SPATIOTEMPORAL AND ECONOMIC ANALYSIS OF VESSEL MONITORING SYSTEM DATA WITHIN THE NEW YORK BIGHT CALL AREAS

Rhode Island Department of Environmental Management
Division of Marine Fisheries

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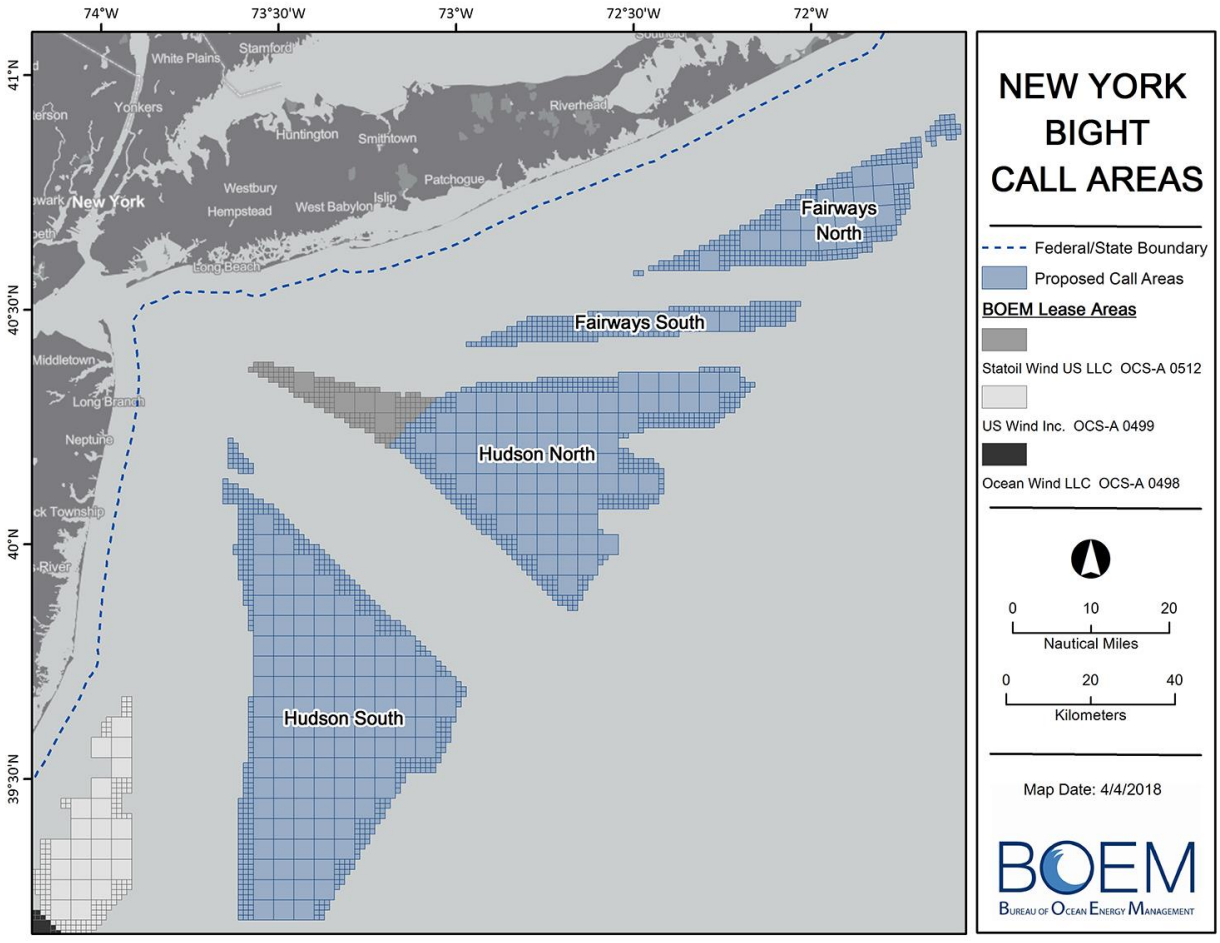

https://www.boem.gov/uploadedImages/BOEM/Renewable_Energy_Program/State_Activities/NY/NYCall_4_4_2018.jpg

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4 LIST OF ACRONYMS AND TERMS

ACCSP – Atlantic Coastal Cooperative Statistics Program
ASMFC – Atlantic States Marine Fisheries Commission
BOEM – Bureau of Ocean Energy Management
Call – call for information and nominations
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
OCS – outer continental shelf
OLE – Office of Law Enforcement
RAM – random access memory
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
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. 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 (now leased to Statoil) 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 in late 2017 that covered all the WEAs off MA, RI, and NY/NJ as of March 2017. When the NY Bight Call Areas were released by BOEM in December 2017, BOEM requested that RI DEM run the same analysis on the new NY Call Areas.

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 a brief format within this report, though a detailed description, the code, and all supplementing files are available within the earlier report (RI DEM 2017).

The purpose of this analysis is to provide developers and managers with an additional 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 12 tables of ex-vessel values, 602 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 Summer Flounder, Scup, Black Sea Bass FMP. The Sea Scallop fishery is estimated to have over $211 million coming from the combined Call Areas over the six-year study period. The most exposed ports were New Bedford, MA; Point Pleasant, NJ; and Cape May, NJ. Hence, the most exposed states were MA and NJ. Finally, the most heavily used gears were the scallop dredge, the ocean quahog/surfclam dredge, and the otter trawl.

6 INTRODUCTION

6.1 PURPOSE

The purpose of this work is to provide developers and managers with an additional, and accurate, source of fishing location and density information. 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 or every 30 minutes, 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

The target area of this study is coverage of the NY Bight Call Areas; see Figure 2. As this effort is an extension on work previously conducted by RI DEM on the New England WEAs, the VMS data request (Figure 3) made previously do not fully cover the NY Bight Call Areas; the Hudson North site is minimally clipped, while only a small section of the Hudson South Site is addressed.

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 (i.e. including vessel identifier information). 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°
South: 39.881°
West: -74.278°
East: -69.726°

Refer to the Figure 3 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 25th, 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

Landings data (sometimes referred to as Dealer Reports) 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's products 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 10.5 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.

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 Call Area 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).

Finally, to determine the value of species harvested within each Call Area, the weights were applied to the landings values. Then the fishing points were spatially clipped by each of the Call Areas, 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 Call Area 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.

It is important to note that these data were not modeled. The fishing value data have simply been subsetted by Call 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 Call Areas resulted in landings in New Hampshire. New Jersey, New York, Connecticut, Rhode Island, and Massachusetts all had landings coming from at least one Call Area; 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 Call Area. 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 Call Areas though they did have fishing in the larger study area. The same applies for certain gear types and species landed.

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.

8.1.1 Ex-vessel Values by State

8.1.1.1 Fishing within the Fairways North Call Area

Massachusetts is the state with the most landings coming from Fairways North Call Area. All annual totals coming into MA exceeded $1,000,000, with the highest annual value of $8,053,086.67 occurring in 2014 (Table 1). The 6-year total reached $19,831,573.79 being landed in Massachusetts. The next state with the highest value was Rhode Island, with a 6-year total of $2,383,746.22. Connecticut had similar landings

from the Fairways North Call Area of $2,241,114.80 over the same time period. New Jersey and New York also had landings from the Call Area approaching $2,000,000 during the study period.

8.1.1.2 Fishing within the Fairways South Call Area

Massachusetts was again the state with the greatest landings coming from the Fairways South Call Area. Each annual landing was $500,000 or greater, with the highest individual annual landing occurring in 2014, with a value of $4,572,122.19 (Table 2). The 6-year total for the state was $14,124,199.50. All other study states' 6-year landings exceeded $1,000,000.

8.1.1.3 Fishing within the Hudson North Call Area

Massachusetts was by far the state with the highest landings from the Hudson North Call Area, with single year landings reaching $33,680,942.33 in 2014 (Table 3). All annual landings exceed $6.4 million dollars for the state with a 6-year total of $93,286,796.75. New Jersey landings from the Hudson North Call Area were also very high, with individual year landings reaching $16,485,287.60 in 2016 and 6-year landings reaching $61,485,287.60. All individual year landings for New Jersey exceeded $6.2 million. The Rhode Island 6-year total came to $8,029,150.44, while the Connecticut total reached $5,507,120.16. Finally, New York landings from the Hudson North Call Area reached $1,203,070.51.

8.1.2 Ex-vessel Values by Port

8.1.2.1 Fishing within the Fairways North Call Area

The Port of New Bedford, MA was the primary landings point for fishing activity within the Fairways North Call Area; over 70% of all 6-year landings by value were in New Bedford at $18,792,780.85 (Table 4). The highest annual value for any Port was $7,257,608.36 in New Bedford, MA. New London, CT was the second highest landings port at over 6% of 6-year landings with a total value of $1,764,357.09. Cape May, NJ; Montauk, NY; and Point Judith, RI were all close behind with values over $1.2 million each (each equivalent to approximately 5% of landings).

8.1.2.2 Fishing within the Fairways South Call Area

New Bedford, MA was the highest grossing port from the Fairways South Call area as well, with total 6-year landings of $13,143,150.76 (Table 5). Individual year landings reached approximately $4.5 million in 2012 and 2014. Cape May, NJ was the next highest value port for fishing in the Call Area, with 2012 landings reaching $1,315,524.69, and 6-year landings of $2,752,442.29. Point Pleasant, NJ also had 6-year landings exceeding $1 million, with a total of $1,212,486.92.

8.1.2.3 Fishing within the Hudson North Call Area

Catch from the Hudson North Call Area was landed in over 14 ports, with New Bedford, MA as the highest grossing port with a 6-year total of $88,728,870.58 (Table 6). Individual year landings in New Bedford reached $32 million in 2014 and $22 million in 2016. The ports of Cape May, NJ and Point Pleasant, NJ also had high landings with 6-year totals of $25,713,596.17 and $15,737,724.58, respectively. Barnegat Light, NJ; Fairhaven, MA; New London, CT; Point Judith, RI; and Stonington, CT all had moderately high landings, with individual years exceeding $500,000. Barnegat Light, NJ; Fairhaven, MA; and Point Judith, RI all had individual years (non-confidential) with landings from the Hudson North Call Area over $1 million.

8.1.3 Ex-Vessel Values by Gear

8.1.3.1 Fishing within the Fairways North Call Area

Five gear types with VMS requirements were used in the Fairways North Call Area that resulted in non-confidential landings: ocean quahog/surfclam dredge, scallop dredge, sink gillnet, otter trawl, and pair trawl (Table 7). The scallop dredge resulted in the highest landings in comparison to the other gear types, with individual years all exceeding $1 million, and a single year approaching $10 million. The 6-year total was $24,619,810.64. Otter trawling and sink gillnetting also resulted in 6-year landings greater than $1 million.

8.1.3.2 Fishing within the Fairways South Call Area

Results were similar for the Fairways South Call Area in terms of which gears were used, except for the addition of otter trawling specifically for scallops. 6-year landings were $23,460,260.94 for the scallop dredge (Table 8) and individual year landings reached $8,135,424.03 in 2012. Otter trawling also reached $1.4 million over the 6-year period.

8.1.3.3 Fishing within the Hudson North Call Area

Landings by gear were greatest in the Hudson North Call Area, especially for the scallop dredge (Table 9). Individual year landings from the Hudson North Call Area all exceeded $9 million, while 2014 fishing using a scallop dredge reached $44,004,574.21. Otter trawling resulted in $5,074,686.50 over the six years; 2012 and 2016 landings were over $1 million.

8.1.4 Ex-Vessel Values by Species or FMP

8.1.4.1 Fishing within the Fairways North Call Area

The primary species landed from the Fairways North Call Area with VMS recording requirements, in order of higher to lower landings, were: sea scallop; monkfish; squid, mackerel, butterfish; and summer flounder, scup, black sea bass. Total 6-year sea scallop landings were $24,860,923.44 (Table 10). In 2014, landings from this call area reached $9.9 million for sea scallops; all individual years reached $1.4 million or greater.

8.1.4.2 Fishing within the Fairways South Call Area

The sea scallop fishery dominated landings by value from the Fairways South Call Area as well, with total landings of $24,217,702.44 (Table 11). All individual years for the sea scallop fishery exceeded $900,000 with the highest single year being 2012 with $8,573,604.81. Other species' landings were lower than for the Fairways North Call Area.

8.1.4.3 Fishing within the Hudson North Call Area

As with other metrics of evaluating fisheries landings, by species, the Hudson North Call Area is again the highest value area of the three proposed. The 6-year total for sea scallops added up to $162,009,236.15 with individual years all exceeding $14.5 million and the highest year (2014) reaching $49 million (Table 12). Similar to the Fairways North Call Area, the primary other species/FMPs were monkfish; squid, mackerel, butterfish; and summer flounder, scup, black sea bass. All three species groupings had over $1 million in 6-year landings.

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, or changes in management

(e.g. rotating scallop closures). 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 (Erdas Imagine .img files) be overlaid on other site-specific layers by managers and developers to more clearly identify the areas that may be environmentally sensitive or valuable to the fishing industry.

Figures are organized by fishery, ordered by state landed in (Figure 4-8), port landed in (Figure 9-27), gear used (Figures 28-33), and species harvested (Figures 34-48). Figures for high value species or fisheries with higher densities of activity within the Call Areas are also shown on an annual basis (Figures 49-72).

The four highest value species/FMPs with fishing activity in the various Call Areas were: sea scallops; monkfish; squid, mackerel, butterfish FMP; and summer flounder, scup, black sea bass. Sea scallops were harvested in all three Call Areas and activity was fairly evenly distributed (i.e. no clear hot spots; Figures 44, 49-54). The same was true for the other three species (Figures 46-47, 61-66), with the exception of monkfish (Figures 40, 67-72), which did have a small area of higher density fishing in the northeast point of the Fairways North Call Area.

The primary gears were the scallop dredge, the ocean quahog/surfclam dredge, and the otter trawl. All three gears showed full coverage of the three Call Areas, with both the otter trawl and the scallop dredge being used ubiquitously throughout the Call Areas (Figures 29 & 31). The ocean quahog/surfclam dredge was used slightly more heavily in the inner section of the Hudson North and the Fairways South Call Areas (Figure 28). The northern, northwestern, and southwestern edges of the lease area had the highest densities of fishing activity in all years (Figures 55-60).

MA and NJ were the most exposed states in terms of activity by landing port. MA activity (Figure 4) appears to correspond heavily to scallop harvesting, which is to be expected, as New Bedford (Figure 19) is the primary port for landing sea scallops. NJ activity was heaviest in the western portion of the Hudson North and Fairways South Call Areas (Figure 6); the same pattern was reflected in NJ's primary ports: Atlantic City (Figure 9), Barnegat Light (Figure 10), Cape May (Figure 13), and Point Pleasant (Figure 25).

Also consider that the Hudson South Call Area was not analyzed in this work due to data limitations. Limited mentions of fishing activity in the Hudson South Call Area in this report are not indicative of low density fishing activity.

9 REFERENCES

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10 APPENDIX I: TABLES AND FIGURES

10.1 TABLES

10.1.1 Tables by State Landed

Table 1. Annual non-confidential landings in each study state coming from the Fairways North Call Area. (-) = no landings.

	2011	2012	2013	2014	2015	2016	Non-Confidential Total
CT	$185,346.16	$569,214.45	$520,501.20	$484,232.35	C	$481,820.64	$2,241,114.80
MA	$4,361,503.62	$1,250,853.45	$2,587,973.11	$8,053,086.67	$1,057,328.11	$2,520,828.83	$19,831,573.79
NJ	$24,396.80	$185,058.89	$266,361.15	$861,950.31	$434,025.25	$147,605.95	$1,919,398.35
NY	$387,885.24	$209,043.03	$501,132.64	$309,612.31	$123,276.35	$304,740.98	$1,835,690.55
RI	$35,916.47	$269,405.67	$833,747.16	$891,796.82	$63,696.66	$289,183.44	$2,383,746.22

Table 2. Annual non-confidential landings in each study state coming from the Fairways South Call Area. (-) = no landings.

State	2011	2012	2013	2014	2015	2016	Non-Confidential Total
CT	$468,970.15	$631,033.91	$390,039.85	$116,803.71	C	$83,109.90	$1,689,957.52
MA	$1,895,491.70	$5,298,555.09	$1,123,323.28	$4,572,122.19	$677,389.66	$557,317.58	$14,124,199.50
NJ	$911,142.77	$2,059,147.38	$1,360,053.82	$1,205,949.88	$358,011.34	$1,086,839.73	$6,981,144.92
NY	$134,114.28	$658,678.67	$213,223.59	$61,301.74	$70,566.62	$38,587.69	$1,176,472.59
RI	$360,357.87	$280,305.24	$401,799.53	$301,806.12	$32,961.70	$73,976.81	$1,451,207.27

Table 3. Annual non-confidential landings in each study state coming from the Hudson North Call Area. (-) = no landings.

State	2011	2012	2013	2014	2015	2016	Non-Confidential Total
CT	$1,266,033.41	$973,893.55	$338,382.32	$1,230,793.70	C	$1,698,017.18	$5,507,120.16
MA	$15,823,402.30	$8,830,138.33	$3,955,757.61	$33,680,942.33	$6,441,286.96	$24,555,269.22	$93,286,796.75
NJ	$6,562,446.83	$9,970,016.45	$6,200,787.61	$13,354,988.40	$8,679,234.66	$16,717,813.65	$61,485,287.60
NY	$119,009.93	$197,544.50	$157,661.54	$243,376.59	$64,707.11	$420,770.84	$1,203,070.51
RI	$476,730.86	$2,307,159.55	$528,173.11	$1,425,867.87	$102,915.46	$3,188,303.59	$8,029,150.44

10.1.2 Tables by Port Landed

Table 4. Annual non-confidential landings in each study port (within the six study states) coming from the Fairways North Call Area. (C) = confidential landings and (-) = no landings. Amagansett, NY; Atlantic City, NJ; Avalon, NJ; Barnegat Light, NJ; Barnstable, MA; Belford, MA; Boston, MA; Davisville, RI; East Hampton, NY; Fall River, MA; Greenport, NY; Mystic, CT; Narragansett, RI; New Haven, CT; Niantic, CT; North Kingstown, RI; Point Lookout, NY; Provincetown Wharf, MA; Wakefield, RI; Westport, MA; and Wildwood, NJ all had confidential six-year total landings coming from the Fairways North Call Area.

	2011	**2012**	**2013**	**2014**	**2015**	**2016**	**Non-Confidential Total**
Cape May, NJ	-	$161,437.85	$211,047.54	$693,411.17	$396,813.64	$83,559.72	$1,546,269.92
East Haven, CT	-	-	-	-	-	$3,312.64	$3,312.64
Fairhaven, MA	C	C	C	C	C	$148,608.17	$148,608.17
Gloucester, MA	-	-	C	$11,450.30	$42,145.04	C	$53,595.34
Hampton Bays, NY	$106,085.45	$18,747.32	$71,906.26	$51,371.40	$22,542.86	$15,123.60	$285,776.89
Montauk, NY	$262,678.66	$187,511.88	$427,390.19	$244,935.79	$96,472.94	$228,340.91	$1,447,330.37
New Bedford, MA	$4,354,076.82	$1,225,436.15	$2,577,906.87	$7,257,608.36	$1,012,223.80	$2,365,528.85	$18,792,780.85
New London, CT	$179,223.84	$543,003.21	$450,903.21	$376,424.39	C	$214,802.44	$1,764,357.09
Newport, RI	C	C	$507,357.72	-	-	-	$507,357.72
Point Judith, RI	$35,107.59	$72,245.59	$281,319.72	$493,176.62	$63,696.66	$267,502.71	$1,213,048.89
Point Pleasant, NJ	$24,038.07	$20,707.06	$41,017.94	$85,341.77	$25,186.40	$26,266.80	$222,558.04
Shinnecock Reservation, NY	$6,086.67	$1,374.31	$1,590.27	$12,792.26	$3,141.27	$45,042.46	$70,027.24
Stonington, CT	$5,803.22	$21,165.74	$69,597.99	$107,807.96	-	$263,289.76	$467,664.67

Table 5. Annual landings in each port (within the six study states) coming from the Fairways South Call Area. (C) = confidential landings and (-) = no landings. w). Amagansett, NY; Atlantic City, NJ; Avalon, NJ; Belford, MA; Boston, MA; Chatham, MA; Davisville, RI; East Haven, CT; Fairhaven, MA; Fall River, MA; Gloucester, MA; Newport, RI; North Kingstown, RI; Point Lookout, NY; Provincetown Wharf, Sea Isle City, NJ; and Wildwood, NJ all had confidential six-year total landings coming from the Fairways South Call Area.

Port	2011	2012	2013	2014	2015	2016	Non-Confidential Total
Barnegat Light, NJ	C	C	C	$512,612.90	C	C	$512,612.90
Cape May, NJ	$163,656.59	$1,315,524.69	$591,732.86	$460,710.80	$98,945.24	$121,872.11	$2,752,442.29
Hampton Bays, NY	$110,155.62	$529,431.72	$200,972.67	$41,699.19	$21,258.59	$32,759.92	$936,277.71
Montauk, NY	$19,359.90	$35,313.34	$712.21	$8,676.92	$28,274.11	$3,553.07	$95,889.55
New Bedford, MA	$1,872,925.94	$4,548,157.70	$1,121,143.81	$4,486,961.36	$598,665.44	$515,296.51	$13,143,150.76
New London, CT	C	$82,076.27	$170,190.61	C	C	C	$252,266.88
Point Judith, RI	$353,830.64	$34,149.14	$192,644.18	$105,793.85	$32,961.70	$73,904.53	$793,284.04
Point Pleasant, NJ	$10,574.59	$319,905.87	$193,925.80	$189,062.82	$57,367.57	$441,650.27	$1,212,486.92
Shinnecock Reservation, NY	$4,598.77	$81,261.24	$938.73	$10,925.63	$20,747.24	C	$118,471.61
Stonington, CT	$182,455.99	$548,957.63	C	$97,997.40	-	$80,944.27	$910,355.29

Table 6. Annual landings in each port (within the six study states) coming from the Hudson North Call Area. (C) = confidential landings and (-) = no landings. Avalon, NJ; Barnegat, NJ; Belford, NJ; Belmar, NJ; Boston, MA; Brielle, NJ; Chatham, MA; Davisville, RI; East Haven, CT; Fall River, MA; Freeport, NY; Gloucester, MA; Greenport, NY; Mystic, CT; North Kingstown, RI; Provincetown Wharf, MA; Sea Isle City, NJ; Westport, MA; and Wildwood, NJ all had confidential six-year total landings coming from the Hudson North Call Area.

Port	2011	2012	2013	2014	2015	2016	Non-Confidential Total
Atlantic City, NJ	C	C	C	$71,401.09	$57,110.69	C	$128,511.78
Barnegat Light, NJ	$1,443,190.11	$2,575,655.77	C	$2,824,797.09	$2,542,978.32	C	$9,386,621.29
Cape May, NJ	$3,833,768.43	$4,414,614.40	$2,936,392.90	$5,977,043.31	$2,385,525.60	$6,166,251.53	$25,713,596.17
Fairhaven, MA	C	C	C	C	C	$2,541,670.25	$2,541,670.25
Hampton Bays, NY	$21,782.89	$42,664.35	$13,014.85	$16,961.66	$3,877.40	$172,684.56	$270,985.71
Montauk, NY	$70,780.26	$82,304.98	$41,062.77	$204,799.19	$24,965.83	$110,904.14	$534,817.17
New Bedford, MA	$15,021,268.6	$8,473,892.11	$3,938,295.05	$32,942,373.5	$6,351,741.71	$22,001,299.5	$88,728,870.58
New London, CT	$473,682.74	$809,502.24	C	C	C	$321,752.08	$1,604,937.06
Newport, RI	C	C	$66,382.04	-	-	C	$66,382.04
Point Judith, RI	$454,655.77	$93,658.18	$308,323.88	$894,089.83	$102,915.46	$3,051,366.92	$4,905,010.04
Point Lookout, NY	$24,563.52	$34,547.24	$100,599.04	$21,536.59	C	C	$181,246.39
Point Pleasant, NJ	$515,561.54	$2,314,532.32	$1,252,360.36	$3,548,050.36	$3,025,133.17	$5,082,086.83	$15,737,724.58
Shinnecock Reservation, NY	C	C	C	C	$5,392.13	$12,675.70	$18,067.83
Stonington, CT	$792,350.67	$164,391.30	C	$621,548.74	-	$958,523.42	$2,536,814.13

10.1.3 Tables by Gear Used

Table 7. Annual landings caught using each gear type within the Fairways North Call Area. (C) = confidential landings and (-) = no landings.

	2011	2012	2013	2014	2015	2016	Non-Confidential Total
DREDGE, OCEAN QUAHOG/SURF CLAM	C	$6,537.21	C	C	$14,027.38	$110,997.31	$131,561.90
DREDGE, SCALLOP	$4,505,822.69	$1,836,532.83	$3,876,376.40	$9,922,670.11	$1,427,369.12	$3,051,039.49	$24,619,810.64
GILL NET, SINK	$210,600.75	$354,089.18	$324,209.01	$186,759.35	$68,402.82	$263,380.09	$1,407,441.20
OTTER TRAWL, BOTTOM, FISH	$224,900.64	$273,682.99	$375,376.30	$474,620.94	$134,918.88	$296,740.79	$1,780,240.54
PAIR TRAWL, MIDWATER	C	C	$81,127.54	-	$31,281.52	$14,925.61	$127,334.67

Table 8. Annual landings caught using each gear type within the Fairways South Call Area. (C) = confidential landings and (-) = no landings.

Gear	2011	2012	2013	2014	2015	2016	Non-Confidential Total
DREDGE, OCEAN QUAHOG/SURF CLAM	$1,492.56	$1,412.76	$20,562.11	$13,017.44	$8,567.97	$4,774.22	$49,827.06
DREDGE, SCALLOP	$3,647,049.49	$8,135,424.03	$2,891,850.63	$6,171,663.78	$953,611.17	$1,660,661.84	$23,460,260.94
GILL NET, SINK	-	-	C	C	$9,031.89	-	$9,031.89
OTTER TRAWL, BOTTOM, FISH	$118,409.33	$615,110.91	$343,808.49	$54,472.24	$161,599.19	$117,633.42	$1,411,033.58
OTTER TRAWL, BOTTOM, SCALLOP	C	$123,660.33	C	C	-	-	$123,660.33
PAIR TRAWL, MIDWATER	-	$51,502.38	$214,721.51	-	C	$55,227.67	$321,451.56

Table 9. Annual landings caught using each gear type within the Hudson North Call Area. (C) = confidential landings and (-) = no landings.

Gear	2011	2012	2013	2014	2015	2016	Non-Confidential Total
DREDGE, OCEAN QUAHOG/SURF CLAM	$52,421.86	$195,592.06	$156,213.85	$154,174.61	$136,012.69	$219,660.03	$914,075.10
DREDGE, SCALLOP	$23,516,178.33	$19,969,615.78	$9,283,979.23	$48,861,448.36	$14,290,579.11	$44,004,574.21	$159,926,375.02
GILL NET, SINK	$388,688.57	$215,783.64	C	C	$161,158.59	C	$765,630.80
OTTER TRAWL, BOTTOM, FISH	$194,362.08	$1,566,487.88	$465,328.34	$453,567.18	$487,197.70	$1,907,743.32	$5,074,686.50
OTTER TRAWL, BOTTOM, SCALLOP	C	$56,538.26	$362,410.32	$254,280.54	C	C	$673,229.12
OTTER TRAWL, MIDWATER	-	C	$78,206.21	C	C	C	$78,206.21
PAIR TRAWL, MIDWATER	C	$232,052.07	$125,800.08	C	$32,443.04	C	$390,295.19

10.1.4 Tables by Species Caught

Table 10. Annual landings of each species (or grouped species in a shared FMP) caught within the Fairways North Call Area. (C) = confidential landings and (-) = no landings.

	2011	2012	2013	2014	2015	2016	Non-Confidential Total
Bluefish FMP	$1,988.19	$4,468.29	$437.17	$664.81	$2,267.43	$4,389.74	$14,215.63
DOGFISH, SMOOTH	$661.49	$7.71	$552.10	$690.41	$916.59	$94.75	$2,923.05
DOGFISH, SPINY	$5,979.11	$1,517.56	$574.24	$1,344.07	$315.38	$15.92	$9,746.28
DORY, AMERICAN JOHN	$271.96	$1,294.87	$603.32	$307.39	$402.21	$2,431.27	$5,311.02
EEL, CONGER	$32.19	$93.94	-	$21.02	C	$13.84	$160.99
FLOUNDER, FOURSPOT	C	$31.74	$42.62	$182.97	$16.55	$18.96	$292.84
Monkfish FMP	$232,535.40	$375,374.70	$343,962.53	$254,511.88	$75,061.34	$271,645.20	$1,553,091.05
Northeast Multispecies FMP	$56,091.83	$8,375.94	$181,705.57	$53,232.66	$36,674.16	$19,640.25	$355,720.41
Northeast Small Mesh Multispecies FMP	$19,847.65	$59,857.60	$7,169.38	$14,851.87	$2,906.06	$33,068.78	$137,701.34
ROBINS, SEA	C	$8.68	$31.23	$32.13	$70.17	$4.98	$147.19
Sea Scallop FMP	$4,573,969.27	$1,835,853.74	$3,903,931.50	$9,927,707.15	$1,453,548.33	$3,165,913.45	$24,860,923.44
Skate FMP	C	C	$253.50	$1,689.57	$1,671.94	$2,671.15	$6,286.16
Squid Mackerel Butterfish FMP	$20,159.43	$83,458.99	$203,790.98	$266,113.99	$39,527.40	$102,393.54	$715,444.33
Summer Flounder, Scup, Black Sea Bass FMP	$82,826.58	$112,947.89	$64,720.26	$79,270.65	$64,734.07	$141,375.96	$545,875.41

Table 11. Annual landings of each species (or grouped species in a shared FMP) caught within the the Fairways South Call Area. (C) = confidential landings and (-) = no landings.

Species or FMP	2011	2012	2013	2014	2015	2016	Non-Confidential Total
Bluefish FMP	$571.94	$8,894.74	$236.83	$499.42	$1,356.39	$212.53	$11,771.85
DOGFISH, SMOOTH	$122.30	$431.90	C	C	$437.78	$30.86	$1,022.84
DOGFISH, SPINY	$1,366.45	$6,193.90	C	C	-	-	$7,560.35
DORY, AMERICAN JOHN	C	$121.06	C	C	$37.34	$122.04	$280.44
Monkfish FMP	$22,393.82	$51,378.01	$17,367.58	$22,384.78	$14,579.91	$4,528.85	$132,632.95
Northeast Multispecies FMP	$545.69	$37,515.37	$344,403.48	$9,341.53	$1,931.55	$56,143.90	$449,881.52
Northeast Small Mesh Multispecies FMP	$2,854.85	$30,196.11	$1,960.55	$668.58	$1,343.66	$548.69	$37,572.44
Sea Scallop FMP	$3,711,115.63	$8,573,604.81	$3,063,671.92	$6,208,486.32	$978,674.22	$1,682,149.54	$24,217,702.44
Skate FMP	-	-	-	C	$31.02	$40.67	$71.69
Squid Mackerel Butterfish FMP	$1,326.59	$55,944.33	$13,537.67	$2,116.43	$41,225.88	$69,176.33	$183,327.23
Summer Flounder, Scup, Black Sea Bass FMP	$29,629.16	$163,371.06	$43,723.79	$14,073.57	$99,260.93	$26,853.41	$376,911.92

Table 12. Annual landings of each species (or grouped species in a shared FMP) caught within the Hudson North Call Area. (C) = confidential landings and (-) = no landings.

Species or FMP	2011	2012	2013	2014	2015	2016	Non-Confidential Total
Bluefish FMP	$155.08	$846.53	$397.00	$429.95	$4,009.57	$6,123.18	$11,961.31
DOGFISH, SMOOTH	$178.77	$142.09	$68.52	C	$644.50	$2,612.97	$3,646.85
DOGFISH, SPINY	C	$339.79	-	C	C	C	$339.79
DORY, AMERICAN JOHN	$1,085.40	$308.45	$178.05	$120.58	$633.57	$1,614.87	$3,940.92
EEL, CONGER	-	C	-	C	C	$84.03	$84.03
Monkfish FMP	$480,655.22	$347,848.96	$144,723.15	$277,879.01	$225,151.64	$153,592.80	$1,629,850.78
Northeast Multispecies FMP	$95,138.28	$114,231.28	$385,874.43	$25,233.94	$20,146.22	$78,066.19	$718,690.34
Northeast Small Mesh Multispecies FMP	$3,686.41	$40,926.85	$2,723.06	$6,938.68	$1,871.00	$5,738.92	$61,884.92
ROBINS, SEA	C	C	C	C	$47.06	$441.29	$488.35
Sea Scallop FMP	$23,493,973.23	$20,304,672.96	$9,839,287.92	$49,168,607.48	$14,586,357.84	$44,616,336.72	$162,009,236.15
Skate FMP	C	$1,963.85	C	$1,144.45	$2,326.48	$3,103.62	$8,538.40
Squid Mackerel Butterfish FMP	$129,059.16	$1,441,891.38	$110,080.41	$168,353.48	$94,640.65	$485,626.49	$2,429,651.57
Summer Flounder, Scup, Black Sea Bass FMP	$43,562.86	$25,540.88	$86,063.73	$206,567.70	$350,152.43	$1,225,189.26	$1,937,076.86

10.2 FIGURES

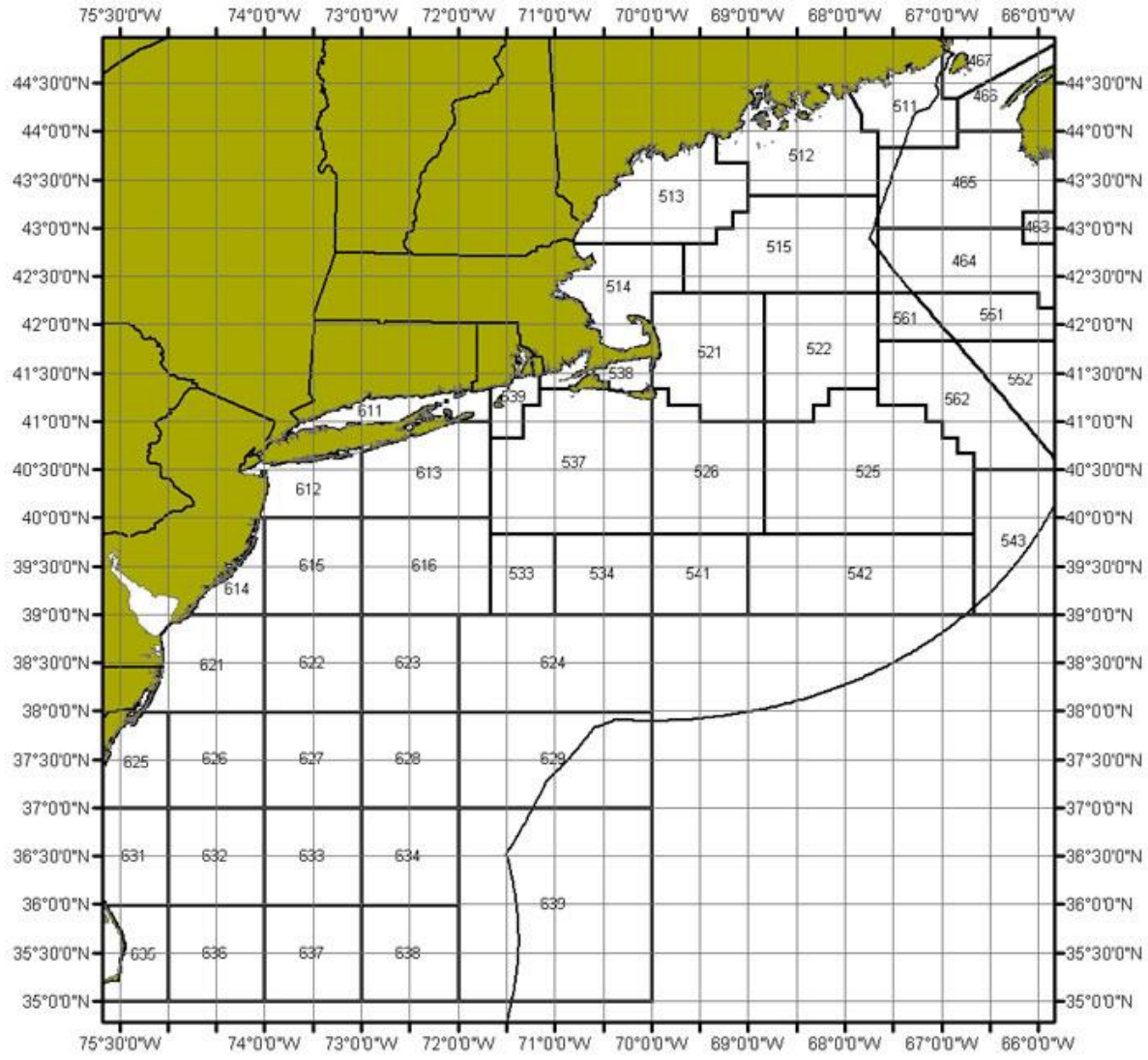

Figure 1. NOAA Fisheries Greater Atlantic Region statistical areas

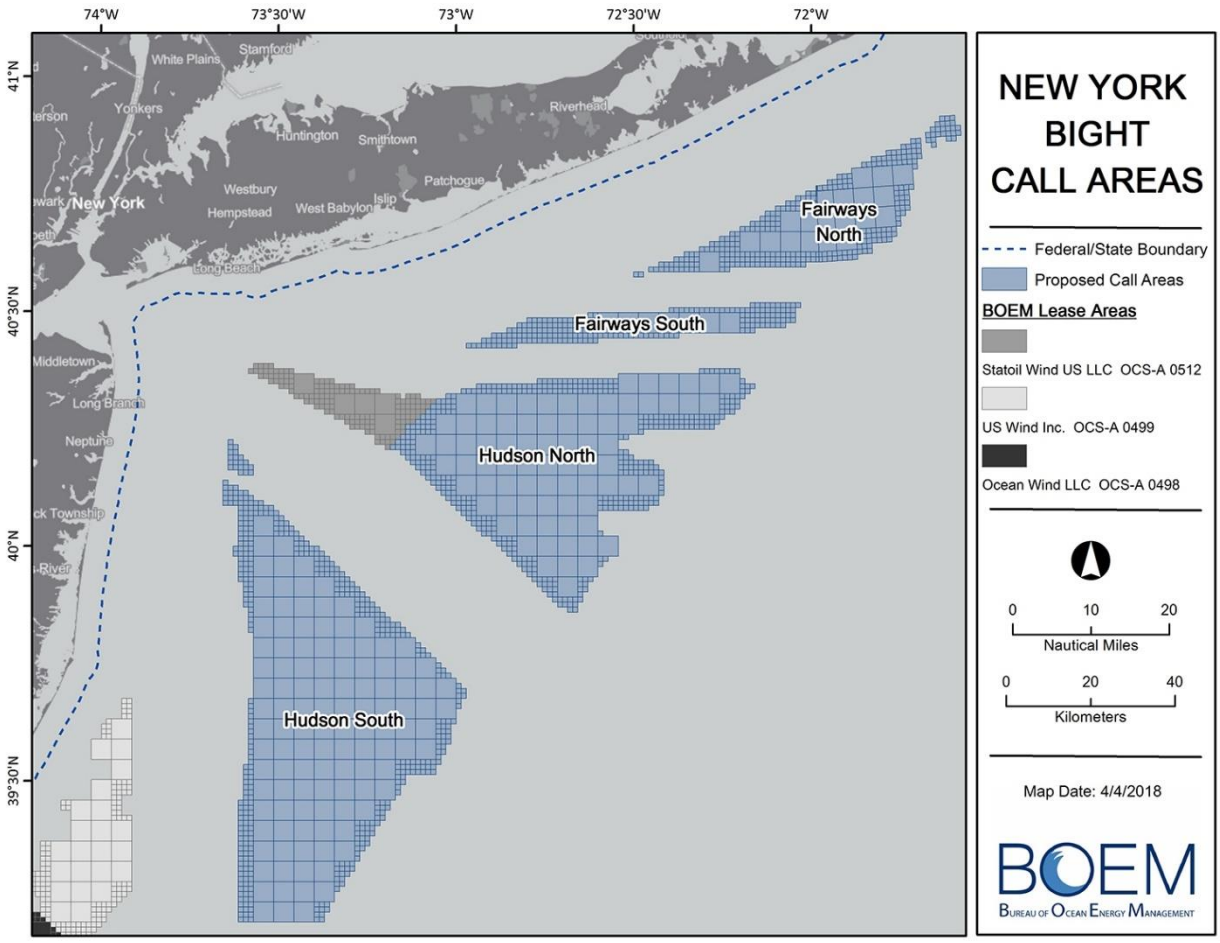

Figure 2. New York Bight Call Areas proposed by BOEM for consideration during the Area Identification process.

