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Comment On: BOEM-2011-0005-0001
Commercial Leasing for Wind Power; Call for Information and Nominations Outer Continental Shelf Offshore New Jersey

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Comment from Alison Chase, organization

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General Comment

Attached please find NRDC's comments on the New Jersey Wind Energy Area (letter and Attachment 1, Parts A & B, and Attachment 2, Parts A & B).

Attachments

BOEM-2011-0005-DRAFT-0021.1: Comment from Alison Chase, organization
BOEM-2011-0005-DRAFT-0021.2: Comment from Alison Chase, organization
BOEM-2011-0005-DRAFT-0021.3: Comment from Alison Chase, organization
BOEM-2011-0005-DRAFT-0021.4: Comment from Alison Chase, organization
BOEM-2011-0005-DRAFT-0021.5: Comment from Alison Chase, organization

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***Filed electronically via* www.regulations.gov**

Re: Comments on the New Jersey Wind Energy Area

Dear Mr. Waskes:

The Natural Resources Defense Council, Inc. ("NRDC") appreciates the opportunity to comment in response to the Bureau of Ocean Energy Management, Regulation and Enforcement's ("BOEMRE") call for additional information related to leasing the agency's proposed Wind Energy Area ("WEA") on the Outer Continental Shelf ("OCS") offshore of New Jersey.[1] We incorporate by reference and expand on the comments we submitted on March 11, 2011 regarding the Mid-Atlantic WEA Regional Environmental Assessment ("EA") (Attachment 1).[2]

Introduction

NRDC is an environmental advocacy organization headquartered in New York City, with more than 1.3 million members and online activists. NRDC uses law, science and the support of our members and online activists to protect the planet's natural resources and ensure a safe and healthy

[1] Call for Information and Nominations for Commercial Leasing for Wind Power on the Outer Continental Shelf Offshore New Jersey, 76 Fed. Reg. 22130 (Apr. 20, 2011).

[2] These comments, submitted electronically at www.regulations.gov and by mail, were in response to Notice of Intent to Prepare an Environmental Assessment for Mid-Atlantic Wind Energy Areas, 76 Fed. Reg. 7226 (Feb. 9, 2011).

environment for all living things. Curbing global warming, protecting the marine environment, and building a clean renewable energy future are critical priorities for NRDC.

NRDC supports immediate and strong action to replace the outdated fossil fuel technologies that have resulted in catastrophic, wide-ranging and systemic damage to the environment and public health, including to our oceans, through ocean acidification and other impacts. Offshore wind energy offers one of the most promising sources of emissions-free electricity close to electricity load centers and we hope to see the United States act swiftly to embrace its potential to be a global leader in the development and implementation of offshore wind energy technology. NRDC is a leader in supporting the sustainable development of offshore wind in the United States, and is a supporter of the Cape Wind offshore wind project.

It is also critical, of course, that this new energy source be developed in an environmentally responsible manner that will serve to encourage additional development while protecting vulnerable ocean habitats and species. Worldwide, our oceans are experiencing a silent collapse as a result of pollution, destruction of productive marine habitat, overexploitation of fish stocks, and global warming impacts. Additional ocean industry must be carefully developed to minimize impacts on these already stressed resources.

In order to evaluate the ecological impacts of the proposed WEAs, NRDC recently initiated a study to help identify (a) any potential conflicts between development of wind energy projects within the WEAs and the protection of important marine ecologic resources in the region, and (b) possible mitigation options for any such potential conflicts. We mapped several ecological data layers against the proposed Mid-Atlantic WEA boundaries and provided a first cut of these maps in our previous comments. These comments update several of the New Jersey WEA maps with additional ecological data. Based on our initial analysis of possible conflicts, we then reached out to several marine resources experts to see if our maps and the conclusions we drew from them matched what they had witnessed in the field. What we learned from the experts was that oftentimes the maps did not tell the full story, and further data gathering efforts are needed to improve our understanding of chronically under sampled marine resources. We asked the experts to address all of the WEAs in their remarks and not limit their comments to New Jersey. NRDC will continue to study these issues and the analysis presented herein is still being finalized. NRDC will supplement these comments at a later time.

We appreciate that BOEMRE used ecological information from the New Jersey Ocean/Wind Baseline Study ("NJ Baseline Study") to identify areas off of New Jersey that might not be suitable for development, such as shoals and ridges. As such, we hope that the below comments – particularly those from the experts – serve to further refine the WEA boundaries and identify additional research needed and mitigation measures that would help address potential impacts within BOEMRE's proposed WEAs.[3]

As mentioned in our previous comments, we also encourage the Department of the Interior ("DOI") – even as it to moves to help address the urgency of the global warming crisis – to explicitly commit to adhering to the National Ocean Policy and the Coastal and Marine Spatial Planning ("CMSP")

[3] Call for Information and Nominations for Commercial Leasing for Wind Power on the Outer Continental Shelf Offshore New Jersey, 76 Fed. Reg. 22136 (Apr. 20, 2011).

principles.[4] While CMSP plans are not yet in place, CMSP principles can still be brought to bear on the process. These comments are not intended to suggest that CMSP efforts should be used as a mechanism to slow down or obstruct the development of offshore wind energy. NRDC agrees with the comments made in the Final Recommendations of the Interagency Ocean Policy Task Force that "CMSP is not meant to delay or halt existing or pending plans and projects related to marine and Great Lakes environments or their uses."[5] Rather, we recommend that incorporating the National Ocean Policy and CMSP principles into this effort would encourage intra- and interagency coordination, improve transparency of wind siting efforts, and help ensure environmentally protective offshore renewable energy siting, construction and operations.

Our goal in submitting these comments is to (1) point to further environmental analysis that should be undertaken (either as part of a cumulative impacts analysis or as part of the project-specific environmental review, depending on the nature of the needed analysis) and to field studies where appropriate, and (2) to start to identify possible mitigation options for potential impacts.

WEA Mapping Analysis

As referenced above, NRDC expanded on our initial maps of overlaps between the New Jersey ("NJ") WEA and important marine ecologic resources by mapping additional Geographic Information System ("GIS") biological data layers relating to avian and marine mammal presence taken from the NJ Baseline Study. We also mapped preliminary bat detection data from the NJ Baseline Study that was generated by a joint project of University of Maryland's Center for Environmental Science, Frostburg State University and the Maryland Department of Natural Resources. NRDC's maps and the methodology can be found in Attachment 2.

Below we have noted certain overlaps between the New Jersey WEA and specific biologic and habitat resources.

- For the avian species examined – the common loon, common tern, northern gannet, long-tailed duck, scoter, black scoter, red-breasted merganser, red-throated loon, and surf scoter – the highest species densities occurred in the OCS blocks within the New Jersey WEA that are closer to shore. (See avian mapping at Figures 1-14, 22.) As noted in the NJ Baseline Study, depth and distance to shore were the best predictors of avian densities (for the species and times/places studied). In general, densities of these particular species decrease in waters greater than 20 meters and distances greater than 7.6 miles offshore. This is encouraging as the NJ WEA is mainly in waters greater than 20 meters. However, it is important to note that in the spring there was a higher concentration of birds in waters deeper than 20 meters – of these, the most abundant species was the northern gannet. Additionally, birds were found in even deeper waters, greater than 30 meters, in the summer; the laughing gull was the most abundant species.

[4] White House Council on Environmental Quality, Executive Office of the President, Final Recommendations of the Interagency Ocean Policy Task Force, 15-17 (2010), *available at* http://www.whitehouse.gov/files/documents/OPTF_FinalRecs.pdf.

[5] *Id* at 63.

- During the NJ Baseline Study, the following species were identified within the WEA: North Atlantic right whale, fin whale, humpback whale, minke whale, bottlenose dolphin, short-beaked common dolphin, harbor porpoise and harbor seal. Based on modeling results, the threatened and endangered marine mammals (the North Atlantic right whale, the fin whale, and the humpback whale) were predicted throughout the NJ Baseline Study area, but can be seen particularly within the northern portion of the WEA in depths that were identified between 12 to 26 meters roughly 2 and 31 kilometers from shore, largely offshore of Little Egg Harbor. (See marine mammal mapping at Figures 16-21, 24-25.)

- Preliminary bat data shows that the most common bat found within the New Jersey WEA is the Eastern red bat. (See Figure 15.) Bats were identified up to 21 kilometers from shore, however, average distances ranged from 8 to 12 kilometers from shore. Offshore results showed that detections were higher in the fall, while onshore results showed that detections peaked during summer months.

WEA Expert Analysis

We worked with the following marine resources experts to improve our understanding of some of the potential conflicts identified by our mapping effort:

(1) Marine mammal impacts: Christopher Clark, I.P. Johnson Director of Bioacoustics Research Program, Cornell Lab of Ornithology (http://vivo.cornell.edu/display/individual5549);

(2) Avian impacts: Andrew Farnsworth, Research Associate, Conservation Science Program, Cornell Lab of Ornithology;[6]

(3) Bat impacts: Thomas H. Kunz, Professor of Biology and the Director of the Center for Ecology and Conservation Biology at Boston University (http://www.bu.edu/cecb/bats/kunz-bio/); and

(4) Fish and sea turtle impacts: John A. Musick, Professor of Marine Science, Emeritus, Virginia Institute of Marine Science (http://www.vims.edu/about/directory/faculty/musick.php).

Below please see the key findings from the experts' analyses of possible impacts that could be caused by construction and/or operation of wind turbines within the New Jersey WEA, as well as within the WEAs proposed for the waters offshore of Maryland, Delaware and Virginia.[7] To the extent possible, the experts also identified mitigation measures to offset such impacts. All the experts stressed the need for additional data and their recommended studies are presented here.

We point out the overlap of these specific biological and habitat resources with portions of the WEAs in order to stress the importance of studying the potential impacts of offshore energy development

[6] With respect to potential avian impacts, we also consulted with David Mizrahi, Vice-president for Research and Monitoring, New Jersey Audubon (http://www.njaudubon.org/SectionResearch/MeetOurStaff.aspx).

[7] Final expert assessments will be provided separately.

generally and of specific offshore wind projects in these areas, particularly as a cumulative matter, and the importance of developing appropriate mitigation measures. Due to the lack of data, we are not at this time advocating for specific changes in the WEA boundaries; if and when the necessary data becomes available in the future, we may recommend discrete boundary changes.

We stress that all forms of electricity generation have adverse environmental impacts, and that the coal-fired generation that still provides almost fifty percent of electricity in the United States has particularly grievous and wide-ranging – indeed catastrophic – environmental impacts. It is for this reason that we support well-sited and appropriately mitigated offshore wind projects as a key part of our energy future.

Potential Avian Impacts and Mitigation Measures/ Additional Data Needs

According to Dr. Andrew Farnsworth's analysis to date from the limited data available, the nearer shore and shallower areas within the WEAs appear to be important feeding and migration areas for loons, terns, and scoters; depending on the presence of fish, gannets may also use these areas. This potential conflict can be clearly seen with the NJ WEA; whereas only limited data are available for the other WEAs, impacts on the same suite of species are also likely at these sites. The WEA areas could additionally offer critical habitat, both at the surface and in the airspace above the water, for large numbers of migrant waterbirds, shorebirds, and passerines in the spring and fall. Dr. Farnsworth suggested that the WEAs will have large numbers of migrant waterbirds, shorebirds, and passerines during March, May, August and November, especially under certain weather conditions, such as stalled frontal boundaries where favorable migration conditions and poor visibility exist simultaneously. Data on such movements of these species through the WEAs is essentially non-existent.

The existing mapping is not detailed enough to define the particular interactions between birds and turbines or the extent to which impacts would occur.[8] For the sample of species included in the mapping from the NJ Baseline Study, the overlaps in bird distributions and the WEAs are sufficient to suggest potentially significant impacts, at least with respect to the shallower and near shore blocks. Such impacts could include displacement from the prime feeding areas within shallow water and nearer shore blocks and/or collision with operational turbines or support structures.

Overall, so few data on distributions of birds offshore – both local movement and large-scale migrations – exist that determining the nature and extent of adverse effects from wind development and operation is not currently possible. A multi-year, robust regional study of birds is needed to determine the temporal patterns of movement and the flying altitude of a variety of birds. A year or two of data collection – as was done for the high quality but limited in temporal scope NJ Baseline Study – cannot account for variations in patterns caused by multi-year meteorological or oceanic cycles. Further, a cohesive study of the potential trophic effects from turbine construction and operation (*e.g.*, if fish are drawn to the artificial reef created by the turbines or if fish leave the area due to habitat disruption what will that mean for bird populations that prey on these species?) is

[8] According to David Mizrahi, the reason for this is that the data are helpful in suggesting occupancy of certain species in certain times, but do not provide insight into how long the species are at particular locations or how they are moving through the area. For example, does an individual travel to and from the space daily or does it arrive and remain there for extended periods of time?

needed. Studies must also account for alcids and other seabirds which occur primarily in the open ocean in this region.

The possible scale of displacement and disturbance among bird populations will vary, possibly greatly, as a result of seasonal differences, behavioral differences among species, and the availability of feeding and perching areas. It is recommended that multiple methods of study (*e.g.*, radar, thermal, acoustic, direct observation) be used within the region during all phases of pre-construction investigation, construction and operation to build an understanding of the risks involved and the mitigation efforts needed. Mitigation of operational turbines should include an assessment of what daily, seasonally, and annually periods are most likely to have bird distributions in or near the WEA in order to understand when and how to curtail operation.

Strict protocols for lighting are needed for all construction activities and operational turbines, as different wavelengths of flashing and non-flashing lights result in different behaviors from birds. Thus far, it appears that flashing lights of blue and green reduce conflicts; red and white lights should be eliminated from structures.

Potential Marine Mammal Impacts and Mitigation Measures/ Additional Data Needs

According to Dr. Christopher Clark's analysis to date temporal and spatial data for marine mammals in the Mid-Atlantic is sorely lacking. The maps that we provide as Attachment 2, and which are based on the NJ Baseline Study and visual data, are able to offer only a patchy look at marine mammal presence. Fin and humpback whales are routinely acoustically detected in the region from mid-fall through late winter; this is not reflected in the maps. Further, it was only recent efforts by Cornell University's Lab of Ornithology to continuously monitor for North Atlantic right whales offshore of New York and New Jersey that revealed that these whales were found from the coast to 70 miles offshore throughout the entire sampling periods in late winter and early spring. A significant effort using acoustical survey methods that provides baseline data on the occurrences, distributions and densities of marine mammals in the WEAs is needed to quantify marine mammal presence in regional waters.

Given limited data, the assumption is that the WEA areas offer potentially important, but possibly not critical, habitat for marine mammals during certain times of the year. Ongoing work by Duke and the University of North Carolina has begun to fill an important data gap on marine mammal seasonal occurrences and distributions in the southern part of the region, but more baseline data are needed. In the absence of strong data, a precautionary approach as with that recommended in the recent CMSP principles should be adopted to minimize the risks associated with offshore wind construction and development.

After further information is gathered, one key mitigation step is that construction should avoid migration periods or times when marine mammals are known or expected to be present. Highly endangered species like the North Atlantic right whale should not be exposed to the harm from possible ship strikes. Further, the potential acoustic impacts from pile driving and other acute noise-generating activities on marine mammals that rely on sound for communication and navigation need to be better quantified.

Potential Fish and Sea Turtle Impacts and Mitigation Measures/ Additional Data Needs

According to Dr. Jack Musick's analysis to date, the main potential impact to both fish and turtles from wind turbine construction will likely be the pressure waves caused by the sound from pile driving. Sharks, skates, rays and sea turtles will likely experience temporary impacts, but species like sea herring and menhaden that have a connection between their swim bladders and inner ear will detect the sound at greater distances and may avoid the area. For fish species adjacent to the sound, the sound has the potential to rupture swim bladders which would kill the fish immediately; however, this issue would probably be restricted to the initial startup of the drivers and might be mitigated by slow startup of the drivers.

Fish within the identified WEAs tend to feed on a variety of prey, allowing them to feed in a variety of areas and thus they are unlikely to suffer serious impacts from habitat disturbance as a result of wind energy development. The following exceptions, which should be explored for protection from impacts, are:

- The inner edge of the WEA located off of Beach Haven, New Jersey where spawning aggregations of weakfish have been documented;

- Hard bottom or structured habitat available for black sea bass, tautog and cunner; and

- The innermost sections of the WEA blocks nearest to the entrance of Chesapeake Bay and off of Northern New Jersey that are important for Atlantic sturgeon, which is under review by the National Marine Fisheries Service for listing under the Endangered Species Act.

Loggerhead turtles consume a variety of benthic macroinvertebrates and areas with dense populations of species like horseshoe crabs, snails and bivalves might need protection to ensure healthy loggerhead populations. Experts on invertebrate populations would need to be consulted to determine how such areas could be identified.

It should be noted that a major problem in interpreting sea turtle sighting data is that visibility is determined by turtles surfacing; diving patterns, however, can vary by a factor of five or more depending on season, hydrography and turtle behavior mode. For instance, research has shown that loggerheads in lower Chesapeake Bay in the summer spend approximately five percent of the time on the surface and ninety-five percent foraging on the bottom while along the coast in spring during active migration, and when they first enter the bay mouth, they may spend more than twenty percent of their time on the surface. Sea turtle sightings data must be interpreted along with specific information on diving behavior.

Of additional concern with regards to construction is that it will bring increased boat traffic, and, with this, increased ship strikes. Currently, ship strikes are a major cause of turtle strandings in the region. Given that loggerheads primarily use channel edges and inlets, regulating boat speed of vessels involved in WEA construction in these areas might help mitigate such vessel strikes.

Once construction ends, the potential impacts on fishes and sea turtles from wind turbine operations will likely be primarily from low frequency sounds and the electromagnetic fields induced around the DC cables that are used to transport the energy to shore. While the impact of turbine sounds appears to have little negative effect on fishes, the nature of the low frequency sounds is complex and relies

on wind speed, water depth, substrate and number of turbines. Additional research is needed on local fish species in order to determine any harmful effects. The electromagnetic fields from transmission cables offer a greater concern, as many fish and sea turtles are capable of detecting magnetic fields and may use the Earth's magnetic field in orientation and migration. At least some of the transmission cables from the WEAs will run perpendicular to the coast – across the inshore migratory corridor used by a majority of migratory fishes. Sharks, skates, rays and sturgeon are particularly sensitive to very weak electric fields such as those produced by prey organisms and it is unclear what impact the electromagnetic fields from cables will have on them. Burial and shielding will mitigate impacts at least partially, but potentially not completely. The potential effect of transmission line geomagnetic fields on sea turtle behavior should also be researched.

Potential Bat Impacts and Mitigation Measures/ Additional Data Needs

According to Dr. Thomas Kunz's analysis to date, operational offshore turbines within the WEAs pose the potential for impacts to populations of migratory tree-roosting species in the eastern United States (*e.g.*, eastern red bat, silver-haired bat and hoary bat). Onshore studies have found that migratory tree bats actively investigate turbines – stationary and moving – perhaps as stop-over habitat, making them highly susceptible to deaths from direct strikes or barotrauma. Of increased concern is the fact that bats are mating at the same time of the year that they are migrating.

No studies to date have explicitly focused on the interactions of bats with offshore facilities; all existing data stems from onshore studies and anecdotal observations. Further, data is lacking with respect to bat migration through the WEAs. The University of Maryland project suffered from not being able to acoustically differentiate between all bat species. Additional acoustic monitoring, radiotracking, and infrared thermal imaging are needed before conclusions can be made regarding bat presence in the WEAs and the possibilities for interaction with wind turbines. Pre-construction studies should address the presence and temporal and spatial variation of bat populations at project sites and within the WEAs.

Post-construction studies onshore might offer lessons for the offshore environment. Onshore studies have indicated that changing the cut-in speed (the minimum speed at which a turbine could operate), and curtailment of turbine activity during periods of spring and fall migration, each of which are known to significantly reduce deaths from wind turbines. Bats and their insect prey are more active when wind speed is less than 7 meters/second. Currently most utility scale turbines are programmed to operate at wind speed as low as 3 meters/ second – even though that is not the most optimal speed for energy generation. If cut-in speed was increased to 6.5 meters/second, bat fatalities could be significantly reduced. Curtailment could also be used during bat (and bird) migration periods, which in the Mid-Atlantic would be from roughly mid-August through early November.

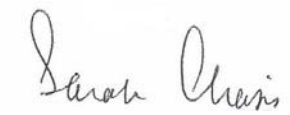
Conclusion

Offshore wind energy offers great promise for our nation's energy future, and we look forward to the development of the first generation of offshore wind projects in the United States with all deliberate speed. Furthermore, New Jersey is uniquely positioned to advance this important renewable energy resource given the passage of the Offshore Wind Economic Development Act ("OWEDA"). The New Jersey legislation essentially creates a carve-out for offshore wind generation within their Renewable Portfolio Standard ("RPS") using commodities known as Offshore Renewable Energy

Credits ("ORECs"). The goal is to have electricity suppliers obtain ORECs, demonstrating that their electricity has in fact come from offshore wind. Since New Jersey's RPS requires that 22.5 percent of their energy is sourced from renewable energy by 2021, offshore wind generation becomes a critical component for reaching this goal. NRDC is supportive of New Jersey reaching this goal in the most environmentally sustainable manner. To that end, BOEMRE should address the data needs identified in these comments in order to adequately understand and mitigate for potential conflicts between its development in the Mid-Atlantic and the protection of the region's important marine ecologic resources. We hope that the above information and questions will assist the BOEMRE in identifying appropriate field studies to be conducted, and in the agency's decision-making process regarding leasing and that these issues will be addressed in the regional EA, in a region-wide cumulative impacts analysis, and in project specific environmental review. We also reiterate our previous request that BOEMRE's Smart from the Start process incorporate the National Ocean Policy and the CMSP principles; this would be a key way to ensure both ecological protection and meaningful stakeholder engagement.

Thank you again for this opportunity to provide comments. We look forward to continuing to work with BOEMRE on this effort, which will enable our country to continue moving forward to build a clean energy economy.

Respectfully Submitted,



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Attachments

Attachment 1

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March 11, 2011

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Filed electronically via* www.regulations.gov *and by mail

Re: Comments on Mid-Atlantic WEA Regional EA

Dear Program Manager:

The Natural Resources Defense Council, Inc. ("NRDC") appreciates this opportunity to comment in response to the Bureau of Ocean Energy Management, Regulation and Enforcement's ("BOEMRE") preparation of an Environmental Assessment ("EA") to analyze the impacts of leasing and associated site characterization surveys and site assessment activities in prospective areas identified for priority commercial wind development, called Wind Energy Areas ("WEA"), located off the coast of several mid-Atlantic states. Notice of Intent to Prepare an Environmental Assessment for Mid-Atlantic Wind Energy Areas, 76 Fed. Reg. 7226 (Feb. 9, 2011). NRDC is an international environmental advocacy organization headquartered in New York City, with over 1.3 million members and e-activists. NRDC uses law, science and the support of our members and online activists to protect the planet's natural resources and ensure a safe and healthy environment for all living things; mitigating climate change impacts, protecting the marine environment all while advancing a clean renewable energy future are critical priorities for NRDC.

NRDC has long been a strong supporter of clean renewable energy. The technology for producing electricity from wind energy has improved greatly over the past twenty-five years, and wind—on and offshore—now represents one of the most promising sources of emissions free electricity. To that end, the United States has the potential to be a world leader on clean energy, including wind power and offshore wind technologies.

There are currently no offshore wind projects in operation in the United States. The decade long rigorous regulatory and environmental review process for the Cape Wind project both demonstrated that the environmental benefits of the Cape Wind project outweighed its impacts, and highlighted the need for a thorough approval process that can be completed in a reasonable period of time. As a result, stakeholders are now paying close attention to how to improve the existing permitting and environmental review process of granting leases to domestic offshore wind projects. In many states a new coal-fired power plant can be sited in two years, but BOEMRE has estimated that it will take between seven to nine years for an offshore wind project to go through the approval process under current procedures. Clearly, we must rectify this cumbersome process in order to move forward with the first generation of offshore wind projects and we're pleased that DOI is taking steps to do just that.

Additional proposals for offshore wind projects highlight the benefits and impacts of this renewable technology in the post-Deepwater Horizon oil spill era. The potential benefits of these projects are undeniable and the need to properly assess their environmental impacts remains a priority. Fortunately, the Administration's "Smart from the Start" initiative is specifically designed to address these concerns.

It is also essential that this process is carried out in a careful, transparent and environmentally responsible way that protects the marine environment and is fully consistent with applicable environmental laws and the President's recent Executive Order creating a national ocean policy. To that end, we submit the following comments on the proposed notice.

Leasing Instrument Clarification

NRDC supports a process that will expedite prompt site characterization and assessment, while at the same time ensuring that no development rights are granted until after there has been a full environmental review of the proposed project and the project has been approved.

For this reason, it is imperative that BOEMRE clarify the nature of the leases they intend to issue for these WEAs. The following principles endeavor to ensure thorough and well-timed environmental review, investor certainty, and a streamlined process for achieving and adhering to these principles:

- The lease shall ensure that no other party will be granted any right or interest that would interfere with the conduct of reasonable site assessment and characterization activities for the lease site.
- The lease shall provide the lessee with the exclusive right to apply for the approval of a COP for the site and with the right to have no COP application from other potential lessees considered unless the lease has been terminated by the Secretary. "Bases for termination shall include, but are not limited to, a lessee's abandonment of the lease or failure to make sufficient progress toward an approvable COP."
- The lease shall confer no right of occupancy on submerged lands of the OCS other than for routine site characterization and assessment activities.

- The grant of a lease shall in no way affect or impair the Secretary of the Interior's authority to deny pursuant to the factors in OCSLA section 8(p), without compensation, development rights to the lessee in connection with its review of the COP.

Clarifications Regarding NEPA Compliance

BOEMRE is currently planning to conduct two NEPA analyses throughout the process of leasing and developing wind energy projects throughout the four WEAs: the regional EA that is the subject of this Notice and separate Environmental Impact Statements ("EIS") or EAs in conjunction with each COP that is submitted for approval. The notice envisions that the proposed regional EA would constitute NEPA compliance throughout both the leasing and site assessment plan ("SAP") stages for all leases issued in the areas covered by the WEAs (approximately 900 square miles). The proposed scope of the EA would be limited to the environmental effects of site assessment or characterization activities and would not assess the construction and operations stage of development.

We have several points of concern. First, in order to justify preparation of an EA, rather than a full-fledged EIS, DOI must make absolutely clear that only highly conditioned leases will be issued and no irretrievable commitment of resources will be made with the issuance of these leases. Commercial leases that confer exclusive rights to construct and operate wind farms, unless highly conditioned, could severely limit the Government's ability to tailor future wind energy development based on future assessments of development impacts, including cumulative impacts. The highly conditioned leases should follow the principles annunciated above. To that end, we request that a model lease instrument be provided in advance of the lease sales, so the public can review and comment on the type of lease envisioned. If the proposed leases constrain the Secretary's ability to deny development of these leases, without compensation, following NEPA review of the COP, then DOI should prepare an EIS prior to lease issuance.

Second, the NOI notes that NEPA analysis for a future submitted COP "will likely take the form of an EIS." We believe that the Department of Interior should clarify that a full EIS will be prepared prior to approval of any individual COP. Full environmental review of a project is required under law, needed to protect wildlife and other natural resources, and important for securing public support for projects. Developers would not receive the right to erect any wind turbines until the Government conducts an EIS analyzing all potential impacts of the project, and reviews and approves the developer's COP.

Third, it is important to ensure that the proposed NEPA review process adequately provides for comprehensive assessment of the cumulative impacts and indirect effects of multiple projects that are likely to flow directly from the proposed action. It is important that, before COP approval, a comprehensive EIS is prepared that analyzes not only a single project, but also the cumulative impacts of reasonably foreseeable offshore wind energy projects in the region and of their accompanying transmission infrastructure. This analysis is needed to ensure that, as development of the various WEAs proceed, adequate attention is given to the collective impacts of these projects on migrating whales, sea birds, and other wildlife and habitats so that appropriate mitigation and ecosystem management efforts can be applied.

NEPA requires BOEMRE to take a "hard look" at the cumulative and indirect effects of developing multiple wind energy projects along a large swath of the mid-Atlantic coast.[1] Such an overarching analysis is not only required by NEPA,[2] but would also provide important information for effective marine spatial planning that is crucial to minimizing potential resource conflicts and environmental harm while maximizing the sustainable use of the oceans.

One suggested approach could be to prepare a regional EIS on the cumulative and indirect impacts of multiple wind farms in the WEAs concurrent with the site assessment activities that would be approved under the more limited EA being proposed now. Another approach would conduct such analysis within the EIS submitted with the first COP application. Either of these approaches enables developers to begin gathering essential data within the timeline proposed as part of the Smart from the Start Initiative, but also ensures that a more comprehensive environmental analysis is conducted before construction and operations begin.

