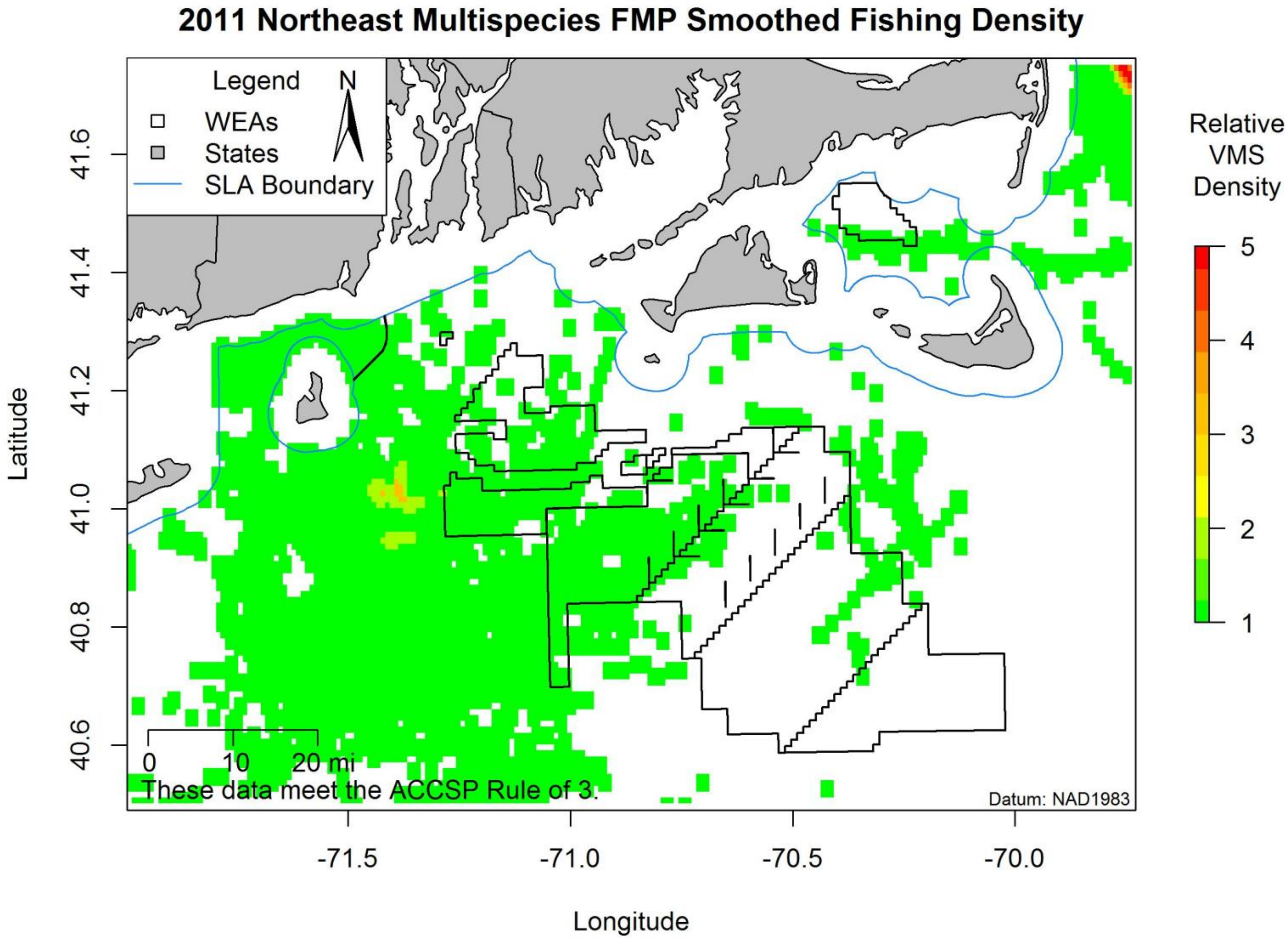

Figure 176. Smoothed federal fishing activity south of Rhode Island and Massachusetts of all trips in 2011 where Northeast Multispecies FMP species (American plaice, Atlantic cod, Atlantic halibut, Atlantic pollock, Atlantic wolfish - prohibited, haddock, ocean pout - prohibited, redfish, white hake, windowpane flounder - prohibited, winter flounder, witch flounder, yellowtail flounder) were caught

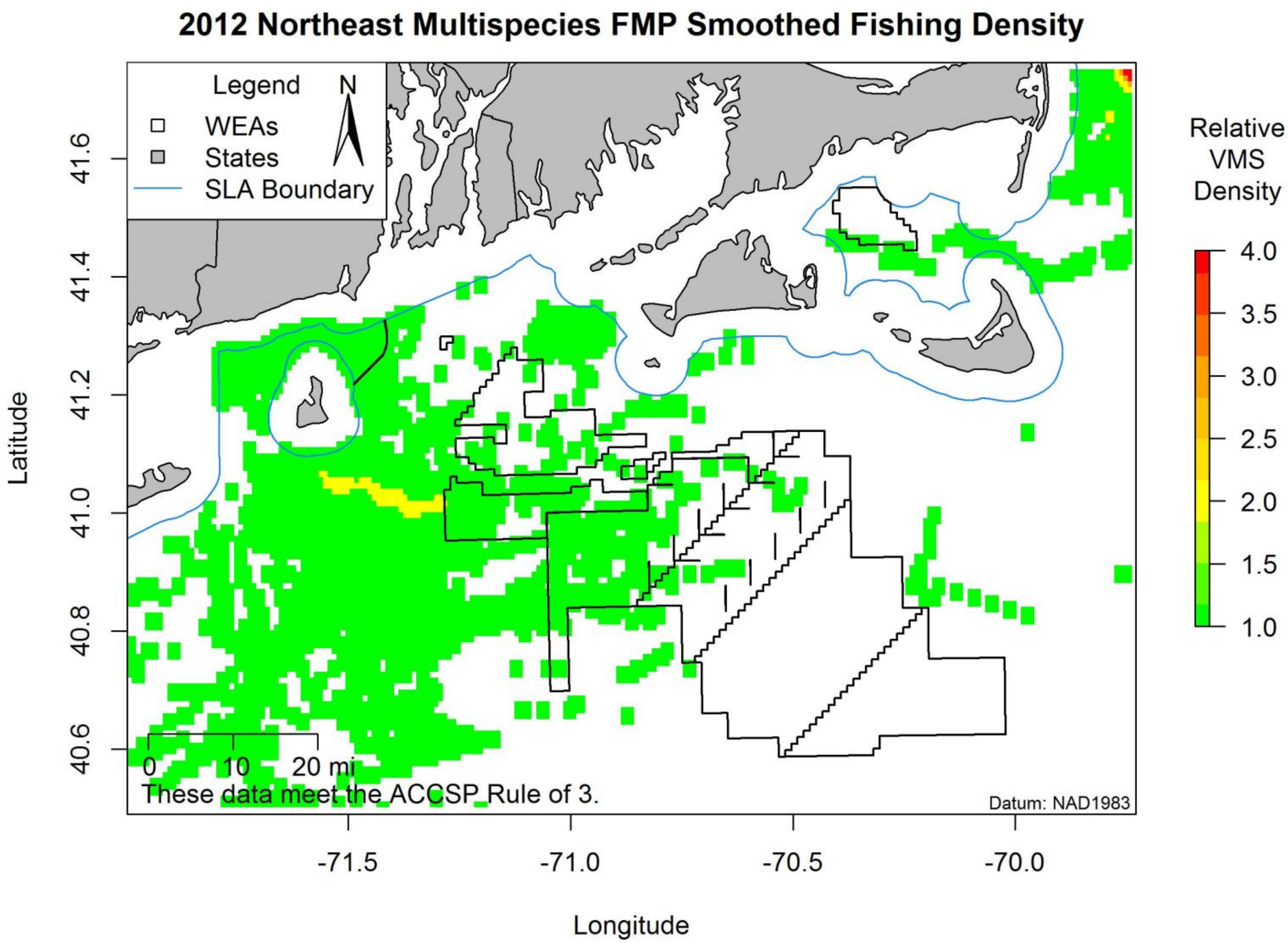

Figure 177. Smoothed federal fishing activity south of Rhode Island and Massachusetts of all trips in 2012 where Northeast Multispecies FMP species (American plaice, Atlantic cod, Atlantic halibut, Atlantic pollock, Atlantic wolffish - prohibited, haddock, ocean pout - prohibited, redfish, white hake, windowpane flounder - prohibited, winter flounder, witch flounder, yellowtail flounder) were caught

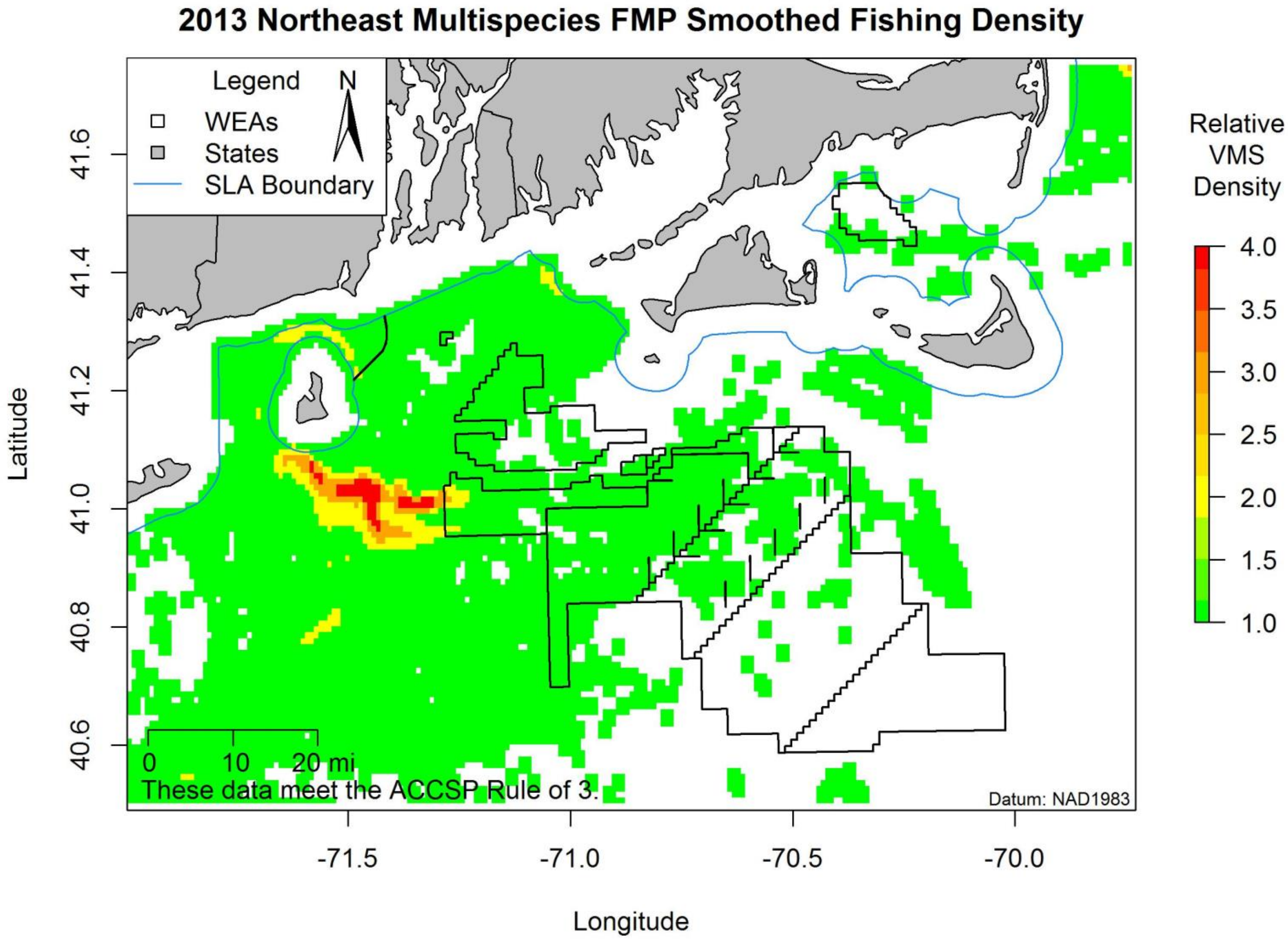

Figure 178. Smoothed federal fishing activity south of Rhode Island and Massachusetts of all trips in 2013 where Northeast Multispecies FMP species (American plaice, Atlantic cod, Atlantic halibut, Atlantic pollock, Atlantic wolfish - prohibited, haddock, ocean pout - prohibited, redfish, white hake, windowpane flounder - prohibited, winter flounder, witch flounder, yellowtail flounder) were caught

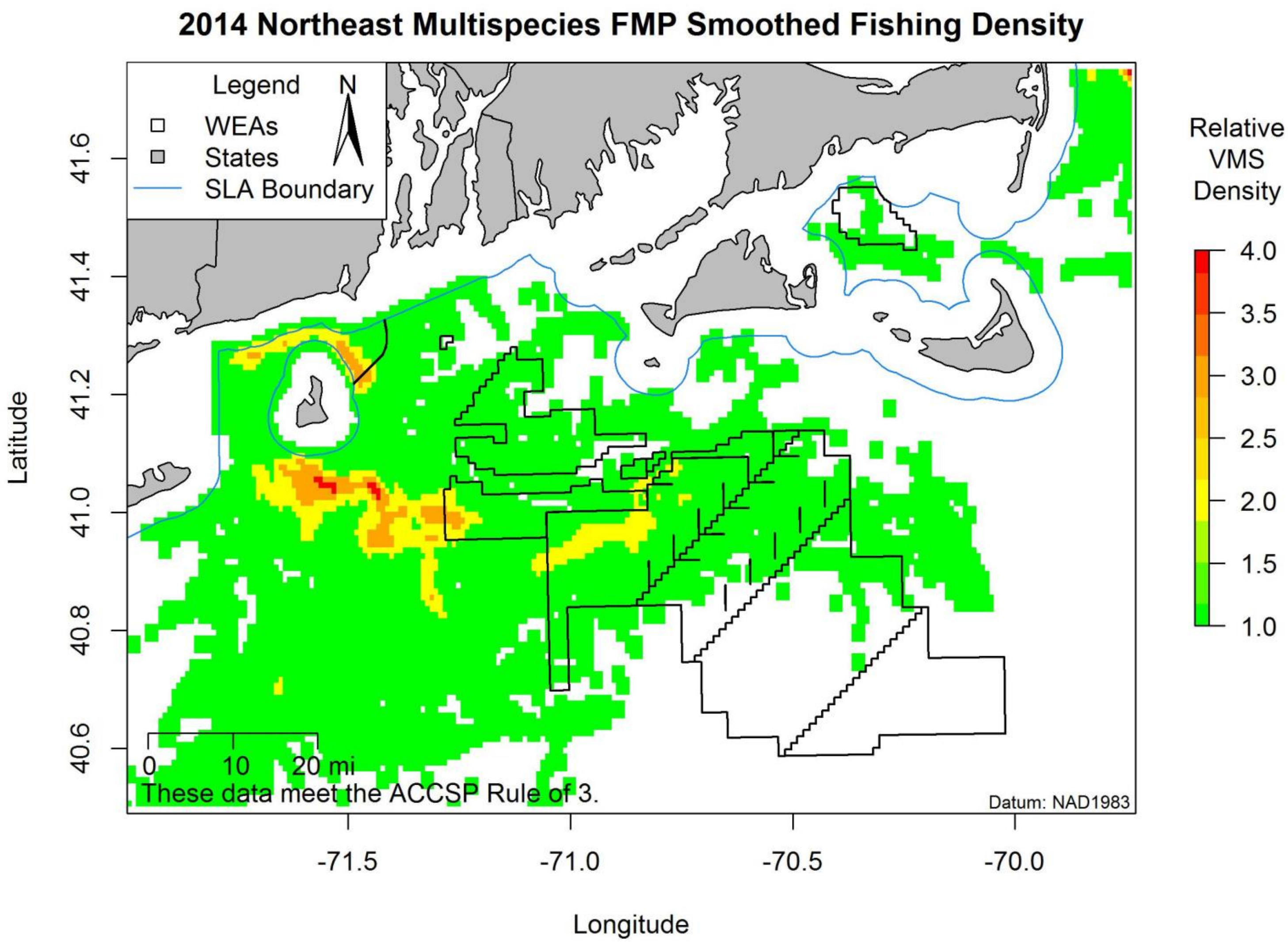

Figure 179. Smoothed federal fishing activity south of Rhode Island and Massachusetts of all trips in 2014 where Northeast Multispecies FMP species (American plaice, Atlantic cod, Atlantic halibut, Atlantic pollock, Atlantic wolfish - prohibited, haddock, ocean pout - prohibited, redfish, white hake, windowpane flounder - prohibited, winter flounder, witch flounder, yellowtail flounder) were caught

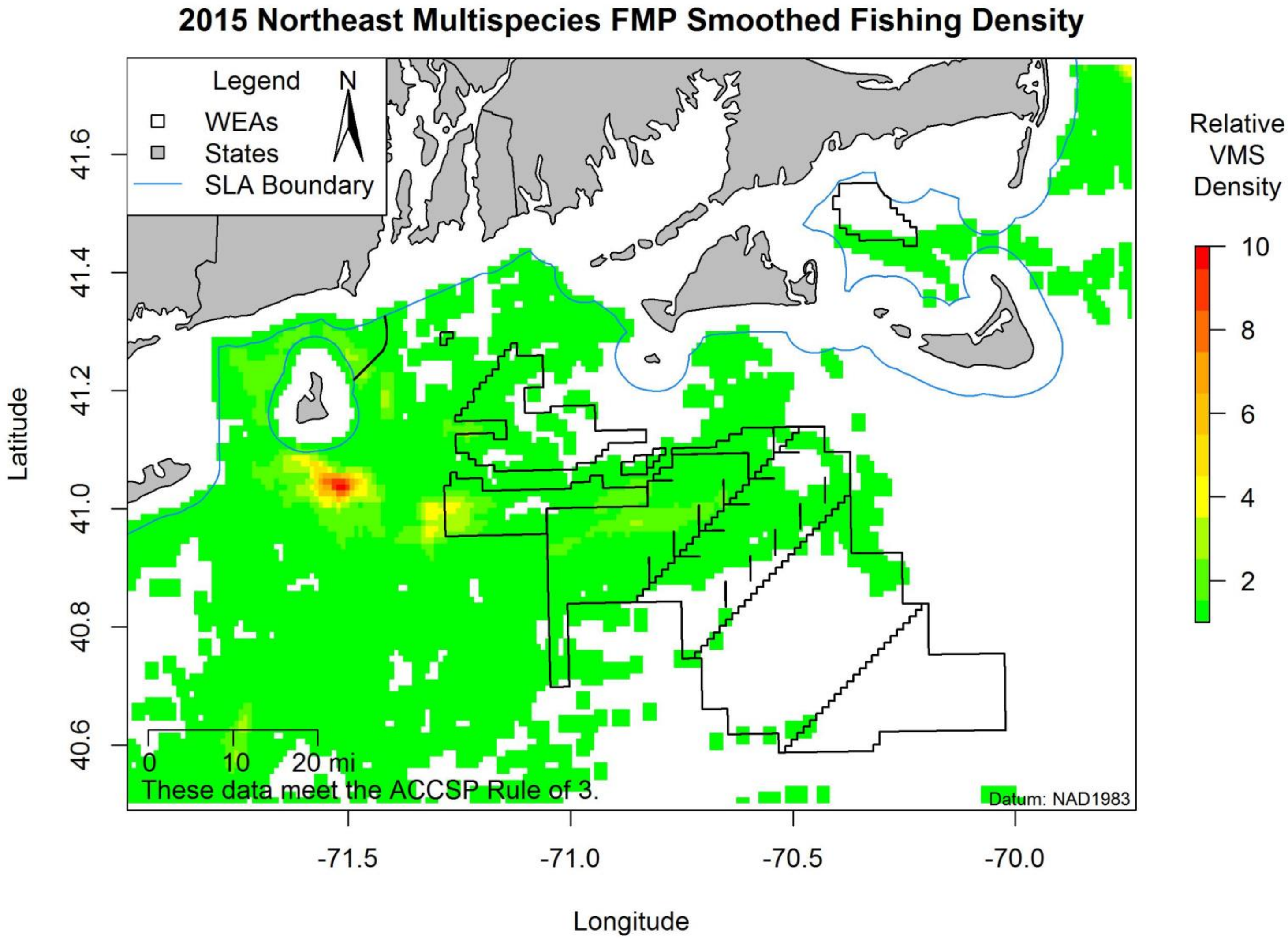

Figure 180. Smoothed federal fishing activity south of Rhode Island and Massachusetts of all trips in 2015 where Northeast Multispecies FMP species (American plaice, Atlantic cod, Atlantic halibut, Atlantic pollock, Atlantic wolfish - prohibited, haddock, ocean pout - prohibited, redfish, white hake, windowpane flounder - prohibited, winter flounder, witch flounder, yellowtail flounder) were caught

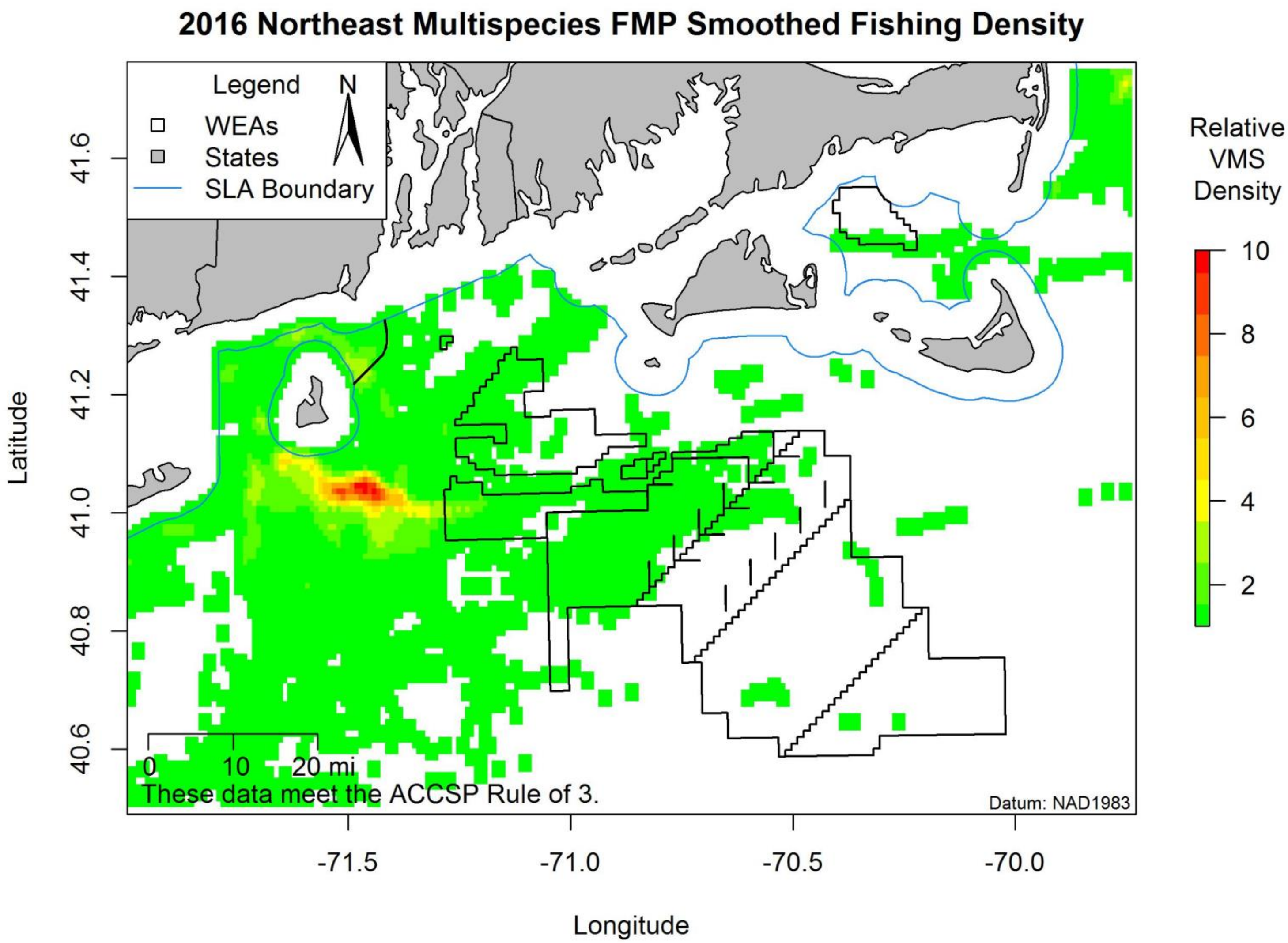

Figure 181. Smoothed federal fishing activity south of Rhode Island and Massachusetts of all trips in 2016 where Northeast Multispecies FMP species (American plaice, Atlantic cod, Atlantic halibut, Atlantic pollock, Atlantic wolfish - prohibited, haddock, ocean pout - prohibited, redfish, white hake, windowpane flounder - prohibited, winter flounder, witch flounder, yellowtail flounder) were caught

11 Appendix II: Detailed Methods, R Code and Supporting Files

11.1 Detailed Methods

11.1.1 Data Formatting

After data were obtained from their respective sources (described in Section 7), the following steps were taken to format the files prior to analysis.

11.1.1.1 Vessel Monitoring System Data

NOAA's OLE provided 75 html files of VMS data: one file per month. Each file containing approximately 500,000 rows of data, where each row corresponded to a single VMS location recorded. The files were formatted so that they could be opened using Microsoft Excel. To simplify later analyses, each file was opened in Excel and saved as a comma separated values text file (.csv). This file format reads into R more efficiently.

11.1.1.2 Vessel Trip Reports

All states' VTR data were downloaded as .csv files, opened in Microsoft Excel, and saved as text (.txt) files. Prior to saving each file in .txt format from Excel, the Supplier Trip ID column and the serial number columns required data reformatting. Both columns contained some numbers with 14 or more digits, which Excel had stored in scientific notation. These numbers are unique identifiers and therefore must be displayed in their entirety. Both columns were formatted as numeric digits with no decimal points prior to saving. This ensured that the data read into R from the text files correctly.

It is important to note that there was an issue with the Supplier Trip ID and serial number columns in the VTRs. Each paper VTR is assigned a report number, as are the eVTRs. Paper VTR numbers are 8 digits in length, while eVTR numbers are 14 digits long. The correct VTR numbers for paper reports were stored in the serial number column, while the correct eVTR numbers were stored in the Supplier Trip ID column. This was clear because the other entries in the Supplier Trip ID column had 7 digits (meaning it cannot be a VTR number) and other entries in the serial number column had greater than or less than 14 digits (meaning it cannot be an eVTR number).

To confirm that this was the case, Nichole Ares (RI DEM Principal Marine Biologist) checked a random assortment of both the eVTR and VTR numbers from both columns in NOAA's VTR database; this database contains the same VTR information as SAFIS. She found that the 14 digit and 8 digit numbers from the two columns all had correct information in the corresponding NOAA columns, while the other numbers (not 8 or 14 digits in length) did not match to any trip reports. Therefore, the two columns needed to be merged into a single column containing the actual VTR/eVTR numbers. This was taken care of during later analysis steps.

11.1.1.3 Landings

All states' landings entries were downloaded as .csv files, opened in Microsoft Excel, and saved as text (.txt) files. Prior to saving each file in .txt format from Excel, the Supplier Trip ID column required data reformatting. This is one of the same columns that existed in the VTR data, and contained the same type of information. The column included some numbers with 14 or more digits, which Excel had put in scientific notation. These numbers are unique identifiers and therefore must be displayed in their entirety. The column was formatted as numeric digits with no decimal points prior to saving. This ensured that the data read into R from the text files correctly.

11.1.2 Connecting All Three Datasets

11.1.2.1 Merging VTRs with Landings

Prior to combining the VTRs with the landings data, each individual dataset had to be merged into a single file. A single VTR file for all years between 2011 and 2016 existed for each state; the same was true of the landings files. Refer to Appendix items 11.2.1 and 11.2.2 for code to merge each of the individual files into single VTR and landings files. Each script loops through all files and binds them into one longer file, drops all unnecessary columns of data, and formats the date columns as dates in R.

When merging the VTR and landings datasets into a single dataset, the merge must include the VTR number and the species to ensure that each species recorded on a VTR matches up with its corresponding landings from that trip; landings are organized by species landed where each row corresponds to a single species (and sometimes a body part or grade of that species) sold to a dealer.

Unfortunately, ACCSP stores species information differently from NOAA. Since the landings data were pulled from the ACCSP Data Warehouse and the VTRs were pulled from SAFIS (whose data is actually copied from NOAA's VTR database), the species lists in the two datasets will not match up. For example, the species American Plaice is recorded as "FLOUNDER, AMERICAN PLAICE /DAB" in the VTRs and as "PLAICE, AMERICAN" in the landings.

Additionally, many species can be sold in different grades or by different levels of processing or body parts. For example, monkfish (also called goosefish or anglerfish) can be sold intact or their heads, tails, and livers can be sold separately. Since these analyses are focused on landings value specifically, body parts and grades are not important and can be grouped by species. If the focus were on pounds landed, it would not be possible to combine the data in this way.

To allow the merge to work properly, the addNewData function created by Daniel Falster (https://gist.github.com/dfalster/5589956) was used to convert all species entries into the format used in the landings. This function requires the user to create a lookup table that dictates what items to replace and what to replace them with. After determining all possible species naming conventions (including different grades or body parts) in each of the two datasets using the unique function in R's base package, a lookup table (Appendix II Table 29) was created in Microsoft Excel where the "newValue" corresponded to the species format used in the landings. The Excel file was saved as a .csv before running the merging code, which pulls the file into R before running the addNewData function.

There was also an issue with the VTR serial numbers, which was first addressed in Section 11.1.1.2. Refer to Section 11.1.1.2 for more details on this problem. The merge includes the VTR serial number as one of its parameters on which to merge the two datasets. It was necessary to create a new column of true VTR numbers that pulled the correct numbers from each of the two other columns. To accomplish this, a new column was created and then populated using a pair of ifelse statements. First, each cell was filled with a 14 digit eVTR number from the Supplier Trip ID column, only if the number in the Supplier Trip ID column actually had 14 characters, otherwise it was filled with an "NA". The next ifelse statement then filled any cells in the new column containing an "NA" with the value from the serial number column IF the value in the serial number column had 8 characters. After this step, there were still some rows with incorrect VTR numbers in the final column. These incorrect numbers were mostly state report numbers that will not match to any federal fishing (i.e. they do not have an actual VTR number, instead they have state logbook numbers recorded in the serial number column). To isolate and remove these entries, all special characters and letters were removed from the entries in the new VTR column using the gsub function in the R base package. Many of the state logbook entries have letters and/or dashes; removing these characters reduced the number of characters. Finally, another ifelse statement was used to convert all entries in the final VTR row with a number of characters not equal to 8 or 14 back to an "NA" value.

At this point, the two datasets were ready to be merged into a single dataset. An inner join (using the merge function in the R base package) was used to combine the two by matching on the corrected VTR numbers and species names.

Refer to Appendix II 11.2.3 and Table 29 for the code and lookup table to carry out these operations.

11.1.2.2 Merging the VMS Data to the Combined VTR and Landings

The next step prior to actual analysis was to merge the combined VTR/landings dataset created in the previous step to the VMS fishing location data. At this point, all 75 VMS data files (.csv files) had been saved into a folder. Each of the files contained approximately 500,000 rows of data. The combined VTR/landings file had over 1 million rows of data. Due to the size of each VMS file, the 75 VMS files could not be combined into a single file for merging. For this reason, the merging script loops through a list of all vessels (from the merged VTR/landings) and pulls all matching VMS entries from each of the 75 VMS files by matching up the federal vessel permit number. The script merges the matching vessel data to the data in the previously merged landings/VTR data. These data are all compiled into a single data frame for each vessel.

The merging between the landings/VTR and the VMS data was done using the federal vessel permit number (in the VMS and the VTR) instead of using the vessel name. This was done because vessel names can change and there may be multiple vessels with the same name. Using the federal permit number ensured a correct merge.

It is important to note that there are two objectives of this analysis. The first is to establish the value of fishing activity that occurs within each of the wind energy areas. The second is to map the density of fishing activity in the entire area. These goals dictate the format of the product created during this step. When merging the location data to the VTR/landings, the desired resulting merge produces a file with at least one row of data per fishing location recorded for each species landed on that corresponding trip; if the fisherman sold a species to more than one dealer after that trip, there will be double the rows for that species. There is a one to many relationship for each landed species value and all the locations recorded for that trip. This issue is addressed in later steps.

It is necessary to include all actual fishing points and since a vessel could sit stationary, the timestamp is required to ensure that all fishing time/coordinates are included. Subsetting was needed because the merge to the landings/VTR created a row for every location/time combination for every single species landed on that trip. Subsetting temporally eliminates the duplicated information by removing any point where the date and time from the VMS do not fall between the start and end dates and times from the VTR. All points with speeds over five knots were also removed from the analysis because speeds over this threshold are likely transiting and not fishing. A five-knot cutoff was used for this step, though further steps include a more detailed speed subsetting because most fishing occurs at four knots or less, with the exception of the scallop dredge fishery, which can fish at speeds up to five knots. These speed thresholds were taken from the VMS analysis conducted for the Northeast Regional Ocean Council (NROC) posted on the Northeast Regional Ocean Data Portal.

Refer to Appendix item 11.2.4 for the code to carry out these operations.

Please note that this step took over 25 days to run on a computer with 4 cores, 16 gigabytes of random-access memory (RAM), and a 64-bit operating system. The 32-bit version of R software is limited to only 2 gigabytes of RAM, whether the computer has more memory available or not. Therefore, the script will not work on a computer with a 32-bit operating system, as the 64-bit version of R is necessary to run this code. The code could have been written in a more efficient form, but more efficient versions required more RAM than the available computer had. Hence, a slower processing code was the only option due to technological limitations.

The final merging code created 832 files containing the combined VMS, VTR, and landings data. There were 1892 vessels in the merged VTR and landings data, meaning that those vessels landed catch in one of the target states: NH, MA, RI, CT, NY, or NJ. The code was written not to save a file for any vessel whose merged VTR/landings data did not match to any of the VMS data since these vessels did not fish in the target area (Figure 2). Therefore, only 832 vessels fished in the target area and landed in one of the six target states. The other 1060 boats fished outside of the target area but did land in a target state. Additional vessels not in the 1892 from the merged VTR/landings did fish in the target area but did not land in one of the target states.

It is important to note that these analyses do not account for all vessels fishing within the area offshore New Jersey to Massachusetts. Landings from NH, MA, RI, CT, NY, and NJ were obtained, but any vessel that fished in the area of interest but did not land in one of these states was not included in the final analysis. There were 428 vessels included in the VMS data that did not match any of the landings in target states. Therefore, some components of certain fisheries are not included; the type of fishing and the value of their landings was unable to be quantified for 428 vessels. To remedy this issue in future analyses, landings, VTR, and VMS data should be collected and analyzed coastwide, even though VMS is less common in the South Atlantic.

11.1.3 Aggregating Spatial Data by Species, Gear Type, Port Landed, and State Landed

The second to last step of the analysis was to produce maps showing fishing density within each of the WEAs. To begin, all merged fishing data was read into R and combined into a single data frame of only fishing points (i.e. already subsetted by speed to eliminate transiting points). The data were edited using two lookup tables (Section 11.2.5 Tables 30 and 31) to simplify data by grouping certain species (caught together or within the same Fishery Management Plan, FMP) and certain gear types. Next, port names were shortened in certain cases using the gsub function to limit the length of the port specific file names that will be produced. For example, “North Kingstown (local name Wickford)” was shortened to “North Kingstown”. Vectors of unique species, gears, ports, and states were then created to loop through to produce corresponding maps.

Next, shapefiles of the states (from ArcGIS Online), WEAs (from the BOEM Renewable Energy GIS Data webpage), and a three-nautical mile buffer from the shoreline were read into R. All spatial data files were projected into the North Atlantic Datum 1983 using the reference ellipsoid GRS80.

Then a for loop was used to loop through each species that occurred in the compiled vessel dataset. First, the data for a single species was subsetted. Then a confidentiality check was implemented by counting the unique occurrences of vessels (via permit number), fishermen, and dealers that occurred within the species' dataset. If all occurrences had three or more of each for vessels, fishermen, and dealers, a character string stating, "These data meet the ACCSP Rule of 3" was saved. If this condition was not met, the character string was saved stating, "THESE DATA ARE CONFIDENTIAL."

The point data were then converted to a spatial points data frame. The data were clipped by a three-nautical mile buffer to remove all points within state waters. This was done by creating a shapefile of state waters in ArcGIS 10.4 (Environmental Systems Research Institute - ESRI) and using the state waters shape within the for loop in R to remove fishing points that overlap with it.

Next, an empty grid with 0.01-degree resolution covering the entire VMS area was created and populated using the rasterize function in the raster package. This function carries out a function within each grid cell. In this case, the function of choice was to count the number of VMS points that fell within each grid cell to create a grid of point densities.

After the fishing point density raster had been created, it was plotted along with the WEAs, states, and submerged lands act boundary. Then, maps were created for each raw fishing density raster: 1) covering the total area, 2) covering just offshore Massachusetts and Rhode Island, 3) covering only south of Long Island. These maps are all confidential and are not shown in the results. The rasters were also saved as .img (ERDAS Imagine format) files for use in the value aggregation step.

To ensure compliance with the ACCSP Rule of 3, the raw fishing density raster was also smoothed out using a focal window function. The focal function, also in the raster package, was used with a 3x3 grid to calculate the sum of the center cell and 8 cells around it, for every single grid cell. The sum was used instead of the mean because the inclusion of neighboring cells with no data (i.e. no VMS points recorded there) will dilute the values of each raster cell and reduce the number of cells containing data. Using the sum with the na.rm command set to True within the focal function ensures that no data are lost in the raster smoothing process. The sum command does inflate the raster values themselves, but this method provides relative values that can be used to visually identify fishing hotspots without dropping any of the raw data. For confidentiality, the raster values were reclassified on an equal interval scale from 1 to 10 where 1 corresponds to low density and 10 corresponds to high density of fishing points (i.e. the 0-10th percentiles become 1, the 10-20th percentiles become 2, etc.). The final product is a map of relative fishing density. Since the product is a relative density map, there is no issue with inflating the numbers using the sum function in the smoothing step.

The smoothed raster was then plotted in the same three formats as the raw fishing data. The confidentiality statement created earlier was printed on each map so that confidential level maps (i.e. too few vessels, fishermen, or dealers) could be omitted from the final report. The plotted maps were saved as .jpg files and the smoothed rasters were saved as .img files.

The loop then closed and moved on to the next species. Separate for loops were also used to produce fishing density rasters and maps by gear used, port landed, and state landed.

In addition to density mapping for total fishing activity over the 2011-2016 time period, yearly analyses were also carried out. A large for loop was used to loop through the years, with nested for loops inside the larger loop to produce rasters and maps of raw fishing density and smoothed fishing density by species, gear, landing port, and landing state within each year.

The plotted maps are included in Appendix I of this document. For viewing ease within the document, the Appendix map scales labels have been simplified to “Low”, “Medium”, and “High”, rather than 1-10; the actual scales remain the same.

Refer to section 11.2.5 and Tables 30 and 31 for R code and lookup tables used to carry out these operations.

11.1.4 Aggregating Monetary Value Data by Species, Gear Type, and Port as a Function of Fishing Density

Since data preparation was finally complete at this stage, data were ready for aggregation of fishing location information to determine the value to each fishery within each WEA. A shapefile all the WEAs acquired from the BOEM Renewable Energy GIS Data webpage was read into R. All spatial data files were projected into the North Atlantic Datum 1983 using the reference ellipsoid GRS80.

All fishing data (i.e. the merged VMS/VTR/landings) were read in from .csv files and revised using the same two lookup tables (Tables 30 and 31) and port naming conventions used in step 11.1.3. All points with average speeds greater than four knots were dropped from analysis to eliminate transiting for all fisheries other than the scallop fishery. In a previous step (11.1.2), all points with speeds greater than five knots were removed to reduce the file sizes for each vessel prior to merging with landings or VTR (which contain species harvested information). In reality, most fishing activity happens at four or fewer knots. Now that landings and VTR data had been combined, the scallop fishing data could be isolated (keeping points with speeds up to five knots) and the remaining data could be subsetted to remove all points with speeds between four and five knots. This was done within the for loop as well.

An empty data frame for each of the WEAs was created to be filled by a for loop. The loop would open each vessel’s csv (created in the step 11.1.2.2), subset the fishing data points with coordinates within each WEA, add the subsetted data points to the corresponding WEA’s data frame created before the loop began, then move on to the next vessel’s data.

Multiple steps were carried out within the for loop before subsetting by WEA. The first was to calculate a weighted fishing point value, using that species’ fishing density raster for each year individually. This was done separately for each year, for each species, to ensure that interannual changes in the species’ geographic location were addressed. The weighting was done using the following methods. The for loop contained a nested loop within it where the first loop subsetted all data by year of landings, and the second loop subsetted data by species landed. Once the annual species data were isolated, the corresponding raster from step 11.1.3 was read into the workspace. The values of all cells in the raster were summed to calculate the total number of fishing points for that year. Then all cells were divided by the total number of fishing points. This created a fishing weight raster, where each cell represents the proportion of total fishing that occurred in that area. Next, the fishing point data were converted to a spatial points dataframe and overlaid on top of the new fishing weight raster. The extract function, in the raster package, was used to extract the raster cell values to the points (i.e. the specific value of a grid cell was added as a new column to the points that fall within that cell). The points were then converted back to a data frame for simpler analysis.

By using the fishing density rasters to weight the fishing point value data, all state fishing points were dropped. This occurred because the fishing density rasters were clipped by state fishing activity, meaning there were no raster data within state waters. Therefore, no weight could be assigned to cells within state waters and the overlapping fishing points were assigned a weight of 0, eliminating them from further analysis.

The first step to calculate the fishing points weighted dollar values was to use the table function to count the occurrences of each unique Supplier Trip Id. Since certain species are sold in grades or as different body parts, or they can be sold to multiple dealers, there may be duplicate location points (i.e. duplicate row with the same Supplier Trip ID and species will exist for the any species sold in grades or by body parts). For example, if goosefish (monkfish) tails are sold separately from the livers, there will be two rows for every point location on that trip for goosefish. To remedy this issue, a unique identifier was created by pasting the Supplier Trip ID and the dollar value of the landings together in a new column. If there are multiple grades or body parts, the prices are different, while the Supplier Trip IDs will be the same. The number of unique occurrences in the new unique identifier column indicates the number of grades sold. Finally, to calculate the correct number of fishing points for each trip for a single species, the number of occurrences of each Supplier Trip ID was divided by the number of grades. The corrected number of fishing points per trip was stored in a new column.

Next, within each grade of each species for each trip, the aggregate function was used to sum the column of the extracted raster values. Then, the individual raster values were divided by the summed value to create a weight of fishing activity within a trip. Finally, the total trip value (for each grade) was multiplied by the new trip-specific weight to calculate the weighted landings value for each fishing point.

The last step inside the nested for loops was to subset points within each WEA. The data were converted to a spatial points data frame again, subsetted spatially by WEA, converted back to data frame format and added on to the corresponding WEA data frame (created before the loop) prior to the loop running again using the next species' data.

After the for loop had compiled data tables of all fishing points and their corresponding values data for each of the WEAs, we could sum weighted value data by fishery, gear type, port and state landed. This was done using the aggregate function, setting the summary statistics function as the sum. At the same time, for each grouping by species, gear, port, or state landed for each year, the number of vessels, fishermen, and dealers was calculated. Any value that did not include three or more of each vessels, fishermen, and dealers was omitted and replaced with a value of "C," denoting the data point as confidential. All output tables were exported as csv files.

Refer to section 11.2.6 and Tables 30 and 31 for R code and lookup tables used to carry out these operations.

Please note that the town of Wakefield, RI is spelled incorrectly in all products. The town name is spelled incorrectly in SAFIS as "Wakefiled" and therefore was not altered in the products.

11.2 R Scripts

The following R scripts will need to be modified to be used by others. All pathnames will require updating to match the folder configuration and file naming conventions selected by the user. Additionally, depending on how the user downloads the data files from SAFIS and the ACCSP Warehouse, he or she may need to update certain lines of code to reflect differences in how the column headers of the data files are named.