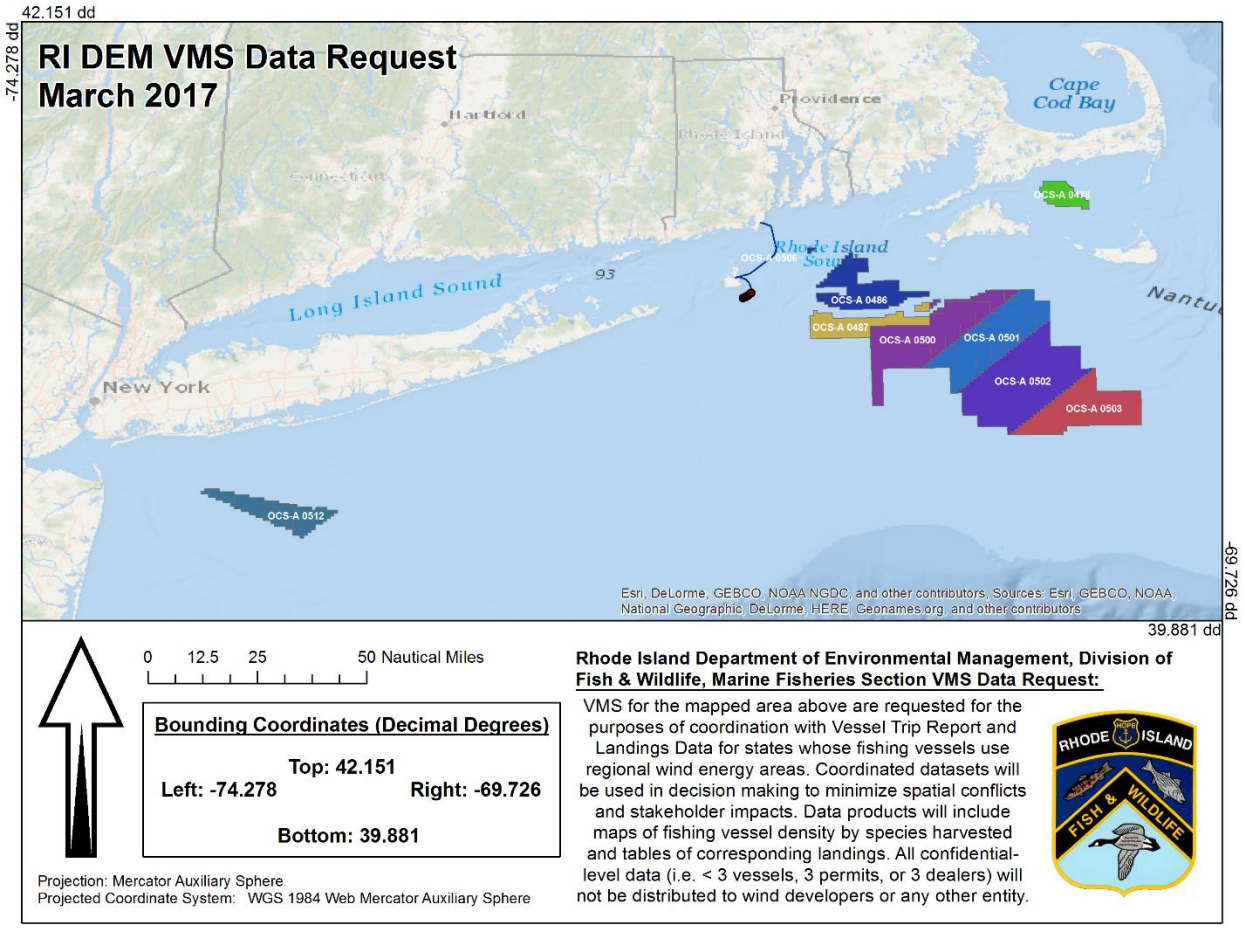

Figure 3. Map provided to NOAA's OLE as part of DEM's VMS data request submitted on March 28th, 2017.

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.

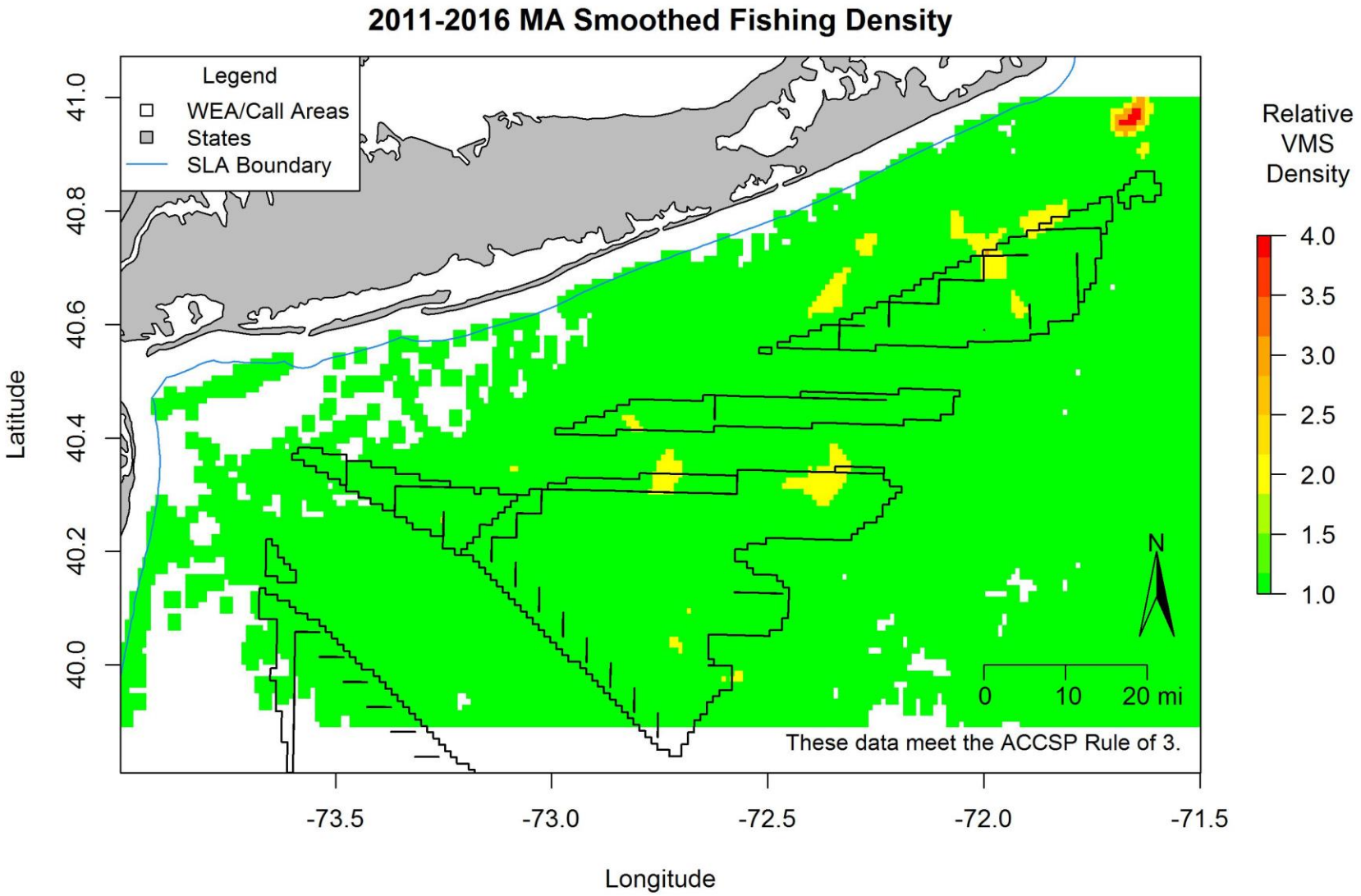

Figure 4. Smoothed federal fishing activity (all fisheries) resulting in landings in MA between 2011 and 2016

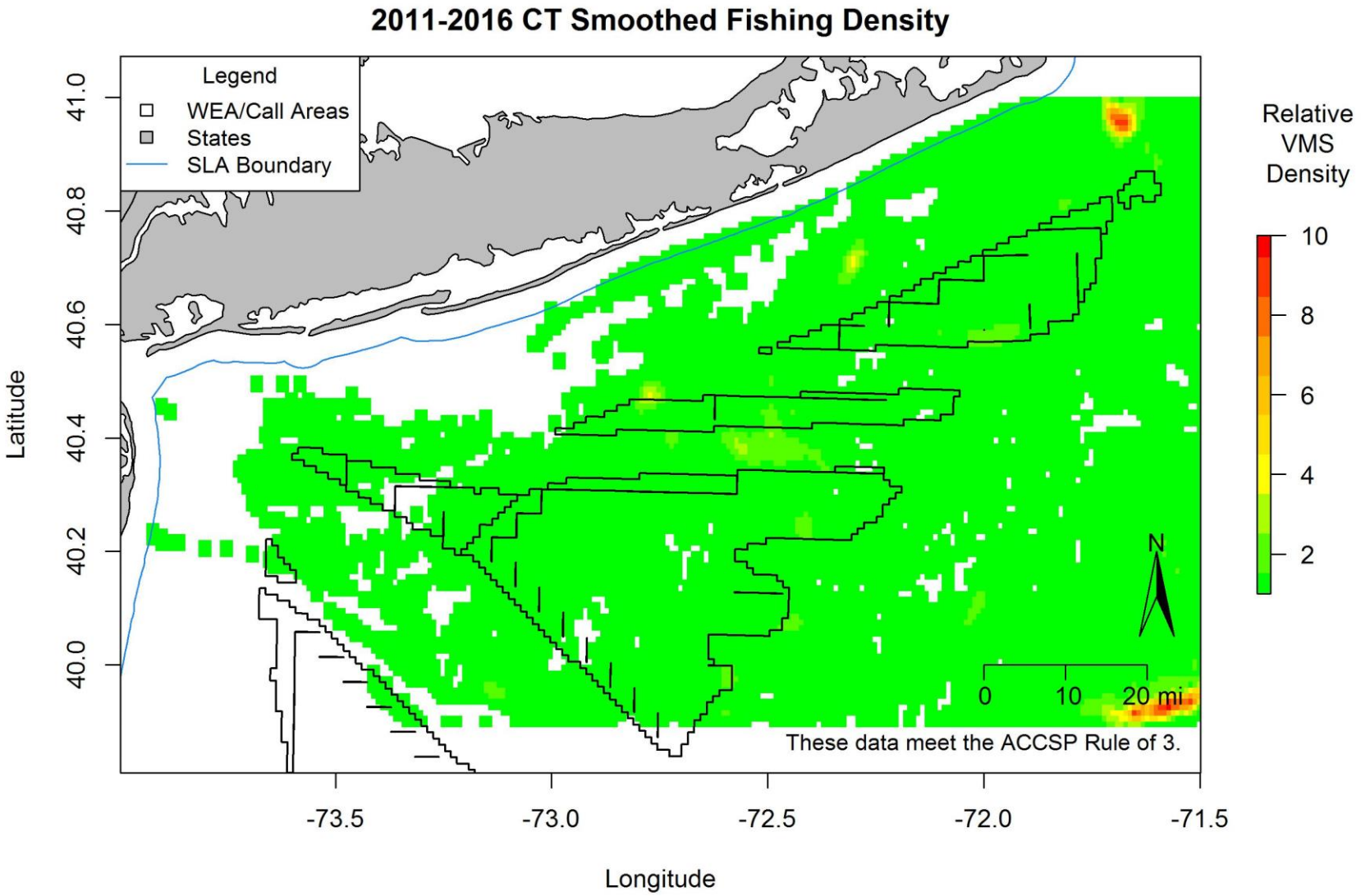

Figure 5. Smoothed federal fishing activity (all fisheries) resulting in landings in CT between 2011 and 2016

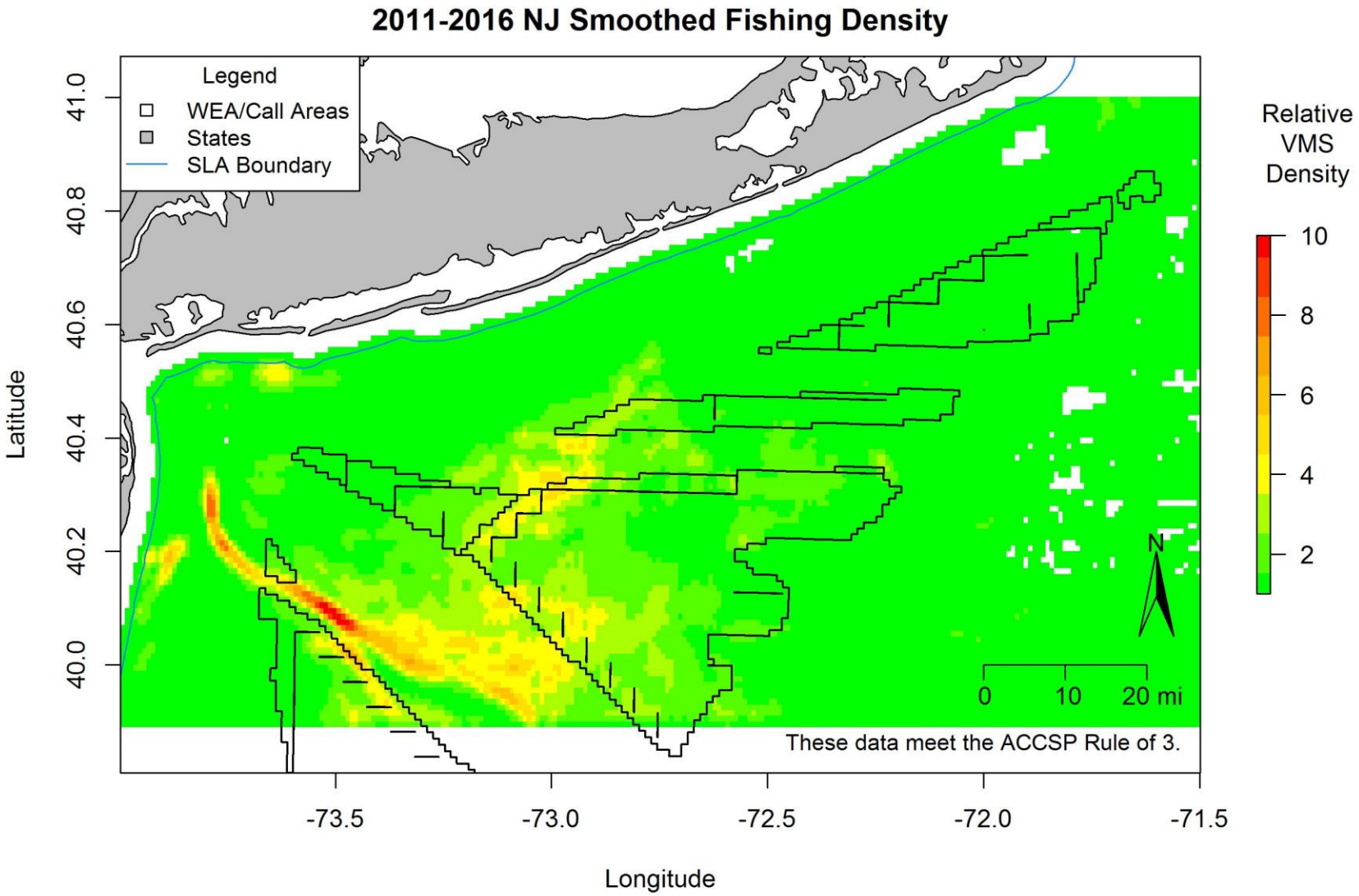

Figure 6. Smoothed federal fishing activity (all fisheries) resulting in landings in NJ between 2011 and 2016

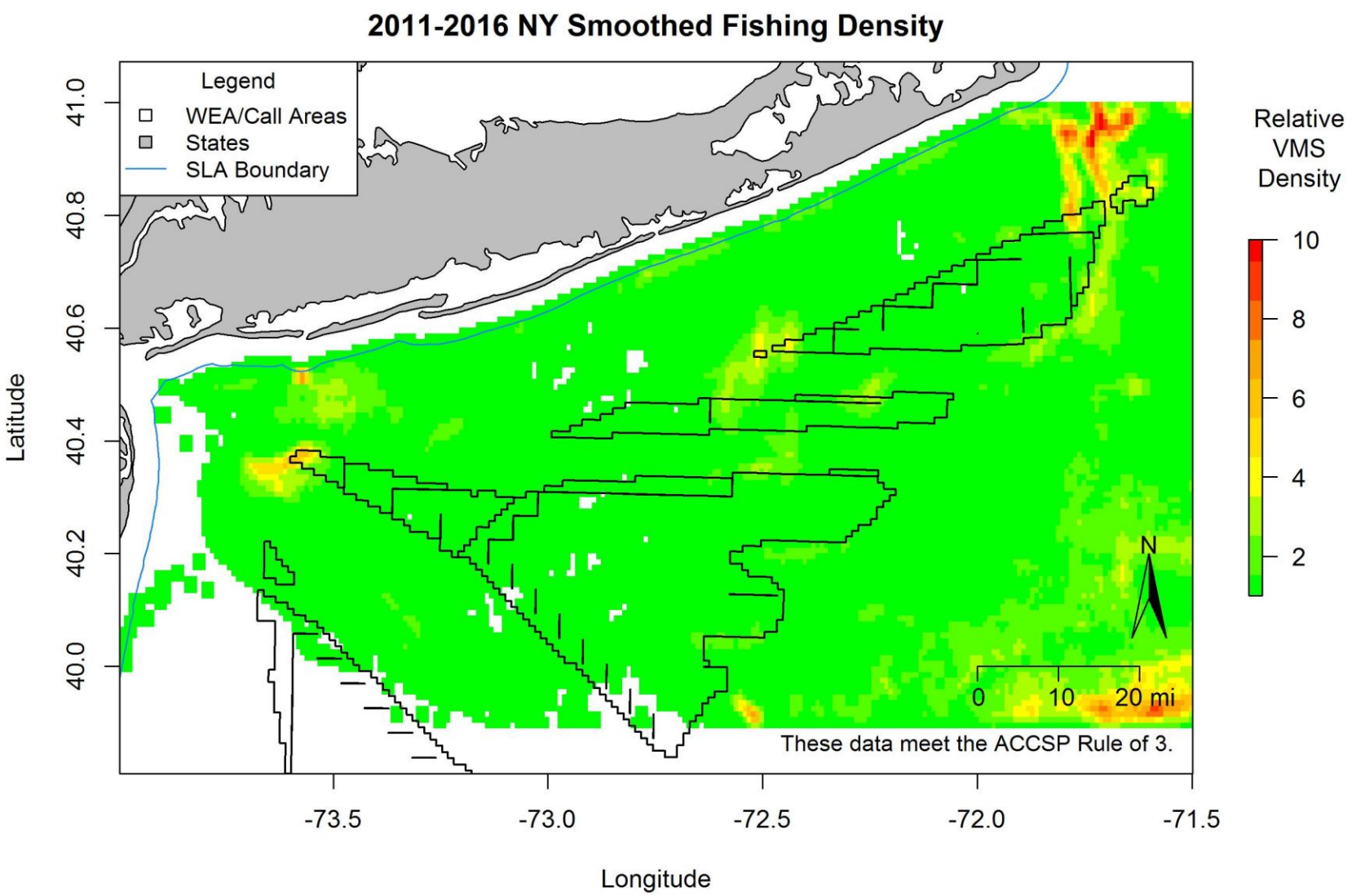

Figure 7. Smoothed federal fishing activity (all fisheries) resulting in landings in NY between 2011 and 2016

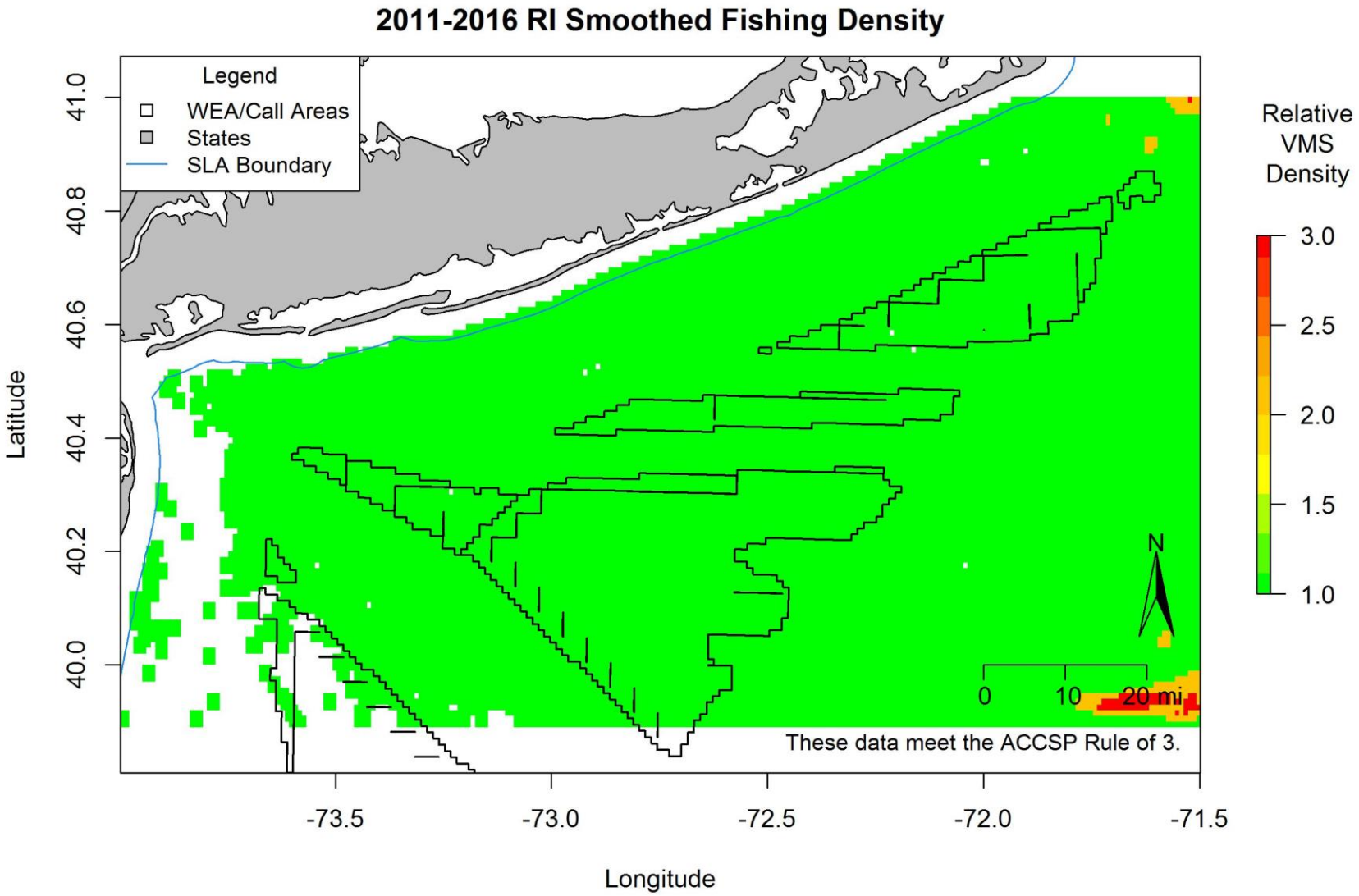

Figure 8. Smoothed federal fishing activity (all fisheries) resulting in landings in RI between 2011 and 2016

10.2.2 2011-2016 Maps by Port Landed

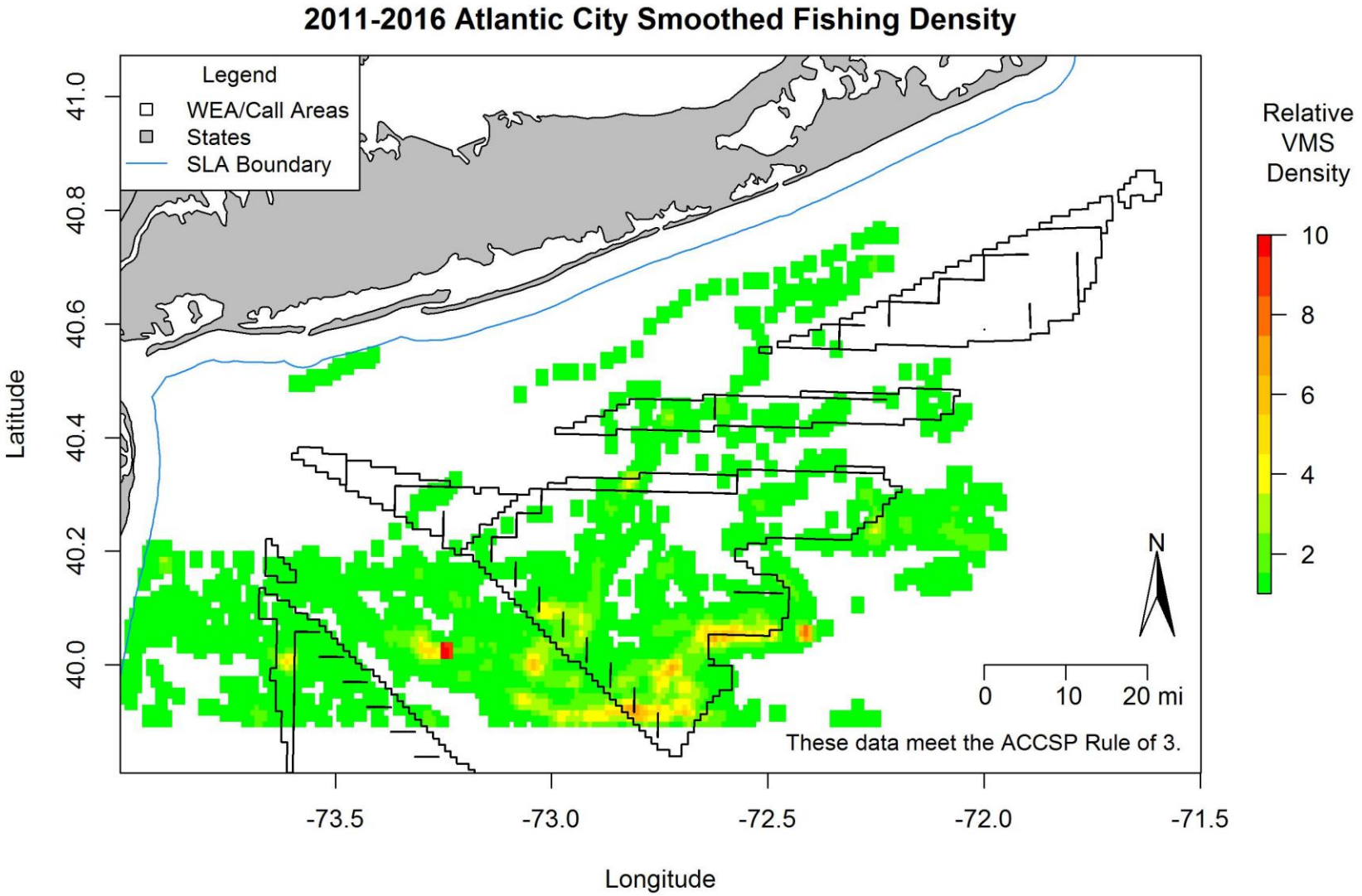

Figure 9. Smoothed federal fishing activity (all fisheries) resulting in landings in Atlantic City, NJ between 2011 and 2016

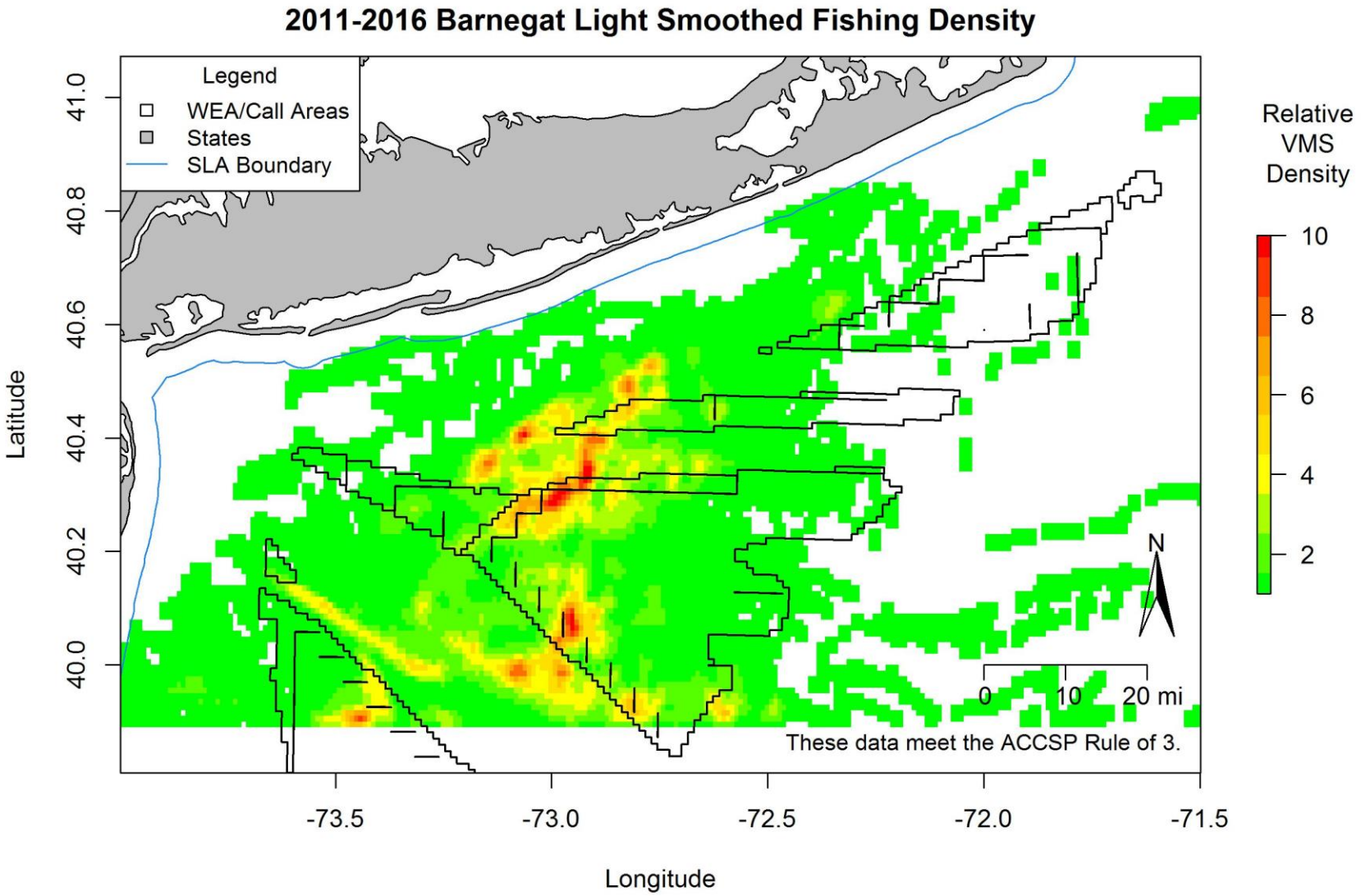

Figure 10. Smoothed federal fishing activity (all fisheries) resulting in landings in Barnegat Light, NJ between 2011 and 2016

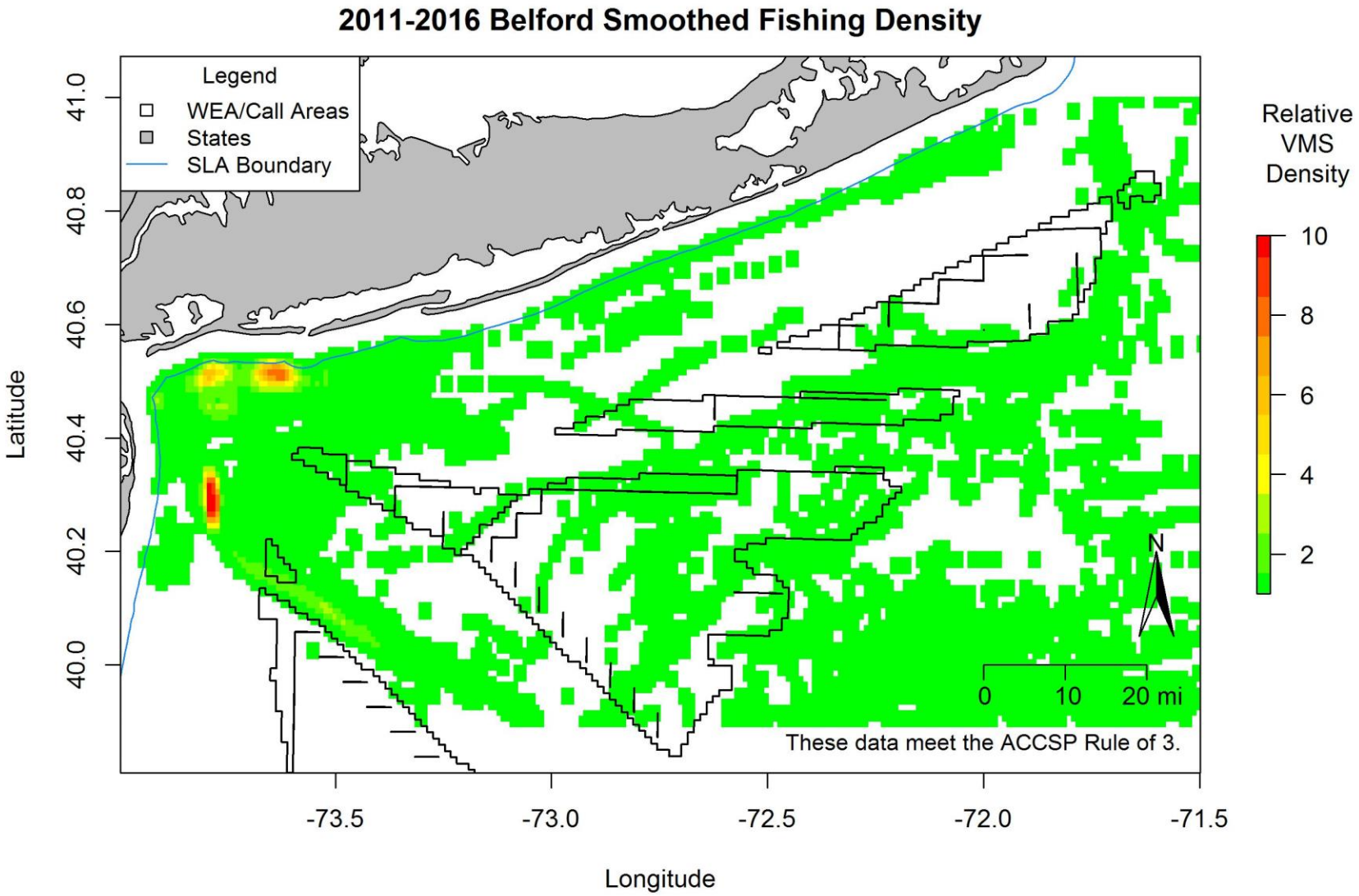

Figure 11. Smoothed federal fishing activity (all fisheries) resulting in landings in Belford, NJ between 2011 and 2016

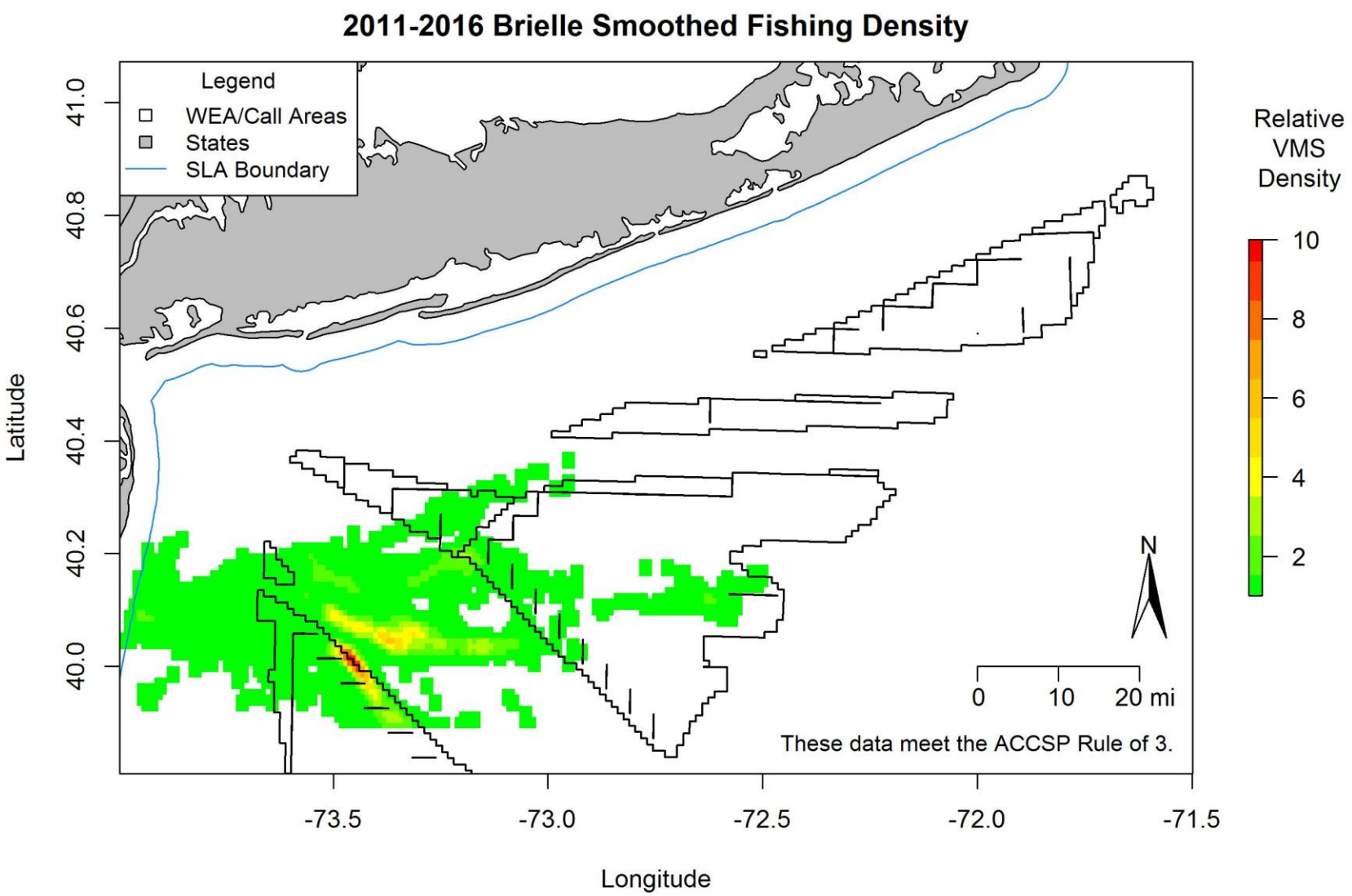

Figure 12. Smoothed federal fishing activity (all fisheries) resulting in landings in Brielle, NJ between 2011 and 2016