Integration of National Ocean Policy and Coastal Marine Spatial Planning Principles

Last July, the President issued Executive Order ("EO") 13457 establishing a first-ever national ocean policy.[3] That policy states that it is the policy of the United States to protect, maintain, and restore the health and biological productivity of ocean, coastal and Great Lakes ecosystems and resources.[4] The EO also adopts the recommendations of the Interagency Ocean Policy Task Force and that directs agencies to implement those recommendations.[5] Those recommendations in turn call for agency decision-making to be guided by stewardship principles in furtherance of the national ocean policy, including the following:

[1] National Environmental Policy Act (NEPA) of 1969 § 102(C), 42 U.S.C. § 4332(2)(C) (1970); *Marsh v. Or. Natural Res. Council*, 490 U.S. 360, 368-71 (1989); *see* 40 C.F.R. § 1508.7 (1978) (defining "cumulative impact" as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time."); 40 C.F.R. § 1508.8(b) (1978) (defining "indirect effects" as those that are "caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems."). *See also Atchison, Topeka and Santa Fe Ry. Co. v. Alexander*, 480 F. Supp.980, 996 (D.D.C. 1979) (establishing "that under NEPA an EIS for one project must discuss the impact of other which are so related as to be part of the same 'action.' . . . The cumulative environmental impact of a planned series of related projects cannot be shielded by the preparation of separate EISs.").

[2] *See Kleppe v. Sierra Club*, 427 U.S. 390, 410 (1976) (". . . when several proposals for . . . actions that will have cumulative or synergistic environmental impact upon a region are pending concurrently before an agency, their environmental consequences must be considered together."); *LeFlamme v. FERC*, 842 F.2d 1063, 1072 (9th Cir. 1988) (requiring FERC to consider "all past, present, and reasonably foreseeable" impacts "future projects may have on" the American River Basin prior to issuing a license for the "initial development" of the basin.); *see also Nat'l Audubon Soc'y v. Dep't. of Navy*, 422 F.3d 174, 196 (6th Cir. 2005) (requiring Navy to consider cumulative impacts of flights from proposed aircraft landing field with existing military flights).

[3] Exec. Order No. 13,547, 75 Fed. Reg. 43023 (July 22, 2010).

[4] *Id.* at § 2(a)(i).

[5] *Id.* at § 1.

- Policies, programs, and activities of the United States should be managed and conducted in a manner that seeks to prevent or minimize adverse environmental impacts to the ocean, our coasts, and the Great Lakes ecosystems and resources, including cumulative impacts, and to ensure and improve their integrity. They should be managed and conducted in a manner that does not undermine efforts to protect, maintain, and restore healthy and biologically diverse ecosystems and the full range of services they provide.

- Decision-making will be guided by a precautionary approach as reflected in the Rio Declaration of 1992, which states in pertinent part, "[w]here there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."

- Actions should endeavor to promote the principles that environmental damage should be avoided wherever practicable and that environmental costs should be internalized, taking into account the approach that those who cause environmental damage should generally bear the cost of that damage.[6]

DOI should explicitly commit to adhering to the national ocean policy and principles in its implementation of the Smart from the Start program. While Coastal and Marine Spatial Plans are not yet in place, CMSP principles can still be brought to bear on the process.[7] Finally, DOI should also ensure that it is fully utilizing the resources and mechanism of the National Ocean Council ("NOC"), established by the EO, to coordinate its program with those of other federal agencies managing activities and resources in the same geographic area.

As part of fulfilling these requirements, NRDC recommends that the following elements should be integrated throughout the offshore wind planning and deployment process:

- Identification and protection of ecologically important and sensitive areas and species.
- Conduct of an open and transparent process.
- Development of important baseline environmental data (*e.g.*, habitat mapping) for the purposes of ensuring environmentally protective offshore renewable energy siting, construction and operations.
- Provision of publically accessible data including thorough digital maps that can be queried and manipulated as decision-support tools.
- Plans that anticipate and address the potential build-out and cumulative impacts that could arise from the siting of multiple renewable energy facilities.
- Greater certainty for renewable energy developers—reductions in commercial risk and net regulatory burden.

[6] WHITE HOUSE COUNCIL ON ENV'TL QUALITY, EXECUTIVE OFFICE OF THE PRESIDENT, FINAL RECOMMENDATIONS OF THE INTERAGENCY OCEAN POLICY TASK FORCE, 15-17 (2010), *available at* http://www.whitehouse.gov/files/documents/OPTF_FinalRecs.pdf.

[7] *Id.* at 18.

WEA Technical Analysis

NRDC recently initiated a study to help identify (a) potential conflicts between development of wind energy projects within the WEAs and the protection of important marine ecologic resources in the region, and (b) possible mitigation options for any such conflicts. As part of this study, we conducted an initial "Phase 1" round of mapping, which was limited in scope, in part, to enable completion for use in this scoping process. While our study is not yet complete, we briefly describe below the methodology utilized for the Phase 1 mapping and discuss key preliminary results with respect to potential conflicts, including by reference to selected maps (Attachment 1). We may provide supplemental mapping information to BOEMRE as the study proceeds.

Methodology for Phase 1 Mapping

For the Phase 1 mapping, we mapped a selected set of Geographic Information System ("GIS") biologic, habitat and other data layers together with the location of each of the WEAs. The biologic resources mapped in Phase 1 included:

- **Ten marine mammals** and **two sea turtle species-** presented in terms of sightings per unit effort ("SPUE") per season placed into five categories for display purposes: 0 (grey, no presence), 0-25% (green, low), 25-50% (yellow, moderate), 50-75% (orange, moderate-high), and 75-100% (red, high).
- **Ten marine fisheries-** presented in terms of weighted persistence (combination of abundance and persistence over time) per season placed into seven categories (0-7), with only categories 4 (3 decades, high abundance), 5 (4 decades, low abundance), and 6 (4 decades, high abundance) displayed in maps.
- **Four pelagic fisheries**- presented in terms of persistence per season and placed into four categories (0-4), with 0=no presence and 4=4 decades.
- **Pelagic species "richness"-** represents combined observations of fourteen pelagic species **(**albacore tuna, Atlantic bluefin tuna, bigeye thresher, blue marlin, dusky shark, great hammerhead, porbeagle, sand tiger, sandbar shark, scalloped hammerhead, shortfin mako, swordfish, thresher shark, and white marlin) and all life stages. This data is presented in seven categories with the highest category representing 26-30 different species and life stages.
- **Avian species for the New Jersey WEA and the portions of the Maryland and Delaware WEAs closest to the coast**- (a) for the New Jersey WEA, five specific species placed into six categories based on density (with 1=highest density and 6=zero observations), as well as avian "hotspots" (representing the top 20%); and (b) for the covered portions of the Maryland and Delaware WEAs, total waterbird observations placed into five categories based on density; Phase 1 mapping did not include avian species for the Virginia WEA.

We based the selection of specific species to be included in Phase 1 mapping based upon data availability, species vulnerability and species status.

Habitat resources mapped in Phase 1 included:

- **"Essential Fish Habitat"("EFH") for four pelagic species and, for the New Jersey WEA, EFH for seven marine species**, as determined by National Marine Fisheries Service of the National Oceanic and Atmospheric Administration ("NOAA") and which is presented according to life stage (spawning/egg/larvae, neonate, juvenile, and adult).
- **"Combined" EFH for fourteen pelagic species** (see above), which represents EFHs combined by species and life cycle to create a single EFH map.
- **"Habitat Areas of Particular Concern" ("HAPC") for sandbar shark**, as determined by NMFS.
- **Depth, slope, sediment type and grain size, seabed form, and benthic habitats**.

The primary source of datasets for both biologic and habitat resources was The Nature Conservancy's ("TNC") Northwest Atlantic Marine Ecological Assessment ("NAMERA"). Other data sources included United States Fish and Wildlife Service ("USFWS") and the National Oceanic and Atmospheric Administration ("NOAA"). For the New Jersey WEA, the New Jersey Ocean/Wind Power Ecological Baseline Study was an additional and important source of data for EFH and avian species.

A more detailed description of the Phase 1 mapping methodology is provided as Attachment 2.

Phase 1 Mapping Results

We highlight below certain overlaps of interest between the WEAs and specific biologic and habitat resources identified as a result of the Phase 1 mapping. We note that, in most cases, these mapped overlaps are relatively coarse in scale because most of the NAMERA datasets are provided in 10x10 minute grid blocks, where a single value for the grid square was derived from more detailed underlying data. A 10x10 minute square represents approximately 79 square nautical miles.

Virginia WEA

- For marine mammals, humpback whale, bottlenose dolphin, the North Atlantic right whale, and the Atlantic white-sided dolphin were the four species categorized as having a "moderate", "moderate-high", or "high" SPUE within or surrounding the Virginia WEA. Marine mammal presence was greatest during the winter, followed by spring. (Figures 1-8) (for Figures, see Attachment 1)

- For sea turtles, leatherbacks showed "low" to "moderate" values, while loggerheads showed "moderate", "moderate-high", and "high" values; the high value was in the loggerhead summer season. Sea turtle presence was greatest during the spring and summer. (Figures 9-13)

- For marine fisheries, black sea bass, scup, summer flounder, butterfish, spiny dogfish, and blueback herring all had high abundance and persistence (value 6) within or

surrounding the Virginia WEA. Fisheries presence (value 4, 5, or 6) was greater in spring than fall. (Figures 14-23)

- For pelagic species, Atlantic bluefin tuna and the sandbar shark had the highest persistence *within* the Virginia WEA. There was moderately high overlap between combined pelagic EFH and the WEA. (Figures 24-30)

Maryland and Delaware WEAs

- For marine mammals, North Atlantic right whales, and bottlenose dolphins were the species categorized with a "moderate" or "moderate-high" SPUE within or surrounding the Delaware and Maryland WEAs. Marine mammal presence was lowest in the fall, and even between winter, spring, and summer. (Figures 32-36)

- For sea turtles, both species showed "moderate", "moderate-high", and "high" values. Sea turtle presence was greatest during the spring and summer. (Figures 37-41)

- For marine fisheries, scup, summer flounder, butterfish, spiny dogfish, and blueback herring all had high abundance and persistence (value 6) in or around the WEAs; alewife, currently highly depleted, also had a value 4 (3 decades, high abundance). Fisheries presence (values 4, 5, or 6) was greater in spring than fall. (Figures 42-50)

- For pelagic species, the sandbar shark, Atlantic bluefin tuna, and sand tiger shark all showed strong persistence (4 decades) within or surrounding the Delaware and Maryland WEAs. The sandbar shark and sand tiger shark had three life stages of EFH within the Delaware and Maryland WEAs. Overlap of combined EFH with the WEAs was moderately high. (Figures 51-57)

- The Maryland and Delaware WEAs straddled the entirety of the 10-20 meter depth contour and the 10-30 meter depth contour in places, which is of concern considering some species or populations may preferentially migrate or forage in these depth ranges. Additional analysis of overlaps with benthic habitat and seabed forms is also warranted. (Figures 59-62)

New Jersey WEA

- For marine mammals, the fin whale, the minke whale, and the bottlenose dolphin had "moderate" or "moderate-high" SPUE within or surrounding the WEA. Marine mammal presence was greatest during the spring and summer. (Figures 63-70)

- For sea turtles, leatherbacks fell between the "low" to "high" categories during the spring, summer, and fall, while loggerheads were in the "low" to "moderate-high" categories in the summer and "low" category in the spring and fall. (Figures 71-76)

- For marine fisheries, black sea bass, scup, summer founder, butterfish, spiny dogfish, and blueback herring all had high abundance and persistence (value 6) within or surrounding

the New Jersey WEA. Fisheries presence (value 4, 5, or 6) was nearly equal in spring than fall. Black sea bass and summer founder also had EFH for at least 3 life stages within the New Jersey WEA. (Figures 77-96)

- For pelagic species, Atlantic bluefin tuna and the sandbar shark had the highest persistence *within* the New Jersey WEA. The sandbar shark was the only species examined to have high persistence (value 6) and EFH for all three life stages within the New Jersey WEA. There was significant overlap between combined pelagic EFH and the New Jersey WEA. (Figures 97-103)

- For the avian species examined, the common loon, the common tern, and the northern gannet had the highest densities within the New Jersey WEA. Avian species overlap with the New Jersey WEA was significant overall. (Figures 104-110)

- The New Jersey WEA straddled the entirety of the 10-20 meter isobaths, which is of concern considering some species or populations may preferentially migrate or forage in that range. (Figure 111)

Additional mapping and interpretive analyses are required to adequately understand potential conflicts between development of wind energy projects within the WEAs and the protection of important marine ecologic resources in the region, as well as to identify possible mitigation options for any such conflicts. Such additional mapping should include (1) more fine scale resolution of overlaps, (2) additional biologic resources, particularly avian species in the Virginia, Delaware, and Maryland WEAs, and (3) additional habitat information. In terms of interpretive analyses, cumulative impacts are of particular concern as indicated above; we note that Phase 1 mapping identified many of the same species across the WEAs. In addition, given that many of the marine species of interest are highly mobile, it will be critical to adequately understand the importance of specific areas of overlap in terms of individual species' life histories, movements and migrations, physiological vulnerabilities, and species' status and trends.

We ask that BOEMRE conduct such additional mapping and analysis as part of the regional EA. BOEMRE should ensure that the regional EA process specifically includes an analysis of the impact of the site assessment/characterization activities on potentially-affected marine species and their habitats (including cumulative impacts), identification and analysis of different alternative mitigation measures, and any necessary further studies to be able to determine potential impacts of construction and operation phases on these species and their habitat.

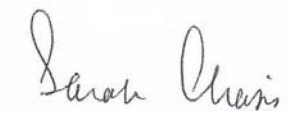
Conclusion

We thank you for the opportunity to provide comments on the scope of BOEMRE's planned Regional EA, lease issuance alternatives, and site assessment activities. This EA must account for the environmental benefits of developing the Mid-Atlantic region's offshore wind resources, including the global warming and other pollution risks of further delay in developing these resources and a prolonged dependence on fossil fuels, as well as the potential impacts of offshore wind development on ocean ecosystems and the identification of mitigation efforts necessary to accommodate a successful MSP regime. NRDC applauds BOEMRE's attention to these issues

and encourages additional opportunities for meaningful public stakeholder engagement. We look forward to remaining important stakeholders in this effort, which will enable our country to continue moving forward to build a clean energy economy.

Thank you again for this opportunity to provide comments.