11.2.1 R Code to Merge All Landings Files into a Single Formatted Comma Separated Values File

This script produces a single merged CSV file containing all landings data. The headers of necessary columns pulled from the ACCSP data warehouse are as follows: State.Postal, Port, Common.Name, Scientific.Name, Landed.Lbs, Dollars, Vessel, Vessel.Federal.License, Supplier.Trip.Id, Valid.ITIS, Landing.Date, Fisherman, and Dealer.License.Nbr. Other columns may be pulled during the data acquisition process, though this code will remove all unnecessary columns to keep files smaller for processing.

```
# Combining all states' files and dropping unnecessary data to keep files small

# Tell r not to use scientific notation (we need all digits of the trip.ids)
options(scipen=999)

setwd("C:/Livermore/Federal_Offshore_Wind/Large_Scale_VMS/Data/Dealer_Reports")

# List all Landings Files in Dealer_Reports Folder
files<-list.files("C:/Livermore/Federal_Offshore_Wind/Large_Scale_VMS/Data/Dealer_Reports",pattern=".txt")

# Create empty dataframe to fill
schema<-read.delim("CT_2011-2016_Landings.txt",sep="\t",header=T,fill=T,stringsAsFactors=F)
allLand<-schema
allLand<-allLand[0,]

# Loop through files and combine them into one
for (file in files){
  newFile<-read.delim(file,sep="\t",header=T,fill=T,stringsAsFactors=F)
  allLand<-rbind(allLand,newFile)
}

### Fix yr formatting
# Some states do by century others just last 2 digits
# Use year, month, and day columns to create a new date column that is consistent across states
allLand$Landing.Date<-paste(allLand$Day.in.month,"-",allLand$Month.in.year,"-",allLand$Year,sep="")

# Format as dates and then remove old date column
allLand$Landing.Date<-as.Date(allLand$Landing.Date,"%d-%m-%Y")
allLand$Unload.Date<-NULL

# Columns you will need:
Keeps<-c("State.Postal","Port","Common.Name","Scientific.Name","Landed.Lbs","Dollars","Vessel",
         "Vessel.Federal.License","Supplier.Trip.Id","Valid.ITIS","Landing.Date","Fisherman",
         "Dealer.License.Nbr")

allLand<-allLand[,(names(allLand) %in% Keeps)]

# Save aggregated file
write.csv(allLand,"C:/Livermore/Federal_Offshore_Wind/Large_Scale_VMS/Data/Prepped_Data/AllLand_2011-2016.csv")
```

11.2.2 R Code to Merge All VTR Files into a Single Formatted File

This script produces a single merged CSV file containing all VTR data. The headers of necessary columns pulled from SAFIS are as follows: Common.Name, Gear.name, Supplier.trip.id, Start.year, Start.month, Start.day, Nbr.of.crew, Fed.ves.permit, Sup.ves.hull, Cg.or.streg, Date.land, Area.code, Accsp.gear, Depth, Sppname, It is, and Serial.num. Other columns may be pulled during the data acquisition process, though this code will remove all unnecessary columns to keep files smaller for processing.

```
# We need to combine the VTR report to determine the trip dates (no in landings)
# and gear types (not reliable in landings).
# The federal vessel permit number and landings values are all in the dealer reports.
```

```
# Tell r not to use scientific notation (we need all digits of the trip.ids)
options(scipen=999)

setwd("C:/Livermore/Federal_Offshore_Wind/Large_Scale_VMS/Data/VTR")

# List all VTR Files in VTR Folder
files<-list.files("C:/Livermore/Federal_Offshore_Wind/Large_Scale_VMS/Data/VTR",pattern=".txt")

# Create empty dataframe to fill
schema<-read.delim("RI_2011-2016_VTR.txt",sep="\t",header=T,fill=T,stringsAsFactors=F)
allVTR<-schema
allVTR<-allVTR[0,]

# Loop through files and combine them into one
for (file in files){
  newFile<-read.delim(file,sep="\t",header=T,fill=T,stringsAsFactors=F)
  allVTR<-rbind(allVTR,newFile)
}

# Columns you will need
keeps<-c("Common.Name","Gear.name","Supplier.trip.id","Start.year","Start.month","Start.day","Nbr.of.crew",
         "Fed.ves.permit","Sup.ves.hull","Cg.or.streg","Date.land","Area.code","Accsp.gear","Depth","Sppname",
         "Itis","Serial.num")

# Drop columns we don't need
allVTR<-allVTR[,(names(allVTR) %in% keeps)]

# Fed.ves.permit and Cg.or.streg failed to come through the NOAA Database data pull so we will use the permit
number in the landings
drops<-c("Fed.ves.permit","Cg.or.streg")
allVTR<-allVTR[,!(names(allVTR) %in% drops)]

# Format as dates
allVTR$Start.day<-as.character(allVTR$Start.day)
allVTR$Start.month<-as.character(allVTR$Start.month)
allVTR$Start.year<-as.character(allVTR$Start.year)
allVTR$Trip.Start.Date<-paste(allVTR$Start.day,allVTR$Start.month,allVTR$Start.year,sep="/")
allVTR$Trip.Start.Date<-as.Date(allVTR$Trip.Start.Date,"%d/%m/%Y")
allVTR$Date.land<-as.Date(allVTR$Date.land,"%d-%b-%y")

# Export list of all sppname to make sure there are no made up entries that do not occur in the VTR guidelines
# Sometimes people do not use the correct code
Specieslist<-unique(allVTR$Common.Name)
write.csv(Specieslist,"C:/Livermore/Federal_Offshore_Wind/Large_Scale_VMS/Data/SpeciesList.csv")

# Rename the common.name column so it does not have the same column name as in landings
allVTR$Species<-allVTR$Common.Name
allVTR$Common.Name<-NULL

# Export combined file of all VTR with federal permits
write.csv(allVTR,"C:/Livermore/Federal_Offshore_Wind/Large_Scale_VMS/Data/Prepped_Data/FedVTR_2011-2015.csv")
```

11.2.3 R Code to Merge Formatted VTR File to Formatted Landings File

This script merges the landings to the VTR by matching the Supplier Trip IDs (the VTR number) in both datasets. The merge also includes species as a merging parameter. Prior to merging, a lookup table is used to ensure that all species are recorded the same way in both datasets.

```
# Merging VTR and Landings data and minimizing file size
require(stringr)

# Tell r not to use scientific notation
options(scipen=999)

# Insert addNewData function from GitHub (https://gist.github.com/dfalster/5589956)
addNewData <- function(newDataFileName, data, allowedVars){

  import <- readNewData(newDataFileName, allowedVars)

  if( !is.null(import)){
    for(i in seq_len(nrow(import))){  #Make replacements
      col.to <- import$newVariable[i]
      col.from <- import$lookupVariable[i]
      if(is.na(col.from)){ # apply to whole column
```

```
        data[col.to] <- import$newValue[i]
      } else { # apply to subset
        rows <- data[[col.from]] == import$lookupValue[i]
        data[rows,col.to] <- import$newValue[i]
      }
    }
  }
  data
}

readNewData <- function(newDataFileName, allowedVars){

  if( file.exists(newDataFileName)){
    import <- read.csv(newDataFileName, header=TRUE, stringsAsFactors=FALSE,
                       strip.white=TRUE)
    if( nrow(import)> 0 ){

      #Check columns names for import are right
      expectedColumns<- c("lookupVariable","lookupValue","newVariable","newValue")
      nameIsOK <-  expectedColumns %in% names(import)
      if(any(!nameIsOK))
        stop("Incorrect name in lookup table for ",
             newDataFileName, "--> ", paste(expectedColumns[!nameIsOK],
                                            collapse=", "))

      #Check values of newVariable are in list of allowed variables
      import$lookupVariable[import$lookupVariable == ""] <- NA
      nameIsOK <- import$newVariable %in% allowedVars
      if(any(!nameIsOK))
        stop("Incorrect name(s) in newVariable column of ",
             newDataFileName, "--> ", paste(import$newVariable[!nameIsOK],
                                            collapse=", "))
    } else {
      import <- NULL
    }
  } else {
    import <- NULL
  }
  import
}

setwd("C:/Livermore/Federal_Offshore_Wind/Large_Scale_VMS/Data/Prepped_Data")

landings<-read.csv("AllLand_2011-2016.csv")
landings$X<-NULL
vtr<-read.csv("C:/Livermore/Federal_Offshore_Wind/Large_Scale_VMS/Data/Prepped_Data/FedVTR_2011-2015.csv")
vtr$X<-NULL

# Merge the two based on:
# 1. Supplier.Trip.Id (in Landings) and Serial.Number (in VTR)
# 2. Species.Name (in both datasets - variable that I create using a lookup/translate table)

# Cannot use ITIS number because some species are classified under groupings in landings
# and other species are classified under groupings in VTR (e.g. in landings they have some
# drums under red drums' ITIS #, others under black drums' ITIS #, and some under
# generic drums' ITIS #). It was too challenging to do a lookup table using ITIS #s due
# to the likelihood of human error on identifying differences in numbers, so the translation
# table was developed on species name (including spelling, punctuation, capitalization, and
# species groupings in some cases).
# Not all species will occur in both tables since some species are more coastal and not
# caught in federal waters.

# Use lookup table to change VTR species names to landings species names
# Since we are looking exclusively at value, skate wings and goosefish/monkfish parts
# were grouped with the rest of the species. These two groups cannot be analyzed in terms
# of pounds landed now.
# In the lookup table, the lookupVariable is from the VTR data and the newVariable
# is from the landings data. The output will match the formatting in dealer reports/landings.
vtr$Species<-as.character(vtr$Species)
GoodSpeciesVTR<-read.csv("C:/Livermore/Federal_Offshore_Wind/Large_Scale_VMS/LOOKUP_TABLE_NE.csv")
allowedVars<-c("Common.Name")
GoodSpeciesVTR<-
addNewData("C:/Livermore/Federal_Offshore_Wind/Large_Scale_VMS/LOOKUP_TABLE_NE.csv",vtr,allowedVars)
GoodSpeciesVTR$X<-NULL
GoodSpeciesVTR$Sppname<-NULL
GoodSpeciesVTR$Species<-NULL
GoodSpeciesVTR$Start.year<-NULL
GoodSpeciesVTR$Start.month<-NULL
GoodSpeciesVTR$Start.day<-NULL

# Rename columns before merge to clairfy what data is in landings and what data is in VTR
```

```
colnames(GoodSpeciesVTR)<-c("VTR.Gear.name","VTR.Supplier.trip.id","VTR.Nbr.of.crew",
                            "VTR.Sup.ves.hull","VTR.Date.land","VTR.Serial.Num","VTR.Area.code",
                            "VTR.Accsp.gear","VTR.Depth","VTR.Itis","VTR.Trip.Start.Date",
                            "VTR.Common.Name")
colnames(landings)<-c("Land.State","Land.Port","Land.Common.Name","Land.Scientific.Name",
                      "Land.Landed.Lbs","Land.Dollars","Land.Dealer.License.Nbr","Land.Fisherman",
                      "Land.Vessel","Land.Vessel.Federal.License",
                      "Land.Supplier.Trip.Id","Land.Valid.ITIS","Land.Landing.Date")

# Dropped landing date from merging parameters because dates can differ
# by one evening between VTR and dealer reports because dealer may not submit a report until following morning.
# I.e. we dropped Landing.Date (in landings) and Trip.End.Date (in VTR) from merge.

# This VTR-landings merging step must occur before merging to VMS to account for multiday trips.
# You need the landings from the dealer reports, as well as the trip start and
# end dates from the VTR.

# Something odd is going on with the VTR numbers. The eVTR numbers in the Supplier.Trip.Id column of the VTR data
# are correct, but the 7 digit numbers are not. SAFIS may generate these as unique identifiers.
# Paper VTR's have 8 digit serial numbers, whic is contained in the Serial.num column. The eVTRs in the Serial.num
# column are not correct. We need to clean up the data so that we have a new column containing the correct VTR
numbers.
GoodSpeciesVTR$True.VTR.Number<-
ifelse(nchar(GoodSpeciesVTR$VTR.Supplier.trip.id)==14,GoodSpeciesVTR$VTR.Supplier.trip.id,NA)
GoodSpeciesVTR$True.VTR.Number<-ifelse(is.na(GoodSpeciesVTR$True.VTR.Number)==T,GoodSpeciesVTR$VTR.Serial.Num,
                                    GoodSpeciesVTR$True.VTR.Num)
GoodSpeciesVTR$True.VTR.Number<-
ifelse(nchar(GoodSpeciesVTR$True.VTR.Number)==14|nchar(GoodSpeciesVTR$True.VTR.Number)==8,
                                       GoodSpeciesVTR$True.VTR.Number,NA)
GoodSpeciesVTR<-na.omit(GoodSpeciesVTR)

# Drop all landings with VTR numbers (Supplier Trip IDs) that don't have federal VTR numbers
# i.e. 8 digits for paper vtr and 14 for eVTR
landings$Land.Supplier.Trip.Id<-as.character(landings$Land.Supplier.Trip.Id)

# One none eVTR set of codes has 14 digits. We will remove special characters to make it have a different
# number of characters
landings$Land.Supplier.Trip.Id<-str_replace_all(landings$Land.Supplier.Trip.Id,"[^[:alnum:]]","")
landings$StrLen<-nchar(landings$Land.Supplier.Trip.Id)
landSub<-subset(landings,StrLen==8 | StrLen==14)
landSub$StrLen<-NULL

# Make sure merging columns have same data types
landSub$Land.Supplier.Trip.Id<-as.numeric(as.character(landSub$Land.Supplier.Trip.Id))
landSub<-na.omit(landSub)
GoodSpeciesVTR$True.VTR.Number<-as.numeric(as.character(GoodSpeciesVTR$True.VTR.Number))

# Run merge as a natural join (drop rows from both dataframes that do not match up)
LandVTR<-merge(x=landSub,y=GoodSpeciesVTR,by.x=c("Land.Supplier.Trip.Id","Land.Common.Name"),
               by.y=c("True.VTR.Number","VTR.Common.Name"))

LandVTR$VTR.Serial.Num<-NULL
LandVTR$VTR.Supplier.trip.id<-NULL

# Save large merged file
write.csv(LandVTR,"LandVTR.csv")
```

Table 29. Lookup table used in VTR_Landings_Merge.R to make all species names uniform between the dealer reports/landings and the VTR prior to merging. This table formatting is required of the addNewData function. The Sppname column comes from the VTR, while the Common.Name comes from the landings.

lookupVariable	lookupValue	newVariable	newValue	source
Sppname	ALBACORE	Common.Name	ALBACORE	Julia L.
Sppname	ALEWIFE	Common.Name	ALEWIFE	Julia L.
Sppname	AMBERJACK, SPECIES NOT SPECIFIED	Common.Name	AMBERJACK	Julia L.
Sppname	ANCHOVY,BAY	Common.Name	ANCHOVY,BAY	Julia L.
Sppname	CLAM, BLOODARC	Common.Name	ARK, BLOOD	Julia L.
Sppname	ATLANTIC SALMON	Common.Name	ATLANTIC SALMON	Julia L.
Sppname	BARRA	Common.Name	BARRACUDAS	Julia L.

Sppname	BARRELFISH	Common.Name	BARRELFISH	Julia L.
Sppname	BLACK SEA BASS	Common.Name	BASS, BLACK SEA	Julia L.
Sppname	STRIPED BASS	Common.Name	BASS, STRIPED	Julia L.
Sppname	BLUEFISH	Common.Name	BLUEFISH	Julia L.
Sppname	BONITO	Common.Name	BONITO, ATLANTIC	Julia L.
Sppname	BUTTERFISH	Common.Name	BUTTERFISH	Julia L.
Sppname	CLAM, RAZOR	Common.Name	CLAM ATLANTIC RAZOR	Julia L.
Sppname	CLAM, ARCTIC SURF	Common.Name	CLAM, ARCTIC SURF	Julia L.
Sppname	CLAM,QUAHOG,HARD	Common.Name	CLAM, NORTHERN QUAHOG	Julia L.
Sppname	CLAM,QUAHOG,HARD/BUSHEL	Common.Name	CLAM, NORTHERN QUAHOG	Julia L.
Sppname	QUAHOGS/BUSHEL	Common.Name	CLAM, NORTHERN QUAHOG	Julia L.
Sppname	CLSO	Common.Name	CLAM, SOFT	Julia L.
Sppname	CLAM, SPECIES NOT SPECIFIED	Common.Name	CLAM, SPECIES NOT SPECIFIED	Julia L.
Sppname	COBIA	Common.Name	COBIA	Julia L.
Sppname	COD	Common.Name	COD, ATLANTIC	Julia L.
Sppname	COD,MILT	Common.Name	COD, ATLANTIC	Julia L.
Sppname	CRAB, ROCK	Common.Name	CRAB, ATLANTIC ROCK	Julia L.
Sppname	CRAB, ROCK/BUSHEL	Common.Name	CRAB, ATLANTIC ROCK	Julia L.
Sppname	CRAB, BLUE	Common.Name	CRAB, BLUE	Julia L.
Sppname	CRAB, BLUE/BUSHEL	Common.Name	CRAB, BLUE	Julia L.
Sppname	CRAB, CANCER	Common.Name	CRAB, CANCER	Julia L.
Sppname	CRAB, GREEN	Common.Name	CRAB, GREEN	Julia L.
Sppname	CRAB, HERMIT	Common.Name	CRAB, HERMIT	Julia L.
Sppname	CRAB, HORSESHOE	Common.Name	CRAB, HORSESHOE	Julia L.
Sppname	CRAB, JONAH	Common.Name	CRAB, JONAH	Julia L.
Sppname	CRAB, JONAH/BUSHEL	Common.Name	CRAB, JONAH	Julia L.
Sppname	CRAB, LADY	Common.Name	CRAB, LADY	Julia L.
Sppname	CRAB, QUEEN SNOW	Common.Name	CRAB, QUEEN SNOW	Julia L.
Sppname	CRAB, RED	Common.Name	CRAB, RED DEEPSEA	Julia L.
Sppname	CRAB, RED/BUSHEL	Common.Name	CRAB, RED DEEPSEA	Julia L.
Sppname	CRAB, SPECIES NOT SPECIFIED	Common.Name	CRAB, SPECIES NOT SPECIFIED	Julia L.
Sppname	CRAB, SPECIES NOT SPECIFIED/BUSHEL	Common.Name	CRAB, SPECIES NOT SPECIFIED/BUSHEL	Julia L.
Sppname	CRAB, SPIDER	Common.Name	CRABS, SPIDER	Julia L.
Sppname	CROAKER, ATLANTIC	Common.Name	CROAKER, ATLANTIC	Julia L.
Sppname	SEA CUCUMBERS	Common.Name	CUCUMBERS, SEA	Julia L.
Sppname	CUNNER	Common.Name	CUNNER	Julia L.
Sppname	CUSK	Common.Name	CUSK	Julia L.
Sppname	DOGFISH, BLACK	Common.Name	DOGFISH, BLACK	Julia L.
Sppname	DOGFISH, CHAIN	Common.Name	DOGFISH, CHAIN	Julia L.
Sppname	DOGFISH, SMOOTH	Common.Name	DOGFISH, SMOOTH	Julia L.
Sppname	DOGFISH,SMOOTH,FINS	Common.Name	DOGFISH, SMOOTH	Julia L.
Sppname	DOGFISH, SPECIES NOT SPECIFIED	Common.Name	DOGFISH, SPECIES NOT SPECIFIED	Julia L.
Sppname	DOGFISH, SPINY	Common.Name	DOGFISH, SPINY	Julia L.
Sppname	DOGFISH,SPINY,FINS	Common.Name	DOGFISH, SPINY	Julia L.
Sppname	DOLPHIN FISH / MAHI-MAHI	Common.Name	DOLPHINFISH	Julia L.
Sppname	JOHN DORY	Common.Name	DORY, AMERICAN JOHN	Julia L.
Sppname	DRUM, BLACK	Common.Name	DRUM, BLACK	Julia L.

Sppname	DRUM, RED	Common.Name	DRUM, RED	Julia L.
Sppname	DRUM, SPECIES NOT SPECIFIED	Common.Name	DRUM, SPECIES NOT SPECIFIED	Julia L.
Sppname	DRUM, SPECIES NOT SPECIFIED	Common.Name	DRUM, SPECIES NOT SPECIFIED	Julia L.
Sppname	EEL, AMERICAN	Common.Name	EEL, AMERICAN	Julia L.
Sppname	EEL, CONGER	Common.Name	EEL, CONGER	Julia L.
Sppname	EEL, SPECIES NOT SPECIFIED	Common.Name	EEL, SPECIES NOT SPECIFIED	Julia L.
Sppname	ESCOLAR	Common.Name	ESCOLAR	Julia L.
Sppname	FLOUNDER, FOURSPOT	Common.Name	FLOUNDER, FOURSPOT	Julia L.
Sppname	FLOUNDER, SOUTHERN	Common.Name	FLOUNDER, SOUTHERN	Julia L.
Sppname	FLOUNDER, SPECIES NOT SPECIFIED	Common.Name	FLOUNDER, SPECIES NOT SPECIFIED	Julia L.
Sppname	FLOUNDER, SUMMER / FLUKE	Common.Name	FLOUNDER, SUMMER	Julia L.
Sppname	FLOUNDER, WINTER / BLACKBACK	Common.Name	FLOUNDER, WINTER	Julia L.
Sppname	FLOUNDER, WITCH / GRAY SOLE	Common.Name	FLOUNDER, WITCH	Julia L.
Sppname	FLOUNDER, YELLOWTAIL	Common.Name	FLOUNDER, YELLOWTAIL	Julia L.
Sppname	GARFISH	Common.Name	GARFISHES	Julia L.
Sppname	MONK HEADS	Common.Name	GOOSEFISH	Julia L.
Sppname	MONK LIVERS	Common.Name	GOOSEFISH	Julia L.
Sppname	MONK TAILS	Common.Name	GOOSEFISH	Julia L.
Sppname	MONKFISH / ANGLERFISH / GOOSEFISH	Common.Name	GOOSEFISH	Julia L.
Sppname	GRENADIER, ROUGH HEADED	Common.Name	GRENADIER, ROUGH HEADED	Julia L.
Sppname	GROUPER, SNOWY	Common.Name	GROUPER, SNOWY	Julia L.
Sppname	GROUPER, SPECIES NOT SPECIFIED	Common.Name	GROUPERS	Julia L.
Sppname	GRUNT, SPECIES NOT SPECIFIED	Common.Name	GRUNTS	Julia L.
Sppname	HADDOCK	Common.Name	HADDOCK	Julia L.
Sppname	HADDOCK ROE	Common.Name	HADDOCK	Julia L.
Sppname	HAGFISH	Common.Name	HAGFISH	Julia L.
Sppname	HAKE, OFFSHORE	Common.Name	HAKE, OFFSHORE	Julia L.
Sppname	HAKE, RED / LING	Common.Name	HAKE, RED	Julia L.
Sppname	HAKE, SILVER / WHITING	Common.Name	HAKE, SILVER	Julia L.
Sppname	HAKE,SPOTTED	Common.Name	HAKE, SPOTTED	Julia L.
Sppname	HAKE, WHITE	Common.Name	HAKE, WHITE	Julia L.
Sppname	HAKE,SPECIES NOT SPECIFIED	Common.Name	HAKE,SPECIES NOT SPECIFIED	Julia L.
Sppname	HALIBUT, ATLANTIC	Common.Name	HALIBUT, ATLANTIC	Julia L.
Sppname	HALIBUT, GREENLAND	Common.Name	HALIBUT, GREENLAND	Julia L.
Sppname	HERRING, ATLANTIC	Common.Name	HERRING, ATLANTIC	Julia L.
Sppname	HERRING, BLUE BACK	Common.Name	HERRING, BLUEBACK	Julia L.
Sppname	HERRING/BUSHEL	Common.Name	HERRING/BUSHEL	Julia L.
Sppname	HOGFISH	Common.Name	HOGFISH	Julia L.
Sppname	CREVALLE	Common.Name	JACK, CREVALLE	Julia L.
Sppname	LADYFISH	Common.Name	LADYFISH	Julia L.
Sppname	LOBSTER, AMERICAN	Common.Name	LOBSTER, AMERICAN	Julia L.
Sppname	LUMPFISH	Common.Name	LUMPFISH	Julia L.
Sppname	MACKEREL, ATLANTIC	Common.Name	MACKEREL, ATLANTIC	Julia L.
Sppname	MACKEREL, CHUB	Common.Name	MACKEREL, CHUB	Julia L.
Sppname	MACKEREL, FRIGATE	Common.Name	MACKEREL, FRIGATE	Julia L.
Sppname	MACKEREL, KING	Common.Name	MACKEREL, KING	Julia L.

Sppname	MACKEREL, SPANISH	Common.Name	MACKEREL, SPANISH	Julia L.
Sppname	MARLIN, BLUE	Common.Name	MARLIN, BLUE	Julia L.
Sppname	MARLIN, WHITE	Common.Name	MARLIN, WHITE	Julia L.
Sppname	MENHADEN	Common.Name	MENHADEN, ATLANTIC	Julia L.
Sppname	MULLETS	Common.Name	MULLETS	Julia L.
Sppname	MUSSELS	Common.Name	MUSSEL, SEA	Julia L.
Sppname	NO CATCH	Common.Name	NO CATCH	Julia L.
Sppname	OCEAN SUNFISH / MOOLA	Common.Name	OCEAN SUNFISH / MOOLA	Julia L.
Sppname	OCTOPUS, SPECIES NOT SPECIFIED	Common.Name	OCTOPUS	Julia L.
Sppname	OPAH / MOONFISH	Common.Name	OPAH	Julia L.
Sppname	OTHER FINFISH	Common.Name	OTHER FINFISH	Julia L.
Sppname	OTHER FINFISH	Common.Name	OTHER FINFISH	Julia L.
Sppname	OTHER INVERTEBRATES	Common.Name	OTHER INVERTEBRATES	Julia L.
Sppname	OTHER INVERTEBRATES	Common.Name	OTHER INVERTEBRATES	Julia L.
Sppname	OYSTERS,PUBLIC UNCLASSIFIED	Common.Name	OYSTER, EASTERN	Julia L.
Sppname	PERCH, SAND	Common.Name	PERCH, SAND	Julia L.
Sppname	PERCH, WHITE	Common.Name	PERCH, WHITE	Julia L.
Sppname	FLOUNDER, AMERICAN PLAICE /DAB	Common.Name	PLAICE, AMERICAN	Julia L.
Sppname	POLLOCK	Common.Name	POLLOCK	Julia L.
Sppname	POMPANO, COMMON	Common.Name	POMPANO, FLORIDA	Julia L.
Sppname	RED PORGY	Common.Name	PORGY, RED	Julia L.
Sppname	OCEAN POUT	Common.Name	POUT, OCEAN	Julia L.
Sppname	PUFFER, NORTHERN	Common.Name	PUFFER, NORTHERN	Julia L.
Sppname	CLAM, QUAHOG, OCEAN	Common.Name	QUAHOG, OCEAN	Julia L.
Sppname	SEA RAVEN	Common.Name	RAVEN, SEA	Julia L.
Sppname	RAY,COWNOSE	Common.Name	RAY,COWNOSE	Julia L.
Sppname	REDFISH / OCEAN PERCH	Common.Name	REDFISH, ACADIAN	Julia L.
Sppname	REDFISH, GOLDEN	Common.Name	REDFISH, GOLDEN	Julia L.
Sppname	RIBBONFISH	Common.Name	RIBBONFISHES	Julia L.
Sppname	SEA ROBINS	Common.Name	ROBINS, SEA	Julia L.
Sppname	BLACK BELLIED ROSEFISH	Common.Name	ROSEFISH, BLACKBELLY	Julia L.
Sppname	BLUE RUNNER	Common.Name	RUNNER, BLUE	Julia L.
Sppname	ROUGH SCAD	Common.Name	SCAD, ROUGH	Julia L.
Sppname	SCALLOP, BAY	Common.Name	SCALLOP, BAY	Julia L.
Sppname	SCI	Common.Name	SCALLOP, ICELAND	Julia L.
Sppname	SCALLOP, SEA	Common.Name	SCALLOP, SEA	Julia L.
Sppname	SCALLOPS/BUSHEL	Common.Name	SCALLOP, SEA	Julia L.
Sppname	SCALLOPS/GALLON	Common.Name	SCALLOP, SEA	Julia L.
Sppname	SCALLOPS/SHELLS	Common.Name	SCALLOP, SEA	Julia L.
Sppname	SCULPINS	Common.Name	SCULPINS	Julia L.
Sppname	SCUP / PORGY	Common.Name	SCUP	Julia L.
Sppname	SEATROUT, SPECIES NOT SPECIFIED	Common.Name	SEATROUT, SPECIES NOT SPECIFIED	Julia L.
Sppname	WEAKFISH, SPOTTED / SPOTTED SEA TROUT	Common.Name	SEATROUT, SPOTTED	Julia L.
Sppname	SHAD, AMERICAN	Common.Name	SHAD, AMERICAN	Julia L.
Sppname	SHAD, GIZZARD	Common.Name	SHAD, GIZZARD	Julia L.
Sppname	SHAD, HICKORY	Common.Name	SHAD, HICKORY	Julia L.

Sppname	SHARK, ANGEL	Common.Name	SHARK, ANGEL	Julia L.
Sppname	SHARK, SHARPNOSE	Common.Name	SHARK, ATLANTIC SHARPNOSE	Julia L.
Sppname	SHARK, BASKING	Common.Name	SHARK, BASKING	Julia L.
Sppname	SHARK, BLACKTIP	Common.Name	SHARK, BLACKTIP	Julia L.
Sppname	SHARK, BLUE	Common.Name	SHARK, BLUE	Julia L.
Sppname	SHARK, BULL	Common.Name	SHARK, BULL	Julia L.
Sppname	SHARK, DUSKY	Common.Name	SHARK, DUSKY	Julia L.
Sppname	SHARK, FINETOOTH	Common.Name	SHARK, FINETOOTH	Julia L.
Sppname	SHARK, GREENLAND	Common.Name	SHARK, GREENLAND	Julia L.
Sppname	SHARK, HAMMERHEAD	Common.Name	SHARK, HAMMERHEAD	Julia L.
Sppname	SHARK, LEMON	Common.Name	SHARK, LEMON	Julia L.
Sppname	SHARK, MAKO, LONGFIN	Common.Name	SHARK, MAKO, LONGFIN	Julia L.
Sppname	SHARK, MAKO, SHORTFIN	Common.Name	SHARK, MAKO, SHORTFIN	Julia L.
Sppname	SHARK, MAKO, SPECIES NOT SPECIFIED	Common.Name	SHARK, MAKO, SPECIES NOT SPECIFIED	Julia L.
Sppname	SHARK, NOT SPECIFIED	Common.Name	SHARK, NOT SPECIFIED	Julia L.
Sppname	SHARK, NURSE	Common.Name	SHARK, NURSE	Julia L.
Sppname	SHWT	Common.Name	SHARK, OCEANIC WHITETIP	Julia L.
Sppname	SHARK, PORBEAGLE	Common.Name	SHARK, PORBEAGLE	Julia L.
Sppname	SHARK, SAND TIGER	Common.Name	SHARK, SAND TIGER	Julia L.
Sppname	SHARK, SANDBAR	Common.Name	SHARK, SANDBAR	Julia L.
Sppname	SHARK, SPINNER	Common.Name	SHARK, SPINNER	Julia L.
Sppname	SHARK, THRESHER	Common.Name	SHARK, THRESHER	Julia L.
Sppname	SHARK, THRESHER, BIGEYE	Common.Name	SHARK, THRESHER, BIGEYE	Julia L.
Sppname	SHARK, TIGER	Common.Name	SHARK, TIGER	Julia L.
Sppname	SHARK, WHITE	Common.Name	SHARK, WHITE	Julia L.
Sppname	SHEEPSHEAD	Common.Name	SHEEPSHEAD	Julia L.
Sppname	SHRIMP (MANTIS)	Common.Name	SHRIMP, MANTIS	Julia L.
Sppname	SHRIMP (PANDALID)	Common.Name	SHRIMP, NORTHERN	Julia L.
Sppname	SHRIMP, SPECIES NOT SPECIFIED	Common.Name	SHRIMP, SPECIES NOT SPECIFIED	Julia L.
Sppname	SHRIMP (PENAEID)	Common.Name	SHRIMPS, PENAEID	Julia L.
Sppname	SILVERSIDES, ATLANTIC	Common.Name	SILVERSIDE, ATLANTIC	Julia L.
Sppname	SKATE UNCLASSIFIED	Common.Name	SKATE UNCLASSIFIED	Julia L.
Sppname	SKATE WINGS UNCLASSIFIED	Common.Name	SKATE WINGS UNCLASSIFIED	Julia L.
Sppname	SKATE WINGS, LITTLE/WINTER MIXED	Common.Name	SKATE WINGS, LITTLE/WINTER MIXED	Julia L.
Sppname	SKATE WINGS, BARNDOOR	Common.Name	SKATE, BARNDOOR	Julia L.
Sppname	SKATE, BARNDOOR	Common.Name	SKATE, BARNDOOR	Julia L.
Sppname	SKATE WINGS, CLEARNOSE	Common.Name	SKATE, CLEARNOSE	Julia L.
Sppname	SKATE,CLEARNOSE	Common.Name	SKATE, CLEARNOSE	Julia L.
Sppname	SKATE WINGS, LITTLE (SUMMER)	Common.Name	SKATE, LITTLE	Julia L.
Sppname	SKATE, LITTLE (SUMMER)	Common.Name	SKATE, LITTLE	Julia L.
Sppname	SKATE, LITTLE/WINTER MIXED	Common.Name	SKATE, LITTLE/WINTER MIXED	Julia L.
Sppname	SKATE, ROSETT	Common.Name	SKATE, ROSETT	Julia L.
Sppname	SKATE WINGS, SMOOTH	Common.Name	SKATE, SMOOTH	Julia L.
Sppname	SKATE, SMOOTH	Common.Name	SKATE, SMOOTH	Julia L.
Sppname	SKATE, SPINYTAIL	Common.Name	SKATE, SPINYTAIL	Julia L.
Sppname	SKATE WINGS, THORNY	Common.Name	SKATE, THORNY	Julia L.

Sppname	SKATE, THORNY	Common.Name	SKATE, THORNY	Julia L.
Sppname	SKATE WINGS, WINTER (BIG)	Common.Name	SKATE, WINTER	Julia L.
Sppname	SKATE, WINTER (BIG)	Common.Name	SKATE, WINTER	Julia L.
Sppname	SMLT	Common.Name	SMELTS	Julia L.
Sppname	SNAPPER, RED	Common.Name	SNAPPER, RED	Julia L.
Sppname	SNAP	Common.Name	SNAPPERS	Julia L.
Sppname	SPADEFISH	Common.Name	SPADEFISH	Julia L.
Sppname	SPOT	Common.Name	SPOT	Julia L.
Sppname	SQUID / LOLIGO	Common.Name	SQUID, LONGFIN INSHORE	Julia L.
Sppname	SQUID / ILLEX	Common.Name	SQUID, NORTHERN SHORTFIN	Julia L.
Sppname	SQUID, SPECIES NOT SPECIFIED	Common.Name	SQUID, SPECIES NOT SPECIFIED	Julia L.
Sppname	STARFISH	Common.Name	STARFISH	Julia L.
Sppname	STARGAZER,NORTHERN	Common.Name	STARGAZER, NORTHERN	Julia L.
Sppname	STURGEON, ATLANTIC	Common.Name	STURGEON, ATLANTIC	Julia L.
Sppname	STURGEON, SHORT-NOSE	Common.Name	STURGEON, SHORT-NOSE	Julia L.
Sppname	STURGEON, SPECIES NOT SPECIFIED	Common.Name	STURGEON, SPECIES NOT SPECIFIED	Julia L.
Sppname	CLA	Common.Name	SURFCLAM, ARCTIC	Julia L.
Sppname	CLAM, SURF	Common.Name	SURFCLAM, ATLANTIC	Julia L.
Sppname	CLAM, SURF/BUSHEL	Common.Name	SURFCLAM, ATLANTIC	Julia L.
Sppname	SWORDFISH *****???***** 4328 / 4320	Common.Name	SWORDFISH	Julia L.
Sppname	TAUTOG	Common.Name	TAUTOG	Julia L.
Sppname	TILEFISH, SPECIES NOT SPECIFIED	Common.Name	TILEFISH	Julia L.
Sppname	TILEFISH, BLUELINE	Common.Name	TILEFISH, BLUELINE	Julia L.
Sppname	TILEFISH, GOLDEN	Common.Name	TILEFISH, GOLDEN	Julia L.
Sppname	TILEFISH, SAND	Common.Name	TILEFISH, SAND	Julia L.
Sppname	TOADFISH, OYSTER	Common.Name	TOADFISHES	Julia L.
Sppname	TRIGGERFISH	Common.Name	TRIGGERFISHES	Julia L.
Sppname	WKSQ	Common.Name	TROUT, SEA	Julia L.
Sppname	TUNA, ALBACORE	Common.Name	TUNA, ALBACORE	Julia L.
Sppname	BET	Common.Name	TUNA, BIGEYE	Julia L.
Sppname	TUNA, BIG EYE	Common.Name	TUNA, BLACKFIN	Julia L.
Sppname	TUNA, BLACKFIN	Common.Name	TUNA, BLUEFIN	Julia L.
Sppname	TUNA, BLUEFIN	Common.Name	TUNA, SKIPJACK	Julia L.
Sppname	TUNA, SPECIES NOT SPECIFIED	Common.Name	TUNA, SPECIES NOT SPECIFIED	Julia L.
Sppname	TUNA, YELLOWFIN	Common.Name	TUNA, YELLOWFIN	Julia L.
Sppname	TUNA, LITTLE	Common.Name	TUNNY, LITTLE	Julia L.
Sppname	TURTLE, LEATHERBACK	Common.Name	TURTLE, LEATHERBACK	Julia L.
Sppname	TURTLE, LOGGERHEAD	Common.Name	TURTLE, LOGGERHEAD	Julia L.
Sppname	TURTLE, UNIDENTIFIED	Common.Name	TURTLE, UNIDENTIFIED	Julia L.
Sppname	SEA URCHINS	Common.Name	URCHINS, SEA	Julia L.
Sppname	WAHOO	Common.Name	WAHOO	Julia L.
Sppname	WEAKFISH / SQUETEAGUE / GRAY SEA TROUT	Common.Name	WEAKFISH / SQUETEAGUE / GRAY SEA TROUT	Julia L.
Sppname	WHELK, CHANNELED	Common.Name	WHELK, CHANNELED	Julia L.
Sppname	WHELK, CHANNELED/BUSHEL	Common.Name	WHELK, CHANNELED	Julia L.
Sppname	WHELK, KNOBBED	Common.Name	WHELK, KNOBBED	Julia L.
Sppname	WHELK, KNOBBED/BUSHEL	Common.Name	WHELK, KNOBBED	Julia L.

Sppname	WHELK, LIGHTNING	Common.Name	WHELK, LIGHTNING	Julia L.
Sppname	WHELK,WAVED	Common.Name	WHELK, WAVED	Julia L.
Sppname	WHITING, BLACK	Common.Name	WHITING, BLACK	Julia L.
Sppname	WHITING, KING / KINGFISH	Common.Name	WHITING, KING	Julia L.
Sppname	FLOUNDER, SAND-DAB / WINDOWPANE / BRILL	Common.Name	WINDOWPANE	Julia L.
Sppname	WOLFFISH / OCEAN CATFISH	Common.Name	WOLFFISH, ATLANTIC	Julia L.
Sppname	WOLFISH, NORTHERN	Common.Name	WOLFISH, NORTHERN	Julia L.
Sppname	WOLFISH, SPOTTED	Common.Name	WOLFISH, SPOTTED	Julia L.
Sppname	WRECKFISH	Common.Name	WRECKFISH	Julia L.

The addNewData.R function was developed by Daniel Falster and can be downloaded from GitHubGist at https://gist.github.com/dfalster/5589956.

11.2.4 R Code to Merge Formatted VTR/Landings File to Each of the VMS .csv Files One Vessel at a Time

This script loops through the list of vessels produced in the previous script and pulls all matching VMS entries from each of the 75 VMS files by matching up the federal vessel permit number. The output of this script is a single .csv file for each vessel who fished in the target area (refer to Figure 2) and landed their catch in NH, MA, RI, CT, NY, or NJ. If the vessel landed elsewhere, or if they landed in the aforementioned states but did not fish in the target area, no file was produced.

The column headers required of the VMS data files are as follows: LATITUDE, LONGITUDE, AVG_SPEED, PERMIT, VMS.DATE, VMS.TIME. Additional columns may be obtained from NOAA's OLE. Any unnecessary colums will be removed by this script.

Please note that this script took over 25 days to run on a computer with 4 cores, 16 gigabytes of random-access memory (RAM), and a 64-bit operating system. The 32-bit version of R software is limited to only 2 gigabytes of RAM, whether the computer has more memory available or not. Therefore, this script will not work on a computer with a 32-bit operating system, as the 64-bit version of R is necessary to run this code. The code could have been written in a more efficient form, but more efficient versions required more RAM that the available computer had. Hence, a slower processing code was the only option due to technological limitations.

```
# Looping through the VMS files and combining with the merged landings/VTR

options(scipen=999)
require(stringr)
require(rgdal)

setwd("C:/Livermore/Federal_Offshore_Wind/Large_Scale_VMS/Data/Prepped_Data")

LandVTR<-read.csv("LandVTR.csv")

# Pull a list of all vessels in the merged landings/VTR data
vessels<-unique(LandVTR$Land.Vessel.Federal.License)
vessels<-as.vector(as.character(vessels))

# Export vessel list
write.csv(vessels,"11-16_VesselList.csv")

# List all VMS Files in VMS Folder (75 monthly files in this case)
files<-list.files("C:/Livermore/Federal_Offshore_Wind/Large_Scale_VMS/Data/VMS",pattern=".csv")
```

```
# Read in a csv of the correct formatting for the final vessel data frames
format<-read.csv("FinalFormatting.csv")
format$X<-NULL

# Write list of columns to keep (drop all others)
Keeps<-c("LATITUDE","LONGITUDE","AVG_SPEED","PERMIT","VMS.DATE","VMS.TIME")
locKeeps<-c("LATITUDE","LONGITUDE","AVG_SPEED","PERMIT","VMS.DATE","VMS.TIME",
            "Land.Supplier.Trip.Id","Land.Port","VTR.Gear.name","VTR.Nbr.of.crew",
            "VTR.Accsp.gear","Land.Common.Name","Land.State","Land.Fisherman",
            "Land.Dealer.License.Nbr")

# Loop through the vessel list to pull all VMS data specific to that boat
# and drop all unnecessary data (i.e. does not match up correctly in time)

vesselNum<-0

for (permitNum in vessels){

  # Bring in our formatting file
  thisVesselLoc<-format

  vesselNum<-vesselNum+1

  # Loop through VMS files and create one file of this vessel's data
  for (file in files){

    # Read in file, reformat columns
    fullName<-paste("C:/Livermore/Federal_Offshore_Wind/Large_Scale_VMS/Data/VMS/",file,sep="")
    newFile<-read.csv(fullName)
    newFile$AVG_SPEED<-as.numeric(as.character(newFile$AVG_SPEED))
    newFile$VMS.DATE<-newFile$UTC.DATE.TIME
    newFile$VMS.DATE<-as.POSIXct(strptime(newFile$VMS.DATE,"%m/%d/%Y %H:%M"))
    newFile$VMS.TIME<-str_sub(newFile$VMS.DATE,-8,-1)
    newFile$VMS.DATE<-str_sub(newFile$VMS.DATE,1,10)
    newFile$VMS.DATE<-as.Date(as.character(newFile$VMS.DATE),"%Y-%m-%d")

    # Subset file by vessel and drop all rows where speed is too great for fishing
    fileSubset<-subset(newFile,PERMIT==permitNum & AVG_SPEED<=5)

    # Drop unnecessary rows
    fileSubset<-fileSubset[,(names(fileSubset) %in% Keeps)]

    # Merge this vessel's data from this one file to the VTR/Landings data on vessel
    # permit number and time frame
    fileMerge<-merge(fileSubset,LandVTR,by.x="PERMIT",by.y="Land.Vessel.Federal.License")

    # Now need to drop all rows where the merge matched information up that is incorrect temporally
    fileMerge$VMS.DATE<-as.Date(fileMerge$VMS.DATE,format="%Y-%m-%d")
    fileMerge$VTR.Trip.Start.Date<-as.Date(fileMerge$VTR.Trip.Start.Date,format="%Y-%m-%d")
    fileMerge$VTR.Date.land<-as.Date(fileMerge$VTR.Date.land,format="%Y-%m-%d")
    #fileMerge$DatesMatch<-fileMerge$VMS.DATE>=fileMerge$VTR.Trip.Start.Date &
fileMerge$VMS.DATE<=fileMerge$VTR.Date.land
    fileMerge2<-subset(fileMerge,VMS.DATE>=VTR.Trip.Start.Date & VMS.DATE<=VTR.Date.land)

    # Remove no longer necessary objects
    remove(fileMerge)
    remove(fileSubset)
    remove(newFile)

    fileMerge2$X<-NULL

    # Bind this file's data to all other files for this vessel
    thisVesselLoc<-rbind(thisVesselLoc,fileMerge2)

    remove(fileMerge2)

  }

  # Add a column of the number of points of fishing per trip
  if (nrow(thisVesselLoc)>0){

    # Calculate the frequency of each fishing trip (number of total location points recorded per trip)
    # First need to remove duplicated rows (locations repeated for each species)
    thisVesselLoc2<-thisVesselLoc
    thisVesselLoc2$Coded.Variable<-paste(thisVesselLoc2$Land.Supplier.Trip.Id,thisVesselLoc2$LATITUDE,
                                         thisVesselLoc2$VMS.DATE,thisVesselLoc2$VMS.TIME)

    thisVesselLoc2<-thisVesselLoc2[!duplicated(thisVesselLoc2[,c("Coded.Variable")]),]

    tripFishing<-as.data.frame(table(thisVesselLoc2$Land.Supplier.Trip.Id))
    colnames(tripFishing)<-c("Trip","Fishing.Pts")
```

```
    # Merge the frequency table to the vessel data to add a column of the number of points per trip
    # We need all the data with duplicates by species because we will subset by species later on.
    # The frequency of points comes from the other dataset where this has been addressed already.
    thisVesselLoc<-merge(thisVesselLoc,tripFishing,by.x ="Land.Supplier.Trip.Id",by.y="Trip")

    # Remove the unnecessary files
    remove(tripFishing)
    remove(thisVesselLoc2)

    # Divide the value column by the number of fishing points. Then we can just add together points later
    # because their value should reflect each point's equal proportional value.
    thisVesselLoc$Land.Dollars<-as.numeric(as.character(thisVesselLoc$Land.Dollars))
    thisVesselLoc$Fishing.Pts<-as.numeric(as.character(thisVesselLoc$Fishing.Pts))
    thisVesselLoc$Prop.Value<-thisVesselLoc$Land.Dollars/thisVesselLoc$Fishing.Pts

    # Save this boat's data
    filename<-paste("Vessel_",permitNum,".csv",sep="")
    write.csv(thisVesselLoc,filename)

  }

  print(paste("Vessel permit number ",permitNum," data merging complete.",sep=""))
  progress<-100*(vesselNum/length(vessels))
  print(paste("This is vessel ",vesselNum," out of ",length(vessels)," total vessels.",sep=""))

  if (nrow(thisVesselLoc)<1){
    print(paste("This vessel did not fish in the target area, though it did land in one of the target states:
NY, MA, RI, CT, NY, or NJ."))
    print(paste("No .csv of landings and VMS will be saved for this vessel."))
  }

  print(paste("Process ",round(progress,2),"% complete at ",Sys.time(),".",sep=""))

  remove(file)
  remove(filename)

  gc()

}
```

11.2.5 R Code Aggregating Spatial Data by Species and/or Fishery, Gear Used, Port Landed, and State

This code finally takes all spatial VMS data and plots maps of fishing density by species landed, gear used, port landed, and state landed. Maps and rasters (in ERDAS Imagine .img format) of VMS densities were produced for each of the aforementioned criteria for each single year between 2011 and 2016, as well as an aggregated version for 2011-2016. A map of all WEAs and fishing density was produced for each year and criteria, along with a closeup map of the area south of New York and a closeup map of the area offshore Massachusetts and Rhode Island.