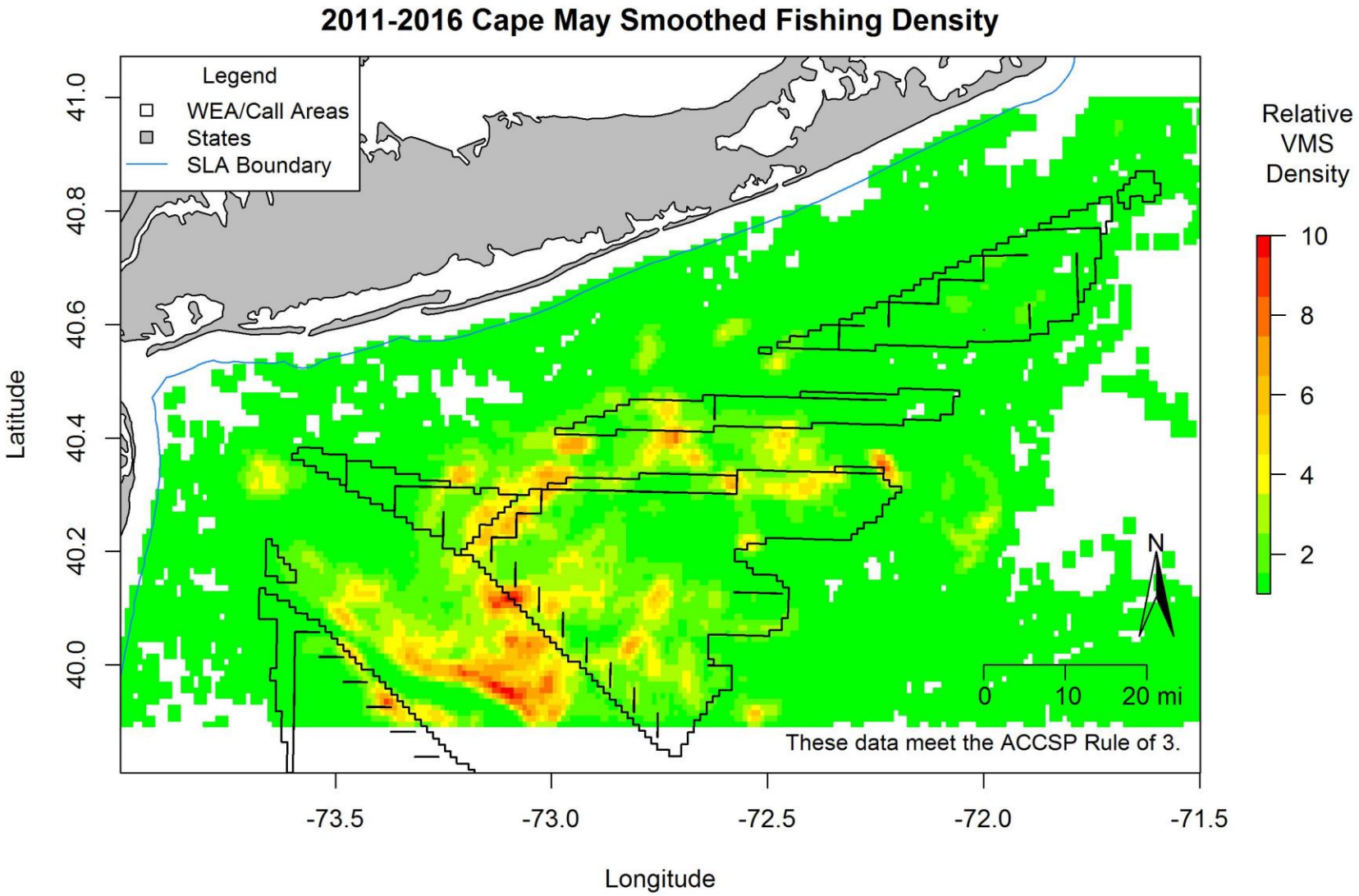

Figure 13. Smoothed federal fishing activity (all fisheries) resulting in landings in Cape May, NJ between 2011 and 2016

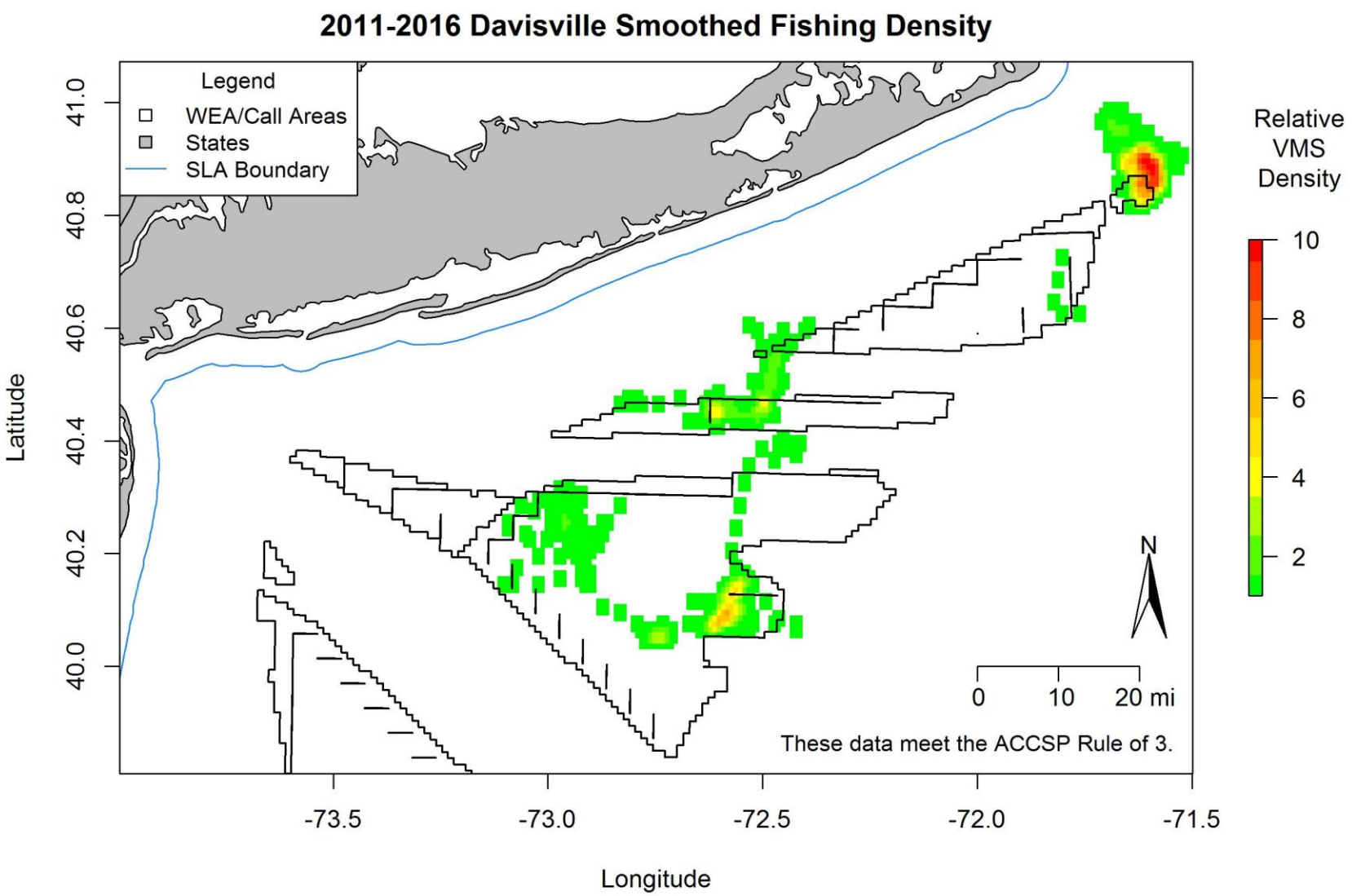

Figure 14. Smoothed federal fishing activity (all fisheries) resulting in landings in Davisville, NJ between 2011 and 2016

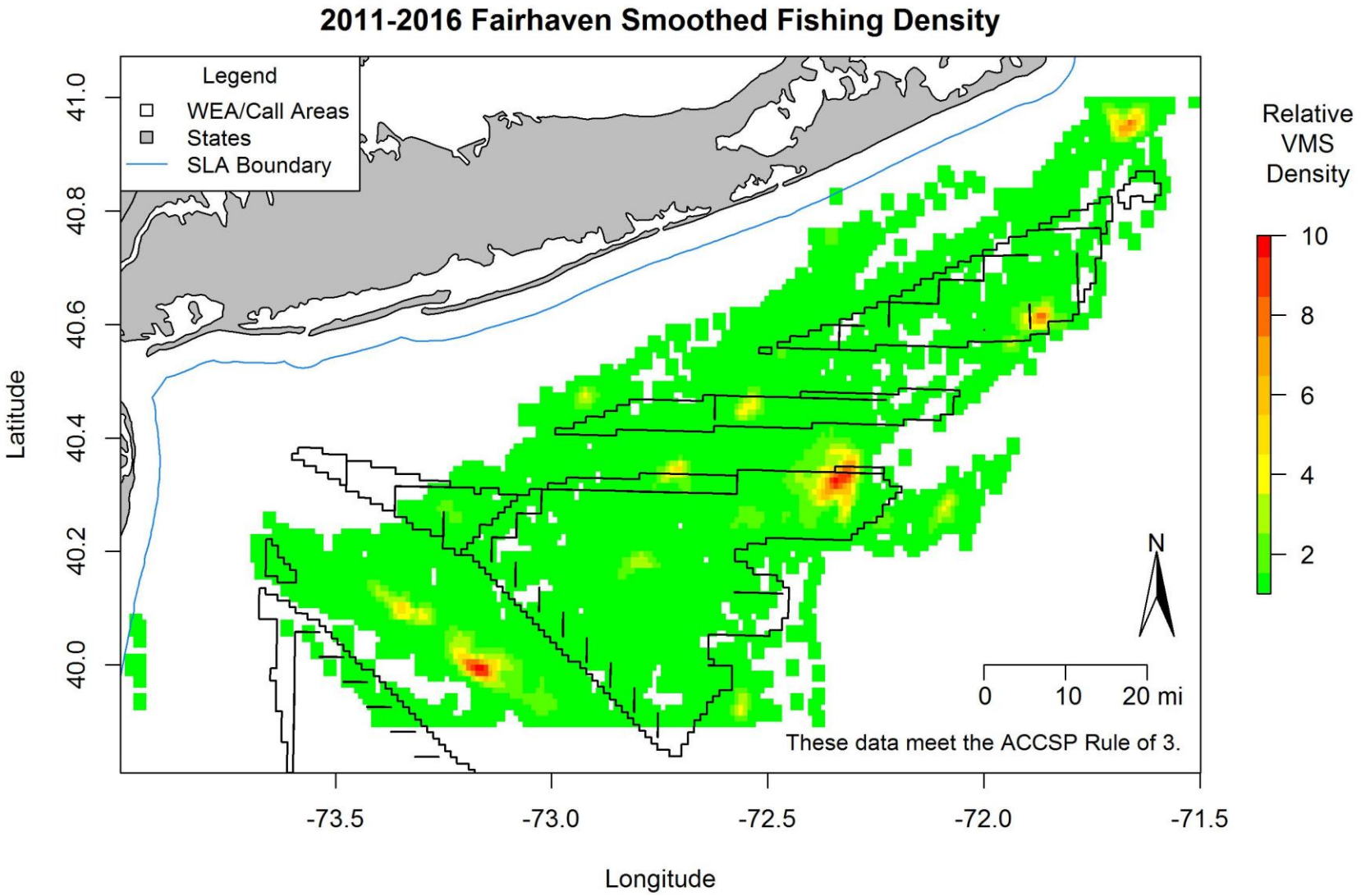

Figure 15. Smoothed federal fishing activity (all fisheries) resulting in landings in Fairhaven, MA between 2011 and 2016

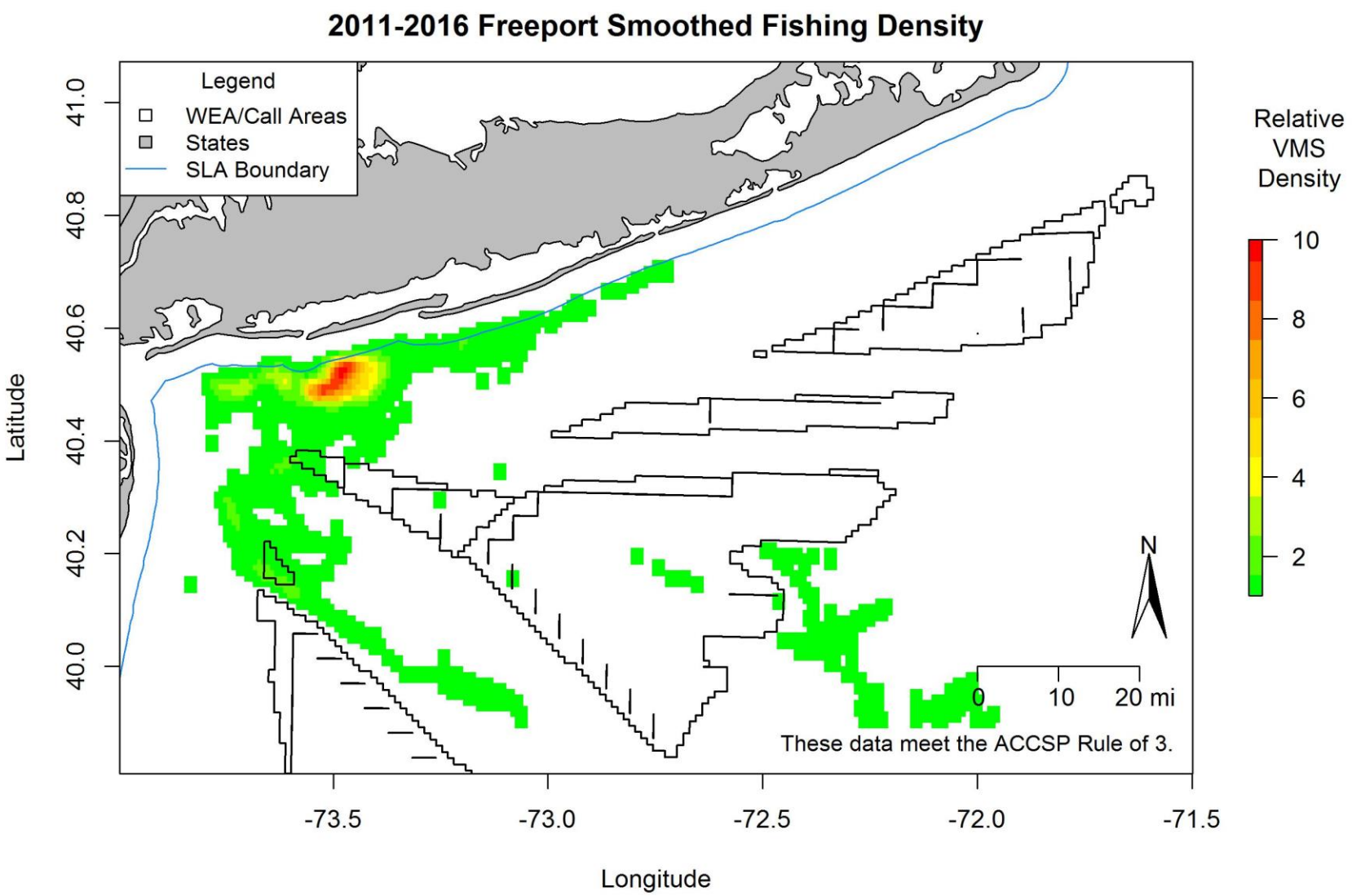

Figure 16. Smoothed federal fishing activity (all fisheries) resulting in landings in Freeport, NY between 2011 and 2016

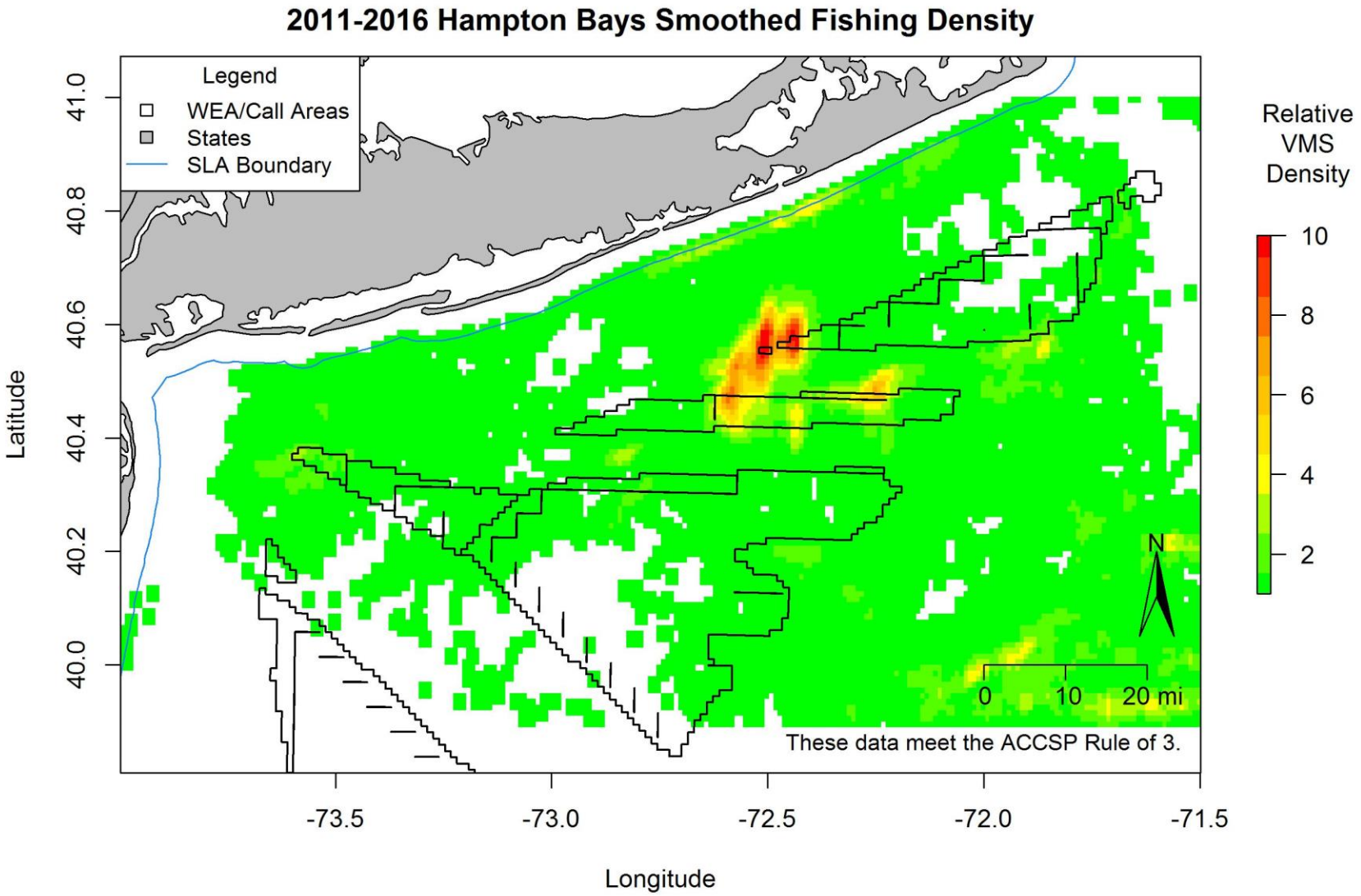

Figure 17. Smoothed federal fishing activity (all fisheries) resulting in landings in Hampton Bays, NY between 2011 and 2016

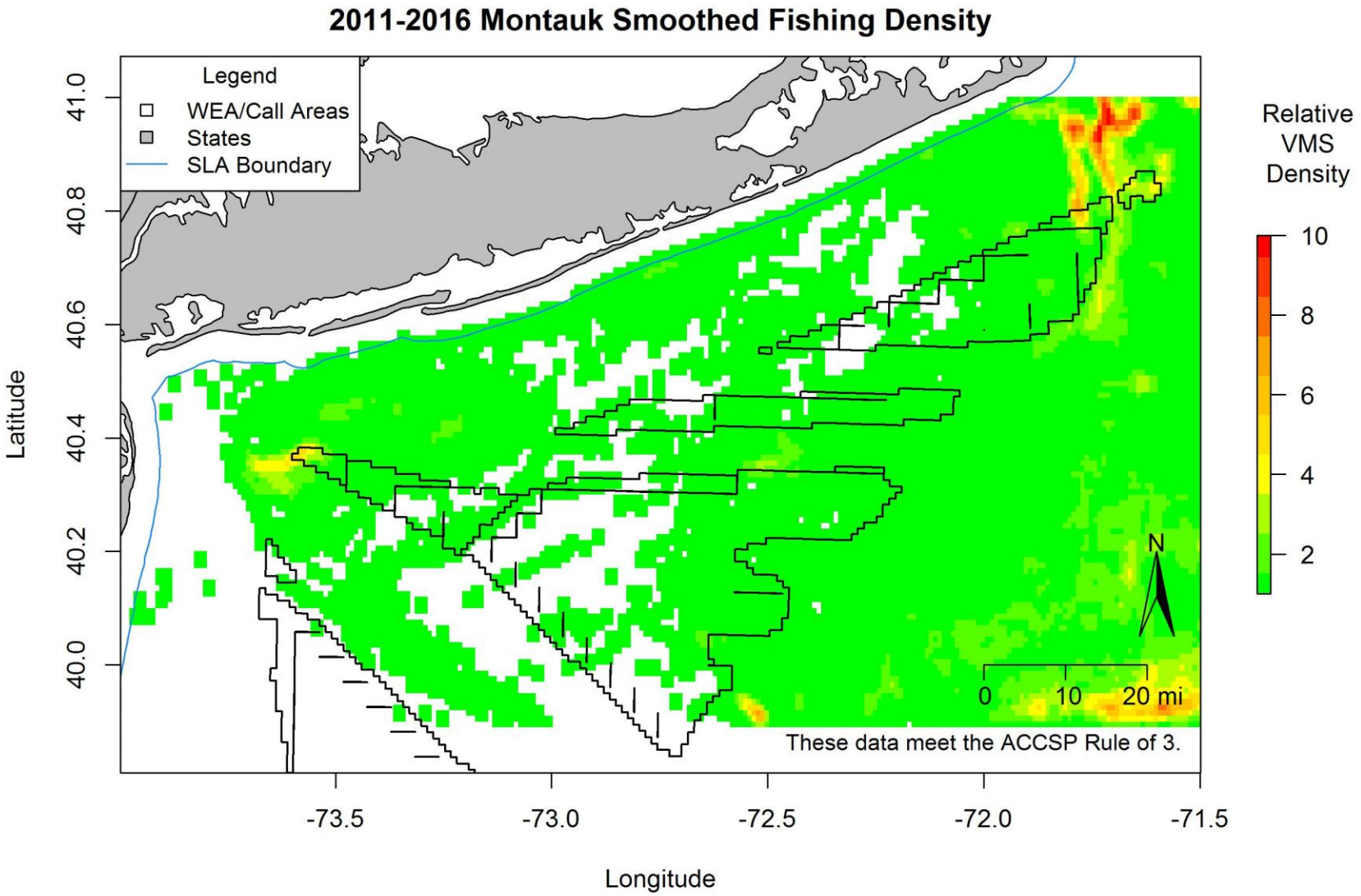

Figure 18. Smoothed federal fishing activity (all fisheries) resulting in landings in Montauk, NY between 2011 and 2016

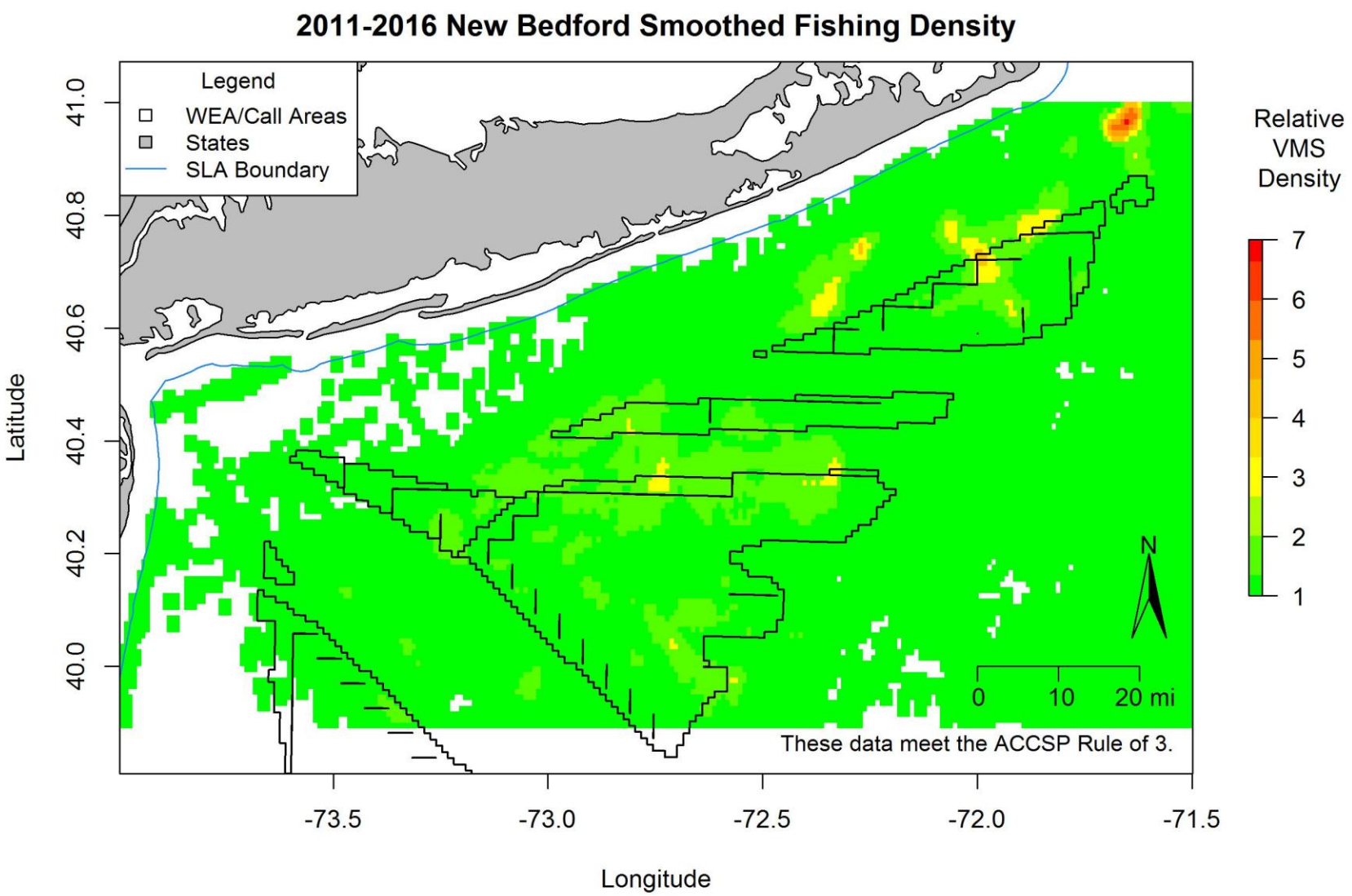

Figure 19. Smoothed federal fishing activity (all fisheries) resulting in landings in New Bedford, MA between 2011 and 2016

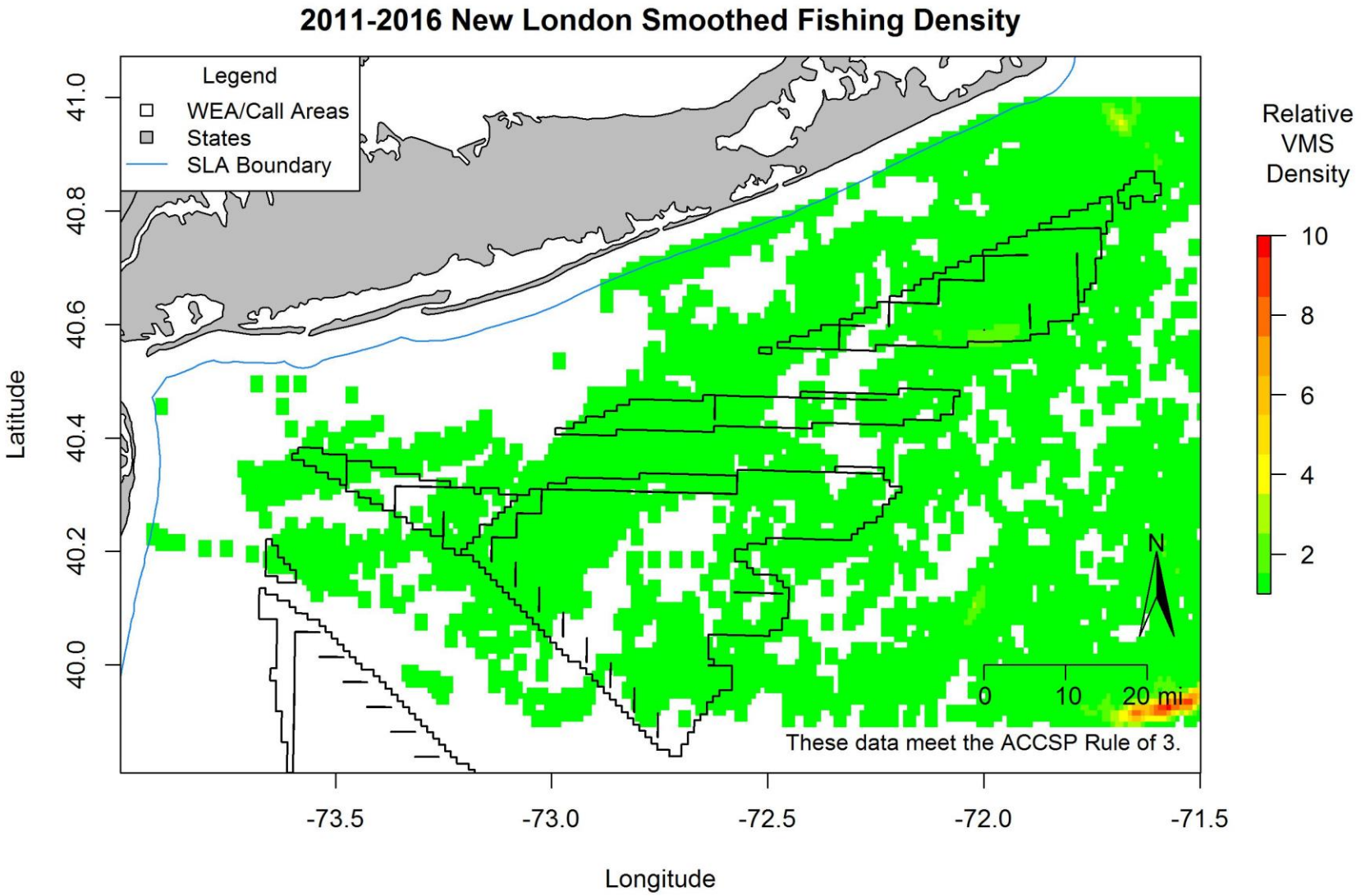

Figure 20. Smoothed federal fishing activity (all fisheries) resulting in landings in New London, CT between 2011 and 2016

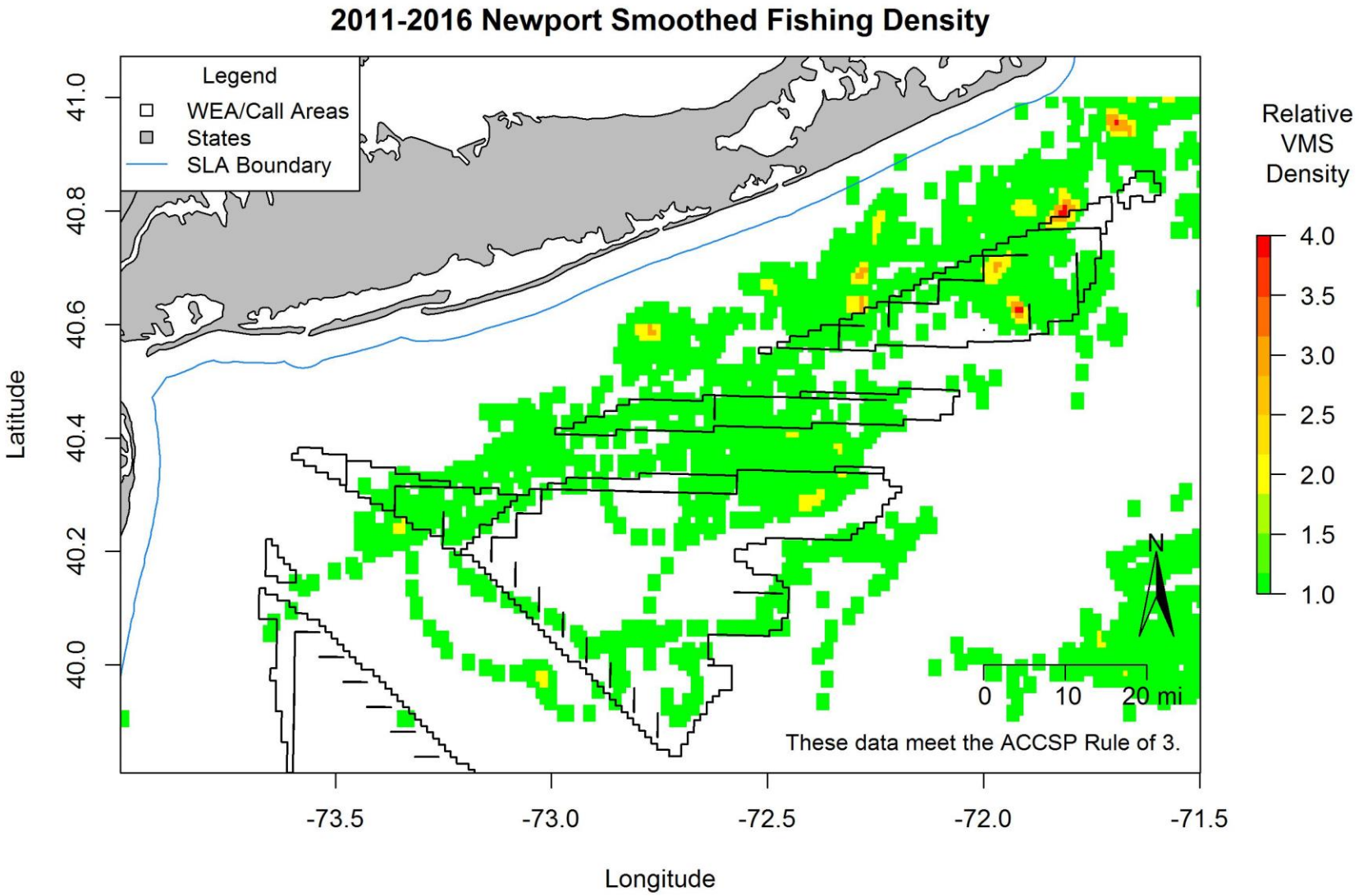

Figure 21. Smoothed federal fishing activity (all fisheries) resulting in landings in Newport, RI between 2011 and 2016

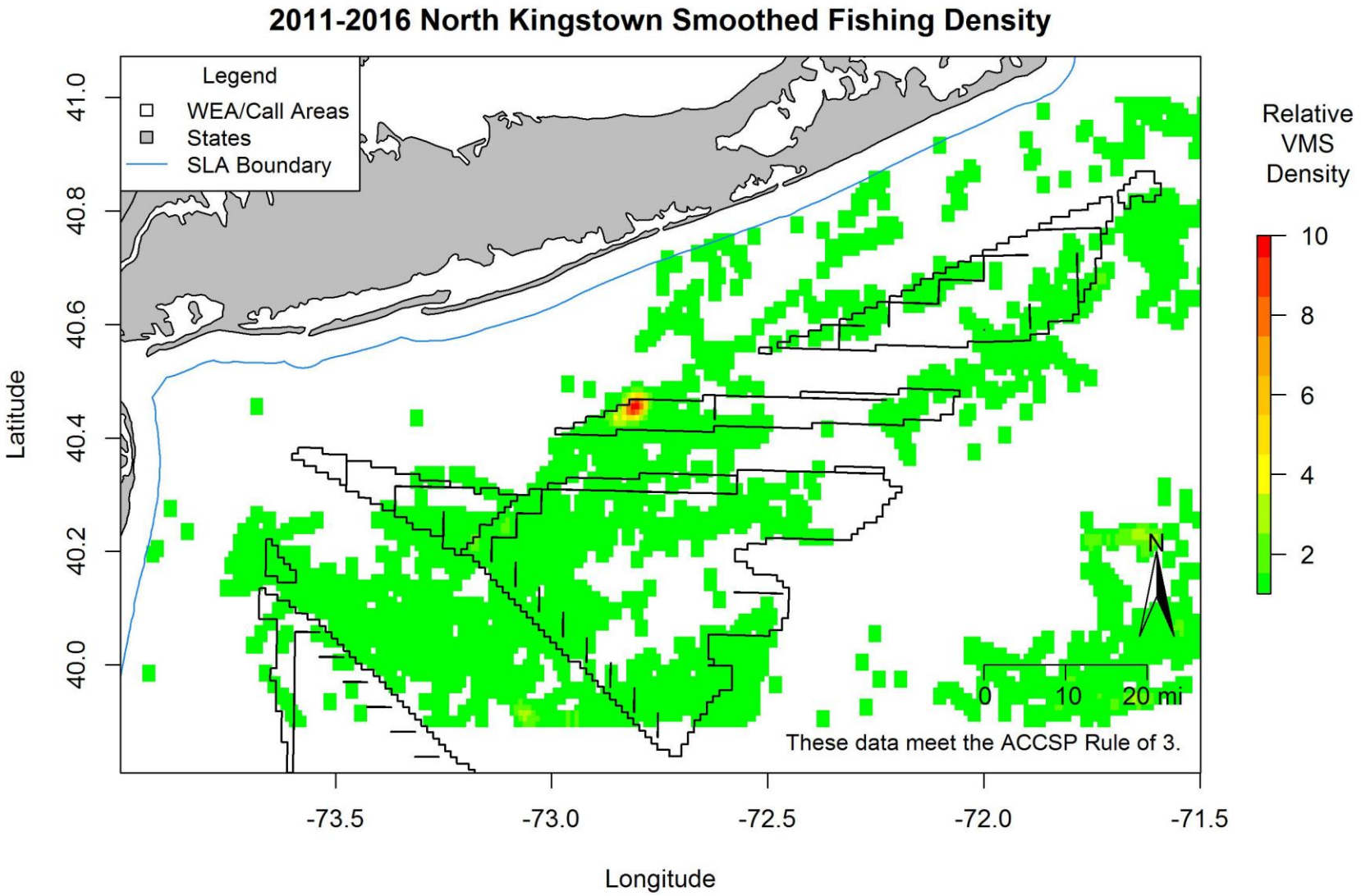

Figure 22. Smoothed federal fishing activity (all fisheries) resulting in landings in North Kingstown, RI between 2011 and 2016