Respectfully Submitted,



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Attachments

Attachment 1: FIGURES

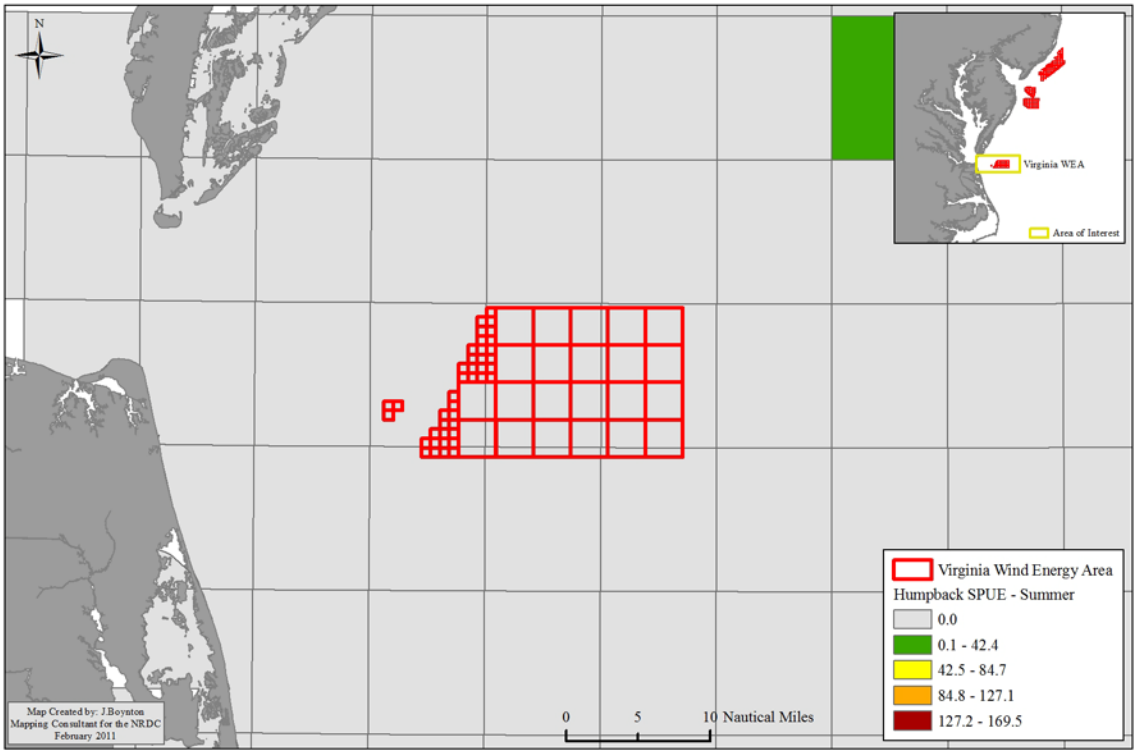

Figure 1: Humpback whale SPUE summer season - Virginia WEA

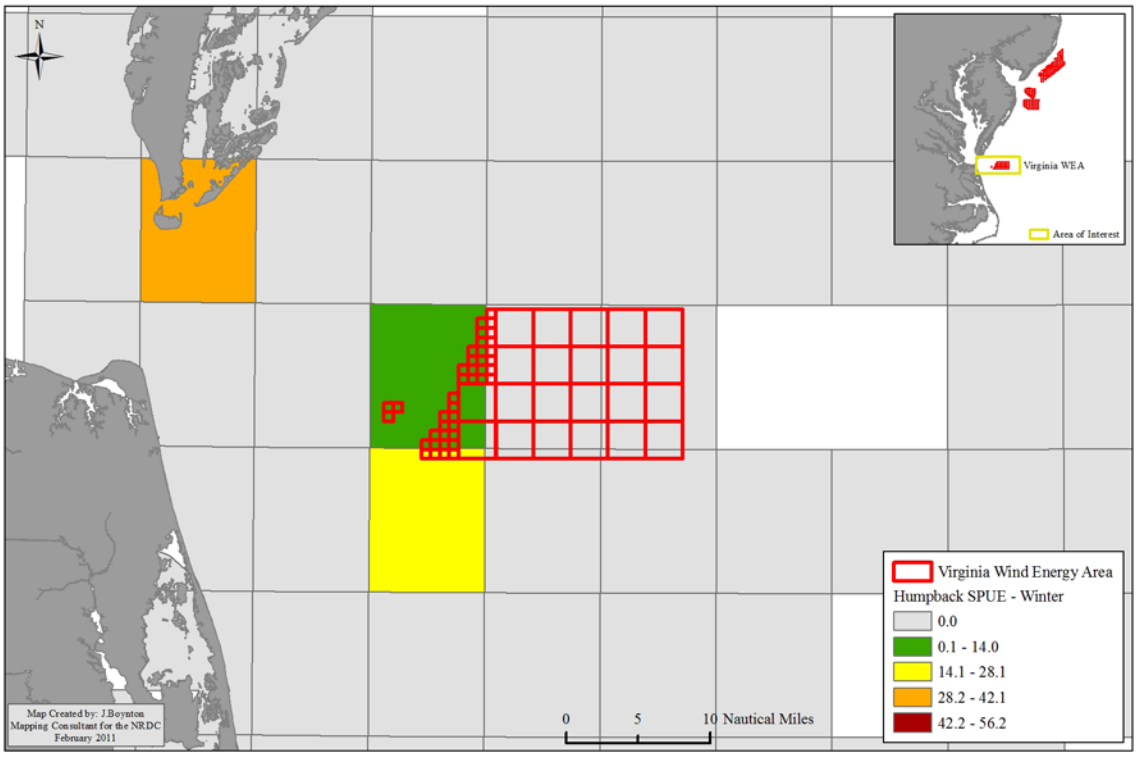

Figure 2: Humpback whale SPUE winter season - Virginia WEA

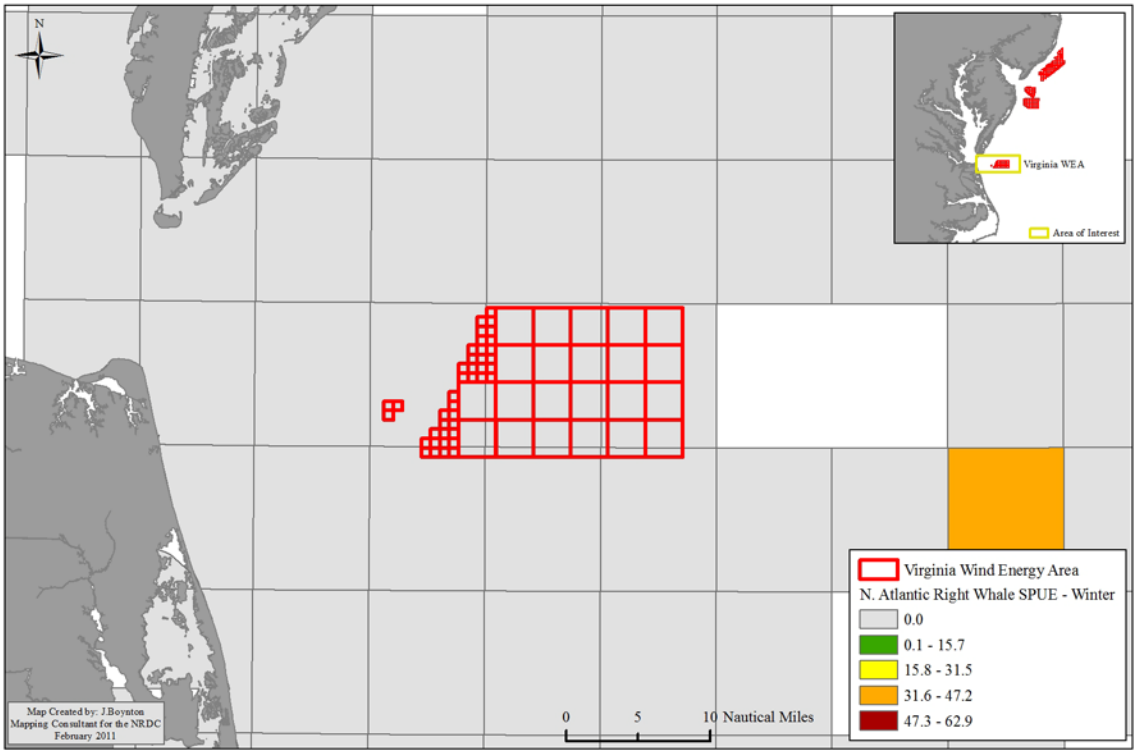

Figure 3: North Atlantic Right Whale SPUE winter season - Virginia WEA

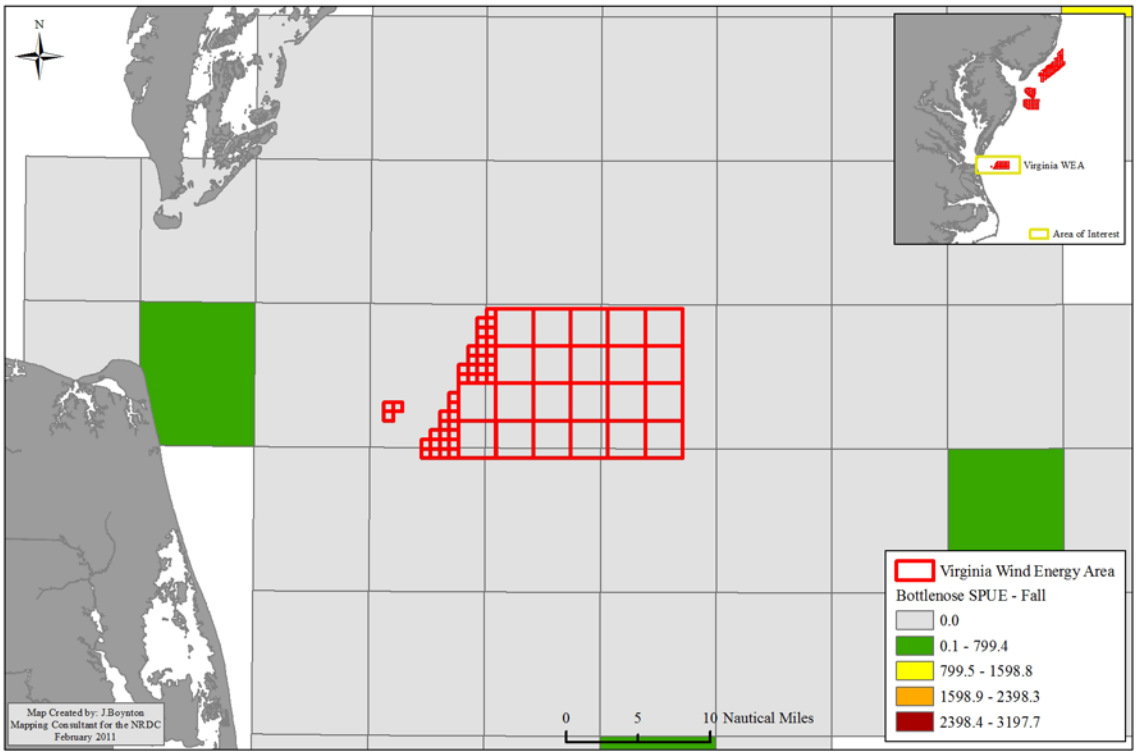

Figure 4: Bottlenose dolphin SPUE fall season - Virginia WEA

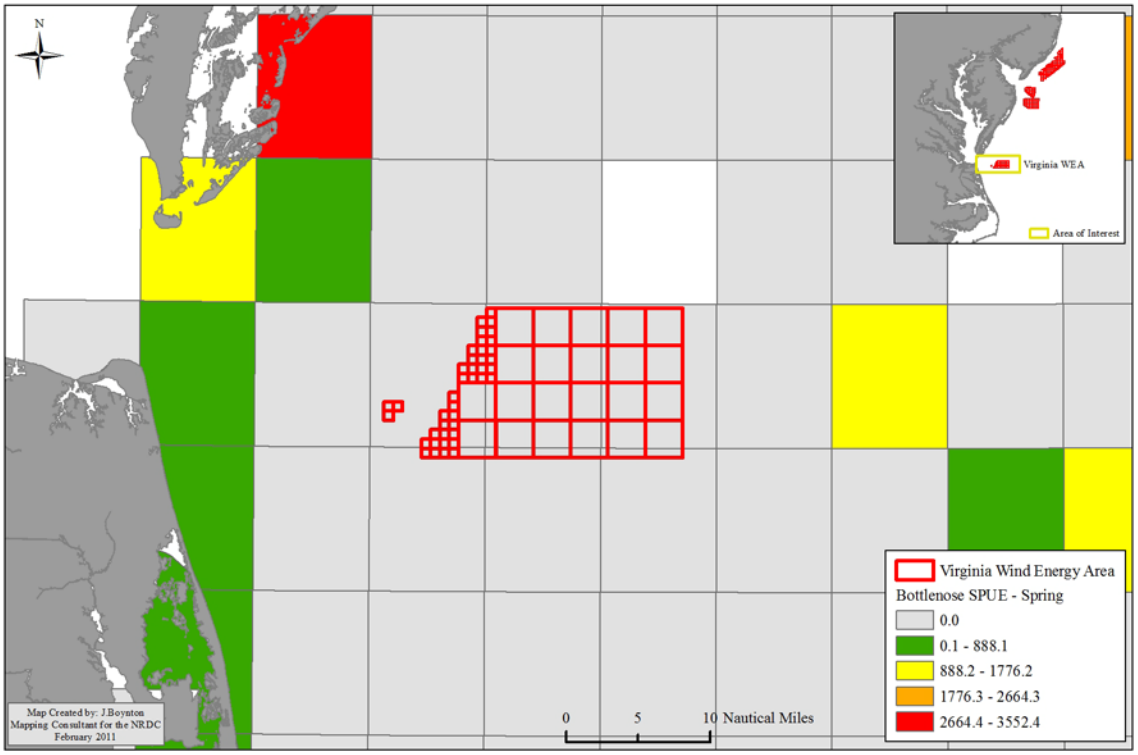

Figure 5: Bottlenose dolphin SPUE spring season - Virginia WEA

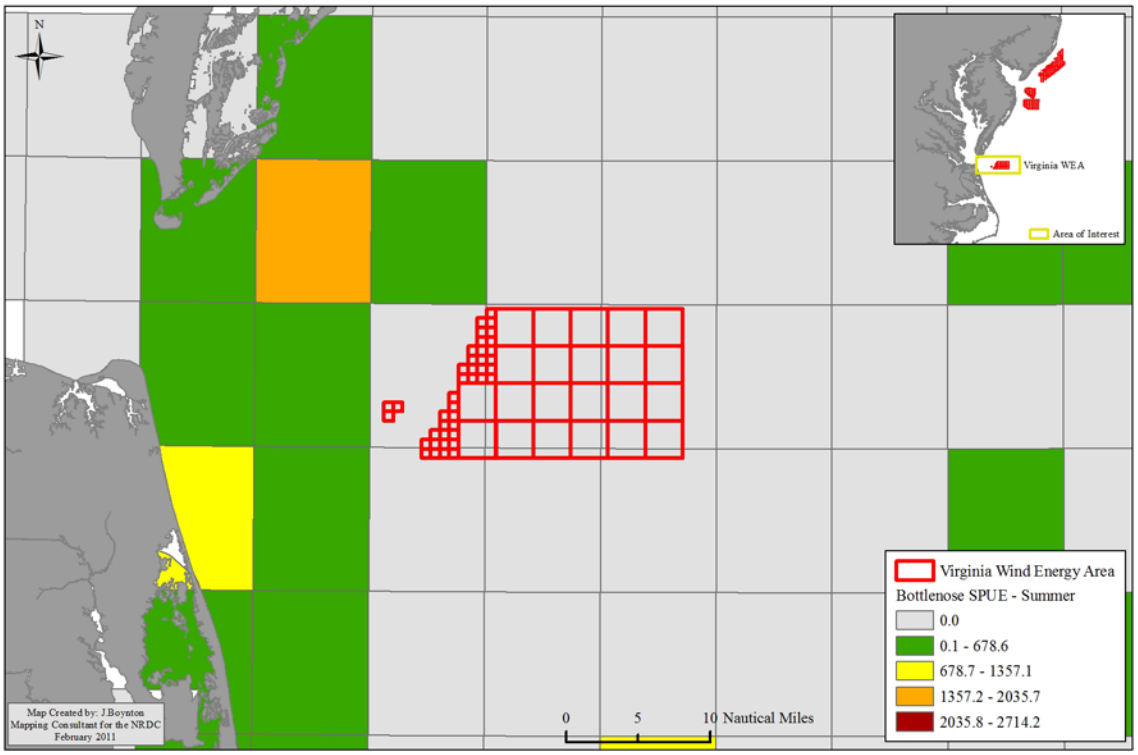

Figure 6: Bottlenose SPUE summer season - Virginia WEA

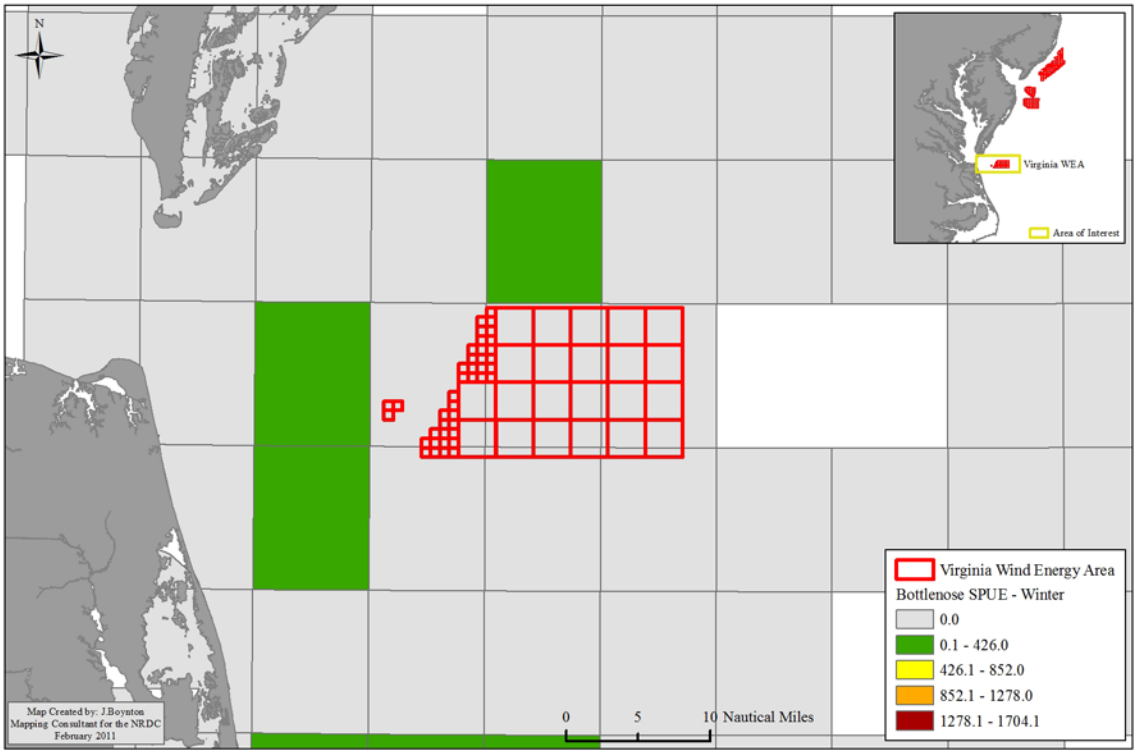

Figure 7: Bottlenose SPUE winter season - Virginia WEA

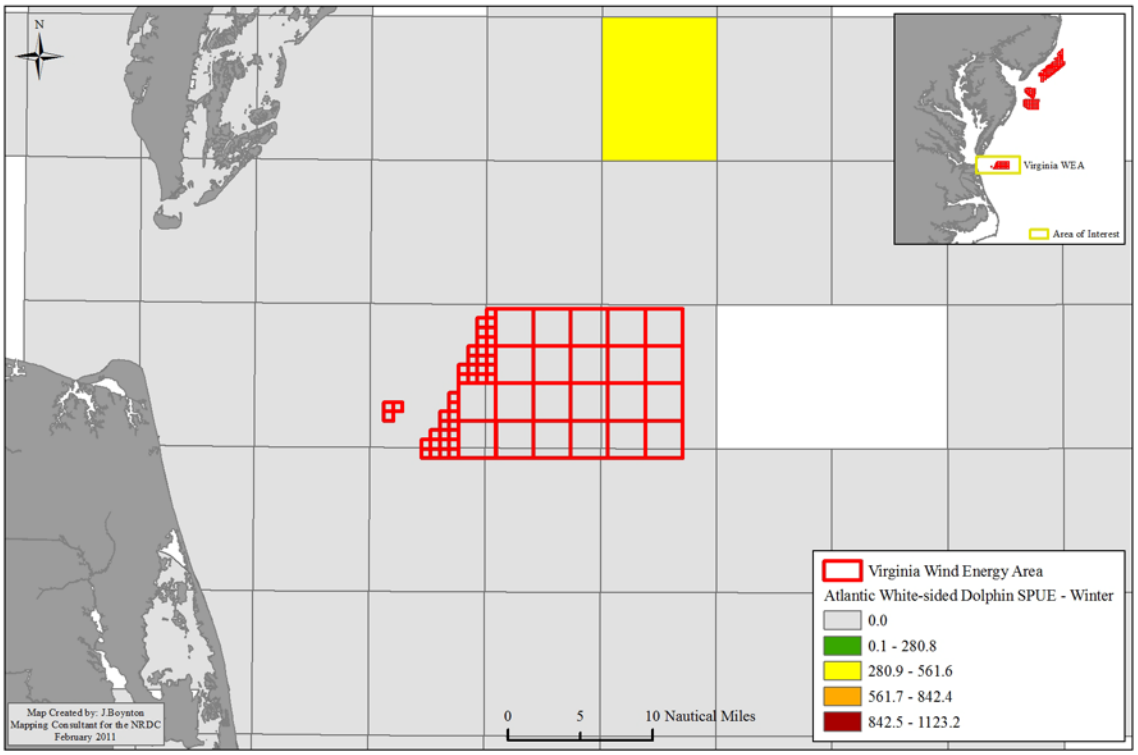

Figure 8: Atlantic white-sided dolphin SPUE winter season - Virginia WEA

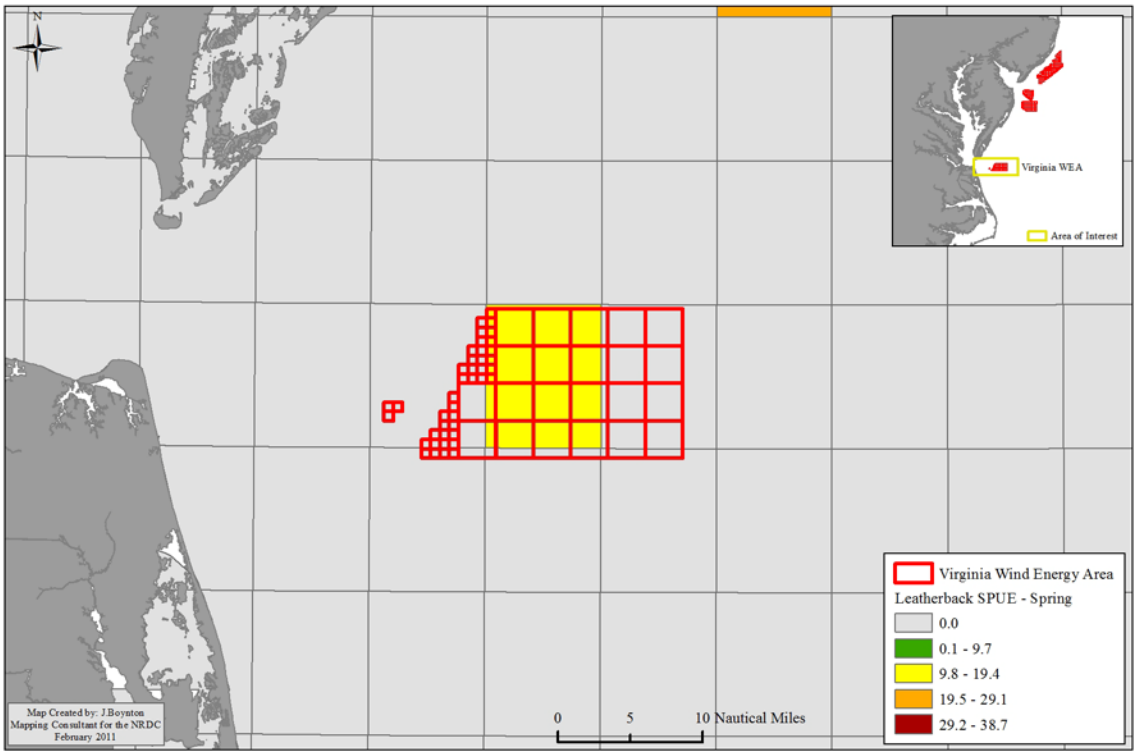

Figure 9: Leatherback SPUE spring season - Virginia WEA

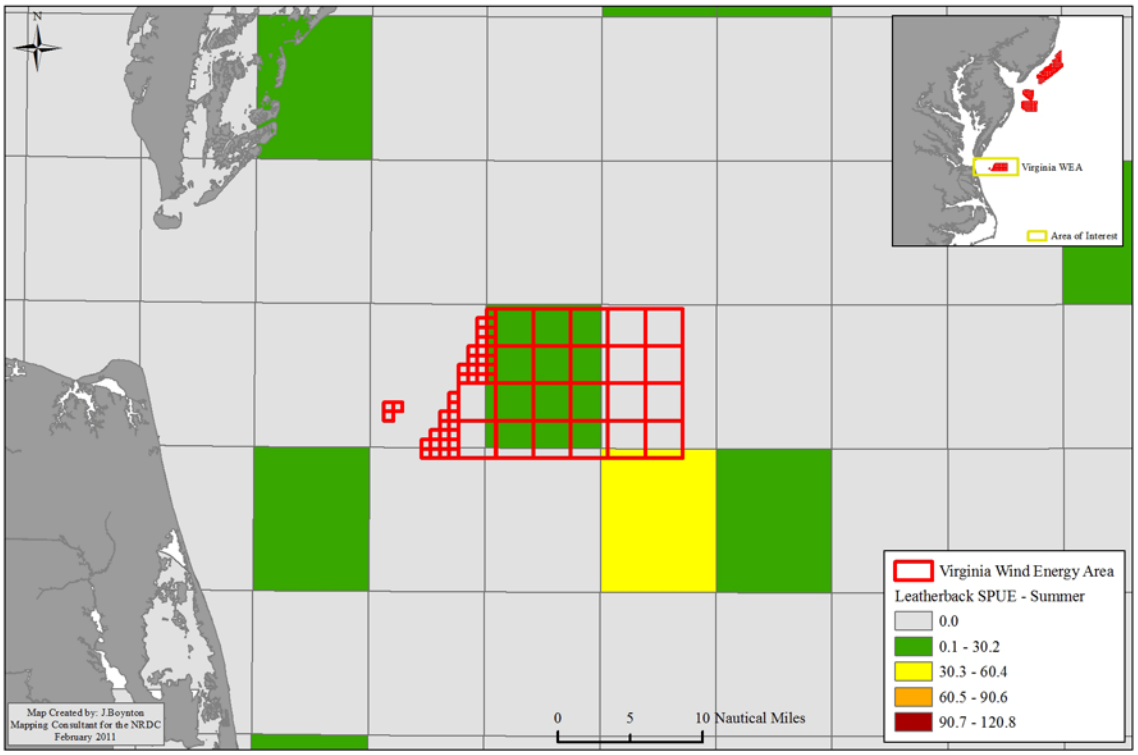