Additionally, to comply with the ACCSP Rule of 3 for every single grid cell, a smoothing function was applied to the raster of fishing density using 3x3 cell focal search window and the sum function, meaning that each grid cell was converted to the sum of the individual cell and the 8 grid cells surrounding it. These data were also saved as a raster in ERDAS Imagine format (.img) and maps were output in the same format as for the unSmoothed federal fishing density raster.

```
options(scipen=999)
require(stringr)
require(rgdal)
require(reshape)
require(formattable)
require(raster)
require(sp)
require(maps)

setwd("C:/Livermore/Federal_Offshore_Wind/Large_Scale_VMS/Data/Results")

# Insert addNewData function from GitHub (https://gist.github.com/dfalster/5589956)
```

```
addNewData <- function(newDataFileName, data, allowedVars){

  import <- readNewData(newDataFileName, allowedVars)

  if( !is.null(import)){
    for(i in seq_len(nrow(import))){  #Make replacements
      col.to <- import$newVariable[i]
      col.from <- import$lookupVariable[i]
      if(is.na(col.from)){ # apply to whole column
        data[col.to] <- import$newValue[i]
      } else { # apply to subset
        rows <- data[[col.from]] == import$lookupValue[i]
        data[rows,col.to] <- import$newValue[i]
      }
    }
  }
  data
}

readNewData <- function(newDataFileName, allowedVars){

  if( file.exists(newDataFileName)){
    import <- read.csv(newDataFileName, header=TRUE, stringsAsFactors=FALSE,
                       strip.white=TRUE)
    if( nrow(import)> 0 ){

      #Check columns names for import are right
      expectedColumns<- c("lookupVariable","lookupValue","newVariable","newValue")
      nameIsOK <-  expectedColumns %in% names(import)
      if(any(!nameIsOK))
        stop("Incorrect name in lookup table for ",
             newDataFileName, "--> ", paste(expectedColumns[!nameIsOK],
                                            collapse=", "))

      #Check values of newVariable are in list of allowed variables
      import$lookupVariable[import$lookupVariable == ""] <- NA
      nameIsOK <- import$newVariable %in% allowedVars
      if(any(!nameIsOK))
        stop("Incorrect name(s) in newVariable column of ",
             newDataFileName, "--> ", paste(import$newVariable[!nameIsOK],
                                            collapse=", "))
    } else {
      import <- NULL
    }
  } else {
    import <- NULL
  }
  import
}

pts2011<-read.csv("C:/Livermore/Federal_Offshore_Wind/Large_Scale_VMS/Data/Prepped_Data/2011_fishing_pts.csv")
pts2012<-read.csv("C:/Livermore/Federal_Offshore_Wind/Large_Scale_VMS/Data/Prepped_Data/2012_fishing_pts.csv")
pts2013<-read.csv("C:/Livermore/Federal_Offshore_Wind/Large_Scale_VMS/Data/Prepped_Data/2013_fishing_pts.csv")
pts2014<-read.csv("C:/Livermore/Federal_Offshore_Wind/Large_Scale_VMS/Data/Prepped_Data/2014_fishing_pts.csv")
pts2015<-read.csv("C:/Livermore/Federal_Offshore_Wind/Large_Scale_VMS/Data/Prepped_Data/2015_fishing_pts.csv")
pts2016<-read.csv("C:/Livermore/Federal_Offshore_Wind/Large_Scale_VMS/Data/Prepped_Data/2016_fishing_pts.csv")

allDat<-rbind(pts2011,pts2012)
remove(pts2011,pts2012)
allDat<-rbind(allDat,pts2013)
remove(pts2013)
allDat<-rbind(allDat,pts2014)
remove(pts2014)
allDat<-rbind(allDat,pts2015)
remove(pts2015)

allDat$X.1<-NULL
allDat$X<-NULL
pts2016$X.1<-NULL
pts2016$X<-NULL

allDat<-rbind(allDat,pts2016)
remove(pts2016)

write.csv(allDat,"All_Spatial_Data.csv")

# Clean up data to save space
keeps<-c("LATITUDE","LONGITUDE","VMS.DATE","Land.Common.Name","Land.State","Land.Port","Land.Dollars",
         "Land.Dealer.License.Nbr","Land.Fisherman","Land.Landing.Date","VTR.Gear.name","VTR.Nbr.of.crew",
         "VTR.Date.land","Year","Prop.Value","PERMIT")
allDat<-allDat[,(names(allDat) %in% keeps)]
```

```
remove(keeps)

# Apply gear and species lookup tables to simplify/group certain outputs logically
GroupedGear<-read.csv("C:/Livermore/Federal_Offshore_Wind/Large_Scale_VMS/Gear_Lookup_Table.csv")
allDat$VTR.Gear.name<-as.character(allDat$VTR.Gear.name)
allDat.GroupedGear<-GroupedGear
allowedVars<-c("VTR.Gear.name")
allDat.GroupedGear<-
addNewData("C:/Livermore/Federal_Offshore_Wind/Large_Scale_VMS/Gear_Lookup_Table.csv",allDat,allowedVars)
allDat.GroupedGear$X<-NULL
remove(allDat,GroupedGear)

GroupedSpecies<-read.csv("C:/Livermore/Federal_Offshore_Wind/Large_Scale_VMS/Species_Lookup_2.csv")
allDat.GroupedGear$Land.Common.Name<-as.character(allDat.GroupedGear$Land.Common.Name)
allDat.Grouped<-GroupedSpecies
allowedVars<-c("Land.Common.Name")
allDat.Grouped<-
addNewData("C:/Livermore/Federal_Offshore_Wind/Large_Scale_VMS/Species_Lookup_2.csv",allDat.GroupedGear,allowed
Vars)
allDat.Grouped$X<-NULL
remove(allDat.GroupedGear,GroupedSpecies)

# Shorten port names
allDat.Grouped$Land.Port<-gsub(" (census name for Falmouth Center)","",allDat.Grouped$Land.Port,fixed=T)
allDat.Grouped$Land.Port<-gsub(" (census name for Chatham Center)","",allDat.Grouped$Land.Port,fixed=T)
allDat.Grouped$Land.Port<-gsub(" (census name for Plymouth Center)","",allDat.Grouped$Land.Port,fixed=T)
allDat.Grouped$Land.Port<-gsub(" (census name for Scituate Center)","",allDat.Grouped$Land.Port,fixed=T)
allDat.Grouped$Land.Port<-gsub(" (census name for Nantucket Center)","",allDat.Grouped$Land.Port,fixed=T)
allDat.Grouped$Land.Port<-gsub(" Indian","",allDat.Grouped$Land.Port,fixed=T)
allDat.Grouped$Land.Port<-gsub(" (Borough of New York)","",allDat.Grouped$Land.Port,fixed=T)
allDat.Grouped$Land.Port<-gsub(" (local name Wickford)","",allDat.Grouped$Land.Port,fixed=T)
allDat.Grouped$Land.Port<-gsub(" (Town of)","",allDat.Grouped$Land.Port,fixed=T)
allDat.Grouped$Land.Port<-gsub(" (census name Narragansett Pier)","",allDat.Grouped$Land.Port,fixed=T)
allDat.Grouped$Land.Port<-gsub(" (census name Westerly Center)","",allDat.Grouped$Land.Port,fixed=T)
allDat.Grouped$Land.Port<-gsub(" (Hyannisport)","",allDat.Grouped$Land.Port,fixed=T)
allDat.Grouped$Land.Port<-gsub(" (census name for Marshfield Compact)","",allDat.Grouped$Land.Port,fixed=T)
allDat.Grouped$Land.Port<-gsub(" (East Lyme (sta.))","",allDat.Grouped$Land.Port,fixed=T)
allDat.Grouped$Land.Port<-gsub(" (census name for Sandwich Center)","",allDat.Grouped$Land.Port,fixed=T)

WEAreas<-
readOGR(dsn="C:/Livermore/Federal_Offshore_Wind/Large_Scale_VMS/Data/WEA_Shapefiles/AtlanticLeaseAreas_032817.s
hp",
                 layer="AtlanticLeaseAreas_032817")
subLandsAct<-
readOGR(dsn="C:/Livermore/Federal_Offshore_Wind/Large_Scale_VMS/Data/WEA_Shapefiles/subLandsAct.shp",
                     layer="subLandsAct")

#   Transform   and   project   each   shapefile   to   match   the   lat/long   coordinates\NYWEA.shape<-
spTransform(NYWEA.shape.x,CRS("+proj=longlat +datum=NAD83 +no_defs +ellps=GRS80 +towgs84=0,0,0"))
WEAreas.shape<-spTransform(WEAreas,CRS("+proj=longlat +datum=NAD83 +no_defs +ellps=GRS80 +towgs84=0,0,0"))
subLandsAct.shape<-spTransform(subLandsAct,CRS("+proj=longlat      +datum=NAD83      +no_defs      +ellps=GRS80
+towgs84=0,0,0"))

remove(WEAreas,subLandsAct)

# Make lists of species, gears, states, and ports for looping
states<-as.vector(sort(unique(as.character(allDat.Grouped$Land.State))))
gears<-as.vector(sort(unique(as.character(allDat.Grouped$VTR.Gear.name))))
ports<-as.vector(sort(unique(as.character(allDat.Grouped$Land.Port))))
species<-as.vector(sort(unique(as.character(allDat.Grouped$Land.Common.Name))))

# Remove any UNKNOWN entries
ports<-sort(ports[!ports=="UNKNOWN"])

stateOutlines<-
readOGR(dsn="C:/Livermore/Federal_Offshore_Wind/Large_Scale_VMS/Data/WEA_Shapefiles/State_Outlines.shp",
                       layer="State_Outlines")
stateOutlines<-spTransform(stateOutlines,CRS("+proj=longlat +datum=NAD83 +no_defs +ellps=GRS80 +towgs84=0,0,0"))

coastlineBuffer<-
readOGR(dsn="C:/Livermore/Federal_Offshore_Wind/Large_Scale_VMS/Data/WEA_Shapefiles/3nmBuffered.shp",
                         layer="3nmBuffered")
coastlineBuffer<-spTransform(coastlineBuffer,CRS("+proj=longlat     +datum=NAD83     +no_defs     +ellps=GRS80
+towgs84=0,0,0"))

speciesKeeps<-c("LATITUDE","LONGITUDE")

# Function to add North Arrow
north.arrow = function(x, y, h) {
  polygon(c(x, x, x + h/2), c(y - h, y, y - (1 + sqrt(3)/2) * h),
          col = "black", border = NA)
```

```
  polygon(c(x, x + h/2, x, x - h/2), c(y - h, y - (1 + sqrt(3)/2) *
                                        h, y, y - (1 + sqrt(3)/2) * h))
  text(x, y, "N", adj = c(0.5, 0), cex = 1)
}

# Color palette
pal<-colorRampPalette(c("green","yellow","orange","red"))

# Do overall (all years) mapping for all species, states, gear types, and ports
for (fish in species){

  # Subset by species
  subDat<-subset(allDat.Grouped,Land.Common.Name==fish)

  # Confidentiality check
  Boats<-as.numeric(length(unique(subDat$PERMIT)))
  Fishermen<-as.numeric(length(unique(subDat$Land.Fisherman)))
  Dealers<-as.numeric(length(unique(subDat$Land.Dealer.License.Nbr)))
  if (Boats>2 & Fishermen>2 & Dealers>2){
    confidCheck<-"These data meet the ACCSP Rule of 3."
    fileNameConfid<-"NC"
  } else {
    confidCheck<-"THESE DATA ARE CONFIDENTIAL."
    fileNameConfid<-"C"
  }

  # Drop unnecessary data for mapping
  subDat2<-subDat[,(names(subDat) %in% speciesKeeps)]

  # Convert to coordinates (spatial points data frame)
  coordinates(subDat2)<-c("LONGITUDE","LATITUDE")

  # Project to match the WEA's projection
  proj4string(subDat2)<-"+proj=longlat +datum=NAD83 +no_defs +ellps=GRS80 +towgs84=0,0,0"

  # Drop all points within a quarter nautical mile of land to eliminate port activity
  subDat2<-subDat2[coastlineBuffer,]

  if(length(subDat2)>0){

    # Create empty raster
    rast<-raster(xmn=-74.278,ymn=39.881,xmx=-69.726,ymx=42.151,res=0.01)

    # Fill raster with number of points within each cell
    datRast<-rasterize(subDat2,rast,fun="count")

    filename<-paste("2011-2016_",fish,"_fishing_density_",fileNameConfid,".jpg",sep="")
    plotTitle<-paste("2011-2016 ",fish," Fishing Density",sep="")
    jpeg(filename,width=24,height=16,units="cm",res=300)
    par(mai=c(1.02,1.02,0.5,0.5))
    plot(datRast,xlab="Longitude",ylab="Latitude",main=plotTitle,col=pal(10))
    plot(WEAreas.shape,add=TRUE,lwd=1.5)
    plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
    plot(stateOutlines,add=TRUE,col="gray")
    box(lty="solid",col="black")
    text(-70.7,39.925,labels=confidCheck)
    legend("topleft",legend=c("WEAs","States","SLA Boundary"),
           title="Legend",bty="o",pt.bg=c("white","gray",NA),
           lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
           col=c("black","black","dodgerblue2"),pt.cex=1.2)
    text(-69.4,41.8,labels="VMS\nPoint\nDensity",xpd=TRUE)
    text(-70.1,40.019,labels="Datum: NAD1983",cex=0.7)
    north.arrow(-73.39,42,0.08)
    map.scale(x=-71.4,y=40.12,relwidth=0.15,metric=FALSE,ratio=FALSE)
    dev.off()

    # Smooth via focal statistics
    datRastFocal<-focal(datRast,w=matrix(1,3,3),fun=sum,na.rm=T)

    # Reclassify values since they are only relative at this point
    maxDens<-maxValue(datRastFocal)
    m<-c(0,0.1*maxDens,1,
         0.1*maxDens,0.2*maxDens,2,
         0.2*maxDens,0.3*maxDens,3,
         0.3*maxDens,0.4*maxDens,4,
         0.4*maxDens,0.5*maxDens,5,
         0.5*maxDens,0.6*maxDens,6,
         0.6*maxDens,0.7*maxDens,7,
         0.7*maxDens,0.8*maxDens,8,
         0.8*maxDens,0.9*maxDens,9,
         0.9*maxDens,maxDens,10)
```

```
rclmat<-matrix(m,ncol=3,byrow=TRUE)
rc<-reclassify(datRastFocal,rclmat)

filename<-paste("2011-2016_",fish,"_focal_density_",fileNameConfid,".jpg",sep="")
plotTitle<-paste("2011-2016 ",fish," Smoothed Fishing Density",sep="")
jpeg(filename,width=24,height=16,units="cm",res=300)
par(mai=c(1.02,1.02,0.5,0.5))
plot(rc,xlab="Longitude",ylab="Latitude",main=plotTitle,col=pal(10))
plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
plot(WEAreas.shape,add=TRUE,lwd=1.5)
plot(stateOutlines,add=TRUE,col="gray")
box(lty="solid",col="black")
text(-70.7,39.925,labels=confidCheck)
legend("topleft",legend=c("WEAs","States","SLA Boundary"),
       title="Legend",bty="o",pt.bg=c("white","gray",NA),
       lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
       col=c("black","black","dodgerblue2"),pt.cex=1.2)
text(-69.4,41.8,labels="Relative\nVMS\nDensity",xpd=TRUE)
text(-70.1,40.019,labels="Datum: NAD1983",cex=0.7)
north.arrow(-73.39,42,0.08)
map.scale(x=-71.4,y=40.12,relwidth=0.15,metric=FALSE,ratio=FALSE)
dev.off()

# Closeup #1
filename2<-paste("2011-2016_",fish,"_fishing_density_off_MA-RI_",fileNameConfid,".jpg",sep="")
plotTitle2<-paste("2011-2016 ",fish," Fishing Density",sep="")
jpeg(filename2,width=22,height=16,units="cm",res=300)
par(mai=c(1.02,1.02,0.5,0.5))
plot(datRast,xlab="Longitude",ylab="Latitude",main=plotTitle2,col=pal(10),
     xlim=c(-72,-69),ylim=c(40.5,41.75),xaxs="i",yaxs="i")
plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
plot(WEAreas.shape,add=TRUE,lwd=1.5)
plot(stateOutlines,add=TRUE,col="gray")
box(lty="solid",col="black")
text(-71.45,40.525,labels=confidCheck)
legend("topleft",legend=c("WEAs","States","SLA Boundary"),
       title="Legend",bty="o",pt.bg=c("white","gray",NA),
       lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
       col=c("black","black","dodgerblue2"),pt.cex=1.2)
text(-69.5,41.6,labels="VMS\nPoint\nDensity",xpd=TRUE)
text(-69.9,40.51,labels="Datum: NAD1983",cex=0.7)
north.arrow(-71.5,41.71,0.065)
map.scale(x=-71.95,y=40.625,relwidth=0.15,metric=FALSE,ratio=FALSE)
dev.off()

filename2<-paste("2011-2016_",fish,"_focal_density_off_MA-RI_",fileNameConfid,".jpg",sep="")
plotTitle2<-paste("2011-2016 ",fish," Smoothed Fishing Density",sep="")
jpeg(filename2,width=22,height=16,units="cm",res=300)
par(mai=c(1.02,1.02,0.5,0.5))
plot(rc,xlab="Longitude",ylab="Latitude",main=plotTitle2,col=pal(10),
     xlim=c(-72,-69),ylim=c(40.5,41.75),xaxs="i",yaxs="i")
plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
plot(WEAreas.shape,add=TRUE,lwd=1.5)
plot(stateOutlines,add=TRUE,col="gray")
box(lty="solid",col="black")
text(-71.45,40.525,labels=confidCheck)
legend("topleft",legend=c("WEAs","States","SLA Boundary"),
       title="Legend",bty="o",pt.bg=c("white","gray",NA),
       lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
       col=c("black","black","dodgerblue2"),pt.cex=1.2)
text(-69.5,41.6,labels="Relative\nVMS\nDensity",xpd=TRUE)
text(-69.9,40.51,labels="Datum: NAD1983",cex=0.7)
north.arrow(-71.5,41.71,0.065)
map.scale(x=-71.95,y=40.625,relwidth=0.15,metric=FALSE,ratio=FALSE)
dev.off()

# Closeup #2
filename3<-paste("2011-2016_",fish,"_fishing_density_S_of_LongIsland_",fileNameConfid,".jpg",sep="")
plotTitle3<-paste("2011-2016 ",fish," Fishing Density",sep="")
jpeg(filename3,width=26,height=18,units="cm",res=300)
par(mai=c(1.02,1.02,0.5,0.5))
plot(datRast,xlab="Longitude",ylab="Latitude",main=plotTitle3,col=pal(10),xlim=c(-74,-72),ylim=c(40,41))
plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
plot(WEAreas.shape,add=TRUE,lwd=1.5)
plot(stateOutlines,add=TRUE,col="gray")
box(lty="solid",col="black")
text(-72.38,40,labels=confidCheck)
north.arrow(-72.07,40.24,0.09)
legend("topleft",legend=c("WEAs","States","SLA Boundary"),
       title="Legend",bty="o",pt.bg=c("white","gray",NA),
       lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
```

```
          col=c("black","black","dodgerblue2"),pt.cex=1.2)
    text(-71.85,40.85,labels="VMS\nPoint\nDensity",xpd=TRUE)
    text(-72.15,40.05,labels="Datum: NAD1983",cex=0.8)
    map.scale(x=-72.7,y=40.09,relwidth=0.1,metric=FALSE,ratio=FALSE)
    dev.off()

    filename3<-paste("2011-2016_",fish,"_focal_density_S_of_LongIsland_",fileNameConfid,".jpg",sep="")
    plotTitle3<-paste("2011-2016 ",fish," Smoothed Fishing Density",sep="")
    jpeg(filename3,width=26,height=18,units="cm",res=300)
    par(mai=c(1.02,1.02,0.5,0.5))
    plot(rc,xlab="Longitude",ylab="Latitude",main=plotTitle3,col=pal(10),xlim=c(-74,-72),ylim=c(40,41))
    plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
    plot(WEAreas.shape,add=TRUE,lwd=1.5)
    plot(stateOutlines,add=TRUE,col="gray")
    box(lty="solid",col="black")
    text(-72.38,40,labels=confidCheck)
    north.arrow(-72.07,40.24,0.09)
    legend("topleft",legend=c("WEAs","States","SLA Boundary"),
          title="Legend",bty="o",pt.bg=c("white","gray",NA),
          lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
          col=c("black","black","dodgerblue2"),pt.cex=1.2)
    text(-71.85,40.85,labels="Relative\nVMS\nDensity",xpd=TRUE)
    text(-72.15,40.05,labels="Datum: NAD1983",cex=0.8)
    map.scale(x=-72.7,y=40.09,relwidth=0.1,metric=FALSE,ratio=FALSE)
    dev.off()

    # Save the raster
    filename4<-paste("2011-2016_",fish,"_fishing.img",sep="")
    filename5<-paste("2011-2016_",fish,"_focal_",fileNameConfid,".img",sep="")
    writeRaster(datRast,filename4,format="HFA")
    writeRaster(rc,filename5,format="HFA")

  }

}

remove(datRast,datRastFocal,rc,rclmat,m,maxDens,subDat,subDat2,confidCheck,fileNameConfid,Boats,Fishermen,Deale
rs)

for (state in states){

  # Subset by state
  subDat<-subset(allDat.Grouped,Land.State==state)

  # Confidentiality check
  Boats<-as.numeric(length(unique(subDat$PERMIT)))
  Fishermen<-as.numeric(length(unique(subDat$Land.Fisherman)))
  Dealers<-as.numeric(length(unique(subDat$Land.Dealer.License.Nbr)))
  if (Boats>2 & Fishermen>2 & Dealers>2){
    confidCheck<-"These data meet the ACCSP Rule of 3."
    fileNameConfid<-"NC"
  } else {
    confidCheck<-"THESE DATA ARE CONFIDENTIAL."
    fileNameConfid<-"C"
  }

  # Drop unnecessary data for mapping
  subDat2<-subDat[,(names(subDat) %in% speciesKeeps)]

  # Convert to coordinates (spatial points data frame)
  coordinates(subDat2)<-c("LONGITUDE","LATITUDE")

  # Project to match the WEA's projection
  proj4string(subDat2)<-"+proj=longlat +datum=NAD83 +no_defs +ellps=GRS80 +towgs84=0,0,0"

  # Drop all points within a quarter nautical mile of land to eliminate port activity
  subDat2<-subDat2[coastlineBuffer,]

  if(length(subDat2)>0){

    # Create empty raster
    rast<-raster(xmn=-74.278,ymn=39.881,xmx=-69.726,ymx=42.151,res=0.01)

    # Fill raster with number of points within each cell
    datRast<-rasterize(subDat2,rast,fun="count")

    filename<-paste("2011-2016_",state,"_fishing_density_",fileNameConfid,".jpg",sep="")
    plotTitle<-paste("2011-2016 ",state," Fishing Density",sep="")
    jpeg(filename,width=24,height=16,units="cm",res=300)
    par(mai=c(1.02,1.02,0.5,0.5))
    plot(datRast,xlab="Longitude",ylab="Latitude",main=plotTitle,col=pal(10))
```

```
plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
plot(WEAreas.shape,add=TRUE,lwd=1.5)
plot(stateOutlines,add=TRUE,col="gray")
box(lty="solid",col="black")
text(-70.7,39.925,labels=confidCheck)
legend("topleft",legend=c("WEAs","States","SLA Boundary"),
       title="Legend",bty="o",pt.bg=c("white","gray",NA),
       lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
       col=c("black","black","dodgerblue2"),pt.cex=1.2)
text(-69.4,41.8,labels="VMS\nPoint\nDensity",xpd=TRUE)
text(-70.1,40.019,labels="Datum: NAD1983",cex=0.7)
north.arrow(-73.39,42,0.08)
map.scale(x=-71.4,y=40.12,relwidth=0.15,metric=FALSE,ratio=FALSE)
dev.off()

# Smooth via focal statistics
datRastFocal<-focal(datRast,w=matrix(1,3,3),fun=sum,na.rm=T)

# Reclassify values since they are only relative at this point
maxDens<-maxValue(datRastFocal)
m<-c(0,0.1*maxDens,1,
     0.1*maxDens,0.2*maxDens,2,
     0.2*maxDens,0.3*maxDens,3,
     0.3*maxDens,0.4*maxDens,4,
     0.4*maxDens,0.5*maxDens,5,
     0.5*maxDens,0.6*maxDens,6,
     0.6*maxDens,0.7*maxDens,7,
     0.7*maxDens,0.8*maxDens,8,
     0.8*maxDens,0.9*maxDens,9,
     0.9*maxDens,maxDens,10)
rclmat<-matrix(m,ncol=3,byrow=TRUE)
rc<-reclassify(datRastFocal,rclmat)

filename<-paste("2011-2016_",state,"_focal_density_",fileNameConfid,".jpg",sep="")
plotTitle<-paste("2011-2016 ",state," Smoothed Fishing Density",sep="")
jpeg(filename,width=24,height=16,units="cm",res=300)
par(mai=c(1.02,1.02,0.5,0.5))
plot(rc,xlab="Longitude",ylab="Latitude",main=plotTitle,col=pal(10))
plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
plot(WEAreas.shape,add=TRUE,lwd=1.5)
plot(stateOutlines,add=TRUE,col="gray")
box(lty="solid",col="black")
text(-70.7,39.925,labels=confidCheck)
legend("topleft",legend=c("WEAs","States","SLA Boundary"),
       title="Legend",bty="o",pt.bg=c("white","gray",NA),
       lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
       col=c("black","black","dodgerblue2"),pt.cex=1.2)
text(-69.4,41.8,labels="Relative\nVMS\nDensity",xpd=TRUE)
text(-70.1,40.019,labels="Datum: NAD1983",cex=0.7)
north.arrow(-73.39,42,0.08)
map.scale(x=-71.4,y=40.12,relwidth=0.15,metric=FALSE,ratio=FALSE)
dev.off()

# Closeup #1
filename2<-paste("2011-2016_",state,"_fishing_density_off_MA-RI_",fileNameConfid,".jpg",sep="")
plotTitle2<-paste("2011-2016 ",state," Fishing Density",sep="")
jpeg(filename2,width=22,height=16,units="cm",res=300)
par(mai=c(1.02,1.02,0.5,0.5))
plot(datRast,xlab="Longitude",ylab="Latitude",main=plotTitle2,col=pal(10),
     xlim=c(-72,-69),ylim=c(40.5,41.75),xaxs="i",yaxs="i")
plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
plot(WEAreas.shape,add=TRUE,lwd=1.5)
plot(stateOutlines,add=TRUE,col="gray")
box(lty="solid",col="black")
text(-71.45,40.525,labels=confidCheck)
legend("topleft",legend=c("WEAs","States","SLA Boundary"),
       title="Legend",bty="o",pt.bg=c("white","gray",NA),
       lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
       col=c("black","black","dodgerblue2"),pt.cex=1.2)
text(-69.5,41.6,labels="VMS\nPoint\nDensity",xpd=TRUE)
text(-69.9,40.51,labels="Datum: NAD1983",cex=0.7)
north.arrow(-71.5,41.71,0.065)
map.scale(x=-71.95,y=40.625,relwidth=0.15,metric=FALSE,ratio=FALSE)
dev.off()

filename2<-paste("2011-2016_",state,"_focal_density_off_MA-RI_",fileNameConfid,".jpg",sep="")
plotTitle2<-paste("2011-2016 ",state," Smoothed Fishing Density",sep="")
jpeg(filename2,width=22,height=16,units="cm",res=300)
par(mai=c(1.02,1.02,0.5,0.5))
plot(rc,xlab="Longitude",ylab="Latitude",main=plotTitle2,col=pal(10),
     xlim=c(-72,-69),ylim=c(40.5,41.75),xaxs="i",yaxs="i")
```

```
    plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
    plot(WEAreas.shape,add=TRUE,lwd=1.5)
    plot(stateOutlines,add=TRUE,col="gray")
    box(lty="solid",col="black")
    text(-71.45,40.525,labels=confidCheck)
    legend("topleft",legend=c("WEAs","States","SLA Boundary"),
           title="Legend",bty="o",pt.bg=c("white","gray",NA),
           lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
           col=c("black","black","dodgerblue2"),pt.cex=1.2)
    text(-69.5,41.6,labels="Relative\nVMS\nDensity",xpd=TRUE)
    text(-69.9,40.51,labels="Datum: NAD1983",cex=0.7)
    north.arrow(-71.5,41.71,0.065)
    map.scale(x=-71.95,y=40.625,relwidth=0.15,metric=FALSE,ratio=FALSE)
    dev.off()

    # Closeup #2
    filename3<-paste("2011-2016_",state,"_fishing_density_S_of_LongIsland_",fileNameConfid,".jpg",sep="")
    plotTitle3<-paste("2011-2016 ",state," Fishing Density",sep="")
    jpeg(filename3,width=26,height=18,units="cm",res=300)
    par(mai=c(1.02,1.02,0.5,0.5))
    plot(datRast,xlab="Longitude",ylab="Latitude",main=plotTitle3,col=pal(10),xlim=c(-74,-72),ylim=c(40,41))
    plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
    plot(WEAreas.shape,add=TRUE,lwd=1.5)
    plot(stateOutlines,add=TRUE,col="gray")
    box(lty="solid",col="black")
    text(-72.38,40,labels=confidCheck)
    north.arrow(-72.07,40.24,0.09)
    legend("topleft",legend=c("WEAs","States","SLA Boundary"),
           title="Legend",bty="o",pt.bg=c("white","gray",NA),
           lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
           col=c("black","black","dodgerblue2"),pt.cex=1.2)
    text(-71.85,40.85,labels="VMS\nPoint\nDensity",xpd=TRUE)
    text(-72.15,40.05,labels="Datum: NAD1983",cex=0.8)
    map.scale(x=-72.7,y=40.09,relwidth=0.1,metric=FALSE,ratio=FALSE)
    dev.off()

    filename3<-paste("2011-2016_",state,"_focal_density_S_of_LongIsland_",fileNameConfid,".jpg",sep="")
    plotTitle3<-paste("2011-2016 ",state," Smoothed Fishing Density",sep="")
    jpeg(filename3,width=26,height=18,units="cm",res=300)
    par(mai=c(1.02,1.02,0.5,0.5))
    plot(rc,xlab="Longitude",ylab="Latitude",main=plotTitle3,col=pal(10),xlim=c(-74,-72),ylim=c(40,41))
    plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
    plot(WEAreas.shape,add=TRUE,lwd=1.5)
    plot(stateOutlines,add=TRUE,col="gray")
    box(lty="solid",col="black")
    text(-72.38,40,labels=confidCheck)
    north.arrow(-72.07,40.24,0.09)
    legend("topleft",legend=c("WEAs","States","SLA Boundary"),
           title="Legend",bty="o",pt.bg=c("white","gray",NA),
           lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
           col=c("black","black","dodgerblue2"),pt.cex=1.2)
    text(-71.85,40.85,labels="Relative\nVMS\nDensity",xpd=TRUE)
    text(-72.15,40.05,labels="Datum: NAD1983",cex=0.8)
    map.scale(x=-72.7,y=40.09,relwidth=0.1,metric=FALSE,ratio=FALSE)
    dev.off()

    # Save the raster
    filename4<-paste("2011-2016_",state,"_fishing.img",sep="")
    filename5<-paste("2011-2016_",state,"_focal_",fileNameConfid,".img",sep="")
    writeRaster(datRast,filename4,format="HFA")
    writeRaster(rc,filename5,format="HFA")

  }

}


remove(datRast,datRastFocal,rc,rclmat,m,maxDens,subDat,subDat2,confidCheck,fileNameConfid,Boats,Fishermen,Deale
rs)

for (port in ports){

  # Subset by port
  subDat<-subset(allDat.Grouped,Land.Port==port)

  # Confidentiality check
  Boats<-as.numeric(length(unique(subDat$PERMIT)))
  Fishermen<-as.numeric(length(unique(subDat$Land.Fisherman)))
  Dealers<-as.numeric(length(unique(subDat$Land.Dealer.License.Nbr)))
  if (Boats>2 & Fishermen>2 & Dealers>2){
    confidCheck<-"These data meet the ACCSP Rule of 3."
```

```
    fileNameConfid<-"NC"
  } else {
    confidCheck<-"THESE DATA ARE CONFIDENTIAL."
    fileNameConfid<-"C"
  }

  # Drop unnecessary data for mapping
  subDat2<-subDat[,(names(subDat) %in% speciesKeeps)]

  # Convert to coordinates (spatial points data frame)
  coordinates(subDat2)<-c("LONGITUDE","LATITUDE")

  # Project to match the WEA's projection
  proj4string(subDat2)<-"+proj=longlat +datum=NAD83 +no_defs +ellps=GRS80 +towgs84=0,0,0"

  # Drop all points within a quarter nautical mile of land to eliminate port activity
  subDat2<-subDat2[coastlineBuffer,]

  if(length(subDat2)>0){

    # Create empty raster
    rast<-raster(xmn=-74.278,ymn=39.881,xmx=-69.726,ymx=42.151,res=0.01)

    # Fill raster with number of points within each cell
    datRast<-rasterize(subDat2,rast,fun="count")

    filename<-paste("2011-2016_",port,"_fishing_density_",fileNameConfid,".jpg",sep="")
    plotTitle<-paste("2011-2016 ",port," Fishing Density",sep="")
    jpeg(filename,width=24,height=16,units="cm",res=300)
    par(mai=c(1.02,1.02,0.5,0.5))
    plot(datRast,xlab="Longitude",ylab="Latitude",main=plotTitle,col=pal(10))
    plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
    plot(WEAreas.shape,add=TRUE,lwd=1.5)
    plot(stateOutlines,add=TRUE,col="gray")
    box(lty="solid",col="black")
    text(-70.7,39.925,labels=confidCheck)
    legend("topleft",legend=c("WEAs","States","SLA Boundary"),
           title="Legend",bty="o",pt.bg=c("white","gray",NA),
           lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
           col=c("black","black","dodgerblue2"),pt.cex=1.2)
    text(-69.4,41.8,labels="VMS\nPoint\nDensity",xpd=TRUE)
    text(-70.1,40.019,labels="Datum: NAD1983",cex=0.7)
    north.arrow(-73.39,42,0.08)
    map.scale(x=-71.4,y=40.12,relwidth=0.15,metric=FALSE,ratio=FALSE)
    dev.off()

    # Smooth via focal statistics
    datRastFocal<-focal(datRast,w=matrix(1,3,3),fun=sum,na.rm=T)

    # Reclassify values since they are only relative at this point
    maxDens<-maxValue(datRastFocal)
    m<-c(0,0.1*maxDens,1,
         0.1*maxDens,0.2*maxDens,2,
         0.2*maxDens,0.3*maxDens,3,
         0.3*maxDens,0.4*maxDens,4,
         0.4*maxDens,0.5*maxDens,5,
         0.5*maxDens,0.6*maxDens,6,
         0.6*maxDens,0.7*maxDens,7,
         0.7*maxDens,0.8*maxDens,8,
         0.8*maxDens,0.9*maxDens,9,
         0.9*maxDens,maxDens,10)
    rclmat<-matrix(m,ncol=3,byrow=TRUE)
    rc<-reclassify(datRastFocal,rclmat)

    filename<-paste("2011-2016_",port,"_focal_density_",fileNameConfid,".jpg",sep="")
    plotTitle<-paste("2011-2016 ",port," Smoothed Fishing Density",sep="")
    jpeg(filename,width=24,height=16,units="cm",res=300)
    par(mai=c(1.02,1.02,0.5,0.5))
    plot(rc,xlab="Longitude",ylab="Latitude",main=plotTitle,col=pal(10))
    plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
    plot(WEAreas.shape,add=TRUE,lwd=1.5)
    plot(stateOutlines,add=TRUE,col="gray")
    box(lty="solid",col="black")
    text(-70.7,39.925,labels=confidCheck)
    legend("topleft",legend=c("WEAs","States","SLA Boundary"),
           title="Legend",bty="o",pt.bg=c("white","gray",NA),
           lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
           col=c("black","black","dodgerblue2"),pt.cex=1.2)
    text(-69.4,41.8,labels="Relative\nVMS\nDensity",xpd=TRUE)
    text(-70.1,40.019,labels="Datum: NAD1983",cex=0.7)
    north.arrow(-73.39,42,0.08)
```

```
map.scale(x=-71.4,y=40.12,relwidth=0.15,metric=FALSE,ratio=FALSE)
dev.off()

# Closeup #1
filename2<-paste("2011-2016_",port,"_fishing_density_off_MA-RI_",fileNameConfid,".jpg",sep="")
plotTitle2<-paste("2011-2016 ",port," Fishing Density",sep="")
jpeg(filename2,width=22,height=16,units="cm",res=300)
par(mai=c(1.02,1.02,0.5,0.5))
plot(datRast,xlab="Longitude",ylab="Latitude",main=plotTitle2,col=pal(10),
     xlim=c(-72,-69),ylim=c(40.5,41.75),xaxs="i",yaxs="i")
plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
plot(WEAreas.shape,add=TRUE,lwd=1.5)
plot(stateOutlines,add=TRUE,col="gray")
box(lty="solid",col="black")
text(-71.45,40.525,labels=confidCheck)
legend("topleft",legend=c("WEAs","States","SLA Boundary"),
       title="Legend",bty="o",pt.bg=c("white","gray",NA),
       lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
       col=c("black","black","dodgerblue2"),pt.cex=1.2)
text(-69.5,41.6,labels="VMS\nPoint\nDensity",xpd=TRUE)
text(-69.9,40.51,labels="Datum: NAD1983",cex=0.7)
north.arrow(-71.5,41.71,0.065)
map.scale(x=-71.95,y=40.625,relwidth=0.15,metric=FALSE,ratio=FALSE)
dev.off()

filename2<-paste("2011-2016_",port,"_focal_density_off_MA-RI_",fileNameConfid,".jpg",sep="")
plotTitle2<-paste("2011-2016 ",port," Smoothed Fishing Density",sep="")
jpeg(filename2,width=22,height=16,units="cm",res=300)
par(mai=c(1.02,1.02,0.5,0.5))
plot(rc,xlab="Longitude",ylab="Latitude",main=plotTitle2,col=pal(10),
     xlim=c(-72,-69),ylim=c(40.5,41.75),xaxs="i",yaxs="i")
plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
plot(WEAreas.shape,add=TRUE,lwd=1.5)
plot(stateOutlines,add=TRUE,col="gray")
box(lty="solid",col="black")
text(-71.45,40.525,labels=confidCheck)
legend("topleft",legend=c("WEAs","States","SLA Boundary"),
       title="Legend",bty="o",pt.bg=c("white","gray",NA),
       lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
       col=c("black","black","dodgerblue2"),pt.cex=1.2)
text(-69.5,41.6,labels="Relative\nVMS\nDensity",xpd=TRUE)
text(-69.9,40.51,labels="Datum: NAD1983",cex=0.7)
north.arrow(-71.5,41.71,0.065)
map.scale(x=-71.95,y=40.625,relwidth=0.15,metric=FALSE,ratio=FALSE)
dev.off()

# Closeup #2
filename3<-paste("2011-2016_",port,"_fishing_density_S_of_LongIsland_",fileNameConfid,".jpg",sep="")
plotTitle3<-paste("2011-2016 ",port," Fishing Density",sep="")
jpeg(filename3,width=26,height=18,units="cm",res=300)
par(mai=c(1.02,1.02,0.5,0.5))
plot(datRast,xlab="Longitude",ylab="Latitude",main=plotTitle3,col=pal(10),xlim=c(-74,-72),ylim=c(40,41))
plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
plot(WEAreas.shape,add=TRUE,lwd=1.5)
plot(stateOutlines,add=TRUE,col="gray")
box(lty="solid",col="black")
text(-72.38,40,labels=confidCheck)
north.arrow(-72.07,40.24,0.09)
legend("topleft",legend=c("WEAs","States","SLA Boundary"),
       title="Legend",bty="o",pt.bg=c("white","gray",NA),
       lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
       col=c("black","black","dodgerblue2"),pt.cex=1.2)
text(-71.85,40.85,labels="VMS\nPoint\nDensity",xpd=TRUE)
text(-72.15,40.05,labels="Datum: NAD1983",cex=0.8)
map.scale(x=-72.7,y=40.09,relwidth=0.1,metric=FALSE,ratio=FALSE)
dev.off()

filename3<-paste("2011-2016_",port,"_focal_density_S_of_LongIsland_",fileNameConfid,".jpg",sep="")
plotTitle3<-paste("2011-2016 ",port," Smoothed Fishing Density",sep="")
jpeg(filename3,width=26,height=18,units="cm",res=300)
par(mai=c(1.02,1.02,0.5,0.5))
plot(rc,xlab="Longitude",ylab="Latitude",main=plotTitle3,col=pal(10),xlim=c(-74,-72),ylim=c(40,41))
plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
plot(WEAreas.shape,add=TRUE,lwd=1.5)
plot(stateOutlines,add=TRUE,col="gray")
box(lty="solid",col="black")
text(-72.38,40,labels=confidCheck)
north.arrow(-72.07,40.24,0.09)
legend("topleft",legend=c("WEAs","States","SLA Boundary"),
       title="Legend",bty="o",pt.bg=c("white","gray",NA),
       lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
```

```
          col=c("black","black","dodgerblue2"),pt.cex=1.2)
    text(-71.85,40.85,labels="Relative\nVMS\nDensity",xpd=TRUE)
    text(-72.15,40.05,labels="Datum: NAD1983",cex=0.8)
    map.scale(x=-72.7,y=40.09,relwidth=0.1,metric=FALSE,ratio=FALSE)
    dev.off()

    # Save the raster
    filename4<-paste("2011-2016_",port,"_fishing.img",sep="")
    filename5<-paste("2011-2016_",port,"_focal_",fileNameConfid,".img",sep="")
    writeRaster(datRast,filename4,format="HFA")
    writeRaster(rc,filename5,format="HFA")

  }

}

remove(datRast,datRastFocal,rc,rclmat,m,maxDens,subDat,subDat2,confidCheck,fileNameConfid,Boats,Fishermen,Deale
rs)

################# Repeat all, but within a loop by year ########################

years<-c(2011,2012,2013,2014,2015,2016)

for (oneYear in years){

  yearDat<-subset(allDat.Grouped,Year==oneYear)

  # Do overall (all years) mapping for all species, states, gear types, and ports
  for (fish in species){

    # Subset by species
    subDat<-subset(yearDat,Land.Common.Name==fish)

    if((nrow(subDat)>0)==TRUE){

      # Confidentiality check
      Boats<-as.numeric(length(unique(subDat$PERMIT)))
      Fishermen<-as.numeric(length(unique(subDat$Land.Fisherman)))
      Dealers<-as.numeric(length(unique(subDat$Land.Dealer.License.Nbr)))
      if (Boats>2 & Fishermen>2 & Dealers>2){
        confidCheck<-"These data meet the ACCSP Rule of 3."
        fileNameConfid<-"NC"
      } else {
        confidCheck<-"THESE DATA ARE CONFIDENTIAL."
        fileNameConfid<-"C"
      }

      # Drop unnecessary data for mapping
      subDat2<-subDat[,(names(subDat) %in% speciesKeeps)]

      # Convert to coordinates (spatial points data frame)
      coordinates(subDat2)<-c("LONGITUDE","LATITUDE")

      # Project to match the WEA's projection
      proj4string(subDat2)<-"+proj=longlat +datum=NAD83 +no_defs +ellps=GRS80 +towgs84=0,0,0"

      # Drop all points within a quarter nautical mile of land to eliminate port activity
      subDat2<-subDat2[coastlineBuffer,]

      if(length(subDat2)>0){

        # Create empty raster
        rast<-raster(xmn=-74.278,ymn=39.881,xmx=-69.726,ymx=42.151,res=0.01)

        # Fill raster with number of points within each cell
        datRast<-rasterize(subDat2,rast,fun="count")

        filename<-paste(oneYear,"_",fish,"_fishing_density_",fileNameConfid,".jpg",sep="")
        plotTitle<-paste(oneYear," ",fish," Fishing Density",sep="")
        jpeg(filename,width=24,height=16,units="cm",res=300)
        par(mai=c(1.02,1.02,0.5,0.5))
        plot(datRast,xlab="Longitude",ylab="Latitude",main=plotTitle,col=pal(10))
        plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
        plot(WEAreas.shape,add=TRUE,lwd=1.5)
        plot(stateOutlines,add=TRUE,col="gray")
        box(lty="solid",col="black")
        text(-70.7,39.925,labels=confidCheck)
        legend("topleft",legend=c("WEAs","States","SLA Boundary"),
               title="Legend",bty="o",pt.bg=c("white","gray",NA),
               lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
               col=c("black","black","dodgerblue2"),pt.cex=1.2)
```

```
text(-69.4,41.8,labels="VMS\nPoint\nDensity",xpd=TRUE)
text(-70.1,40.019,labels="Datum: NAD1983",cex=0.7)
north.arrow(-73.39,42,0.08)
map.scale(x=-71.4,y=40.12,relwidth=0.15,metric=FALSE,ratio=FALSE)
dev.off()

# Smooth via focal statistics
datRastFocal<-focal(datRast,w=matrix(1,3,3),fun=sum,na.rm=T)

# Reclassify values since they are only relative at this point
maxDens<-maxValue(datRastFocal)
m<-c(0,0.1*maxDens,1,
     0.1*maxDens,0.2*maxDens,2,
     0.2*maxDens,0.3*maxDens,3,
     0.3*maxDens,0.4*maxDens,4,
     0.4*maxDens,0.5*maxDens,5,
     0.5*maxDens,0.6*maxDens,6,
     0.6*maxDens,0.7*maxDens,7,
     0.7*maxDens,0.8*maxDens,8,
     0.8*maxDens,0.9*maxDens,9,
     0.9*maxDens,maxDens,10)
rclmat<-matrix(m,ncol=3,byrow=TRUE)
rc<-reclassify(datRastFocal,rclmat)

filename<-paste(oneYear,"_",fish,"_focal_density_",fileNameConfid,".jpg",sep="")
plotTitle<-paste(oneYear," ",fish," Smoothed Fishing Density",sep="")
jpeg(filename,width=24,height=16,units="cm",res=300)
par(mai=c(1.02,1.02,0.5,0.5))
plot(rc,xlab="Longitude",ylab="Latitude",main=plotTitle,col=pal(10))
plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
plot(WEAreas.shape,add=TRUE,lwd=1.5)
plot(stateOutlines,add=TRUE,col="gray")
box(lty="solid",col="black")
text(-70.7,39.925,labels=confidCheck)
legend("topleft",legend=c("WEAs","States","SLA Boundary"),
       title="Legend",bty="o",pt.bg=c("white","gray",NA),
       lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
       col=c("black","black","dodgerblue2"),pt.cex=1.2)
text(-69.4,41.8,labels="Relative\nVMS\nDensity",xpd=TRUE)
text(-70.1,40.019,labels="Datum: NAD1983",cex=0.7)
north.arrow(-73.39,42,0.08)
map.scale(x=-71.4,y=40.12,relwidth=0.15,metric=FALSE,ratio=FALSE)
dev.off()

# Closeup #1
filename2<-paste(oneYear,"_",fish,"_fishing_density_off_MA-RI_",fileNameConfid,".jpg",sep="")
plotTitle2<-paste(oneYear," ",fish," Fishing Density",sep="")
jpeg(filename2,width=22,height=16,units="cm",res=300)
par(mai=c(1.02,1.02,0.5,0.5))
plot(datRast,xlab="Longitude",ylab="Latitude",main=plotTitle2,col=pal(10),
     xlim=c(-72,-69),ylim=c(40.5,41.75),xaxs="i",yaxs="i")
plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
plot(WEAreas.shape,add=TRUE,lwd=1.5)
plot(stateOutlines,add=TRUE,col="gray")
box(lty="solid",col="black")
text(-71.45,40.525,labels=confidCheck)
legend("topleft",legend=c("WEAs","States","SLA Boundary"),
       title="Legend",bty="o",pt.bg=c("white","gray",NA),
       lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
       col=c("black","black","dodgerblue2"),pt.cex=1.2)