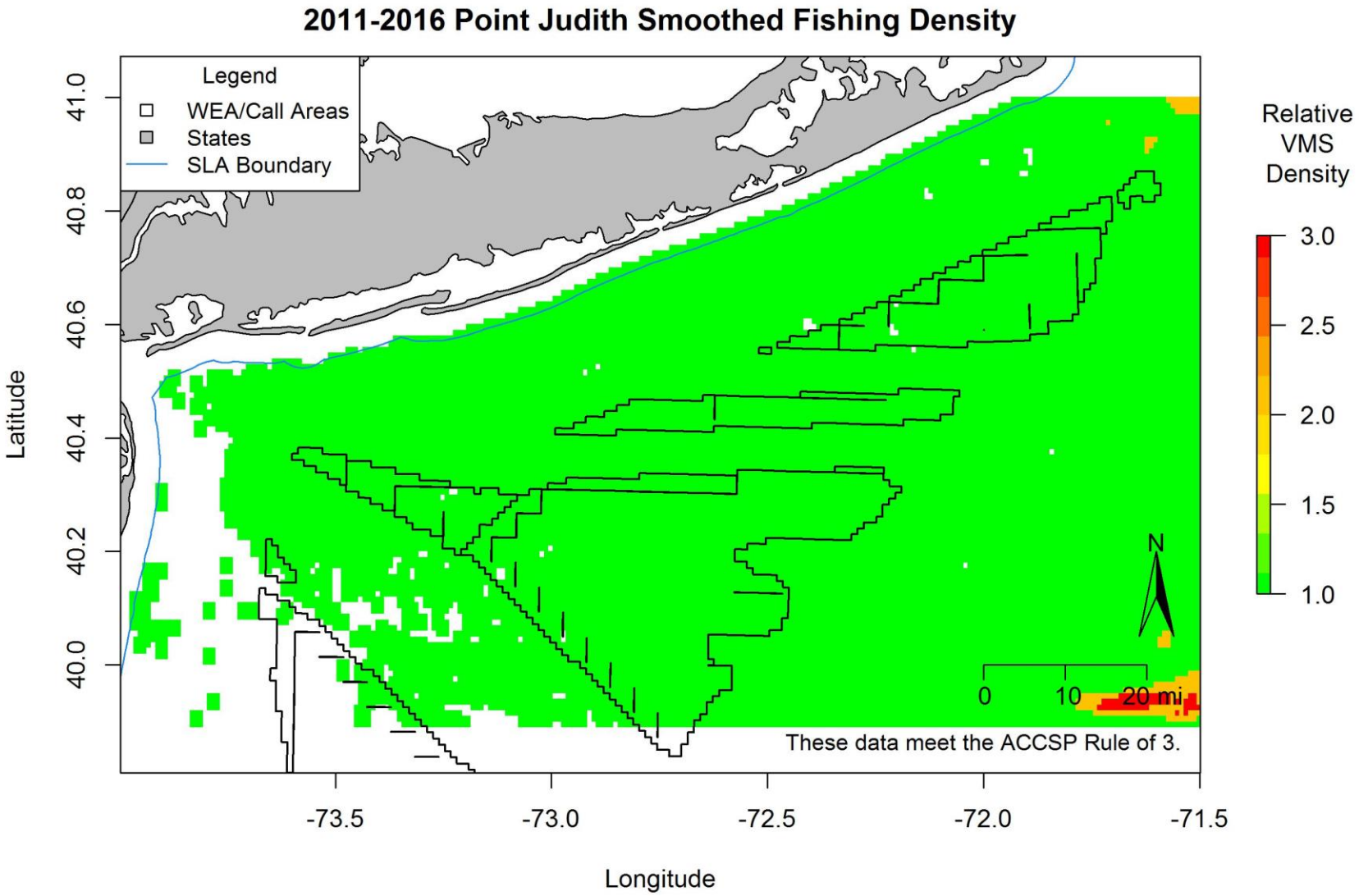

Figure 23. Smoothed federal fishing activity (all fisheries) resulting in landings in Point Judith, RI between 2011 and 2016

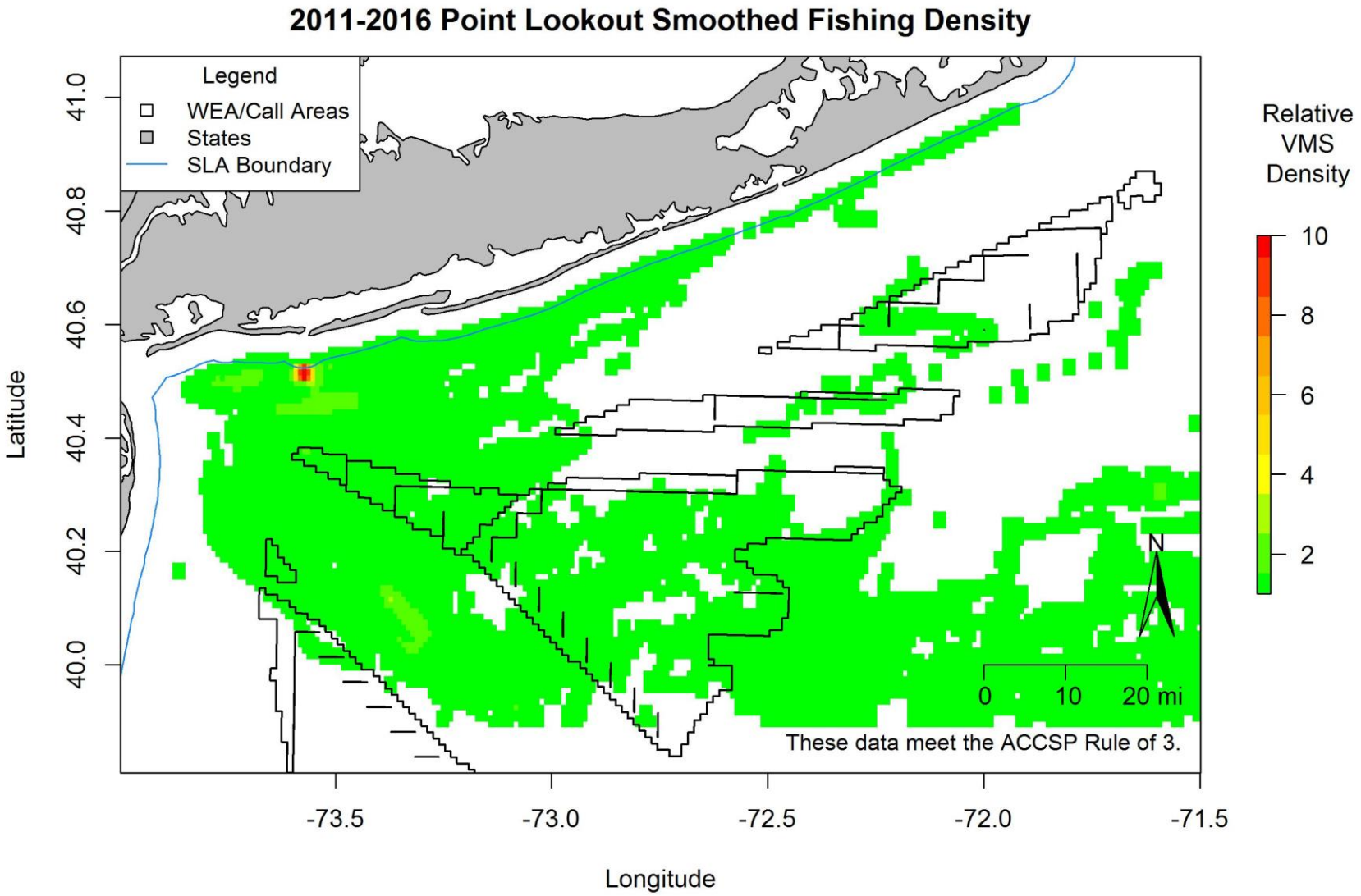

Figure 24. Smoothed federal fishing activity (all fisheries) resulting in landings in Point Lookout, NJ between 2011 and 2016

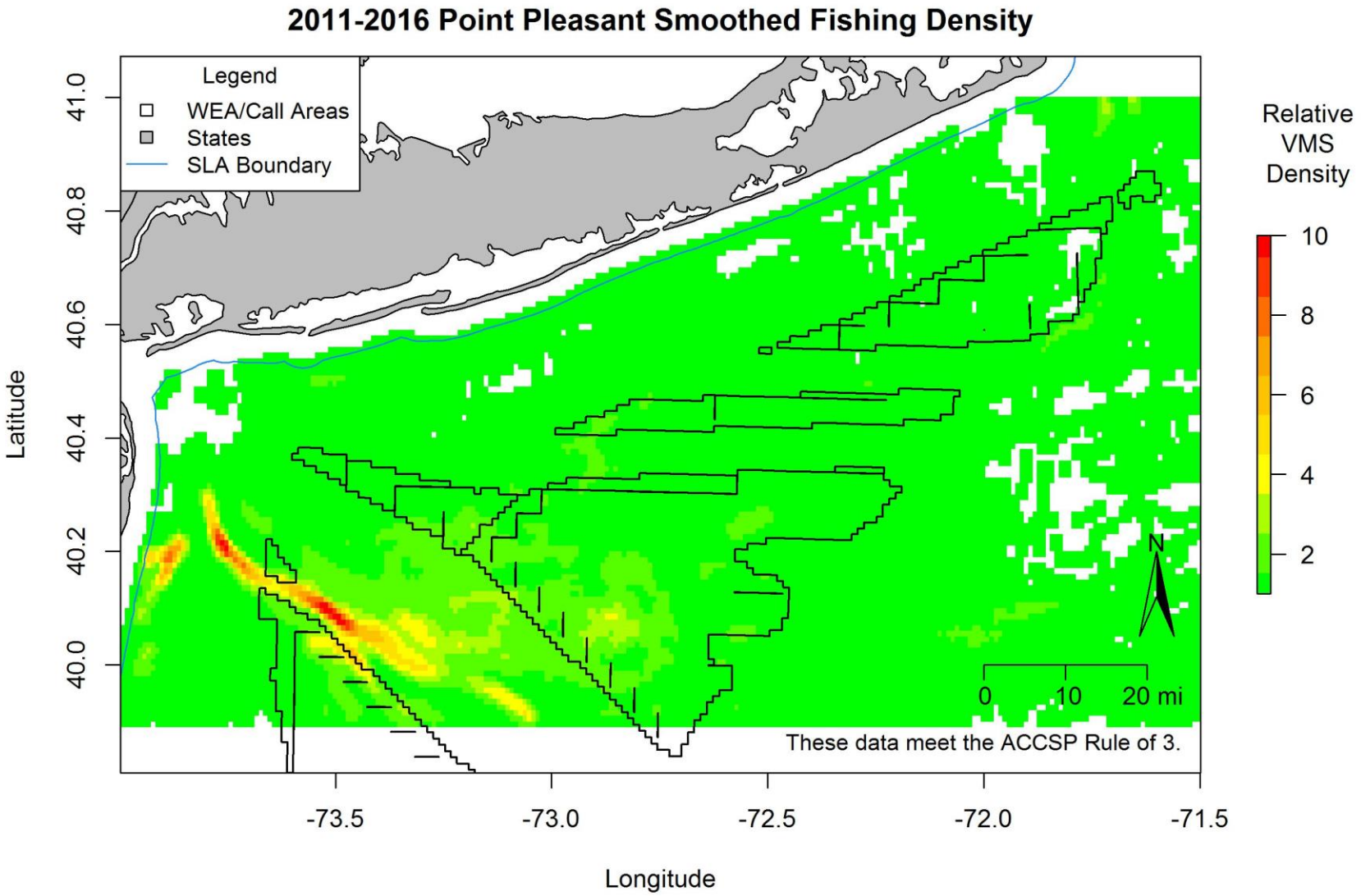

Figure 25. Smoothed federal fishing activity (all fisheries) resulting in landings in Point Pleasant, NJ between 2011 and 2016

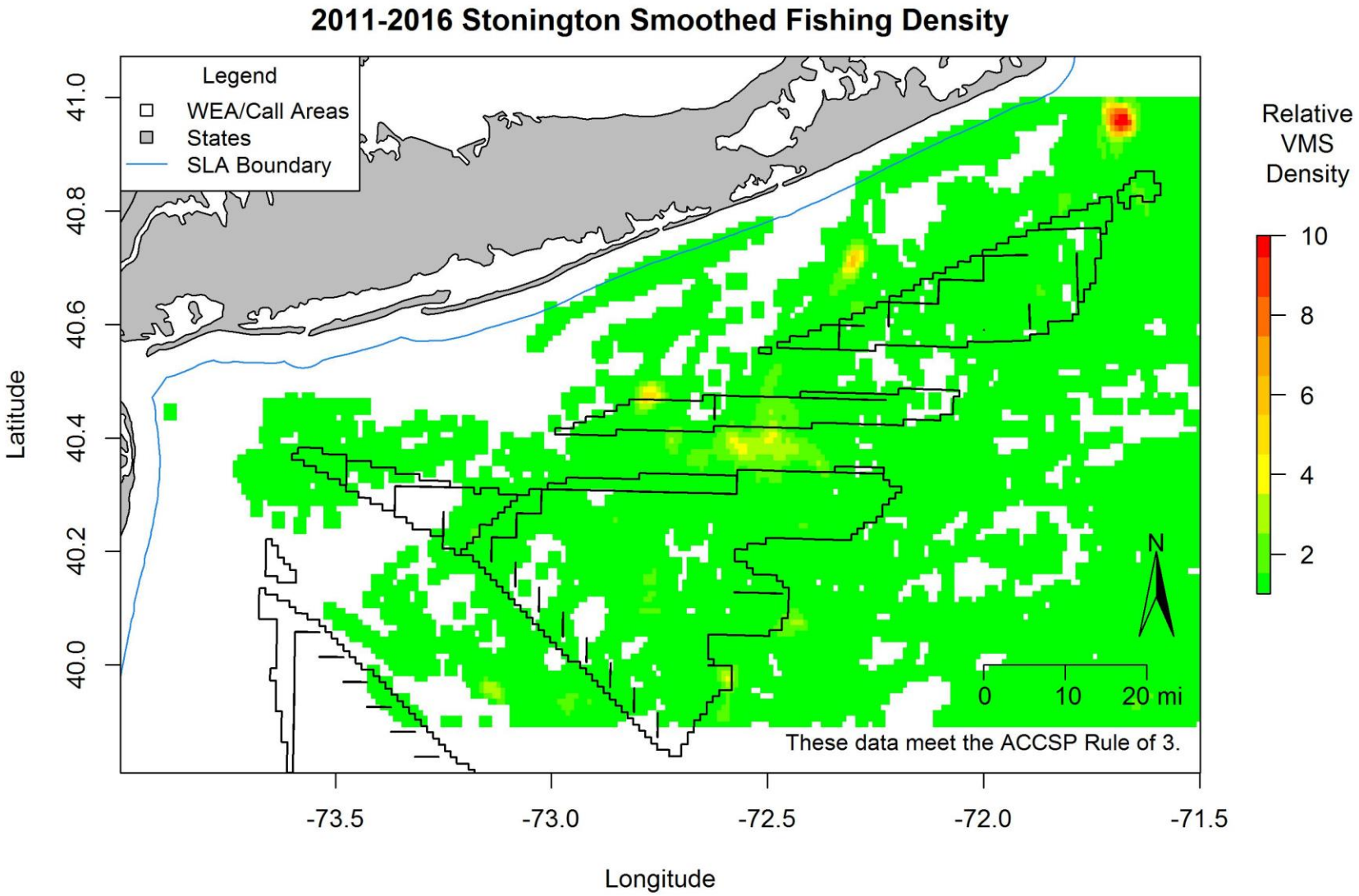

Figure 26. Smoothed federal fishing activity (all fisheries) resulting in landings in Stonington, CT between 2011 and 2016

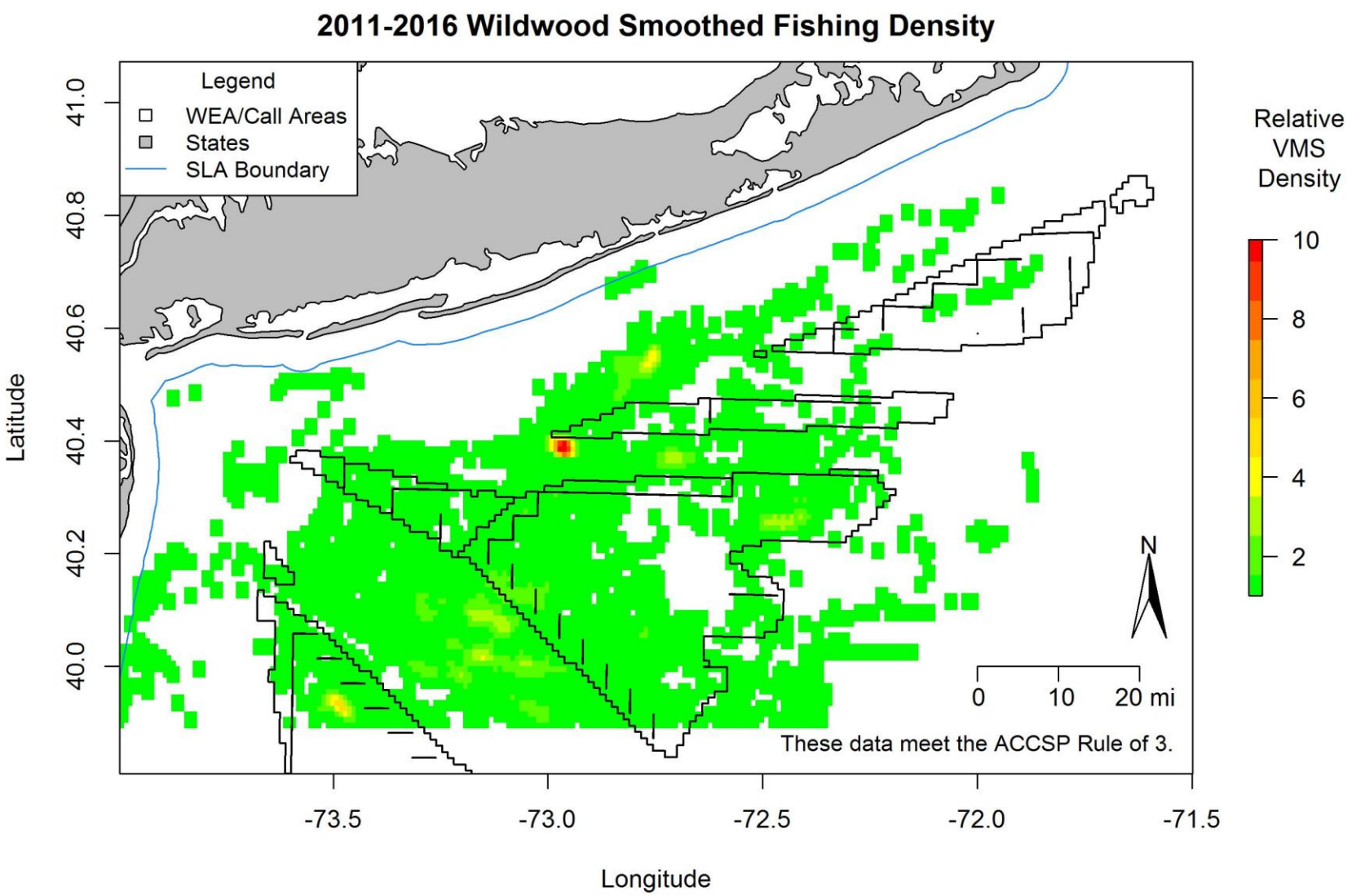

Figure 27. Smoothed federal fishing activity (all fisheries) resulting in landings in Wildwood, NJ between 2011 and 2016

10.2.3 2011-2016 Maps by Gear Used

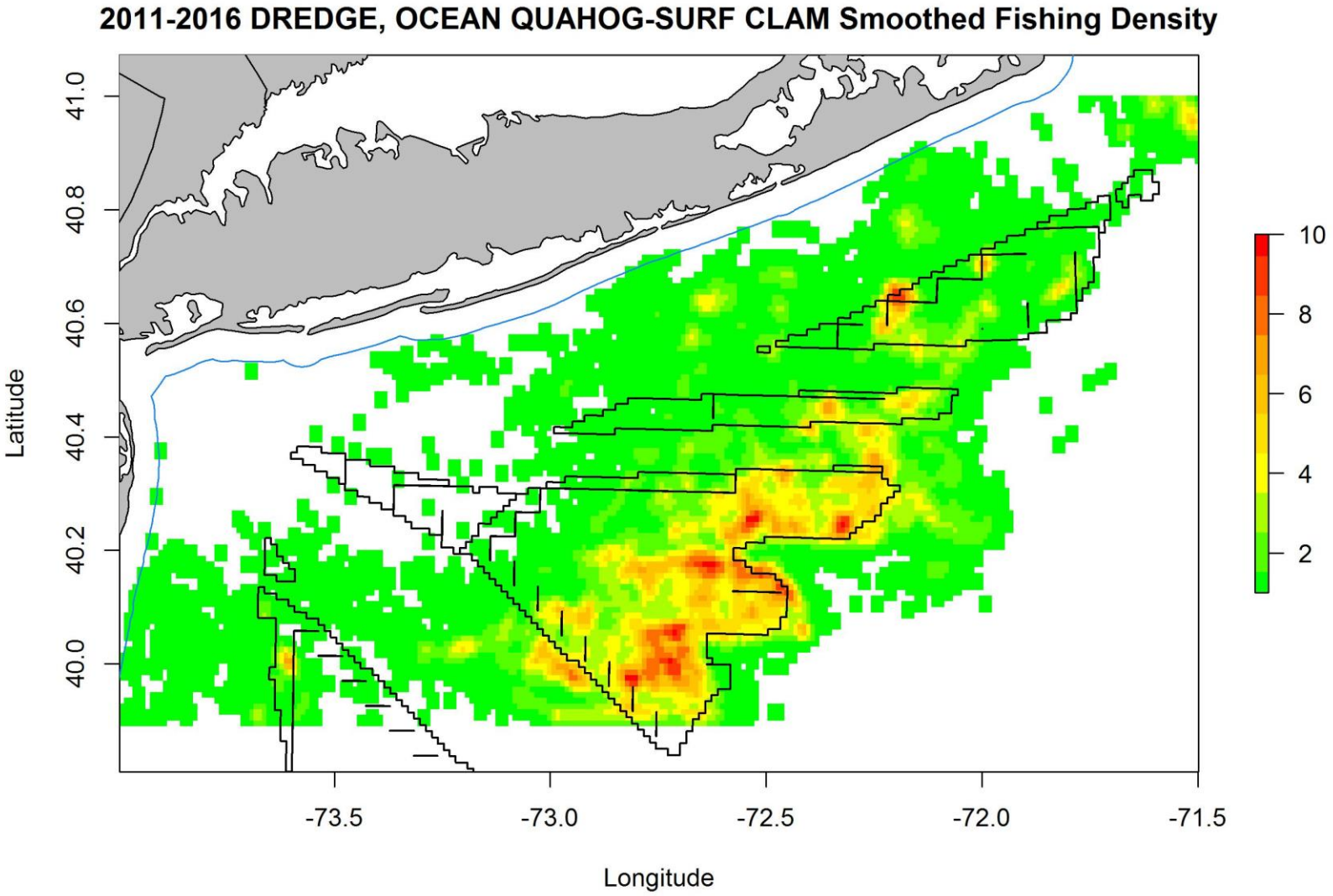

Figure 28. Smoothed federal fishing activity using an ocean quahog/surfclam dredge between 2011 and 2016

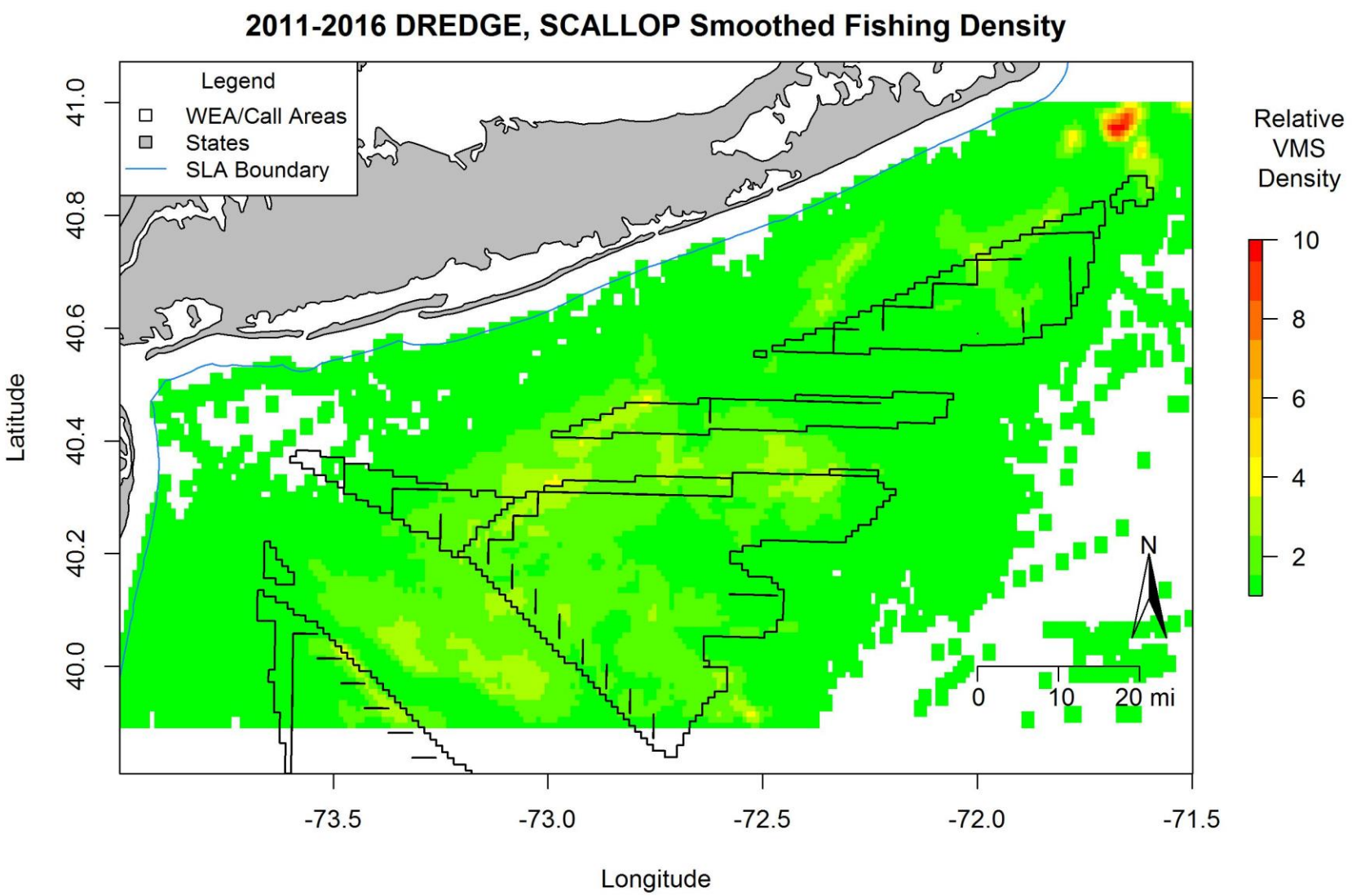

Figure 29. Smoothed federal fishing activity using a scallop dredge between 2011 and 2016

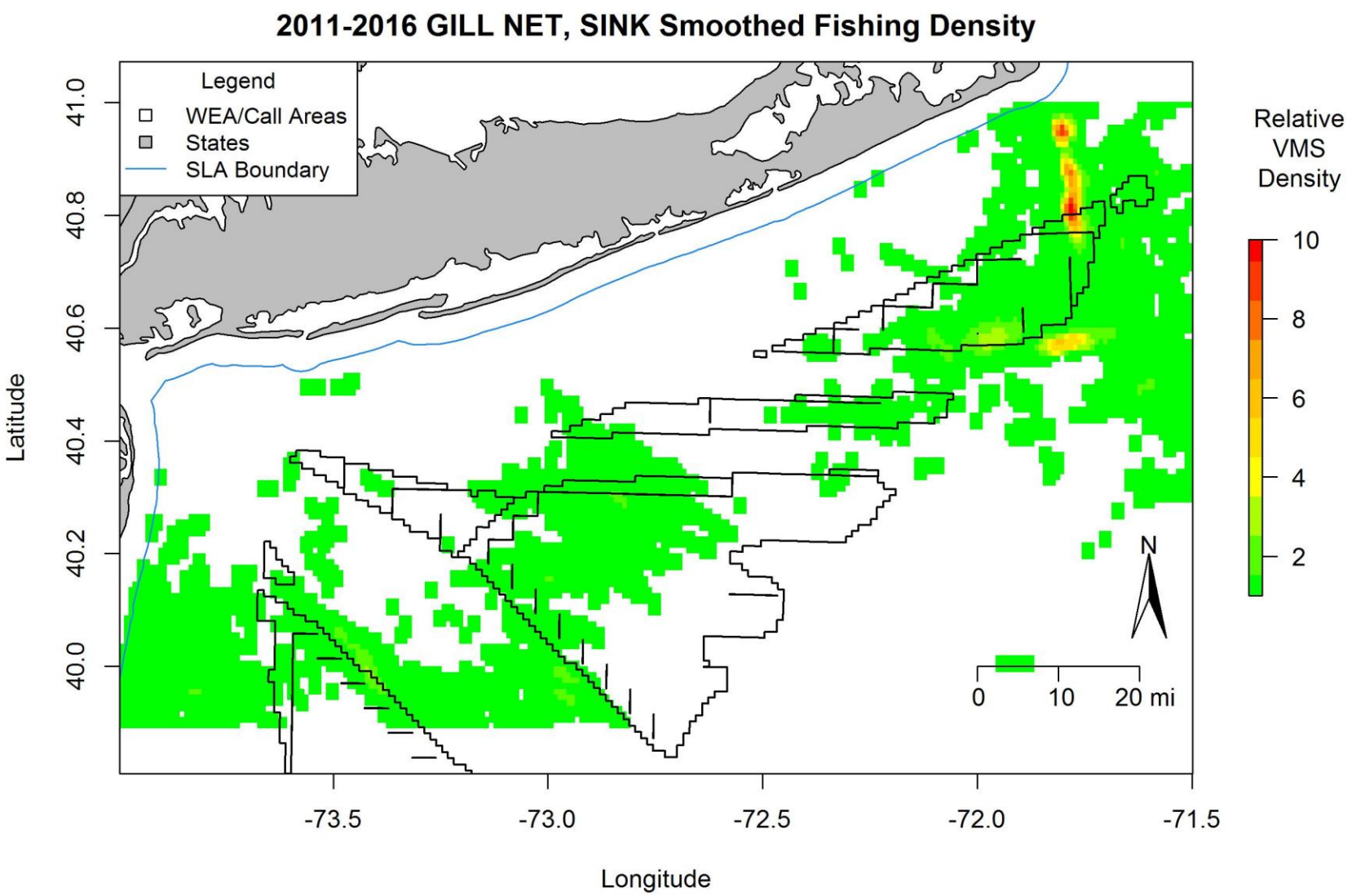

Figure 30. Smoothed federal fishing activity using a sink gill net between 2011 and 2016

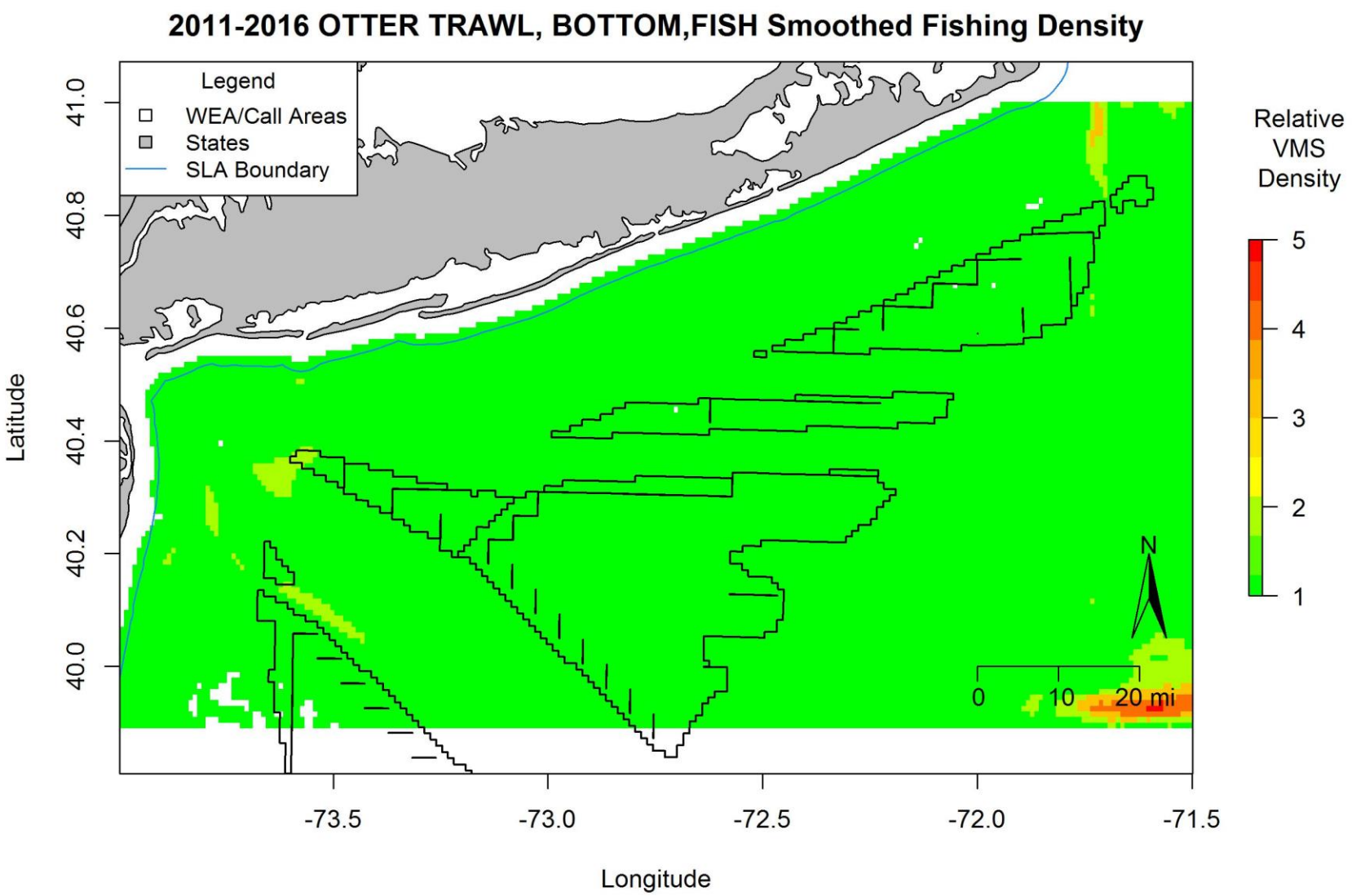

Figure 31. Smoothed federal fishing activity using a bottom fish otter trawl between 2011 and 2016

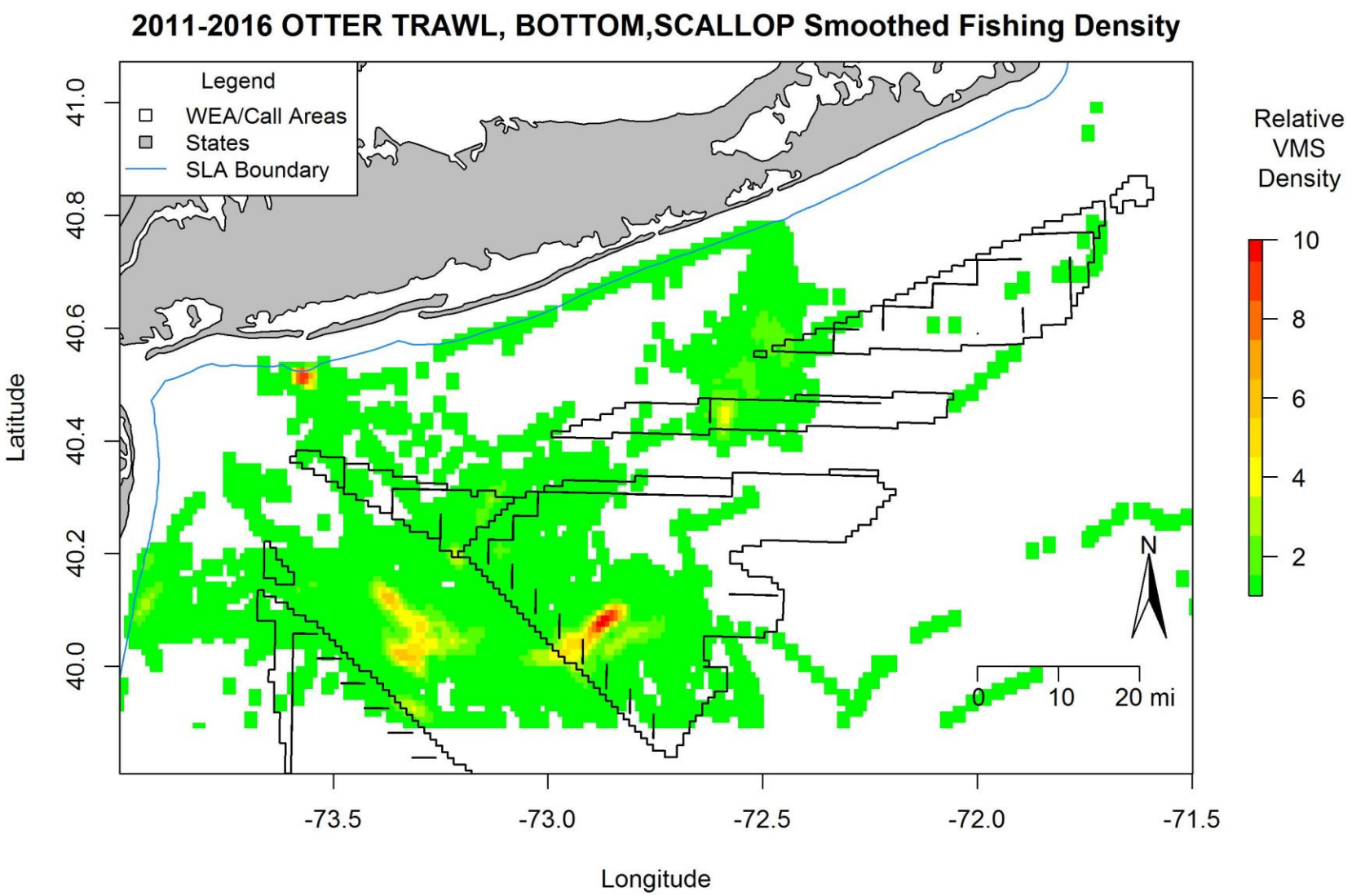

Figure 32. Smoothed federal fishing activity using a bottom scallop otter trawl between 2011 and 2016