Figure 10: Leatherback SPUE summer season - Virginia WEA

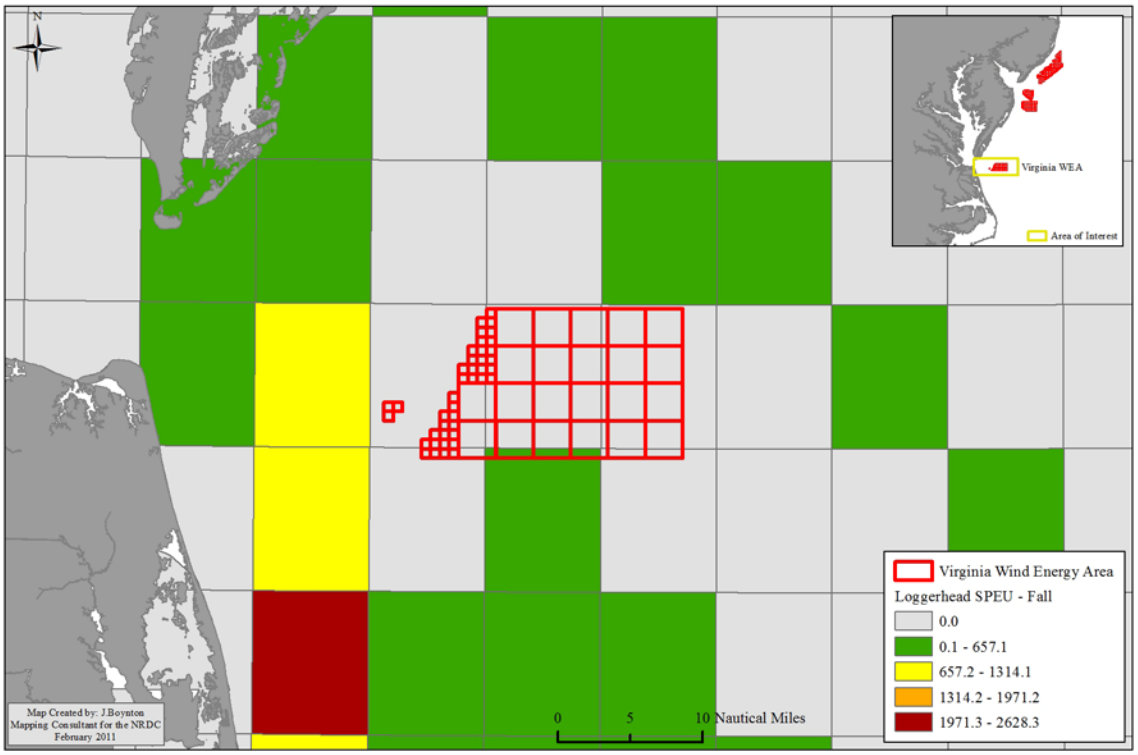

Figure 11: Loggerhead SPUE fall season - Virginia WEA

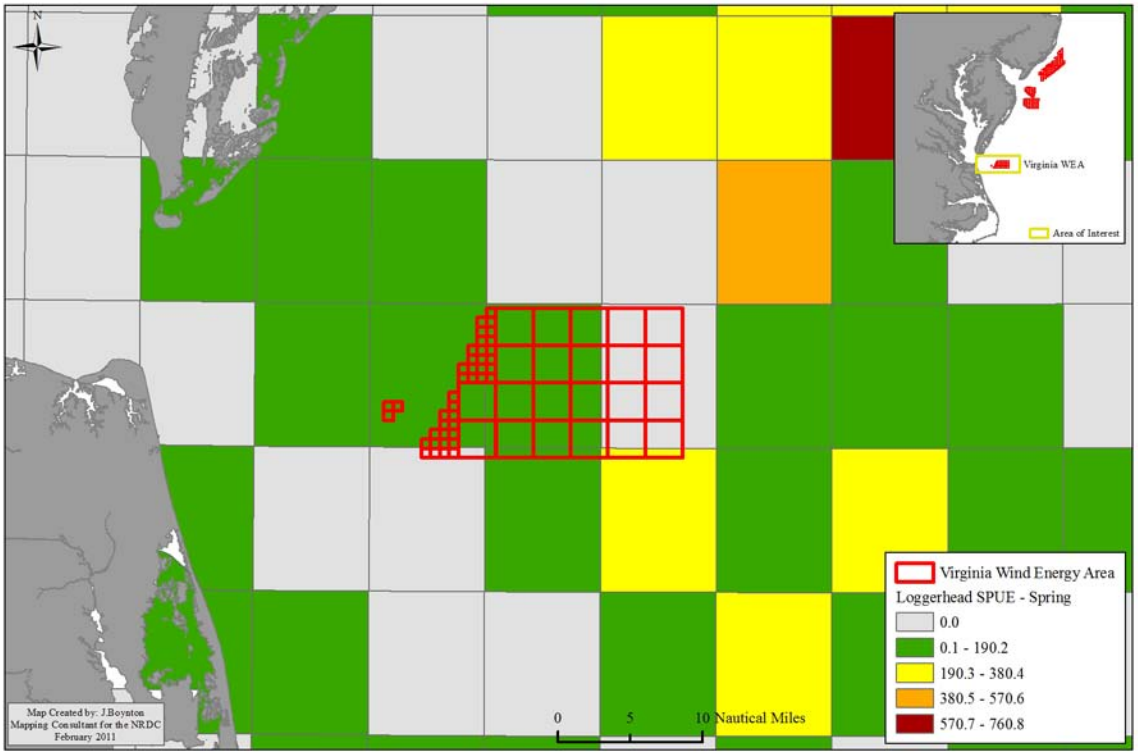

Figure 12: Loggerhead SPUE spring season - Virginia WEA

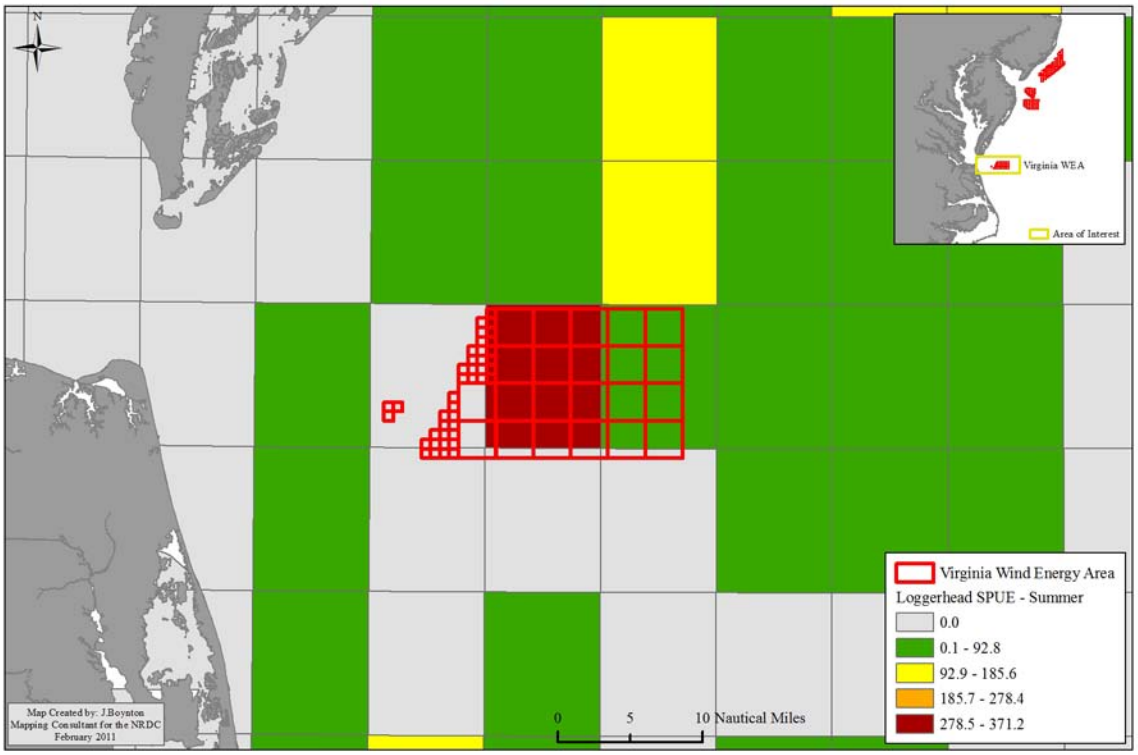

Figure 13: Loggerhead SPUE summer season - Virginia WEA

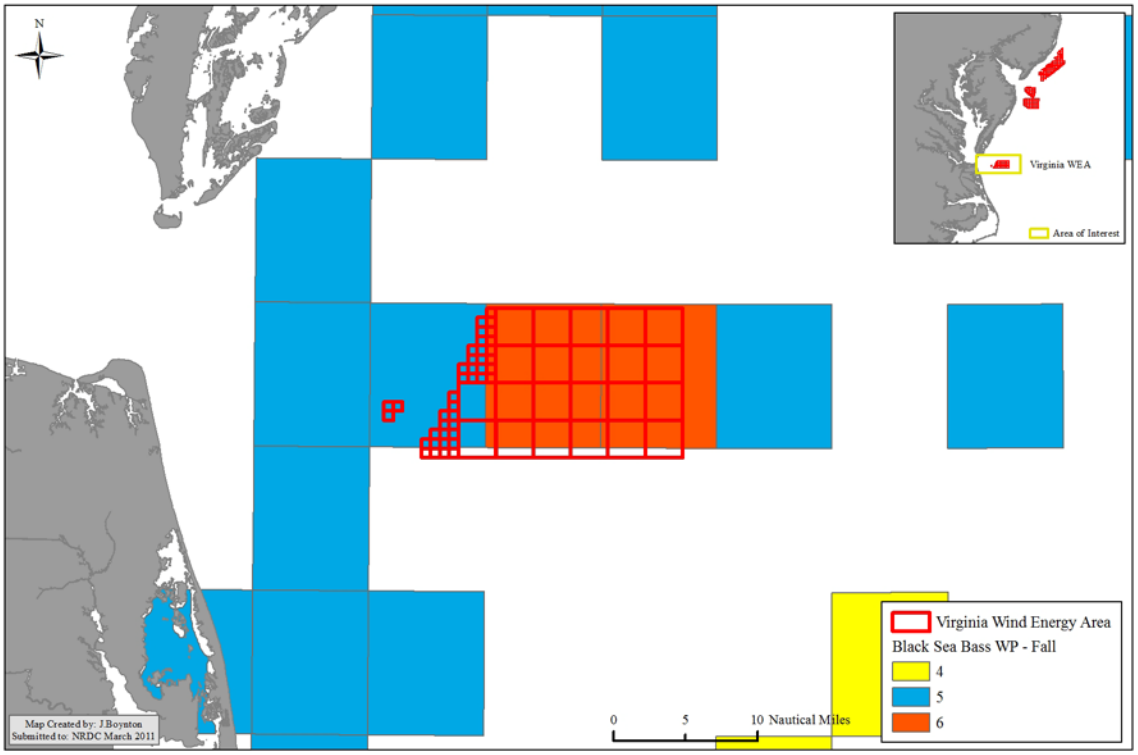

Figure 14: Black sea bass weighted persistence fall season - Virginia WEA

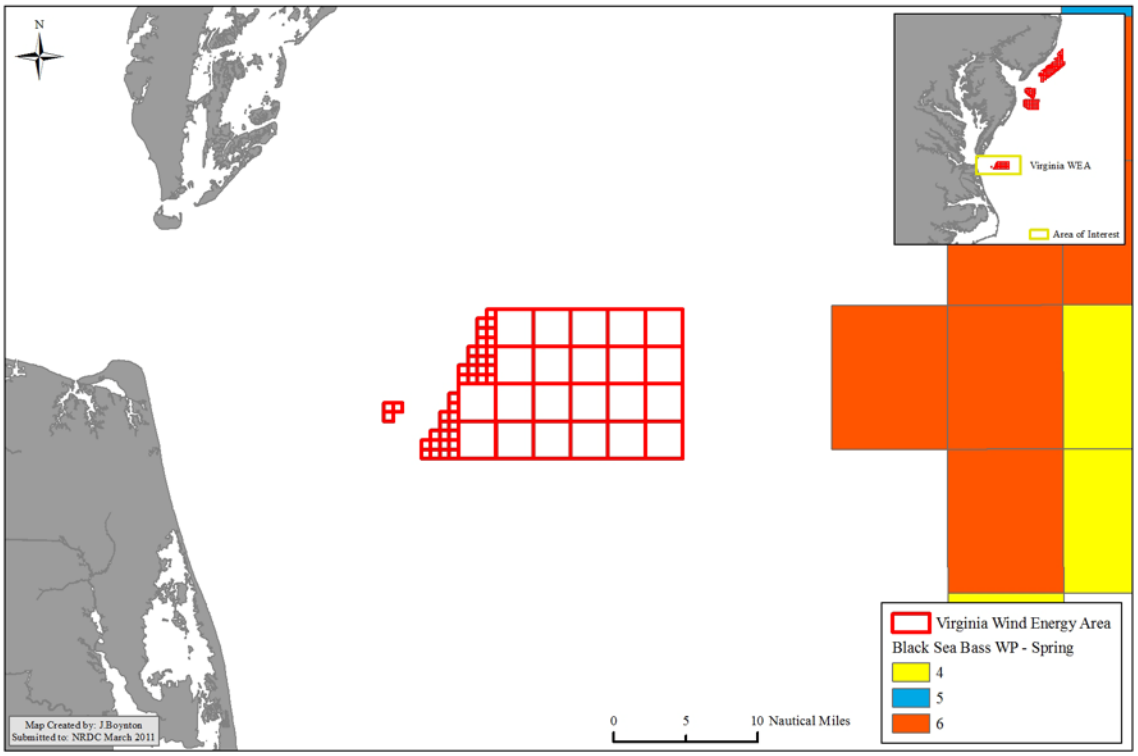

Figure 15: Black sea bass weighted persistence spring season - Virginia WEA

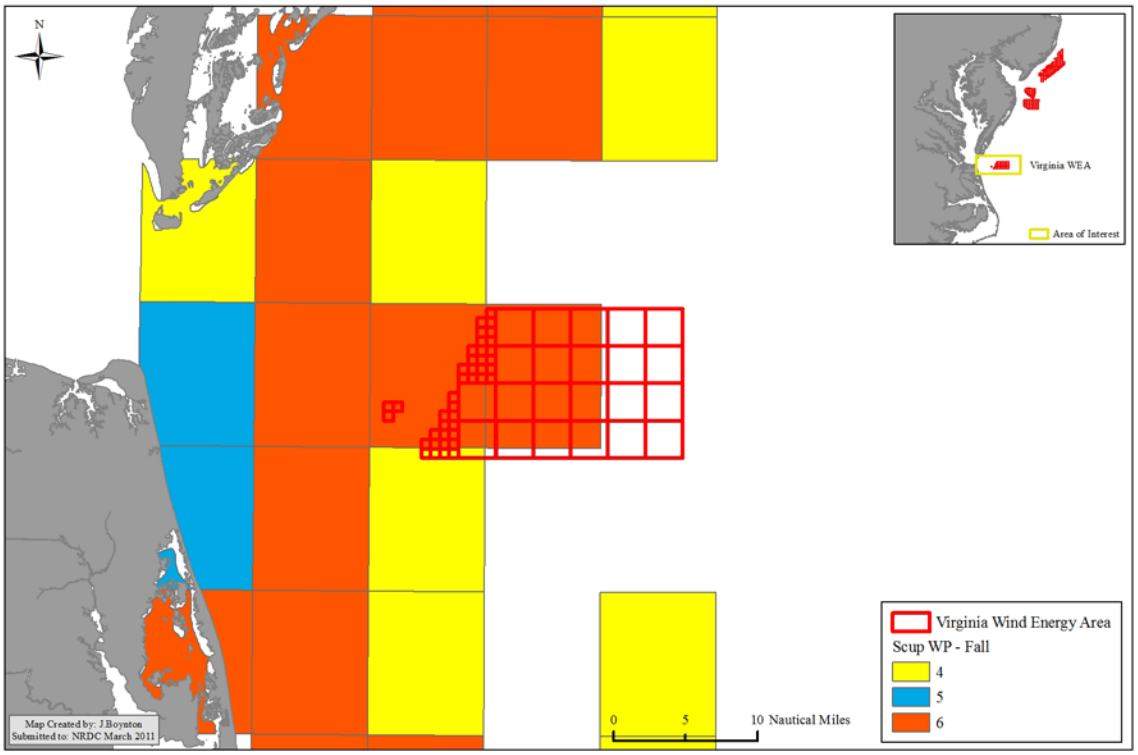

Figure 16: Scup weighted persistence fall season - Virginia WEA

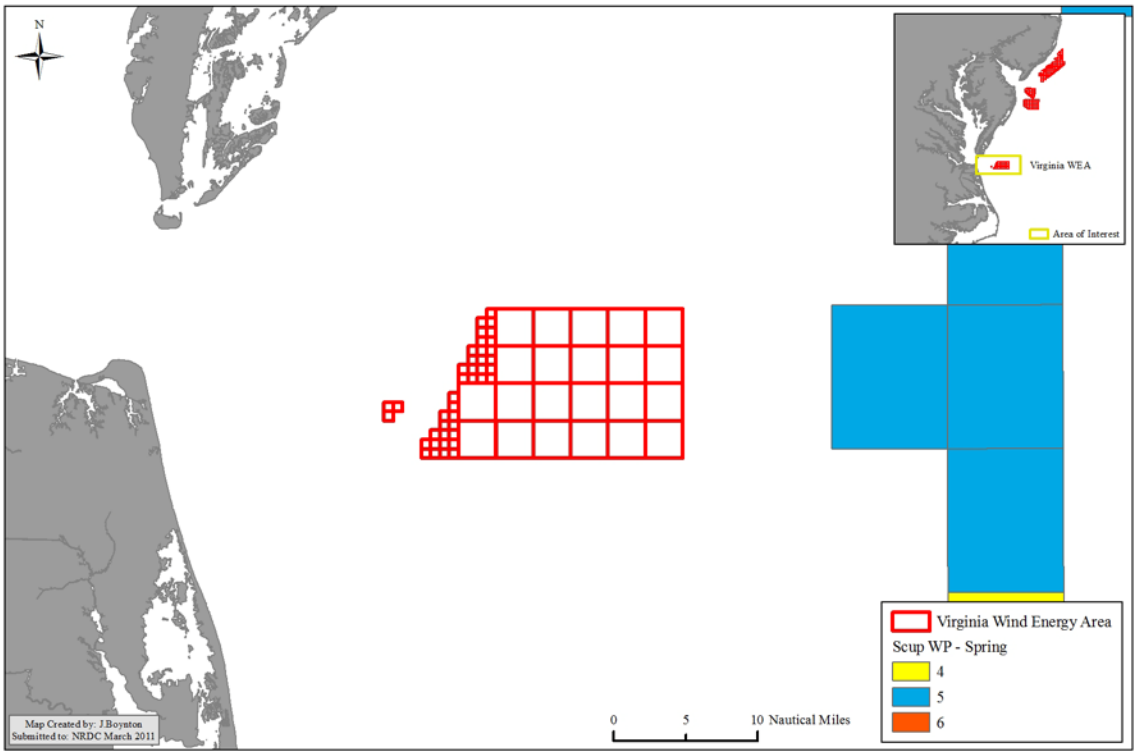

Figure 17: Scup weighted persistence spring season - Virginia WEA

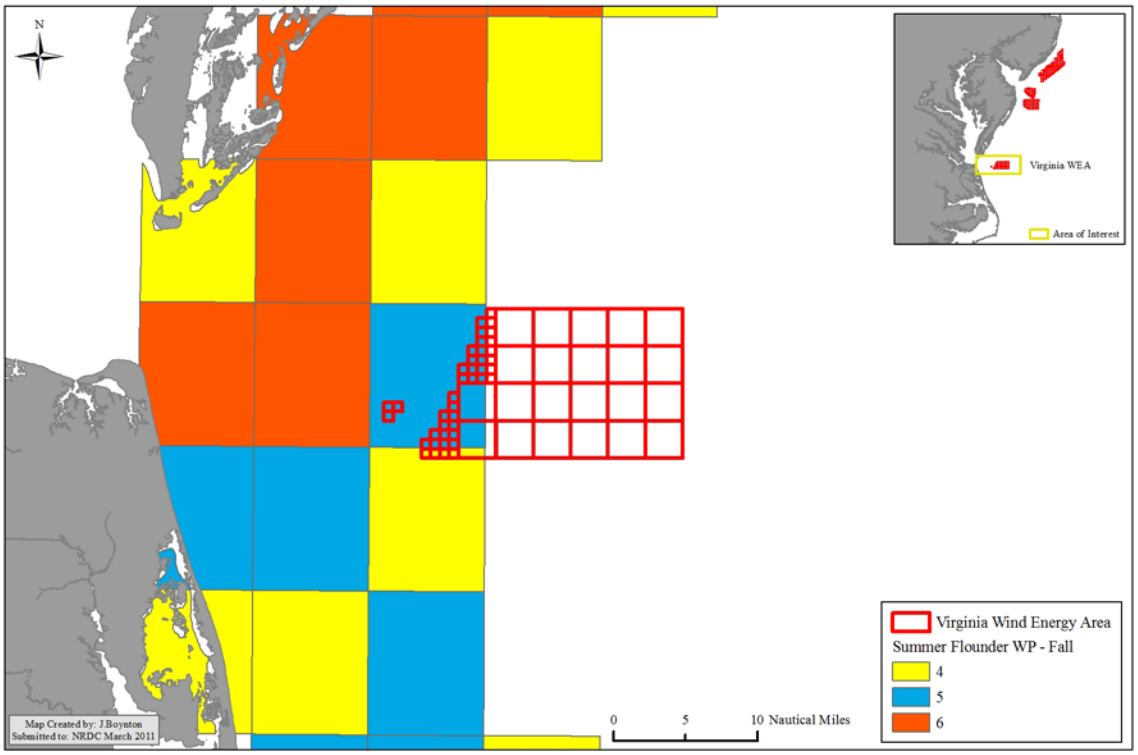

Figure 18: Summer flounder weighted persistence fall season - Virginia WEA

Figure 19: Summer flounder weighted persistence spring season - Virginia WEA

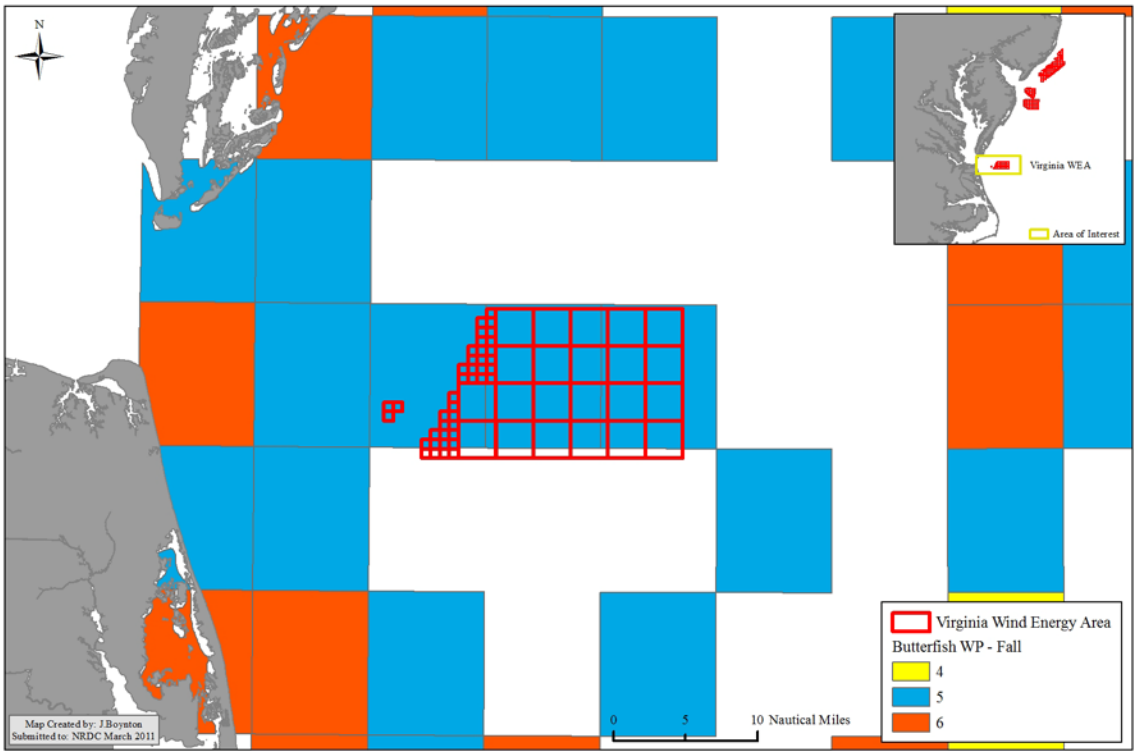

Figure 20: Butterfish weighted persistence fall season - Virginia WEA