text(-69.5,41.6,labels="VMS\nPoint\nDensity",xpd=TRUE)
text(-69.9,40.51,labels="Datum: NAD1983",cex=0.7)
north.arrow(-71.5,41.71,0.065)
map.scale(x=-71.95,y=40.625,relwidth=0.15,metric=FALSE,ratio=FALSE)
dev.off()

filename2<-paste(oneYear,"_",fish,"_focal_density_off_MA-RI_",fileNameConfid,".jpg",sep="")
plotTitle2<-paste(oneYear," ",fish," Smoothed Fishing Density",sep="")
jpeg(filename2,width=22,height=16,units="cm",res=300)
par(mai=c(1.02,1.02,0.5,0.5))
plot(rc,xlab="Longitude",ylab="Latitude",main=plotTitle2,col=pal(10),
     xlim=c(-72,-69),ylim=c(40.5,41.75),xaxs="i",yaxs="i")
plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
plot(WEAreas.shape,add=TRUE,lwd=1.5)
plot(stateOutlines,add=TRUE,col="gray")
box(lty="solid",col="black")
text(-71.45,40.525,labels=confidCheck)
legend("topleft",legend=c("WEAs","States","SLA Boundary"),
       title="Legend",bty="o",pt.bg=c("white","gray",NA),
       lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
       col=c("black","black","dodgerblue2"),pt.cex=1.2)
```

```
        text(-69.5,41.6,labels="Relative\nVMS\nDensity",xpd=TRUE)
        text(-69.9,40.51,labels="Datum: NAD1983",cex=0.7)
        north.arrow(-71.5,41.71,0.065)
        map.scale(x=-71.95,y=40.625,relwidth=0.15,metric=FALSE,ratio=FALSE)
        dev.off()

        # Closeup #2
        filename3<-paste(oneYear,"_",fish,"_fishing_density_S_of_LongIsland_",fileNameConfid,".jpg",sep="")
        plotTitle3<-paste(oneYear," ",fish," Fishing Density",sep="")
        jpeg(filename3,width=26,height=18,units="cm",res=300)
        par(mai=c(1.02,1.02,0.5,0.5))
        plot(datRast,xlab="Longitude",ylab="Latitude",main=plotTitle3,col=pal(10),xlim=c(-74,-
72),ylim=c(40,41))
        plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
        plot(WEAreas.shape,add=TRUE,lwd=1.5)
        plot(stateOutlines,add=TRUE,col="gray")
        box(lty="solid",col="black")
        text(-72.38,40,labels=confidCheck)
        north.arrow(-72.07,40.24,0.09)
        legend("topleft",legend=c("WEAs","States","SLA Boundary"),
               title="Legend",bty="o",pt.bg=c("white","gray",NA),
               lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
               col=c("black","black","dodgerblue2"),pt.cex=1.2)
        text(-71.85,40.85,labels="VMS\nPoint\nDensity",xpd=TRUE)
        text(-72.15,40.05,labels="Datum: NAD1983",cex=0.8)
        map.scale(x=-72.7,y=40.09,relwidth=0.1,metric=FALSE,ratio=FALSE)
        dev.off()

        filename3<-paste(oneYear,"_",fish,"_focal_density_S_of_LongIsland_",fileNameConfid,".jpg",sep="")
        plotTitle3<-paste(oneYear," ",fish," Smoothed Fishing Density",sep="")
        jpeg(filename3,width=26,height=18,units="cm",res=300)
        par(mai=c(1.02,1.02,0.5,0.5))
        plot(rc,xlab="Longitude",ylab="Latitude",main=plotTitle3,col=pal(10),xlim=c(-74,-72),ylim=c(40,41))
        plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
        plot(WEAreas.shape,add=TRUE,lwd=1.5)
        plot(stateOutlines,add=TRUE,col="gray")
        box(lty="solid",col="black")
        text(-72.38,40,labels=confidCheck)
        north.arrow(-72.07,40.24,0.09)
        legend("topleft",legend=c("WEAs","States","SLA Boundary"),
               title="Legend",bty="o",pt.bg=c("white","gray",NA),
               lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
               col=c("black","black","dodgerblue2"),pt.cex=1.2)
        text(-71.85,40.85,labels="Relative\nVMS\nDensity",xpd=TRUE)
        text(-72.15,40.05,labels="Datum: NAD1983",cex=0.8)
        map.scale(x=-72.7,y=40.09,relwidth=0.1,metric=FALSE,ratio=FALSE)
        dev.off()

        # Save the raster
        filename4<-paste(oneYear,"_",fish,"_fishing.img",sep="")
        filename5<-paste(oneYear,"_",fish,"_focal_",fileNameConfid,".img",sep="")
        writeRaster(datRast,filename4,format="HFA",overwrite=TRUE)
        writeRaster(rc,filename5,format="HFA",overwrite=TRUE)

      }

    }

  }

remove(datRast,datRastFocal,rc,rclmat,m,maxDens,subDat,subDat2,confidCheck,fileNameConfid,Boats,Fishermen,Deale
rs)

  for (gear in gears){

    # Subset by gear
    subDat<-subset(yearDat,VTR.Gear.name==gear)

    if((nrow(subDat)>0)==TRUE){

      # Confidentiality check
      Boats<-as.numeric(length(unique(subDat$PERMIT)))
      Fishermen<-as.numeric(length(unique(subDat$Land.Fisherman)))
      Dealers<-as.numeric(length(unique(subDat$Land.Dealer.License.Nbr)))
      if (Boats>2 & Fishermen>2 & Dealers>2){
        confidCheck<-"These data meet the ACCSP Rule of 3."
        fileNameConfid<-"NC"
      } else {
        confidCheck<-"THESE DATA ARE CONFIDENTIAL."
        fileNameConfid<-"C"
```

```
}

# Drop unnecessary data for mapping
subDat2<-subDat[,(names(subDat) %in% speciesKeeps)]

# Convert to coordinates (spatial points data frame)
coordinates(subDat2)<-c("LONGITUDE","LATITUDE")

# Project to match the WEA's projection
proj4string(subDat2)<-"+proj=longlat +datum=NAD83 +no_defs +ellps=GRS80 +towgs84=0,0,0"

# Drop all points within a quarter nautical mile of land to eliminate port activity
subDat2<-subDat2[coastlineBuffer,]

if(length(subDat2)>0){

  # Create empty raster
  rast<-raster(xmn=-74.278,ymn=39.881,xmx=-69.726,ymx=42.151,res=0.01)

  # Fill raster with number of points within each cell
  datRast<-rasterize(subDat2,rast,fun="count")

  gear<-gsub("/","-",gear)

  filename<-paste(oneYear,"_",gear,"_fishing_density_",fileNameConfid,".jpg",sep="")
  plotTitle<-paste(oneYear," ",gear," Fishing Density",sep="")
  jpeg(filename,width=24,height=16,units="cm",res=300)
  par(mai=c(1.02,1.02,0.5,0.5))
  plot(datRast,xlab="Longitude",ylab="Latitude",main=plotTitle,col=pal(10))
  plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
  plot(WEAreas.shape,add=TRUE,lwd=1.5)
  plot(stateOutlines,add=TRUE,col="gray")
  box(lty="solid",col="black")
  text(-70.7,39.925,labels=confidCheck)
  legend("topleft",legend=c("WEAs","States","SLA Boundary"),
         title="Legend",bty="o",pt.bg=c("white","gray",NA),
         lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
         col=c("black","black","dodgerblue2"),pt.cex=1.2)
  text(-69.4,41.8,labels="VMS\nPoint\nDensity",xpd=TRUE)
  text(-70.1,40.019,labels="Datum: NAD1983",cex=0.7)
  north.arrow(-73.39,42,0.08)
  map.scale(x=-71.4,y=40.12,relwidth=0.15,metric=FALSE,ratio=FALSE)
  dev.off()

  # Smooth via focal statistics
  datRastFocal<-focal(datRast,w=matrix(1,3,3),fun=sum,na.rm=T)

  # Reclassify values since they are only relative at this point
  maxDens<-maxValue(datRastFocal)
  m<-c(0,0.1*maxDens,1,
       0.1*maxDens,0.2*maxDens,2,
       0.2*maxDens,0.3*maxDens,3,
       0.3*maxDens,0.4*maxDens,4,
       0.4*maxDens,0.5*maxDens,5,
       0.5*maxDens,0.6*maxDens,6,
       0.6*maxDens,0.7*maxDens,7,
       0.7*maxDens,0.8*maxDens,8,
       0.8*maxDens,0.9*maxDens,9,
       0.9*maxDens,maxDens,10)
  rclmat<-matrix(m,ncol=3,byrow=TRUE)
  rc<-reclassify(datRastFocal,rclmat)

  filename<-paste(oneYear,"_",gear,"_focal_density_",fileNameConfid,".jpg",sep="")
  plotTitle<-paste(oneYear," ",gear," Smoothed Fishing Density",sep="")
  jpeg(filename,width=24,height=16,units="cm",res=300)
  par(mai=c(1.02,1.02,0.5,0.5))
  plot(rc,xlab="Longitude",ylab="Latitude",main=plotTitle,col=pal(10))
  plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
  plot(WEAreas.shape,add=TRUE,lwd=1.5)
  plot(stateOutlines,add=TRUE,col="gray")
  box(lty="solid",col="black")
  text(-70.7,39.925,labels=confidCheck)
  legend("topleft",legend=c("WEAs","States","SLA Boundary"),
         title="Legend",bty="o",pt.bg=c("white","gray",NA),
         lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
         col=c("black","black","dodgerblue2"),pt.cex=1.2)
  text(-69.4,41.8,labels="Relative\nVMS\nDensity",xpd=TRUE)
  text(-70.1,40.019,labels="Datum: NAD1983",cex=0.7)
  north.arrow(-73.39,42,0.08)
  map.scale(x=-71.4,y=40.12,relwidth=0.15,metric=FALSE,ratio=FALSE)
  dev.off()
```

```
        # Closeup #1
        filename2<-paste(oneYear,"_",gear,"_fishing_density_off_MA-RI_",fileNameConfid,".jpg",sep="")
        plotTitle2<-paste(oneYear," ",gear," Fishing Density",sep="")
        jpeg(filename2,width=22,height=16,units="cm",res=300)
        par(mai=c(1.02,1.02,0.5,0.5))
        plot(datRast,xlab="Longitude",ylab="Latitude",main=plotTitle2,col=pal(10),
             xlim=c(-72,-69),ylim=c(40.5,41.75),xaxs="i",yaxs="i")
        plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
        plot(WEAreas.shape,add=TRUE,lwd=1.5)
        plot(stateOutlines,add=TRUE,col="gray")
        box(lty="solid",col="black")
        text(-71.45,40.525,labels=confidCheck)
        legend("topleft",legend=c("WEAs","States","SLA Boundary"),
               title="Legend",bty="o",pt.bg=c("white","gray",NA),
               lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
               col=c("black","black","dodgerblue2"),pt.cex=1.2)
        text(-69.5,41.6,labels="VMS\nPoint\nDensity",xpd=TRUE)
        text(-69.9,40.51,labels="Datum: NAD1983",cex=0.7)
        north.arrow(-71.5,41.71,0.065)
        map.scale(x=-71.95,y=40.625,relwidth=0.15,metric=FALSE,ratio=FALSE)
        dev.off()

        filename2<-paste(oneYear,"_",gear,"_focal_density_off_MA-RI_",fileNameConfid,".jpg",sep="")
        plotTitle2<-paste(oneYear," ",gear," Smoothed Fishing Density",sep="")
        jpeg(filename2,width=22,height=16,units="cm",res=300)
        par(mai=c(1.02,1.02,0.5,0.5))
        plot(rc,xlab="Longitude",ylab="Latitude",main=plotTitle2,col=pal(10),
             xlim=c(-72,-69),ylim=c(40.5,41.75),xaxs="i",yaxs="i")
        plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
        plot(WEAreas.shape,add=TRUE,lwd=1.5)
        plot(stateOutlines,add=TRUE,col="gray")
        box(lty="solid",col="black")
        text(-71.45,40.525,labels=confidCheck)
        legend("topleft",legend=c("WEAs","States","SLA Boundary"),
               title="Legend",bty="o",pt.bg=c("white","gray",NA),
               lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
               col=c("black","black","dodgerblue2"),pt.cex=1.2)
        text(-69.5,41.6,labels="Relative\nVMS\nDensity",xpd=TRUE)
        text(-69.9,40.51,labels="Datum: NAD1983",cex=0.7)
        north.arrow(-71.5,41.71,0.065)
        map.scale(x=-71.95,y=40.625,relwidth=0.15,metric=FALSE,ratio=FALSE)
        dev.off()

        # Closeup #2
        filename3<-paste(oneYear,"_",gear,"_fishing_density_S_of_LongIsland_",fileNameConfid,".jpg",sep="")
        plotTitle3<-paste(oneYear," ",gear," Fishing Density",sep="")
        jpeg(filename3,width=26,height=18,units="cm",res=300)
        par(mai=c(1.02,1.02,0.5,0.5))
        plot(datRast,xlab="Longitude",ylab="Latitude",main=plotTitle3,col=pal(10),xlim=c(-74,-
72),ylim=c(40,41))
        plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
        plot(WEAreas.shape,add=TRUE,lwd=1.5)
        plot(stateOutlines,add=TRUE,col="gray")
        box(lty="solid",col="black")
        text(-72.38,40,labels=confidCheck)
        north.arrow(-72.07,40.24,0.09)
        legend("topleft",legend=c("WEAs","States","SLA Boundary"),
               title="Legend",bty="o",pt.bg=c("white","gray",NA),
               lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
               col=c("black","black","dodgerblue2"),pt.cex=1.2)
        text(-71.85,40.85,labels="VMS\nPoint\nDensity",xpd=TRUE)
        text(-72.15,40.05,labels="Datum: NAD1983",cex=0.8)
        map.scale(x=-72.7,y=40.09,relwidth=0.1,metric=FALSE,ratio=FALSE)
        dev.off()

        filename3<-paste(oneYear,"_",gear,"_focal_density_S_of_LongIsland_",fileNameConfid,".jpg",sep="")
        plotTitle3<-paste(oneYear," ",gear," Smoothed Fishing Density",sep="")
        jpeg(filename3,width=26,height=18,units="cm",res=300)
        par(mai=c(1.02,1.02,0.5,0.5))
        plot(rc,xlab="Longitude",ylab="Latitude",main=plotTitle3,col=pal(10),xlim=c(-74,-72),ylim=c(40,41))
        plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
        plot(WEAreas.shape,add=TRUE,lwd=1.5)
        plot(stateOutlines,add=TRUE,col="gray")
        box(lty="solid",col="black")
        text(-72.38,40,labels=confidCheck)
        north.arrow(-72.07,40.24,0.09)
        legend("topleft",legend=c("WEAs","States","SLA Boundary"),
               title="Legend",bty="o",pt.bg=c("white","gray",NA),
               lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
               col=c("black","black","dodgerblue2"),pt.cex=1.2)
```

```
        text(-71.85,40.85,labels="Relative\nVMS\nDensity",xpd=TRUE)
        text(-72.15,40.05,labels="Datum: NAD1983",cex=0.8)
        map.scale(x=-72.7,y=40.09,relwidth=0.1,metric=FALSE,ratio=FALSE)
        dev.off()

        # Save the raster
        filename4<-paste(oneYear,"_",gear,"_fishing.img",sep="")
        filename5<-paste(oneYear,"_",gear,"_focal_",fileNameConfid,".img",sep="")
        writeRaster(datRast,filename4,format="HFA",overwrite=TRUE)
        writeRaster(rc,filename5,format="HFA",overwrite=TRUE)

      }

    }

  }


remove(datRast,datRastFocal,rc,rclmat,m,maxDens,subDat,subDat2,confidCheck,fileNameConfid,Boats,Fishermen,Deale
rs)

  for (state in states){

    # Subset by state
    subDat<-subset(yearDat,Land.State==state)

    if((nrow(subDat)>0)==TRUE){

      # Confidentiality check
      Boats<-as.numeric(length(unique(subDat$PERMIT)))
      Fishermen<-as.numeric(length(unique(subDat$Land.Fisherman)))
      Dealers<-as.numeric(length(unique(subDat$Land.Dealer.License.Nbr)))
      if (Boats>2 & Fishermen>2 & Dealers>2){
        confidCheck<-"These data meet the ACCSP Rule of 3."
        fileNameConfid<-"NC"
      } else {
        confidCheck<-"THESE DATA ARE CONFIDENTIAL."
        fileNameConfid<-"C"
      }

      # Drop unnecessary data for mapping
      subDat2<-subDat[,(names(subDat) %in% speciesKeeps)]

      # Convert to coordinates (spatial points data frame)
      coordinates(subDat2)<-c("LONGITUDE","LATITUDE")

      # Project to match the WEA's projection
      proj4string(subDat2)<-"+proj=longlat +datum=NAD83 +no_defs +ellps=GRS80 +towgs84=0,0,0"

      # Drop all points within a quarter nautical mile of land to eliminate port activity
      subDat2<-subDat2[coastlineBuffer,]

      if(length(subDat2)>0){

        # Create empty raster
        rast<-raster(xmn=-74.278,ymn=39.881,xmx=-69.726,ymx=42.151,res=0.01)

        # Fill raster with number of points within each cell
        datRast<-rasterize(subDat2,rast,fun="count")

        filename<-paste(oneYear,"_",state,"_fishing_density_",fileNameConfid,".jpg",sep="")
        plotTitle<-paste(oneYear," ",state," Fishing Density",sep="")
        jpeg(filename,width=24,height=16,units="cm",res=300)
        par(mai=c(1.02,1.02,0.5,0.5))
        plot(datRast,xlab="Longitude",ylab="Latitude",main=plotTitle,col=pal(10))
        plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
        plot(WEAreas.shape,add=TRUE,lwd=1.5)
        plot(stateOutlines,add=TRUE,col="gray")
        box(lty="solid",col="black")
        text(-70.7,39.925,labels=confidCheck)
        legend("topleft",legend=c("WEAs","States","SLA Boundary"),
               title="Legend",bty="o",pt.bg=c("white","gray",NA),
               lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
               col=c("black","black","dodgerblue2"),pt.cex=1.2)
        text(-69.4,41.8,labels="VMS\nPoint\nDensity",xpd=TRUE)
        text(-70.1,40.019,labels="Datum: NAD1983",cex=0.7)
        north.arrow(-73.39,42,0.08)
        map.scale(x=-71.4,y=40.12,relwidth=0.15,metric=FALSE,ratio=FALSE)
        dev.off()

        # Smooth via focal statistics
```

```
datRastFocal<-focal(datRast,w=matrix(1,3,3),fun=sum,na.rm=T)

# Reclassify values since they are only relative at this point
maxDens<-maxValue(datRastFocal)
m<-c(0,0.1*maxDens,1,
     0.1*maxDens,0.2*maxDens,2,
     0.2*maxDens,0.3*maxDens,3,
     0.3*maxDens,0.4*maxDens,4,
     0.4*maxDens,0.5*maxDens,5,
     0.5*maxDens,0.6*maxDens,6,
     0.6*maxDens,0.7*maxDens,7,
     0.7*maxDens,0.8*maxDens,8,
     0.8*maxDens,0.9*maxDens,9,
     0.9*maxDens,maxDens,10)
rclmat<-matrix(m,ncol=3,byrow=TRUE)
rc<-reclassify(datRastFocal,rclmat)

filename<-paste(oneYear,"_",state,"_focal_density_",fileNameConfid,".jpg",sep="")
plotTitle<-paste(oneYear," ",state," Smoothed Fishing Density",sep="")
jpeg(filename,width=24,height=16,units="cm",res=300)
par(mai=c(1.02,1.02,0.5,0.5))
plot(rc,xlab="Longitude",ylab="Latitude",main=plotTitle,col=pal(10))
plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
plot(WEAreas.shape,add=TRUE,lwd=1.5)
plot(stateOutlines,add=TRUE,col="gray")
box(lty="solid",col="black")
text(-70.7,39.925,labels=confidCheck)
legend("topleft",legend=c("WEAs","States","SLA Boundary"),
       title="Legend",bty="o",pt.bg=c("white","gray",NA),
       lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
       col=c("black","black","dodgerblue2"),pt.cex=1.2)
text(-69.4,41.8,labels="Relative\nVMS\nDensity",xpd=TRUE)
text(-70.1,40.019,labels="Datum: NAD1983",cex=0.7)
north.arrow(-73.39,42,0.08)
map.scale(x=-71.4,y=40.12,relwidth=0.15,metric=FALSE,ratio=FALSE)
dev.off()

# Closeup #1
filename2<-paste(oneYear,"_",state,"_fishing_density_off_MA-RI_",fileNameConfid,".jpg",sep="")
plotTitle2<-paste(oneYear," ",state," Fishing Density",sep="")
jpeg(filename2,width=22,height=16,units="cm",res=300)
par(mai=c(1.02,1.02,0.5,0.5))
plot(datRast,xlab="Longitude",ylab="Latitude",main=plotTitle2,col=pal(10),
     xlim=c(-72,-69),ylim=c(40.5,41.75),xaxs="i",yaxs="i")
plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
plot(WEAreas.shape,add=TRUE,lwd=1.5)
plot(stateOutlines,add=TRUE,col="gray")
box(lty="solid",col="black")
text(-71.45,40.525,labels=confidCheck)
legend("topleft",legend=c("WEAs","States","SLA Boundary"),
       title="Legend",bty="o",pt.bg=c("white","gray",NA),
       lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
       col=c("black","black","dodgerblue2"),pt.cex=1.2)
text(-69.5,41.6,labels="VMS\nPoint\nDensity",xpd=TRUE)
text(-69.9,40.51,labels="Datum: NAD1983",cex=0.7)
north.arrow(-71.5,41.71,0.065)
map.scale(x=-71.95,y=40.625,relwidth=0.15,metric=FALSE,ratio=FALSE)
dev.off()

filename2<-paste(oneYear,"_",state,"_focal_density_off_MA-RI_",fileNameConfid,".jpg",sep="")
plotTitle2<-paste(oneYear," ",state," Smoothed Fishing Density",sep="")
jpeg(filename2,width=22,height=16,units="cm",res=300)
par(mai=c(1.02,1.02,0.5,0.5))
plot(rc,xlab="Longitude",ylab="Latitude",main=plotTitle2,col=pal(10),
     xlim=c(-72,-69),ylim=c(40.5,41.75),xaxs="i",yaxs="i")
plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
plot(WEAreas.shape,add=TRUE,lwd=1.5)
plot(stateOutlines,add=TRUE,col="gray")
box(lty="solid",col="black")
text(-71.45,40.525,labels=confidCheck)
legend("topleft",legend=c("WEAs","States","SLA Boundary"),
       title="Legend",bty="o",pt.bg=c("white","gray",NA),
       lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
       col=c("black","black","dodgerblue2"),pt.cex=1.2)
text(-69.5,41.6,labels="Relative\nVMS\nDensity",xpd=TRUE)
text(-69.9,40.51,labels="Datum: NAD1983",cex=0.7)
north.arrow(-71.5,41.71,0.065)
map.scale(x=-71.95,y=40.625,relwidth=0.15,metric=FALSE,ratio=FALSE)
dev.off()

# Closeup #2
```

```
        filename3<-paste(oneYear,"_",state,"_fishing_density_S_of_LongIsland_",fileNameConfid,".jpg",sep="")
        plotTitle3<-paste(oneYear," ",state," Fishing Density",sep="")
        jpeg(filename3,width=26,height=18,units="cm",res=300)
        par(mai=c(1.02,1.02,0.5,0.5))
        plot(datRast,xlab="Longitude",ylab="Latitude",main=plotTitle3,col=pal(10),xlim=c(-74,-
72),ylim=c(40,41))
        plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
        plot(WEAreas.shape,add=TRUE,lwd=1.5)
        plot(stateOutlines,add=TRUE,col="gray")
        box(lty="solid",col="black")
        text(-72.38,40,labels=confidCheck)
        north.arrow(-72.07,40.24,0.09)
        legend("topleft",legend=c("WEAs","States","SLA Boundary"),
               title="Legend",bty="o",pt.bg=c("white","gray",NA),
               lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
               col=c("black","black","dodgerblue2"),pt.cex=1.2)
        text(-71.85,40.85,labels="VMS\nPoint\nDensity",xpd=TRUE)
        text(-72.15,40.05,labels="Datum: NAD1983",cex=0.8)
        map.scale(x=-72.7,y=40.09,relwidth=0.1,metric=FALSE,ratio=FALSE)
        dev.off()

        filename3<-paste(oneYear,"_",state,"_focal_density_S_of_LongIsland_",fileNameConfid,".jpg",sep="")
        plotTitle3<-paste(oneYear," ",state," Smoothed Fishing Density",sep="")
        jpeg(filename3,width=26,height=18,units="cm",res=300)
        par(mai=c(1.02,1.02,0.5,0.5))
        plot(rc,xlab="Longitude",ylab="Latitude",main=plotTitle3,col=pal(10),xlim=c(-74,-72),ylim=c(40,41))
        plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
        plot(WEAreas.shape,add=TRUE,lwd=1.5)
        plot(stateOutlines,add=TRUE,col="gray")
        box(lty="solid",col="black")
        text(-72.38,40,labels=confidCheck)
        north.arrow(-72.07,40.24,0.09)
        legend("topleft",legend=c("WEAs","States","SLA Boundary"),
               title="Legend",bty="o",pt.bg=c("white","gray",NA),
               lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
               col=c("black","black","dodgerblue2"),pt.cex=1.2)
        text(-71.85,40.85,labels="Relative\nVMS\nDensity",xpd=TRUE)
        text(-72.15,40.05,labels="Datum: NAD1983",cex=0.8)
        map.scale(x=-72.7,y=40.09,relwidth=0.1,metric=FALSE,ratio=FALSE)
        dev.off()

        # Save the raster
        filename4<-paste(oneYear,"_",state,"_fishing.img",sep="")
        filename5<-paste(oneYear,"_",state,"_focal_",fileNameConfid,".img",sep="")
        writeRaster(datRast,filename4,format="HFA",overwrite=TRUE)
        writeRaster(rc,filename5,format="HFA",overwrite=TRUE)

      }

    }


remove(datRast,datRastFocal,rc,rclmat,m,maxDens,subDat,subDat2,confidCheck,fileNameConfid,Boats,Fishermen,Deale
rs)

    for (port in ports){

      # Subset by port
      subDat<-subset(yearDat,Land.Port==port)

      if((nrow(subDat)>0)==TRUE){

        # Confidentiality check
        Boats<-as.numeric(length(unique(subDat$PERMIT)))
        Fishermen<-as.numeric(length(unique(subDat$Land.Fisherman)))
        Dealers<-as.numeric(length(unique(subDat$Land.Dealer.License.Nbr)))
        if (Boats>2 & Fishermen>2 & Dealers>2){
          confidCheck<-"These data meet the ACCSP Rule of 3."
          fileNameConfid<-"NC"
        } else {
          confidCheck<-"THESE DATA ARE CONFIDENTIAL."
          fileNameConfid<-"C"
        }

        # Drop unnecessary data for mapping
        subDat2<-subDat[,(names(subDat) %in% speciesKeeps)]

        # Convert to coordinates (spatial points data frame)
        coordinates(subDat2)<-c("LONGITUDE","LATITUDE")

        # Project to match the WEA's projection
```

```
proj4string(subDat2)<-"+proj=longlat +datum=NAD83 +no_defs +ellps=GRS80 +towgs84=0,0,0"

# Drop all points within a quarter nautical mile of land to eliminate port activity
subDat2<-subDat2[coastlineBuffer,]

if(length(subDat2)>0){

  # Create empty raster
  rast<-raster(xmn=-74.278,ymn=39.881,xmx=-69.726,ymx=42.151,res=0.01)

  # Fill raster with number of points within each cell
  datRast<-rasterize(subDat2,rast,fun="count")

  filename<-paste(oneYear,"_",port,"_fishing_density_",fileNameConfid,".jpg",sep="")
  plotTitle<-paste(oneYear," ",port," Fishing Density",sep="")
  jpeg(filename,width=24,height=16,units="cm",res=300)
  par(mai=c(1.02,1.02,0.5,0.5))
  plot(datRast,xlab="Longitude",ylab="Latitude",main=plotTitle,col=pal(10))
  plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
  plot(WEAreas.shape,add=TRUE,lwd=1.5)
  plot(stateOutlines,add=TRUE,col="gray")
  box(lty="solid",col="black")
  text(-70.7,39.925,labels=confidCheck)
  legend("topleft",legend=c("WEAs","States","SLA Boundary"),
         title="Legend",bty="o",pt.bg=c("white","gray",NA),
         lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
         col=c("black","black","dodgerblue2"),pt.cex=1.2)
  text(-69.4,41.8,labels="VMS\nPoint\nDensity",xpd=TRUE)
  text(-70.1,40.019,labels="Datum: NAD1983",cex=0.7)
  north.arrow(-73.39,42,0.08)
  map.scale(x=-71.4,y=40.12,relwidth=0.15,metric=FALSE,ratio=FALSE)
  dev.off()

  # Smooth via focal statistics
  datRastFocal<-focal(datRast,w=matrix(1,3,3),fun=sum,na.rm=T)

  # Reclassify values since they are only relative at this point
  maxDens<-maxValue(datRastFocal)
  m<-c(0,0.1*maxDens,1,
       0.1*maxDens,0.2*maxDens,2,
       0.2*maxDens,0.3*maxDens,3,
       0.3*maxDens,0.4*maxDens,4,
       0.4*maxDens,0.5*maxDens,5,
       0.5*maxDens,0.6*maxDens,6,
       0.6*maxDens,0.7*maxDens,7,
       0.7*maxDens,0.8*maxDens,8,
       0.8*maxDens,0.9*maxDens,9,
       0.9*maxDens,maxDens,10)
  rclmat<-matrix(m,ncol=3,byrow=TRUE)
  rc<-reclassify(datRastFocal,rclmat)

  filename2<-paste(oneYear,"_",port,"_focal_density_",fileNameConfid,".jpg",sep="")
  plotTitle2<-paste(oneYear," ",port," Smoothed Fishing Density",sep="")
  jpeg(filename2,width=24,height=16,units="cm",res=300)
  par(mai=c(1.02,1.02,0.5,0.5))
  plot(rc,xlab="Longitude",ylab="Latitude",main=plotTitle2,col=pal(10))
  plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
  plot(WEAreas.shape,add=TRUE,lwd=1.5)
  plot(stateOutlines,add=TRUE,col="gray")
  box(lty="solid",col="black")
  text(-70.7,39.925,labels=confidCheck)
  legend("topleft",legend=c("WEAs","States","SLA Boundary"),
         title="Legend",bty="o",pt.bg=c("white","gray",NA),
         lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
         col=c("black","black","dodgerblue2"),pt.cex=1.2)
  text(-69.4,41.8,labels="Relative\nVMS\nDensity",xpd=TRUE)
  text(-70.1,40.019,labels="Datum: NAD1983",cex=0.7)
  north.arrow(-73.39,42,0.08)
  map.scale(x=-71.4,y=40.12,relwidth=0.15,metric=FALSE,ratio=FALSE)
  dev.off()

  # Closeup #1
  filename3<-paste(oneYear,"_",port,"_fishing_density_off_MA-RI_",fileNameConfid,".jpg",sep="")
  plotTitle3<-paste(oneYear," ",port," Fishing Density",sep="")
  jpeg(filename3,width=22,height=16,units="cm",res=300)
  par(mai=c(1.02,1.02,0.5,0.5))
  plot(datRast,xlab="Longitude",ylab="Latitude",main=plotTitle3,col=pal(10),
       xlim=c(-72,-69),ylim=c(40.5,41.75),xaxs="i",yaxs="i")
  plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
  plot(WEAreas.shape,add=TRUE,lwd=1.5)
  plot(stateOutlines,add=TRUE,col="gray")
```

```
box(lty="solid",col="black")
text(-71.45,40.525,labels=confidCheck)
legend("topleft",legend=c("WEAs","States","SLA Boundary"),
       title="Legend",bty="o",pt.bg=c("white","gray",NA),
       lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
       col=c("black","black","dodgerblue2"),pt.cex=1.2)
text(-69.5,41.6,labels="Relative\nVMS\nDensity",xpd=TRUE)
text(-69.9,40.51,labels="Datum: NAD1983",cex=0.7)
north.arrow(-71.5,41.71,0.065)
map.scale(x=-71.95,y=40.625,relwidth=0.15,metric=FALSE,ratio=FALSE)
dev.off()

filename4<-paste(oneYear,"_",port,"_focal_density_off_MA-RI_",fileNameConfid,".jpg",sep="")
plotTitle4<-paste(oneYear," ",port," Smoothed Fishing Density",sep="")
jpeg(filename4,width=22,height=16,units="cm",res=300)
par(mai=c(1.02,1.02,0.5,0.5))
plot(rc,xlab="Longitude",ylab="Latitude",main=plotTitle4,col=pal(10),
     xlim=c(-72,-69),ylim=c(40.5,41.75),xaxs="i",yaxs="i")
plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
plot(WEAreas.shape,add=TRUE,lwd=1.5)
plot(stateOutlines,add=TRUE,col="gray")
box(lty="solid",col="black")
text(-71.45,40.525,labels=confidCheck)
legend("topleft",legend=c("WEAs","States","SLA Boundary"),
       title="Legend",bty="o",pt.bg=c("white","gray",NA),
       lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
       col=c("black","black","dodgerblue2"),pt.cex=1.2)
text(-69.5,41.6,labels="VMS\nPoint\nDensity",xpd=TRUE)
text(-69.9,40.51,labels="Datum: NAD1983",cex=0.7)
north.arrow(-71.5,41.71,0.065)
map.scale(x=-71.95,y=40.625,relwidth=0.15,metric=FALSE,ratio=FALSE)
dev.off()

# Closeup #2
filename5<-paste(oneYear,"_",port,"_fishing_density_S_of_LongIsland_",fileNameConfid,".jpg",sep="")
plotTitle5<-paste(oneYear," ",port," Fishing Density",sep="")
jpeg(filename5,width=26,height=18,units="cm",res=300)
par(mai=c(1.02,1.02,0.5,0.5))
plot(datRast,xlab="Longitude",ylab="Latitude",main=plotTitle5,col=pal(10),xlim=c(-74,-
72),ylim=c(40,41))
plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
plot(WEAreas.shape,add=TRUE,lwd=1.5)
plot(stateOutlines,add=TRUE,col="gray")
box(lty="solid",col="black")
text(-72.38,40,labels=confidCheck)
north.arrow(-72.07,40.24,0.09)
legend("topleft",legend=c("WEAs","States","SLA Boundary"),
       title="Legend",bty="o",pt.bg=c("white","gray",NA),
       lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
       col=c("black","black","dodgerblue2"),pt.cex=1.2)
text(-71.85,40.85,labels="Relative\nVMS\nDensity",xpd=TRUE)
text(-72.15,40.05,labels="Datum: NAD1983",cex=0.8)
map.scale(x=-72.7,y=40.09,relwidth=0.1,metric=FALSE,ratio=FALSE)
dev.off()

filename6<-paste(oneYear,"_",port,"_focal_density_S_of_LongIsland_",fileNameConfid,".jpg",sep="")
plotTitle6<-paste(oneYear," ",port," Smoothed Fishing Density",sep="")
jpeg(filename6,width=26,height=18,units="cm",res=300)
par(mai=c(1.02,1.02,0.5,0.5))
plot(rc,xlab="Longitude",ylab="Latitude",main=plotTitle6,col=pal(10),xlim=c(-74,-72),ylim=c(40,41))
plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
plot(WEAreas.shape,add=TRUE,lwd=1.5)
plot(stateOutlines,add=TRUE,col="gray")
box(lty="solid",col="black")
text(-72.38,40,labels=confidCheck)
north.arrow(-72.07,40.24,0.09)
legend("topleft",legend=c("WEAs","States","SLA Boundary"),
       title="Legend",bty="o",pt.bg=c("white","gray",NA),
       lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
       col=c("black","black","dodgerblue2"),pt.cex=1.2)
text(-71.85,40.85,labels="VMS\nPoint\nDensity",xpd=TRUE)
text(-72.15,40.05,labels="Datum: NAD1983",cex=0.8)
map.scale(x=-72.7,y=40.09,relwidth=0.1,metric=FALSE,ratio=FALSE)
dev.off()

# Save the raster
filename7<-paste(oneYear,"_",port,"_fishing.img",sep="")
filename8<-paste(oneYear,"_",port,"_focal_",fileNameConfid,".img",sep="")
writeRaster(datRast,filename7,format="HFA",overwrite=TRUE)
writeRaster(rc,filename8,format="HFA",overwrite=TRUE)
```

```
        }

      }

    }

  }

}

remove(datRast,datRastFocal,rc,rclmat,m,maxDens,subDat,subDat2,confidCheck,fileNameConfid,Boats,Fishermen,Deale
rs,
       filename,filename2,filename3,filename4,filename5,filename6,filename7,filename8)

##### The gear files were too large to make for 2011-2016 but we can
##### do raster algebra to add up the annual files into aggregate files
##### covering the whole time period. Note that we cannot do a confidentiality
##### check for each cumulative gear since we only have lat longs. Will need
##### to confirm that at least one year for each gear type meets rule of 3.

# Replace all slashes with hyphens in gear names again
gears<-gsub("/","-",gears)

for (gear in gears){

  yr2011name<-paste("2011_",gear,"_fishing.img",sep="")
  yr2012name<-paste("2012_",gear,"_fishing.img",sep="")
  yr2013name<-paste("2013_",gear,"_fishing.img",sep="")
  yr2014name<-paste("2014_",gear,"_fishing.img",sep="")
  yr2015name<-paste("2015_",gear,"_fishing.img",sep="")
  yr2016name<-paste("2016_",gear,"_fishing.img",sep="")

  existingYears<-vector()

  if (file.exists(yr2011name)==TRUE){
    existingYears<-c(existingYears,yr2011name)
  }
  if (file.exists(yr2012name)==TRUE){
    existingYears<-c(existingYears,yr2012name)
  }
  if (file.exists(yr2013name)==TRUE){
    existingYears<-append(existingYears,yr2013name)
  }
  if (file.exists(yr2014name)==TRUE){
    existingYears<-c(existingYears,yr2014name)
  }
  if (file.exists(yr2015name)==TRUE){
    existingYears<-append(existingYears,yr2015name)
  }
  if (file.exists(yr2016name)==TRUE){
    existingYears<-c(existingYears,yr2016name)
  }

  allYrs<-raster(xmn=-74.278,ymn=39.881,xmx=-69.726,ymx=42.151,res=0.01)
  allYrs[]<-0

  # Add all years up
  if (length(existingYears)>0){
    for (i in existingYears){
      YRi<-raster(i)
      YRi[is.na(YRi[])]<-0
      allYrs<-allYrs+YRi
    }
  }

  allYrs[allYrs==0]<-NA

  filename<-paste("2011-2016_",gear,"_fishing.jpg",sep="")
  plotTitle<-paste("2011-2016 ",gear," Fishing Density",sep="")
  jpeg(filename,width=24,height=16,units="cm",res=300)
  par(mai=c(1.02,1.02,0.5,0.5))
  plot(allYrs,xlab="Longitude",ylab="Latitude",main=plotTitle,col=pal(10))
  plot(WEAreas.shape,add=TRUE,lwd=1.5)
  plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
  plot(stateOutlines,add=TRUE,col="gray")
  box(lty="solid",col="black")
  legend("topleft",legend=c("WEAs","States","SLA Boundary"),
         title="Legend",bty="o",pt.bg=c("white","gray",NA),
         lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
         col=c("black","black","dodgerblue2"),pt.cex=1.2)
  text(-69.4,41.8,labels="Relative\nVMS\nDensity",xpd=TRUE)
```

```
text(-70.1,40.019,labels="Datum: NAD1983",cex=0.7)
north.arrow(-73.39,42,0.08)
map.scale(x=-71.4,y=40.12,relwidth=0.15,metric=FALSE,ratio=FALSE)
dev.off()

# Smooth via focal statistics
allYrsFocal<-focal(allYrs,w=matrix(1,3,3),fun=sum,na.rm=T)

# Reclassify values since they are only relative at this point
maxDens<-maxValue(allYrsFocal)
m<-c(0,0.1*maxDens,1,
     0.1*maxDens,0.2*maxDens,2,
     0.2*maxDens,0.3*maxDens,3,
     0.3*maxDens,0.4*maxDens,4,
     0.4*maxDens,0.5*maxDens,5,
     0.5*maxDens,0.6*maxDens,6,
     0.6*maxDens,0.7*maxDens,7,
     0.7*maxDens,0.8*maxDens,8,
     0.8*maxDens,0.9*maxDens,9,
     0.9*maxDens,maxDens,10)
rclmat<-matrix(m,ncol=3,byrow=TRUE)
allrc<-reclassify(allYrsFocal,rclmat)

filename<-paste("2011-2016_",gear,"_focal.jpg",sep="")
plotTitle<-paste("2011-2016 ",gear," Smoothed Fishing Density",sep="")
jpeg(filename,width=24,height=16,units="cm",res=300)
par(mai=c(1.02,1.02,0.5,0.5))
plot(allrc,xlab="Longitude",ylab="Latitude",main=plotTitle,col=pal(10))
plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
plot(WEAreas.shape,add=TRUE,lwd=1.5)
plot(stateOutlines,add=TRUE,col="gray")
box(lty="solid",col="black")
legend("topleft",legend=c("WEAs","States","SLA Boundary"),
       title="Legend",bty="o",pt.bg=c("white","gray",NA),
       lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
       col=c("black","black","dodgerblue2"),pt.cex=1.2)
text(-69.4,41.8,labels="Relative\nVMS\nDensity",xpd=TRUE)
text(-70.1,40.019,labels="Datum: NAD1983",cex=0.7)
north.arrow(-73.39,42,0.08)
map.scale(x=-71.4,y=40.12,relwidth=0.15,metric=FALSE,ratio=FALSE)
dev.off()

# Closeup #1
filename2<-paste("2011-2016_",gear,"_fishing_density_off_MA-RI.jpg",sep="")
plotTitle2<-paste("2011-2016 ",gear," Fishing Density",sep="")
jpeg(filename2,width=22,height=16,units="cm",res=300)
par(mai=c(1.02,1.02,0.5,0.5))
plot(allYrs,xlab="Longitude",ylab="Latitude",main=plotTitle2,col=pal(10),
     xlim=c(-72,-69),ylim=c(40.5,41.75),xaxs="i",yaxs="i")
plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
plot(WEAreas.shape,add=TRUE,lwd=1.5)
plot(stateOutlines,add=TRUE,col="gray")
box(lty="solid",col="black")
legend("topleft",legend=c("WEAs","States","SLA Boundary"),
       title="Legend",bty="o",pt.bg=c("white","gray",NA),
       lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
       col=c("black","black","dodgerblue2"),pt.cex=1.2)
text(-69.5,41.6,labels="VMS\nPoint\nDensity",xpd=TRUE)
text(-69.9,40.51,labels="Datum: NAD1983",cex=0.7)
north.arrow(-71.5,41.71,0.065)
map.scale(x=-71.95,y=40.625,relwidth=0.15,metric=FALSE,ratio=FALSE)
dev.off()

filename2<-paste("2011-2016_",gear,"_focal_density_off_MA-RI.jpg",sep="")
plotTitle2<-paste("2011-2016 ",gear," Smoothed Fishing Density",sep="")
jpeg(filename2,width=22,height=16,units="cm",res=300)
par(mai=c(1.02,1.02,0.5,0.5))
plot(allrc,xlab="Longitude",ylab="Latitude",main=plotTitle2,col=pal(10),
     xlim=c(-72,-69),ylim=c(40.5,41.75),xaxs="i",yaxs="i")
plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
plot(WEAreas.shape,add=TRUE,lwd=1.5)
plot(stateOutlines,add=TRUE,col="gray")
box(lty="solid",col="black")
legend("topleft",legend=c("WEAs","States","SLA Boundary"),
       title="Legend",bty="o",pt.bg=c("white","gray",NA),
       lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
       col=c("black","black","dodgerblue2"),pt.cex=1.2)
text(-69.5,41.6,labels="Relative\nVMS\nDensity",xpd=TRUE)
text(-69.9,40.51,labels="Datum: NAD1983",cex=0.7)
north.arrow(-71.5,41.71,0.065)
map.scale(x=-71.95,y=40.625,relwidth=0.15,metric=FALSE,ratio=FALSE)
```

```
  dev.off()

  # Closeup #2
  filename3<-paste("2011-2016_",gear,"_fishing_density_S_of_LongIsland.jpg",sep="")
  plotTitle3<-paste("2011-2016 ",gear," Fishing Density",sep="")
  jpeg(filename3,width=26,height=18,units="cm",res=300)
  par(mai=c(1.02,1.02,0.5,0.5))
  plot(allYrs,xlab="Longitude",ylab="Latitude",main=plotTitle3,col=pal(10),xlim=c(-74,-72),ylim=c(40,41))
  plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
  plot(WEAreas.shape,add=TRUE,lwd=1.5)
  plot(stateOutlines,add=TRUE,col="gray")
  box(lty="solid",col="black")
  north.arrow(-72.07,40.24,0.09)
  legend("topleft",legend=c("WEAs","States","SLA Boundary"),
         title="Legend",bty="o",pt.bg=c("white","gray",NA),
         lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
         col=c("black","black","dodgerblue2"),pt.cex=1.2)
  text(-71.85,40.85,labels="VMS\nPoint\nDensity",xpd=TRUE)
  text(-72.15,40.05,labels="Datum: NAD1983",cex=0.8)
  map.scale(x=-72.7,y=40.09,relwidth=0.1,metric=FALSE,ratio=FALSE)
  dev.off()

  filename3<-paste("2011-2016_",gear,"_focal_density_S_of_LongIsland.jpg",sep="")
  plotTitle3<-paste("2011-2016 ",gear," Smoothed Fishing Density",sep="")
  jpeg(filename3,width=26,height=18,units="cm",res=300)
  par(mai=c(1.02,1.02,0.5,0.5))
  plot(allrc,xlab="Longitude",ylab="Latitude",main=plotTitle3,col=pal(10),xlim=c(-74,-72),ylim=c(40,41))
  plot(subLandsAct.shape,add=TRUE,col="dodgerblue2")
  plot(WEAreas.shape,add=TRUE,lwd=1.5)
  plot(stateOutlines,add=TRUE,col="gray")
  box(lty="solid",col="black")
  north.arrow(-72.07,40.24,0.09)
  legend("topleft",legend=c("WEAs","States","SLA Boundary"),
         title="Legend",bty="o",pt.bg=c("white","gray",NA),
         lty=c( -1,-1,1),pch=c(22,22,-1),bg=c("white"),
         col=c("black","black","dodgerblue2"),pt.cex=1.2)
  text(-71.85,40.85,labels="Relative\nVMS\nDensity",xpd=TRUE)
  text(-72.15,40.05,labels="Datum: NAD1983",cex=0.8)
  map.scale(x=-72.7,y=40.09,relwidth=0.1,metric=FALSE,ratio=FALSE)
  dev.off()

  filename4<-paste("2011-2016_",gear,"_fishing.img",sep="")
  filename5<-paste("2011-2016_",gear,"_focal.img",sep="")
  writeRaster(allYrs,filename4,format="HFA",overwrite=TRUE)
  writeRaster(allrc,filename5,format="HFA",overwrite=TRUE)

  # Will need to check to make sure at least one year for each gear type
  # meets rule of 3. We have no other way to check compliance here because
  # we dropped all other data (only locations left).

}
```