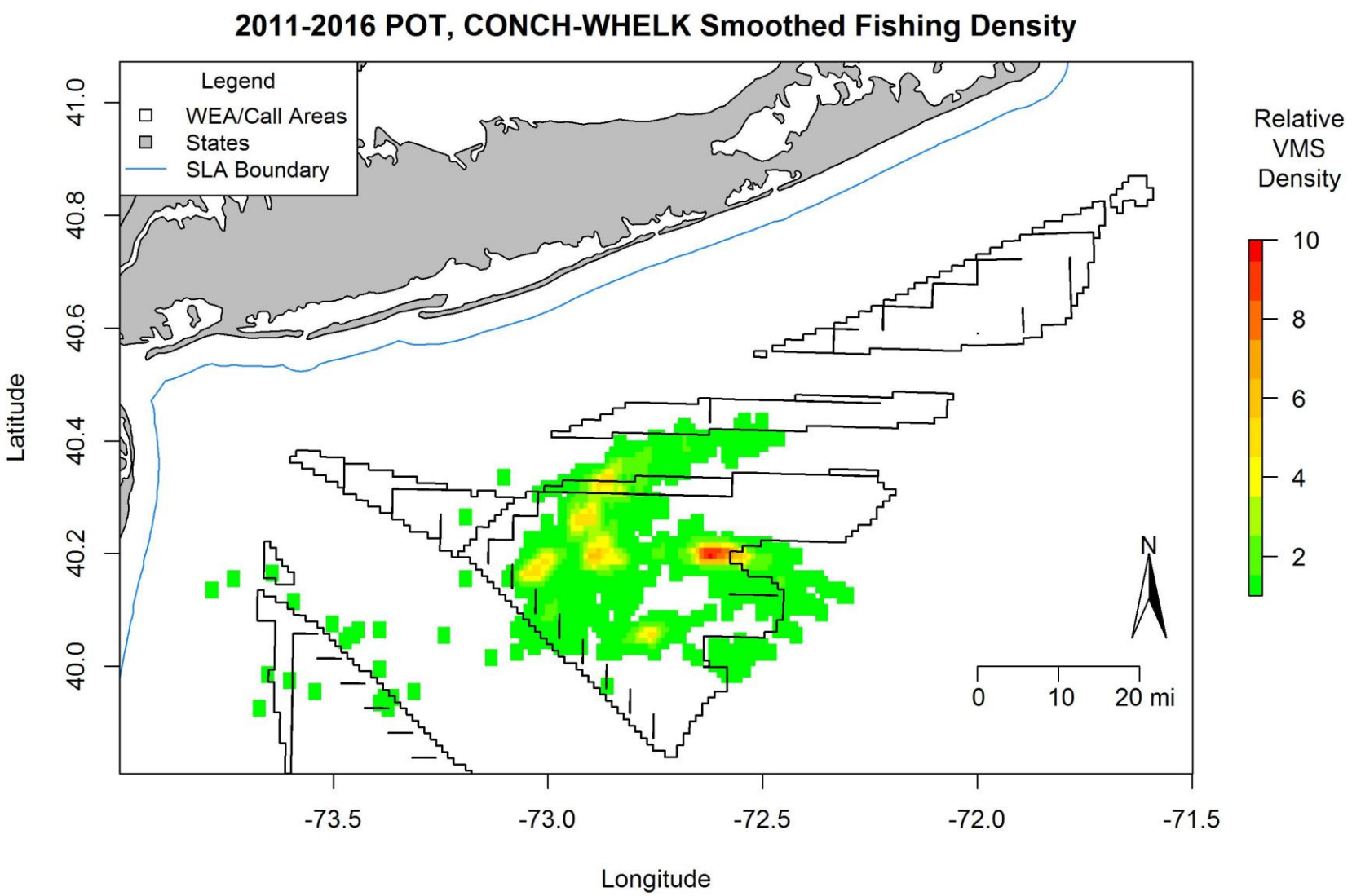

Figure 33. Smoothed federal fishing activity using conch/whelk pots between 2011 and 2016

10.2.4 2011-2016 Maps by Species Caught

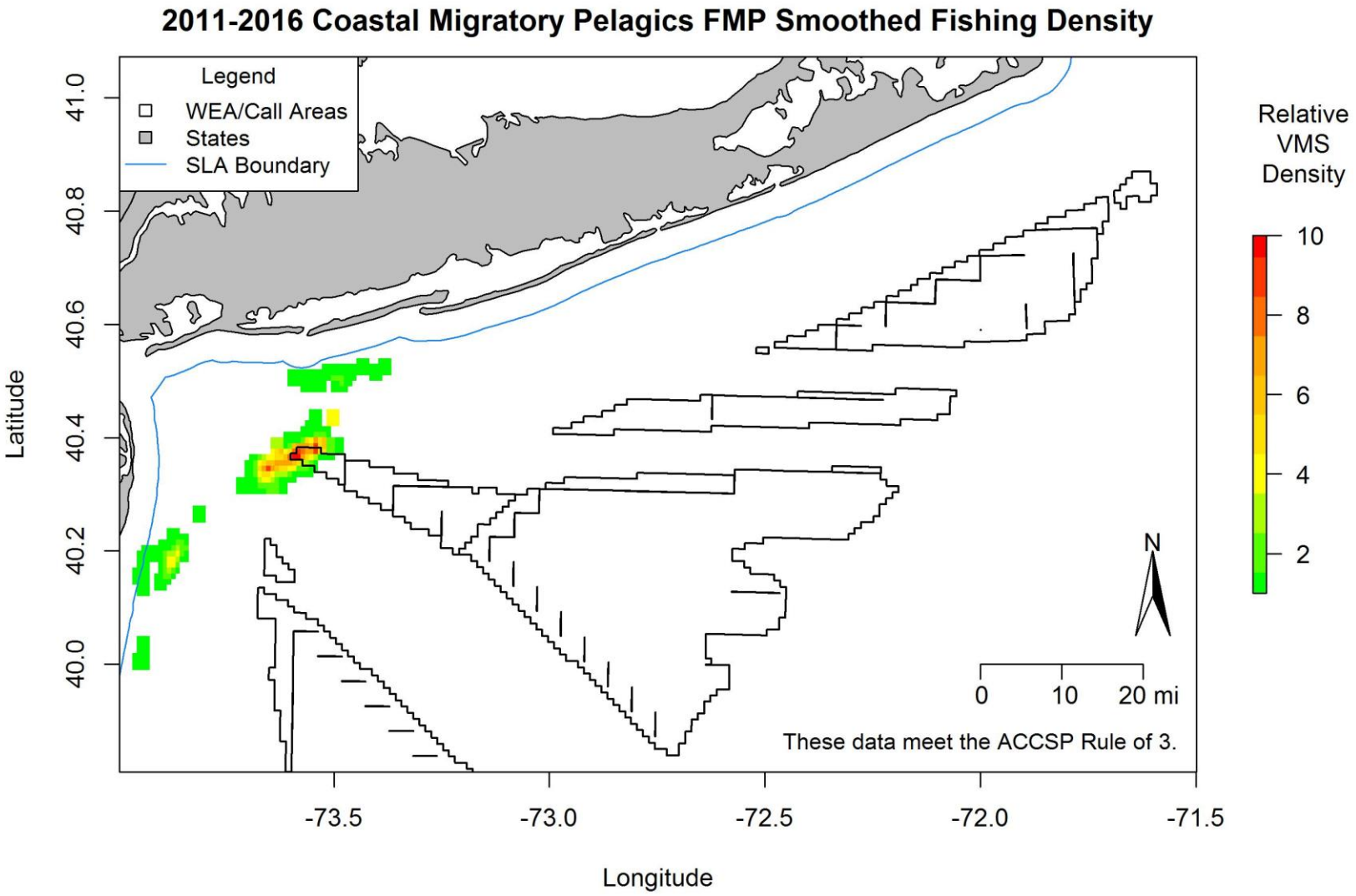

Figure 34. Smoothed federal fishing activity of all trips between 2011 and 2016 where Coastal Migratory Pelagics FMP species were caught

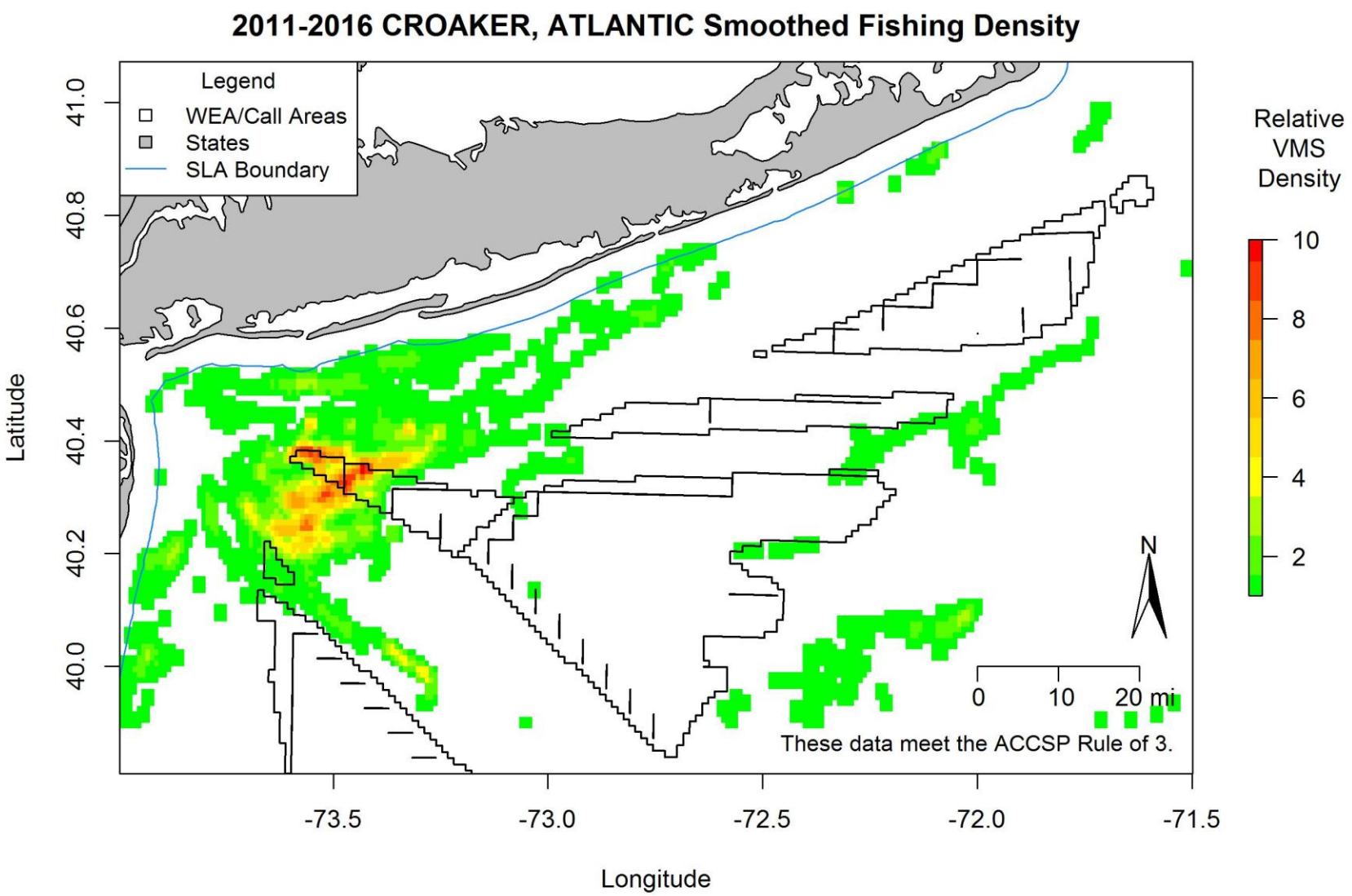

Figure 35. Smoothed federal fishing activity of all trips between 2011 and 2016 where Atlantic croaker were caught

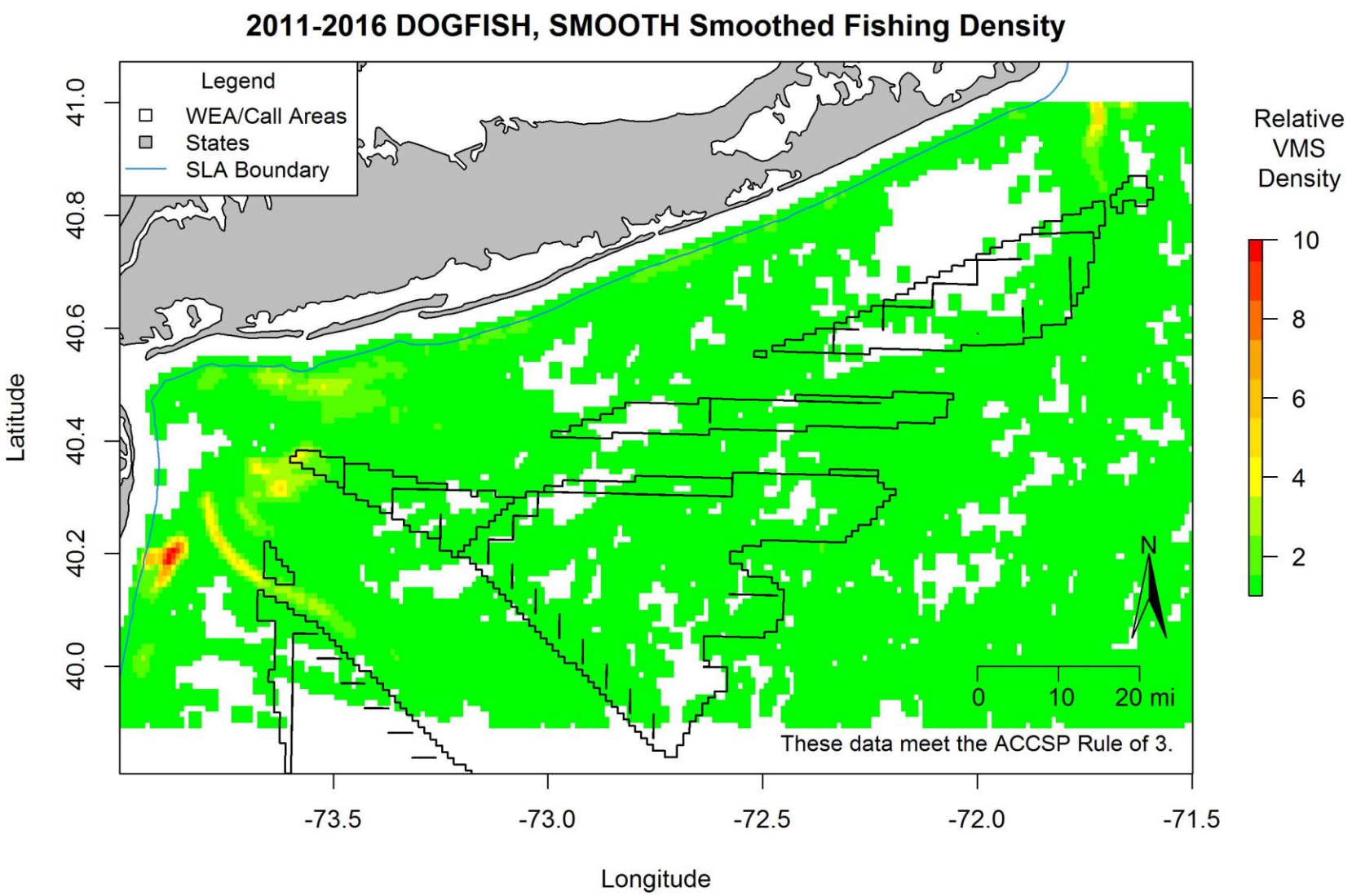

Figure 36. Smoothed federal fishing activity of all trips between 2011 and 2016 where smooth dogfish were caught

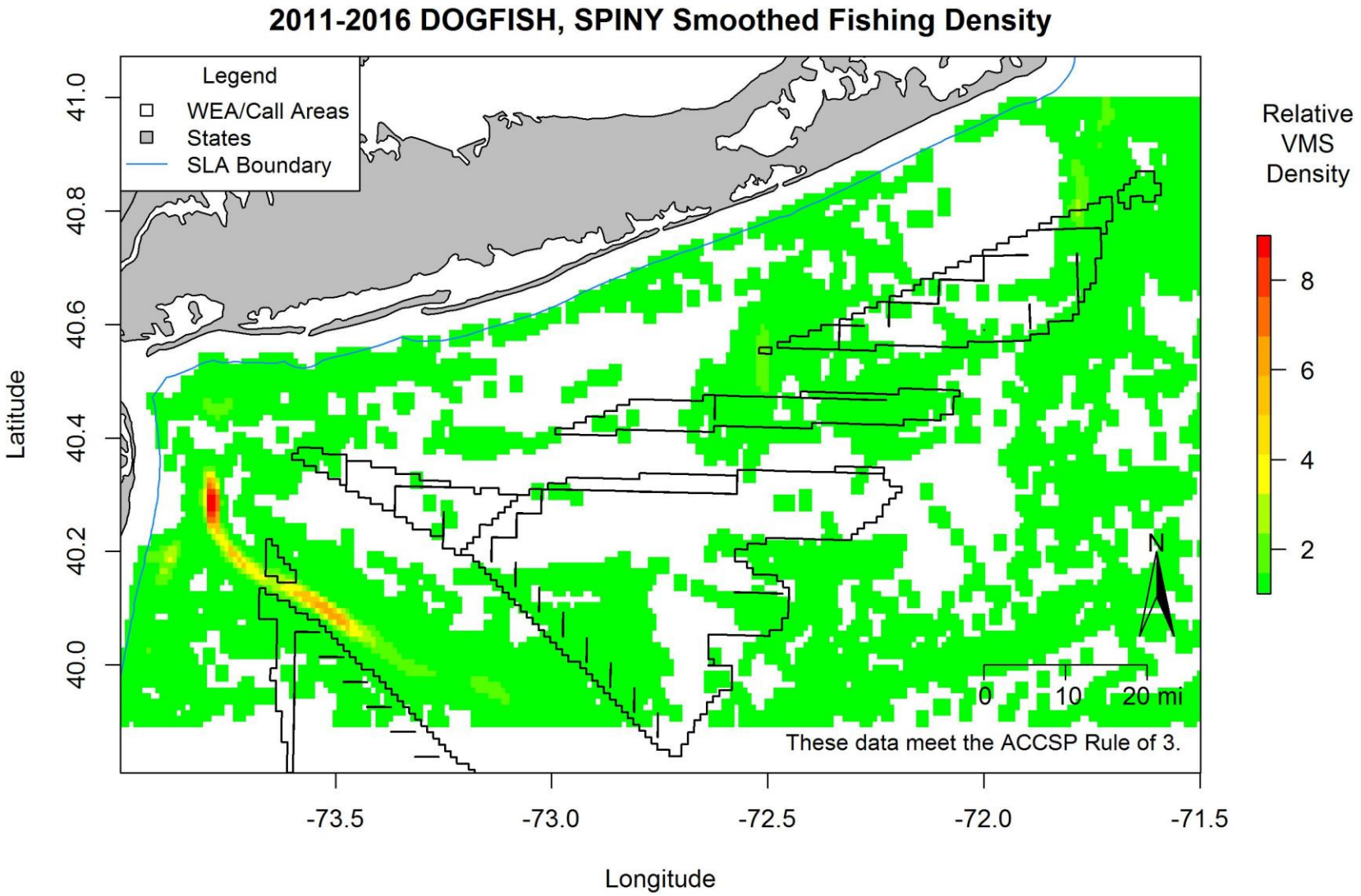

Figure 37. Smoothed federal fishing activity of all trips between 2011 and 2016 where spiny dogfish were caught

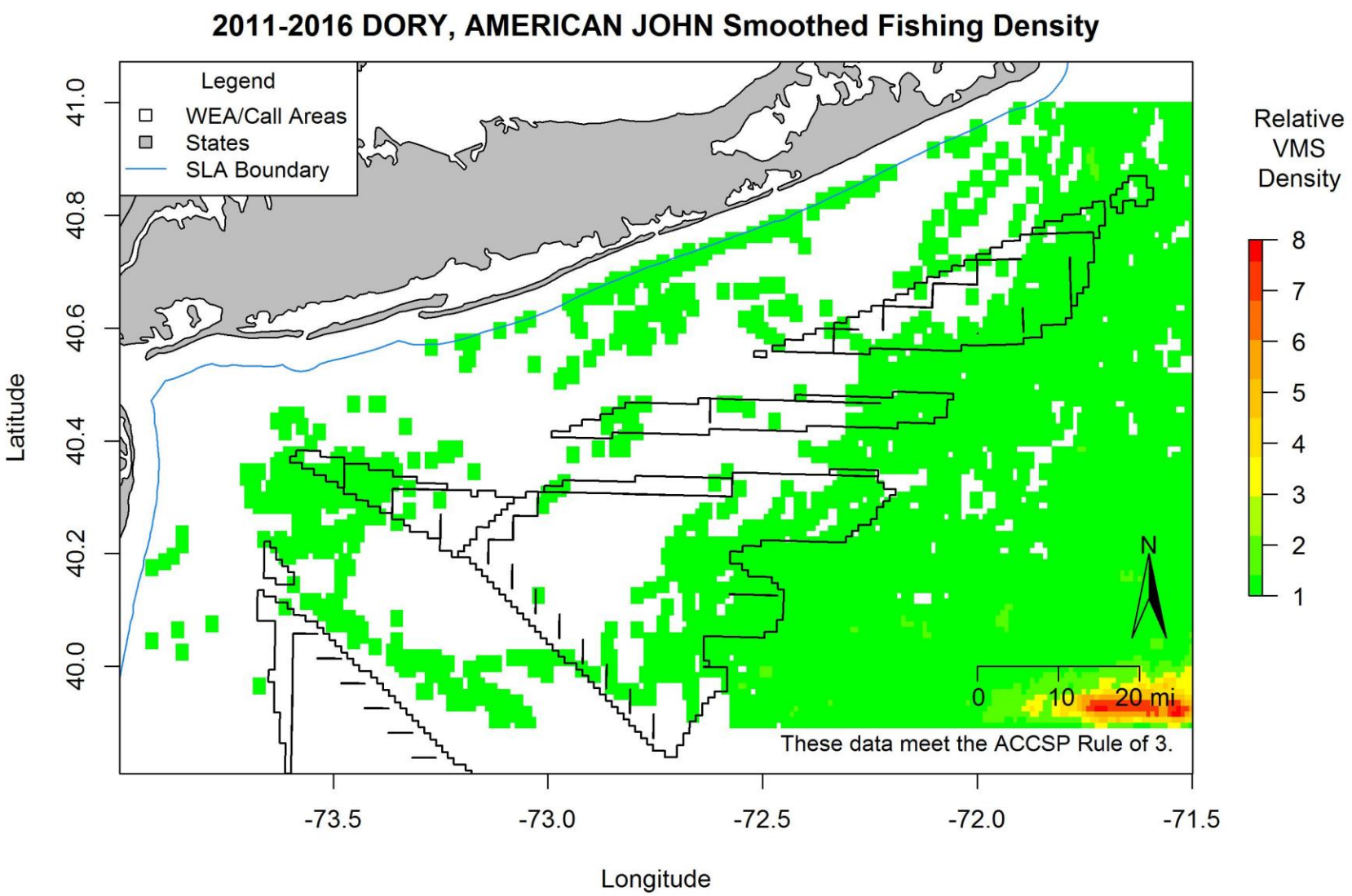

Figure 38. Smoothed federal fishing activity of all trips between 2011 and 2016 American John Dory were caught

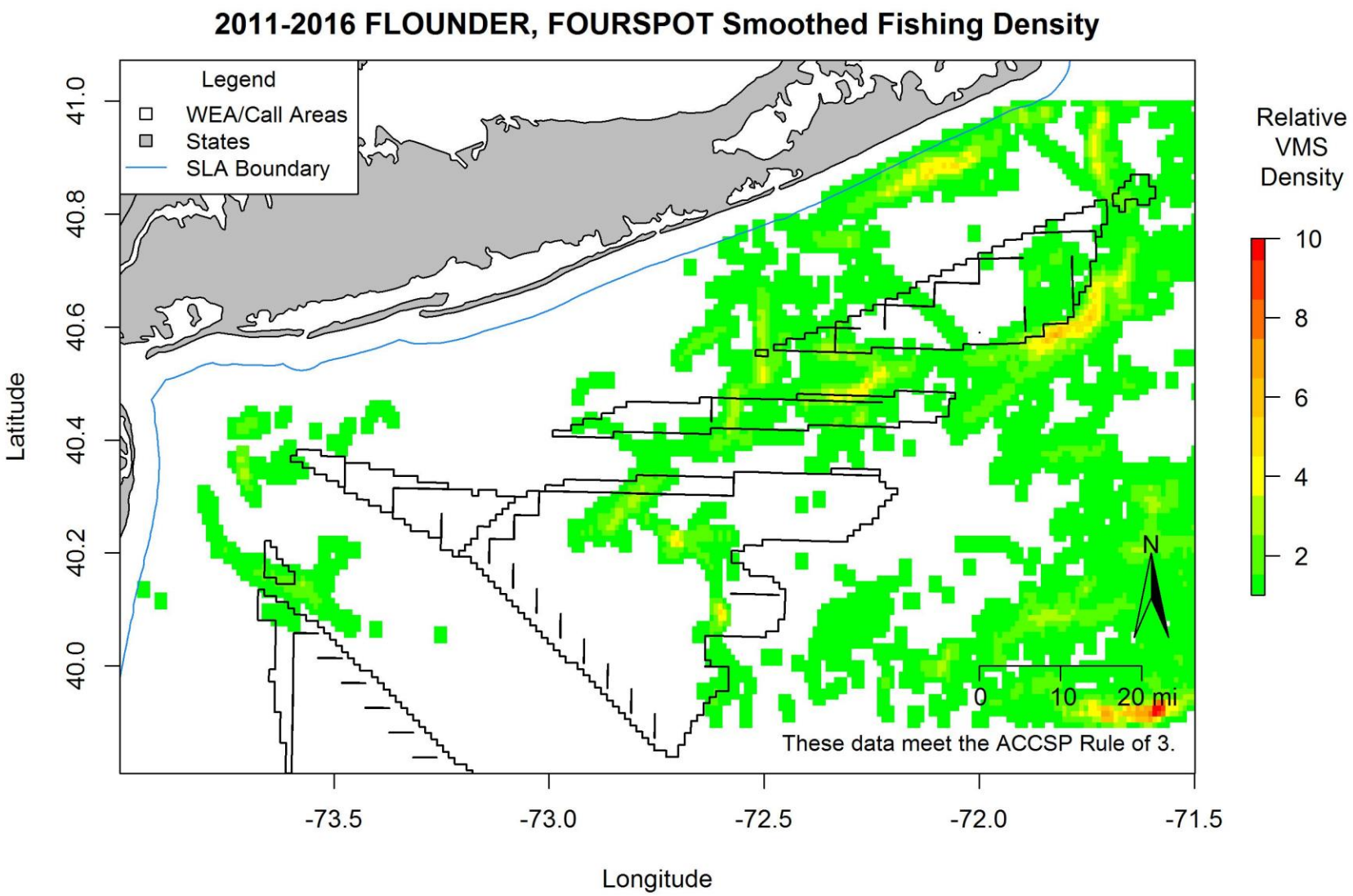

Figure 39. Smoothed federal fishing activity of all trips between 2011 and 2016 where fourspot flounder were caught

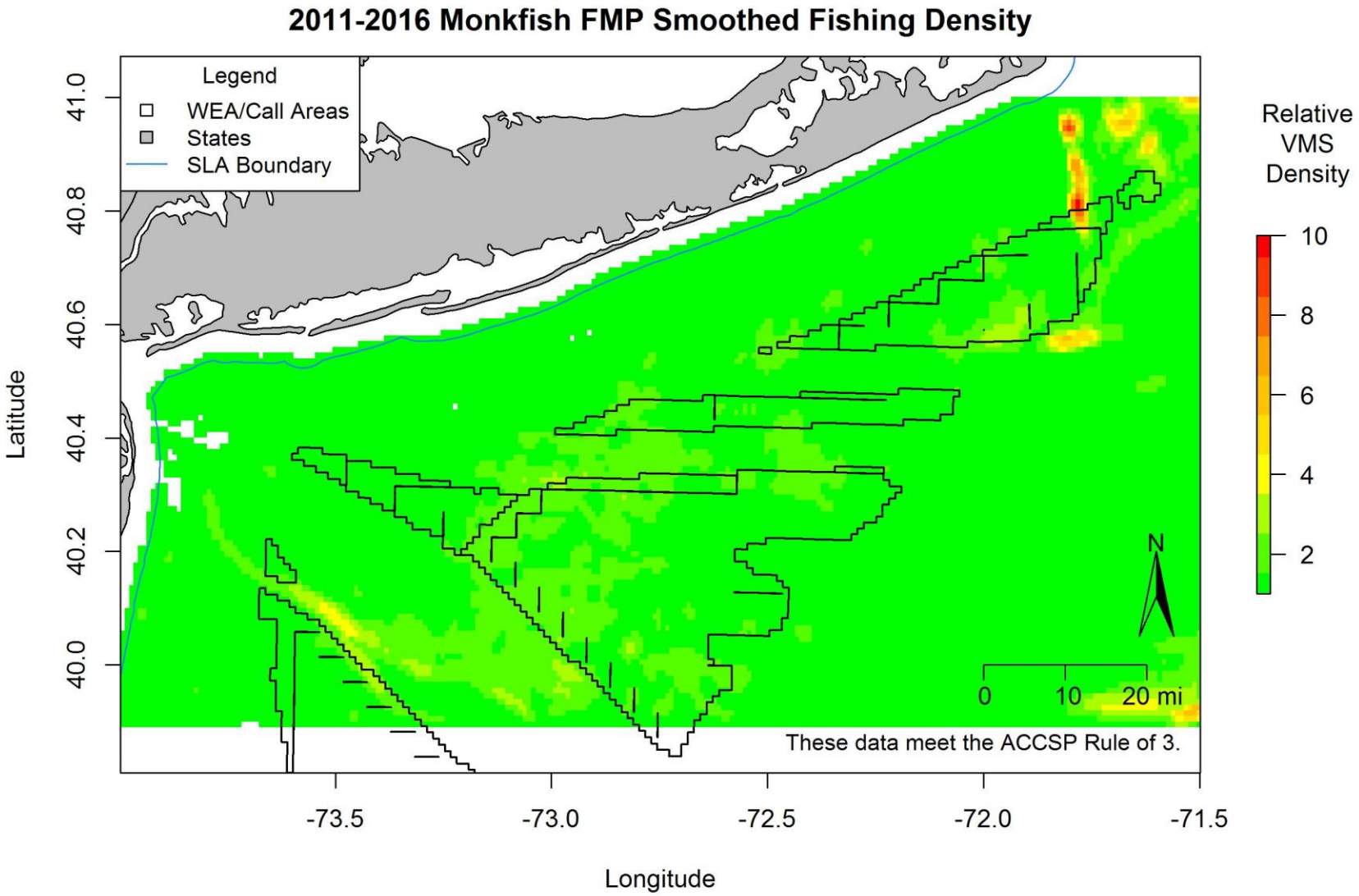

Figure 40. Smoothed federal fishing activity of all trips between 2011 and 2016 where monkfish were caught

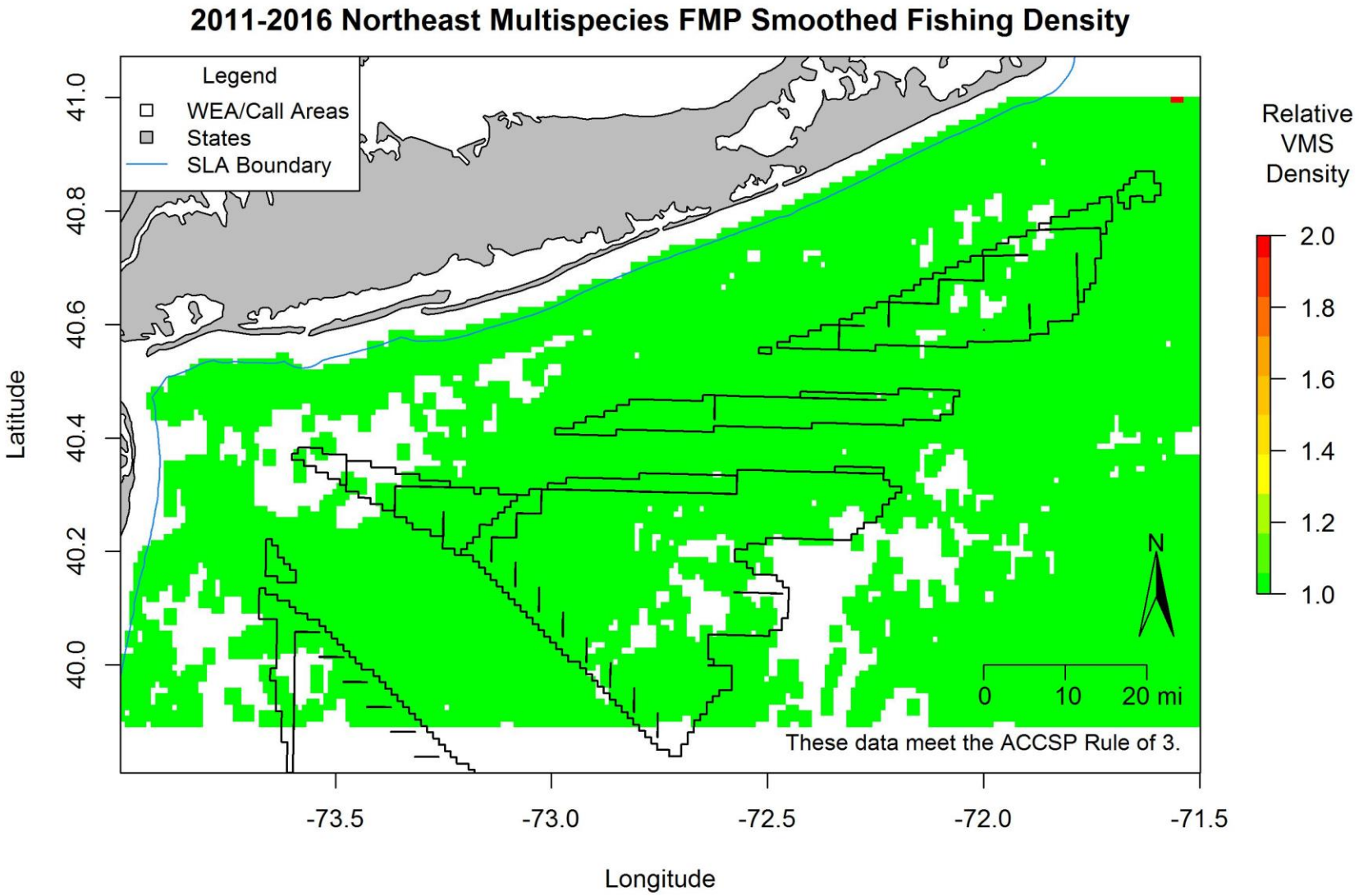

Figure 41. Smoothed federal fishing activity of all trips between 2011 and 2016 where Northeast Multispecies FMP species were caught

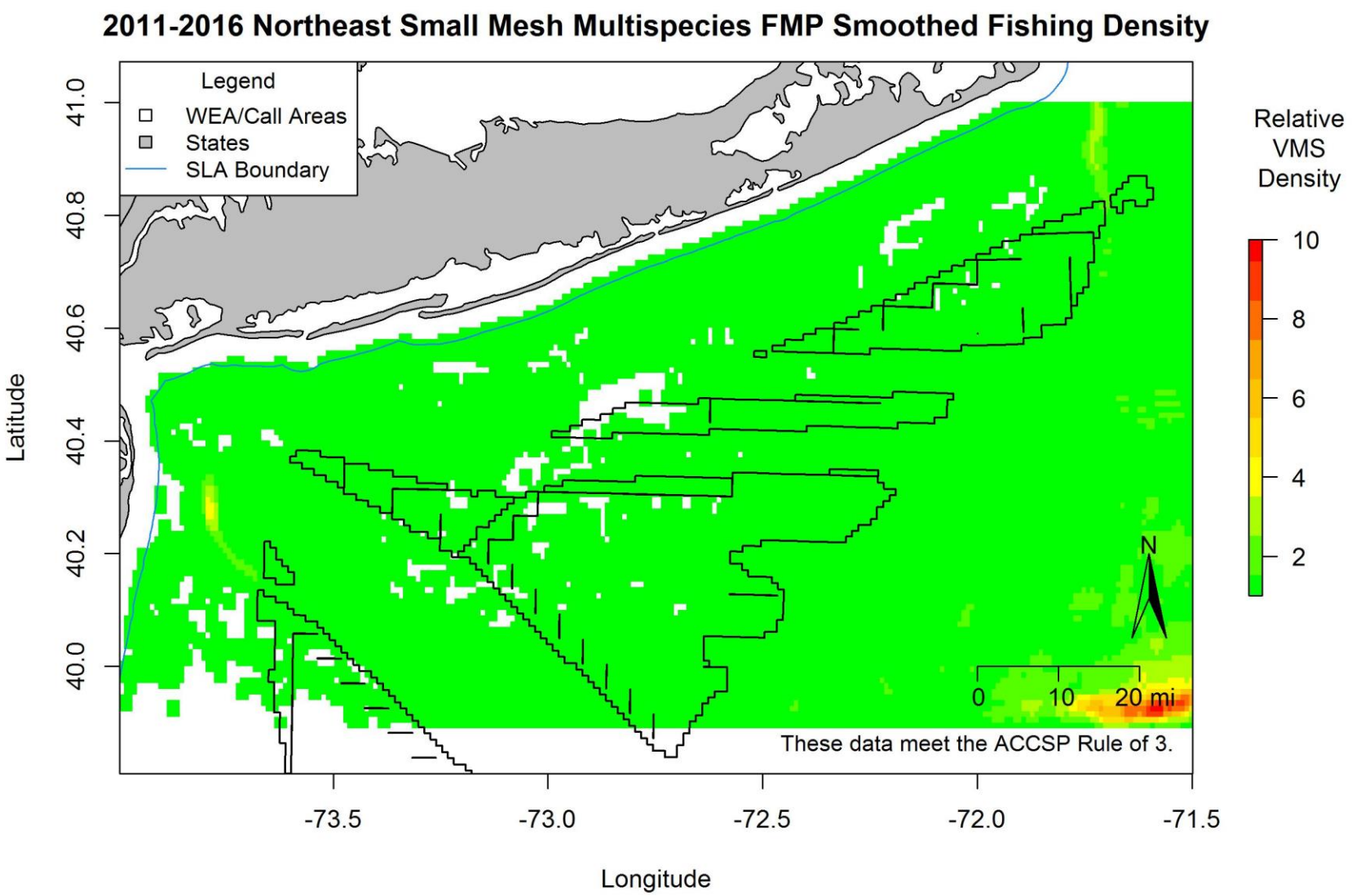

Figure 42. Smoothed federal fishing activity of all trips between 2011 and 2016 where Northeast Small Mesh Multispecies FMP species were caught