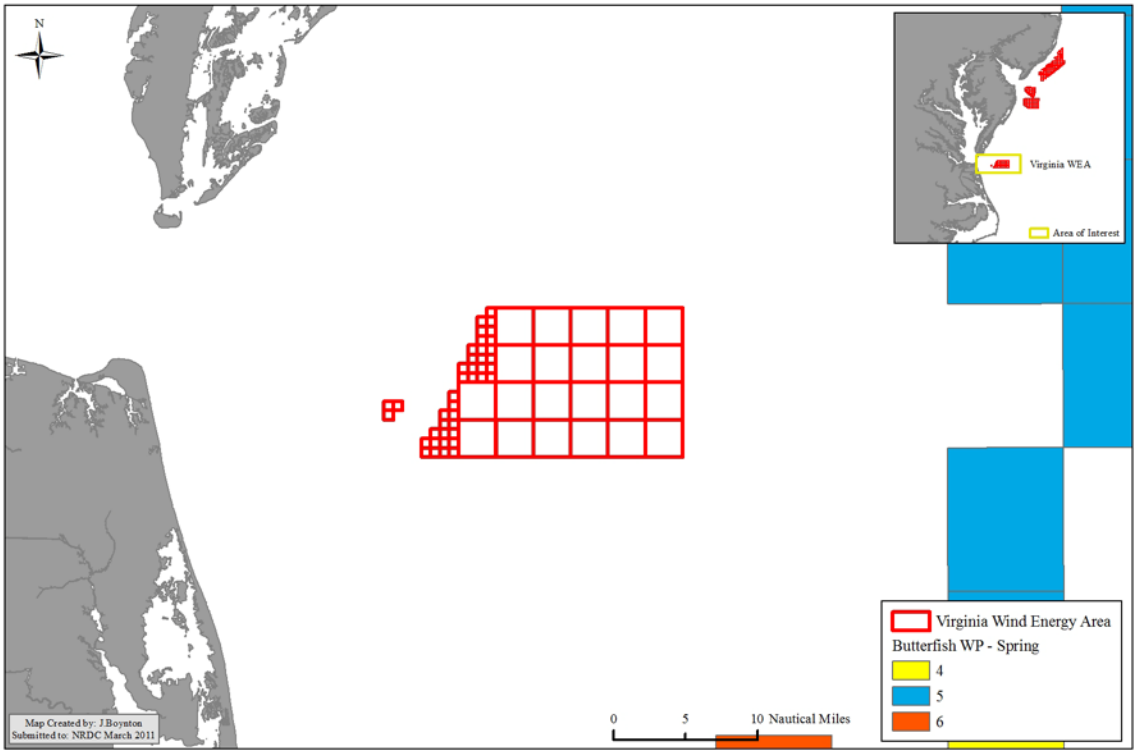

Figure 21: Butterfish weighted persistence spring season - Virginia WEA

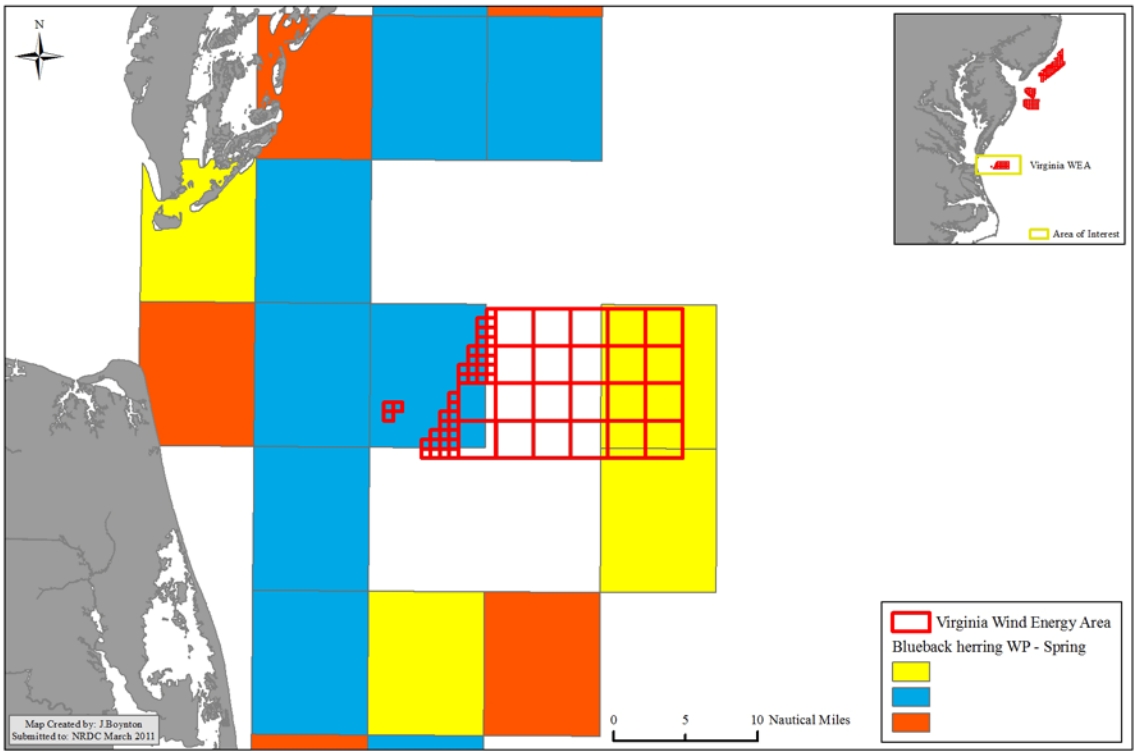

Figure 22: Blueback herring weighted persistence spring season - Virginia WEA

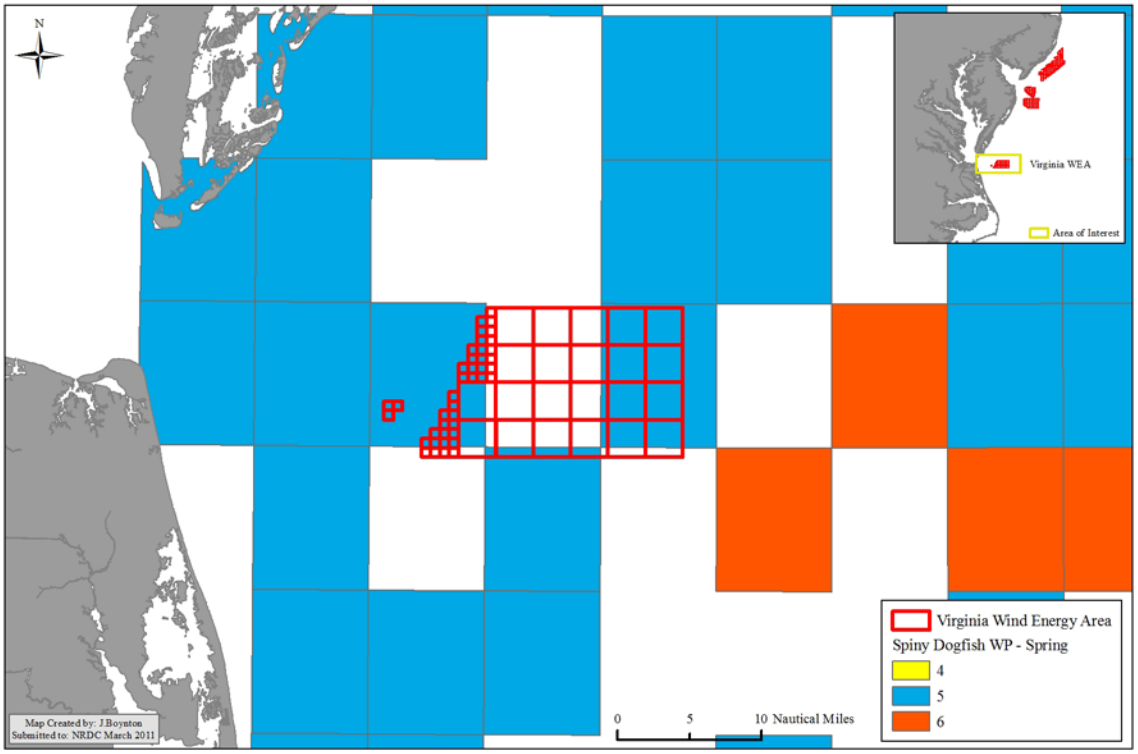

Figure 23: Spiny dogfish weighted persistence spring season - Virginia WEA

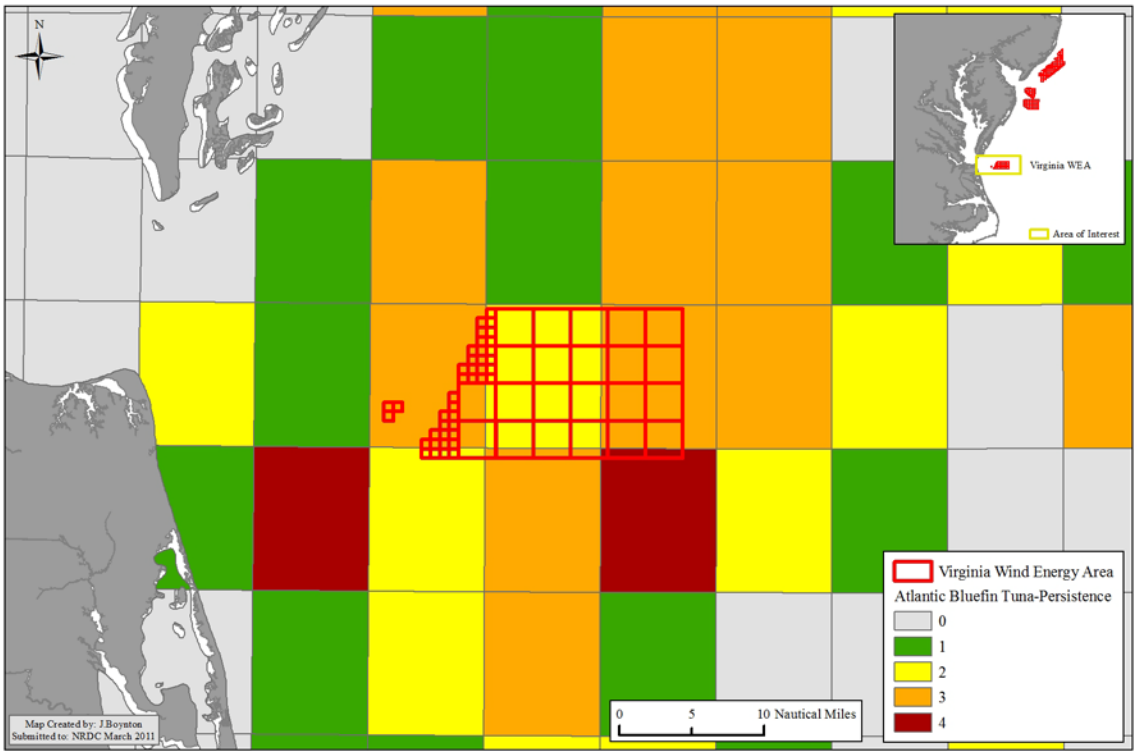

Figure 24: Atlantic bluefin tuna persistence - Virginia WEA

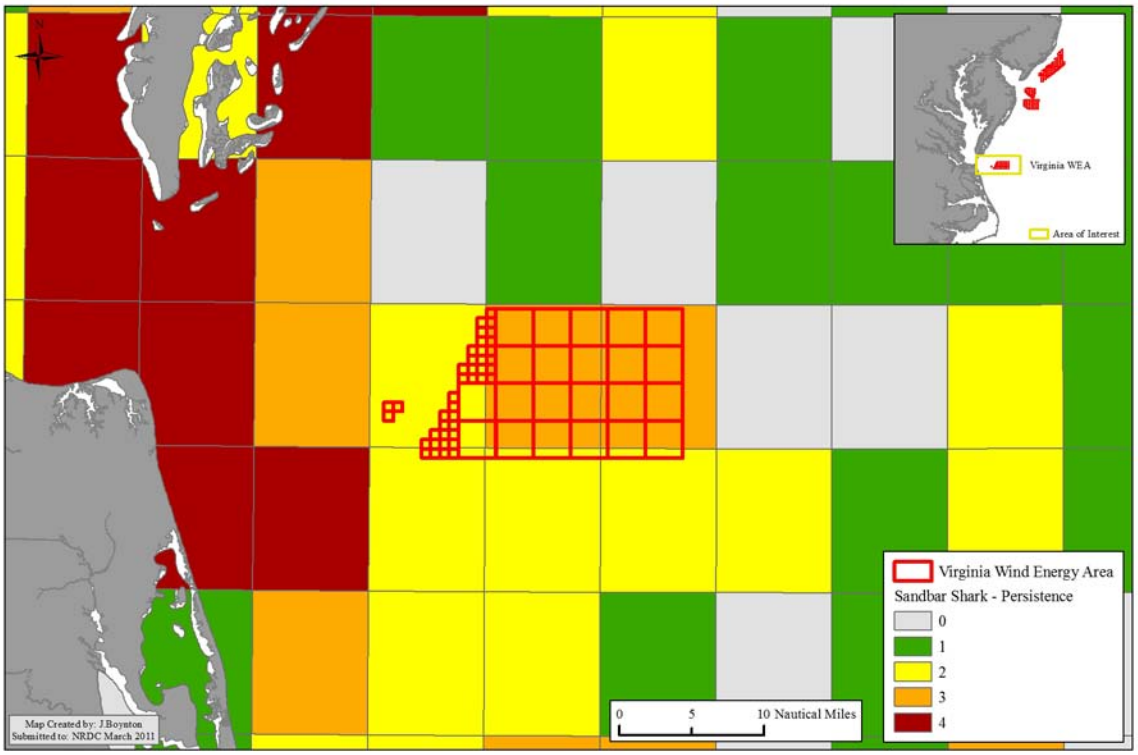

Figure 25: Sandbar shark persistence - Virginia WEA

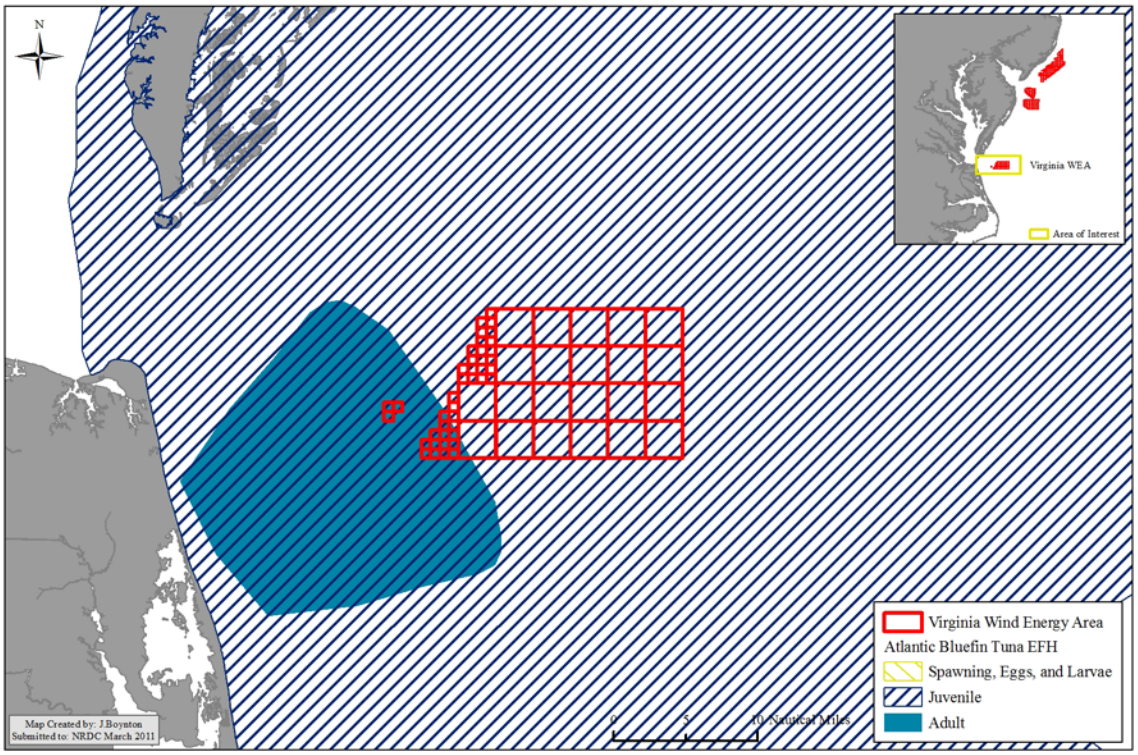

Figure 26: Atlantic bluefin tuna EFH - Virginia WEA

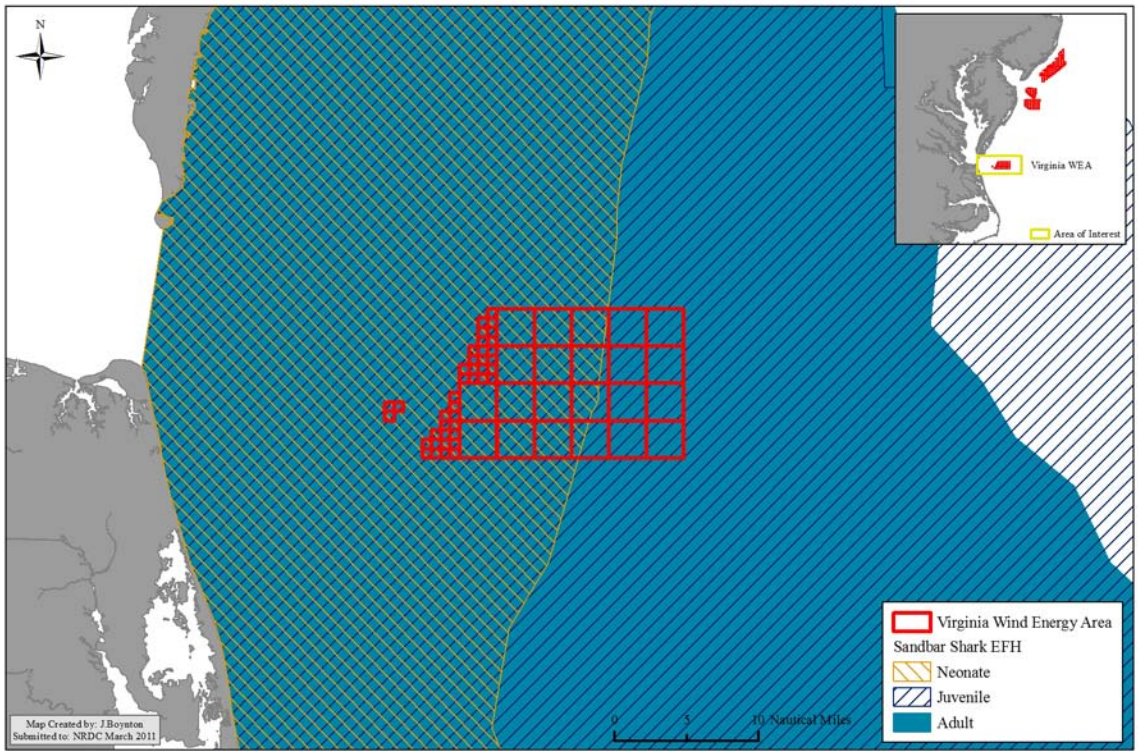

Figure 27: Sandbar shark EFH - Virginia WEA

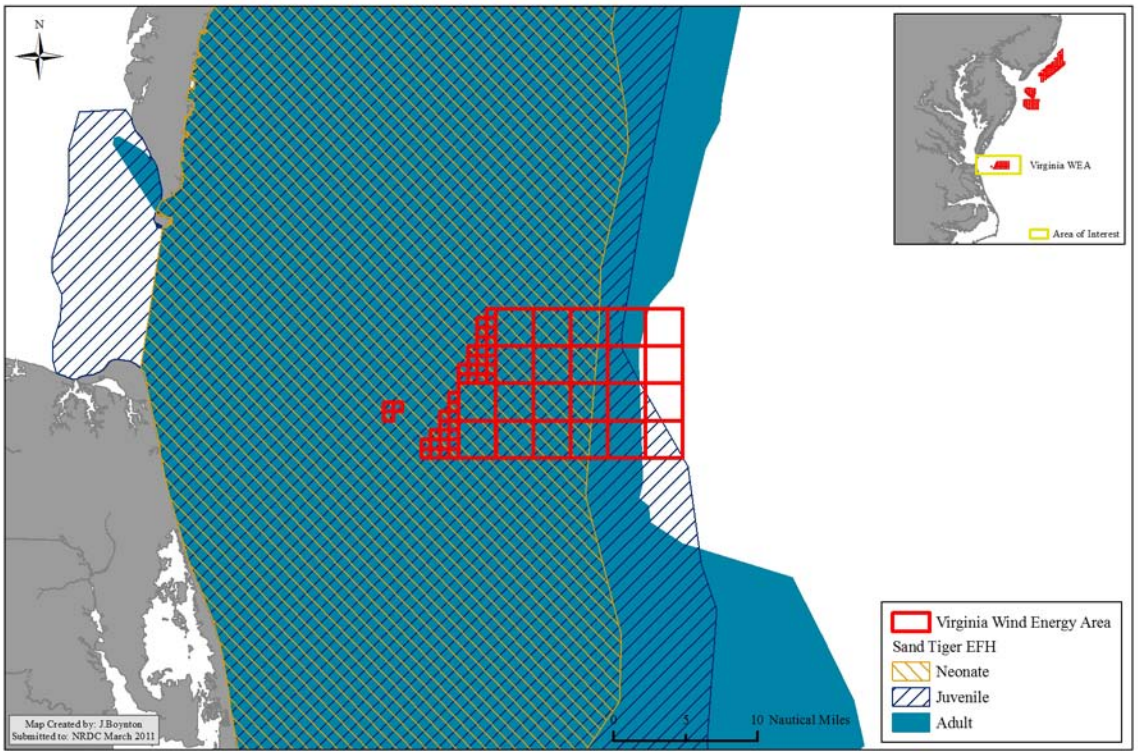

Figure 28: Sand Tiger EFH - Virginia WEA

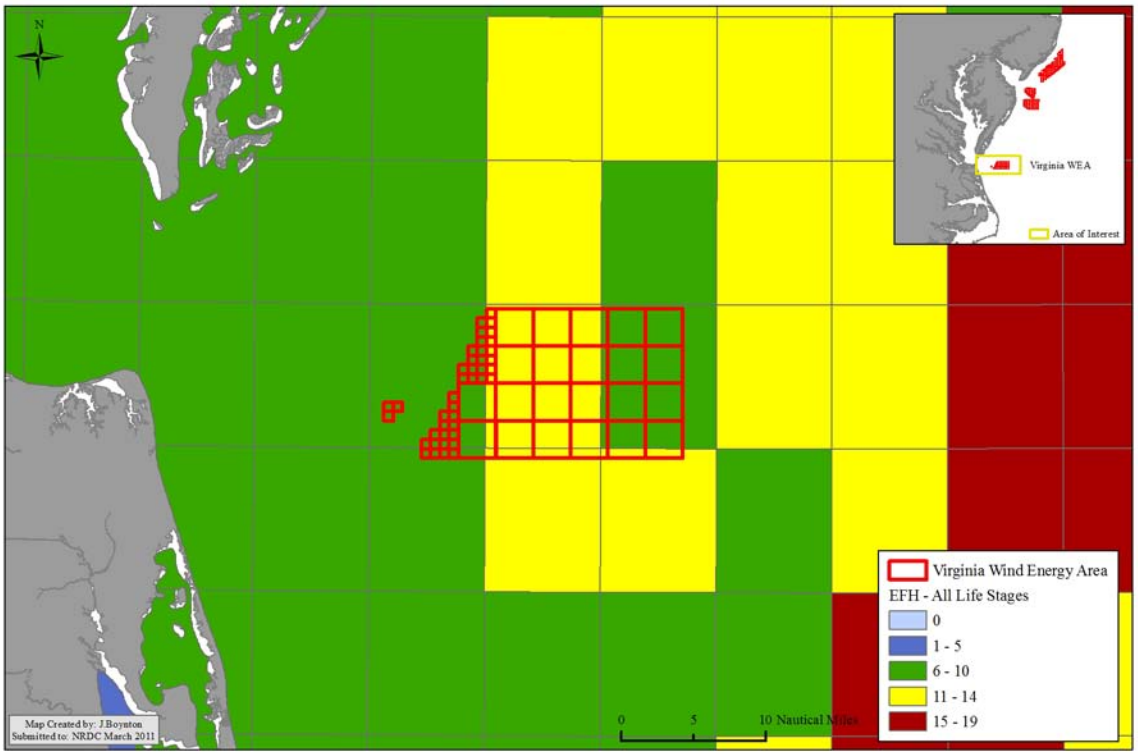

Figure 29: EFH (all species and life stages combined) - Virginia WEA

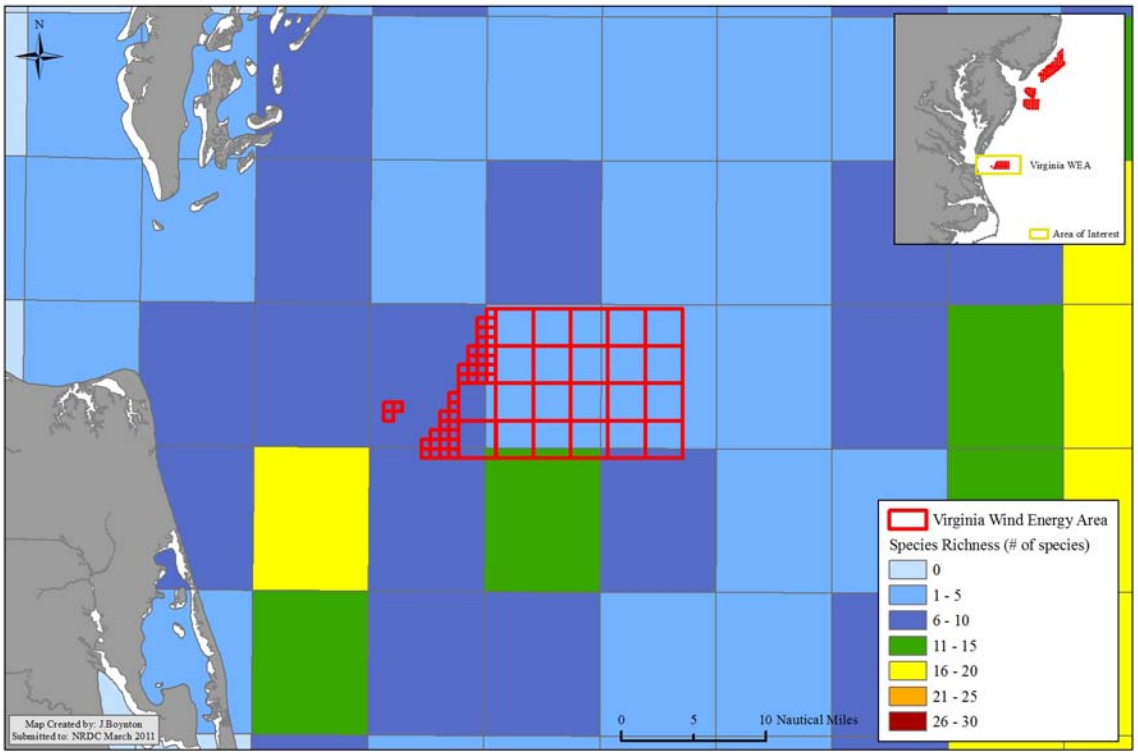

Figure 30: Species richness (all species and life stages combined) - Virginia WEA