Table 30. Lookup table used in Value_Aggregation.R to update some species names to their corresponding fishery management plans prior to summing value by year and species/fishery. This table formatting is required of the addNewData function.

lookupVariable	lookupValue	newVariable	newValue	source
Land.Common.Name	ALBACORE	Land.Common.Name	ALBACORE	Julia L.
Land.Common.Name	ALEWIFE	Land.Common.Name	ALEWIFE	Julia L.
Land.Common.Name	AMBERJACK	Land.Common.Name	AMBERJACK	Julia L.
Land.Common.Name	ANCHOVY,BAY	Land.Common.Name	ANCHOVY,BAY	Julia L.
Land.Common.Name	ARK, BLOOD	Land.Common.Name	ARK, BLOOD	Julia L.
Land.Common.Name	ATLANTIC SALMON	Land.Common.Name	ATLANTIC SALMON	Julia L.
Land.Common.Name	BARRACUDAS	Land.Common.Name	BARRACUDAS	Julia L.
Land.Common.Name	BARRELFISH	Land.Common.Name	BARRELFISH	Julia L.
Land.Common.Name	BASS, BLACK SEA	Land.Common.Name	Summer Flounder, Scup, Black Sea Bass FMP	Julia L.

Land.Common.Name	BASS, STRIPED	Land.Common.Name	BASS, STRIPED	Julia L.
Land.Common.Name	BLUEFISH	Land.Common.Name	Bluefish FMP	Julia L.
Land.Common.Name	BONITO, ATLANTIC	Land.Common.Name	BONITO, ATLANTIC	Julia L.
Land.Common.Name	BUTTERFISH	Land.Common.Name	Squid Mackerel Butterfish FMP	Julia L.
Land.Common.Name	CLAM ATLANTIC RAZOR	Land.Common.Name	CLAM ATLANTIC RAZOR	Julia L.
Land.Common.Name	CLAM, ARCTIC SURF	Land.Common.Name	CLAM, ARCTIC SURF	Julia L.
Land.Common.Name	CLAM, NORTHERN QUAHOG	Land.Common.Name	CLAM, NORTHERN QUAHOG	Julia L.
Land.Common.Name	CLAM, SOFT	Land.Common.Name	CLAM, SOFT	Julia L.
Land.Common.Name	CLAM, SPECIES NOT SPECIFIED	Land.Common.Name	CLAM, SPECIES NOT SPECIFIED	Julia L.
Land.Common.Name	COBIA	Land.Common.Name	Coastal Migratory Pelagics FMP	Julia L.
Land.Common.Name	COD, ATLANTIC	Land.Common.Name	Northeast Multispecies FMP	Julia L.
Land.Common.Name	CRAB, ATLANTIC ROCK	Land.Common.Name	CRAB, ATLANTIC ROCK	Julia L.
Land.Common.Name	CRAB, BLUE	Land.Common.Name	CRAB, BLUE	Julia L.
Land.Common.Name	CRAB, CANCER	Land.Common.Name	CRAB, CANCER	Julia L.
Land.Common.Name	CRAB, GREEN	Land.Common.Name	CRAB, GREEN	Julia L.
Land.Common.Name	CRAB, HERMIT	Land.Common.Name	CRAB, HERMIT	Julia L.
Land.Common.Name	CRAB, HORSESHOE	Land.Common.Name	CRAB, HORSESHOE	Julia L.
Land.Common.Name	CRAB, JONAH	Land.Common.Name	CRAB, JONAH	Julia L.
Land.Common.Name	CRAB, LADY	Land.Common.Name	CRAB, LADY	Julia L.
Land.Common.Name	CRAB, QUEEN SNOW	Land.Common.Name	CRAB, QUEEN SNOW	Julia L.
Land.Common.Name	CRAB, RED DEEPSEA	Land.Common.Name	Northeast Red Crab FMP	Julia L.
Land.Common.Name	CRAB, SPECIES NOT SPECIFIED	Land.Common.Name	CRAB, SPECIES NOT SPECIFIED	Julia L.
Land.Common.Name	CRABS, SPIDER	Land.Common.Name	CRABS, SPIDER	Julia L.
Land.Common.Name	CROAKER, ATLANTIC	Land.Common.Name	CROAKER, ATLANTIC	Julia L.
Land.Common.Name	CUCUMBERS, SEA	Land.Common.Name	CUCUMBERS, SEA	Julia L.
Land.Common.Name	CUNNER	Land.Common.Name	CUNNER	Julia L.
Land.Common.Name	CUSK	Land.Common.Name	CUSK	Julia L.
Land.Common.Name	DOGFISH, BLACK	Land.Common.Name	DOGFISH, BLACK	Julia L.
Land.Common.Name	DOGFISH, CHAIN	Land.Common.Name	DOGFISH, CHAIN	Julia L.
Land.Common.Name	DOGFISH, SMOOTH	Land.Common.Name	DOGFISH, SMOOTH	Julia L.
Land.Common.Name	DOGFISH, SPECIES NOT SPECIFIED	Land.Common.Name	DOGFISH, SPECIES NOT SPECIFIED	Julia L.
Land.Common.Name	DOGFISH, SPINY	Land.Common.Name	DOGFISH, SPINY	Julia L.
Land.Common.Name	DOLPHINFISH	Land.Common.Name	DOLPHINFISH	Julia L.
Land.Common.Name	DORY, AMERICAN JOHN	Land.Common.Name	DORY, AMERICAN JOHN	Julia L.
Land.Common.Name	DRUM, BLACK	Land.Common.Name	DRUM, BLACK	Julia L.
Land.Common.Name	DRUM, RED	Land.Common.Name	DRUM, RED	Julia L.
Land.Common.Name	DRUM, SPECIES NOT SPECIFIED	Land.Common.Name	DRUM, SPECIES NOT SPECIFIED	Julia L.
Land.Common.Name	EEL, AMERICAN	Land.Common.Name	EEL, AMERICAN	Julia L.
Land.Common.Name	EEL, CONGER	Land.Common.Name	EEL, CONGER	Julia L.
Land.Common.Name	EEL, SPECIES NOT SPECIFIED	Land.Common.Name	EEL, SPECIES NOT SPECIFIED	Julia L.
Land.Common.Name	ESCOLAR	Land.Common.Name	ESCOLAR	Julia L.
Land.Common.Name	FLOUNDER, SOUTHERN	Land.Common.Name	FLOUNDER, SOUTHERN	Julia L.
Land.Common.Name	FLOUNDER, SPECIES NOT SPECIFIED	Land.Common.Name	FLOUNDER, SPECIES NOT SPECIFIED	Julia L.

Land.Common.Name	FLOUNDER, SUMMER	Land.Common.Name	Summer Flounder, Scup, Black Sea Bass FMP	Julia L.
Land.Common.Name	FLOUNDER, WINTER	Land.Common.Name	Northeast Multispecies FMP	Julia L.
Land.Common.Name	FLOUNDER, WITCH	Land.Common.Name	Northeast Multispecies FMP	Julia L.
Land.Common.Name	FLOUNDER, YELLOWTAIL	Land.Common.Name	Northeast Multispecies FMP	Julia L.
Land.Common.Name	GARFISHES	Land.Common.Name	GARFISHES	Julia L.
Land.Common.Name	GOOSEFISH	Land.Common.Name	Monkfish FMP	Julia L.
Land.Common.Name	GRENADIER, ROUGH HEADED	Land.Common.Name	GRENADIER, ROUGH HEADED	Julia L.
Land.Common.Name	GROUPER, SNOWY	Land.Common.Name	GROUPER, SNOWY	Julia L.
Land.Common.Name	GROUPERS	Land.Common.Name	GROUPERS	Julia L.
Land.Common.Name	GRUNTS	Land.Common.Name	GRUNTS	Julia L.
Land.Common.Name	HADDOCK	Land.Common.Name	Northeast Multispecies FMP	Julia L.
Land.Common.Name	HAGFISH	Land.Common.Name	HAGFISH	Julia L.
Land.Common.Name	HAKE, OFFSHORE	Land.Common.Name	Northeast Small Mesh Multispecies FMP	Julia L.
Land.Common.Name	HAKE, RED	Land.Common.Name	Northeast Small Mesh Multispecies FMP	Julia L.
Land.Common.Name	HAKE, SILVER	Land.Common.Name	Northeast Small Mesh Multispecies FMP	Julia L.
Land.Common.Name	HAKE, SPOTTED	Land.Common.Name	HAKE, SPOTTED	Julia L.
Land.Common.Name	HAKE, WHITE	Land.Common.Name	Northeast Multispecies FMP	Julia L.
Land.Common.Name	HAKE,SPECIES NOT SPECIFIED	Land.Common.Name	HAKE,SPECIES NOT SPECIFIED	Julia L.
Land.Common.Name	HALIBUT, ATLANTIC	Land.Common.Name	HALIBUT, ATLANTIC	Julia L.
Land.Common.Name	HALIBUT, GREENLAND	Land.Common.Name	HALIBUT, GREENLAND	Julia L.
Land.Common.Name	HERRING, ATLANTIC	Land.Common.Name	Northeast Multispecies FMP	Julia L.
Land.Common.Name	HERRING, BLUEBACK	Land.Common.Name	HERRING, BLUEBACK	Julia L.
Land.Common.Name	HERRING/BUSHEL	Land.Common.Name	HERRING/BUSHEL	Julia L.
Land.Common.Name	HOGFISH	Land.Common.Name	HOGFISH	Julia L.
Land.Common.Name	JACK, CREVALLE	Land.Common.Name	JACK, CREVALLE	Julia L.
Land.Common.Name	LADYFISH	Land.Common.Name	LADYFISH	Julia L.
Land.Common.Name	LOBSTER, AMERICAN	Land.Common.Name	LOBSTER, AMERICAN	Julia L.
Land.Common.Name	LUMPFISH	Land.Common.Name	LUMPFISH	Julia L.
Land.Common.Name	MACKEREL, ATLANTIC	Land.Common.Name	Squid Mackerel Butterfish FMP	Julia L.
Land.Common.Name	MACKEREL, CHUB	Land.Common.Name	Squid Mackerel Butterfish FMP	Julia L.
Land.Common.Name	MACKEREL, FRIGATE	Land.Common.Name	MACKEREL, FRIGATE	Julia L.
Land.Common.Name	MACKEREL, KING	Land.Common.Name	Coastal Migratory Pelagics FMP	Julia L.
Land.Common.Name	MACKEREL, SPANISH	Land.Common.Name	Coastal Migratory Pelagics FMP	Julia L.
Land.Common.Name	MARLIN, BLUE	Land.Common.Name	MARLIN, BLUE	Julia L.
Land.Common.Name	MARLIN, WHITE	Land.Common.Name	MARLIN, WHITE	Julia L.
Land.Common.Name	MENHADEN, ATLANTIC	Land.Common.Name	MENHADEN, ATLANTIC	Julia L.
Land.Common.Name	MULLETS	Land.Common.Name	MULLETS	Julia L.
Land.Common.Name	MUSSEL, SEA	Land.Common.Name	MUSSEL, SEA	Julia L.
Land.Common.Name	NO CATCH	Land.Common.Name	NO CATCH	Julia L.
Land.Common.Name	OCEAN SUNFISH / MOOLA	Land.Common.Name	OCEAN SUNFISH / MOOLA	Julia L.
Land.Common.Name	OCTOPUS	Land.Common.Name	OCTOPUS	Julia L.
Land.Common.Name	OPAH	Land.Common.Name	OPAH	Julia L.
Land.Common.Name	OTHER FINFISH	Land.Common.Name	OTHER FINFISH	Julia L.
Land.Common.Name	OTHER INVERTEBRATES	Land.Common.Name	OTHER INVERTEBRATES	Julia L.

Land.Common.Name	OYSTER, EASTERN	Land.Common.Name	OYSTER, EASTERN	Julia L.
Land.Common.Name	PERCH, SAND	Land.Common.Name	PERCH, SAND	Julia L.
Land.Common.Name	PERCH, WHITE	Land.Common.Name	PERCH, WHITE	Julia L.
Land.Common.Name	PLAICE, AMERICAN	Land.Common.Name	Northeast Multispecies FMP	Julia L.
Land.Common.Name	POLLOCK	Land.Common.Name	Northeast Multispecies FMP	Julia L.
Land.Common.Name	POMPANO, FLORIDA	Land.Common.Name	POMPANO, FLORIDA	Julia L.
Land.Common.Name	PORGY, RED	Land.Common.Name	PORGY, RED	Julia L.
Land.Common.Name	POUT, OCEAN	Land.Common.Name	Northeast Multispecies FMP	Julia L.
Land.Common.Name	PUFFER, NORTHERN	Land.Common.Name	PUFFER, NORTHERN	Julia L.
Land.Common.Name	QUAHOG, OCEAN	Land.Common.Name	QUAHOG, OCEAN	Julia L.
Land.Common.Name	RAVEN, SEA	Land.Common.Name	RAVEN, SEA	Julia L.
Land.Common.Name	RAY,COWNOSE	Land.Common.Name	RAY,COWNOSE	Julia L.
Land.Common.Name	REDFISH, ACADIAN	Land.Common.Name	REDFISH, ACADIAN	Julia L.
Land.Common.Name	REDFISH, GOLDEN	Land.Common.Name	REDFISH, GOLDEN	Julia L.
Land.Common.Name	RIBBONFISHES	Land.Common.Name	RIBBONFISHES	Julia L.
Land.Common.Name	ROBINS, SEA	Land.Common.Name	ROBINS, SEA	Julia L.
Land.Common.Name	ROSEFISH, BLACKBELLY	Land.Common.Name	ROSEFISH, BLACKBELLY	Julia L.
Land.Common.Name	RUNNER, BLUE	Land.Common.Name	RUNNER, BLUE	Julia L.
Land.Common.Name	SCAD, ROUGH	Land.Common.Name	SCAD, ROUGH	Julia L.
Land.Common.Name	SCALLOP, BAY	Land.Common.Name	SCALLOP, BAY	Julia L.
Land.Common.Name	SCALLOP, ICELAND	Land.Common.Name	SCALLOP, ICELAND	Julia L.
Land.Common.Name	SCALLOP, SEA	Land.Common.Name	Sea Scallop FMP	Julia L.
Land.Common.Name	SCULPINS	Land.Common.Name	SCULPINS	Julia L.
Land.Common.Name	SCUP	Land.Common.Name	Summer Flounder, Scup, Black Sea Bass FMP	Julia L.
Land.Common.Name	SEATROUT, SPECIES NOT SPECIFIED	Land.Common.Name	SEATROUT, SPECIES NOT SPECIFIED	Julia L.
Land.Common.Name	SEATROUT, SPOTTED	Land.Common.Name	SEATROUT, SPOTTED	Julia L.
Land.Common.Name	SHAD, AMERICAN	Land.Common.Name	SHAD, AMERICAN	Julia L.
Land.Common.Name	SHAD, GIZZARD	Land.Common.Name	SHAD, GIZZARD	Julia L.
Land.Common.Name	SHAD, HICKORY	Land.Common.Name	SHAD, HICKORY	Julia L.
Land.Common.Name	SHARK, ANGEL	Land.Common.Name	SHARK, ANGEL	Julia L.
Land.Common.Name	SHARK, ATLANTIC SHARPNOSE	Land.Common.Name	SHARK, ATLANTIC SHARPNOSE	Julia L.
Land.Common.Name	SHARK, BASKING	Land.Common.Name	SHARK, BASKING	Julia L.
Land.Common.Name	SHARK, BLACKTIP	Land.Common.Name	SHARK, BLACKTIP	Julia L.
Land.Common.Name	SHARK, BLUE	Land.Common.Name	SHARK, BLUE	Julia L.
Land.Common.Name	SHARK, BULL	Land.Common.Name	SHARK, BULL	Julia L.
Land.Common.Name	SHARK, DUSKY	Land.Common.Name	SHARK, DUSKY	Julia L.
Land.Common.Name	SHARK, FINETOOTH	Land.Common.Name	SHARK, FINETOOTH	Julia L.
Land.Common.Name	SHARK, GREENLAND	Land.Common.Name	SHARK, GREENLAND	Julia L.
Land.Common.Name	SHARK, HAMMERHEAD	Land.Common.Name	SHARK, HAMMERHEAD	Julia L.
Land.Common.Name	SHARK, LEMON	Land.Common.Name	SHARK, LEMON	Julia L.
Land.Common.Name	SHARK, MAKO, LONGFIN	Land.Common.Name	SHARK, MAKO, LONGFIN	Julia L.
Land.Common.Name	SHARK, MAKO, SHORTFIN	Land.Common.Name	SHARK, MAKO, SHORTFIN	Julia L.
Land.Common.Name	SHARK, MAKO, SPECIES NOT SPECIFIED	Land.Common.Name	SHARK, MAKO, SPECIES NOT SPECIFIED	Julia L.
Land.Common.Name	SHARK, NOT SPECIFIED	Land.Common.Name	SHARK, NOT SPECIFIED	Julia L.
Land.Common.Name	SHARK, NURSE	Land.Common.Name	SHARK, NURSE	Julia L.

Land.Common.Name	SHARK, OCEANIC WHITETIP	Land.Common.Name	SHARK, OCEANIC WHITETIP	Julia L.
Land.Common.Name	SHARK, PORBEAGLE	Land.Common.Name	SHARK, PORBEAGLE	Julia L.
Land.Common.Name	SHARK, SAND TIGER	Land.Common.Name	SHARK, SAND TIGER	Julia L.
Land.Common.Name	SHARK, SANDBAR	Land.Common.Name	SHARK, SANDBAR	Julia L.
Land.Common.Name	SHARK, SPINNER	Land.Common.Name	SHARK, SPINNER	Julia L.
Land.Common.Name	SHARK, THRESHER	Land.Common.Name	SHARK, THRESHER	Julia L.
Land.Common.Name	SHARK, THRESHER, BIGEYE	Land.Common.Name	SHARK, THRESHER, BIGEYE	Julia L.
Land.Common.Name	SHARK, TIGER	Land.Common.Name	SHARK, TIGER	Julia L.
Land.Common.Name	SHARK, WHITE	Land.Common.Name	SHARK, WHITE	Julia L.
Land.Common.Name	SHEEPSHEAD	Land.Common.Name	SHEEPSHEAD	Julia L.
Land.Common.Name	SHRIMP, MANTIS	Land.Common.Name	SHRIMP, MANTIS	Julia L.
Land.Common.Name	SHRIMP, NORTHERN	Land.Common.Name	SHRIMP, NORTHERN	Julia L.
Land.Common.Name	SHRIMP, SPECIES NOT SPECIFIED	Land.Common.Name	SHRIMP, SPECIES NOT SPECIFIED	Julia L.
Land.Common.Name	SHRIMPS, PENAEID	Land.Common.Name	SHRIMPS, PENAEID	Julia L.
Land.Common.Name	SILVERSIDE, ATLANTIC	Land.Common.Name	SILVERSIDE, ATLANTIC	Julia L.
Land.Common.Name	SKATE UNCLASSIFIED	Land.Common.Name	Skate FMP	Julia L.
Land.Common.Name	SKATE WINGS UNCLASSIFIED	Land.Common.Name	Skate FMP	Julia L.
Land.Common.Name	SKATE WINGS, LITTLE/WINTER MIXED	Land.Common.Name	Skate FMP	Julia L.
Land.Common.Name	SKATE, BARNDOOR	Land.Common.Name	Skate FMP	Julia L.
Land.Common.Name	SKATE, CLEARNOSE	Land.Common.Name	Skate FMP	Julia L.
Land.Common.Name	SKATE, LITTLE	Land.Common.Name	Skate FMP	Julia L.
Land.Common.Name	SKATE, LITTLE/WINTER MIXED	Land.Common.Name	Skate FMP	Julia L.
Land.Common.Name	SKATE, ROSETT	Land.Common.Name	Skate FMP	Julia L.
Land.Common.Name	SKATE, SMOOTH	Land.Common.Name	Skate FMP	Julia L.
Land.Common.Name	SKATE, SPINYTAIL	Land.Common.Name	Skate FMP	Julia L.
Land.Common.Name	SKATE, THORNY	Land.Common.Name	Skate FMP	Julia L.
Land.Common.Name	SKATE, WINTER	Land.Common.Name	Skate FMP	Julia L.
Land.Common.Name	SMELTS	Land.Common.Name	SMELTS	Julia L.
Land.Common.Name	SNAPPER, RED	Land.Common.Name	SNAPPER, RED	Julia L.
Land.Common.Name	SNAPPERS	Land.Common.Name	SNAPPERS	Julia L.
Land.Common.Name	SPADEFISH	Land.Common.Name	SPADEFISH	Julia L.
Land.Common.Name	SPOT	Land.Common.Name	SPOT	Julia L.
Land.Common.Name	SQUID, LONGFIN INSHORE	Land.Common.Name	Squid Mackerel Butterfish FMP	Julia L.
Land.Common.Name	SQUID, NORTHERN SHORTFIN	Land.Common.Name	Squid Mackerel Butterfish FMP	Julia L.
Land.Common.Name	SQUID, SPECIES NOT SPECIFIED	Land.Common.Name	Squid Mackerel Butterfish FMP	Julia L.
Land.Common.Name	STARFISH	Land.Common.Name	STARFISH	Julia L.
Land.Common.Name	STARGAZER, NORTHERN	Land.Common.Name	STARGAZER, NORTHERN	Julia L.
Land.Common.Name	STURGEON, ATLANTIC	Land.Common.Name	STURGEON, ATLANTIC	Julia L.
Land.Common.Name	STURGEON, SHORT-NOSE	Land.Common.Name	STURGEON, SHORT-NOSE	Julia L.
Land.Common.Name	STURGEON, SPECIES NOT SPECIFIED	Land.Common.Name	STURGEON, SPECIES NOT SPECIFIED	Julia L.
Land.Common.Name	SURFCLAM, ARCTIC	Land.Common.Name	SURFCLAM, ARCTIC	Julia L.
Land.Common.Name	SURFCLAM, ATLANTIC	Land.Common.Name	SURFCLAM, ATLANTIC	Julia L.
Land.Common.Name	SWORDFISH	Land.Common.Name	SWORDFISH	Julia L.

Land.Common.Name	TAUTOG	Land.Common.Name	TAUTOG	Julia L.
Land.Common.Name	TILEFISH	Land.Common.Name	TILEFISH	Julia L.
Land.Common.Name	TILEFISH, BLUELINE	Land.Common.Name	TILEFISH, BLUELINE	Julia L.
Land.Common.Name	TILEFISH, GOLDEN	Land.Common.Name	Tilefish FMP	Julia L.
Land.Common.Name	TILEFISH, SAND	Land.Common.Name	TILEFISH, SAND	Julia L.
Land.Common.Name	TOADFISHES	Land.Common.Name	TOADFISHES	Julia L.
Land.Common.Name	TRIGGERFISHES	Land.Common.Name	TRIGGERFISHES	Julia L.
Land.Common.Name	TROUT, SEA	Land.Common.Name	TROUT, SEA	Julia L.
Land.Common.Name	TUNA, ALBACORE	Land.Common.Name	TUNA, ALBACORE	Julia L.
Land.Common.Name	TUNA, BIGEYE	Land.Common.Name	TUNA, BIGEYE	Julia L.
Land.Common.Name	TUNA, BLACKFIN	Land.Common.Name	TUNA, BLACKFIN	Julia L.
Land.Common.Name	TUNA, BLUEFIN	Land.Common.Name	TUNA, BLUEFIN	Julia L.
Land.Common.Name	TUNA, SKIPJACK	Land.Common.Name	TUNA, SKIPJACK	Julia L.
Land.Common.Name	TUNA, SPECIES NOT SPECIFIED	Land.Common.Name	TUNA, SPECIES NOT SPECIFIED	Julia L.
Land.Common.Name	TUNA, YELLOWFIN	Land.Common.Name	TUNA, YELLOWFIN	Julia L.
Land.Common.Name	TUNNY, LITTLE	Land.Common.Name	TUNNY, LITTLE	Julia L.
Land.Common.Name	TURTLE, LEATHERBACK	Land.Common.Name	TURTLE, LEATHERBACK	Julia L.
Land.Common.Name	TURTLE, LOGGERHEAD	Land.Common.Name	TURTLE, LOGGERHEAD	Julia L.
Land.Common.Name	TURTLE, UNIDENTIFIED	Land.Common.Name	TURTLE, UNIDENTIFIED	Julia L.
Land.Common.Name	URCHINS, SEA	Land.Common.Name	URCHINS, SEA	Julia L.
Land.Common.Name	WAHOO	Land.Common.Name	WAHOO	Julia L.
Land.Common.Name	WEAKFISH / SQUETEAGUE / GRAY SEA TROUT	Land.Common.Name	WEAKFISH / SQUETEAGUE / GRAY SEA TROUT	Julia L.
Land.Common.Name	WHELK, CHANNELED	Land.Common.Name	WHELK, CHANNELED	Julia L.
Land.Common.Name	WHELK, KNOBBED	Land.Common.Name	WHELK, KNOBBED	Julia L.
Land.Common.Name	WHELK, LIGHTNING	Land.Common.Name	WHELK, LIGHTNING	Julia L.
Land.Common.Name	WHELK, WAVED	Land.Common.Name	WHELK, WAVED	Julia L.
Land.Common.Name	WHITING, BLACK	Land.Common.Name	WHITING, BLACK	Julia L.
Land.Common.Name	WHITING, KING	Land.Common.Name	KINGFISH, SOUTHERN	Julia L.
Land.Common.Name	WINDOWPANE	Land.Common.Name	Northeast Multispecies FMP	Julia L.
Land.Common.Name	WOLFFISH, ATLANTIC	Land.Common.Name	Northeast Multispecies FMP	Julia L.
Land.Common.Name	WOLFISH, NORTHERN	Land.Common.Name	WOLFISH, NORTHERN	Julia L.
Land.Common.Name	WOLFISH, SPOTTED	Land.Common.Name	WOLFISH, SPOTTED	Julia L.
Land.Common.Name	WRECKFISH	Land.Common.Name	WRECKFISH	Julia L.

Table 31. Lookup table used in Value_Aggregation.R to group similar gear types prior to summing values by year and gear type. This table formatting is required of the addNewData function.

lookupVariable	lookupValue	newVariable	newValue	source
VTR.Gear.name	CARRIER VESSEL	VTR.Gear.name	CARRIER VESSEL	Julia L.
VTR.Gear.name	DIVING GEAR	VTR.Gear.name	DIVING GEAR	Julia L.
VTR.Gear.name	DREDGE, MUSSEL	VTR.Gear.name	DREDGE, MUSSEL	Julia L.
VTR.Gear.name	DREDGE, OCEAN QUAHOG/SURF CLAM	VTR.Gear.name	DREDGE, OCEAN QUAHOG/SURF CLAM	Julia L.
VTR.Gear.name	DREDGE, OTHER	VTR.Gear.name	DREDGE, OTHER	Julia L.
VTR.Gear.name	DREDGE, SCALLOP,SEA	VTR.Gear.name	DREDGE, SCALLOP	Julia L.

VTR.Gear.name	DREDGE, SCALLOP-CHAIN MAT	VTR.Gear.name	DREDGE, SCALLOP	Julia L.
VTR.Gear.name	DREDGE, URCHIN	VTR.Gear.name	DREDGE, URCHIN	Julia L.
VTR.Gear.name	DREDGE,SCALLOP,CHAIN MAT,MOD	VTR.Gear.name	DREDGE, SCALLOP	Julia L.
VTR.Gear.name	DREDGE,SCALLOP,TURTLE DEFLECT	VTR.Gear.name	DREDGE, SCALLOP	Julia L.
VTR.Gear.name	FYKE NET	VTR.Gear.name	FYKE NET	Julia L.
VTR.Gear.name	GILL NET, DRIFT,LARGE MESH	VTR.Gear.name	GILL NET, DRIFT,LARGE MESH	Julia L.
VTR.Gear.name	GILL NET, DRIFT,SMALL MESH	VTR.Gear.name	GILL NET, DRIFT,SMALL MESH	Julia L.
VTR.Gear.name	GILL NET, OTHER	VTR.Gear.name	GILL NET, OTHER	Julia L.
VTR.Gear.name	GILL NET, RUNAROUND	VTR.Gear.name	GILL NET, RUNAROUND	Julia L.
VTR.Gear.name	GILL NET, SINK	VTR.Gear.name	GILL NET, SINK	Julia L.
VTR.Gear.name	HAND LINE/ROD & REEL	VTR.Gear.name	HAND LINE/ROD & REEL	Julia L.
VTR.Gear.name	HAND RAKE	VTR.Gear.name	HAND RAKE	Julia L.
VTR.Gear.name	HARPOON	VTR.Gear.name	HARPOON	Julia L.
VTR.Gear.name	LONGLINE, BOTTOM	VTR.Gear.name	LONGLINE, BOTTOM	Julia L.
VTR.Gear.name	LONGLINE, PELAGIC	VTR.Gear.name	LONGLINE, PELAGIC	Julia L.
VTR.Gear.name	OTHER GEAR	VTR.Gear.name	UNKNOWN	Julia L.
VTR.Gear.name	OTTER TRAWL, BEAM	VTR.Gear.name	OTTER TRAWL, BOTTOM,FISH	Julia L.
VTR.Gear.name	OTTER TRAWL, BOTTOM,FISH	VTR.Gear.name	OTTER TRAWL, BOTTOM,FISH	Julia L.
VTR.Gear.name	OTTER TRAWL, BOTTOM,OTHER	VTR.Gear.name	OTTER TRAWL, BOTTOM,FISH	Julia L.
VTR.Gear.name	OTTER TRAWL, BOTTOM,SCALLOP	VTR.Gear.name	OTTER TRAWL, BOTTOM,SCALLOP	Julia L.
VTR.Gear.name	OTTER TRAWL, BOTTOM,SHRIMP	VTR.Gear.name	OTTER TRAWL, BOTTOM,SHRIMP	Julia L.
VTR.Gear.name	OTTER TRAWL, MIDWATER	VTR.Gear.name	OTTER TRAWL, MIDWATER	Julia L.
VTR.Gear.name	OTTER TRAWL, RUHLE	VTR.Gear.name	OTTER TRAWL, BOTTOM,FISH	Julia L.
VTR.Gear.name	PAIR TRAWL, MIDWATER	VTR.Gear.name	PAIR TRAWL, MIDWATER	Julia L.
VTR.Gear.name	POT, CONCH/WHELK	VTR.Gear.name	POT, CONCH/WHELK	Julia L.
VTR.Gear.name	POT, CRAB	VTR.Gear.name	POT, CRAB/LOBSTER	Julia L.
VTR.Gear.name	POT, EEL	VTR.Gear.name	POT, EEL	Julia L.
VTR.Gear.name	POT, FISH	VTR.Gear.name	POT, FISH	Julia L.
VTR.Gear.name	POT, HAG	VTR.Gear.name	POT, HAG	Julia L.
VTR.Gear.name	POT, LOBSTER	VTR.Gear.name	POT, CRAB/LOBSTER	Julia L.
VTR.Gear.name	POT, OTHER	VTR.Gear.name	POT, OTHER	Julia L.
VTR.Gear.name	POT, SHRIMP	VTR.Gear.name	POT, SHRIMP	Julia L.
VTR.Gear.name	SEINE, DANISH	VTR.Gear.name	SEINE, DANISH	Julia L.
VTR.Gear.name	SEINE, PURSE	VTR.Gear.name	SEINE, PURSE	Julia L.
VTR.Gear.name	TRAP	VTR.Gear.name	TRAP	Julia L.
VTR.Gear.name	UNKNOWN	VTR.Gear.name	UNKNOWN	Julia L.
VTR.Gear.name	WEIR	VTR.Gear.name	WEIR	Julia L.