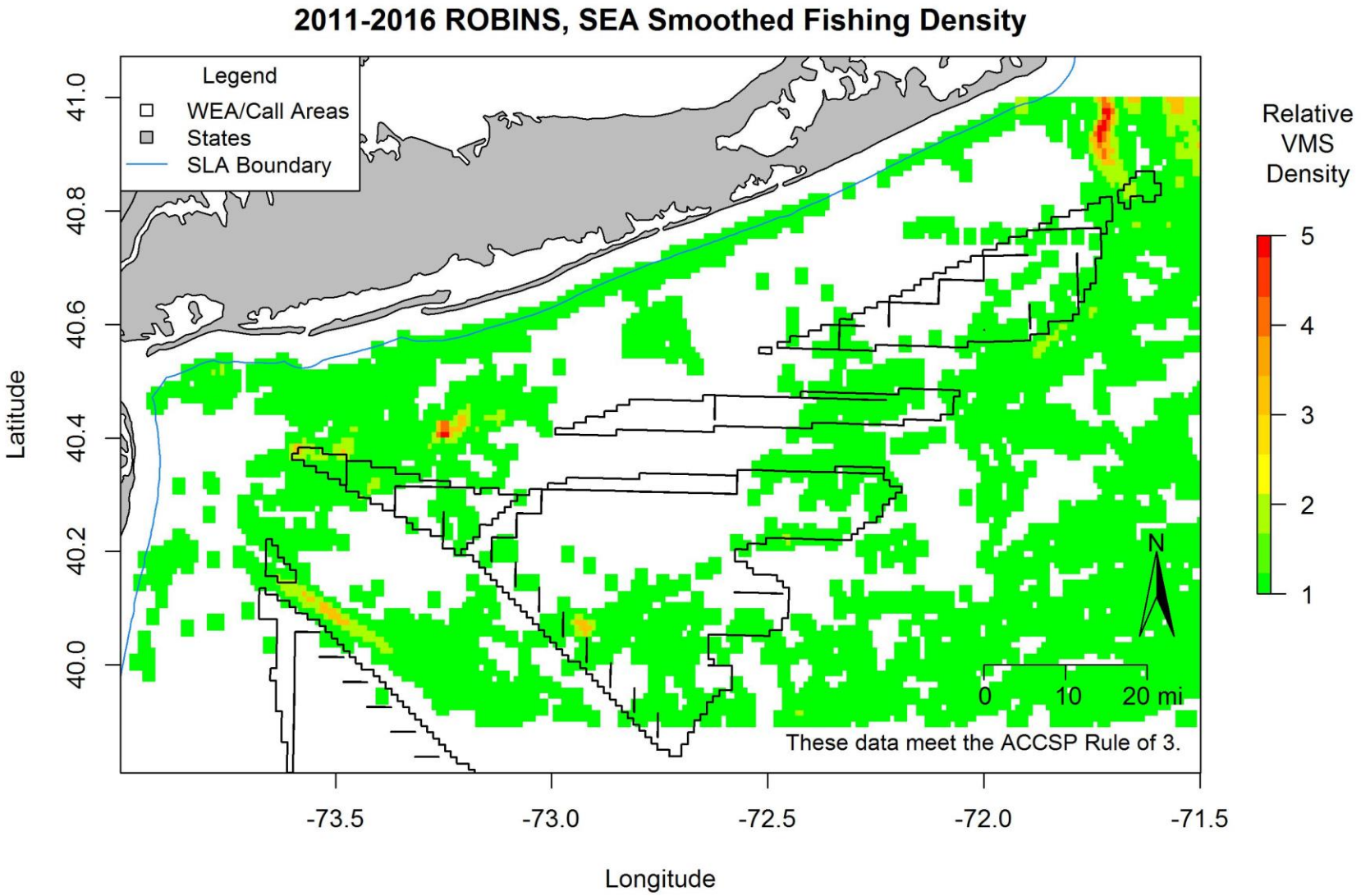

Figure 43. Smoothed federal fishing activity of all trips between 2011 and 2016 where sea robins were caught

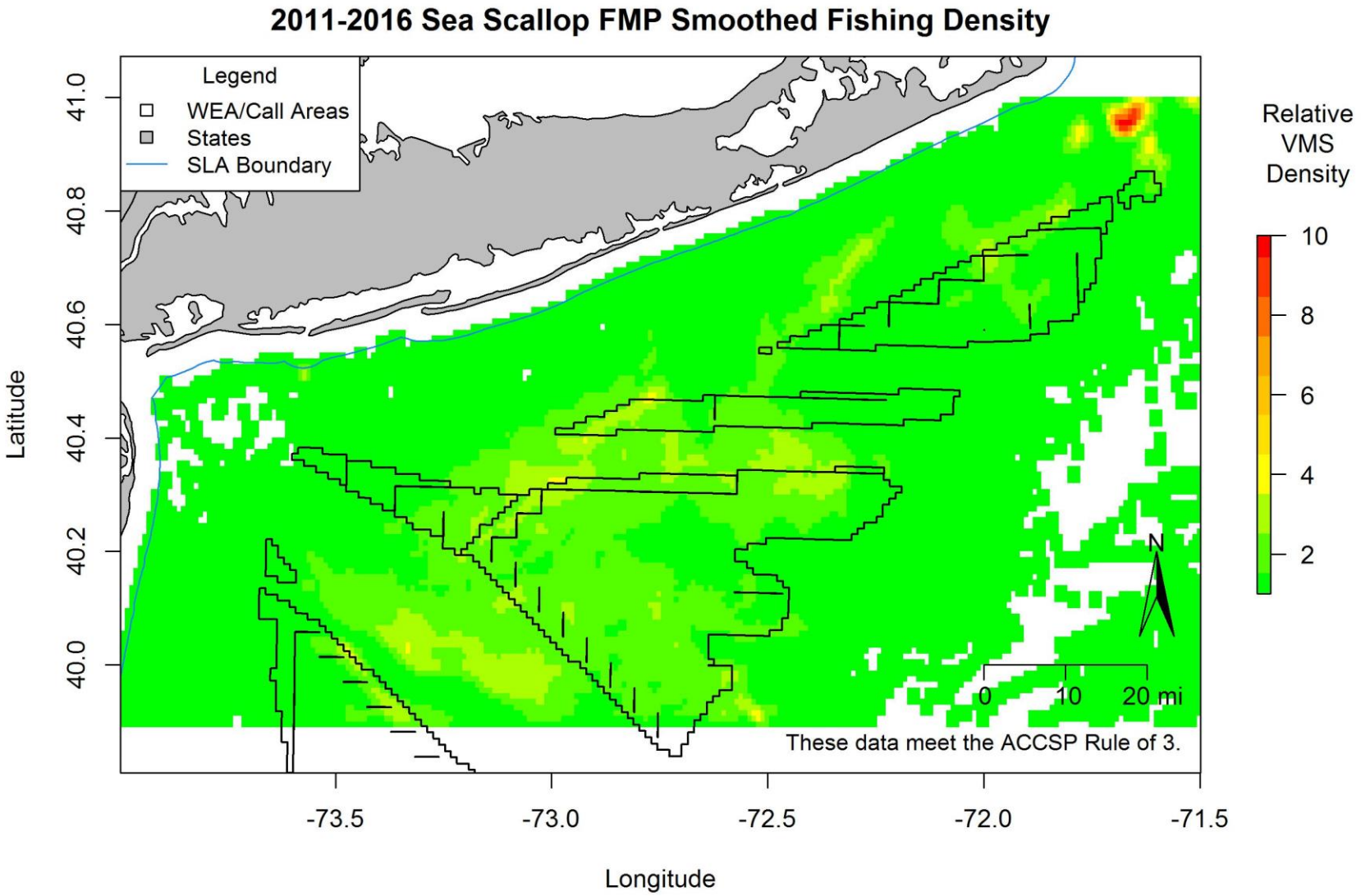

Figure 44. Smoothed federal fishing activity of all trips between 2011 and 2016 where sea scallops were caught

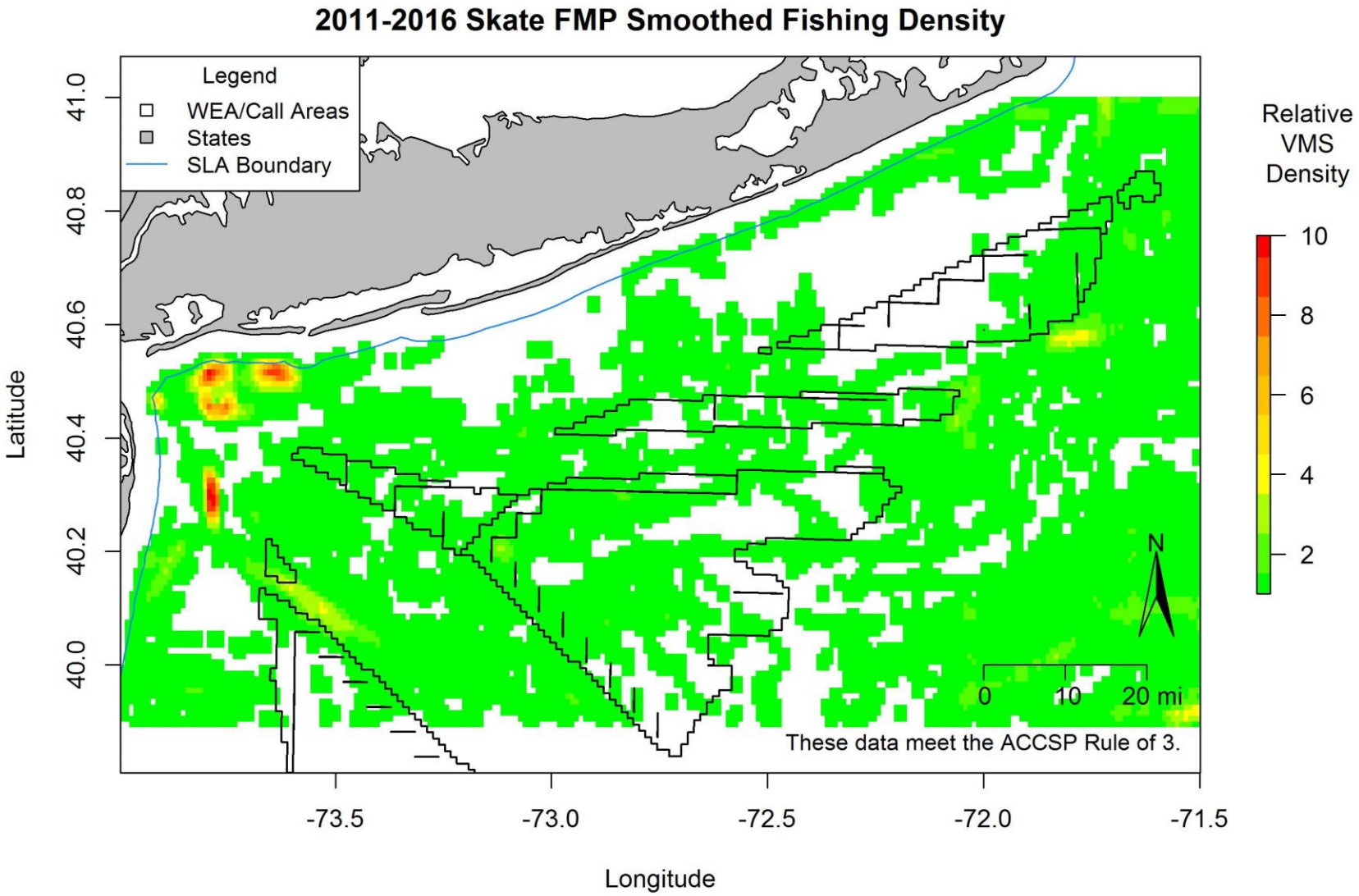

Figure 45. Smoothed federal fishing activity of all trips between 2011 and 2016 where skate FMP species were caught

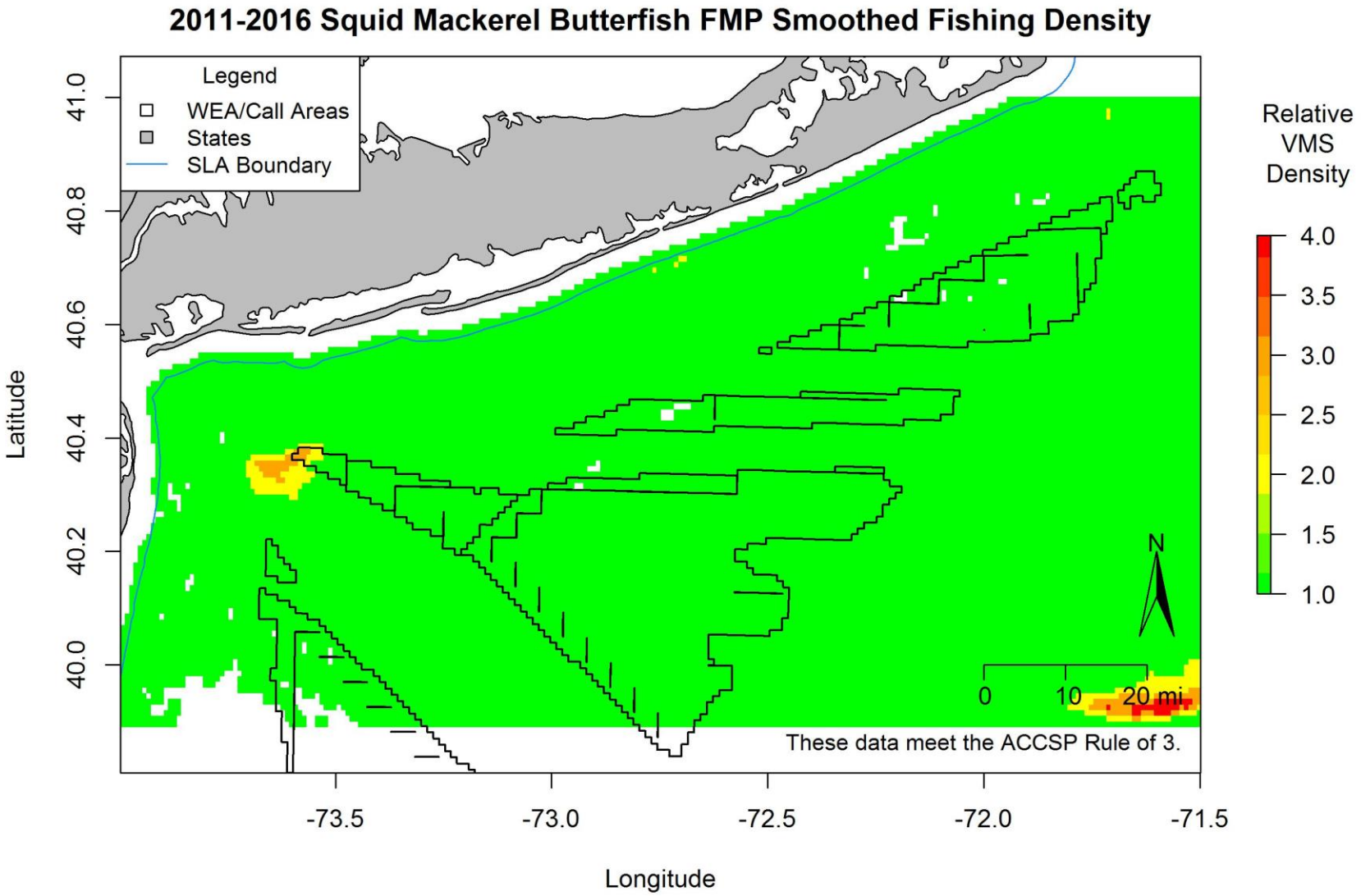

Figure 46. Smoothed federal fishing activity of all trips between 2011 and 2016 where Squid, Mackerel, Butterfish FMP species were caught

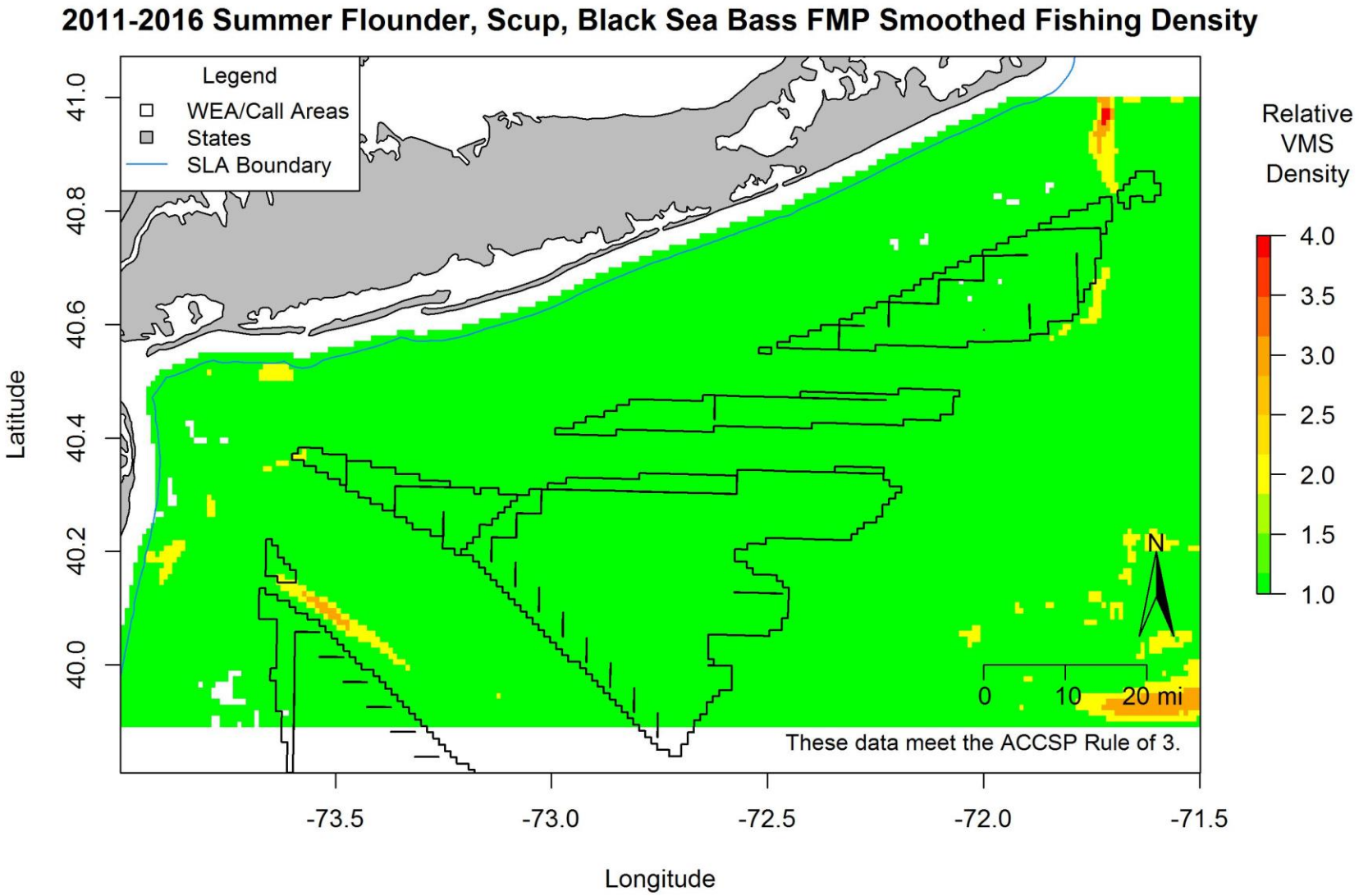

Figure 47. Smoothed federal fishing activity of all trips between 2011 and 2016 where Summer Flounder, Scup, Black Sea Bass FMP species were caught

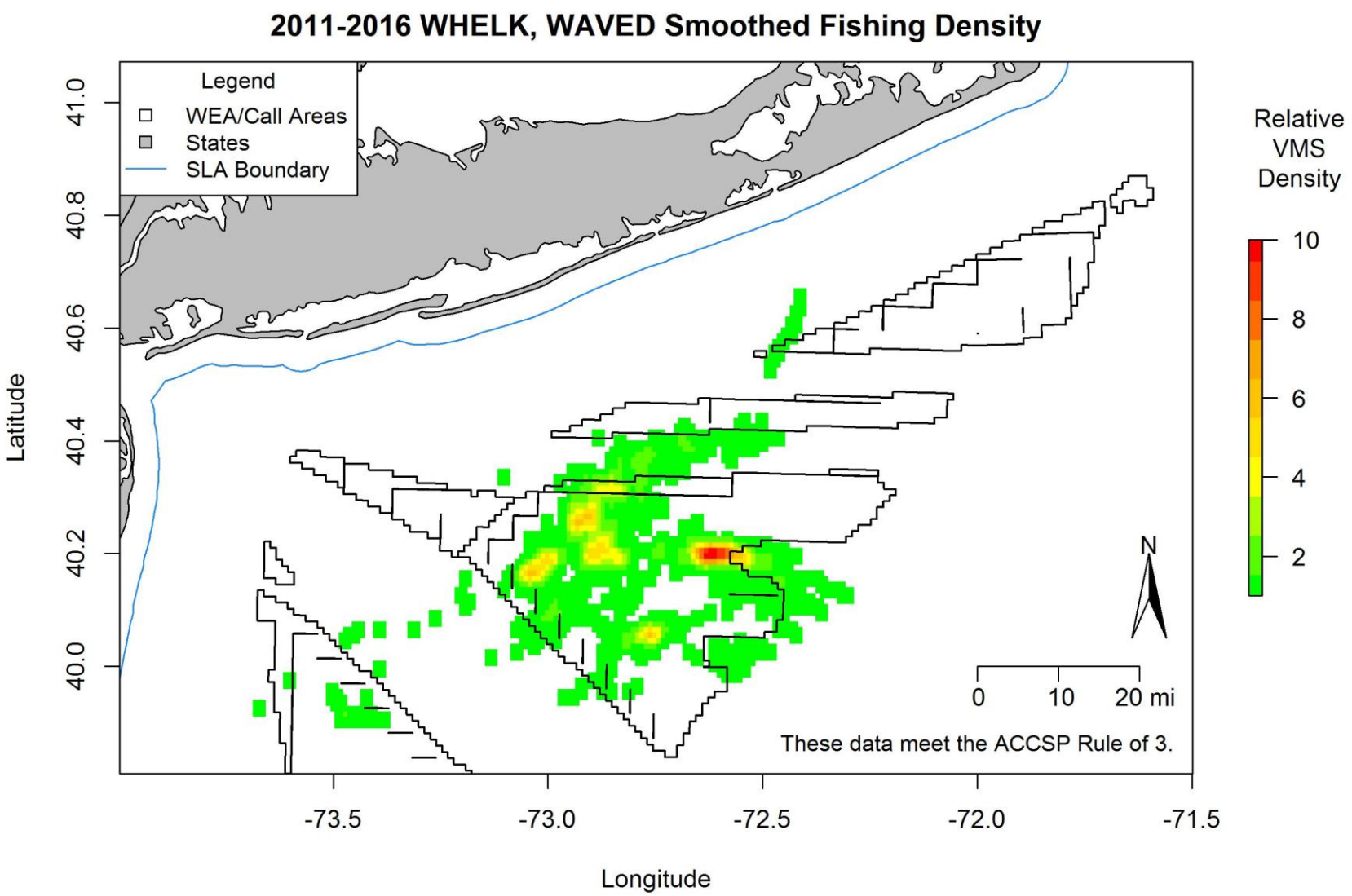

Figure 48. Smoothed federal fishing activity of all trips between 2011 and 2016 where waved whelk were caught

10.2.5 Maps for Most Exposed Species/Fisheries

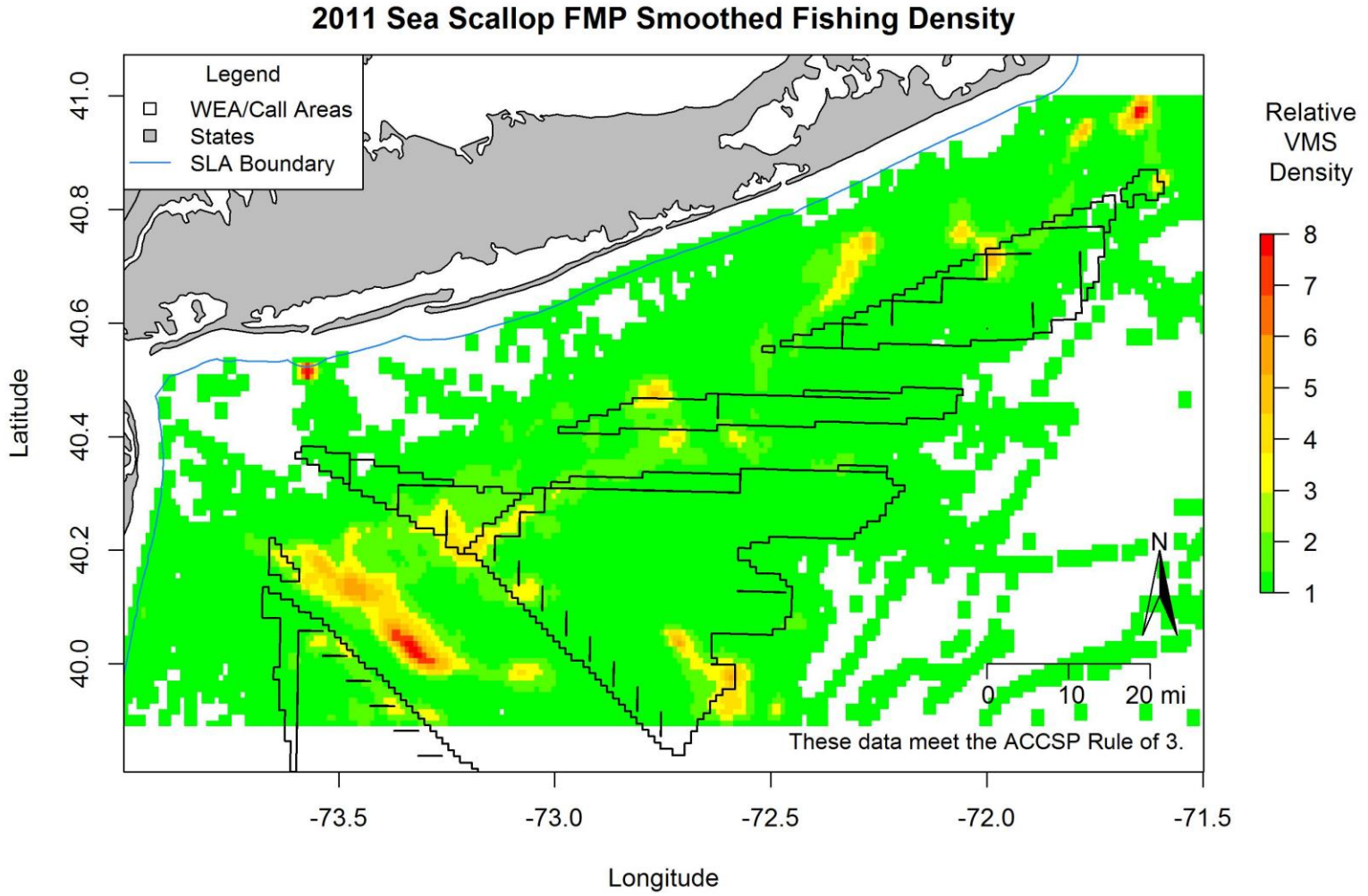

Figure 49. Smoothed federal fishing activity of all trips in 2011 where sea scallops were caught

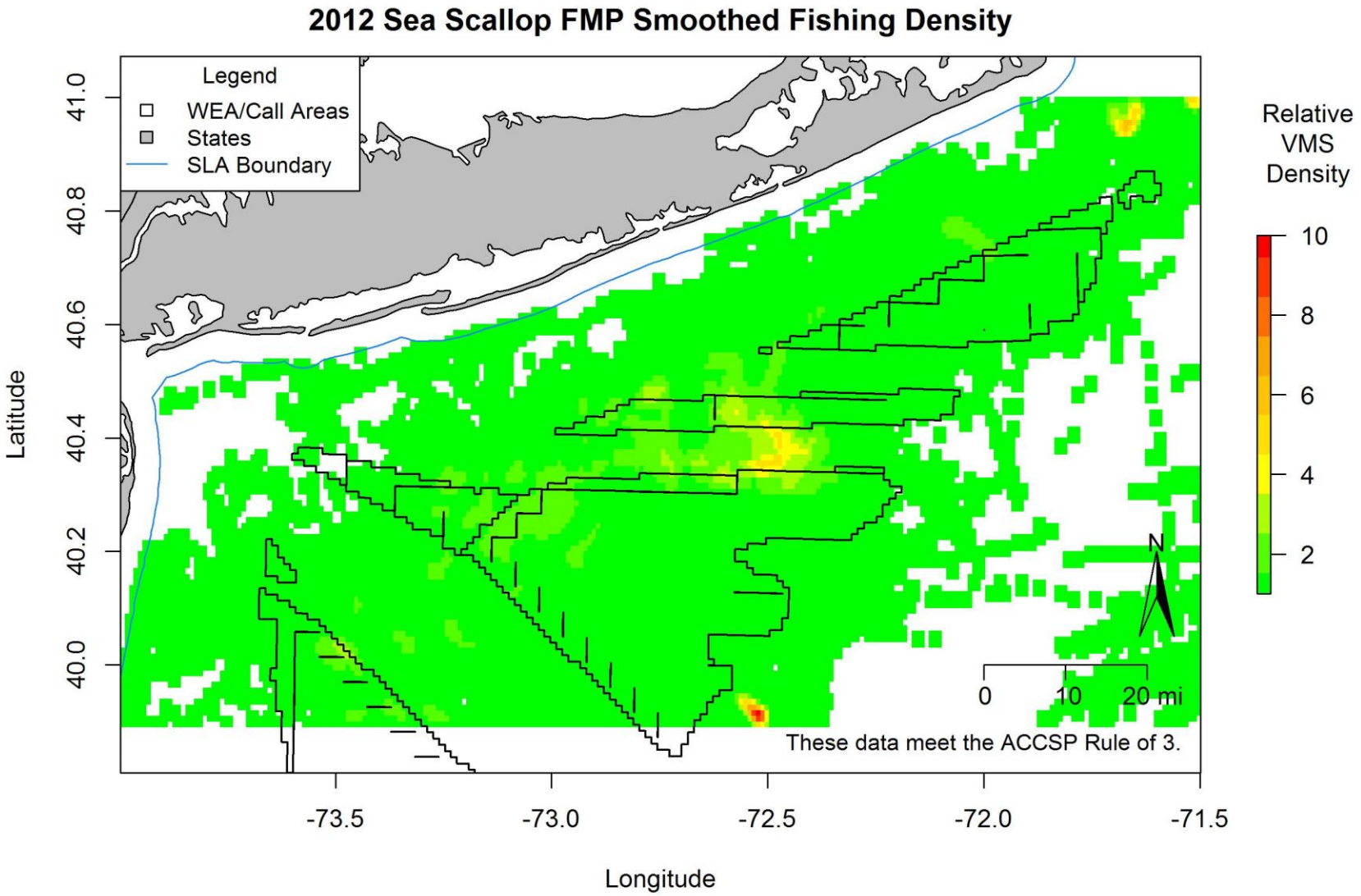

Figure 50. Smoothed federal fishing activity of all trips in 2012 where sea scallops were caught

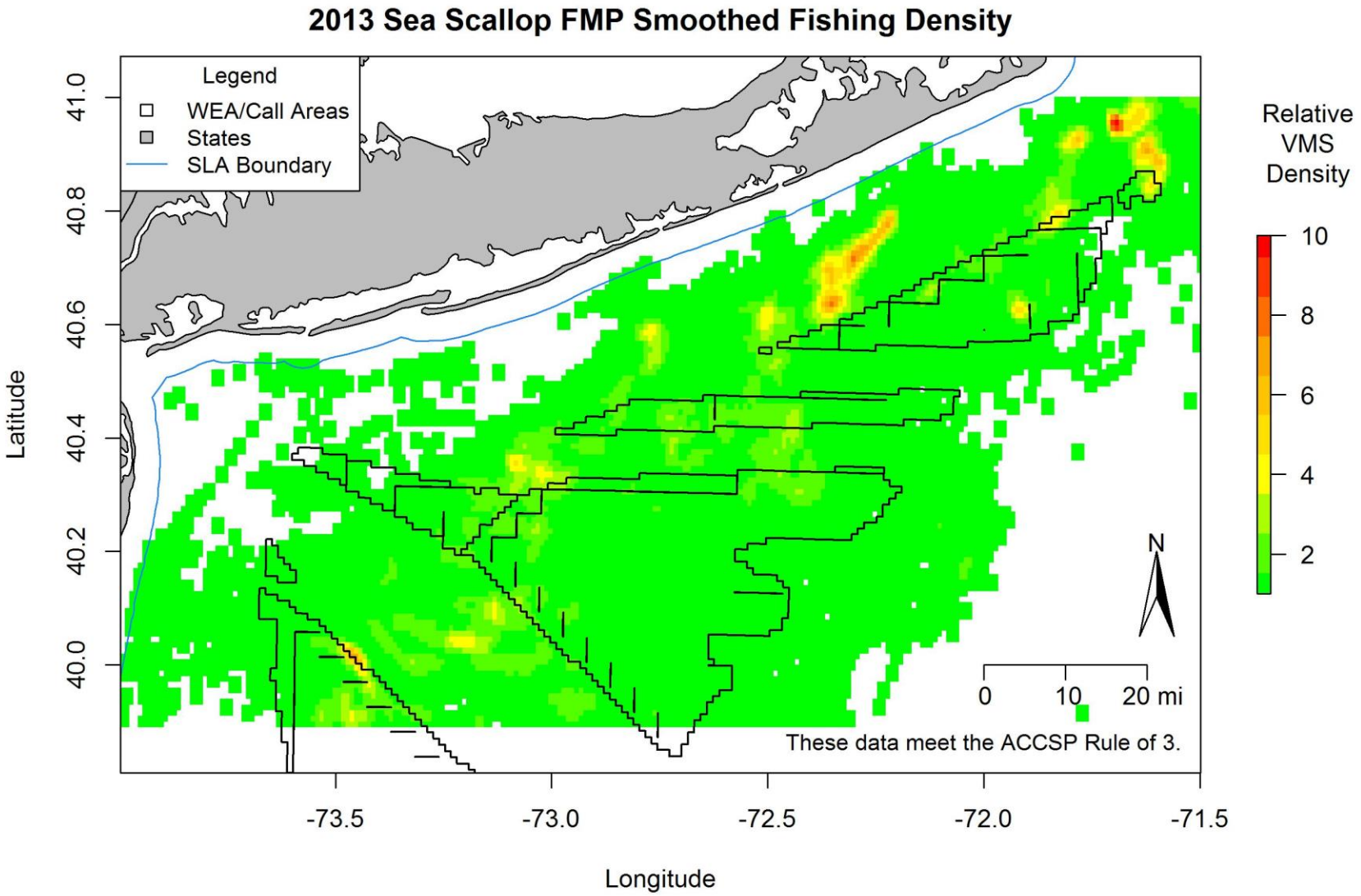

Figure 51. Smoothed federal fishing activity of all trips in 2013 where sea scallops were caught

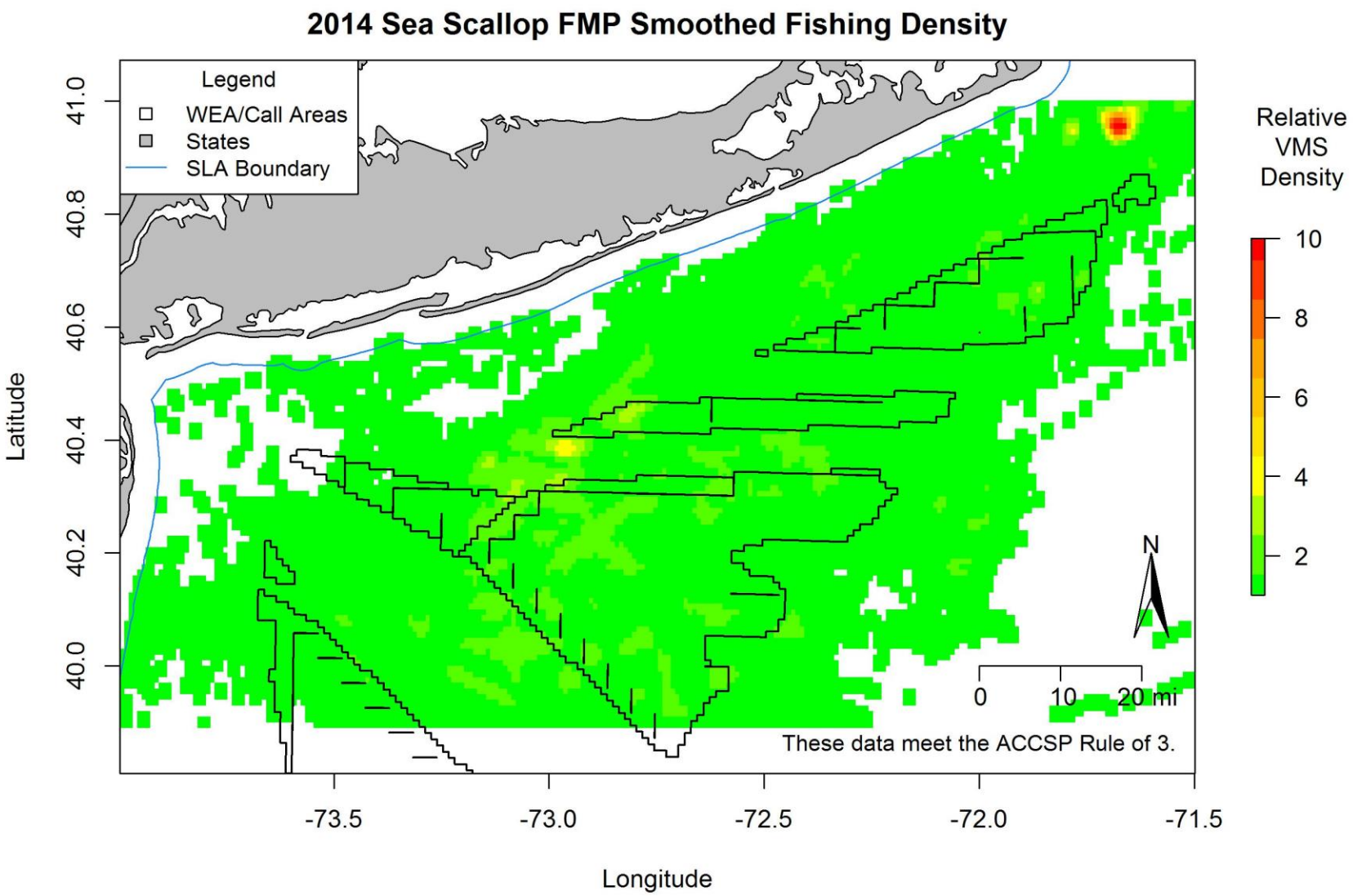

Figure 52. Smoothed federal fishing activity of all trips in 2014 where sea scallops were caught