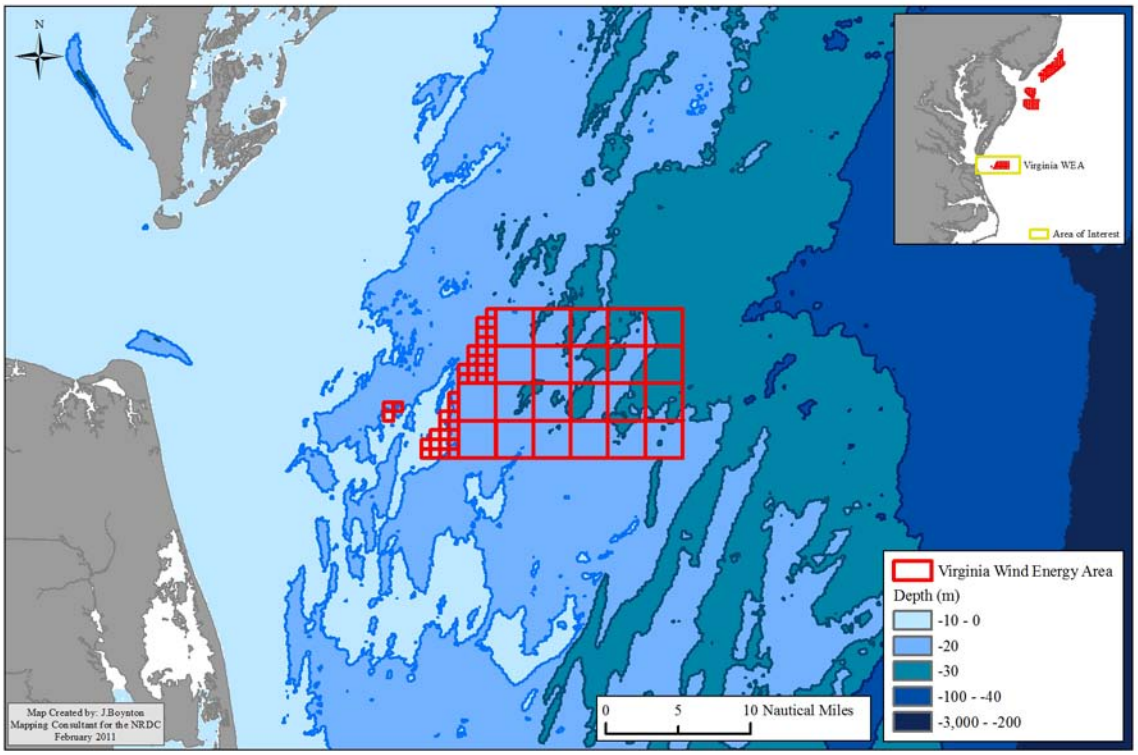

Figure 31: Depth contours - Virginia WEA

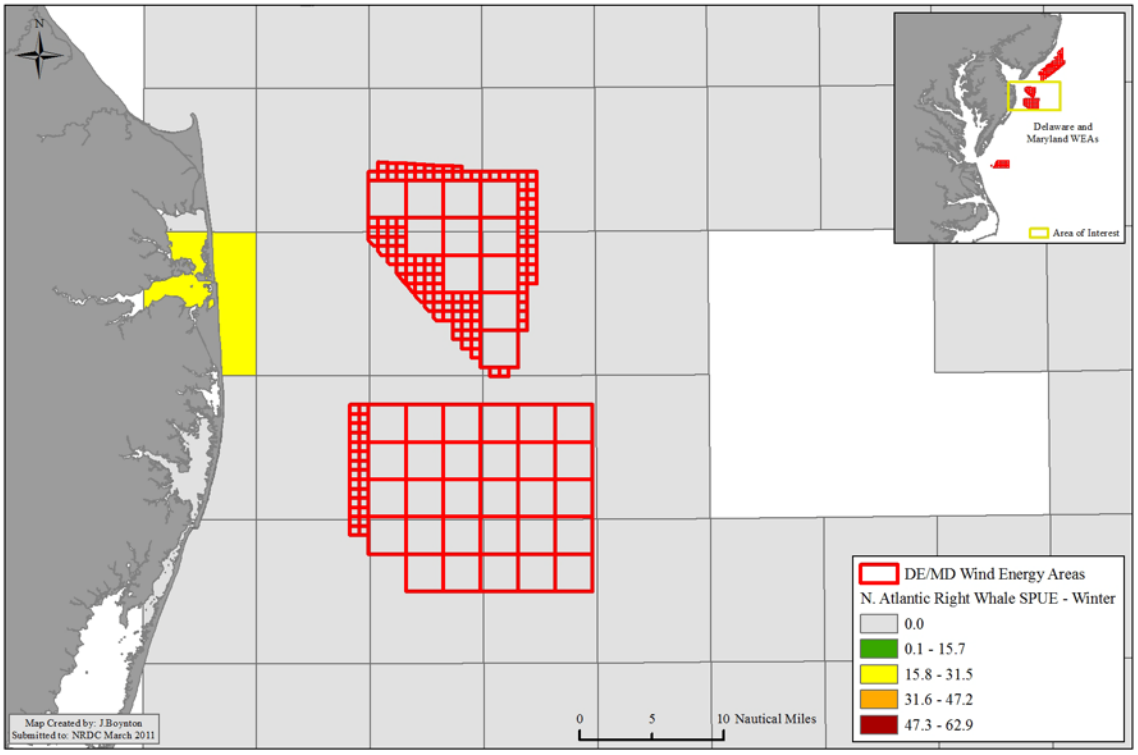

Figure 32: North Atlantic Right Whale SPUE winter season – DE/MD WEAS

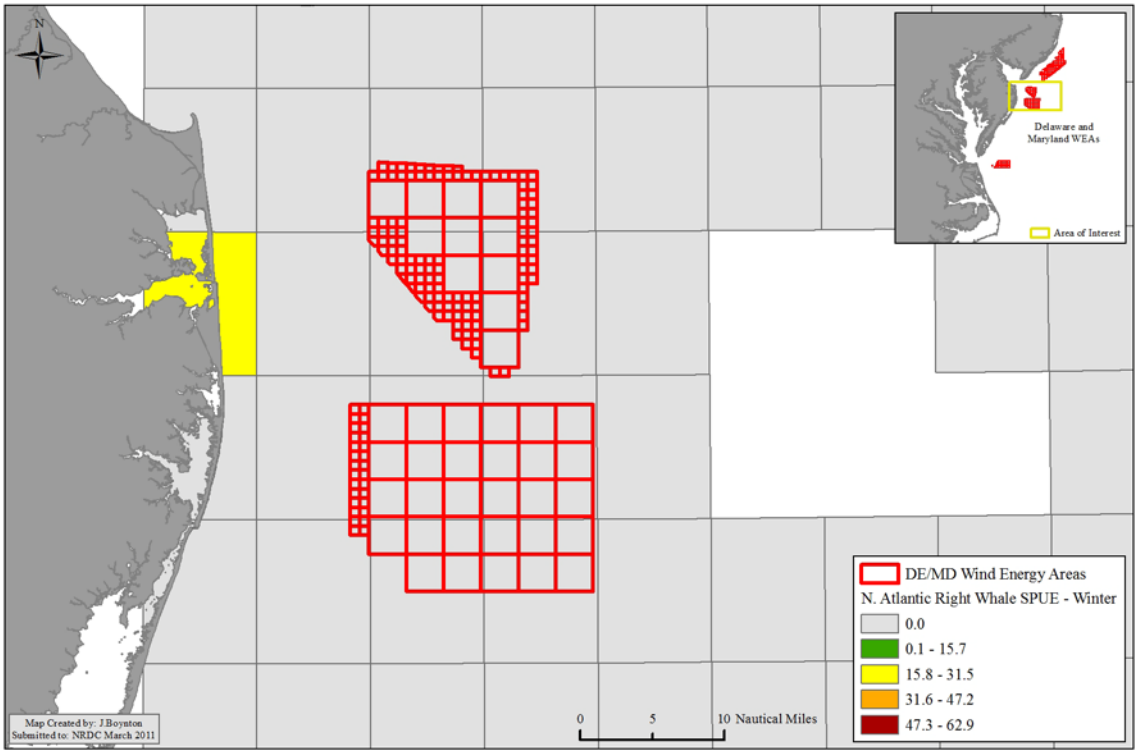

Figure 33: North Atlantic Right Whale SPUE winter season – DE/MD WEAS

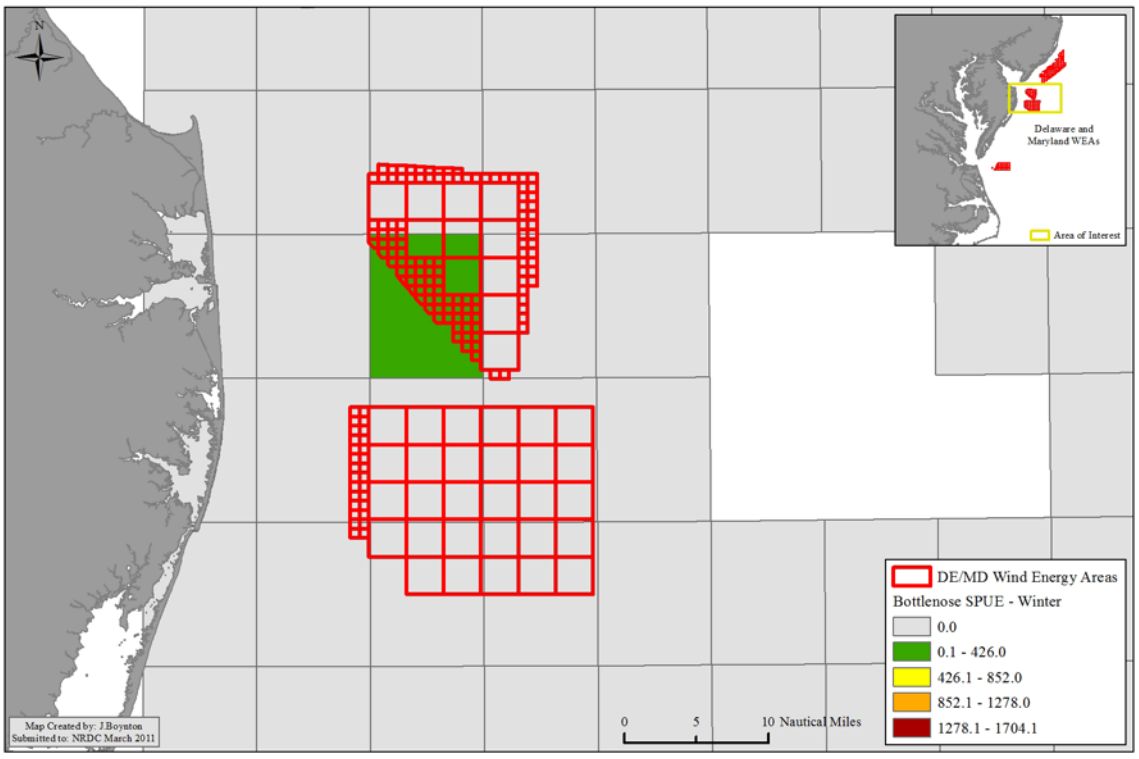

Figure 34: Bottlenose dolphin SPUE winter season – DE/MD WEAS

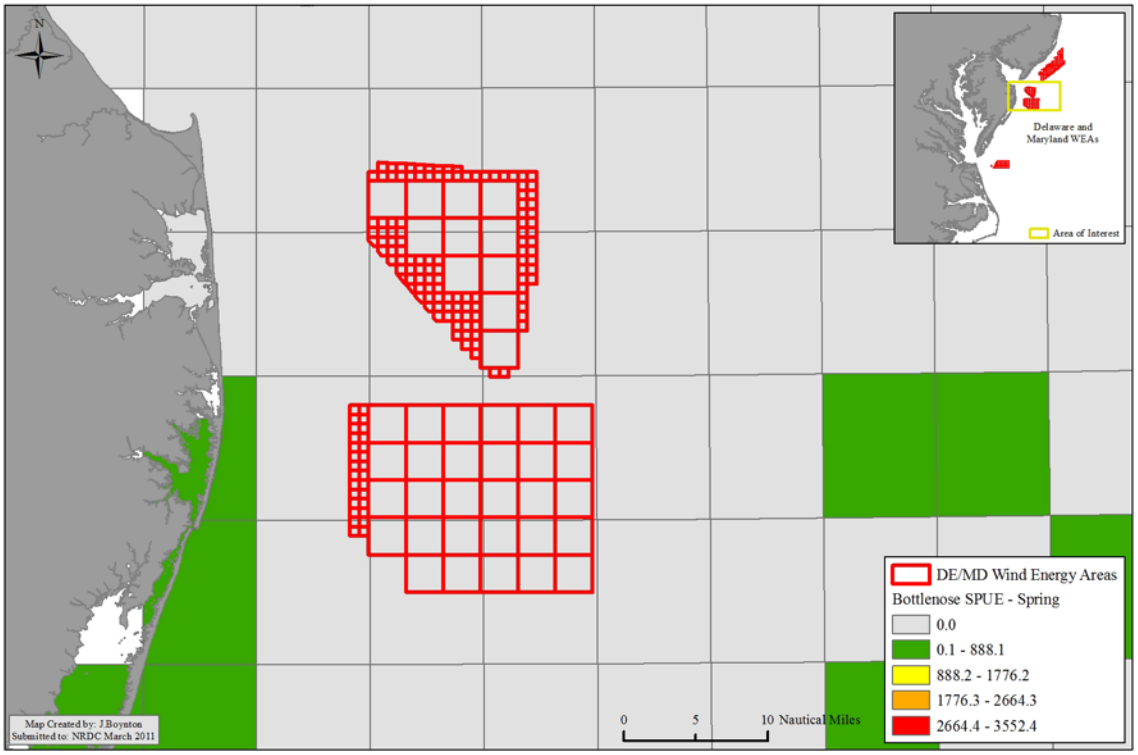

Figure 35: Bottlenose dolphin SPUE spring season – DE/MD WEAS

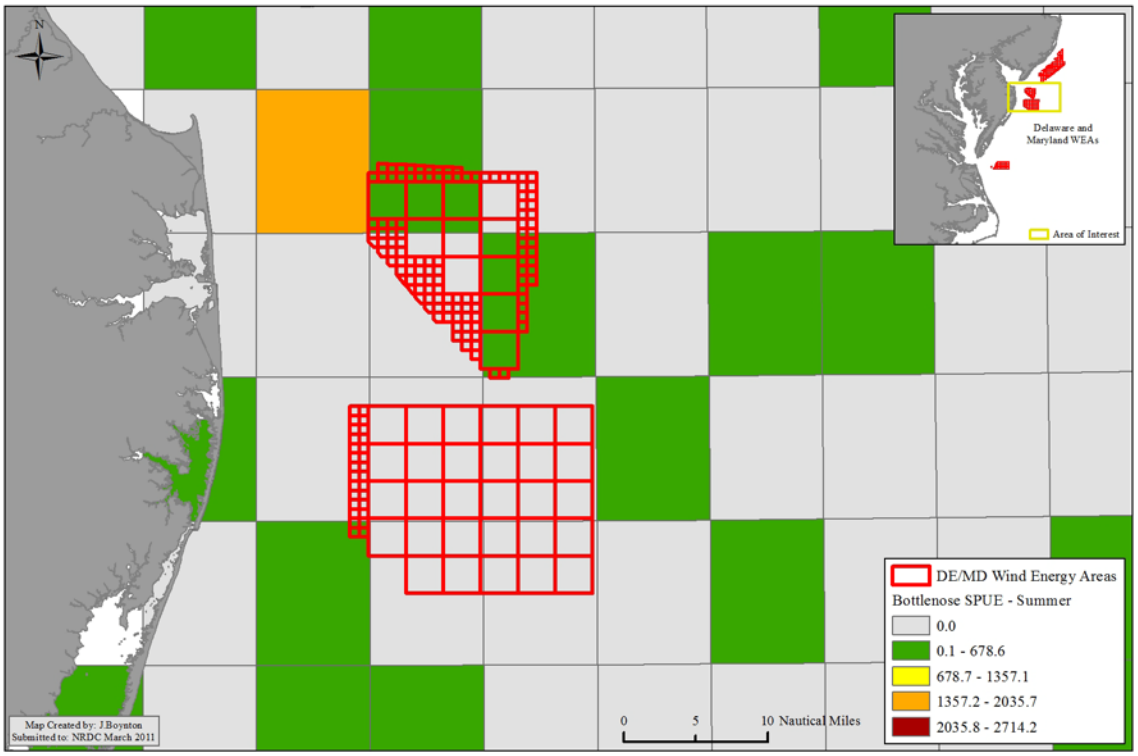

Figure 36: Bottlenose dolphin SPUE summer season – DE/MD WEAS

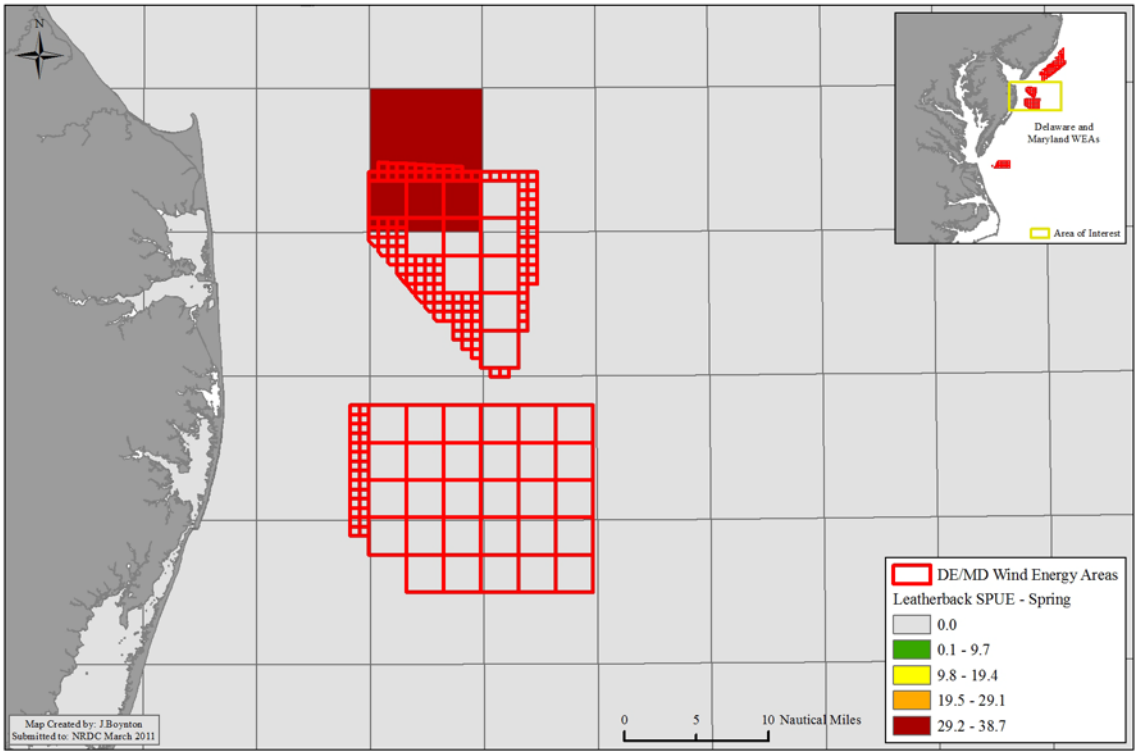

Figure 37: Leatherback SPUE spring season – DE/MD WEAS

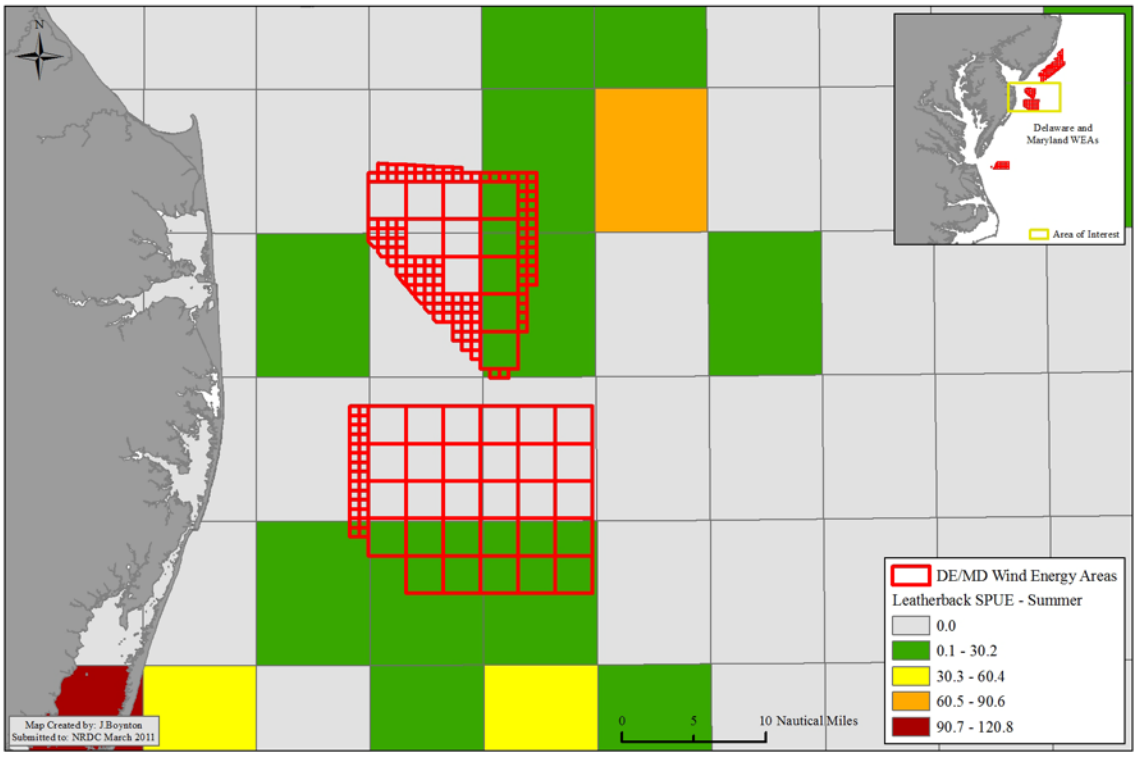

Figure 38: Leatherback SPUE summer season – DE/MD WEAS

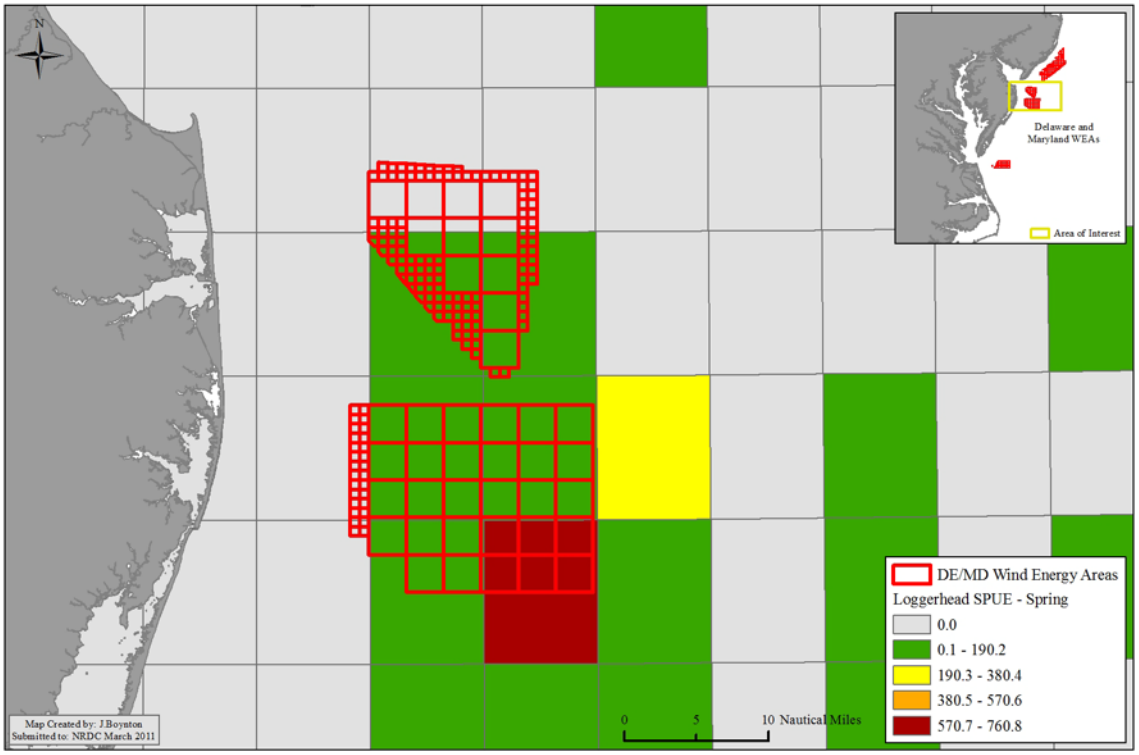

Figure 39: Loggerhead SPUE spring season – DE/MD WEAS

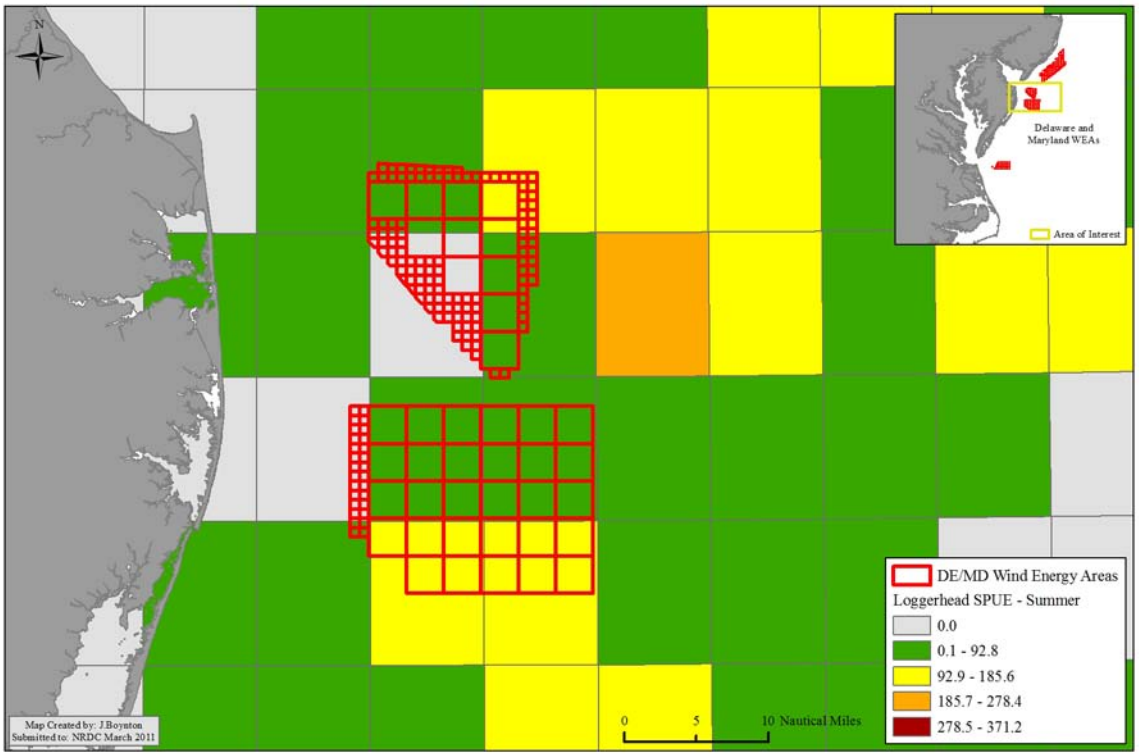

Figure 40: Loggerhead SPUE summer season – DE/MD WEAS

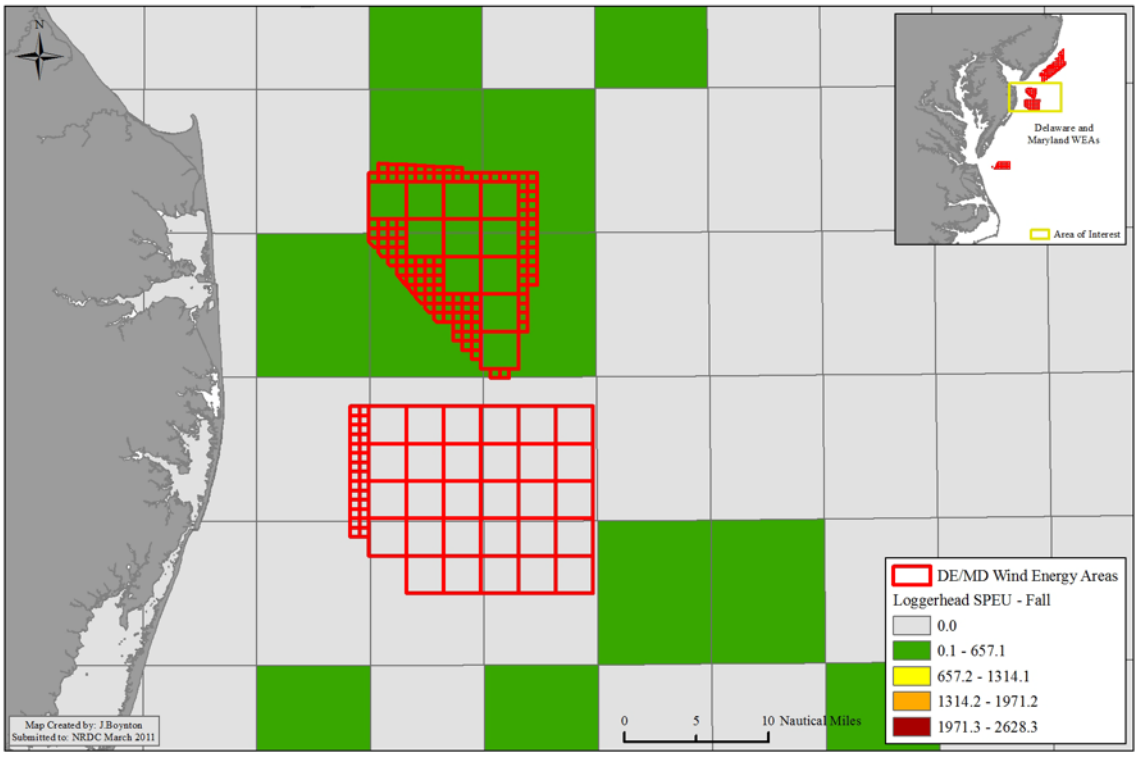

Figure 41: Loggerhead SPUE fall season – DE/MD WEAS

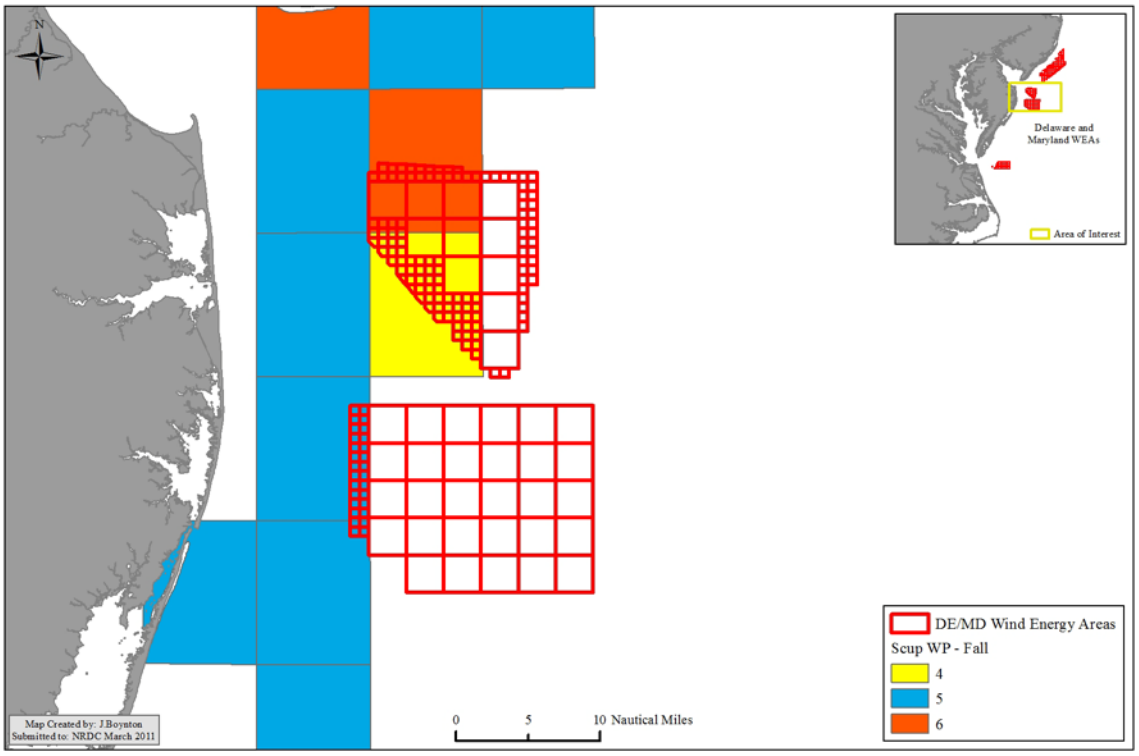

Figure 42: Scup weighted persistence fall season – DE/MD WEAS

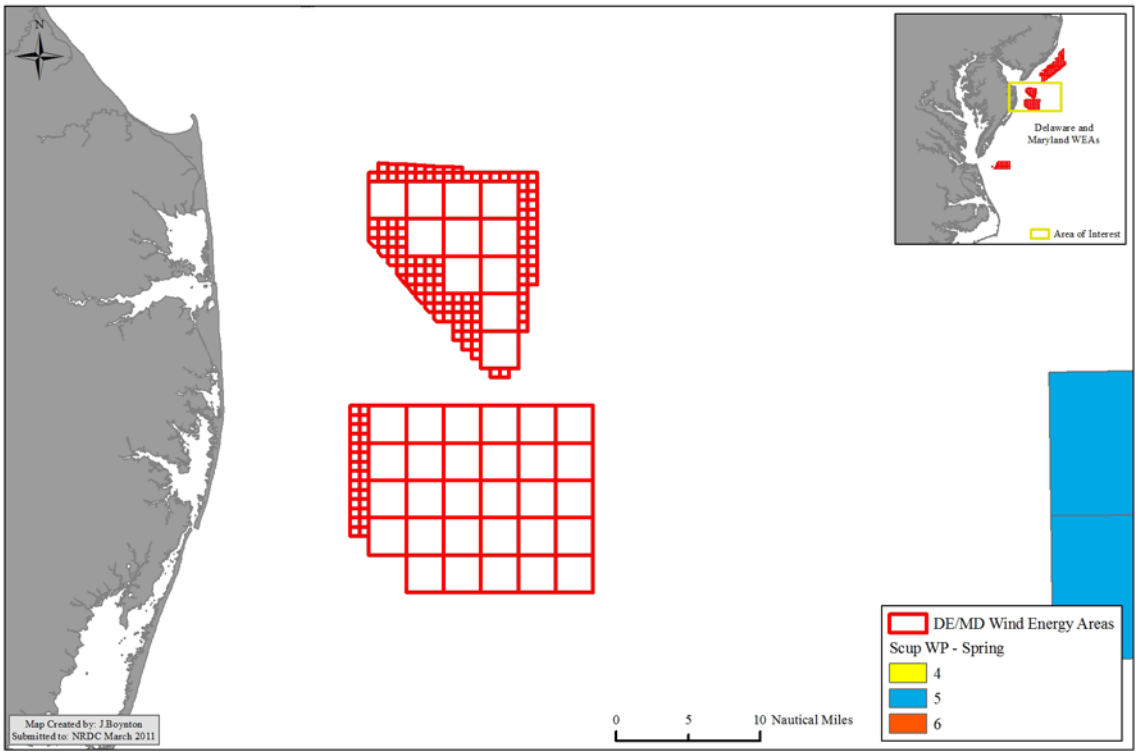