11.2.6 R Code Aggregating Value Data by Species and/or Fishery, Gear Used, Port Landed, and State Landed

This code loops through the completed files created for each vessel, subsets the points that fall within wind energy areas, and sums the values within each area by species landed, gear type, landing port, and landing state. Prior to summing the values falling within WEAs, the ex-vessel value for each point was calculated. This was done by weighting all points within an individual trip by the fishing density raster created in the previous step. Each VMS fishing point's weight was then multiplied by the total trip ex-vessel value to assign each VMS point a weighted ex-vessel value. These values were then summed by fishery as mentioned above. Finally, this code does a confidentiality check (counts the number of vessels, number of fishermen, and number of dealers) on all aggregated landings to ensure compliance with the ACCSP "rule of 3." Refer to the section 7.4.4 for more details.

```
options(scipen=999)
require(stringr)
require(rgdal)
require(reshape)
require(formattable)
require(raster)

setwd("C:/Livermore/Federal_Offshore_Wind/Large_Scale_VMS/Data/Results")


# Insert addNewData function from GitHub (https://gist.github.com/dfalster/5589956)
addNewData <- function(newDataFileName, data, allowedVars){

  import <- readNewData(newDataFileName, allowedVars)

  if( !is.null(import)){
    for(i in seq_len(nrow(import))){  #Make replacements
      col.to <- import$newVariable[i]
      col.from <- import$lookupVariable[i]
      if(is.na(col.from)){ # apply to whole column
        data[col.to] <- import$newValue[i]
      } else { # apply to subset
        rows <- data[[col.from]] == import$lookupValue[i]
        data[rows,col.to] <- import$newValue[i]
      }
    }
  }
  data
}

readNewData <- function(newDataFileName, allowedVars){

  if( file.exists(newDataFileName)){
    import <- read.csv(newDataFileName, header=TRUE, stringsAsFactors=FALSE,
                       strip.white=TRUE)
    if( nrow(import)> 0 ){

      #Check columns names for import are right
      expectedColumns<- c("lookupVariable","lookupValue","newVariable","newValue")
      nameIsOK <-  expectedColumns %in% names(import)
      if(any(!nameIsOK))
        stop("Incorrect name in lookup table for ",
             newDataFileName, "--> ", paste(expectedColumns[!nameIsOK],
                                             collapse=", "))

      #Check values of newVariable are in list of allowed variables
      import$lookupVariable[import$lookupVariable == ""] <- NA
      nameIsOK <- import$newVariable %in% allowedVars
      if(any(!nameIsOK))
        stop("Incorrect name(s) in newVariable column of ",
             newDataFileName, "--> ", paste(import$newVariable[!nameIsOK],
                                             collapse=", "))
    } else {
      import <- NULL
    }
  } else {
    import <- NULL
  }
  import
}

pts2011<-read.csv("C:/Livermore/Federal_Offshore_Wind/Large_Scale_VMS/Data/Prepped_Data/2011_fishing_pts.csv")
pts2012<-read.csv("C:/Livermore/Federal_Offshore_Wind/Large_Scale_VMS/Data/Prepped_Data/2012_fishing_pts.csv")
pts2013<-read.csv("C:/Livermore/Federal_Offshore_Wind/Large_Scale_VMS/Data/Prepped_Data/2013_fishing_pts.csv")
pts2014<-read.csv("C:/Livermore/Federal_Offshore_Wind/Large_Scale_VMS/Data/Prepped_Data/2014_fishing_pts.csv")
pts2015<-read.csv("C:/Livermore/Federal_Offshore_Wind/Large_Scale_VMS/Data/Prepped_Data/2015_fishing_pts.csv")
pts2016<-read.csv("C:/Livermore/Federal_Offshore_Wind/Large_Scale_VMS/Data/Prepped_Data/2016_fishing_pts.csv")

allDat<-rbind(pts2011,pts2012)
remove(pts2011,pts2012)
```

```
allDat<-rbind(allDat,pts2013)
remove(pts2013)
allDat<-rbind(allDat,pts2014)
remove(pts2014)
allDat<-rbind(allDat,pts2015)
remove(pts2015)

allDat$X.1<-NULL
allDat$X<-NULL
pts2016$X.1<-NULL
pts2016$X<-NULL

allDat<-rbind(allDat,pts2016)
remove(pts2016)

# Clean up data to save space
keeps<-c("LATITUDE","LONGITUDE","VMS.DATE","Land.Common.Name","Land.State","Land.Port","Land.Dollars",
         "Land.Dealer.License.Nbr","Land.Fisherman","Land.Landing.Date","VTR.Gear.name","VTR.Nbr.of.crew",
         "VTR.Date.land","Year","Prop.Value","PERMIT","Land.Supplier.Trip.Id","AVG_SPEED")
allDat<-allDat[,(names(allDat) %in% keeps)]
remove(keeps)

# Subset only points that meet speed restrictions (i.e. <4 knots for all species
# except scallops at <5 knots).
# We have already eliminated all data with speeds over 5 knots at this stage.
scallopDat<-subset(allDat,Land.Common.Name=="SCALLOP, SEA")
restDat<-subset(allDat,Land.Common.Name!="SCALLOP, SEA" & AVG_SPEED<=4)
remove(allDat)
allDat<-rbind(scallopDat,restDat)
remove(scallopDat,restDat)

# Apply gear and species lookup tables to simplify/group certain outputs logically
GroupedGear<-read.csv("C:/Livermore/Federal_Offshore_Wind/Large_Scale_VMS/Gear_Lookup_Table.csv")
allDat$VTR.Gear.name<-as.character(allDat$VTR.Gear.name)
allDat.GroupedGear<-GroupedGear
allowedVars<-c("VTR.Gear.name")
allDat.GroupedGear<-
addNewData("C:/Livermore/Federal_Offshore_Wind/Large_Scale_VMS/Gear_Lookup_Table.csv",allDat,allowedVars)
allDat.GroupedGear$X<-NULL
remove(GroupedGear)

GroupedSpecies<-read.csv("C:/Livermore/Federal_Offshore_Wind/Large_Scale_VMS/Species_Lookup_2.csv")
allDat.GroupedGear$Land.Common.Name<-as.character(allDat.GroupedGear$Land.Common.Name)
allDat.Grouped<-GroupedSpecies
allowedVars<-c("Land.Common.Name")
allDat.Grouped<-
addNewData("C:/Livermore/Federal_Offshore_Wind/Large_Scale_VMS/Species_Lookup_2.csv",allDat.GroupedGear,allowed
Vars)
allDat.Grouped$X<-NULL
remove(allDat.GroupedGear,GroupedSpecies,allowedVars,allDat)

# Shorten port names
allDat.Grouped$Land.Port<-gsub(" (census name for Falmouth Center)","",allDat.Grouped$Land.Port,fixed=T)
allDat.Grouped$Land.Port<-gsub(" (census name for Chatham Center)","",allDat.Grouped$Land.Port,fixed=T)
allDat.Grouped$Land.Port<-gsub(" (census name for Plymouth Center)","",allDat.Grouped$Land.Port,fixed=T)
allDat.Grouped$Land.Port<-gsub(" (census name for Scituate Center)","",allDat.Grouped$Land.Port,fixed=T)
allDat.Grouped$Land.Port<-gsub(" (census name for Nantucket Center)","",allDat.Grouped$Land.Port,fixed=T)
allDat.Grouped$Land.Port<-gsub(" Indian","",allDat.Grouped$Land.Port,fixed=T)
allDat.Grouped$Land.Port<-gsub(" (Borough of New York)","",allDat.Grouped$Land.Port,fixed=T)
allDat.Grouped$Land.Port<-gsub(" (local name Wickford)","",allDat.Grouped$Land.Port,fixed=T)
allDat.Grouped$Land.Port<-gsub(" (Town of)","",allDat.Grouped$Land.Port,fixed=T)
allDat.Grouped$Land.Port<-gsub(" (census name Narragansett Pier)","",allDat.Grouped$Land.Port,fixed=T)
allDat.Grouped$Land.Port<-gsub(" (census name Westerly Center)","",allDat.Grouped$Land.Port,fixed=T)
allDat.Grouped$Land.Port<-gsub(" (Hyannisport)","",allDat.Grouped$Land.Port,fixed=T)
allDat.Grouped$Land.Port<-gsub(" (census name for Marshfield Compact)","",allDat.Grouped$Land.Port,fixed=T)
allDat.Grouped$Land.Port<-gsub(" (East Lyme (sta.))","",allDat.Grouped$Land.Port,fixed=T)
allDat.Grouped$Land.Port<-gsub(" (census name for Sandwich Center)","",allDat.Grouped$Land.Port,fixed=T)

# Make lists of species, gears, states, and ports for looping
states<-as.vector(sort(unique(as.character(allDat.Grouped$Land.State))))
gears<-as.vector(sort(unique(as.character(allDat.Grouped$VTR.Gear.name))))
ports<-as.vector(sort(unique(as.character(allDat.Grouped$Land.Port))))
species<-as.vector(sort(unique(as.character(allDat.Grouped$Land.Common.Name))))

# Remove any UNKNOWN entries
ports<-sort(ports[!ports=="UNKNOWN"])

years<-c(2011,2012,2013,2014,2015,2016)

# Read in shapefile of all layers
```

```
WEAreas<-
readOGR(dsn="C:/Livermore/Federal_Offshore_Wind/Large_Scale_VMS/Data/WEA_Shapefiles/AtlanticLeaseAreas_032817.s
hp",
                 layer="AtlanticLeaseAreas_032817")

NYWEA.shape.x<-WEAreas[WEAreas$LEASE_NUMB=="OCS-A 0512",]
DWW1.shape.x<-WEAreas[WEAreas$LEASE_NUMB=="OCS-A 0486" | WEAreas$LEASE_NUMB=="OCS-A 0487",]
BaySt.shape.x<-WEAreas[WEAreas$LEASE_NUMB=="OCS-A 0500",]
Vineyard.shape.x<-WEAreas[WEAreas$LEASE_NUMB=="OCS-A 0501",]
OCSA502.shape.x<-WEAreas[WEAreas$LEASE_NUMB=="OCS-A 0502",]
OCSA503.shape.x<-WEAreas[WEAreas$LEASE_NUMB=="OCS-A 0503",]

# Transform and project each shapefile to match the lat/long coordinates
NYWEA.shape<-spTransform(NYWEA.shape.x,CRS("+proj=longlat +datum=NAD83 +no_defs +ellps=GRS80 +towgs84=0,0,0"))
DWW1.shape<-spTransform(DWW1.shape.x,CRS("+proj=longlat +datum=NAD83 +no_defs +ellps=GRS80 +towgs84=0,0,0"))
BaySt.shape<-spTransform(BaySt.shape.x,CRS("+proj=longlat +datum=NAD83 +no_defs +ellps=GRS80 +towgs84=0,0,0"))
Vineyard.shape<-spTransform(Vineyard.shape.x,CRS("+proj=longlat +datum=NAD83 +no_defs +ellps=GRS80
+towgs84=0,0,0"))
OCSA502.shape<-spTransform(OCSA502.shape.x,CRS("+proj=longlat +datum=NAD83 +no_defs +ellps=GRS80
+towgs84=0,0,0"))
OCSA503.shape<-spTransform(OCSA503.shape.x,CRS("+proj=longlat +datum=NAD83 +no_defs +ellps=GRS80
+towgs84=0,0,0"))

# Clear up memory (remove unprojected layers)
remove(WEAreas)
remove(NYWEA.shape.x)
remove(DWW1.shape.x)
remove(BaySt.shape.x)
remove(Vineyard.shape.x)
remove(OCSA502.shape.x)
remove(OCSA503.shape.x)

# Create empty dataframe to fill within loops later on
NYWEA.pts<-as.data.frame(matrix(0,ncol=18,nrow=0))
DWW1.pts<-as.data.frame(matrix(0,ncol=18,nrow=0))
BaySt.pts<-as.data.frame(matrix(0,ncol=18,nrow=0))
Vineyard.pts<-as.data.frame(matrix(0,ncol=18,nrow=0))
OCSA502.pts<-as.data.frame(matrix(0,ncol=18,nrow=0))
OCSA503.pts<-as.data.frame(matrix(0,ncol=18,nrow=0))

keeps<-c("LATITUDE","LONGITUDE","VMS.DATE","Land.Common.Name","Land.State","Land.Port","Land.Dollars",
         "Land.Dealer.License.Nbr","Land.Fisherman","Land.Landing.Date","VTR.Gear.name","VTR.Nbr.of.crew",
         "VTR.Date.land","Year","Prop.Value","PERMIT","Land.Supplier.Trip.Id","Weighted.Value")

########################################################################
# First step is to recalculate point values using fishing density raster
# to weight fishing value within a trip
########################################################################

for (year in years){

  yearDat<-subset(allDat.Grouped,Year==year)

  for (fish in species){

    subDat<-subset(yearDat,Land.Common.Name==fish)

    if (nrow(subDat)>0){

      # Read in corresponding raster of fishing density
      rastName<-paste(year,"_",fish,"_fishing_density.img",sep="")

      if (file.exists(rastName)==TRUE){
        densityRast<-raster(rastName)

        # Create a second raster where we calculate the proportion of total
        # fishing points that fall within each cell (i.e. cell value/sum of
        # all cells)
        totalPts<-cellStats(densityRast,stat="sum")
        propRast<-densityRast/totalPts

        propRast<-projectRaster(propRast,crs="+proj=longlat +datum=NAD83 +no_defs +ellps=GRS80 +towgs84=0,0,0")

        # Convert value data frame to spatial points data frame
        # Converting VMS data to a spatial object
        coordinates(subDat)<-c("LONGITUDE","LATITUDE")
        # Project to match the WEA's projection
        proj4string(subDat)<-"+proj=longlat +datum=NAD83 +no_defs +ellps=GRS80 +towgs84=0,0,0"

        # Extract raster values to each point's data frame
        subDat$rastVal<-extract(propRast,subDat,method='simple')
```

```
        # Convert data back to a table
        subDat<-as.data.frame(subDat)

        # Drop all rows where there is no raster value (means this point fell within state waters)
        subDat<-subDat[complete.cases(subDat[,19]),]

        # Recalculate the number of points per trip
        tripCounts<-table(subDat$Land.Supplier.Trip.Id)
        tripCounts<-as.data.frame(tripCounts)
        colnames(tripCounts)<-c("Land.Supplier.Trip.Id","PtCount")

        # There may be multiple grades per species so we need to divide the trip pts by the number of values
        # (different dollar value entries with the same trip ID indicated more than one grade of the species)
        tripGrades<-
as.data.frame(tapply(subDat$Land.Dollars,subDat$Land.Supplier.Trip.Id,function(x)length(unique(x))))
        tripGrades$Land.Supplier.Trip.Id<-rownames(tripGrades)
        colnames(tripGrades)[1]<-"numGrades"

        # Merge trip count and grade count tables
        corTripCounts<-merge(tripCounts,tripGrades)

        # Divide ptCount by numGrades to get the actual trip count numbers
        corTripCounts$TripPoints<-corTripCounts$PtCount/corTripCounts$numGrades

        # Create a new column where the value is the number of fishing points per trip by merging from
        # tripCounts table
        corTripCounts$PtCount<-NULL
        corTripCounts$numGrades<-NULL
        subDat<-merge(subDat,corTripCounts)

        # Sum all raster values within each trip (include dollars to address multiple grades)
        tripRastSum<-aggregate(rastVal~Land.Supplier.Trip.Id+Land.Dollars,data=subDat,FUN=sum)
        colnames(tripRastSum)<-c("Land.Supplier.Trip.Id","Land.Dollars","tripRastVal")
        subDat<-merge(subDat,tripRastSum)

        # New colum of each raster value divided by summed trip raster value (separately for each grade)
        subDat$rasterWt<-subDat$rastVal/subDat$tripRastVal

        # Multiply total trip value by weight (separately for each grade)
        subDat$Weighted.Value<-subDat$Land.Dollars*subDat$rasterWt

        # Recalculate trip point values (Prop.Value) for non-weighted value aggregation
        subDat$Prop.Value<-subDat$Land.Dollars/subDat$TripPoints

        # Drop unnecessary columns to save space
        subDat<-subDat[,(names(subDat) %in% keeps)]

        remove(tripCounts,tripGrades,corTripCounts,tripRastSum)

        # Convert back into spatial points data frame
        coordinates(subDat)<-c("LONGITUDE","LATITUDE")
        proj4string(subDat)<-"+proj=longlat +datum=NAD83 +no_defs +ellps=GRS80 +towgs84=0,0,0"

        # Actually subsetting the VMS data within the WEA
        NYWEA.pts2<-subDat[NYWEA.shape,]
        DWW1.pts2<-subDat[DWW1.shape,]
        BaySt.pts2<-subDat[BaySt.shape,]
        Vineyard.pts2<-subDat[Vineyard.shape,]
        OCSA502.pts2<-subDat[OCSA502.shape,]
        OCSA503.pts2<-subDat[OCSA503.shape,]

        # Convert back to a table
        NYWEA.pts2<-as.data.frame(NYWEA.pts2)
        DWW1.pts2<-as.data.frame(DWW1.pts2)
        BaySt.pts2<-as.data.frame(BaySt.pts2)
        Vineyard.pts2<-as.data.frame(Vineyard.pts2)
        OCSA502.pts2<-as.data.frame(OCSA502.pts2)
        OCSA503.pts2<-as.data.frame(OCSA503.pts2)

        # Bind to other data
        NYWEA.pts<-rbind(NYWEA.pts,NYWEA.pts2)
        DWW1.pts<-rbind(DWW1.pts,DWW1.pts2)
        BaySt.pts<-rbind(BaySt.pts,BaySt.pts2)
        Vineyard.pts<-rbind(Vineyard.pts,Vineyard.pts2)
        OCSA502.pts<-rbind(OCSA502.pts,OCSA502.pts2)
        OCSA503.pts<-rbind(OCSA503.pts,OCSA503.pts2)

        remove(NYWEA.pts2)
        remove(DWW1.pts2)
        remove(BaySt.pts2)
```

```
        remove(Vineyard.pts2)
        remove(OCSA502.pts2)
        remove(OCSA503.pts2)

        remove(subDat)

      }

    }

  }

  remove(yearDat)

}

remove(keeps)
remove(allDat.Grouped)

# Export the WEA files. Each contains many duplicate points (for each species/grade combo)
# but their values have already been converted equally proportionally and weighted by fishing
# density, so they can simply be added together to determine value.
write.csv(NYWEA.pts,"NYWEA_Points.csv")
write.csv(DWW1.pts,"DWW1_Points.csv")
write.csv(BaySt.pts,"BaySt_Points.csv")
write.csv(Vineyard.pts,"Vineyard_Points.csv")
write.csv(OCSA502.pts,"OCSA502_Points.csv")
write.csv(OCSA503.pts,"OCSA503_Points.csv")

# Add column of WEA name and then do aggregations to a single file
# Aggregations by species caught, gear type, state, port, etc.
NYWEA.pts$WEA<-"NYWEA"
DWW1.pts$WEA<-"DWW1"
BaySt.pts$WEA<-"BaySt"
Vineyard.pts$WEA<-"Vineyard"
OCSA502.pts$WEA<-"OCSA502"
OCSA503.pts$WEA<-"OCSA503"

allDat<-rbind(NYWEA.pts,DWW1.pts,BaySt.pts,Vineyard.pts,OCSA502.pts,OCSA503.pts)

WEAs<-c("NYWEA","DWW1","BaySt","Vineyard","OCSA502","OCSA503")

remove(BaySt.pts,DWW1.pts,NYWEA.pts,Vineyard.pts,OCSA502.pts,OCSA503.pts,
       BaySt.shape,DWW1.shape,NYWEA.shape,Vineyard.shape,OCSA502.shape,OCSA503.shape,
       densityRast,fileName,propRast,rastName)

###############################################################################################
# First run aggregations on proportional values (i.e. the equal weighted distribution
# value across a fishing trip).
###############################################################################################

# Aggregate data by species and check all confidentiality requirements

allDat.speciesValue<-aggregate(Prop.Value~Land.Common.Name+Year+WEA,data=allDat,FUN=sum)
allDat.speciesVessel<-aggregate(PERMIT~Land.Common.Name+Year+WEA,data=allDat,function(x) length(unique(x)))
allDat.speciesFisherman<-aggregate(Land.Fisherman~Land.Common.Name+Year+WEA,data=allDat,function(x)
length(unique(x)))
allDat.speciesDealer<-aggregate(Land.Dealer.License.Nbr~Land.Common.Name+Year+WEA,data=allDat,function(x)
length(unique(x)))
allDat.speciesAgg<-merge(allDat.speciesValue,allDat.speciesVessel,by=c("Land.Common.Name","Year","WEA"))
allDat.speciesAgg<-merge(allDat.speciesAgg,allDat.speciesFisherman,by=c("Land.Common.Name","Year","WEA"))
allDat.speciesAgg<-merge(allDat.speciesAgg,allDat.speciesDealer,by=c("Land.Common.Name","Year","WEA"))
colnames(allDat.speciesAgg)<-
c("Land.Species","Land.Year","WEA","Dollar.Value","Num.Vessel","Num.Fishermen","Num.Dealers")

remove(allDat.speciesValue)
remove(allDat.speciesVessel)
remove(allDat.speciesFisherman)
remove(allDat.speciesDealer)

# Aggregate data by gear type
# First group some by gear type

allDat.gearValue<-aggregate(Prop.Value~VTR.Gear.name+Year+WEA,data=allDat,FUN=sum)
allDat.gearVessel<-aggregate(PERMIT~VTR.Gear.name+Year+WEA,data=allDat,function(x) length(unique(x)))
allDat.gearFisherman<-aggregate(Land.Fisherman~VTR.Gear.name+Year+WEA,data=allDat,function(x)
length(unique(x)))
allDat.gearDealer<-aggregate(Land.Dealer.License.Nbr~VTR.Gear.name+Year+WEA,data=allDat,function(x)
length(unique(x)))
allDat.gearAgg<-merge(allDat.gearValue,allDat.gearVessel,by=c("VTR.Gear.name","Year","WEA"))
allDat.gearAgg<-merge(allDat.gearAgg,allDat.gearFisherman,by=c("VTR.Gear.name","Year","WEA"))
```

```
allDat.gearAgg<-merge(allDat.gearAgg,allDat.gearDealer,by=c("VTR.Gear.name","Year","WEA"))
colnames(allDat.gearAgg)<-
c("VTR.Gear","Land.Year","WEA","Dollar.Value","Num.Vessel","Num.Fishermen","Num.Dealers")

remove(allDat.gearValue)
remove(allDat.gearVessel)
remove(allDat.gearFisherman)
remove(allDat.gearDealer)

# Aggregate data by state
allDat.stateValue<-aggregate(Prop.Value~Land.State+Year+WEA,data=allDat,FUN=sum)
allDat.stateVessel<-aggregate(PERMIT~Land.State+Year+WEA,data=allDat,function(x) length(unique(x)))
allDat.stateFisherman<-aggregate(Land.Fisherman~Land.State+Year+WEA,data=allDat,function(x) length(unique(x)))
allDat.stateDealer<-aggregate(Land.Dealer.License.Nbr~Land.State+Year+WEA,data=allDat,function(x)
length(unique(x)))
allDat.stateAgg<-merge(allDat.stateValue,allDat.stateVessel,by=c("Land.State","Year","WEA"))
allDat.stateAgg<-merge(allDat.stateAgg,allDat.stateFisherman,by=c("Land.State","Year","WEA"))
allDat.stateAgg<-merge(allDat.stateAgg,allDat.stateDealer,by=c("Land.State","Year","WEA"))
colnames(allDat.stateAgg)<-
c("Land.State","Land.Year","WEA","Dollar.Value","Num.Vessel","Num.Fishermen","Num.Dealers")

remove(allDat.stateValue)
remove(allDat.stateVessel)
remove(allDat.stateFisherman)
remove(allDat.stateDealer)

# Aggregate data by port
allDat.portValue<-aggregate(Prop.Value~Land.Port+Land.State+Year+WEA,data=allDat,FUN=sum)
allDat.portVessel<-aggregate(PERMIT~Land.Port+Land.State+Year+WEA,data=allDat,function(x) length(unique(x)))
allDat.portFisherman<-aggregate(Land.Fisherman~Land.Port+Land.State+Year+WEA,data=allDat,function(x)
length(unique(x)))
allDat.portDealer<-aggregate(Land.Dealer.License.Nbr~Land.Port+Land.State+Year+WEA,data=allDat,function(x)
length(unique(x)))
allDat.portAgg<-merge(allDat.portValue,allDat.portVessel,by=c("Land.Port","Year","WEA","Land.State"))
allDat.portAgg<-merge(allDat.portAgg,allDat.portFisherman,by=c("Land.Port","Year","WEA","Land.State"))
allDat.portAgg<-merge(allDat.portAgg,allDat.portDealer,by=c("Land.Port","Year","WEA","Land.State"))
colnames(allDat.portAgg)<-
c("Land.Port","Land.Year","WEA","Land.State","Dollar.Value","Num.Vessel","Num.Fishermen","Num.Dealers")

allDat.portAgg$Land.Port<-paste(allDat.portAgg$Land.Port,", ",allDat.portAgg$Land.State,sep="")

remove(allDat.portValue)
remove(allDat.portVessel)
remove(allDat.portFisherman)
remove(allDat.portDealer)

# Export results
write.csv(allDat.gearAgg,"WEA_Land_by_Gear_EqualPropEst.csv")
write.csv(allDat.portAgg,"WEA_Land_by_Port_EqualPropEst.csv")
write.csv(allDat.stateAgg,"WEA_Land_by_State_EqualPropEst.csv")
write.csv(allDat.speciesAgg,"WEA_Land_by_Species_EqualPropEst.csv")

# Compile into cleaner tables

# Clean up confidentiality
allDat.speciesAgg$VesConfid<-ifelse(allDat.speciesAgg$Num.Vessel>=3,1,0)
allDat.speciesAgg$FisherConfid<-ifelse(allDat.speciesAgg$Num.Fishermen>=3,1,0)
allDat.speciesAgg$DealerConfid<-ifelse(allDat.speciesAgg$Num.Dealers>=3,1,0)
allDat.speciesAgg$Confid<-ifelse(allDat.speciesAgg$VesConfid+
                                   allDat.speciesAgg$DealerConfid+
                                   allDat.speciesAgg$DealerConfid>=3,"OK","CONFIDENTIAL")
allDat.speciesAgg$Dollar.Value<-
ifelse(allDat.speciesAgg$Confid=="CONFIDENTIAL","C",allDat.speciesAgg$Dollar.Value)
allDat.speciesAgg<-allDat.speciesAgg[,1:4]

allDat.stateAgg$VesConfid<-ifelse(allDat.stateAgg$Num.Vessel>=3,1,0)
allDat.stateAgg$FisherConfid<-ifelse(allDat.stateAgg$Num.Fishermen>=3,1,0)
allDat.stateAgg$DealerConfid<-ifelse(allDat.stateAgg$Num.Dealers>=3,1,0)
allDat.stateAgg$Confid<-ifelse(allDat.stateAgg$VesConfid+
                                 allDat.stateAgg$DealerConfid+
                                 allDat.stateAgg$DealerConfid>=3,"OK","CONFIDENTIAL")
allDat.stateAgg$Dollar.Value<-round(allDat.stateAgg$Dollar.Value,2)
allDat.stateAgg$Dollar.Value<-ifelse(allDat.stateAgg$Confid=="CONFIDENTIAL","C",allDat.stateAgg$Dollar.Value)
allDat.stateAgg<-allDat.stateAgg[,1:4]

allDat.portAgg$VesConfid<-ifelse(allDat.portAgg$Num.Vessel>=3,1,0)
allDat.portAgg$FisherConfid<-ifelse(allDat.portAgg$Num.Fishermen>=3,1,0)
allDat.portAgg$DealerConfid<-ifelse(allDat.portAgg$Num.Dealers>=3,1,0)
allDat.portAgg$Confid<-ifelse(allDat.portAgg$VesConfid+
                                allDat.portAgg$DealerConfid+
                                allDat.portAgg$DealerConfid>=3,"OK","CONFIDENTIAL")
```

```
allDat.portAgg$Dollar.Value<-round(allDat.portAgg$Dollar.Value,2)
allDat.portAgg$Dollar.Value<-ifelse(allDat.portAgg$Confid=="CONFIDENTIAL","C",allDat.portAgg$Dollar.Value)
allDat.portAgg<-allDat.portAgg[,c(1:3,5)]

allDat.gearAgg$VesConfid<-ifelse(allDat.gearAgg$Num.Vessel>=3,1,0)
allDat.gearAgg$FisherConfid<-ifelse(allDat.gearAgg$Num.Fishermen>=3,1,0)
allDat.gearAgg$DealerConfid<-ifelse(allDat.gearAgg$Num.Dealers>=3,1,0)
allDat.gearAgg$Confid<-ifelse(allDat.gearAgg$VesConfid+
                                allDat.gearAgg$DealerConfid+
                                allDat.gearAgg$DealerConfid>=3,"OK","CONFIDENTIAL")
allDat.gearAgg$Dollar.Value<-round(allDat.gearAgg$Dollar.Value,2)
allDat.gearAgg$Dollar.Value<-ifelse(allDat.gearAgg$Confid=="CONFIDENTIAL","C",allDat.gearAgg$Dollar.Value)
allDat.gearAgg<-allDat.gearAgg[,1:4]

# Subset by WEAs to
for (wea in WEAs){

  # By species by year
  weaSubSp<-subset(allDat.speciesAgg,WEA==wea)
  weaSubSp$WEA<-NULL
  weaSubSp<-reshape(weaSubSp,idvar="Land.Species",timevar="Land.Year",direction="wide")
  colnames(weaSubSp)<-c("Species.FMP","2011","2012","2013","2014","2015","2016")
  weaSubSp[is.na(weaSubSp)]<-0
  fileName<-paste(wea,"_SpeciesLand_by_Year_EqualPropEst.csv",sep="")
  write.csv(weaSubSp,fileName)

  # By state by year
  weaSubSt<-subset(allDat.stateAgg,WEA==wea)
  weaSubSt$WEA<-NULL
  weaSubSt<-reshape(weaSubSt,idvar="Land.State",timevar="Land.Year",direction="wide")
  colnames(weaSubSt)<-c("State","2011","2012","2013","2014","2015","2016")
  weaSubSt[is.na(weaSubSt)]<-0
  fileName<-paste(wea,"_StateLand_by_Year_EqualPropEst.csv",sep="")
  write.csv(weaSubSt,fileName)

  # By port by year
  weaSubPort<-subset(allDat.portAgg,WEA==wea)
  weaSubPort$WEA<-NULL
  weaSubPort<-reshape(weaSubPort,idvar="Land.Port",timevar="Land.Year",direction="wide")
  colnames(weaSubPort)<-c("Port","2011","2012","2013","2014","2015","2016")
  weaSubPort[is.na(weaSubPort)]<-0
  fileName<-paste(wea,"_PortLand_by_Year_EqualPropEst.csv",sep="")
  write.csv(weaSubPort,fileName)

  # By gear by year
  weaSubGear<-subset(allDat.gearAgg,WEA==wea)
  weaSubGear$WEA<-NULL
  weaSubGear<-reshape(weaSubGear,idvar="VTR.Gear",timevar="Land.Year",direction="wide")
  colnames(weaSubGear)<-c("Gear","2011","2012","2013","2014","2015","2016")
  weaSubGear[is.na(weaSubGear)]<-0
  fileName<-paste(wea,"_GearLand_by_Year_EqualPropEst.csv",sep="")
  write.csv(weaSubGear,fileName)

}

for (year in years){

  # By species by year
  yrSubSp<-subset(allDat.speciesAgg,Land.Year==year)
  yrSubSp$Land.Year<-NULL
  yrSubSp<-reshape(yrSubSp,idvar="Land.Species",timevar="WEA",direction="wide")
  colnames(yrSubSp)<-c("Species","Bay.St.Wind","Deepwater.Wind","Statoil","OCS-A.0502","Vineyard.Wind","OCS-
A.0503")
  yrSubSp<-yrSubSp[,c(1,3,2,6,5,7,4)]
  yrSubSp[is.na(yrSubSp)]<-0
  fileName<-paste(year,"_SpeciesLand_by_WEA_EqualPropEst.csv",sep="")
  write.csv(yrSubSp,fileName)

  # By state by year
  yrSubSt<-subset(allDat.stateAgg,Land.Year==year)
  yrSubSt$Land.Year<-NULL
  yrSubSt<-reshape(yrSubSt,idvar="Land.State",timevar="WEA",direction="wide")
  colnames(yrSubSt)<-c("State","Bay.St.Wind","Deepwater.Wind","Statoil","OCS-A.0502","Vineyard.Wind","OCS-
A.0503")
  yrSubSt<-yrSubSt[,c(1,3,2,6,5,7,4)]
  yrSubSt[is.na(yrSubSt)]<-0
  fileName<-paste(year,"_StateLand_by_WEA_EqualPropEst.csv",sep="")
  write.csv(yrSubSt,fileName)

  # By port by year
  yrSubPort<-subset(allDat.portAgg,Land.Year==year)
```

```
  yrSubPort$Land.Year<-NULL
  yrSubPort<-reshape(yrSubPort,idvar="Land.Port",timevar="WEA",direction="wide")
  colnames(yrSubPort)<-c("Port","Bay.St.Wind","Deepwater.Wind","Statoil","OCS-A.0502","Vineyard.Wind","OCS-
A.0503")
  yrSubPort<-yrSubPort[,c(1,3,2,6,5,7,4)]
  yrSubPort[is.na(yrSubPort)]<-0
  fileName<-paste(year,"_PortLand_by_WEA_EqualPropEst.csv",sep="")
  write.csv(yrSubPort,fileName)

  # By gear by year
  yrSubGear<-subset(allDat.gearAgg,Land.Year==year)
  yrSubGear$Land.Year<-NULL
  yrSubGear<-reshape(yrSubGear,idvar="VTR.Gear",timevar="WEA",direction="wide")
  colnames(yrSubGear)<-c("Gear","Bay.St.Wind","Deepwater.Wind","Statoil","OCS-A.0502","Vineyard.Wind","OCS-
A.0503")
  yrSubGear<-yrSubGear[,c(1,3,2,6,5,7,4)]
  yrSubGear[is.na(yrSubGear)]<-0
  fileName<-paste(year,"_GearLand_by_WEA_EqualPropEst.csv",sep="")
  write.csv(yrSubGear,fileName)

}

remove(allDat.gearAgg,allDat.portAgg,allDat.speciesAgg,allDat.stateAgg,
       yrSubGear,yrSubPort,yrSubSp,yrSubSt,
       weaSubGear,weaSubPort,weaSubSp,weaSubSt)

###############################################################################################
# Next run aggregations on fishing density weighted values.
###############################################################################################

# Aggregate data by species and check all confidentiality requirements

allDat.speciesValue<-aggregate(Weighted.Value~Land.Common.Name+Year+WEA,data=allDat,FUN=sum)
allDat.speciesVessel<-aggregate(PERMIT~Land.Common.Name+Year+WEA,data=allDat,function(x) length(unique(x)))
allDat.speciesFisherman<-aggregate(Land.Fisherman~Land.Common.Name+Year+WEA,data=allDat,function(x)
length(unique(x)))
allDat.speciesDealer<-aggregate(Land.Dealer.License.Nbr~Land.Common.Name+Year+WEA,data=allDat,function(x)
length(unique(x)))
allDat.speciesAgg<-merge(allDat.speciesValue,allDat.speciesVessel,by=c("Land.Common.Name","Year","WEA"))
allDat.speciesAgg<-merge(allDat.speciesAgg,allDat.speciesFisherman,by=c("Land.Common.Name","Year","WEA"))
allDat.speciesAgg<-merge(allDat.speciesAgg,allDat.speciesDealer,by=c("Land.Common.Name","Year","WEA"))
colnames(allDat.speciesAgg)<-
c("Land.Species","Land.Year","WEA","Dollar.Value","Num.Vessel","Num.Fishermen","Num.Dealers")

remove(allDat.speciesValue)
remove(allDat.speciesVessel)
remove(allDat.speciesFisherman)
remove(allDat.speciesDealer)
remove(GroupedSpecies)

# Aggregate data by gear type
# First group some by gear type

allDat.gearValue<-aggregate(Weighted.Value~VTR.Gear.name+Year+WEA,data=allDat,FUN=sum)
allDat.gearVessel<-aggregate(PERMIT~VTR.Gear.name+Year+WEA,data=allDat,function(x) length(unique(x)))
allDat.gearFisherman<-aggregate(Land.Fisherman~VTR.Gear.name+Year+WEA,data=allDat,function(x)
length(unique(x)))
allDat.gearDealer<-aggregate(Land.Dealer.License.Nbr~VTR.Gear.name+Year+WEA,data=allDat,function(x)
length(unique(x)))
allDat.gearAgg<-merge(allDat.gearValue,allDat.gearVessel,by=c("VTR.Gear.name","Year","WEA"))
allDat.gearAgg<-merge(allDat.gearAgg,allDat.gearFisherman,by=c("VTR.Gear.name","Year","WEA"))
allDat.gearAgg<-merge(allDat.gearAgg,allDat.gearDealer,by=c("VTR.Gear.name","Year","WEA"))
colnames(allDat.gearAgg)<-
c("VTR.Gear","Land.Year","WEA","Dollar.Value","Num.Vessel","Num.Fishermen","Num.Dealers")

remove(allDat.gearValue)
remove(allDat.gearVessel)
remove(allDat.gearFisherman)
remove(allDat.gearDealer)
remove(GroupedGear)

# Aggregate data by state
allDat.stateValue<-aggregate(Weighted.Value~Land.State+Year+WEA,data=allDat,FUN=sum)
allDat.stateVessel<-aggregate(PERMIT~Land.State+Year+WEA,data=allDat,function(x) length(unique(x)))
allDat.stateFisherman<-aggregate(Land.Fisherman~Land.State+Year+WEA,data=allDat,function(x) length(unique(x)))
allDat.stateDealer<-aggregate(Land.Dealer.License.Nbr~Land.State+Year+WEA,data=allDat,function(x)
length(unique(x)))
allDat.stateAgg<-merge(allDat.stateValue,allDat.stateVessel,by=c("Land.State","Year","WEA"))
allDat.stateAgg<-merge(allDat.stateAgg,allDat.stateFisherman,by=c("Land.State","Year","WEA"))
allDat.stateAgg<-merge(allDat.stateAgg,allDat.stateDealer,by=c("Land.State","Year","WEA"))
```

```
colnames(allDat.stateAgg)<-
c("Land.State","Land.Year","WEA","Dollar.Value","Num.Vessel","Num.Fishermen","Num.Dealers")

remove(allDat.stateValue)
remove(allDat.stateVessel)
remove(allDat.stateFisherman)
remove(allDat.stateDealer)

# Aggregate data by port
allDat.portValue<-aggregate(Weighted.Value~Land.Port+Land.State+Year+WEA,data=allDat,FUN=sum)
allDat.portVessel<-aggregate(PERMIT~Land.Port+Land.State+Year+WEA,data=allDat,function(x) length(unique(x)))
allDat.portFisherman<-aggregate(Land.Fisherman~Land.Port+Land.State+Year+WEA,data=allDat,function(x)
length(unique(x)))
allDat.portDealer<-aggregate(Land.Dealer.License.Nbr~Land.Port+Land.State+Year+WEA,data=allDat,function(x)
length(unique(x)))
allDat.portAgg<-merge(allDat.portValue,allDat.portVessel,by=c("Land.Port","Year","WEA","Land.State"))
allDat.portAgg<-merge(allDat.portAgg,allDat.portFisherman,by=c("Land.Port","Year","WEA","Land.State"))
allDat.portAgg<-merge(allDat.portAgg,allDat.portDealer,by=c("Land.Port","Year","WEA","Land.State"))
colnames(allDat.portAgg)<-
c("Land.Port","Land.Year","WEA","Land.State","Dollar.Value","Num.Vessel","Num.Fishermen","Num.Dealers")

allDat.portAgg$Land.Port<-paste(allDat.portAgg$Land.Port,", ",allDat.portAgg$Land.State,sep="")

remove(allDat.portValue)
remove(allDat.portVessel)
remove(allDat.portFisherman)
remove(allDat.portDealer)

# Export results
write.csv(allDat.gearAgg,"WEA_Land_by_Gear_WeightedEst.csv")
write.csv(allDat.portAgg,"WEA_Land_by_Port_WeightedEst.csv")
write.csv(allDat.stateAgg,"WEA_Land_by_State_WeightedEst.csv")
write.csv(allDat.speciesAgg,"WEA_Land_by_Species_WeightedEst.csv")

# Compile into cleaner tables

# Clean up confidentiality
allDat.speciesAgg$VesConfid<-ifelse(allDat.speciesAgg$Num.Vessel>=3,1,0)
allDat.speciesAgg$FisherConfid<-ifelse(allDat.speciesAgg$Num.Fishermen>=3,1,0)
allDat.speciesAgg$DealerConfid<-ifelse(allDat.speciesAgg$Num.Dealers>=3,1,0)
allDat.speciesAgg$Confid<-ifelse(allDat.speciesAgg$VesConfid+
                                   allDat.speciesAgg$DealerConfid+
                                   allDat.speciesAgg$DealerConfid>=3,"OK","CONFIDENTIAL")
allDat.speciesAgg$Dollar.Value<-
ifelse(allDat.speciesAgg$Confid=="CONFIDENTIAL","C",allDat.speciesAgg$Dollar.Value)
allDat.speciesAgg<-allDat.speciesAgg[,1:4]

allDat.stateAgg$VesConfid<-ifelse(allDat.stateAgg$Num.Vessel>=3,1,0)
allDat.stateAgg$FisherConfid<-ifelse(allDat.stateAgg$Num.Fishermen>=3,1,0)
allDat.stateAgg$DealerConfid<-ifelse(allDat.stateAgg$Num.Dealers>=3,1,0)
allDat.stateAgg$Confid<-ifelse(allDat.stateAgg$VesConfid+
                                 allDat.stateAgg$DealerConfid+
                                 allDat.stateAgg$DealerConfid>=3,"OK","CONFIDENTIAL")
allDat.stateAgg$Dollar.Value<-round(allDat.stateAgg$Dollar.Value,2)
allDat.stateAgg$Dollar.Value<-ifelse(allDat.stateAgg$Confid=="CONFIDENTIAL","C",allDat.stateAgg$Dollar.Value)
allDat.stateAgg<-allDat.stateAgg[,1:4]

allDat.portAgg$VesConfid<-ifelse(allDat.portAgg$Num.Vessel>=3,1,0)
allDat.portAgg$FisherConfid<-ifelse(allDat.portAgg$Num.Fishermen>=3,1,0)
allDat.portAgg$DealerConfid<-ifelse(allDat.portAgg$Num.Dealers>=3,1,0)
allDat.portAgg$Confid<-ifelse(allDat.portAgg$VesConfid+
                                allDat.portAgg$DealerConfid+
                                allDat.portAgg$DealerConfid>=3,"OK","CONFIDENTIAL")
allDat.portAgg$Dollar.Value<-round(allDat.portAgg$Dollar.Value,2)
allDat.portAgg$Dollar.Value<-ifelse(allDat.portAgg$Confid=="CONFIDENTIAL","C",allDat.portAgg$Dollar.Value)
allDat.portAgg<-allDat.portAgg[,c(1:3,5)]

allDat.gearAgg$VesConfid<-ifelse(allDat.gearAgg$Num.Vessel>=3,1,0)
allDat.gearAgg$FisherConfid<-ifelse(allDat.gearAgg$Num.Fishermen>=3,1,0)
allDat.gearAgg$DealerConfid<-ifelse(allDat.gearAgg$Num.Dealers>=3,1,0)
allDat.gearAgg$Confid<-ifelse(allDat.gearAgg$VesConfid+
                                allDat.gearAgg$DealerConfid+
                                allDat.gearAgg$DealerConfid>=3,"OK","CONFIDENTIAL")
allDat.gearAgg$Dollar.Value<-round(allDat.gearAgg$Dollar.Value,2)
allDat.gearAgg$Dollar.Value<-ifelse(allDat.gearAgg$Confid=="CONFIDENTIAL","C",allDat.gearAgg$Dollar.Value)
allDat.gearAgg<-allDat.gearAgg[,1:4]

# Subset by WEAs to
for (wea in WEAs){

  # By species by year
```

```
  weaSubSp<-subset(allDat.speciesAgg,WEA==wea)
  weaSubSp$WEA<-NULL
  weaSubSp<-reshape(weaSubSp,idvar="Land.Species",timevar="Land.Year",direction="wide")
  colnames(weaSubSp)<-c("Species.FMP","2011","2012","2013","2014","2015","2016")
  weaSubSp[is.na(weaSubSp)]<-0
  fileName<-paste(wea,"_SpeciesLand_by_Year_WeightedEst.csv",sep="")
  write.csv(weaSubSp,fileName)

  # By state by year
  weaSubSt<-subset(allDat.stateAgg,WEA==wea)
  weaSubSt$WEA<-NULL
  weaSubSt<-reshape(weaSubSt,idvar="Land.State",timevar="Land.Year",direction="wide")
  colnames(weaSubSt)<-c("State","2011","2012","2013","2014","2015","2016")
  weaSubSt[is.na(weaSubSt)]<-0
  fileName<-paste(wea,"_StateLand_by_Year_WeightedEst.csv",sep="")
  write.csv(weaSubSt,fileName)

  # By port by year
  weaSubPort<-subset(allDat.portAgg,WEA==wea)
  weaSubPort$WEA<-NULL
  weaSubPort<-reshape(weaSubPort,idvar="Land.Port",timevar="Land.Year",direction="wide")
  colnames(weaSubPort)<-c("Port","2011","2012","2013","2014","2015","2016")
  weaSubPort[is.na(weaSubPort)]<-0
  fileName<-paste(wea,"_PortLand_by_Year_WeightedEst.csv",sep="")
  write.csv(weaSubPort,fileName)

  # By gear by year
  weaSubGear<-subset(allDat.gearAgg,WEA==wea)
  weaSubGear$WEA<-NULL
  weaSubGear<-reshape(weaSubGear,idvar="VTR.Gear",timevar="Land.Year",direction="wide")
  colnames(weaSubGear)<-c("Gear","2011","2012","2013","2014","2015","2016")
  weaSubGear[is.na(weaSubGear)]<-0
  fileName<-paste(wea,"_GearLand_by_Year_WeightedEst.csv",sep="")
  write.csv(weaSubGear,fileName)

}

for (year in years){

  # By species by year
  yrSubSp<-subset(allDat.speciesAgg,Land.Year==year)
  yrSubSp$Land.Year<-NULL
  yrSubSp<-reshape(yrSubSp,idvar="Land.Species",timevar="WEA",direction="wide")
  colnames(yrSubSp)<-c("Species","Bay.St.Wind","Deepwater.Wind","Statoil","OCS-A.0502","Vineyard.Wind","OCS-
A.0503")
  yrSubSp<-yrSubSp[,c(1,3,2,6,5,7,4)]
  yrSubSp[is.na(yrSubSp)]<-0
  fileName<-paste(year,"_SpeciesLand_by_WEA_WeightedEst.csv",sep="")
  write.csv(yrSubSp,fileName)

  # By state by year
  yrSubSt<-subset(allDat.stateAgg,Land.Year==year)
  yrSubSt$Land.Year<-NULL
  yrSubSt<-reshape(yrSubSt,idvar="Land.State",timevar="WEA",direction="wide")
  colnames(yrSubSt)<-c("State","Bay.St.Wind","Deepwater.Wind","Statoil","OCS-A.0502","Vineyard.Wind","OCS-
A.0503")
  yrSubSt<-yrSubSt[,c(1,3,2,6,5,7,4)]
  yrSubSt[is.na(yrSubSt)]<-0
  fileName<-paste(year,"_StateLand_by_WEA_WeightedEst.csv",sep="")
  write.csv(yrSubSt,fileName)

  # By port by year
  yrSubPort<-subset(allDat.portAgg,Land.Year==year)
  yrSubPort$Land.Year<-NULL
  yrSubPort<-reshape(yrSubPort,idvar="Land.Port",timevar="WEA",direction="wide")
  colnames(yrSubPort)<-c("Port","Bay.St.Wind","Deepwater.Wind","Statoil","OCS-A.0502","Vineyard.Wind","OCS-
A.0503")
  yrSubPort<-yrSubPort[,c(1,3,2,6,5,7,4)]
  yrSubPort[is.na(yrSubPort)]<-0
  fileName<-paste(year,"_PortLand_by_WEA_WeightedEst.csv",sep="")
  write.csv(yrSubPort,fileName)

  # By gear by year
  yrSubGear<-subset(allDat.gearAgg,Land.Year==year)
  yrSubGear$Land.Year<-NULL
  yrSubGear<-reshape(yrSubGear,idvar="VTR.Gear",timevar="WEA",direction="wide")
  colnames(yrSubGear)<-c("Gear","Bay.St.Wind","Deepwater.Wind","Statoil","OCS-A.0502","Vineyard.Wind","OCS-
A.0503")
  yrSubGear<-yrSubGear[,c(1,3,2,6,5,7,4)]
  yrSubGear[is.na(yrSubGear)]<-0
  fileName<-paste(year,"_GearLand_by_WEA_WeightedEst.csv",sep="")
```

```
  write.csv(yrSubGear,fileName)

}


remove(allDat.gearAgg,allDat.portAgg,allDat.speciesAgg,allDat.stateAgg,
       yrSubGear,yrSubPort,yrSubSp,yrSubSt,
       weaSubGear,weaSubPort,weaSubSp,weaSubSt)

###############################################################################################
# Run all analysis 3rd time but using a unique ID to find the value of all trips that used the
# WEAs, not a proportion (this is the highest estimate).
###############################################################################################

# Create a unique ID to remove all points except one per species per trip
# We need to inclue the landed pounds and dollars because different grades of the
# same species may be landed at the same time from the same trip.

# Aggregate by species
allDat$UniqueID<-paste(allDat$Land.Supplier.Trip.Id,
                       allDat$Land.Common.Name,
                       allDat$Land.Landed.Lbs,
                       allDat$Land.Dollars,sep="")
allDat2<-allDat[!duplicated(allDat[,c("UniqueID")]),]

allDat.speciesValue<-aggregate(Land.Dollars~Land.Common.Name+Year+WEA,data=allDat2,FUN=sum)
allDat.speciesVessel<-aggregate(PERMIT~Land.Common.Name+Year+WEA,data=allDat2,function(x) length(unique(x)))
allDat.speciesFisherman<-aggregate(Land.Fisherman~Land.Common.Name+Year+WEA,data=allDat2,function(x)
length(unique(x)))
allDat.speciesDealer<-aggregate(Land.Dealer.License.Nbr~Land.Common.Name+Year+WEA,data=allDat2,function(x)
length(unique(x)))
allDat.speciesAgg<-merge(allDat.speciesValue,allDat.speciesVessel,by=c("Land.Common.Name","Year","WEA"))
allDat.speciesAgg<-merge(allDat.speciesAgg,allDat.speciesFisherman,by=c("Land.Common.Name","Year","WEA"))
allDat.speciesAgg<-merge(allDat.speciesAgg,allDat.speciesDealer,by=c("Land.Common.Name","Year","WEA"))
colnames(allDat.speciesAgg)<-
c("Land.Species","Land.Year","WEA","Dollar.Value","Num.Vessel","Num.Fishermen","Num.Dealers")

remove(allDat.speciesValue)
remove(allDat.speciesVessel)
remove(allDat.speciesFisherman)
remove(allDat.speciesDealer)

# Aggregate by gear

allDat.gearValue<-aggregate(Land.Dollars~VTR.Gear.name+Year+WEA,data=allDat2,FUN=sum)
allDat.gearVessel<-aggregate(PERMIT~VTR.Gear.name+Year+WEA,data=allDat2,function(x) length(unique(x)))
allDat.gearFisherman<-aggregate(Land.Fisherman~VTR.Gear.name+Year+WEA,data=allDat2,function(x)
length(unique(x)))
allDat.gearDealer<-aggregate(Land.Dealer.License.Nbr~VTR.Gear.name+Year+WEA,data=allDat2,function(x)
length(unique(x)))
allDat.gearAgg<-merge(allDat.gearValue,allDat.gearVessel,by=c("VTR.Gear.name","Year","WEA"))
allDat.gearAgg<-merge(allDat.gearAgg,allDat.gearFisherman,by=c("VTR.Gear.name","Year","WEA"))
allDat.gearAgg<-merge(allDat.gearAgg,allDat.gearDealer,by=c("VTR.Gear.name","Year","WEA"))
colnames(allDat.gearAgg)<-
c("VTR.Gear","Land.Year","WEA","Dollar.Value","Num.Vessel","Num.Fishermen","Num.Dealers")

remove(allDat.gearValue)
remove(allDat.gearVessel)
remove(allDat.gearFisherman)
remove(allDat.gearDealer)

# Aggregate data by state

allDat.stateValue<-aggregate(Land.Dollars~Land.State+Year+WEA,data=allDat2,FUN=sum)
allDat.stateVessel<-aggregate(PERMIT~Land.State+Year+WEA,data=allDat2,function(x) length(unique(x)))
allDat.stateFisherman<-aggregate(Land.Fisherman~Land.State+Year+WEA,data=allDat2,function(x) length(unique(x)))
allDat.stateDealer<-aggregate(Land.Dealer.License.Nbr~Land.State+Year+WEA,data=allDat2,function(x)
length(unique(x)))
allDat.stateAgg<-merge(allDat.stateValue,allDat.stateVessel,by=c("Land.State","Year","WEA"))
allDat.stateAgg<-merge(allDat.stateAgg,allDat.stateFisherman,by=c("Land.State","Year","WEA"))
allDat.stateAgg<-merge(allDat.stateAgg,allDat.stateDealer,by=c("Land.State","Year","WEA"))
colnames(allDat.stateAgg)<-
c("Land.State","Land.Year","WEA","Dollar.Value","Num.Vessel","Num.Fishermen","Num.Dealers")

remove(allDat.stateValue)
remove(allDat.stateVessel)
remove(allDat.stateFisherman)
remove(allDat.stateDealer)

# Aggregate data by port
```

```
allDat.portValue<-aggregate(Land.Dollars~Land.Port+Land.State+Year+WEA,data=allDat2,FUN=sum)
allDat.portVessel<-aggregate(PERMIT~Land.Port+Land.State+Year+WEA,data=allDat2,function(x) length(unique(x)))
allDat.portFisherman<-aggregate(Land.Fisherman~Land.Port+Land.State+Year+WEA,data=allDat2,function(x)
length(unique(x)))
allDat.portDealer<-aggregate(Land.Dealer.License.Nbr~Land.Port+Land.State+Year+WEA,data=allDat2,function(x)
length(unique(x)))
allDat.portAgg<-merge(allDat.portValue,allDat.portVessel,by=c("Land.Port","Year","WEA","Land.State"))
allDat.portAgg<-merge(allDat.portAgg,allDat.portFisherman,by=c("Land.Port","Year","WEA","Land.State"))
allDat.portAgg<-merge(allDat.portAgg,allDat.portDealer,by=c("Land.Port","Year","WEA","Land.State"))
colnames(allDat.portAgg)<-
c("Land.Port","Land.Year","WEA","Land.State","Dollar.Value","Num.Vessel","Num.Fishermen","Num.Dealers")

allDat.portAgg$Land.Port<-paste(allDat.portAgg$Land.Port,", ",allDat.portAgg$Land.State,sep="")

remove(allDat.portValue)
remove(allDat.portVessel)
remove(allDat.portFisherman)
remove(allDat.portDealer)

# Export results
write.csv(allDat.gearAgg,"WEA_Land_by_Gear_TotalTripEst.csv")
write.csv(allDat.portAgg,"WEA_Land_by_Port_TotalTripEst.csv")
write.csv(allDat.stateAgg,"WEA_Land_by_State_TotalTripEst.csv")
write.csv(allDat.speciesAgg,"WEA_Land_by_Species_TotalTripEst.csv")

# Clean up tables again for confidentiality reasons
allDat.speciesAgg$VesConfid<-ifelse(allDat.speciesAgg$Num.Vessel>=3,1,0)
allDat.speciesAgg$FisherConfid<-ifelse(allDat.speciesAgg$Num.Fishermen>=3,1,0)
allDat.speciesAgg$DealerConfid<-ifelse(allDat.speciesAgg$Num.Dealers>=3,1,0)
allDat.speciesAgg$Confid<-ifelse(allDat.speciesAgg$VesConfid+
                                   allDat.speciesAgg$DealerConfid+
                                   allDat.speciesAgg$DealerConfid>=3,"OK","CONFIDENTIAL")
allDat.speciesAgg$Dollar.Value<-
ifelse(allDat.speciesAgg$Confid=="CONFIDENTIAL","C",allDat.speciesAgg$Dollar.Value)
allDat.speciesAgg<-allDat.speciesAgg[,1:4]

allDat.stateAgg$VesConfid<-ifelse(allDat.stateAgg$Num.Vessel>=3,1,0)
allDat.stateAgg$FisherConfid<-ifelse(allDat.stateAgg$Num.Fishermen>=3,1,0)
allDat.stateAgg$DealerConfid<-ifelse(allDat.stateAgg$Num.Dealers>=3,1,0)
allDat.stateAgg$Confid<-ifelse(allDat.stateAgg$VesConfid+
                                 allDat.stateAgg$DealerConfid+
                                 allDat.stateAgg$DealerConfid>=3,"OK","CONFIDENTIAL")
allDat.stateAgg$Dollar.Value<-round(allDat.stateAgg$Dollar.Value,2)
allDat.stateAgg$Dollar.Value<-ifelse(allDat.stateAgg$Confid=="CONFIDENTIAL","C",allDat.stateAgg$Dollar.Value)
allDat.stateAgg<-allDat.stateAgg[,1:4]

allDat.portAgg$VesConfid<-ifelse(allDat.portAgg$Num.Vessel>=3,1,0)
allDat.portAgg$FisherConfid<-ifelse(allDat.portAgg$Num.Fishermen>=3,1,0)
allDat.portAgg$DealerConfid<-ifelse(allDat.portAgg$Num.Dealers>=3,1,0)
allDat.portAgg$Confid<-ifelse(allDat.portAgg$VesConfid+
                                allDat.portAgg$DealerConfid+
                                allDat.portAgg$DealerConfid>=3,"OK","CONFIDENTIAL")
allDat.portAgg$Dollar.Value<-round(allDat.portAgg$Dollar.Value,2)
allDat.portAgg$Dollar.Value<-ifelse(allDat.portAgg$Confid=="CONFIDENTIAL","C",allDat.portAgg$Dollar.Value)
allDat.portAgg<-allDat.portAgg[,c(1:3,5)]

allDat.gearAgg$VesConfid<-ifelse(allDat.gearAgg$Num.Vessel>=3,1,0)
allDat.gearAgg$FisherConfid<-ifelse(allDat.gearAgg$Num.Fishermen>=3,1,0)
allDat.gearAgg$DealerConfid<-ifelse(allDat.gearAgg$Num.Dealers>=3,1,0)
allDat.gearAgg$Confid<-ifelse(allDat.gearAgg$VesConfid+
                                allDat.gearAgg$DealerConfid+
                                allDat.gearAgg$DealerConfid>=3,"OK","CONFIDENTIAL")
allDat.gearAgg$Dollar.Value<-round(allDat.gearAgg$Dollar.Value,2)
allDat.gearAgg$Dollar.Value<-ifelse(allDat.gearAgg$Confid=="CONFIDENTIAL","C",allDat.gearAgg$Dollar.Value)
allDat.gearAgg<-allDat.gearAgg[,1:4]

# Subset by WEAs to
for (wea in WEAs){

  # By species by year
  weaSubSp<-subset(allDat.speciesAgg,WEA==wea)
  weaSubSp$WEA<-NULL
  weaSubSp<-reshape(weaSubSp,idvar="Land.Species",timevar="Land.Year",direction="wide")
  colnames(weaSubSp)<-c("Species.FMP","2011","2012","2013","2014","2015","2016")
  weaSubSp[is.na(weaSubSp)]<-0
  fileName<-paste(wea,"_SpeciesLand_by_Year_TotalTripEst.csv",sep="")
  write.csv(weaSubSp,fileName)

  # By state by year
  weaSubSt<-subset(allDat.stateAgg,WEA==wea)
  weaSubSt$WEA<-NULL
```

```
  weaSubSt<-reshape(weaSubSt,idvar="Land.State",timevar="Land.Year",direction="wide")
  colnames(weaSubSt)<-c("State","2011","2012","2013","2014","2015","2016")
  weaSubSt[is.na(weaSubSt)]<-0
  fileName<-paste(wea,"_StateLand_by_Year_TotalTripEst.csv",sep="")
  write.csv(weaSubSt,fileName)

  # By port by year
  weaSubPort<-subset(allDat.portAgg,WEA==wea)
  weaSubPort$WEA<-NULL
  weaSubPort<-reshape(weaSubPort,idvar="Land.Port",timevar="Land.Year",direction="wide")
  colnames(weaSubPort)<-c("Port","2011","2012","2013","2014","2015","2016")
  weaSubPort[is.na(weaSubPort)]<-0
  fileName<-paste(wea,"_PortLand_by_Year_TotalTripEst.csv",sep="")
  write.csv(weaSubPort,fileName)

  # By gear by year
  weaSubGear<-subset(allDat.gearAgg,WEA==wea)
  weaSubGear$WEA<-NULL
  weaSubGear<-reshape(weaSubGear,idvar="VTR.Gear",timevar="Land.Year",direction="wide")
  colnames(weaSubGear)<-c("Gear","2011","2012","2013","2014","2015","2016")
  weaSubGear[is.na(weaSubGear)]<-0
  fileName<-paste(wea,"_GearLand_by_Year_TotalTripEst.csv",sep="")
  write.csv(weaSubGear,fileName)

}

for (year in years){

  # By species by year
  yrSubSp<-subset(allDat.speciesAgg,Land.Year==year)
  yrSubSp$Land.Year<-NULL
  yrSubSp<-reshape(yrSubSp,idvar="Land.Species",timevar="WEA",direction="wide")
  colnames(yrSubSp)<-c("Species","Bay.St.Wind","Deepwater.Wind","Statoil","OCS-A.0502","Vineyard.Wind","OCS-
A.0503")
  yrSubSp<-yrSubSp[,c(1,3,2,6,5,7,4)]
  yrSubSp[is.na(yrSubSp)]<-0
  fileName<-paste(year,"_SpeciesLand_by_WEA_TotalTripEst.csv",sep="")
  write.csv(yrSubSp,fileName)

  # By state by year
  yrSubSt<-subset(allDat.stateAgg,Land.Year==year)
  yrSubSt$Land.Year<-NULL
  yrSubSt<-reshape(yrSubSt,idvar="Land.State",timevar="WEA",direction="wide")
  colnames(yrSubSt)<-c("State","Bay.St.Wind","Deepwater.Wind","Statoil","OCS-A.0502","Vineyard.Wind","OCS-
A.0503")
  yrSubSt<-yrSubSt[,c(1,3,2,6,5,7,4)]
  yrSubSt[is.na(yrSubSt)]<-0
  fileName<-paste(year,"_StateLand_by_WEA_TotalTripEst.csv",sep="")
  write.csv(yrSubSt,fileName)

  # By port by year
  yrSubPort<-subset(allDat.portAgg,Land.Year==year)
  yrSubPort$Land.Year<-NULL
  yrSubPort<-reshape(yrSubPort,idvar="Land.Port",timevar="WEA",direction="wide")
  colnames(yrSubPort)<-c("Port","Bay.St.Wind","Deepwater.Wind","Statoil","OCS-A.0502","Vineyard.Wind","OCS-
A.0503")
  yrSubPort<-yrSubPort[,c(1,3,2,6,5,7,4)]
  yrSubPort[is.na(yrSubPort)]<-0
  fileName<-paste(year,"_PortLand_by_WEA_TotalTripEst.csv",sep="")
  write.csv(yrSubPort,fileName)

  # By gear by year
  yrSubGear<-subset(allDat.gearAgg,Land.Year==year)
  yrSubGear$Land.Year<-NULL
  yrSubGear<-reshape(yrSubGear,idvar="VTR.Gear",timevar="WEA",direction="wide")
  colnames(yrSubGear)<-c("Gear","Bay.St.Wind","Deepwater.Wind","Statoil","OCS-A.0502","Vineyard.Wind","OCS-
A.0503")
  yrSubGear<-yrSubGear[,c(1,3,2,6,5,7,4)]
  yrSubGear[is.na(yrSubGear)]<-0
  fileName<-paste(year,"_GearLand_by_WEA_TotalTripEst.csv",sep="")
  write.csv(yrSubGear,fileName)

}


remove(allDat.gearAgg,allDat.portAgg,allDat.speciesAgg,allDat.stateAgg,
       yrSubGear,yrSubPort,yrSubSp,yrSubSt,
       weaSubGear,weaSubPort,weaSubSp,weaSubSt)
```

Spatiotemporal and Economic Analysis of Vessel Monitoring System Data within Wind Energy Areas in the Greater North Atlantic

Addendum I

Rhode Island Department of Environmental Management
Division of Marine Fisheries

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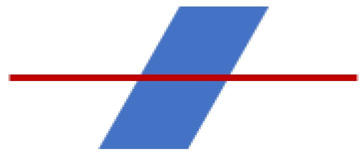
3 Purpose of Addendum

The prior approach takes a fishing density-weighted estimate of fishing value within a WEA and includes only the points within a WEA in the value estimation. This means that only the portion of that trip that overlaps with the WEA is included in the value. An important note about this is that the trips that had been taken previously with a portion of the trip intersecting with the WEA, may now not occur as the WEA may disrupt the fishing activity of the entire trip. See figure below for example.