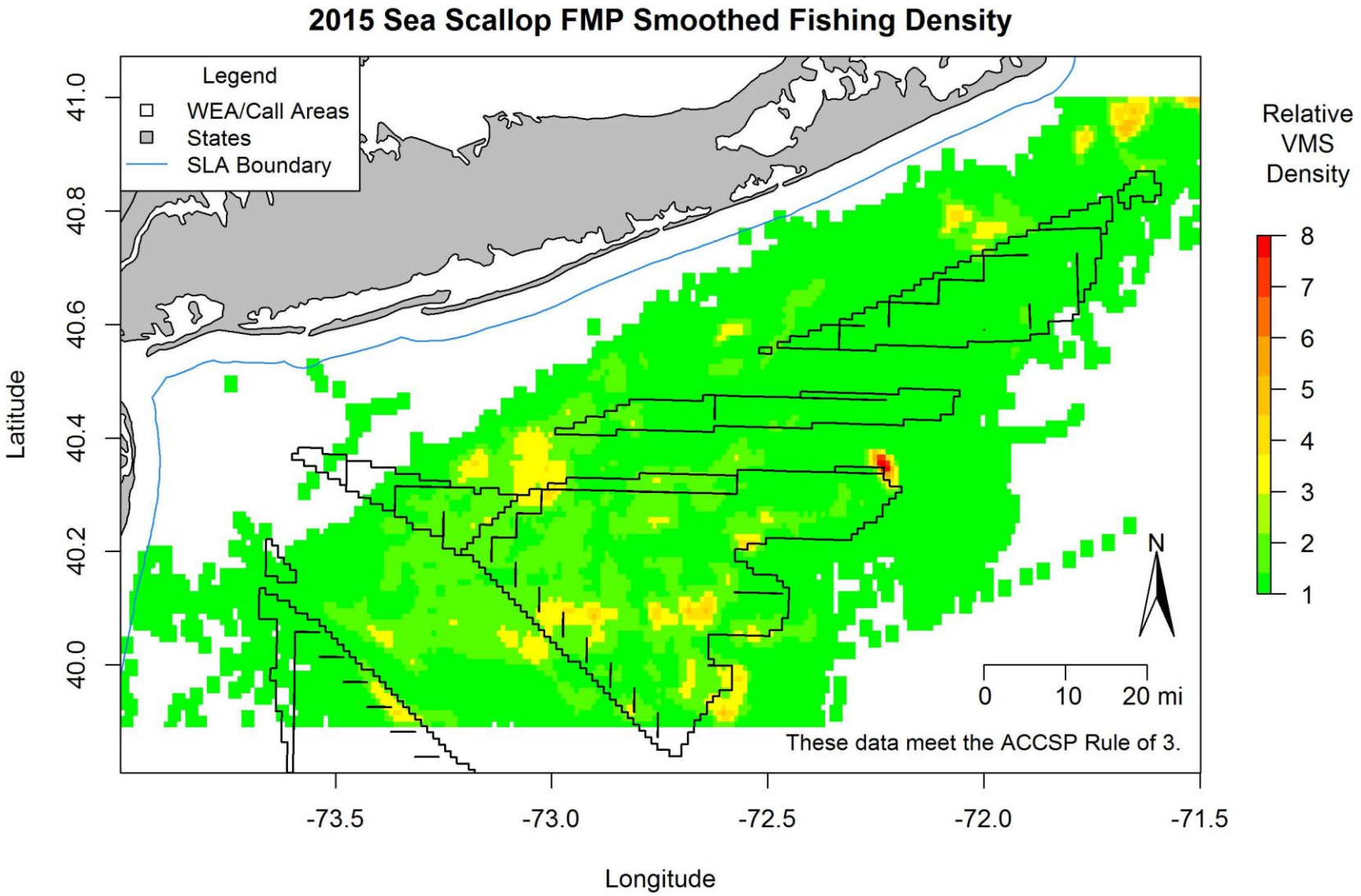

Figure 53. Smoothed federal fishing activity of all trips in 2015 where sea scallops were caught

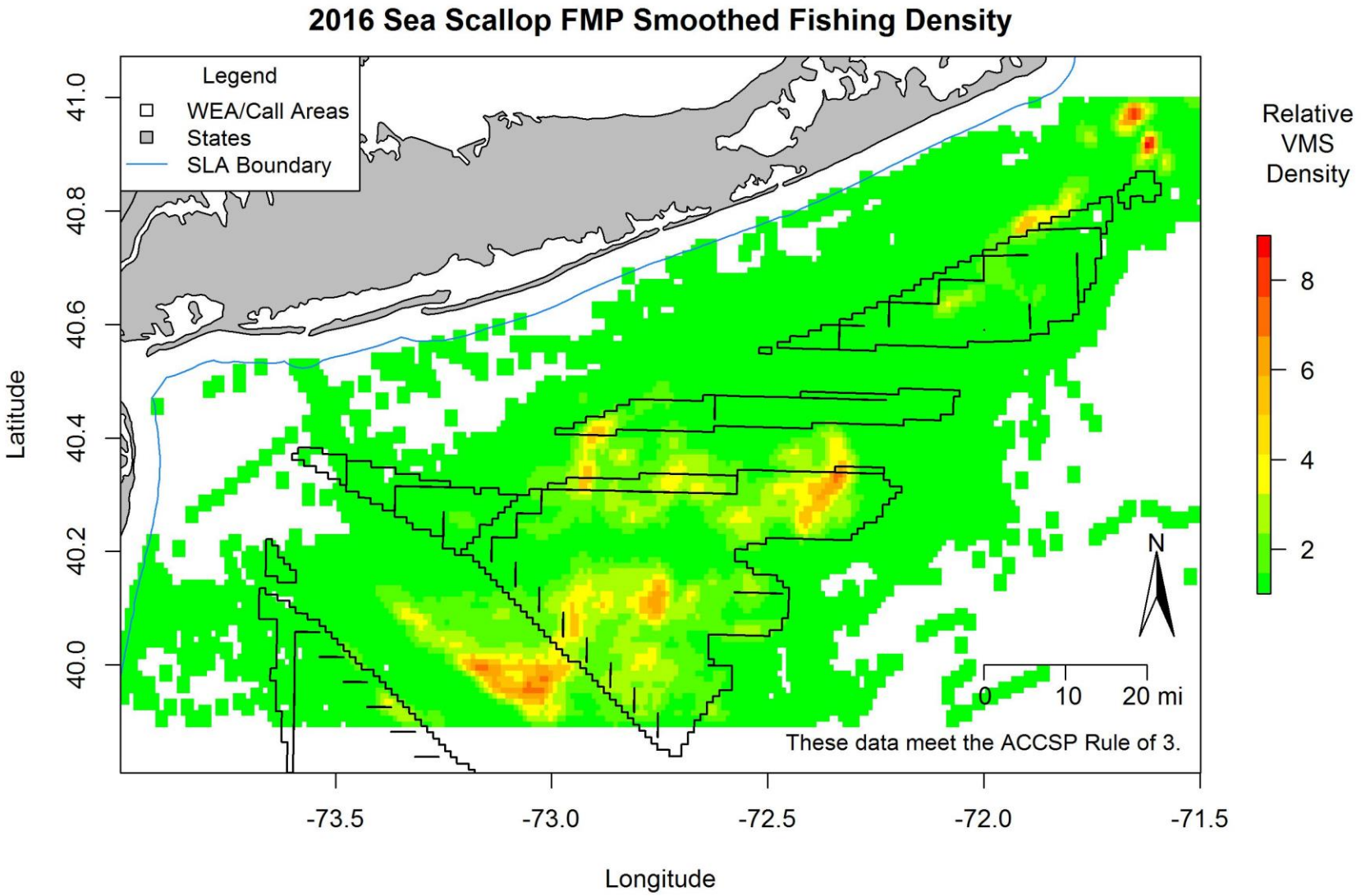

Figure 54. Smoothed federal fishing activity of all trips in 2016 where sea scallops were caught

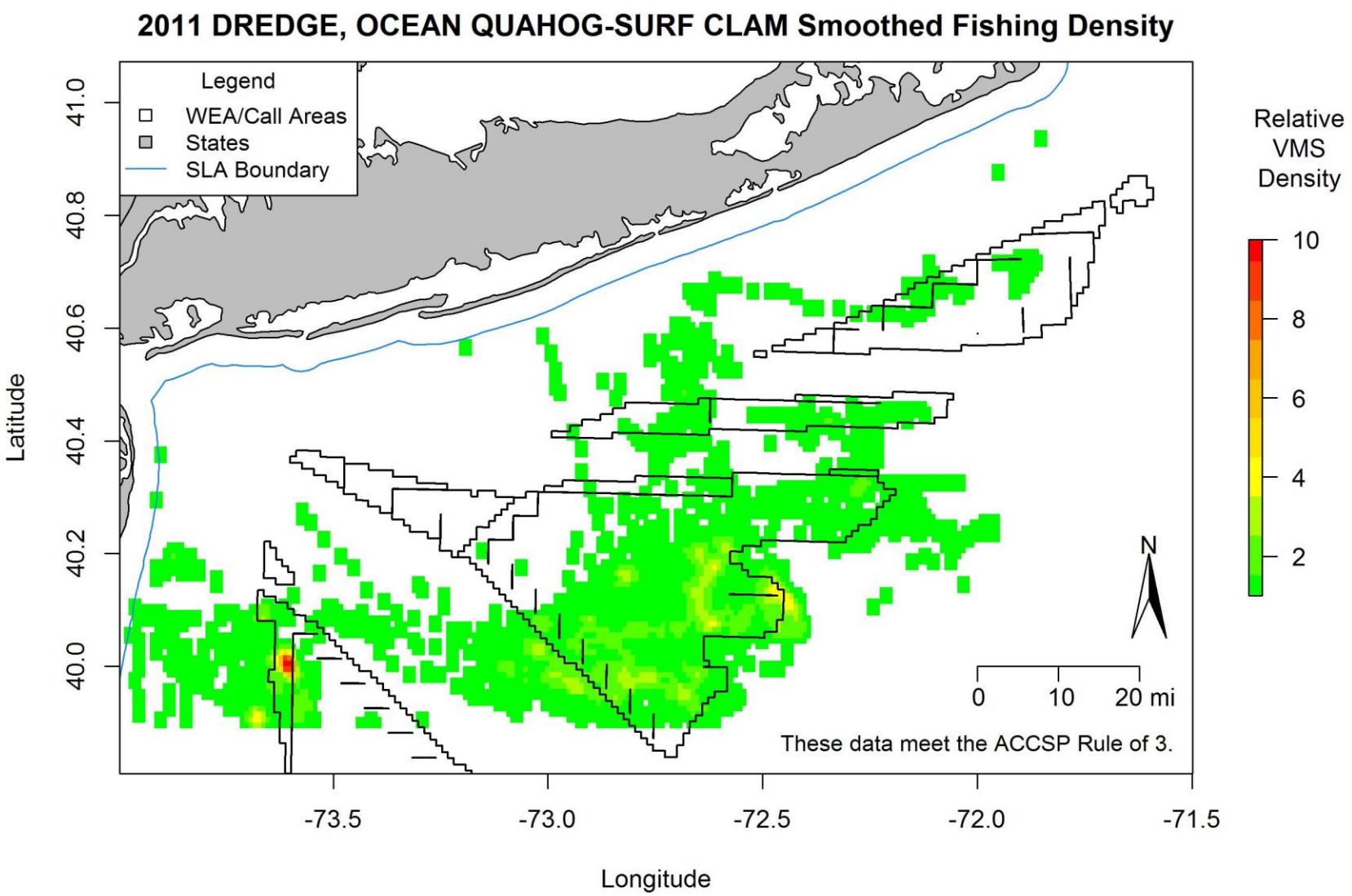

Figure 55. Smoothed federal fishing activity of all trips in 2011 where ocean quahog/surfclam were caught using a hydraulic dredge

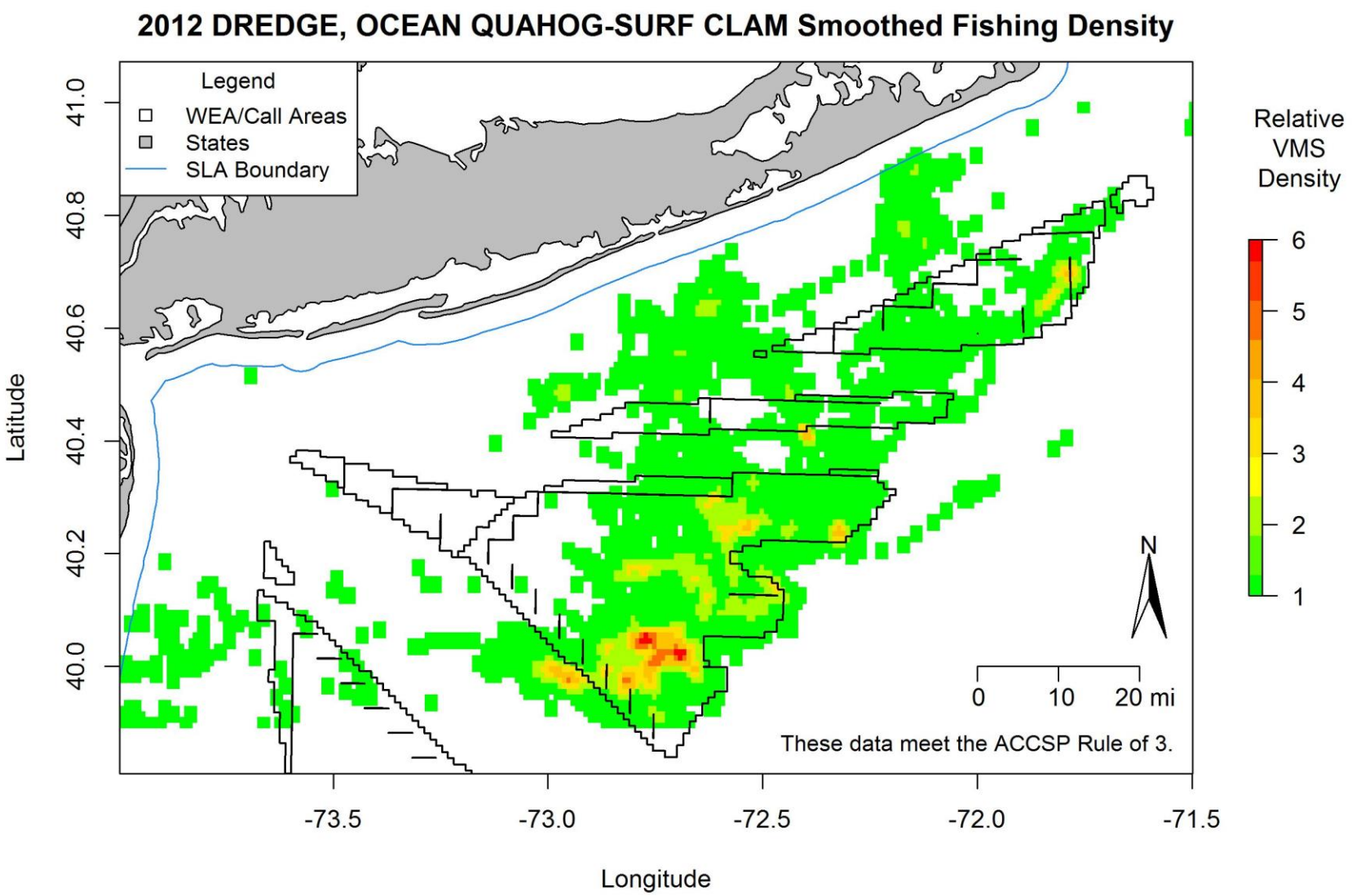

Figure 56. Smoothed federal fishing activity of all trips in 2012 where ocean quahog/surfclam were caught using a hydraulic dredge

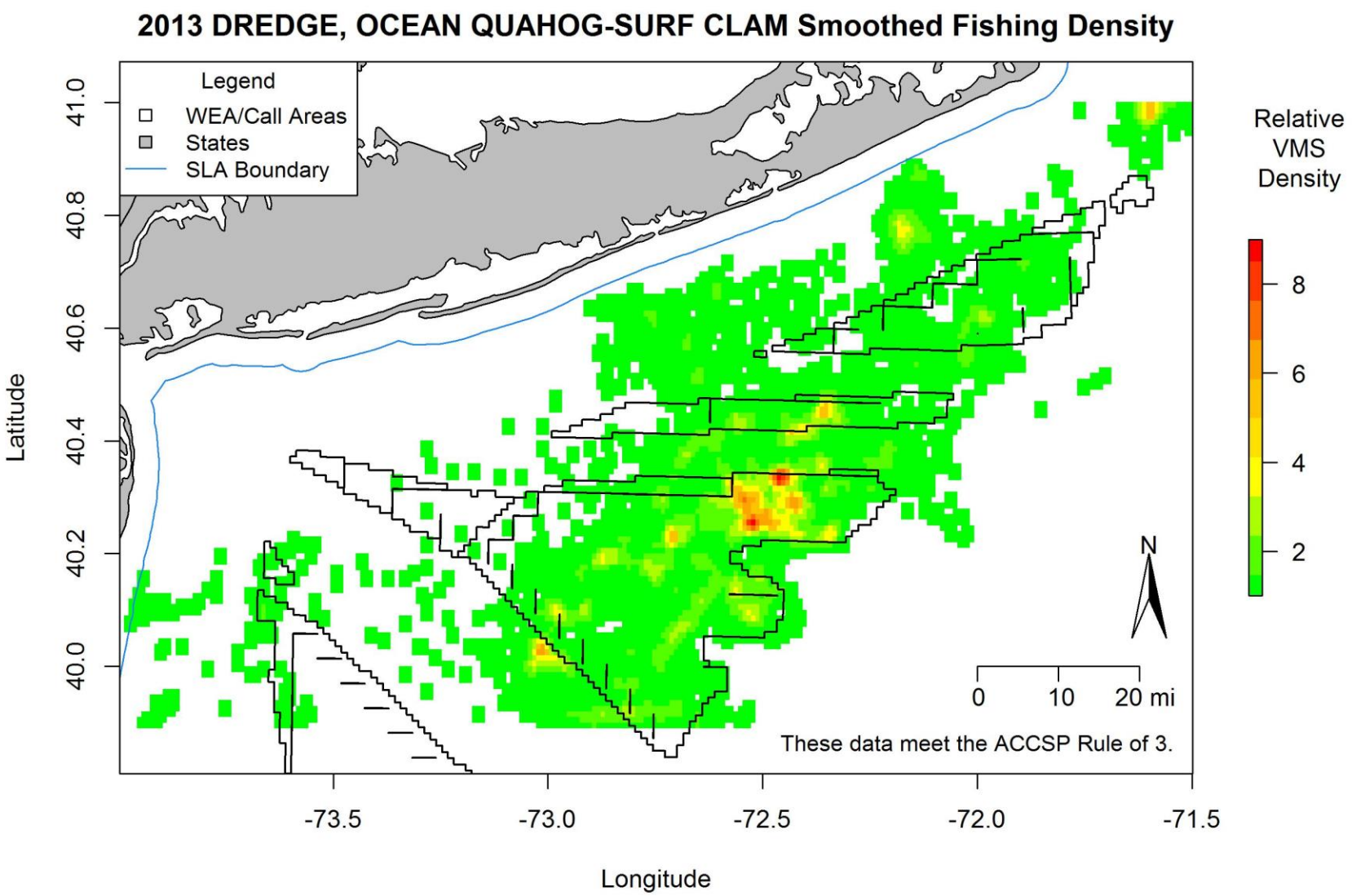

Figure 57. Smoothed federal fishing activity of all trips in 2013 where ocean quahog/surfclam were caught using a hydraulic dredge

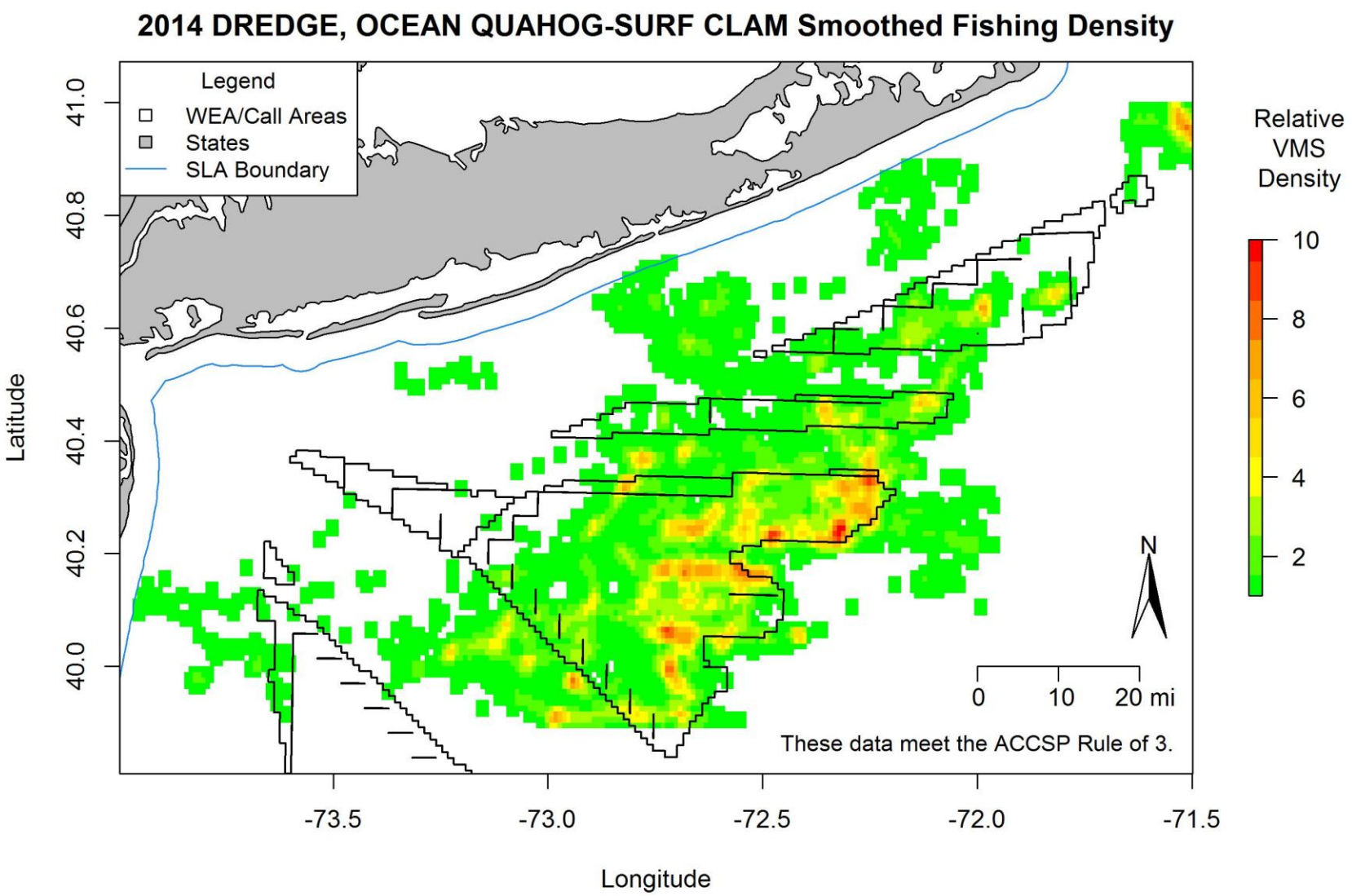

Figure 58. Smoothed federal fishing activity of all trips in 2014 where ocean quahog/surfclam were caught using a hydraulic dredge

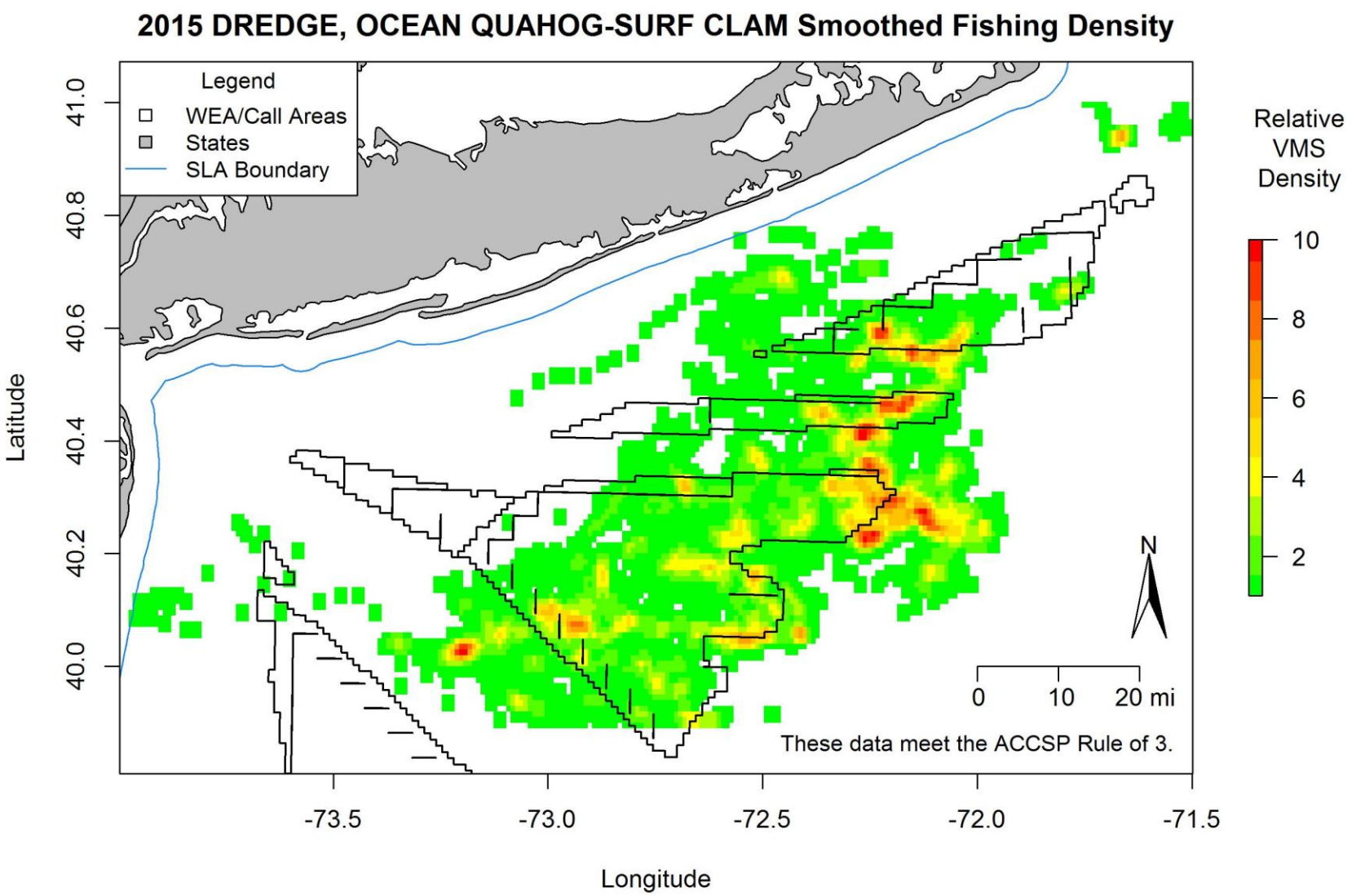

Figure 59. Smoothed federal fishing activity of all trips in 2015 where ocean quahog/surfclam were caught using a hydraulic dredge

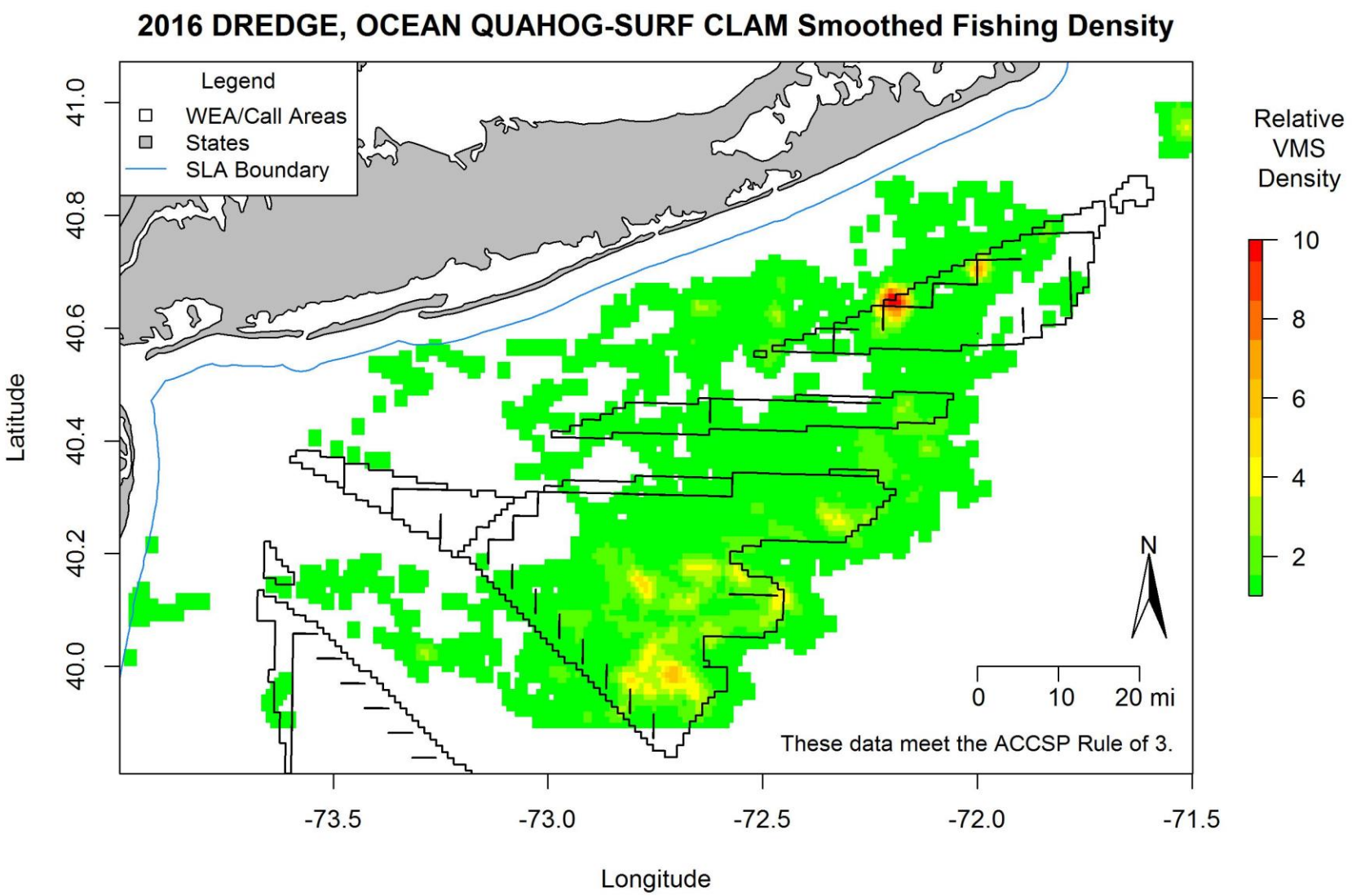

Figure 60. Smoothed federal fishing activity of all trips in 2016 where ocean quahog/surfclam were caught using a hydraulic dredge

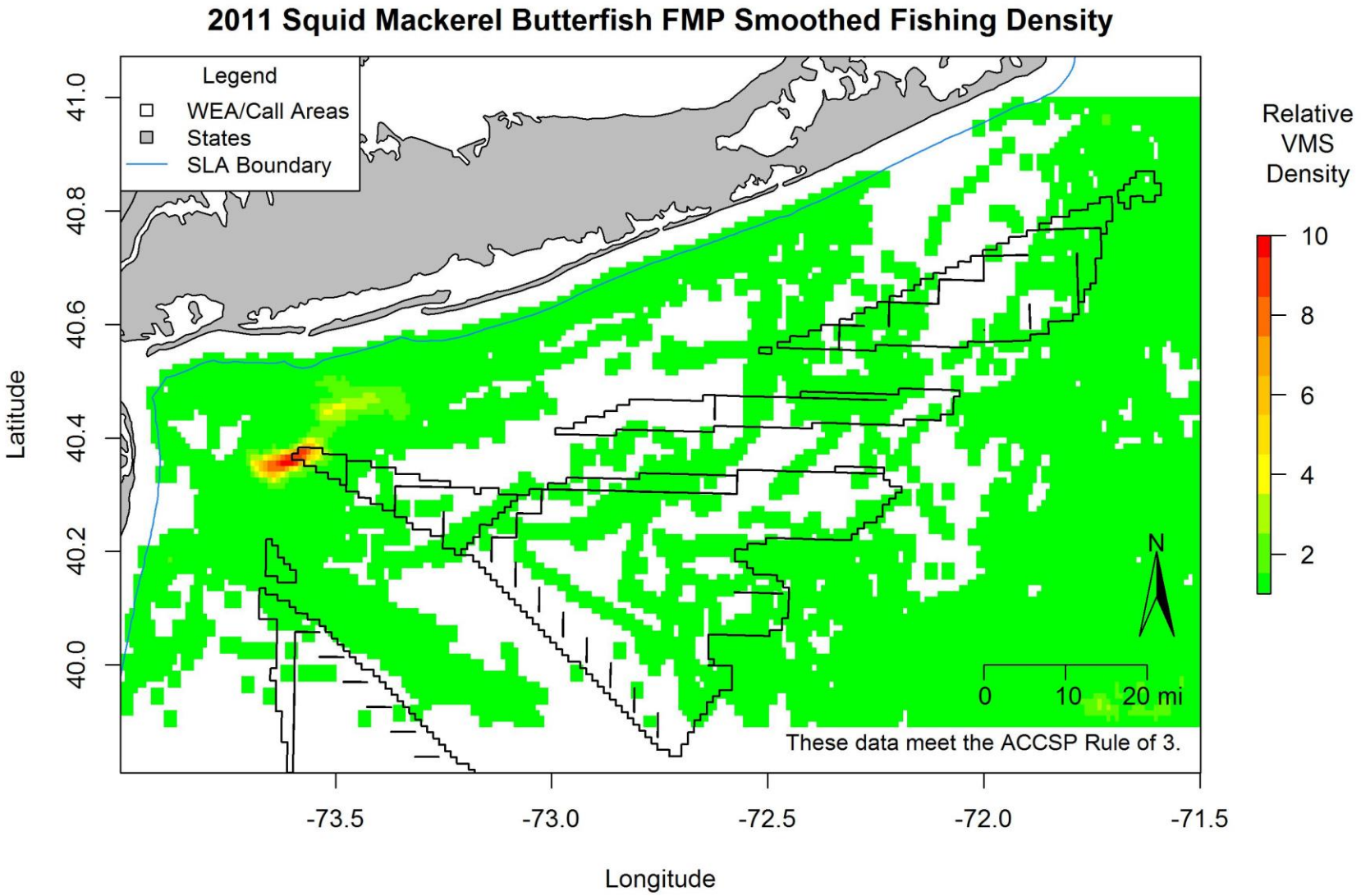

Figure 61. Smoothed federal fishing activity of all trips in 2011 where squid, Atlantic mackerel, and butterfish were caught

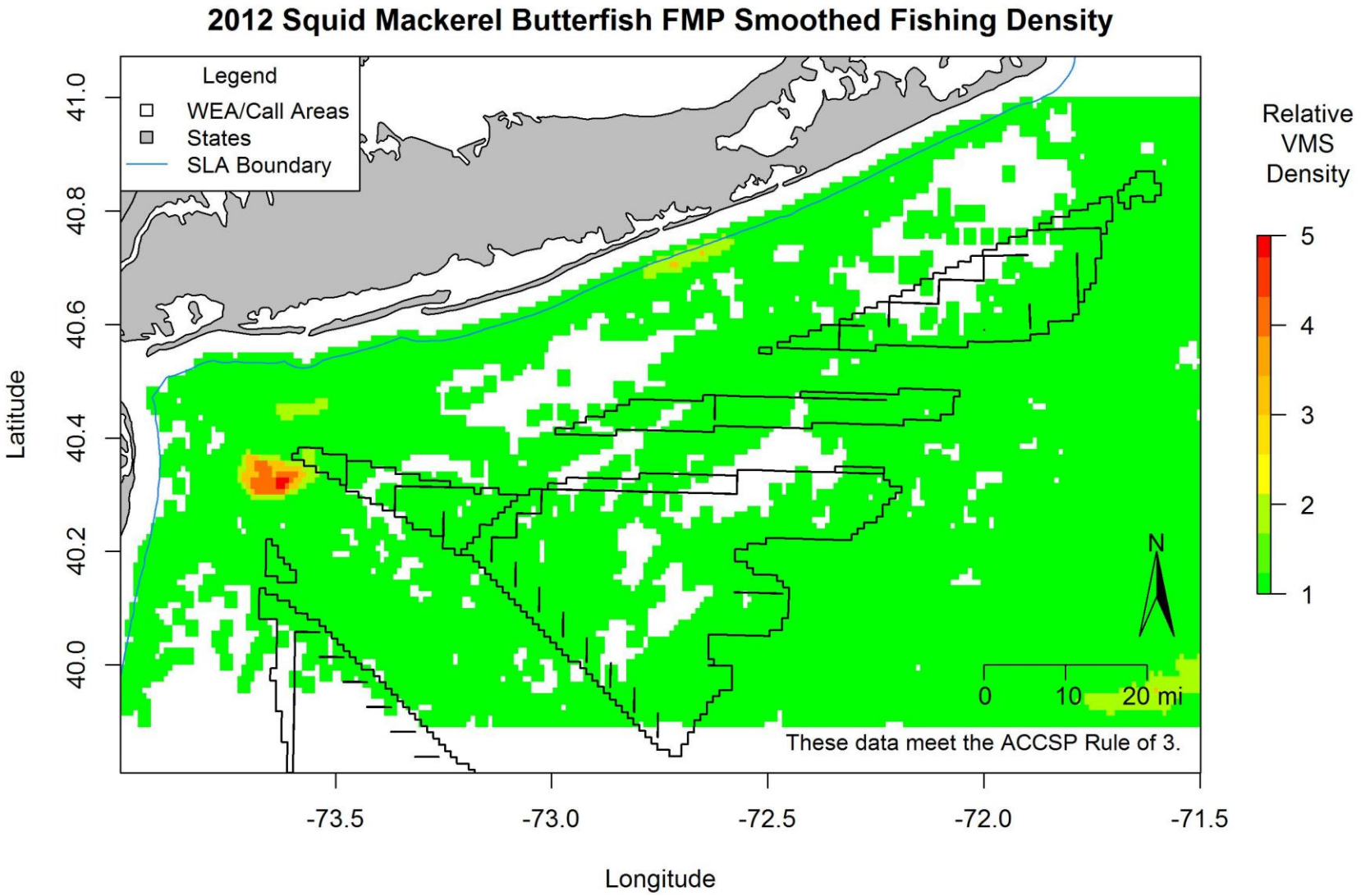

Figure 62. Smoothed federal fishing activity of all trips in 2012 where squid, Atlantic mackerel, and butterfish were caught