Figure 43: Scup weighted persistence spring season – DE/MD WEAS

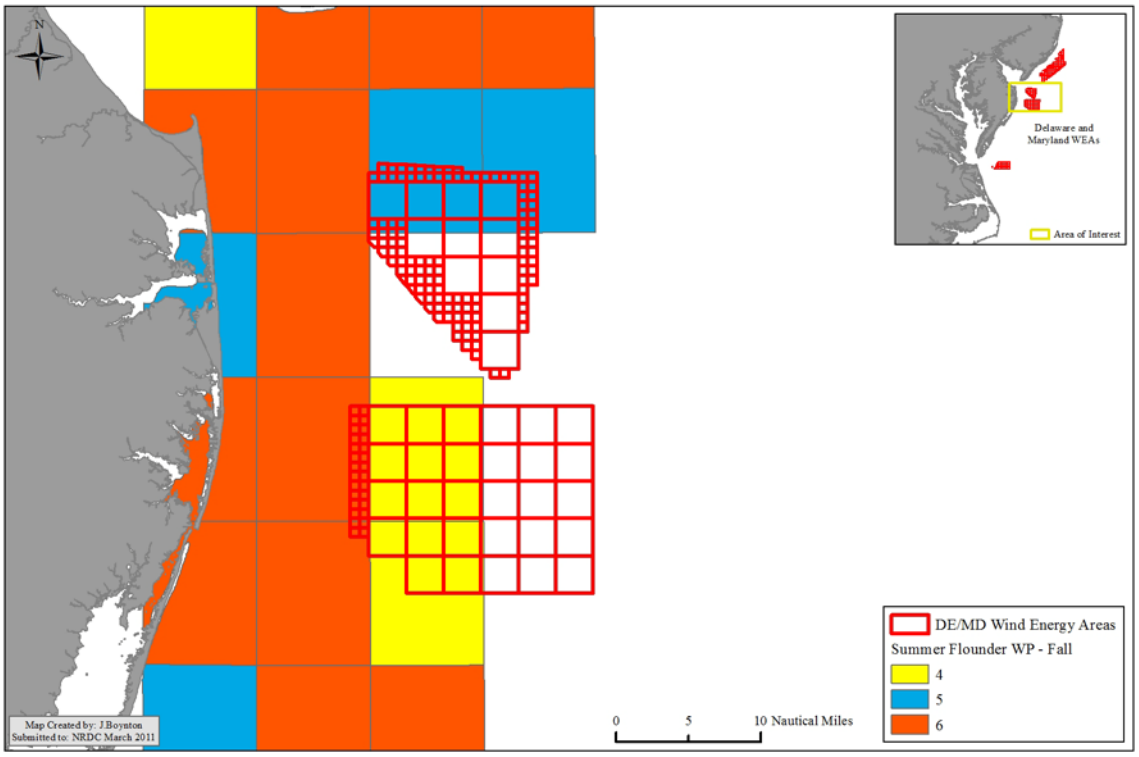

Figure 44: Summer flounder weighted persistence fall season – DE/MD WEAS

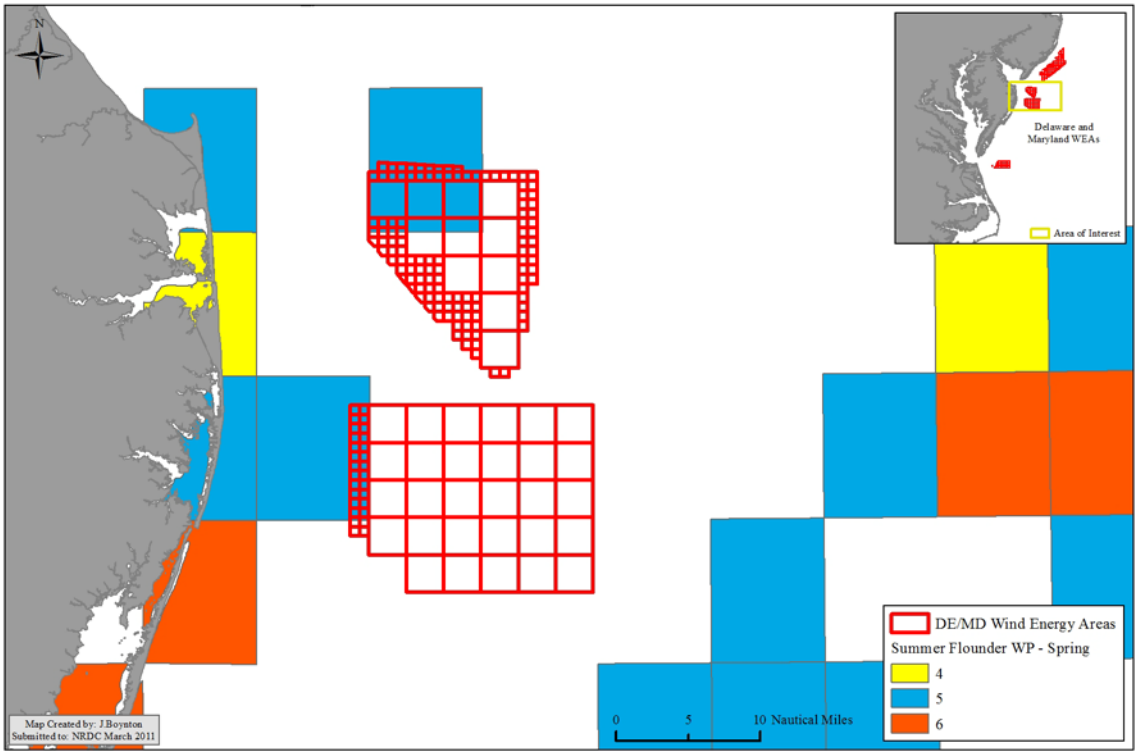

Figure 45: Summer flounder weighted persistence spring season – DE/MD WEAS

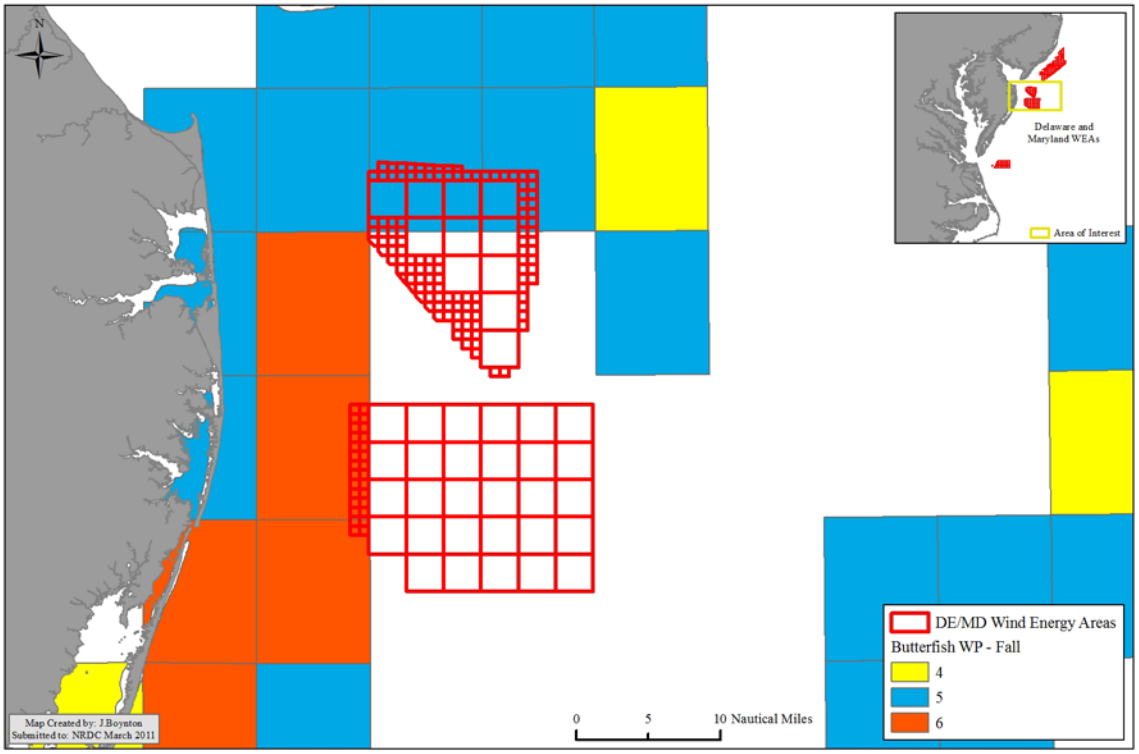

Figure 46: Butterfish weighted persistence fall season – DE/MD WEAS

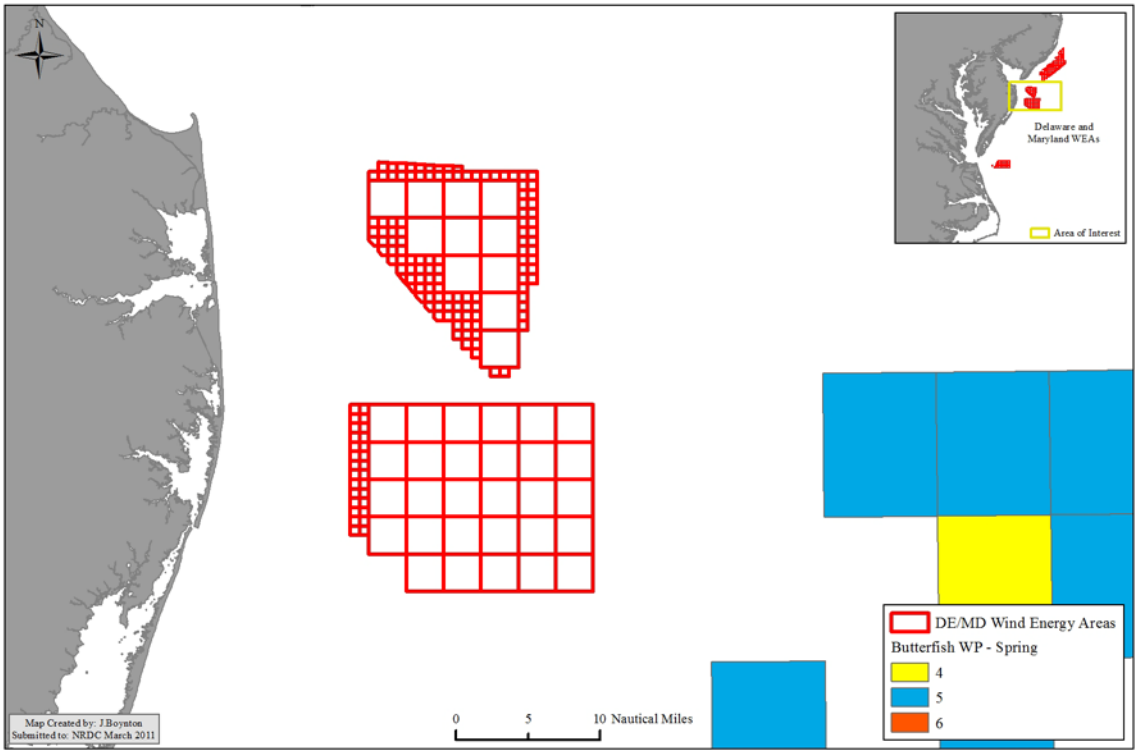

Figure 47: Butterfish weighted persistence spring season – DE/MD WEAS

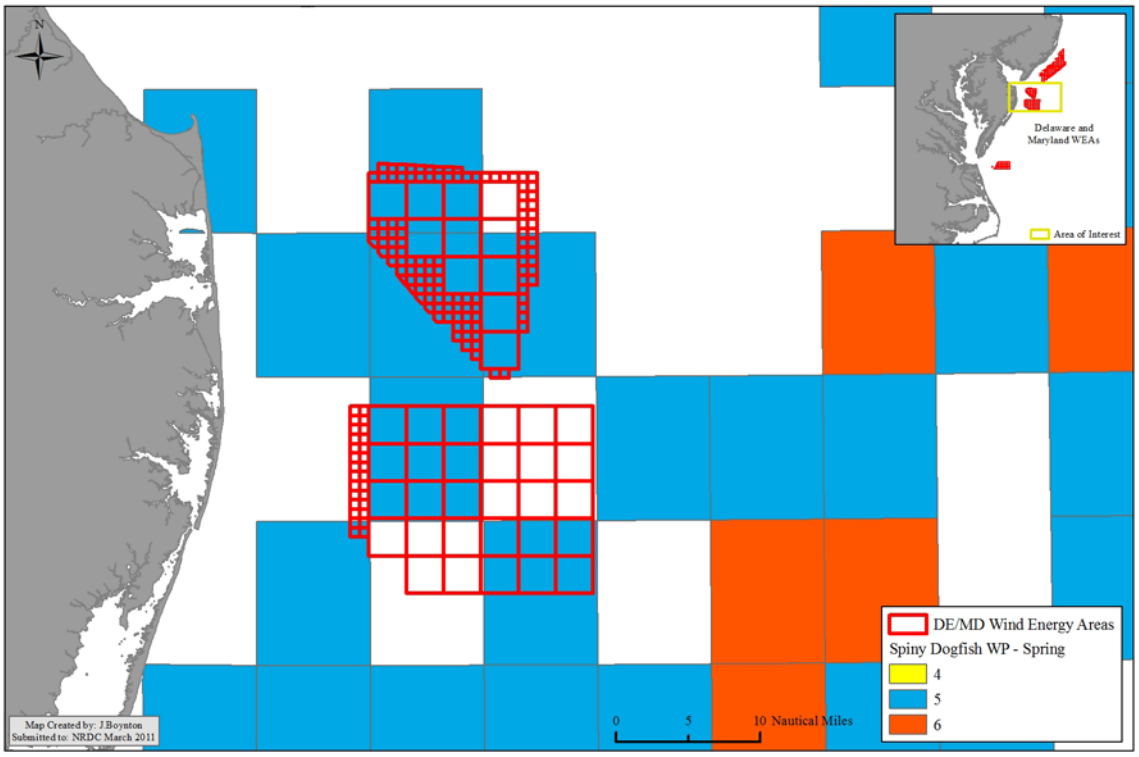

Figure 48: Spiny dogfish weighted persistence spring season – DE/MD WEAS

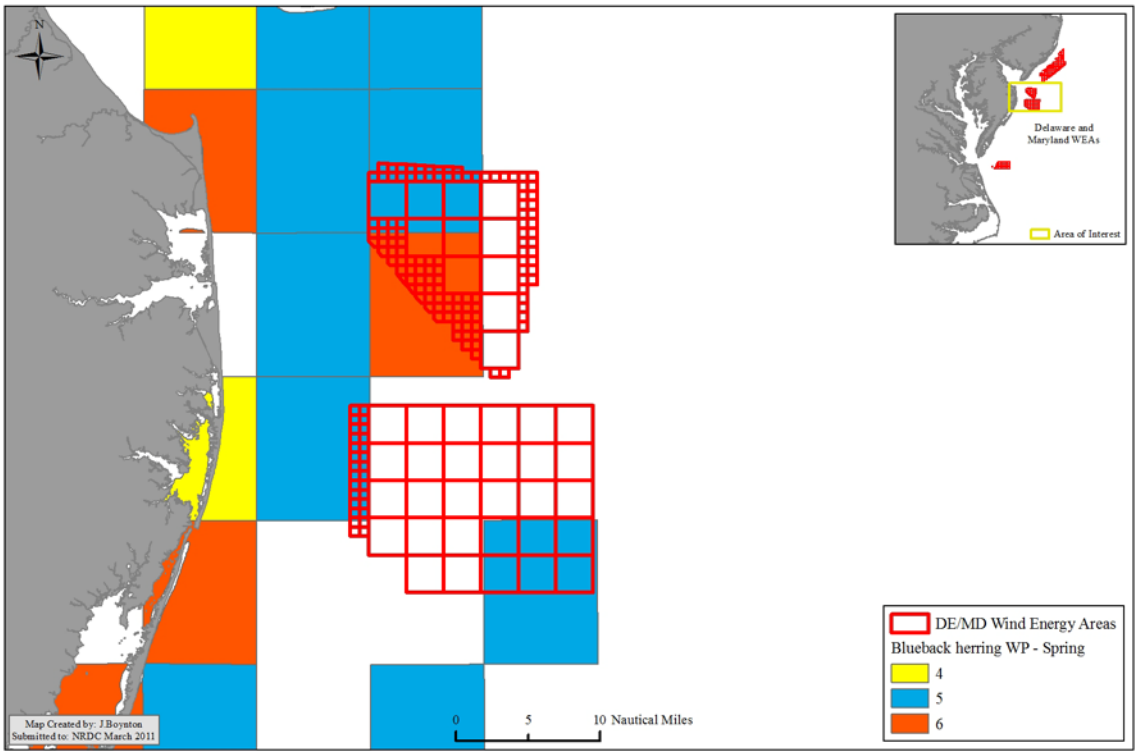

Figure 49: Blueback herring weighted persistence spring season – DE/MD WEAS

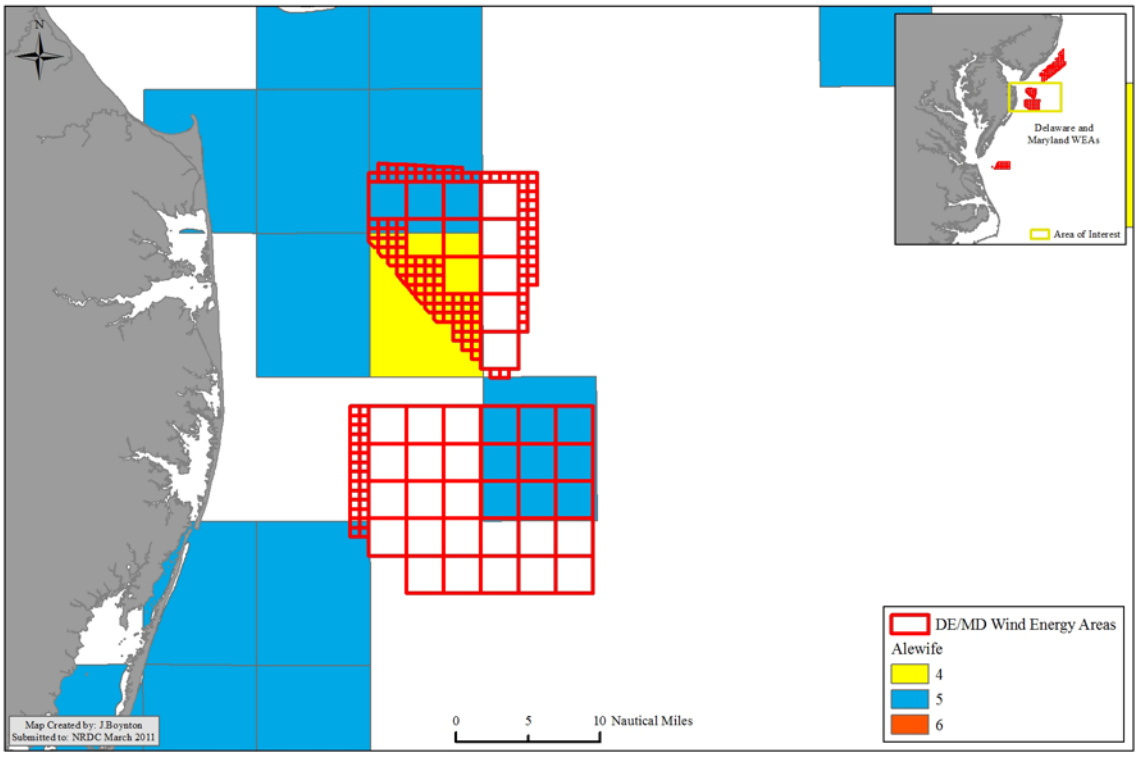

Figure 50: Alewife weighted persistence spring season – DE/MD WEAs

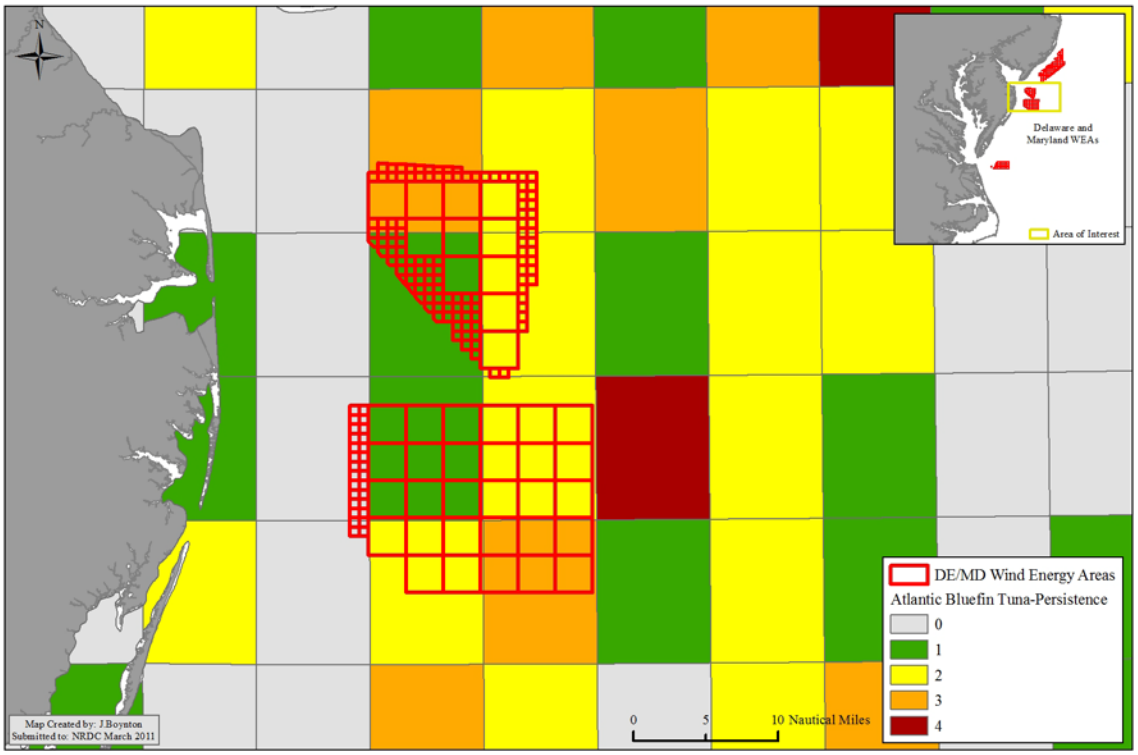

Figure 51: Atlantic bluefin tuna persistence – DE/MD WEAS

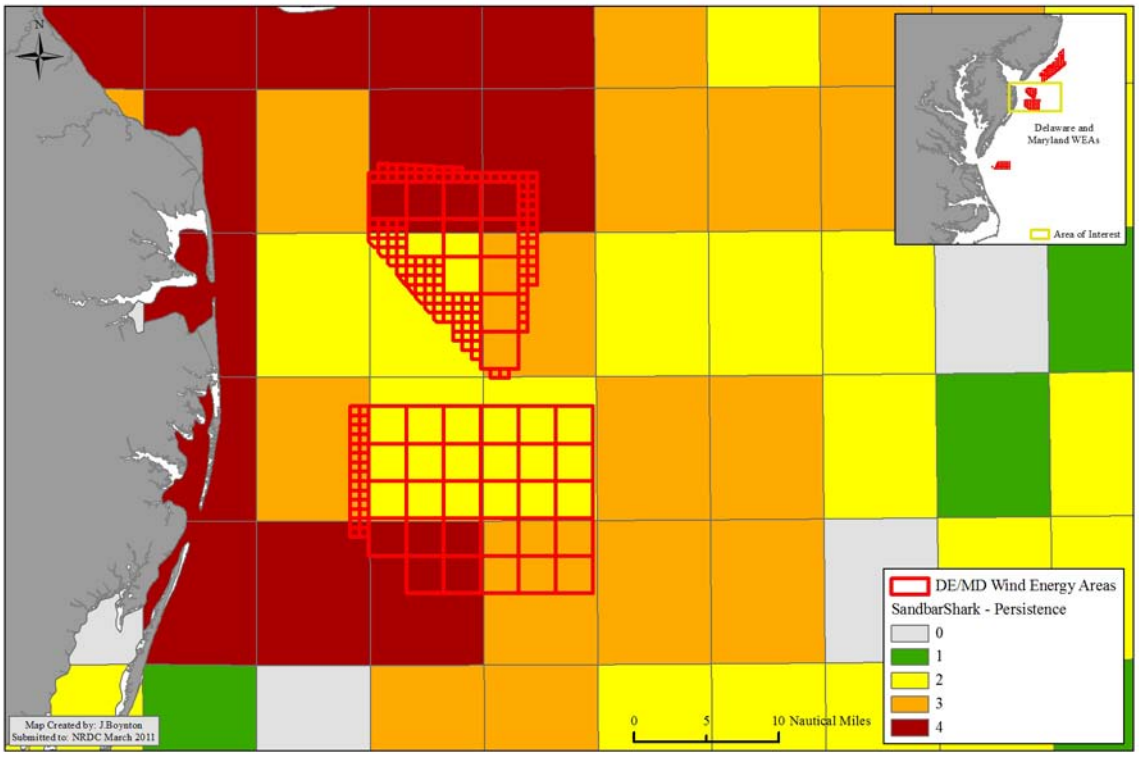

Figure 52: Sandbar shark persistence – DE/MD WEAS

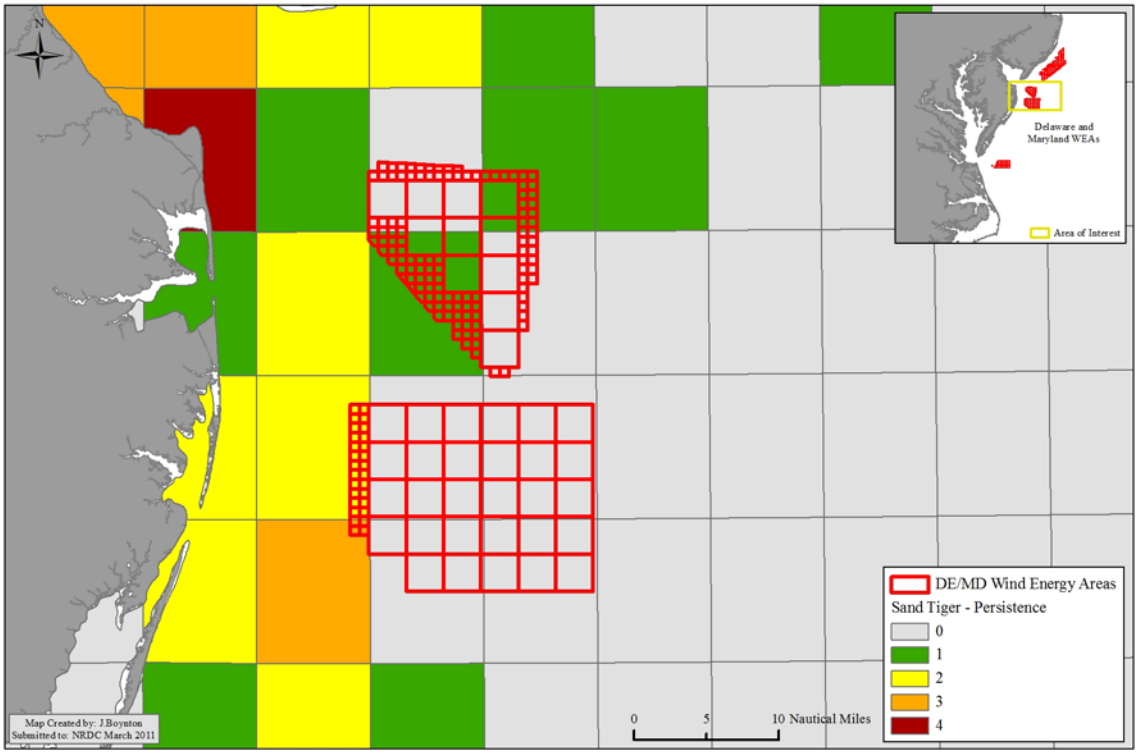

Figure 53: Sand Tiger shark persistence – DE/MD WEAS

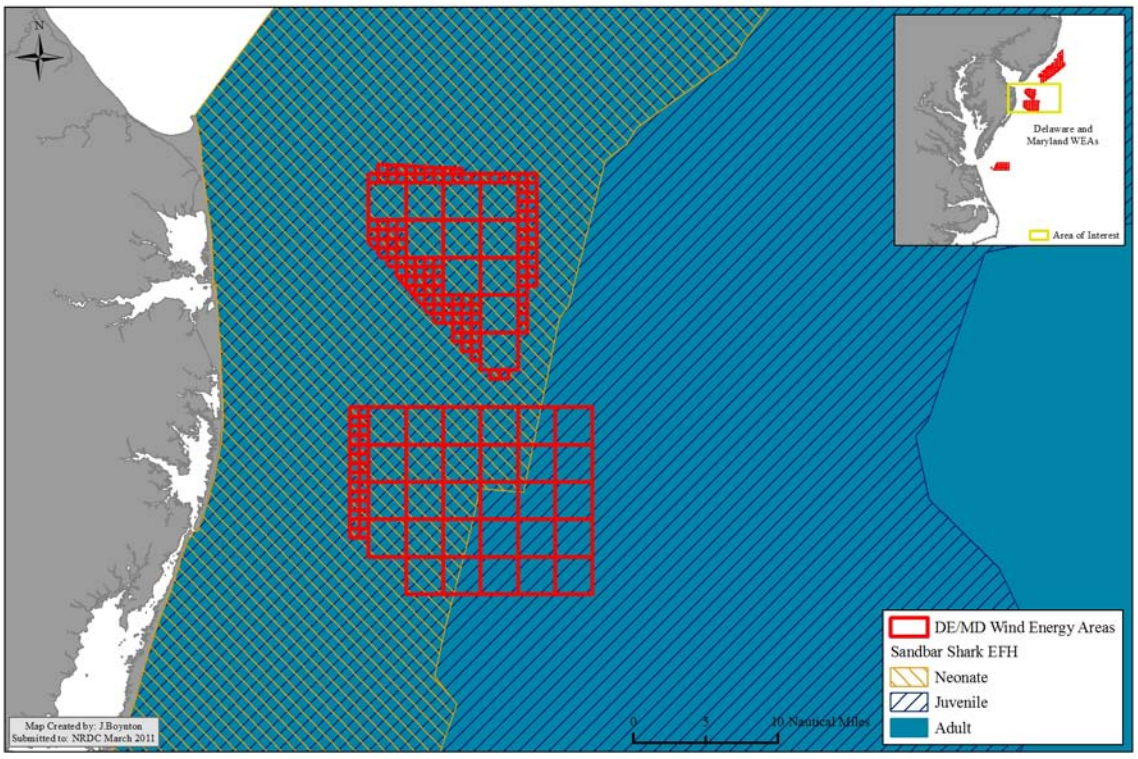

Figure 54: Sandbar shark EFH – DE/MD WEAS

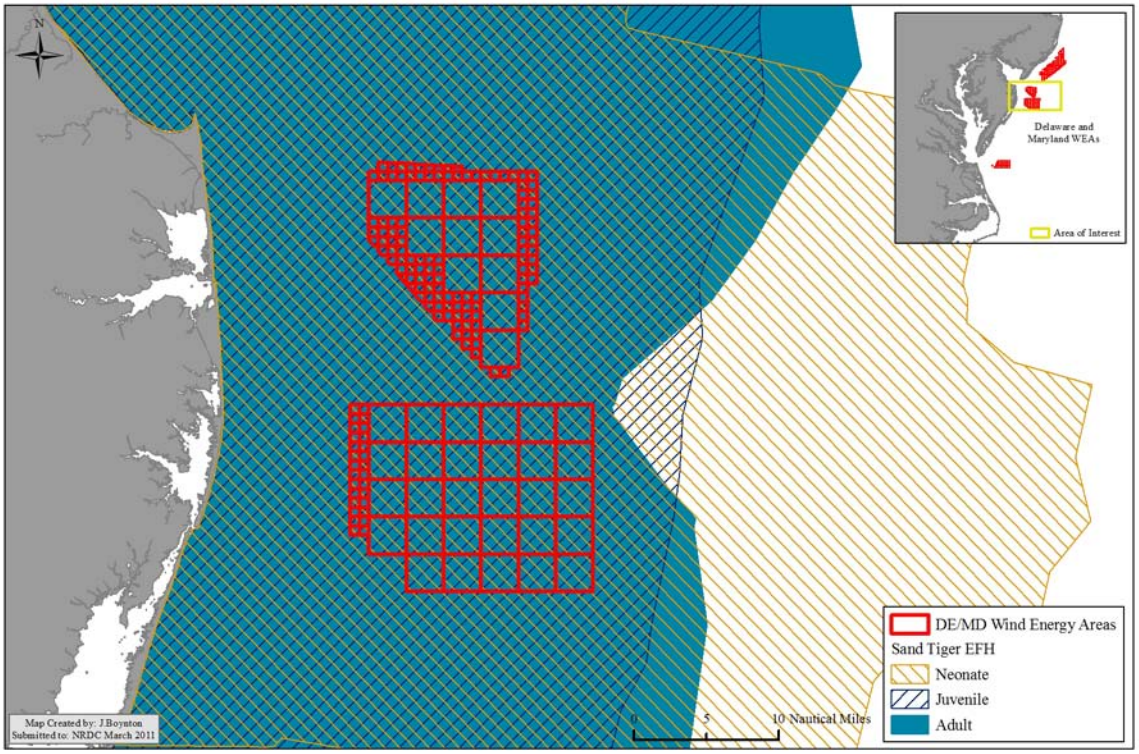