In this example, the blue shape represents a wind farm and the red line represents a fishing tow line. Only the portion where the line intersects the blue shape is included in the current calculation of the value estimation, while in reality, the full trip may be disrupted and may not occur in the future, depending on the final orientation of the wind farm and the area of the WEA the trip is occurring in. Thus, the VMS estimates provided in the original report should be interpreted as a minimal estimate of the total economic exposure created by each individual WEA.

In the additional approach provided in this addendum, the value of each trip in its entirety is included in the value estimation. Thus, the prior estimates may be interpreted as minimal estimates of economic exposure, and the estimates provided in this addendum may be interpreted as maximal estimates of economic exposure (i.e., if every trip that fished in part within a lease area or WEA was prevented). The true economic exposure is likely between the two.

It should also be noted that the values from each lease area or WEA cannot be combined, as overlapping trips may be included in multiple area values. Thus, adding values of areas may include the same trip multiple times.

4 Additional Methods

Following all steps of the previous methodology, a unique identifier was created in a new column by concatenating the species name, price paid to the dealer, the supplier trip ID, and the WEA in which the point occurred. The weighted point value was not used. The unique function in R was then used to select only rows with a unique value in the unique identifier column. This resulted in a dataframe containing a single row per trip per WEA (e.g., if a vessel fished in three WEAs on a single trip, three rows would result in the final dataset where there is a row for each of the WEAs and each row contains the same information except for the contents of the WEA column). From this point, the total trip value was aggregated annually by summing trip values based on the same parameters as before: by species landed, state landed in, port landed in, and gear used.

5 RESULTS

5.1 EX-VESSEL VALUES BY STATE

5.1.1 Fishing within the Deepwater Wind Lease Area

Over the six-year study period, the majority of landings from the Deepwater Wind area were made in two states: MA and RI (Table 1). Landings in both states exceeded $1 million in all years and totaled to $18,936,280.97 in MA and $13,119,899.98 in RI. The maximum annual values occurred in 2014 for MA ($4,525,862.04) and in 2013 for RI ($2,853,162.54).

5.1.2 Fishing within the Bay State Wind Lease Area

The majority of landings from the Bay State Wind area were made in the same two states: MA and RI. The six-year total was $13,539,321.80 for MA and $11,052,133.96 for RI (Table 2). The largest values occurred in 2015 and 2016 for MA landings and 2013, 2014 and 2016 for RI. All annual values for RI exceed $500,000 and all annual values for MA exceed $900,000.

5.1.3 Fishing within the Vineyard Wind Lease Area

RI and MA landed the majority of seafood from the Vineyard Wind area as well (six-year totals of $8,450,797.53 and $6,301,883.92, respectively; Table 3). Annual highs occurred in 2016 for RI ($3,072,606.73) and 2012 for MA ($1,789,728.95). All RI annual values exceeded $500,000 and all MA values exceeded $250,000. The state of NY also had landings greater than $500,000 in 2016.

5.1.4 Fishing within the Statoil (now Equinor) Lease Area

The highest annual landings coming from the Statoil (now Equinor) lease area went to the states of MA ($75,807,134.50 six-year total), NJ ($69,669,101.67 six-year total), and RI ($10,223,430.33 six-year total; Table 4). Annual highs for MA and NJ occurred in 2011 ($24,057,215.22 and $17,334,723.71, respectively) and in 2014 for RI ($3,314,073.96). All MA and NJ annual values exceeded $4 million and all RI annual values exceeded $500,000.

5.1.5 Fishing within the OCS-A 502 and OCS-A 503 WEAs

The values of landings from the OCS-A 502 WEA were greatest going into RI and MA, with RI values exceeding $500,000 in all years and reaching $1,178,043.18 in 2016 and MA values exceeding $250,000 all years and reaching $832,048.04 in 2012 (Table 5). Six-year totals reached $4,807,871.13 and $3,143,475.76 for RI and MA, respectively. There may be landings from this area in states south of NJ, but landings and VTRs were not obtained for those states as part of this work.

The landings values coming from the OCS-A 503 WEA all went to MA and accumulated to a $1,385,740.92 six-year total (Table 6).

5.2 EX-VESSEL VALUES BY PORT

5.2.1 Fishing within the Deepwater Wind Lease Area

The majority of landings from the Deepwater Wind area were made in two ports: New Bedford, MA ($17,718,903.90 six-year total), Point Judith, RI ($10,921,904.75 six-year total; Table 7). Annual highs occurred in 2013 for New Bedford ($4,245,205.20) and in 2014 in Point Judith ($2,402,309.73).

5.2.2 Fishing within the Bay State Wind Lease Area

Bay State Wind area fishing activity also resulted in landings primarily in New Bedford, MA ($11,848,681.65 six-year total) and Point Judith, RI ($10,072,332.00 six-year total; Table 8). Annual highs occurred in 2016 for both ports: $2,835,889.89 in New Bedford and $2,780,553.47 in Point Judith.

5.2.3 Fishing within the Vineyard Wind Lease Area

Fishing activity in the Bay State Wind area lead to landings mostly in Point Judith, RI ($7,999,559.57 six-year total) and New Bedford, MA ($5,539,352.31 six-year total) as well, with annual highs in 2016 for RI ($2,980,772.46) and 2012 for New Bedford ($1,575,748.70; Table 9).

5.2.4 Fishing within the Statoil (now Equinor) Lease Area

Within the Statoil/Equinor lease area, most fishing activity lead to landings in New Bedford, MA ($73,396,735.21 six-year total); Cape May, NJ ($29,305,818.42 six-year total); Point Pleasant, NJ ($14,566,162.22 six-year total); and Point Judith, RI ($6,794,086.01 six-year total; Table 10). Annual highs occurred in the following years for each port: 2011 for New Bedford ($22,525,.826.93) and Cape May ($9,579,036.94) and 2014 for Point Pleasant ($3,126,366,64) and Point Judith ($1,981,498.84).

5.2.5 Fishing within the OCS-A 502 and OCS-A 503 WEAs

Point Judith, RI ($4,395,287.27 six-year total) and New Bedford, MA ($2,349,058.89 six-year total) were the two ports where the majority of landings resulting from OCS-A 502 WEA fishing were made (Table 11). All Point Judith annual values exceeded $500,000 and 2016 reached $1,053,449.80. New Bedford annual landings reached $638,549.63 in 2012.

Fishing activity in the OCS-A 503 WEA resulted in landings primarily in New Bedford, MA and Chatham, MA. No annual values for either port reached $200,000 (Table 12).

5.3 Ex-vessel Values by Species Landed or Fishery Management Plan

5.3.1 Fishing within the Deepwater Wind Lease Area

The primary species/FMPs with landings coming from the Deepwater Wind area were the Sea Scallop FMP ($16,493,426.25 six-year total); the Northeast Multispecies FMP ($5,163,164.05 six-year total); the Monkfish FMP ($4,015,824.52 six-year total), the Squid, Mackerel, Butterfish FMP ($3,086,874.88 six-year total); and the Summer Flounder, Scup, Black Sea Bass FMP ($3,005,156.17 six-year total; Table 13). The annual high for the Sea Scallop FMP was in 2015 ($4,410,115.23); the high for the Northeast Multispecies FMP was in 2014 ($1,266,334.64); the high for the Monkfish FMP was in 2011 ($925,919.40); the annual high for the Squid, Mackerel, Butterfish FMP was in 2016 ($1,482,887.47); the high for the Summer Flounder, Scup, Black Sea Bass FMP was in 2012 ($751,953.72).

5.3.2 Fishing within the Bay State Wind Lease Area

The same six FMPs made up the majority of the landings from the Bay State Wind area. Six-year totals were as follows: $9,647,939.31 for the Sea Scallop FMP (with a 2015 high of $2,734,723.85); $5,930,212.15 for the Squid, Mackerel, Butterfish FMP (with a 2016 high of $3,444,130.25); $3,345,325.14 for the Summer Flounder, Scup Black Sea Bass FMP (with a 2013 high of $1,162,544.00); $3,132,262.82 for the Monkfish FMP (with a 2011 high of $656,789.99); $2,459,280.18 for the Northeast Multispecies FMP (with a 2014 high of $913,013.41); and $1,797,378.40 for the Northeast Small Mesh Multispecies FMP (with a 2016 high of $526,684.06; Table 14).

5.3.3 Fishing within the Vineyard Wind Lease Area

Four FMPs' fishing activity in the Vineyard Wind area resulted in most of the landings: Six-year totals from the Squid, Mackerel, Butterfish FMP; Sea Scallop FMP; Northeast Small Mesh Multispecies FMP; and Summer Flounder, Scup, Black Sea Bass FMP are $7,069,695.55; $3,492,324.72; $2,684,308.09; and $1,880,168.55, respectively (Table 15). Annual highs for both the Squid, Mackerel, Butterfish FMP ($3,819,617) and the Northeast Multispecies FMP ($823,293.34) occurred in 2016. The annual high for the Sea Scallop FMP was in 2012 ($1,366,019.30); for the Summer Flounder, Scup, Black Sea Bass FMP the high was in 2014 ($439,326.13).

5.3.4 Fishing within the Statoil (now Equinor) Lease Area

Landings from the Statoil/Equinor area were predominantly from Sea Scallop FMP activity. The 6-year total was $150,950,679.27, and the annual high occurred in 2011 with $42,167,898.55 (Table 16). All years exceeded $10 million. The Squid, Mackerel, Butterfish FMP also had notable landings with a six-year total of $9,176,405.23 and an annual high of $2,872,684.87 in 2012. The Northeast Multispecies FMP also reached a six-year total of $1,213,518.90 with an annual high of $639,544.07.

5.3.5 Fishing within the OCS-A 502 and OCS-A 503 WEAs

For the fishing activity in OCS-A 502, four FMPs resulted in the most landings: Squid, Mackerel, Butterfish FMP (six-year total of $3,104,337.85; annual high of $1,004,485.53 in 2016); Northeast Small mesh Multispecies FMP (six-year total of $2,367,988.56; annual high of $521,694.80 in 2016); Sea Scallop FMP (six-year total of $1,597,691.33; annual high of $921,463.03 in 2012); and Summer Flounder, Scup, Black Sea Bass FMP (six-year total of $1,525,594.00; annual high of $341,403.04 in 2013; Table 17).

No FMP or species landings reached $100,000 in a single year, though six-year totals accumulated to $342,559.39 for the Monkfish FMP; $208,177.53 for the Squid, Mackerel, Butterfish FMP; and $191,353.34 for the Northeast Small Mesh Multispecies FMP (Table 18).

5.4 Ex-vessel Values by Gear Used

5.4.1 Fishing within the Deepwater Wind Lease Area

The primary gear types used within the Deepwater Wind area were the scallop dredge ($16,486,655.81 six-year total), the bottom fish otter trawl ($12,036,401.50 six-year total), and the sink gill net ($3,599,103.29 six-year total; Table 19). Annual highs for each were: $4,425,062.36 in 2015 for the scallop dredge, $2,710,991.18 in 2014 for the bottom fish otter trawl, and $771,962.08 in 2011 for the sink gill net.

5.4.2 Fishing within the Bay State Wind Lease Area

The Bay State Wind area had the same primary gears used: bottom fish otter trawl (six-year total of $14,302,137.18 and annual high of $4,361,033.47 in 2016), scallop dredge (six-year total of $9,637,579.64 and annual high of $2,745,530.03 in 2015), and sink gill net (six-year total of $2,191,763.16 and annual high of $498,201.33; Table 20).

5.4.3 Fishing within the Vineyard Wind Lease Area

The Vineyard Wind area had the bottom fish otter trawl and the scallop dredge as the main gears used. The otter trawl had a six-year total of $12,550,647.12 with an annual high in 2016 at $5,036,628.76

(Table 21). The scallop dredge six-year total was $3,211,989.30 and the annual high of $1,365,623.30 occurred in 2012.

5.4.4 Fishing within the Statoil (now Equinor) Lease Area

The majority of landings from the Statoil/Equinor area came from scallop dredge usage. The six-year total was $150,385,960.00 and the annual high occurred in 2011 with $42,051,698.69; all annual values exceeded $10 million (Table 22). The bottom fish otter trawl also resulted in a $10,582,433.17 six-year total and an annual high in 2012 of $2,975,215.21; all annual values exceeded $200,000.

5.4.5 Fishing within the OCS-A 502 and OCS-A 503 WEAs

Landings from fishing in the OCS-A 502 WEA indicate that the primary gears were the bottom fish otter trawl and the scallop dredge. The otter trawl annual high occurred in 2016 with $1,882,054.10 and a six-year total of $7,296,152.16 (Table 23). The scallop dredge annual high was in 2012 at $921,463.03 and the six-year total was $1,597,738.28.

The gears most heavily used in the OCS-A 503 WEA were the bottom fish otter trawl and the sink gill net (Table 24).

6 TABLES

6.1 LANDINGS BY STATE – TOTAL TRIP VALUES

Table 1. Annual landings including total trip values in each study state coming from the Deepwater Wind lease area. NH had no landings from the lease area. (C) = confidential landings and (-) = no landings

State	2011	2012	2013	2014	2015	2016	Non-Confidential Total
CT	$123,870.87	$346,462.08	$303,122.64	$347,255.88	C	$144,590.80	$1,265,302.27
MA	$2,730,261.37	$1,352,236.08	$2,146,834.13	$4,270,928.25	$4,525,862.04	$3,910,159.10	$18,936,280.97
NJ	-	C	C	$27,320.80	$82,957.24	$30,680.60	$140,958.64
NY	$45,321.05	$38,989.19	$200,500.55	$115,217.83	$114,039.45	$199,885.15	$713,953.22
RI	$1,336,225.93	$1,763,327.11	$2,853,162.54	$2,674,480.08	$2,215,043.98	$2,277,660.34	$13,119,899.98

Table 2. Annual landings including total trip values in each study state coming from the Bay State Wind lease area. NH had no landings from the lease area. (C) = confidential landings and (-) = no landings

State	2011	2012	2013	2014	2015	2016	Non-Confidential Total
CT	$75,058.87	$387,604.73	$176,318.00	$89,854.03	-	$285,019.21	$1,013,854.84
MA	$1,167,299.03	$988,208.26	$2,091,373.20	$2,685,094.84	$3,243,343.89	$3,364,002.58	$13,539,321.80
NJ	-	C	C	$82,083.12	C	$71,634.06	$153,717.18
NY	$45,263.35	-	$287,633.76	$131,486.40	$145,264.80	$542,551.50	$1,152,199.81
RI	$896,414.82	$528,342.24	$2,655,633.87	$2,438,919.92	$1,663,043.84	$2,869,779.27	$11,052,133.96

Table 3. Annual landings including total trip values in each study state coming from the Vineyard Wind lease area. NH had no landings from the lease area. (C) = confidential landings and (-) = no landings

State	2011	2012	2013	2014	2015	2016	Non-Confidential Total
CT	$111,918.72	C	$132,648.00	C	-	$233,072.85	$477,639.57
MA	$274,093.43	$1,789,728.95	$1,194,243.92	$796,422.64	$641,739.39	$1,605,655.59	$6,301,883.92
NJ	-	C	-	C	$90,548.22	$87,846.31	$178,394.53
NY	C	C	$296,931.95	C	$253,453.50	$515,623.15	$1,066,008.60
RI	$606,220.87	$789,005.63	$1,429,129.66	$1,226,020.96	$1,327,813.68	$3,072,606.73	$8,450,797.53

Table 4. Annual landings including total trip values in each study state coming from the Statoil (now Equinor) lease area. NH had no landings from the lease area. Please note that the RI landings values will differ from the July 22, 2016 RIDEM report on the RI fishing value of the NY WEA. The methodologies of the addendum and the earlier report are the same, but the 2016 report used the original NY WEA shapefile, while this effort utilized the revised WEA now leased to Equinor (BOEM removed four aliquots). (C) = confidential landings and (-) = no landings

State	2011	2012	2013	2014	2015	2016	Non-Confidential Total
CT	$638,664.50	$1,546,826.79	$732,996.61	$308,793.30	-	C	$3,227,281.20
MA	$24,057,215.22	$13,344,927.85	$6,648,677.02	$20,388,010.02	$6,202,893.09	$5,165,411.30	$75,807,134.50
NJ	$17,334,723.71	$13,860,543.40	$12,050,918.65	$13,536,089.82	$8,320,392.47	$4,566,433.62	$69,669,101.67
NY	$1,450,298.12	$804,593.48	$251,559.30	$409,622.07	$154,651.00	$184,348.50	$3,255,072.47
RI	$1,532,575.04	$1,953,586.38	$2,243,578.19	$3,314,073.96	$561,494.71	$618,122.05	$10,223,430.33

Table 5. Annual landings including total trip values in each study state coming from the OCS-A 502 WEA. NH had no landings from the WEA. (C) = confidential landings and (-) = no landings

State	2011	2012	2013	2014	2015	2016	Non-Confidential Total
CT	C	$282,954.82	$60,482.00	C	-	$54,159.35	$397,596.17
MA	$358,111.03	$832,048.04	$679,205.27	$395,111.66	$283,384.59	$595,615.17	$3,143,475.76
NJ	-	C	-	C	C	C	C
NY	C	C	$443,235.36	C	$269,131.45	$126,216.10	$838,582.91
RI	$647,450.68	$804,203.11	$919,800.53	$586,621.54	$671,752.09	$1,178,043.18	$4,807,871.13

Table 6. Annual landings including total trip values in each study state coming from the OCS-A 503 WEA. NH had no landings from the WEA. (C) = confidential landings and (-) = no landings

State	2011	2012	2013	2014	2015	2016	Non-Confidential Total
CT	-	C	C	-	-	C	C
MA	$198,361.36	$369,185.71	$222,789.30	$274,004.94	$267,136.76	$54,262.85	$1,385,740.92
NY	C	C	C	C	C	-	C
RI	C	C	C	-	-	C	C

6.2 Landings by Port – Total Trip Values

Table 7. Annual non-confidential landings including total trip values in each port (within the six study states) coming from the Deepwater Wind lease area. (C) = confidential landings and (-) = no landings

Port	2011	2012	2013	2014	2015	2016	Non-Confidential Total
Atlantic City, NJ	-	C	-	-	-	-	C
Barnegat Light, NJ	-	-	-	-	C	-	C
Barnstable, MA	-	-	-	C	-	-	C
Boston, MA	-	-	-	-	C	C	C
Cape May, NJ	-	-	C	C	-	C	C
Chatham, MA	C	C	$9,265.90	C	C	-	$9,265.90
Chilmark, MA	C	-	-	-	-	-	C
Dartmouth, MA	C	-	-	-	-	-	C
Davisville, RI	-	-	-	-	C	-	C
East Haven, CT	-	-	-	-	-	C	C
Fairhaven, MA	C	-	-	-	C	-	C
Fall River, MA	-	-	-	C	-	C	C
Falmouth, MA	-	C	-	-	-	-	C
Gloucester, MA	C	C	C	C	C	C	C
Greenport, NY	C	-	-	C	-	-	C
Hampton Bays, NY	C	C	C	-	C	C	C
Jamestown, RI	-	-	C	C	C	-	C
Little Compton, RI	$257,095.75	$146,843.45	$145,008.60	C	C	C	$548,947.80
Menemsha, MA	-	-	-	-	C	-	C
Montauk, NY	$32,687.35	$24,338.19	$174,511.55	$94,200.20	$94,162.95	$178,132.65	$598,032.89
Mystic, CT	-	-	-	-	C	C	C
Nantucket, MA	-	-	-	-	C	-	C
New Bedford, MA	$2,637,639.56	$1,221,606.41	$1,992,516.01	$4,106,837.35	$4,245,205.20	$3,515,099.37	$17,718,903.90
New London, CT	C	C	$80,979.35	C	C	C	$80,979.35
New Shoreham, RI	-	-	-	C	-	-	C

Port	2011	2012	2013	2014	2015	2016	Non-Confidential Total
Newport, RI	C	$204,685.52	$425,583.69	C	C	C	$630,269.21
North Kingstown, RI	-	-	-	-	-	C	C
Plymouth, MA	C	-	-	-	-	-	C
Point Judith, RI	$968,865.38	$1,381,278.69	$2,272,575.66	$2,402,309.73	$1,922,545.60	$1,974,329.69	$10,921,904.75
Point Pleasant, NJ	-	-	-	C	$53,735.19	C	$53,735.19
Portsmouth, RI	-	-	-	C	-	-	C
Providence, RI	-	-	C	-	-	-	C
Provincetown Wharf, MA	-	-	-	-	C	C	C
Shinnecock Reservation, NY	-	-	-	-	-	C	C
Stonington, CT	$61,418.75	$260,997.37	$222,143.29	C	-	C	$544,559.41
Tiverton, RI	-	C	C	$18,622.76	C	-	$18,622.76
Westport, MA	$59,714.20	C	$116,987.37	$89,058.40	C	$255,187.32	$520,947.29
Wildwood, NJ	-	-	-	-	-	C	C
Woods Hole, MA	-	C	C	C	-	-	C

Table 8. Annual non-confidential landings including total trip values in each port (within the six study states) coming from the Bay State Wind lease area. (C) = confidential landings and (-) = no landings

Port	2011	2012	2013	2014	2015	2016	Non-Confidential Total
Atlantic City, NJ	-	C	-	-	-	-	C
Barnegat Light, NJ	-	-	-	C	-	-	C
Boston, MA	-	-	-	-	C	$72,398.35	$72,398.35
Cape May, NJ	-	-	-	-	-	C	C
Chatham, MA	C	$53,595.05	$71,143.15	C	C	C	$124,738.20
East Haven, CT	-	-	-	-	-	C	C
Fairhaven, MA	C	-	-	-	C	-	C
Fall River, MA	C	-	-	-	-	-	C
Falmouth, MA	-	C	-	-	-	-	C
Gloucester, MA	C	C	C	-	C	$285,542.69	$285,542.69
Greenport, NY	C	-	-	C	-	-	C
Hampton Bays, NY	-	-	C	-	C	C	C
Harwich Port, MA	-	-	-	C	C	-	C
Little Compton, RI	C	C	C	C	C	C	C
Menemsha, MA	-	-	-	-	C	C	C
Montauk, NY	$40,994.65	-	$261,644.76	$122,699.65	$125,388.30	$422,474.85	$973,202.21
Mystic, CT	-	-	-	-	-	C	C
New Bedford, MA	$903,463.60	$711,464.76	$1,925,866.99	$2,516,011.50	$2,955,984.91	$2,835,889.89	$11,848,681.65
New London, CT	C	C	$176,318.00	C	-	C	$176,318.00
Newport, RI	C	C	$221,813.30	C	C	-	$221,813.30
North Kingstown, RI	C	-	-	C	-	C	C
Point Judith, RI	$599,011.91	$481,832.34	$2,413,597.17	$2,172,444.62	$1,624,892.49	$2,780,553.47	$10,072,332.00
Point Pleasant, NJ	-	-	C	$74,699.62	C	C	$74,699.62
Provincetown Wharf, MA	-	-	-	C	C	-	C
Shinnecock Reservation, NY	-	-	-	-	-	C	C
Stonington, CT	C	C	-	C	-	C	C

Port	2011	2012	2013	2014	2015	2016	Non-Confidential Total
Tiverton, RI	-	-	C	-	C	-	C
Westport, MA	$168,608.87	$108,245.52	$80,231.96	C	C	$157,091.90	$514,178.25
Woods Hole, MA	-	-	C	C	C	-	C

Table 9. Annual non-confidential landings including total trip values in each port (within the six study states) coming from the Vineyard Wind lease area. (C) = confidential landings and (-) = no landings

Port	2011	2012	2013	2014	2015	2016	Non-Confidential Total
Barnegat Light, NJ	-	-	-	-	C	-	C
Belford, NJ	-	-	-	-	-	C	C
Boston, MA	-	-	C	-	C	C	C
Cape May, NJ	-	C	-	C	C	C	C
Chatham, MA	$102,120.19	$144,879.42	$70,968.05	$37,902.22	C	C	$355,869.88
East Haven, CT	-	-	-	-	-	C	C
Gloucester, MA	C	C	-	-	-	C	C
Hampton Bays, NY	-	-	C	-	C	C	C
Harwich Port, MA	-	-	-	-	C	C	C
Little Compton, RI	-	-	-	C	-	C	C
Montauk, NY	C	C	$268,142.95	C	$149,538.50	$401,899.00	$819,580.45
Mystic, CT	-	-	-	-	-	C	C
New Bedford, MA	$110,137.34	$1,575,748.70	$1,112,523.15	$732,842.02	$550,396.53	$1,457,704.57	$5,539,352.31
New London, CT	$55,807.52	C	C	C	-	C	$55,807.52
Newport, RI	-	-	C	-	-	-	C
North Kingstown, RI	C	-	-	-	-	C	C
Point Judith, RI	$480,937.02	$777,024.63	$1,215,988.56	$1,217,023.22	$1,327,813.68	$2,980,772.46	$7,999,559.57
Point Pleasant, NJ	-	-	-	C	C	C	C
Providence, RI	-	-	C	-	-	-	C
Provincetown Wharf, MA	C	-	-	-	C	-	C
Shinnecock Reservation, NY	-	-	-	-	-	C	C
Stonington, CT	C	-	C	-	-	C	C
Wakefield, RI	-	C	-	-	-	-	C
Westport, MA	C	C	C	C	C	C	C
Woods Hole, MA	-	-	-	-	C	-	C

Table 10. Annual non-confidential landings including total trip values in each port (within the six study states) coming from the Statoil (now Equinor) lease area. (C) = confidential landings and (-) = no landings

Port	2011	2012	2013	2014	2015	2016	Non-Confidential Total
Atlantic City, NJ	-	-	-	C	C	-	C
Avalon, NJ	C	C	C	-	-	-	C
Barnegat Light, NJ	C	C	C	C	C	C	C
Barnstable, MA	C	-	-	-	-	-	C
Belford, NJ	C	C	C	C	C	C	C
Belmar, NJ	-	C	-	-	-	-	C
Boston, MA	-	-	-	-	C	-	C
Brielle, NJ	-	C	-	C	-	-	C
Cape May, NJ	$9,579,036.94	$5,578,437.90	$5,081,283.32	$5,399,652.54	$2,762,439.87	$904,967.85	$29,305,818.42
Fairhaven, MA	C	-	C	-	-	C	C
Fall River, MA	-	C	-	-	-	-	C
Freeport, NY	C	-	-	-	-	-	C
Gloucester, MA	-	-	-	-	-	C	C
Hampton Bays, NY	$362,610.45	$103,360.33	$118,106.10	$93,798.37	$26,762.98	-	$704,638.23
Islip, NY	C	-	-	-	-	-	C
Montauk, NY	$809,664.97	$564,480.90	$69,407.20	$156,690.85	$92,846.10	C	$1,693,090.02
New Bedford, MA	$22,525,826.93	$13,330,527.85	$6,445,810.38	$20,388,010.02	$6,187,677.29	$4,518,882.74	$73,396,735.21
New London, CT	C	$1,212,846.89	C	C	-	-	$1,212,846.89
Newport, RI	C	C	C	-	-	-	C
North Kingstown, RI	$0.00	C	C	C	-	-	C
Point Judith, RI	$1,363,878.64	$1,021,764.14	$1,362,466.08	$1,981,498.84	$561,494.71	$502,983.60	$6,794,086.01
Point Lookout, NY	C	$136,752.25	$46,056.00	$149,262.85	C	C	$332,071.10
Point Pleasant, NJ	$2,348,012.05	$2,706,423.66	$2,211,076.49	$3,126,366.65	$2,439,751.90	$1,734,532.47	$14,566,163.22
Sea Isle City, NJ	-	-	-	-	C	-	C
Shinnecock Reservation, NY	C	-	C	C	C	-	C

Port	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**Non-Confidential Total**
Stonington, CT	C	C	C	$294,126.55	-	C	$294,126.55
Wildwood, NJ	C	C	C	C	C	-	C

Table 11. Annual non-confidential landings including total trip values in each port (within the six study states) coming from the OCS-A 502 WEA. (C) = confidential landings and (-) = no landings

Port	2011	2012	2013	2014	2015	2016	Non-Confidential Total
Boston, MA	-	-	C	-	C	-	C
Cape May, NJ	-	C	-	C	-	-	C
Chatham, MA	$144,945.46	$158,191.01	$54,136.85	$58,907.80	$37,213.62	C	$453,394.74
Falmouth, MA	-	C	-	-	-	-	C
Gloucester, MA	-	C	C	-	-	-	C
Hampton Bays, NY	-	-	C	C	C	C	C
Harwich Port, MA	-	-	-	-	C	C	C
Little Compton, RI	-	C	-	-	-	-	C
Montauk, NY	C	C	$435,005.36	C	$144,552.45	$76,525.70	$656,083.51
Mystic, CT	-	-	-	-	-	C	C
New Bedford, MA	$147,728.97	$638,549.63	$546,255.39	$276,345.76	$211,924.53	$528,254.61	$2,349,058.89
New London, CT	-	C	C	C	-	C	C
Newport, RI	-	-	$211,676.25	-	-	-	$211,676.25
North Kingstown, RI	C	-	-	-	-	C	C
Point Judith, RI	$638,752.75	$738,637.81	$706,073.28	$586,621.54	$671,752.09	$1,053,449.80	$4,395,287.27
Point Lookout, NY	-	C	-	-	-	-	C
Point Pleasant, NJ	-	-	-	C	C	C	C
Providence, RI	-	-	C	-	-	-	C
Provincetown Wharf, MA	C	C	-	C	C	-	C
Shinnecock Reservation, NY	-	-	-	-	-	C	C
Stonington, CT	C	C	C	-	-	C	C
Wakefield, RI	-	C	-	-	-	-	C
Westport, MA	C	C	C	C	-	C	C
Woods Hole, MA	-	-	C	-	C	-	C

Table 12. Annual non-confidential landings including total trip values in each port (within the six study states) coming from the OCS-A 503 WEA. (C) = confidential landings and (-) = no landings

Port	2011	2012	2013	2014	2015	2016	Non-Confidential Total
Chatham, MA	$60,880.56	$82,354.34	C	$91,147.31	$53,667.60	$39,080.42	$327,130.23
Fairhaven, MA	-	C	-	-	C	-	C
Hampton Bays, NY	-	-	C	-	-	-	C
Harwich Port, MA	-	-	-	-	-	C	C
Little Compton, RI	-	C	-	-	-	-	C
Montauk, NY	C	C	C	C	C	-	C
Mystic, CT	-	-	-	-	-	C	C
New Bedford, MA	C	$53,176.04	$155,262.27	$143,132.03	$31,681.33	C	$383,251.67
New London, CT	-	C	C	-	-	C	C
Point Judith, RI	C	-	C	-	-	C	C
Stonington, CT	-	C	-	-	-	-	C
Westport, MA	C	-	C	C	-	-	C
Woods Hole, MA	-	-	-	-	C	-	C

6.3 Landings by Species or FMP – Total Trip Values

Table 13. Annual non-confidential landings including total trip values by species landed or fishery management plan (within the six study states) coming from the Deepwater Wind lease area. (C) = confidential landings and (-) = no landings

Species or FMP	2011	2012	2013	2014	2015	2016	Non-Confidential Total
Bluefish FMP	$9,096.26	$7,500.31	$4,109.19	$6,227.16	$3,356.58	$3,254.15	$33,543.65
BONITO, ATLANTIC	C	C	C	C	C	-	C
CRAB, ATLANTIC ROCK	C	-	C	-	-	-	C
CUNNER	C	-	$198.55	C	C	-	$198.55
DOGFISH, SMOOTH	C	C	$870.40	C	$1,154.90	$2,126.75	$4,152.05
DOGFISH, SPINY	$16,458.29	$33,322.12	$27,757.90	$28,053.67	$16,114.89	$28,550.91	$150,257.78
DORY, AMERICAN JOHN	C	$736.88	$4,295.64	C	C	C	$5,032.52
EEL, CONGER	C	C	$67.16	C	$22.11	C	$89.27
FLOUNDER, FOURSPOT	-	-	C	-	C	C	C
GROUPERS	C	-	-	-	-	-	C
HAKE, SPOTTED	-	-	-	-	C	C	C
HALIBUT, ATLANTIC	-	C	C	C	-	-	C
Monkfish FMP	$925,919.40	$844,800.19	$739,770.90	$677,262.47	$442,675.36	$385,396.20	$4,015,824.52
Northeast Multispecies FMP	$309,589.16	$621,192.20	$1,207,467.07	$1,266,334.64	$720,703.84	$1,037,877.14	$5,163,164.05
Northeast Red Crab FMP	C	-	-	-	C	-	C
Northeast Small Mesh Multispecies FMP	$127,199.24	$88,680.47	$191,422.34	$284,182.68	$139,364.50	$155,633.84	$986,483.07
RAVEN, SEA	C	-	-	-	-	-	C
ROBINS, SEA	C	C	C	C	C	C	C
Sea Scallop FMP	$2,290,449.90	$1,045,779.61	$1,926,741.61	$3,986,075.76	$4,410,115.23	$2,834,264.14	$16,493,426.25
SHARK, SANDBAR	C	-	-	-	-	-	C
SHARK, THRESHER	-	C	-	-	-	-	C
Skate FMP	$5,104.01	$50,723.22	$47,400.22	$109,629.11	$122,178.77	$69,191.16	$404,226.49

Species or FMP	2011	2012	2013	2014	2015	2016	Non-Confidential Total
Squid Mackerel Butterfish FMP	$176,331.44	$219,009.53	$514,417.90	$403,011.10	$291,217.44	$1,482,887.47	$3,086,874.88
Summer Flounder, Scup, Black Sea Bass FMP	$326,990.60	$497,591.68	$751,953.72	$630,328.72	$411,423.48	$386,867.97	$3,005,156.17
SWORDFISH	-	-	-	-	-	C	C
TAUTOG	C	C	C	-	C	-	C
TILEFISH, BLUELINE	C	-	-	-	-	C	C
TRIGGERFISHES	C	C	-	-	-	-	C
TUNNY, LITTLE	C	-	-	-	-	-	C

Table 14. Annual non-confidential landings including total trip values by species landed or fishery management plan (within the six study states) coming from the Bay State Wind lease area. (C) = confidential landings and (-) = no landings

Species or FMP	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**Non-Confidential Total**
Bluefish FMP	$9,414.43	$11,671.34	$4,039.60	$8,083.33	$3,257.80	$3,963.11	$40,429.61
BONITO, ATLANTIC	-	C	-	C	C	-	C
CROAKER, ATLANTIC	-	-	-	-	-	C	C
CUNNER	-	-	-	-	C	-	C
DOGFISH, SMOOTH	C	-	$1,336.75	$649.20	$2,092.40	$1,312.65	$5,391.00
DOGFISH, SPINY	$3,372.20	$9,855.34	$8,319.46	$3,145.67	$1,200.05	C	$25,892.72
DORY, AMERICAN JOHN	$1,745.40	C	$2,509.95	C	$701.25	$510.25	$5,466.85
EEL, AMERICAN	-	-	C	-	-	-	C
EEL, CONGER	-	C	C	C	C	$64.10	$64.10
FLOUNDER, FOURSPOT	C	-	-	-	$408.40	C	$408.40
HAKE, SPOTTED	-	-	-	-	C	C	C
HALIBUT, ATLANTIC	-	C	C	C	C	-	C
Monkfish FMP	$656,789.99	$520,898.81	$569,630.75	$654,711.06	$439,986.68	$290,245.53	$3,132,262.82
Northeast Multispecies FMP	$267,854.50	$60,192.03	$355,896.31	$913,013.41	$518,281.71	$344,042.22	$2,459,280.18
Northeast Small Mesh Multispecies FMP	$120,358.48	$298,886.67	$337,996.04	$250,859.66	$262,593.49	$526,684.06	$1,797,378.40
ROBINS, SEA	C	C	C	$32.24	C	-	$32.24
Sea Scallop FMP	$548,177.91	$407,719.52	$1,971,271.12	$1,918,225.27	$2,734,723.85	$2,067,821.64	$9,647,939.31
Skate FMP	C	$7,097.90	$14,035.95	$110,000.49	$89,908.69	$51,192.40	$272,235.43
SPOT	-	-	-	C	-	-	C
Squid Mackerel Butterfish FMP	$332,784.68	$257,638.15	$726,141.40	$678,510.82	$491,006.85	$3,444,130.25	$5,930,212.15
Summer Flounder, Scup, Black Sea Bass FMP	$223,684.79	$269,244.12	$1,162,544.00	$879,443.22	$510,239.69	$300,169.32	$3,345,325.14
SWORDFISH	-	-	-	-	-	C	C
TAUTOG	-	-	C	-	-	-	C

Species or FMP	2011	2012	2013	2014	2015	2016	Non-Confidential Total
TILEFISH, BLUELINE	C	-	-	-	-	C	C
TRIGGERFISHES	-	C	-	C	-	-	C
TUNNY, LITTLE	-	-	-	C	-	-	C

Table 15. Annual non-confidential landings including total trip values by species landed or fishery management plan (within the six study states) coming from the Vineyard Wind lease area. (C) = confidential landings and (-) = no landings

Species or FMP	2011	2012	2013	2014	2015	2016	Non-Confidential Total
Bluefish FMP	$7,391.09	$11,694.84	$4,597.93	$5,616.35	$5,871.85	$3,971.91	$39,143.97
BONITO, ATLANTIC	-	-	-	C	C	C	C
CUNNER	-	-	-	-	C	-	C
DOGFISH, SMOOTH	-	C	$1,469.95	C	$2,599.20	$953.25	$5,022.40
DOGFISH, SPINY	$3,466.62	$2,322.37	$1,105.45	C	$615.55	$2,000.70	$9,510.69
DORY, AMERICAN JOHN	C	$1,111.10	C	C	$711.45	C	$1,822.55
EEL, CONGER	-	C	C	-	C	C	C
FLOUNDER, FOURSPOT	-	-	-	-	C	-	C
HAKE, SPOTTED	-	-	-	-	C	C	C
HALIBUT, ATLANTIC	-	C	-	C	-	C	C
Monkfish FMP	$163,872.44	$254,420.09	$199,032.87	$78,337.86	$121,379.28	$107,970.57	$925,013.11
Northeast Multispecies FMP	$47,408.33	$29,590.43	$158,735.93	$304,299.44	$165,788.61	C	$705,822.74
Northeast Small Mesh Multispecies FMP	$283,047.12	$520,938.60	$395,816.77	$275,346.47	$385,865.78	$823,293.35	$2,684,308.09
ROBINS, SEA	-	C	C	C	$22.90	-	$22.90
Sea Scallop FMP	C	$1,366,019.30	$1,084,202.65	$520,058.47	$243,680.65	$278,363.65	$3,492,324.72
Skate FMP	$19,388.98	C	C	$19,483.98	$41,752.00	$31,703.67	$112,328.63
SPOT	-	-	-	C	-	-	C
Squid Mackerel Butterfish FMP	$374,839.40	$629,863.91	$804,561.45	$515,937.56	$924,875.54	$3,819,617.69	$7,069,695.55
Summer Flounder, Scup, Black Sea Bass FMP	$103,969.23	$174,676.61	$369,104.24	$439,326.13	$419,596.03	$373,496.31	$1,880,168.55
SWORDFISH	-	-	-	-	-	C	C
TAUTOG	-	-	C	-	-	-	C
TILEFISH, BLUELINE	-	-	-	-	-	C	C

Table 16. Annual non-confidential landings including total trip values by species landed or fishery management plan (within the six study states) coming from the Statoil (now Equinor) Wind lease area. (C) = confidential landings and (-) = no landings

Species or FMP	2011	2012	2013	2014	2015	2016	Non-Confidential Total
Bluefish FMP	$6,157.22	$5,976.49	$1,710.03	$2,438.93	$306.50	C	$16,589.17
BONITO, ATLANTIC	-	-	-	C	-	-	C
Coastal Migratory Pelagics FMP	C	-	-	-	-	-	C
CROAKER, ATLANTIC	-	-	-	$3,729.80	C	-	$3,729.80
DOGFISH, SMOOTH	$4,376.58	$4,179.62	$1,851.82	$2,747.80	$2,282.86	C	$15,438.68
DOGFISH, SPINY	$940.25	C	-	-	C	-	$940.25
DORY, AMERICAN JOHN	-	-	C	C	C	-	C
EEL, CONGER	-	C	C	-	-	-	C
Monkfish FMP	$108,743.49	$126,096.84	$56,657.51	$93,015.97	$42,884.43	$45,284.39	$472,682.63
Northeast Multispecies FMP	$115,259.88	$306,453.75	$639,544.07	C	C	$152,261.20	$1,213,518.90
Northeast Small Mesh Multispecies FMP	$8,512.27	$4,662.82	$20,624.19	$3,940.46	$1,907.77	C	$39,647.51
ROBINS, SEA	C	-	-	$70.24	C	-	$70.24
Sea Scallop FMP	$42,167,898.55	$28,099,760.78	$19,830,274.12	$35,840,640.59	$14,370,061.11	$10,642,044.12	$150,950,679.27
SHARK, THRESHER	-	-	-	C	-	-	C
Skate FMP	-	C	-	$27.28	$400.11	C	$427.39
Squid Mackerel Butterfish FMP	$2,481,105.59	$2,872,684.87	$1,341,252.36	$1,823,238.80	$656,415.62	$1,707.99	$9,176,405.23
Summer Flounder, Scup, Black Sea Bass FMP	$119,905.41	$89,168.50	$33,624.27	$152,014.35	$140,059.81	$44,463.43	$579,235.77
TAUTOG	-	C	-	-	-	-	C
TILEFISH, BLUELINE	-	-	C	C	C	-	C
TRIGGERFISHES	-	C	-	-	-	C	C
WHELK, CHANNELED	-	-	C	C	C	C	C

Table 17. Annual non-confidential landings including total trip values by species landed or fishery management plan (within the six study states) coming from the OCS-A 502 WEA. (C) = confidential landings and (-) = no landings