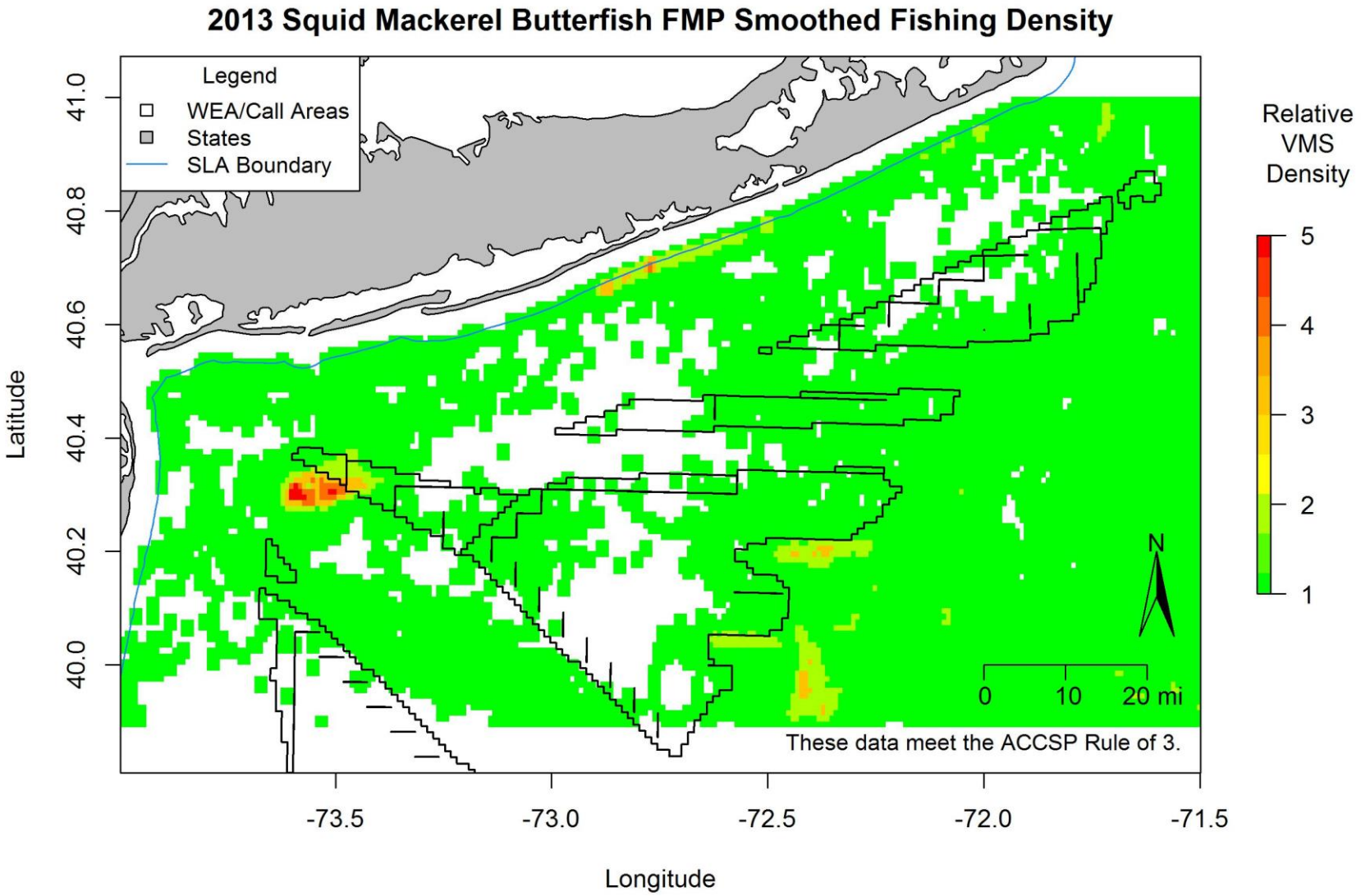

Figure 63. Smoothed federal fishing activity of all trips in 2013 where squid, Atlantic mackerel, and butterfish were caught

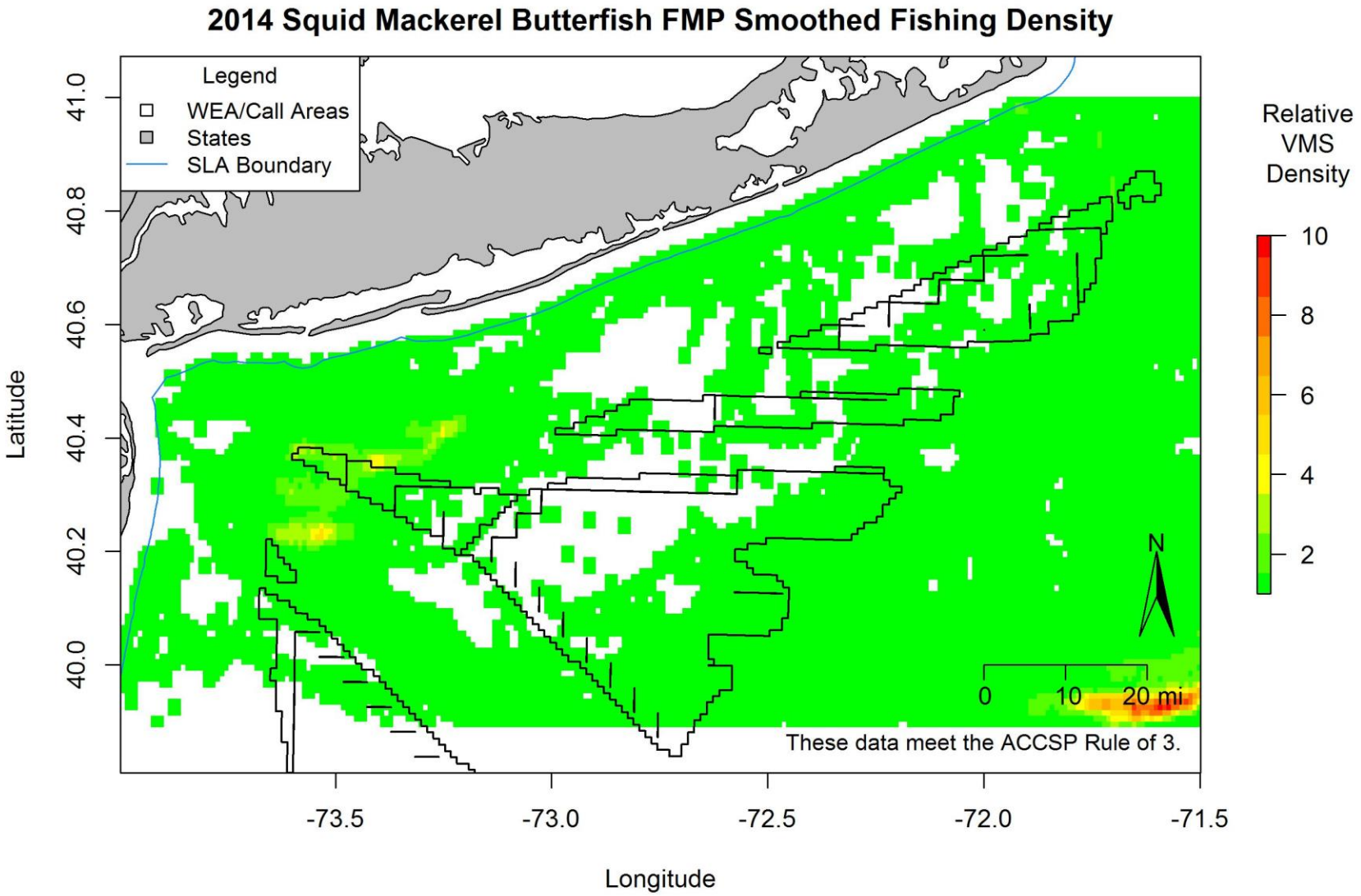

Figure 64. Smoothed federal fishing activity of all trips in 2014 where squid, Atlantic mackerel, and butterfish were caught

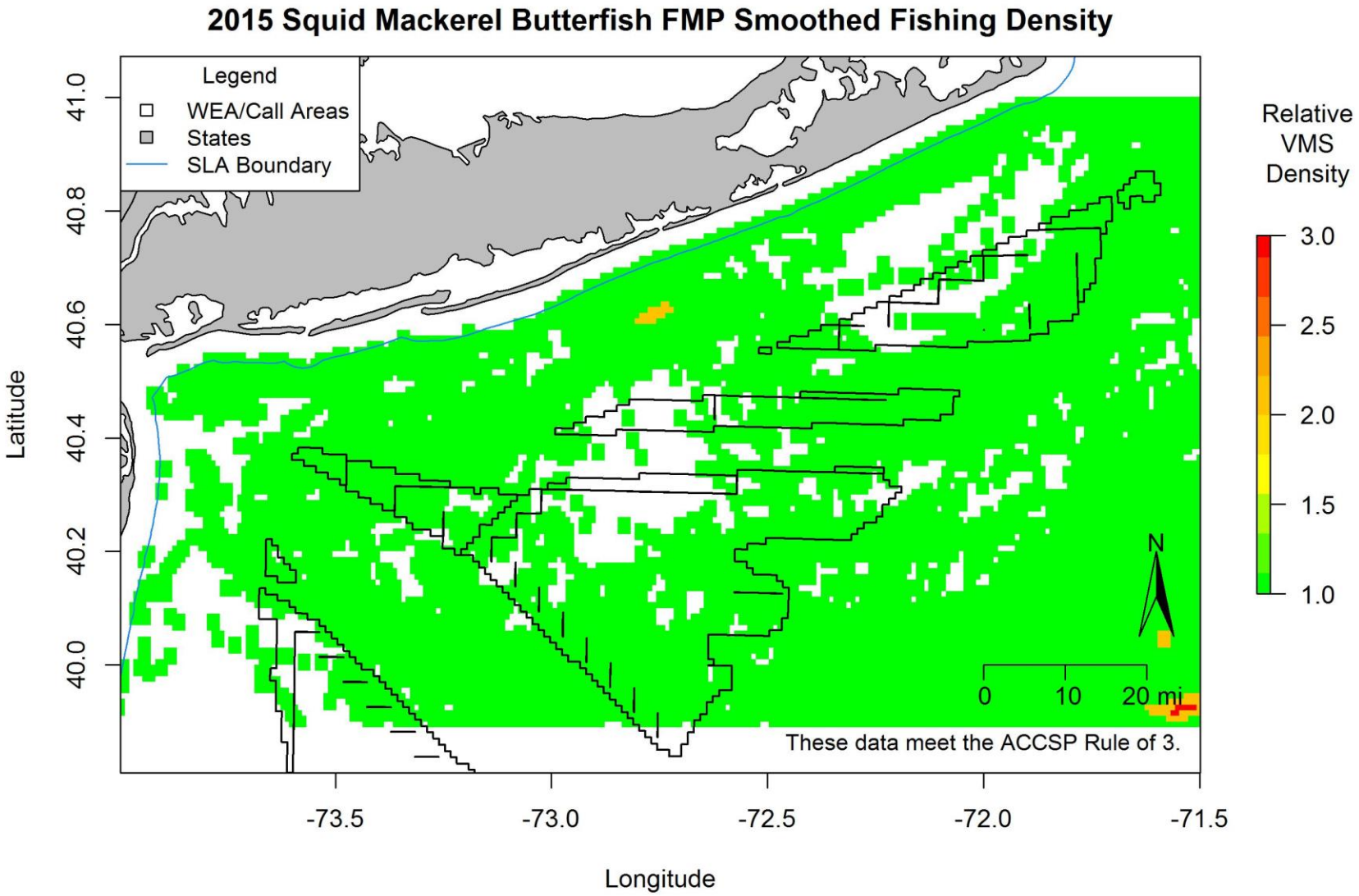

Figure 65. Smoothed federal fishing activity of all trips in 2015 where squid, Atlantic mackerel, and butterfish were caught

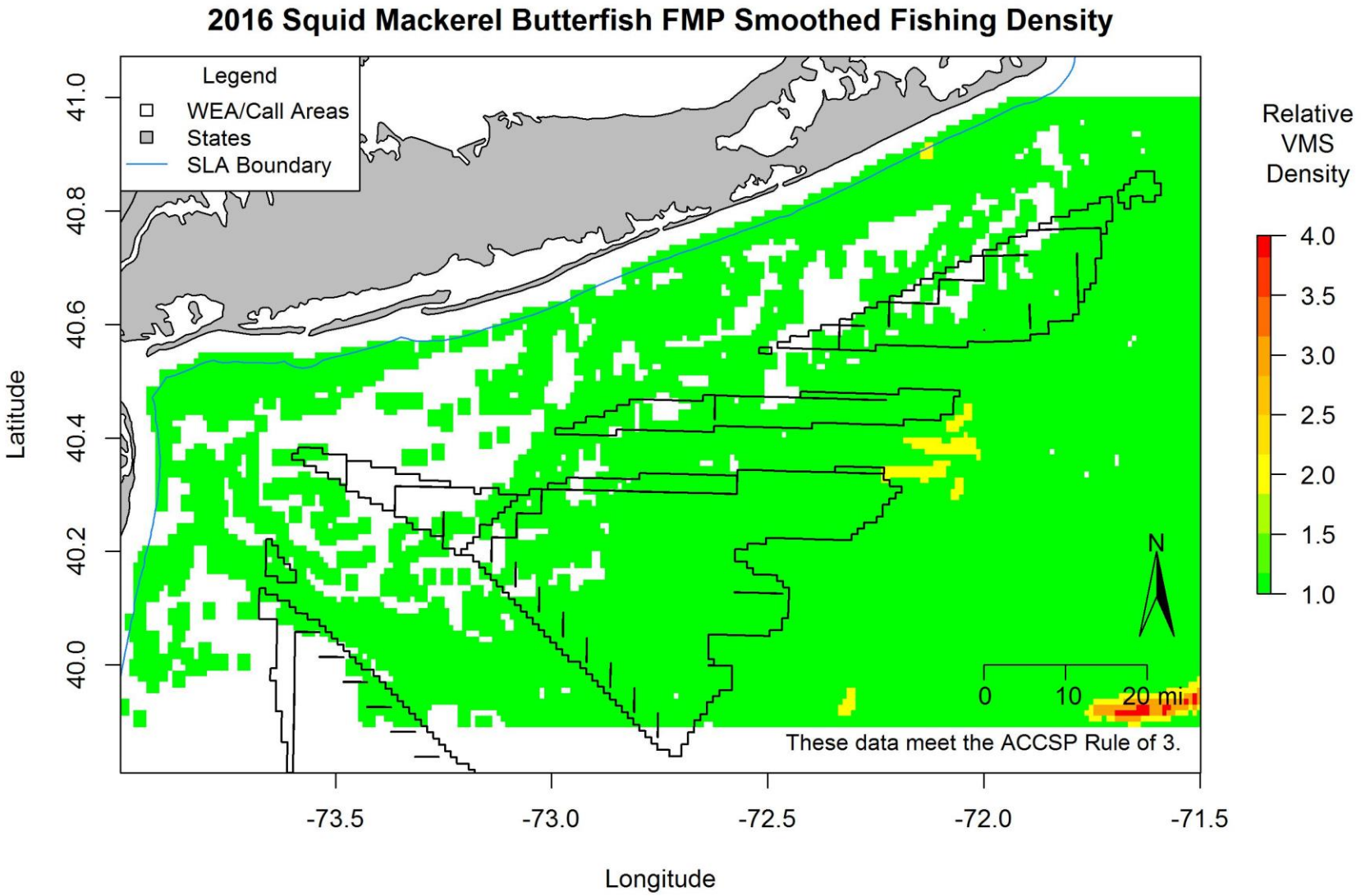

Figure 66. Smoothed federal fishing activity of all trips in 2016 where squid, Atlantic mackerel, and butterfish were caught

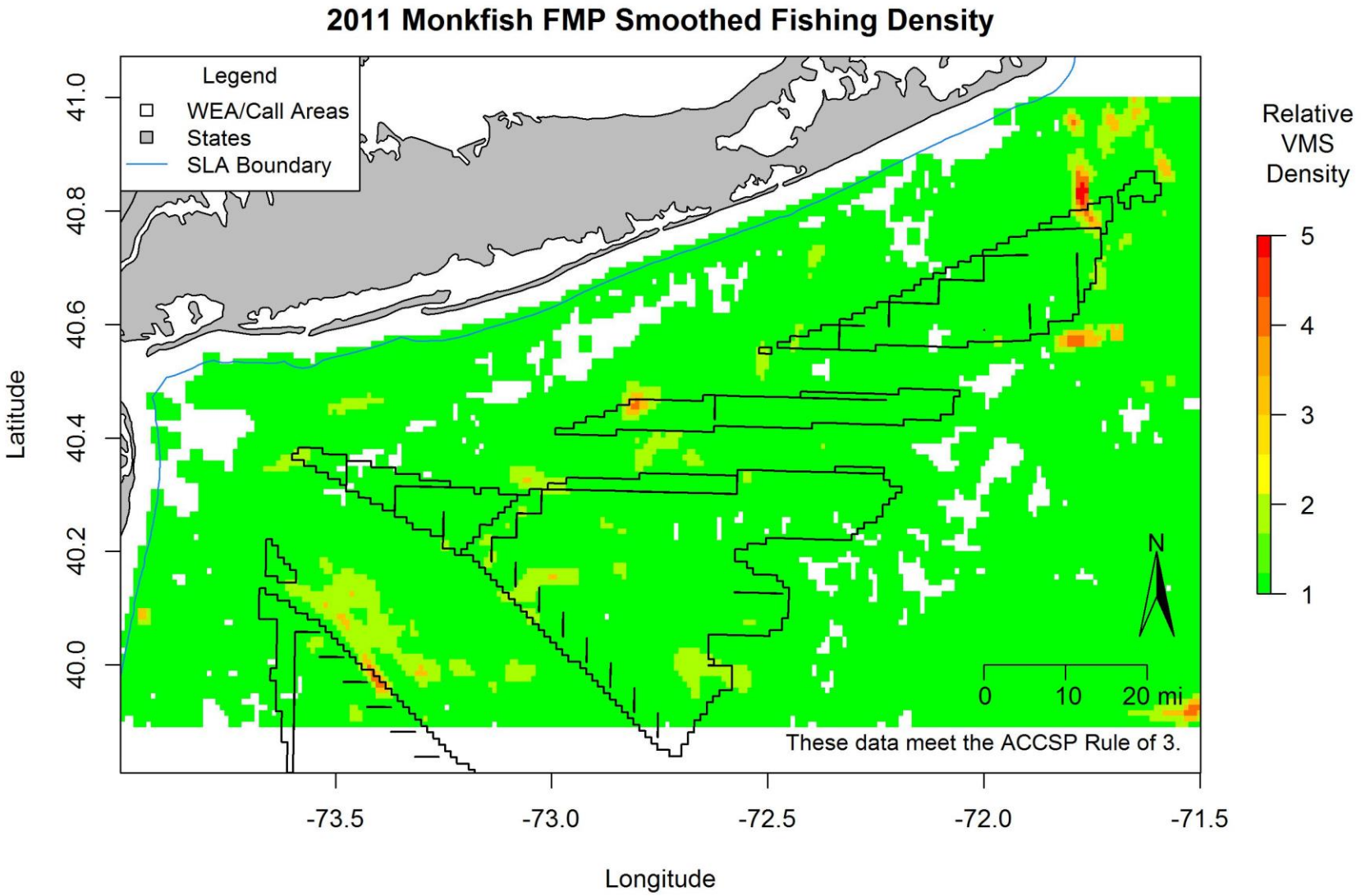

Figure 67. Smoothed federal fishing activity of all trips in 2011 where monkfish was caught

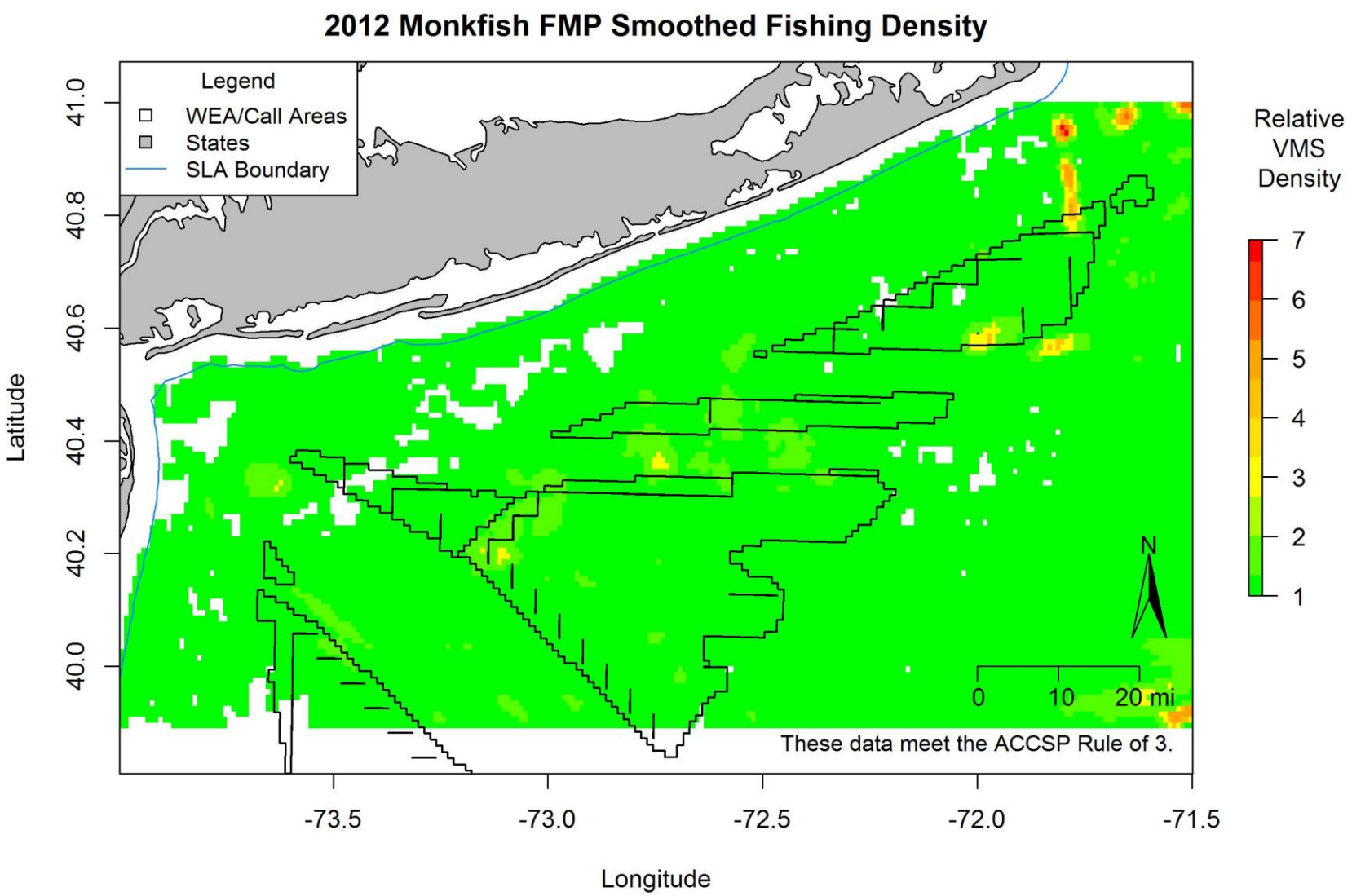

Figure 68. Smoothed federal fishing activity of all trips in 2012 where monkfish was caught

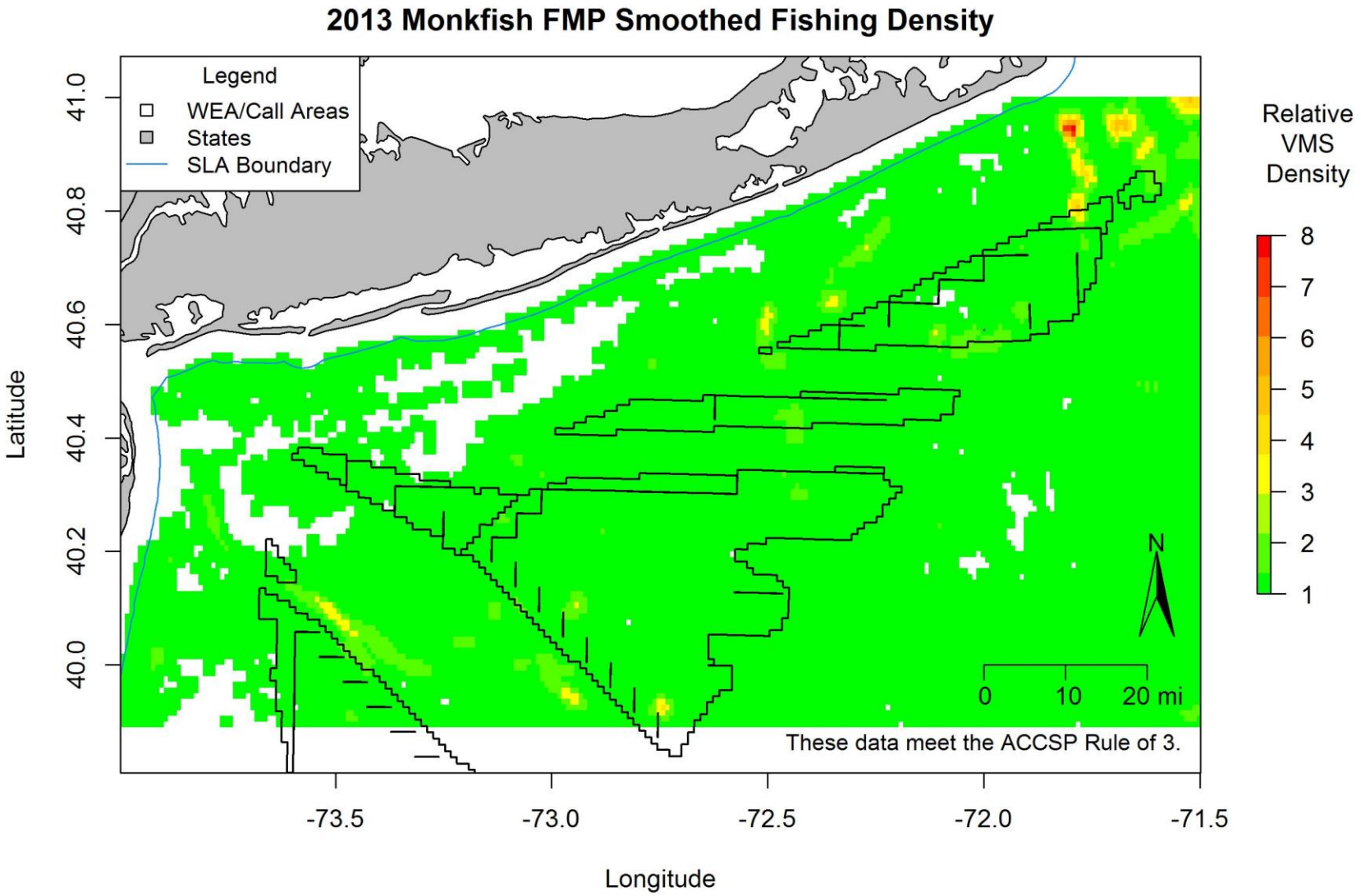

Figure 69. Smoothed federal fishing activity of all trips in 2013 where monkfish was caught

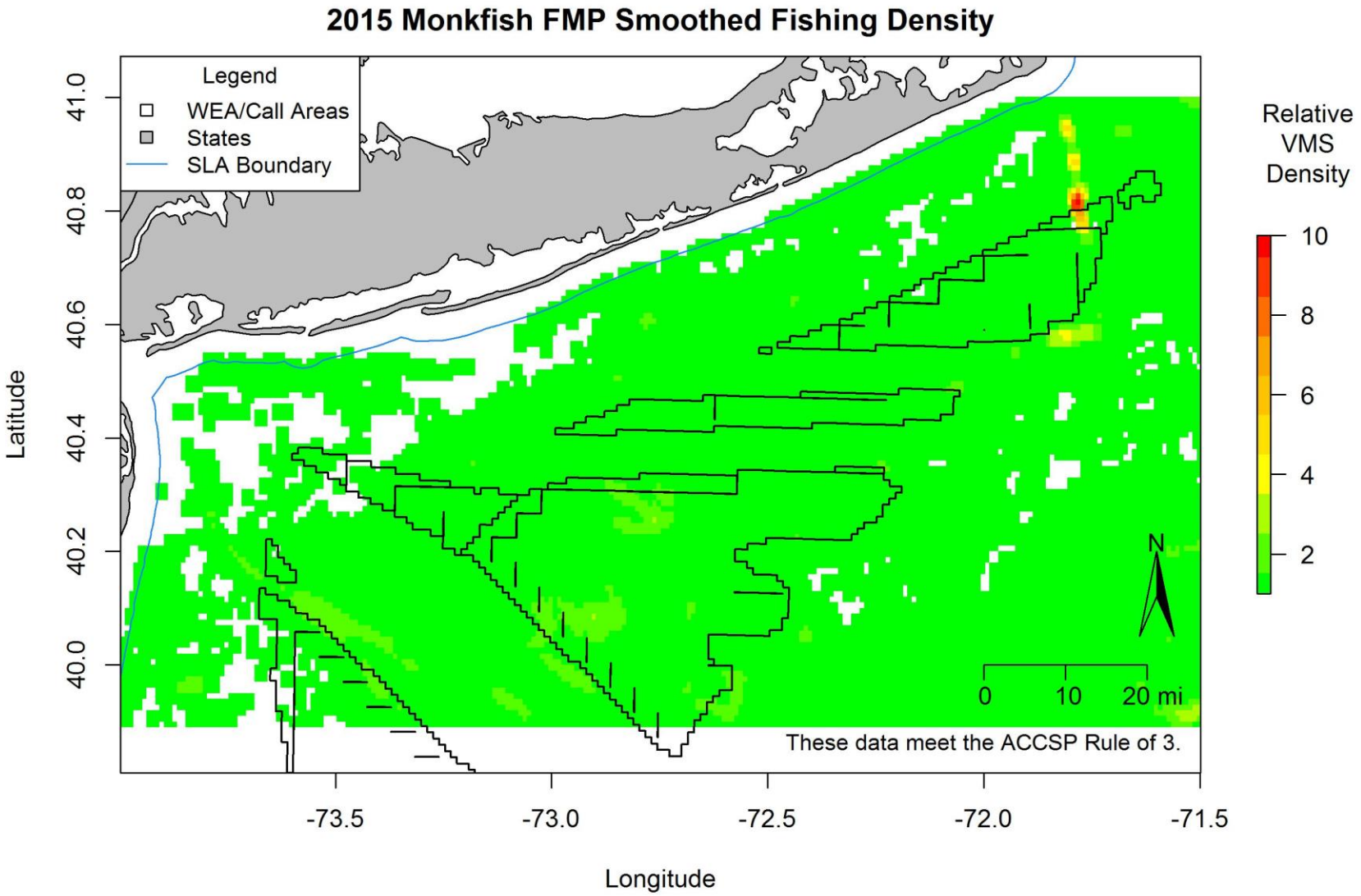

Figure 70. Smoothed federal fishing activity of all trips in 2014 where monkfish was caught

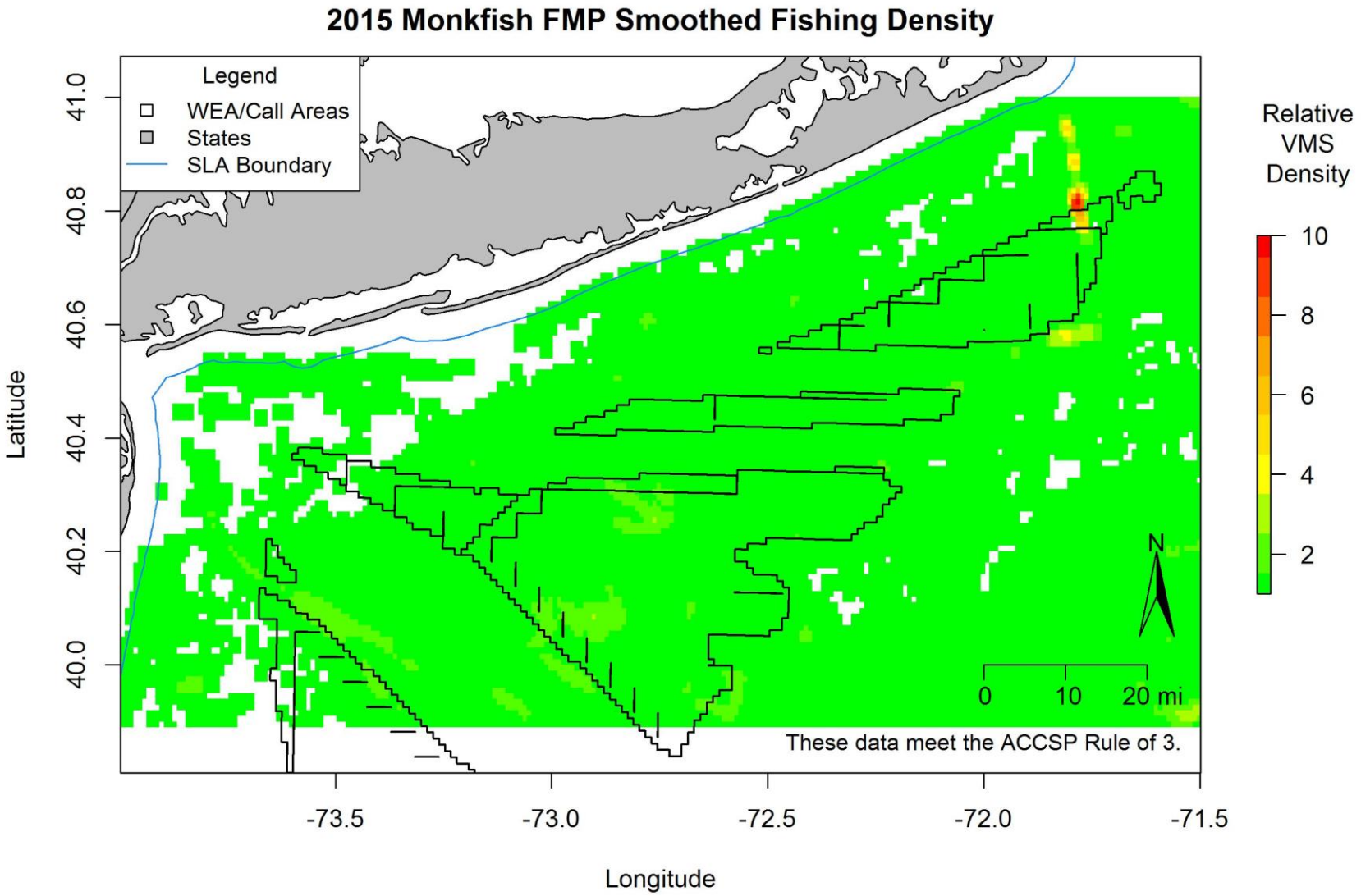

Figure 71. Smoothed federal fishing activity of all trips in 2015 where monkfish was caught

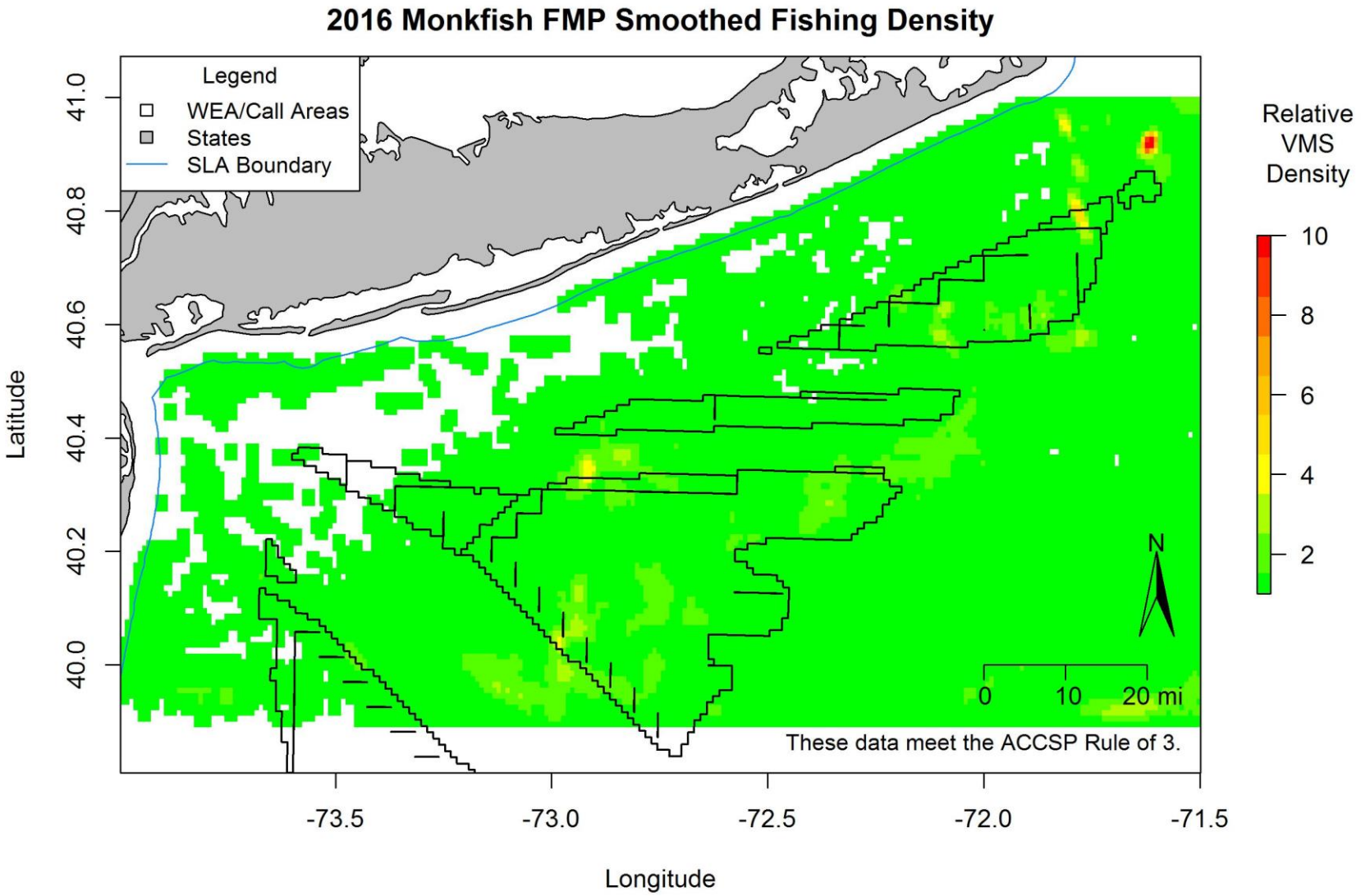

Figure 72. Smoothed federal fishing activity of all trips in 2016 where monkfish was caught