Species or FMP	2011	2012	2013	2014	2015	2016	Non-Confidential Total
Bluefish FMP	$2,110.80	$9,139.54	$3,944.45	$3,632.05	$3,519.50	$4,002.22	$26,348.56
BONITO, ATLANTIC	-	-	-	-	C	-	C
DOGFISH, SMOOTH	C	C	$2,637.05	$1,246.70	$2,944.60	C	$6,828.35
DOGFISH, SPINY	$1,988.39	$296.06	$523.79	C	C	C	$2,808.24
DORY, AMERICAN JOHN	C	C	C	C	C	$1,611.25	$1,611.25
EEL, CONGER	-	C	-	C	C	-	C
FLOUNDER, FOURSPOT	C	-	-	-	-	-	C
HAKE, SPOTTED	-	-	-	-	-	C	C
HALIBUT, ATLANTIC	-	-	C	C	-	C	C
Monkfish FMP	$176,341.15	$218,063.04	$109,212.25	$86,295.75	$45,312.18	$40,712.73	$675,937.10
Northeast Multispecies FMP	$31,173.45	-	$11,974.80	$76,860.52	$25,758.46	C	$145,767.23
Northeast Small Mesh Multispecies FMP	$391,551.51	$456,888.01	$407,280.54	$225,892.48	$364,681.22	$521,694.80	$2,367,988.56
ROBINS, SEA	-	C	C	C	C	-	C
Sea Scallop FMP	C	$921,463.03	$521,336.30	$154,892.00	C	-	$1,597,691.33
Skate FMP	$17,345.21	C	C	$23,017.69	$43,279.79	$18,958.40	$102,601.09
Squid Mackerel Butterfish FMP	$358,111.73	$323,266.19	$632,812.91	$246,432.45	$539,229.04	$1,004,485.53	$3,104,337.85
Summer Flounder, Scup, Black Sea Bass FMP	$129,219.35	$215,668.55	$341,403.04	$268,822.74	$232,805.71	$337,674.61	$1,525,594.00
SWORDFISH	C	-	-	-	-	-	C
TAUTOG	-	-	-	C	-	-	C

Table 18. Annual non-confidential landings including total trip values by species landed or fishery management plan (within the six study states) coming from the OCS-A 503 WEA. (C) = confidential landings and (-) = no landings

Species or FMP	2011	2012	2013	2014	2015	2016	Non-Confidential Total
Bluefish FMP	C	$336.20	$256.75	-	C	C	$592.95
DOGFISH, SMOOTH	-	-	-	-	C	-	C
DOGFISH, SPINY	$880.20	-	-	$875.50	C	C	$1,755.70
DORY, AMERICAN JOHN	C	-	C	-	C	C	C
EEL, CONGER	-	-	-	C	-	-	C
HALIBUT, ATLANTIC	-	-	-	C	-	C	C
Monkfish FMP	$71,854.06	$84,610.05	$19,174.55	$84,160.72	$47,005.23	$35,754.78	$342,559.39
Northeast Multispecies FMP	C	-	-	-	C	C	C
Northeast Small Mesh Multispecies FMP	$47,310.45	$70,192.55	$41,831.22	C	$11,936.07	$20,083.05	$191,353.34
Sea Scallop FMP	-	C	C	C	C	-	C
Skate FMP	$6,009.85	C	C	C	$12,891.65	$6,941.04	$25,842.54
Squid Mackerel Butterfish FMP	$79,656.94	$16,132.25	$54,725.74	C	$23,192.55	$34,470.05	$208,177.53
Summer Flounder, Scup, Black Sea Bass FMP	C	$6,845.38	$8,515.44	C	$17,486.43	$13,106.45	$45,953.70

6.4 Landings by Gear – Total Trip Values

Table 19. Annual non-confidential landings including total trip values by gear type (within the six study states) coming from the Deepwater Wind lease area (C) = confidential landings and (-) = no landings

Gear	2011	2012	2013	2014	2015	2016	Non-Confidential Total
DREDGE, OCEAN QUAHOG/SURF CLAM	-	C	C	C	C	C	C
DREDGE, SCALLOP	$2,300,460.86	$1,035,225.81	$1,890,170.71	$3,990,717.00	$4,425,062.36	$2,845,019.07	$16,486,655.81
GILL NET, RUNAROUND	C	-	-	-	-	-	C
GILL NET, SINK	$771,962.08	$688,129.27	$664,728.59	$573,772.60	$488,219.53	$412,291.22	$3,599,103.29
LONGLINE, BOTTOM	C	C	-	-	-	-	C
OTTER TRAWL, BOTTOM, FISH	$1,102,956.24	$1,631,460.30	$2,565,418.45	$2,710,991.18	$1,589,841.53	$2,435,733.80	$12,036,401.50
OTTER TRAWL, MIDWATER	-	-	-	C	C	$119,664.00	$119,664.00
PAIR TRAWL, MIDWATER	-	C	$259,430.04	C	C	$562,751.02	$822,181.06
POT, CRAB/LOBSTER	$40,024.34	$91,595.20	$106,420.82	$42,330.71	$388,318.25	$177,449.47	$846,138.79
POT, FISH	-	-	C	-	-	C	C

Table 20. Annual non-confidential landings including total trip values by gear type (within the six study state) coming from the Bay State Wind lease area. (C) = confidential landings and (-) = no landings

Gear	2011	2012	2013	2014	2015	2016	Non-Confidential Total
DREDGE, OCEAN QUAHOG/SURF CLAM	-	C	C	C	C	C	C
DREDGE, SCALLOP	$551,261.41	$396,823.52	$1,954,669.82	$1,916,981.10	$2,745,530.03	$2,072,313.76	$9,637,579.64
GILL NET, SINK	$445,459.89	$498,201.33	$258,402.55	$355,938.35	$376,436.65	$257,324.39	$2,191,763.16
OTTER TRAWL, BOTTOM, FISH	$1,109,379.77	$941,317.73	$2,818,303.53	$3,143,594.76	$1,928,507.92	$4,361,033.47	$14,302,137.18
OTTER TRAWL, BOTTOM, SHRIMP	-	-	-	-	-	C	C
OTTER TRAWL, MIDWATER	C	-	-	-	-	C	C
PAIR TRAWL, MIDWATER	-	-	C	-	-	C	C

Table 21. Annual non-confidential landings including total trip values by gear type (within the six study state) coming from the Vineyard Wind lease area. (C) = confidential landings and (-) = no landings

Gear	2011	2012	2013	2014	2015	2016	Non-Confidential Total
DREDGE, OCEAN QUAHOG/SURF CLAM	-	-	-	-	-	C	C
DREDGE, SCALLOP	C	$1,365,623.30	$1,086,063.25	$516,370.35	$243,932.40	C	$3,211,989.30
GILL NET, SINK	$140,381.19	$235,051.15	$102,823.74	$50,562.12	$108,292.02	$116,691.14	$753,801.36
OTTER TRAWL, BOTTOM, FISH	$849,572.84	$1,397,741.78	$1,711,692.15	$1,593,681.22	$1,961,330.37	$5,036,628.76	$12,550,647.12
OTTER TRAWL, BOTTOM, SHRIMP	-	-	-	-	-	C	C
PAIR TRAWL, MIDWATER	C	-	C	-	-	-	C

Table 22. Annual non-confidential landings including total trip values by gear type (within the six study states) coming from the Statoil (now Equinor) lease area. (C) = confidential landings and (-) = no landings

Gear	2011	2012	2013	2014	2015	2016	Non-Confidential Total
DREDGE, OCEAN QUAHOG/SURF CLAM	-	-	C	C	-	-	C
DREDGE, SCALLOP	$42,051,698.69	$27,868,706.58	$19,866,398.12	$35,745,609.90	$14,365,612.55	$10,487,934.16	$150,385,960.00
GILL NET, SINK	C	C	-	-	C	C	C
OTTER TRAWL, BOTTOM, FISH	$2,703,975.13	$2,975,215.21	$1,815,727.84	$2,050,066.99	$820,165.56	$217,282.44	$10,582,433.17
OTTER TRAWL, BOTTOM, SCALLOP	C	$199,768.95	C	$126,951.81	C	-	$326,720.76
OTTER TRAWL, MIDWATER	-	C	C	-	-	C	C
PAIR TRAWL, MIDWATER	C	$446,751.56	C	C	C	C	$446,751.56
POT, CONCH/WHELK	-	-	C	-	-	-	C
SEINE, DANISH	-	-	-	-	C	-	C

Table 23. Annual non-confidential landings including total trip values by gear type (within the six study state) coming from the OCS-A 502 WEA. (C) = confidential landings and (-) = no landings

Gear	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**Non-Confidential Total**
DREDGE, SCALLOP	C	$921,463.03	$522,186.75	$154,088.50	-	-	$1,597,738.28
GILL NET, SINK	$174,898.66	$205,617.76	$77,568.50	$99,571.90	$70,281.82	$55,306.31	$683,244.95
HARPOON	C	-	-	-	-	-	C
OTTER TRAWL, BOTTOM, FISH	$935,443.60	$1,021,851.23	$1,433,022.85	$835,436.25	$1,188,344.13	$1,882,054.10	$7,296,152.16
PAIR TRAWL, MIDWATER	-	-	C	-	-	-	C

Table 24. Annual non-confidential landings including total trip values by gear type (within the six study states) coming from the OCS-A 503 WEA. (C) = confidential landings and (-) = no landings

Gear	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**Non-Confidential Total**
DREDGE, SCALLOP	-	C	C	C	C	-	C
GILL NET, SINK	$67,117.06	$84,235.74	C	$98,525.61	$58,245.55	$42,113.27	$350,237.23
OTTER TRAWL, BOTTOM, FISH	$146,919.99	$103,138.04	$105,575.10	C	$55,216.43	$68,921.55	$479,771.11
OTTER TRAWL, MIDWATER	-	-	-	-	-	C	C

7 APPENDIX

7.1 SIDE-BY-SIDE RESULTS OF THE WEIGHTED AND TOTAL TRIP VALUE APPROACHES

There are substantial differences between the results of the two approaches. This is primarily due to the inclusion of all points within a fishing trip using the total trip value approach, versus only considering the portion of a trip within the actual WEA in the original analysis. There are limitations to both approaches, as more of a trip may be affected by the presence of a wind farm than just the portion that occurs within that wind energy area, but a portion of the trip may still be able to occur. Therefore, there is uncertainty in how a fishery will respond to a wind farm and that response will likely depend on a variety of factors (e.g., turbine layout, number of turbines).

In an effort to clearly demonstrate the range in values coming from both methods, tables of the fisheries landings with both methods side-by-side are presented below. Only fisheries with larger values were included in these tables, though all values are available in the tables in the original document and earlier in this addendum. As previously stated, the weighted and spatially clipped method (referred to as “Weighted” in the tables below) may be interpreted as the lower bound of economic exposure, while the total trip value method (referred to as “Total” in the tables below) may be considered as the upper bound.

7.1.1 Landings by State – Side-by-Side Weighted and Total Trip Values

Table 25. Annual weighted landings and total trip value landings in each study state coming from the Deepwater Wind lease area. (C) = confidential landings and (-) = no landings. White cells correspond to weighted trip values; gray cells correspond to total trip values.

State - Method	2011	2012	2013	2014	2015	2016	Non-Confidential Total
MA - Weighted	$273,295.14	$299,707.13	$293,928.93	$419,532.08	$921,941.08	$1,091,151.12	$3,299,555.48
MA – Total	$2,730,261.37	$1,352,236.08	$2,146,834.13	$4,270,928.25	$4,525,862.04	$3,910,159.10	$18,936,280.97
RI – Weighted	$314,846.27	$344,832.26	$563,106.73	$743,139.01	$798,139.76	$398,520.43	$3,162,584.46
RI – Total	$1,336,225.93	$1,763,327.11	$2,853,162.54	$2,674,480.08	$2,215,043.98	$2,277,660.34	$13,119,899.98

Table 26. Annual weighted landings and total trip value landings in each study state coming from the Bay State Wind lease area (C) = confidential landings and (-) = no landings. White cells correspond to weighted trip values; gray cells correspond to total trip values.

State - Method	2011	2012	2013	2014	2015	2016	Non-Confidential Total
MA - Weighted	$432,258.46	$266,422.90	$677,701.14	$433,150.82	$406,115.57	$1,189,168.36	$3,404,817.25
MA – Total	$1,167,299.03	$988,208.26	$2,091,373.20	$2,685,094.84	$3,243,343.89	$3,364,002.58	$13,539,321.80
RI – Weighted	$132,863.46	$63,579.49	$623,837.32	$699,244.04	$398,902.05	$1,119,799.41	$3,038,225.75
RI – Total	$896,414.82	$528,342.24	$2,655,633.87	$2,438,919.92	$1,663,043.84	$2,869,779.27	$11,052,133.96

Table 27. Annual weighted landings and total trip value landings in each study state coming from the Vineyard Wind lease area (C) = confidential landings and (-) = no landings. White cells correspond to weighted trip values; gray cells correspond to total trip values.

State – Method	2011	2012	2013	2014	2015	2016	Non-Confidential Total
MA - Weighted	$112,425.43	$987,431.20	$551,972.38	$199,069.54	$247,676.22	$675,235.18	$2,773,809.95
MA – Total	$274,093.43	$1,789,728.95	$1,194,243.92	$796,422.64	$641,739.39	$1,605,655.59	$6,301,883.92
RI – Weighted	$56,401.42	$53,035.97	$159,040.67	$257,132.80	$245,168.64	$1,142,581.23	$1,913,360.73
RI – Total	$606,220.87	$789,005.63	$1,429,129.66	$1,226,020.96	$1,327,813.68	$3,072,606.73	$8,450,797.53

Table 28. Annual weighted landings and total trip value landings in each study state coming from the Statoil (now Equinor) lease area. Please note that the RI total trip value landings values will differ from the July 22, 2016 RIDEM report on the RI fishing value of the NY WEA. The methodologies of the addendum and the earlier report are the same, but the 2016 report used the original NY WEA shapefile, while this effort utilized the revised WEA now leased to Equinor (BOEM removed four aliquots). (C) = confidential landings and (-) = no landings. White cells correspond to weighted trip values; gray cells correspond to total trip values.

State - Method	2011	2012	2013	2014	2015	2016	Non-Confidential Total
CT - Weighted	$73,581.40	$136,500.78	$57,180.47	$52,479.53	-	$80.39	$319,822.56
CT – Total	$638,664.50	$1,546,826.79	$732,996.61	$308,793.30	-	C	$3,227,281.20
MA – Weighted	$4,057,730.43	$1,373,540.07	$321,090.37	$1,356,719.10	$497,233.96	$286,700.41	$7,893,014.35
MA – Total	$24,057,215.22	$13,344,927.85	$6,648,677.02	$20,388,010.02	$6,202,893.09	$5,165,411.30	$75,807,134.50
NJ – Weighted	$2,711,295.27	$1,734,064.53	$1,034,975.58	$931,913.90	$1,251,437.97	$390,662.79	$8,054,350.04
NJ – Total	$17,334,723.71	$13,860,543.40	$12,050,918.65	$13,536,089.82	$8,320,392.47	$4,566,433.62	$69,669,101.67
NY – Weighted	$362,532.56	$21,046.42	$28,453.27	$119,737.05	$32,478.57	$3,083.03	$567,330.91
NY – Total	$1,450,298.12	$804,593.48	$251,559.30	$409,622.07	$154,651.00	$184,348.50	$3,255,072.47
RI – Weighted	$261,231.12	$103,638.26	$368,075.46	$589,751.75	$28,715.20	$2,158.15	$1,353,569.95
RI – Total	$1,532,575.04	$1,953,586.38	$2,243,578.19	$3,314,073.96	$561,494.71	$618,122.05	$10,223,430.33

7.1.2 Landings by Port – Side-by-Side Weighted and Total Trip Values

Table 29. Annual weighted landings and total trip value landings in each study port coming from the Deepwater Wind lease area. (C) = confidential landings and (-) = no landings. White cells correspond to weighted trip values; gray cells correspond to total trip values.

Port - Method	2011	2012	2013	2014	2015	2016	Non-Confidential Total
New Bedford, MA - Weighted	$262,238.32	$258,034.31	$231,092.90	$357,096.98	$877,566.42	$969,314.59	$2,955,343.52
New Bedford, MA - Total	$2,637,639.56	$1,221,606.41	$1,992,516.01	$4,106,837.35	$4,245,205.20	$3,515,099.37	$17,718,903.90
Point Judith, RI – Weighted	$135,152.73	$165,805.42	$223,148.68	$623,286.25	$598,181.01	$337,650.67	$2,083,224.76
Point Judith, RI – Total	$968,865.38	$1,381,278.69	$2,272,575.66	$2,402,309.73	$1,922,545.60	$1,974,329.69	$10,921,904.75

Table 30. Annual weighted landings and total trip value landings in each study port coming from the Bay State Wind lease area. (C) = confidential landings and (-) = no landings. White cells correspond to weighted trip values; gray cells correspond to total trip values.

Port - Method	2011	2012	2013	2014	2015	2016	Non-Confidential Total
New Bedford, MA - Weighted	$334,861.50	$143,456.23	$624,583.87	$345,847.43	$356,310.97	$866,115.77	$2,671,175.77
New Bedford, MA - Total	$903,463.60	$711,464.76	$1,925,866.99	$2,516,011.50	$2,955,984.91	$2,835,889.89	$11,848,681.65
Point Judith, RI – Weighted	$111,254.28	$40,401.57	$430,646.01	$679,573.55	$392,247.66	$1,076,542.94	$2,730,666.01
Point Judith, RI – Total	$599,011.91	$481,832.34	$2,413,597.17	$2,172,444.62	$1,624,892.49	$2,780,553.47	$10,072,332.00

Table 31. Annual weighted landings and total trip value landings in each study port coming from the Vineyard Wind lease area. (C) = confidential landings and (-) = no landings. White cells correspond to weighted trip values; gray cells correspond to total trip values.

Port - Method	2011	2012	2013	2014	2015	2016	Non-Confidential Total
New Bedford, MA - Weighted	$37,705.15	$884,492.00	$513,661.67	$177,570.24	$215,194.22	$615,985.94	$2,444,609.22
New Bedford, MA - Total	$110,137.34	$1,575,748.70	$1,112,523.15	$732,842.02	$550,396.53	$1,457,704.57	$5,539,352.31
Point Judith, RI – Weighted	$54,172.29	$52,724.30	$150,418.90	$257,070.74	$245,168.64	$1,111,489.95	$1,871,044.82
Point Judith, RI – Total	$480,937.02	$777,024.63	$1,215,988.56	$1,217,023.22	$1,327,813.68	$2,980,772.46	$7,999,559.57

Table 32. Annual weighted landings and total trip value landings in each study port coming from the Statoil (now Equinor) lease area. (C) = confidential landings and (-) = no landings. White cells correspond to weighted trip values; gray cells correspond to total trip values.

Port - Method	2011	2012	2013	2014	2015	2016	Non-Confidential Total
Cape May, NJ – Weighted	$1,750,250.16	$791,932.12	$186,877.30	$398,576.69	$408,723.38	$31,715.68	$3,568,075.33
Cape May, NJ – Total	$9,579,036.94	$5,578,437.90	$5,081,283.32	$5,399,652.54	$2,762,439.87	$904,967.85	$29,305,818.42
New Bedford, MA - Weighted	$3,674,879.23	$1,371,324.69	$320,027.76	$1,356,719.10	$497,041.09	$248,166.07	$7,468,157.94
New Bedford, MA - Total	$22,525,826.93	$13,330,527.85	$6,445,810.38	$20,388,010.02	$6,187,677.29	$4,518,882.74	$73,396,735.21
Point Judith, RI – Weighted	$253,016.43	$22,716.38	$248,544.28	$318,928.22	$28,715.20	$2,011.25	$873,931.76
Point Judith, RI – Total	$1,363,878.64	$1,021,764.14	$1,362,466.08	$1,981,498.84	$561,494.71	$502,983.60	$6,794,086.01
Point Pleasant, NJ – Weighted	$472,366.07	$240,904.40	$458,312.55	$329,845.18	$496,932.35	$298,034.95	$2,296,395.50
Point Pleasant, NJ – Total	$2,348,012.05	$2,706,423.66	$2,211,076.49	$3,126,366.65	$2,439,751.90	$1,734,532.47	$14,566,163.22

7.1.3 Landings by Species or FMP – Side-by-Side Weighted and Total Trip Values

Table 33. Annual weighted landings and total trip value landings for each species or fishery management plan coming from the Deepwater Wind lease area. (C) = confidential landings and (-) = no landings. White cells correspond to weighted trip values; gray cells correspond to total trip values.

Species/FMP - Method	2011	2012	2013	2014	2015	2016	Non-Confidential Total
Monkfish – Weighted	$321,298.32	$239,799.05	$236,555.53	$193,511.67	$152,545.99	$123,863.90	$1,267,574.46
Monkfish – Total	$925,919.40	$844,800.19	$739,770.90	$677,262.47	$442,675.36	$385,396.20	$4,015,824.52
NE Multispecies - Weighted	$53,035.13	$93,876.42	$189,910.88	$274,121.35	$201,613.35	$188,022.95	$1,000,580.08
NE Multispecies - Total	$309,589.16	$621,192.20	$1,207,467.07	$1,266,334.64	$720,703.84	$1,037,877.14	$5,163,164.05
Sea Scallop – Weighted	$138,251.18	$276,570.66	$286,370.37	$374,632.33	$1,083,888.70	$786,752.88	$2,946,466.12
Sea Scallop – Total	$2,290,449.90	$1,045,779.61	$1,926,741.61	$3,986,075.76	$4,410,115.23	$2,834,264.14	$16,493,426.25
Squid Mackerel Butterfish FMP – Weighted	$4,744.47	$6,440.79	$45,708.28	$65,211.77	$36,526.04	$238,832.79	$397,464.14
Squid Mackerel Butterfish FMP – Total	$176,331.44	$219,009.53	$514,417.90	$403,011.10	$291,217.44	$1,482,887.47	$3,086,874.88
Summer Flounder, Scup, Black Sea Bass FMP – Weighted	$39,499.10	$44,900.47	$120,749.87	$104,692.35	$95,174.20	$79,108.10	$484,124.09
Summer Flounder, Scup, Black Sea Bass FMP – Total	$326,990.60	$497,591.68	$751,953.72	$630,328.72	$411,423.48	$386,867.97	$3,005,156.17

Table 34. Annual weighted landings and total trip value landings for each species or fishery management plan coming from the Bay State Wind lease area. (C) = confidential landings and (-) = no landings. White cells correspond to weighted trip values; gray cells correspond to total trip values.

Species/FMP - Method	2011	2012	2013	2014	2015	2016	Non-Confidential Total
Monkfish – Weighted	$229,048.60	$222,086.17	$131,706.77	$189,995.47	$152,882.29	$120,574.90	$1,046,294.20
Monkfish – Total	$656,789.99	$520,898.81	$569,630.75	$654,711.06	$439,986.68	$290,245.53	$3,132,262.82
NE Multispecies - Weighted	$62,312.83	$13,526.03	$118,795.99	$548,426.99	$287,174.62	$244,375.50	$1,274,611.96
NE Multispecies - Total	$267,854.50	$60,192.03	$355,896.31	$913,013.41	$518,281.71	$344,042.22	$2,459,280.18
Sea Scallop – Weighted	$215,533.91	$24,794.77	$604,396.34	$116,761.02	$221,360.53	$570,567.27	$1,753,413.84
Sea Scallop – Total	$548,177.91	$407,719.52	$1,971,271.12	$1,918,225.27	$2,734,723.85	$2,067,821.64	$9,647,939.31
Squid Mackerel Butterfish FMP – Weighted	$9,146.52	$7,636.56	$178,368.96	$30,494.90	$41,720.44	$1,494,990.24	$1,762,357.62
Squid Mackerel Butterfish FMP – Total	$332,784.68	$257,638.15	$726,141.40	$678,510.82	$491,006.85	$3,444,130.25	$5,930,212.15
Summer Flounder, Scup, Black Sea Bass FMP – Weighted	$31,589.39	$29,318.04	$275,339.95	$262,752.12	$84,752.65	$84,280.35	$768,032.50
Summer Flounder, Scup, Black Sea Bass FMP – Total	$223,684.79	$269,244.12	$1,162,544.00	$879,443.22	$510,239.69	$300,169.32	$3,345,325.14

Table 35. Annual weighted landings and total trip value landings for each species or fishery management plan coming from the Vineyard Wind lease area. (C) = confidential landings and (-) = no landings. White cells correspond to weighted trip values; gray cells correspond to total trip values.

Species/FMP - Method	2011	2012	2013	2014	2015	2016	Non-Confidential Total
NE Small Mesh Multispecies - Weighted	$54,234.24	$61,117.67	$105,568.03	$95,737.31	$144,312.09	$473,309.82	$934,279.16
NE Small Mesh Multispecies - Total	$283,047.12	$520,938.60	$395,816.77	$275,346.47	$385,865.78	$823,293.35	$2,684,308.09
Sea Scallop – Weighted	C	$860,827.35	$486,967.00	$123,920.84	$42,903.90	$3,768.44	$1,518,387.53
Sea Scallop - Total	C	$1,366,019.30	$1,084,202.65	$520,058.47	$243,680.65	$278,363.65	$3,492,324.72
Squid Mackerel Butterfish FMP – Weighted	$19,589.39	$21,041.07	$78,916.33	$74,834.90	$133,944.37	$1,381,315.24	$1,709,641.30
Squid Mackerel Butterfish FMP – Total	$374,839.40	$629,863.91	$804,561.45	$515,937.56	$924,875.54	$3,819,617.69	$7,069,695.55

Table 36. Annual weighted landings and total trip value landings for each species or fishery management plan coming from the Statoil (now Equinor) lease area. (C) = confidential landings and (-) = no landings. White cells correspond to weighted trip values; gray cells correspond to total trip values.

Species/FMP - Method	2011	2012	2013	2014	2015	2016	Non-Confidential Total
NE Multispecies - Weighted	$659.02	$90,114.84	$25,483.60	C	C	$33,077.26	$149,334.72
NE Multispecies - Total	$115,259.88	$306,453.75	$639,544.07	C	C	$152,261.20	$1,213,518.90
Sea Scallop – Weighted	$6,805,054.97	$3,149,266.59	$1,471,671.72	$2,641,411.54	$1,707,500.43	$628,124.80	$16,403,030.05
Sea Scallop – Total	$42,167,898.55	$28,099,760.78	$19,830,274.12	$35,840,640.59	$14,370,061.11	$10,642,044.12	$150,950,679.27
Squid Mackerel Butterfish FMP – Weighted	$619,032.38	$115,326.85	$300,348.77	$370,063.37	$69,641.86	$54.12	$1,474,467.35
Squid Mackerel Butterfish FMP – Total	$2,481,105.59	$2,872,684.87	$1,341,252.36	$1,823,238.80	$656,415.62	$1,707.99	$9,176,405.23

7.1.4 Landings by Gear – Side-by-Side Weighted and Total Trip Values

Table 37. Annual weighted landings and total trip value landings caught by each gear coming from the Deepwater Wind lease area. (C) = confidential landings and (-) = no landings. White cells correspond to weighted trip values; gray cells correspond to total trip values.

Gear - Method	2011	2012	2013	2014	2015	2016	Non-Confidential Total
DREDGE, SCALLOP - Weighted	$141,622.75	$274,007.81	$271,641.80	$374,576.59	$1,087,685.54	$792,707.67	$2,942,242.16
DREDGE, SCALLOP - Total	$2,300,460.86	$1,035,225.81	$1,890,170.71	$3,990,717.00	$4,425,062.36	$2,845,019.07	$16,486,655.81
GILL NET, SINK – Weighted	$349,005.06	$300,934.68	$271,514.48	$229,031.14	$196,435.52	$147,416.20	$1,494,337.08
GILL NET, SINK – Total	$771,962.08	$688,129.27	$664,728.59	$573,772.60	$488,219.53	$412,291.22	$3,599,103.29
OTTER TRAWL, BOTTOM, FISH - Weighted	$109,488.29	$122,999.86	$335,022.52	$566,863.81	$376,647.48	$432,395.06	$1,943,417.02
OTTER TRAWL, BOTTOM, FISH - Total	$1,102,956.24	$1,631,460.30	$2,565,418.45	$2,710,991.18	$1,589,841.53	$2,435,733.80	$12,036,401.50

Table 38. Annual weighted landings and total trip value landings caught by each gear coming from the Bay State Wind lease area. (C) = confidential landings and (-) = no landings. White cells correspond to weighted trip values; gray cells correspond to total trip values.

Gear - Method	2011	2012	2013	2014	2015	2016	Non-Confidential Total
DREDGE, SCALLOP - Weighted	$216,084.09	$21,614.44	$595,947.28	$115,041.91	$220,941.56	$570,600.01	$1,740,229.29
DREDGE, SCALLOP - Total	$551,261.41	$396,823.52	$1,954,669.82	$1,916,981.10	$2,745,530.03	$2,072,313.76	$9,637,579.64
GILL NET, SINK – Weighted	$205,543.55	$228,174.84	$96,138.97	$139,276.23	$160,848.18	$128,020.37	$958,002.14
GILL NET, SINK – Total	$445,459.89	$498,201.33	$258,402.55	$355,938.35	$376,436.65	$257,324.39	$2,191,763.16
OTTER TRAWL, BOTTOM, FISH - Weighted	$152,116.57	$85,719.74	$733,738.82	$1,002,592.16	$486,879.17	$1,716,350.06	$4,177,396.52
OTTER TRAWL, BOTTOM, FISH - Total	$1,109,379.77	$941,317.73	$2,818,303.53	$3,143,594.76	$1,928,507.92	$4,361,033.47	$14,302,137.18

Table 39. Annual weighted landings and total trip value landings caught by each gear coming from the Vineyard Wind lease area. (C) = confidential landings and (-) = no landings. White cells correspond to weighted trip values; gray cells correspond to total trip values.

Gear - Method	2011	2012	2013	2014	2015	2016	Non-Confidential Total
DREDGE, SCALLOP - Weighted	C	$860,813.02	$487,985.38	$123,480.82	$42,929.62	C	$1,515,208.84
DREDGE, SCALLOP - Total	C	$1,365,623.30	$1,086,063.25	$516,370.35	$243,932.40	C	$3,211,989.30
OTTER TRAWL, BOTTOM, FISH - Weighted	$114,166.51	$109,599.42	$226,370.35	$331,493.73	$438,182.18	$1,981,018.41	$3,200,830.60
OTTER TRAWL, BOTTOM, FISH - Total	$849,572.84	$1,397,741.78	$1,711,692.15	$1,593,681.22	$1,961,330.37	$5,036,628.76	$12,550,647.12

Table 40. Annual weighted landings and total trip value landings caught by each gear coming from the Statoil (now Equinor) lease area. (C) = confidential landings and (-) = no landings. White cells correspond to weighted trip values; gray cells correspond to total trip values.

Gear - Method	2011	2012	2013	2014	2015	2016	Non-Confidential Total
DREDGE, SCALLOP - Weighted	$6,773,376.44	$3,107,844.60	$1,476,807.03	$2,572,517.90	$1,700,301.74	$627,537.37	$16,258,385.08
DREDGE, SCALLOP - Total	$42,051,698.69	$27,868,706.58	$19,866,398.12	$35,745,609.90	$14,365,612.55	$10,487,934.16	$150,385,960.00
OTTER TRAWL, BOTTOM, FISH - Weighted	$666,580.55	$138,545.12	$330,454.54	$418,223.93	$96,418.33	$4,002.31	$1,654,224.78
OTTER TRAWL, BOTTOM, FISH - Total	$2,703,975.13	$2,975,215.21	$1,815,727.84	$2,050,066.99	$820,165.56	$217,282.44	$10,582,433.17

7.2 R Code

7.2.1 Code to Aggregate Total Trip Values

```
options(scipen=999)
require(stringr)
require(rgdal)
require(reshape)
require(formattable)
require(raster)

setwd("C:/Livermore/Federal_Offshore_Energy/Wind/Large_Scale_VMS/Data/Results/TotTripVals")

NYWEA.pts<-
read.csv("C:/Livermore/Federal_Offshore_Energy/Wind/Large_Scale_VMS/Data/Results/NYWEA_Points.csv
")
DWW1.pts<-
read.csv("C:/Livermore/Federal_Offshore_Energy/Wind/Large_Scale_VMS/Data/Results/DWW1_Points.csv"
)
BaySt.pts<-
read.csv("C:/Livermore/Federal_Offshore_Energy/Wind/Large_Scale_VMS/Data/Results/BaySt_Points.csv
")
Vineyard.pts<-
read.csv("C:/Livermore/Federal_Offshore_Energy/Wind/Large_Scale_VMS/Data/Results/Vineyard_Points.
csv")
OCSA502.pts<-
read.csv("C:/Livermore/Federal_Offshore_Energy/Wind/Large_Scale_VMS/Data/Results/OCSA502_Points.c
sv")
OCSA503.pts<-
read.csv("C:/Livermore/Federal_Offshore_Energy/Wind/Large_Scale_VMS/Data/Results/OCSA503_Points.c
sv")

# Add column of WEA name and then do aggregations to a single file
# Aggregations by species caught, gear type, state, port, etc.
NYWEA.pts$WEA<-"NYWEA"
DWW1.pts$WEA<-"DWW1"
BaySt.pts$WEA<-"BaySt"
Vineyard.pts$WEA<-"Vineyard"
OCSA502.pts$WEA<-"OCSA502"
OCSA503.pts$WEA<-"OCSA503"

allDat<-rbind(NYWEA.pts,DWW1.pts,BaySt.pts,Vineyard.pts,OCSA502.pts,OCSA503.pts)

WEAs<-c("NYWEA","DWW1","BaySt","Vineyard","OCSA502","OCSA503")

remove(BaySt.pts,DWW1.pts,NYWEA.pts,Vineyard.pts,OCSA502.pts,OCSA503.pts)

# Clean up (we don't need the proportional values for this analysis)
allDat$X<-NULL
allDat$Prop.Value<-NULL
allDat$Weighted.Value<-NULL

##############################################################################################
# Run all analysis using a unique ID to find the value of all trips that used the
# WEAs, not a proportion.
##############################################################################################

# Create a unique ID to remove all points except one per species per trip
# We need to inclue the landed pounds and dollars because different grades of the
# same species may be landed at the same time from the same trip.

# Aggregate by species
allDat$UniqueID<-paste(allDat$Land.Supplier.Trip.Id,
                       allDat$Land.Common.Name,
                       allDat$Land.Dollars,
                       allDat$WEA,sep="")
allDat2<-allDat[!duplicated(allDat[,c("UniqueID")]),]
remove(allDat)
```

```
allDat.speciesValue<-aggregate(Land.Dollars~Land.Common.Name+Year+WEA,data=allDat2,FUN=sum)
allDat.speciesVessel<-aggregate(PERMIT~Land.Common.Name+Year+WEA,data=allDat2,function(x)
length(unique(x)))
allDat.speciesFisherman<-
aggregate(Land.Fisherman~Land.Common.Name+Year+WEA,data=allDat2,function(x) length(unique(x)))
allDat.speciesDealer<-
aggregate(Land.Dealer.License.Nbr~Land.Common.Name+Year+WEA,data=allDat2,function(x)
length(unique(x)))
allDat.speciesAgg<-
merge(allDat.speciesValue,allDat.speciesVessel,by=c("Land.Common.Name","Year","WEA"))
allDat.speciesAgg<-
merge(allDat.speciesAgg,allDat.speciesFisherman,by=c("Land.Common.Name","Year","WEA"))
allDat.speciesAgg<-
merge(allDat.speciesAgg,allDat.speciesDealer,by=c("Land.Common.Name","Year","WEA"))
colnames(allDat.speciesAgg)<-
c("Land.Species","Land.Year","WEA","Dollar.Value","Num.Vessel","Num.Fishermen","Num.Dealers")

remove(allDat.speciesValue)
remove(allDat.speciesVessel)
remove(allDat.speciesFisherman)
remove(allDat.speciesDealer)

# Aggregate by gear

allDat.gearValue<-aggregate(Land.Dollars~VTR.Gear.name+Year+WEA,data=allDat2,FUN=sum)
allDat.gearVessel<-aggregate(PERMIT~VTR.Gear.name+Year+WEA,data=allDat2,function(x)
length(unique(x)))
allDat.gearFisherman<-aggregate(Land.Fisherman~VTR.Gear.name+Year+WEA,data=allDat2,function(x)
length(unique(x)))
allDat.gearDealer<-
aggregate(Land.Dealer.License.Nbr~VTR.Gear.name+Year+WEA,data=allDat2,function(x)
length(unique(x)))
allDat.gearAgg<-merge(allDat.gearValue,allDat.gearVessel,by=c("VTR.Gear.name","Year","WEA"))
allDat.gearAgg<-merge(allDat.gearAgg,allDat.gearFisherman,by=c("VTR.Gear.name","Year","WEA"))
allDat.gearAgg<-merge(allDat.gearAgg,allDat.gearDealer,by=c("VTR.Gear.name","Year","WEA"))
colnames(allDat.gearAgg)<-
c("VTR.Gear","Land.Year","WEA","Dollar.Value","Num.Vessel","Num.Fishermen","Num.Dealers")

remove(allDat.gearValue)
remove(allDat.gearVessel)
remove(allDat.gearFisherman)
remove(allDat.gearDealer)

# Aggregate data by state

allDat.stateValue<-aggregate(Land.Dollars~Land.State+Year+WEA,data=allDat2,FUN=sum)
allDat.stateVessel<-aggregate(PERMIT~Land.State+Year+WEA,data=allDat2,function(x)
length(unique(x)))
allDat.stateFisherman<-aggregate(Land.Fisherman~Land.State+Year+WEA,data=allDat2,function(x)
length(unique(x)))
allDat.stateDealer<-
aggregate(Land.Dealer.License.Nbr~Land.State+Year+WEA,data=allDat2,function(x) length(unique(x)))
allDat.stateAgg<-merge(allDat.stateValue,allDat.stateVessel,by=c("Land.State","Year","WEA"))
allDat.stateAgg<-merge(allDat.stateAgg,allDat.stateFisherman,by=c("Land.State","Year","WEA"))
allDat.stateAgg<-merge(allDat.stateAgg,allDat.stateDealer,by=c("Land.State","Year","WEA"))
colnames(allDat.stateAgg)<-
c("Land.State","Land.Year","WEA","Dollar.Value","Num.Vessel","Num.Fishermen","Num.Dealers")

remove(allDat.stateValue)
remove(allDat.stateVessel)
remove(allDat.stateFisherman)
remove(allDat.stateDealer)

# Aggregate data by port

allDat.portValue<-aggregate(Land.Dollars~Land.Port+Land.State+Year+WEA,data=allDat2,FUN=sum)
allDat.portVessel<-aggregate(PERMIT~Land.Port+Land.State+Year+WEA,data=allDat2,function(x)
length(unique(x)))
```

```
allDat.portFisherman<-
aggregate(Land.Fisherman~Land.Port+Land.State+Year+WEA,data=allDat2,function(x)
length(unique(x)))
allDat.portDealer<-
aggregate(Land.Dealer.License.Nbr~Land.Port+Land.State+Year+WEA,data=allDat2,function(x)
length(unique(x)))
allDat.portAgg<-
merge(allDat.portValue,allDat.portVessel,by=c("Land.Port","Year","WEA","Land.State"))
allDat.portAgg<-
merge(allDat.portAgg,allDat.portFisherman,by=c("Land.Port","Year","WEA","Land.State"))
allDat.portAgg<-
merge(allDat.portAgg,allDat.portDealer,by=c("Land.Port","Year","WEA","Land.State"))
colnames(allDat.portAgg)<-
c("Land.Port","Land.Year","WEA","Land.State","Dollar.Value","Num.Vessel","Num.Fishermen","Num.Dea
lers")

allDat.portAgg$Land.Port<-paste(allDat.portAgg$Land.Port,", ",allDat.portAgg$Land.State,sep="")

remove(allDat.portValue)
remove(allDat.portVessel)
remove(allDat.portFisherman)
remove(allDat.portDealer)

# Export results
write.csv(allDat.gearAgg,"WEA_Land_by_Gear_TotalTripEst.csv")
write.csv(allDat.portAgg,"WEA_Land_by_Port_TotalTripEst.csv")
write.csv(allDat.stateAgg,"WEA_Land_by_State_TotalTripEst.csv")
write.csv(allDat.speciesAgg,"WEA_Land_by_Species_TotalTripEst.csv")

# Clean up tables again for confidentiality reasons
allDat.speciesAgg$VesConfid<-ifelse(allDat.speciesAgg$Num.Vessel>=3,1,0)
allDat.speciesAgg$FisherConfid<-ifelse(allDat.speciesAgg$Num.Fishermen>=3,1,0)
allDat.speciesAgg$DealerConfid<-ifelse(allDat.speciesAgg$Num.Dealers>=3,1,0)
allDat.speciesAgg$Confid<-ifelse(allDat.speciesAgg$VesConfid+
                                   allDat.speciesAgg$DealerConfid+
                                   allDat.speciesAgg$DealerConfid>=3,"OK","CONFIDENTIAL")
allDat.speciesAgg$Dollar.Value<-
ifelse(allDat.speciesAgg$Confid=="CONFIDENTIAL","C",allDat.speciesAgg$Dollar.Value)
allDat.speciesAgg<-allDat.speciesAgg[,1:4]

allDat.stateAgg$VesConfid<-ifelse(allDat.stateAgg$Num.Vessel>=3,1,0)
allDat.stateAgg$FisherConfid<-ifelse(allDat.stateAgg$Num.Fishermen>=3,1,0)
allDat.stateAgg$DealerConfid<-ifelse(allDat.stateAgg$Num.Dealers>=3,1,0)
allDat.stateAgg$Confid<-ifelse(allDat.stateAgg$VesConfid+
                                 allDat.stateAgg$DealerConfid+
                                 allDat.stateAgg$DealerConfid>=3,"OK","CONFIDENTIAL")
allDat.stateAgg$Dollar.Value<-round(allDat.stateAgg$Dollar.Value,2)
allDat.stateAgg$Dollar.Value<-
ifelse(allDat.stateAgg$Confid=="CONFIDENTIAL","C",allDat.stateAgg$Dollar.Value)
allDat.stateAgg<-allDat.stateAgg[,1:4]

allDat.portAgg$VesConfid<-ifelse(allDat.portAgg$Num.Vessel>=3,1,0)
allDat.portAgg$FisherConfid<-ifelse(allDat.portAgg$Num.Fishermen>=3,1,0)
allDat.portAgg$DealerConfid<-ifelse(allDat.portAgg$Num.Dealers>=3,1,0)
allDat.portAgg$Confid<-ifelse(allDat.portAgg$VesConfid+
                                allDat.portAgg$DealerConfid+
                                allDat.portAgg$DealerConfid>=3,"OK","CONFIDENTIAL")
allDat.portAgg$Dollar.Value<-round(allDat.portAgg$Dollar.Value,2)
allDat.portAgg$Dollar.Value<-
ifelse(allDat.portAgg$Confid=="CONFIDENTIAL","C",allDat.portAgg$Dollar.Value)
allDat.portAgg<-allDat.portAgg[,c(1:3,5)]

allDat.gearAgg$VesConfid<-ifelse(allDat.gearAgg$Num.Vessel>=3,1,0)
allDat.gearAgg$FisherConfid<-ifelse(allDat.gearAgg$Num.Fishermen>=3,1,0)
allDat.gearAgg$DealerConfid<-ifelse(allDat.gearAgg$Num.Dealers>=3,1,0)
allDat.gearAgg$Confid<-ifelse(allDat.gearAgg$VesConfid+
                                allDat.gearAgg$DealerConfid+
                                allDat.gearAgg$DealerConfid>=3,"OK","CONFIDENTIAL")
allDat.gearAgg$Dollar.Value<-round(allDat.gearAgg$Dollar.Value,2)
allDat.gearAgg$Dollar.Value<-
ifelse(allDat.gearAgg$Confid=="CONFIDENTIAL","C",allDat.gearAgg$Dollar.Value)
```

```
allDat.gearAgg<-allDat.gearAgg[,1:4]

# Subset by WEAs to
for (wea in WEAs){

  # By species by year
  weaSubSp<-subset(allDat.speciesAgg,WEA==wea)
  weaSubSp$WEA<-NULL
  weaSubSp<-reshape(weaSubSp,idvar="Land.Species",timevar="Land.Year",direction="wide")
  colnames(weaSubSp)<-substr(colnames(weaSubSp),nchar(colnames(weaSubSp))-
3,nchar(colnames(weaSubSp)))
  weaSubSp<-weaSubSp[,order(names(weaSubSp))]
  weaSubSp<-weaSubSp[,c(7,1,2,3,4,5,6)]
  colnames(weaSubSp)[1]<-"Species or FMP"
  weaSubSp[is.na(weaSubSp)]<-0
  fileName<-paste(wea,"_SpeciesLand_by_Year_TotalTripEst.csv",sep="")
  write.csv(weaSubSp,fileName)

  # By state by year
  weaSubSt<-subset(allDat.stateAgg,WEA==wea)
  weaSubSt$WEA<-NULL
  weaSubSt<-reshape(weaSubSt,idvar="Land.State",timevar="Land.Year",direction="wide")
  colnames(weaSubSt)<-substr(colnames(weaSubSt),nchar(colnames(weaSubSt))-
3,nchar(colnames(weaSubSt)))
  weaSubSt<-weaSubSt[,order(names(weaSubSt))]
  weaSubSt<-weaSubSt[,c(7,1,2,3,4,5,6)]
  colnames(weaSubSt)[1]<-"State"
  weaSubSt[is.na(weaSubSt)]<-0
  fileName<-paste(wea,"_StateLand_by_Year_TotalTripEst.csv",sep="")
  write.csv(weaSubSt,fileName)

  # By port by year
  weaSubPort<-subset(allDat.portAgg,WEA==wea)
  weaSubPort$WEA<-NULL
  weaSubPort<-reshape(weaSubPort,idvar="Land.Port",timevar="Land.Year",direction="wide")
  colnames(weaSubPort)<-substr(colnames(weaSubPort),nchar(colnames(weaSubPort))-
3,nchar(colnames(weaSubPort)))
  weaSubPort<-weaSubPort[,order(names(weaSubPort))]
  weaSubPort<-weaSubPort[,c(7,1,2,3,4,5,6)]
  colnames(weaSubPort)[1]<-"Port"
  weaSubPort[is.na(weaSubPort)]<-0
  fileName<-paste(wea,"_PortLand_by_Year_TotalTripEst.csv",sep="")
  write.csv(weaSubPort,fileName)

  # By gear by year
  weaSubGear<-subset(allDat.gearAgg,WEA==wea)
  weaSubGear$WEA<-NULL
  weaSubGear<-reshape(weaSubGear,idvar="VTR.Gear",timevar="Land.Year",direction="wide")
  colnames(weaSubGear)<-substr(colnames(weaSubGear),nchar(colnames(weaSubGear))-
3,nchar(colnames(weaSubGear)))
  weaSubGear<-weaSubGear[,order(names(weaSubGear))]
  weaSubGear<-weaSubGear[,c(7,1,2,3,4,5,6)]
  colnames(weaSubGear)[1]<-"Gear"
  weaSubGear[is.na(weaSubGear)]<-0
  fileName<-paste(wea,"_GearLand_by_Year_TotalTripEst.csv",sep="")
  write.csv(weaSubGear,fileName)

  remove(weaSubGear,weaSubPort,weaSubSp,weaSubSt)

}

remove(allDat.gearAgg,allDat.portAgg,allDat.speciesAgg,allDat.stateAgg)
```