Figure 55: Sand Tiger Shark EFH – DE/MD WEAS

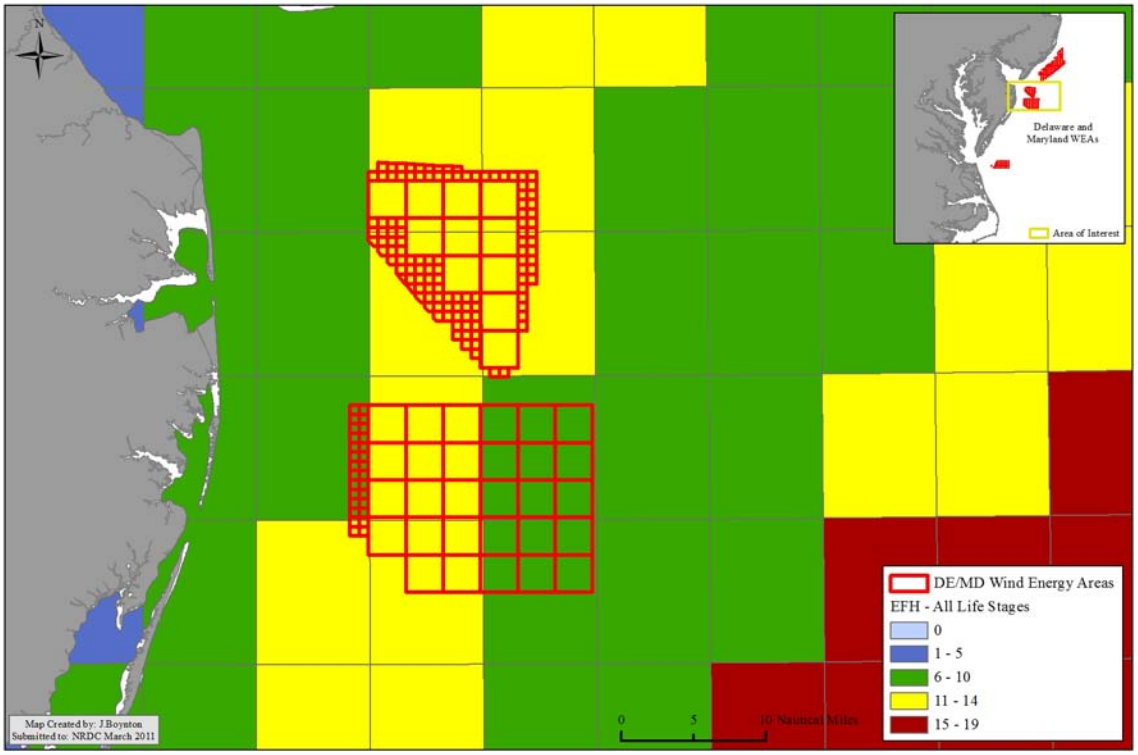

Figure 56: EFH (all species and life stages combined) – DE/MD WEAS

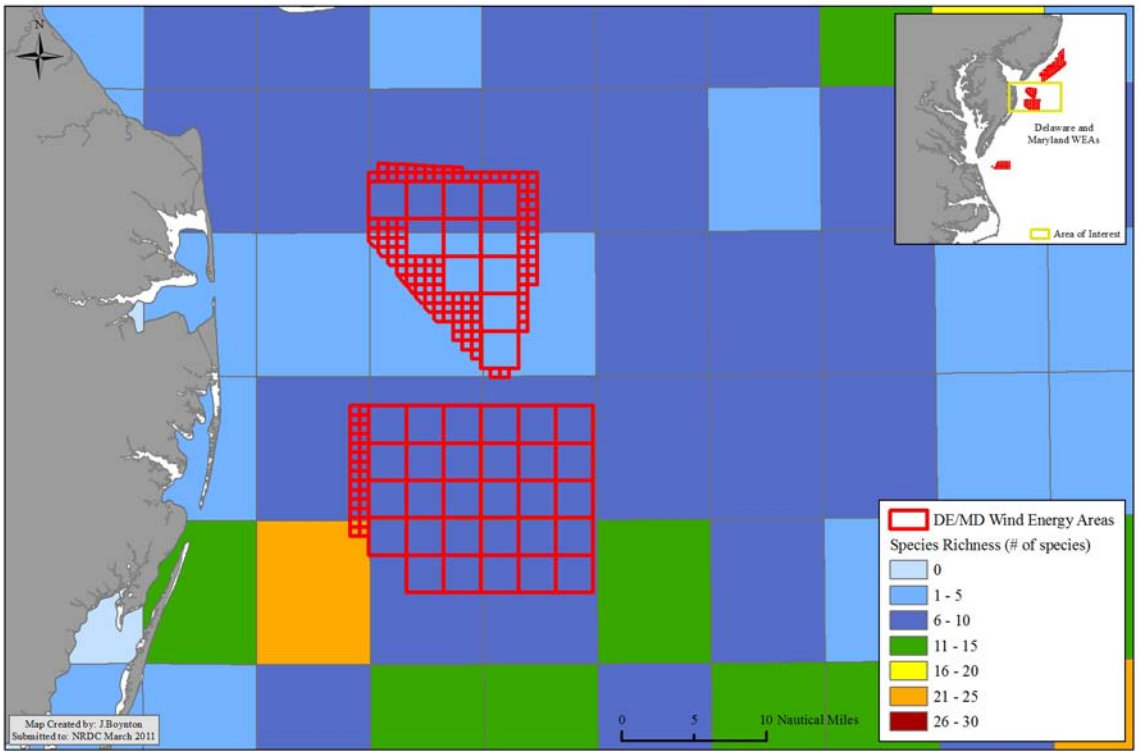

Figure 57: Species richness (all species and life stages combined) – DE/MD WEAS

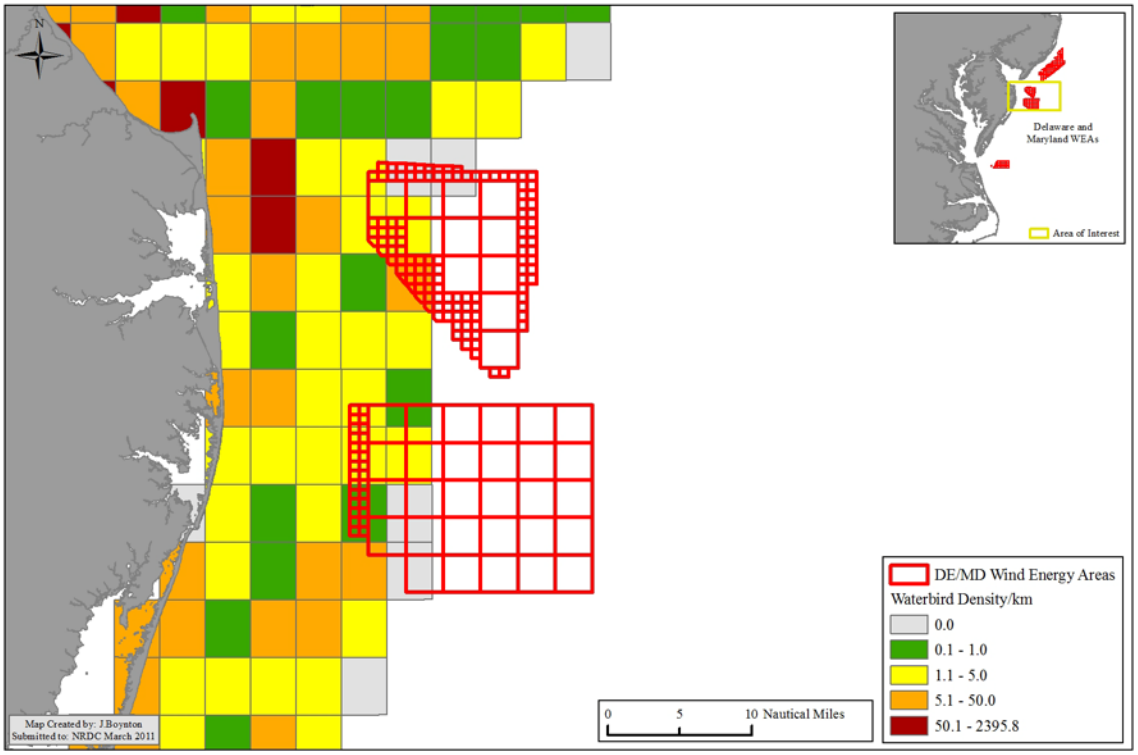

Figure 58: Waterbird density/km – DE/MD WEAS

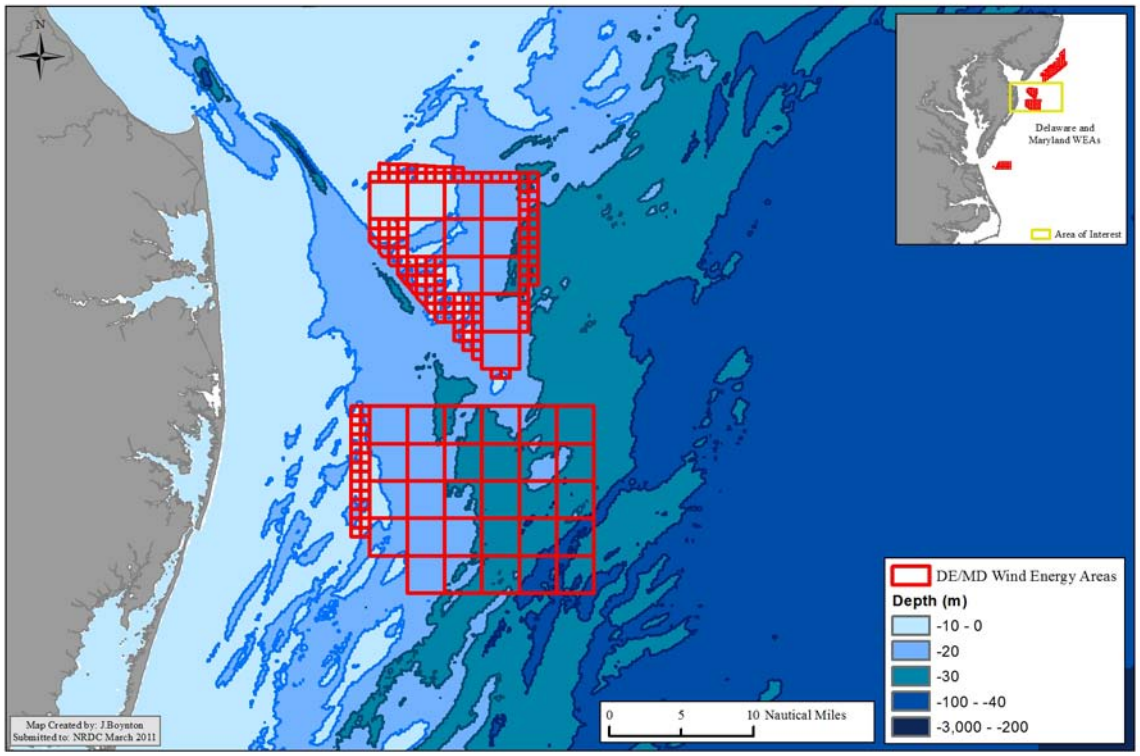

Figure 59: Depth contours – DE/MD WEAs

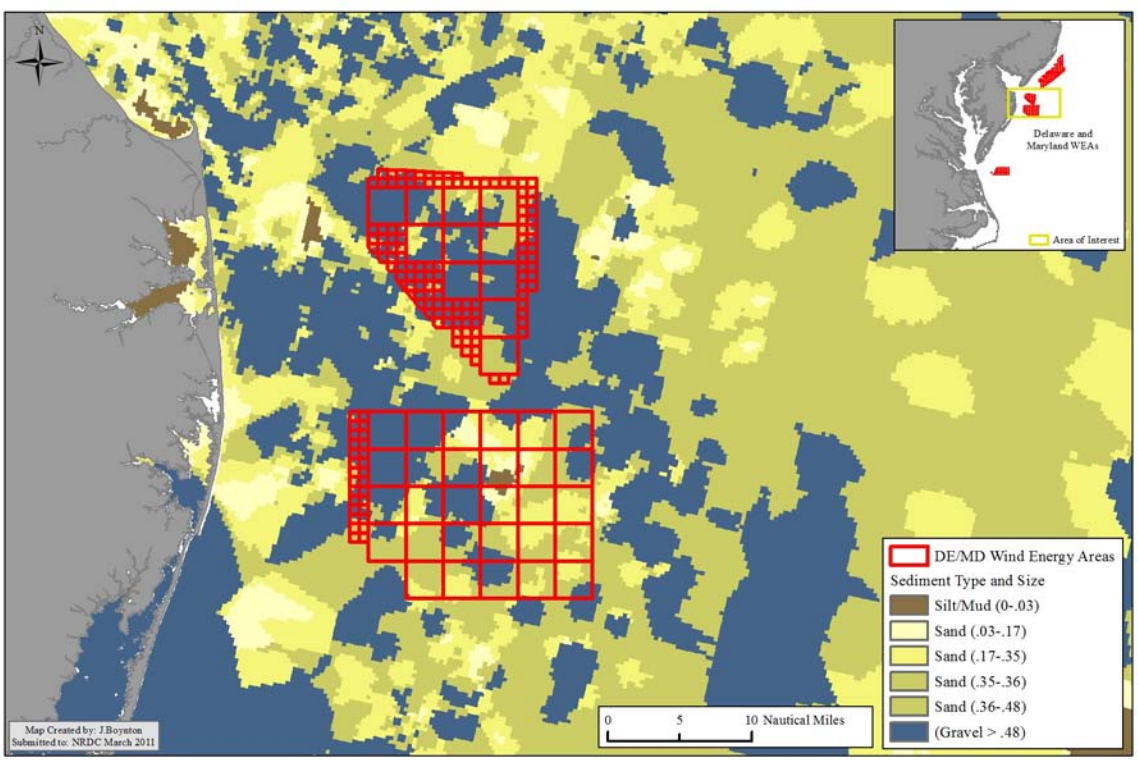

Figure 60: Sediment type and size – DE/MD WEAs

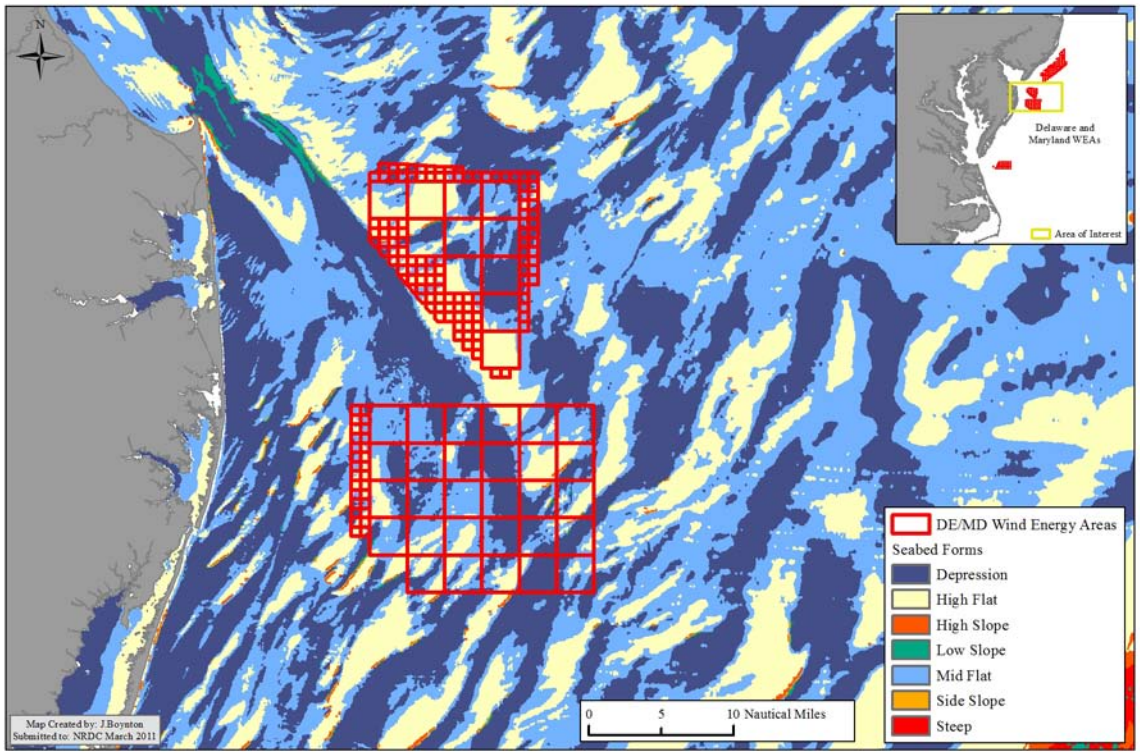

Figure 61: Seabed form – DE/MD WEAs

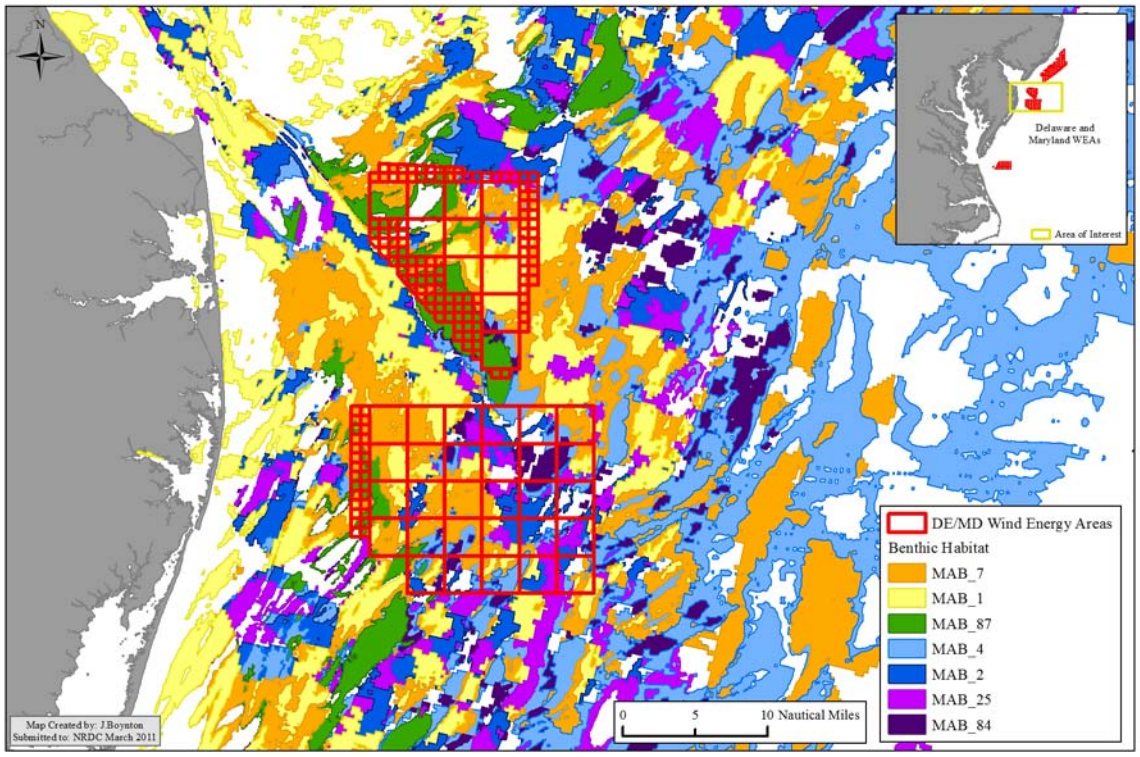

Figure 62: Benthic habitats – DE/MD WEAs

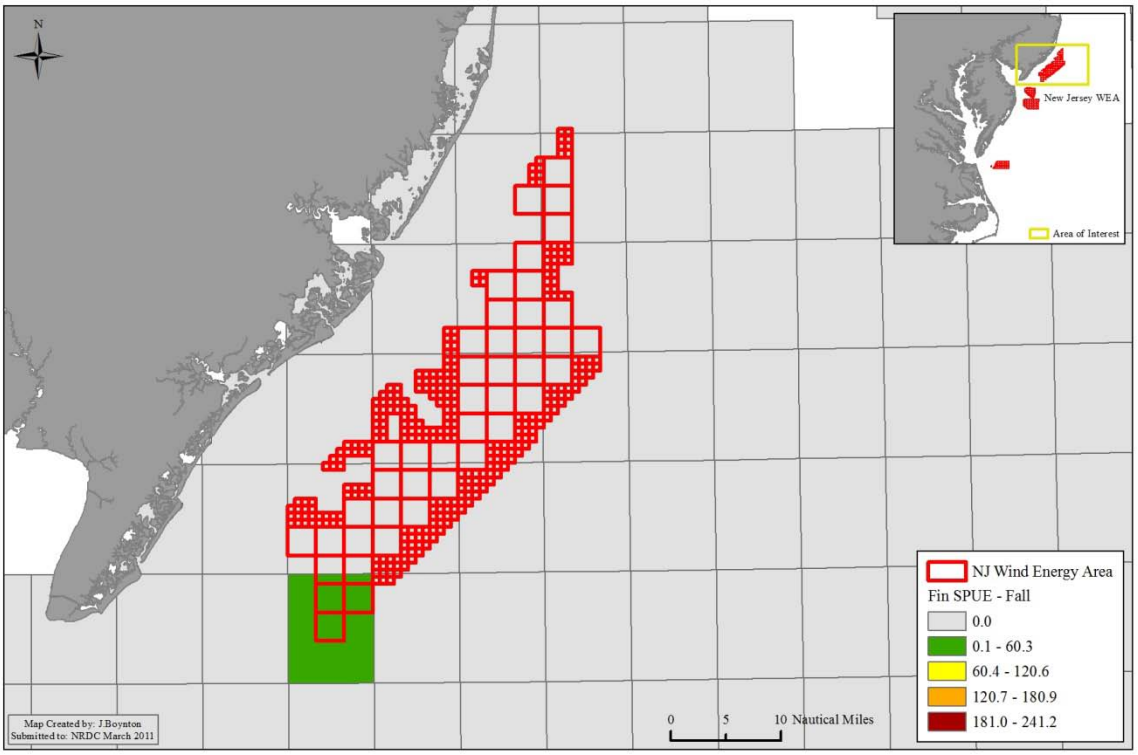

Figure 63: Fin whale SPUE fall season – New Jersey WEA

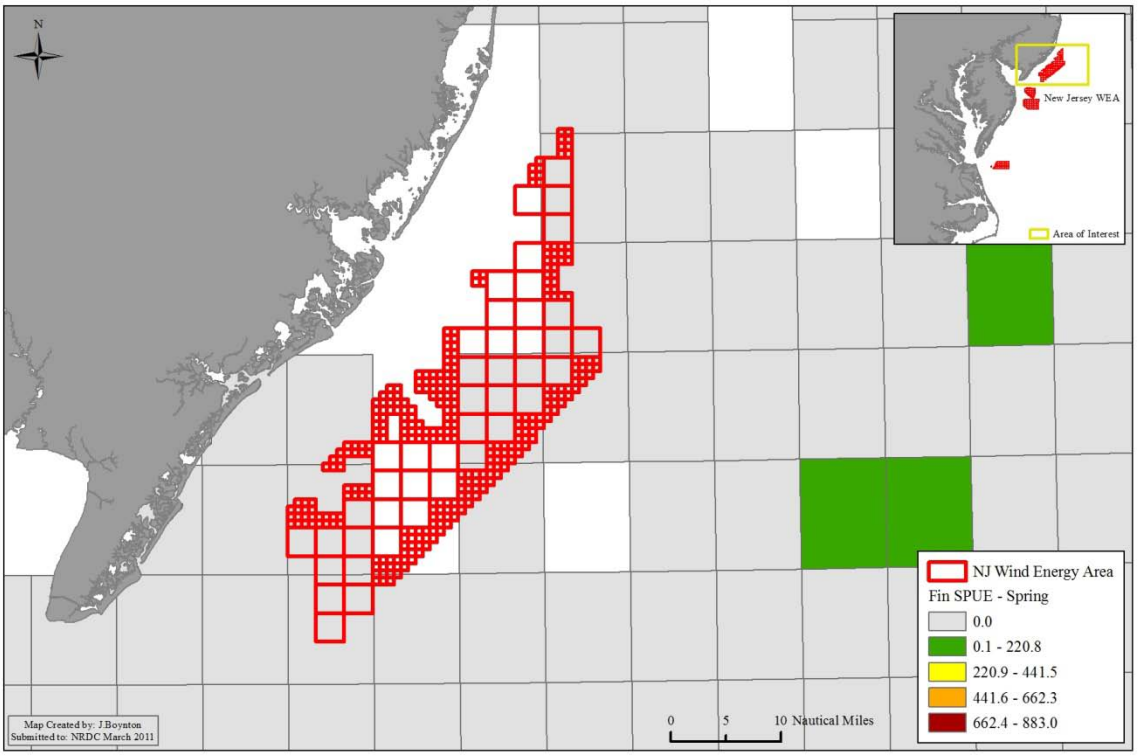

Figure 64: Fin Whale SPUE spring season – New Jersey WEA

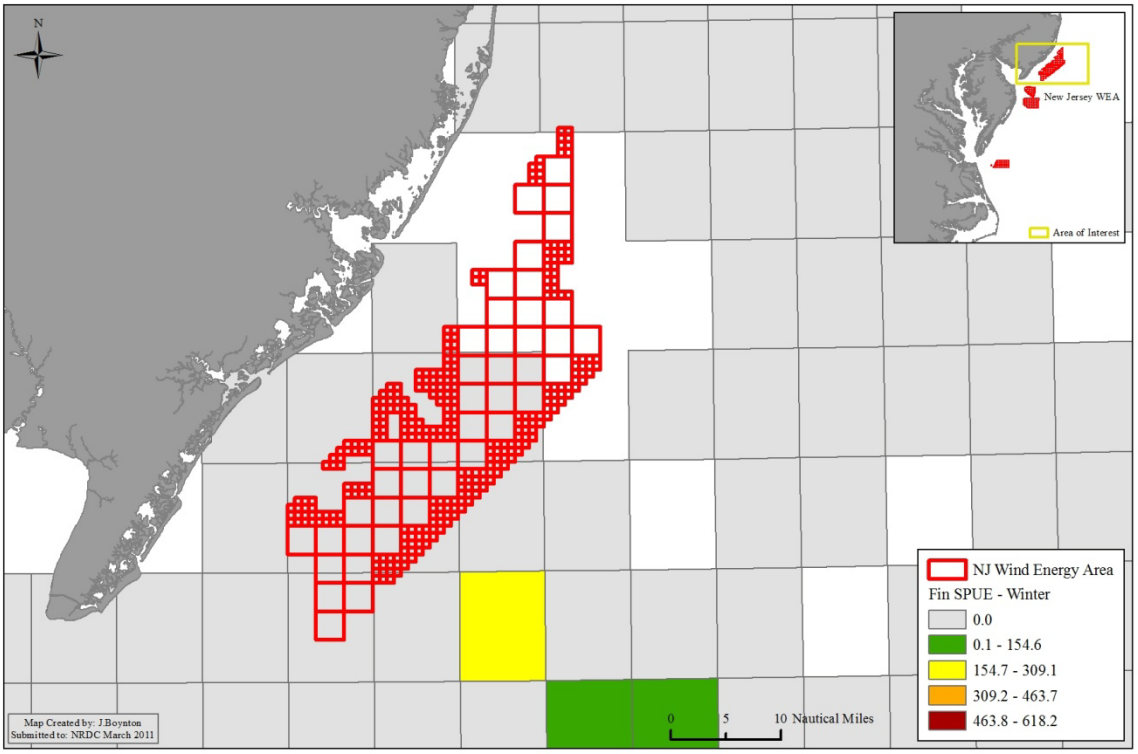

Figure 65: Fin Whale SPUE winter season – New Jersey WEA

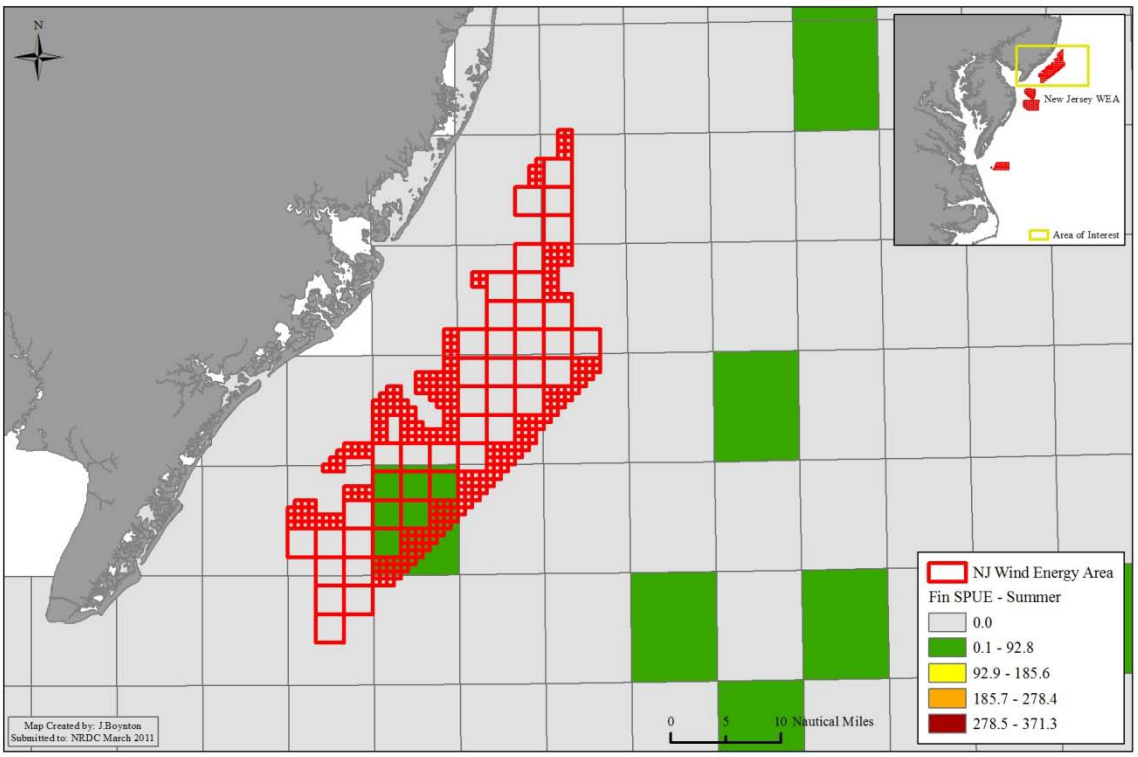

Figure 66: Fin Whale SPUE summer – New Jersey WEA

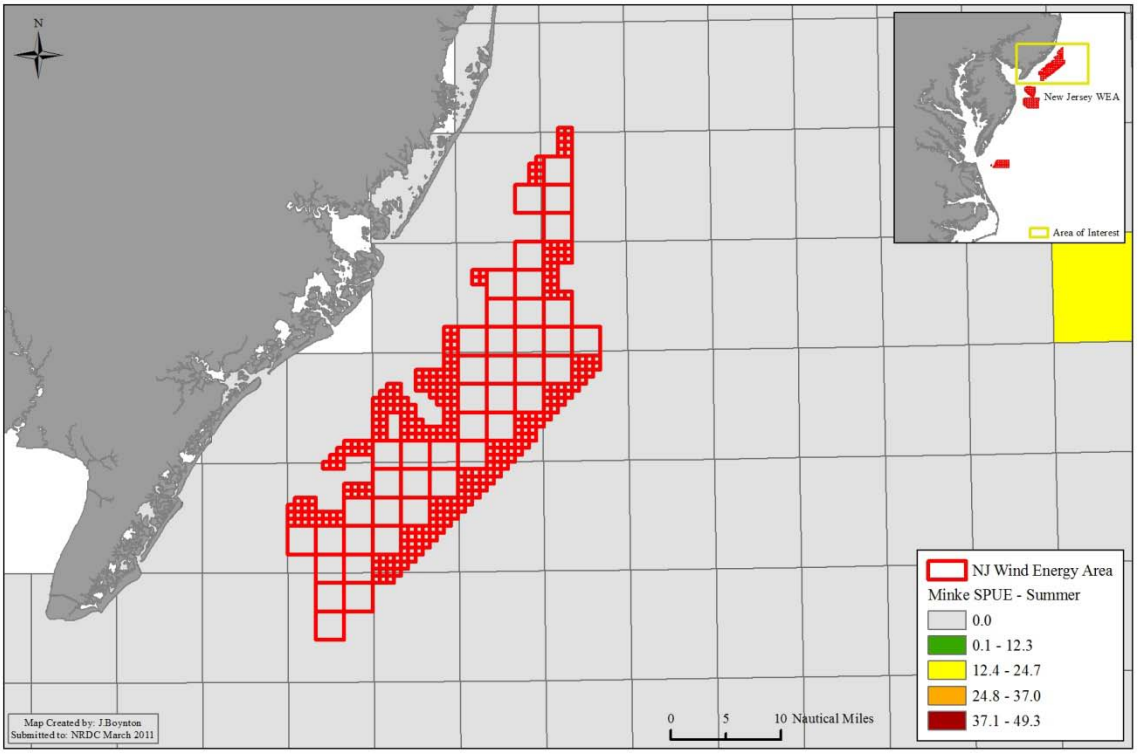

Figure 67: Minke whale SPUE Summer – New Jersey WEA

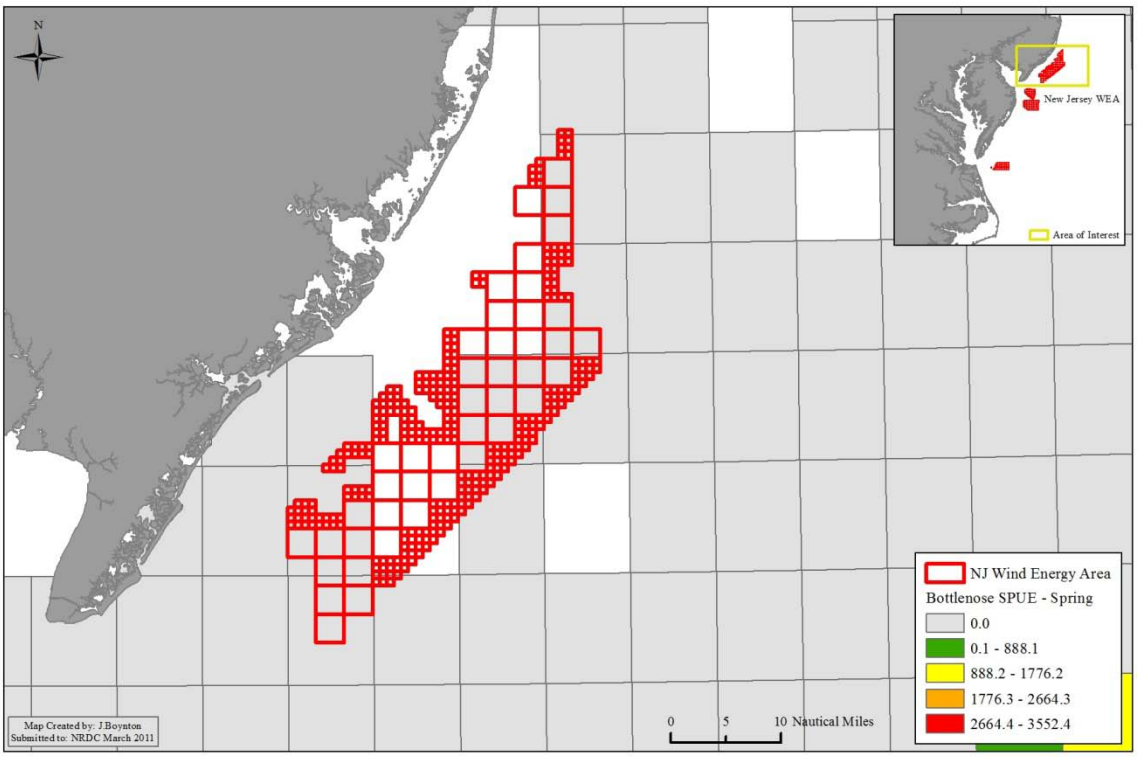

Figure 68: Bottlenose dolphin SPUE spring season – New Jersey WEA

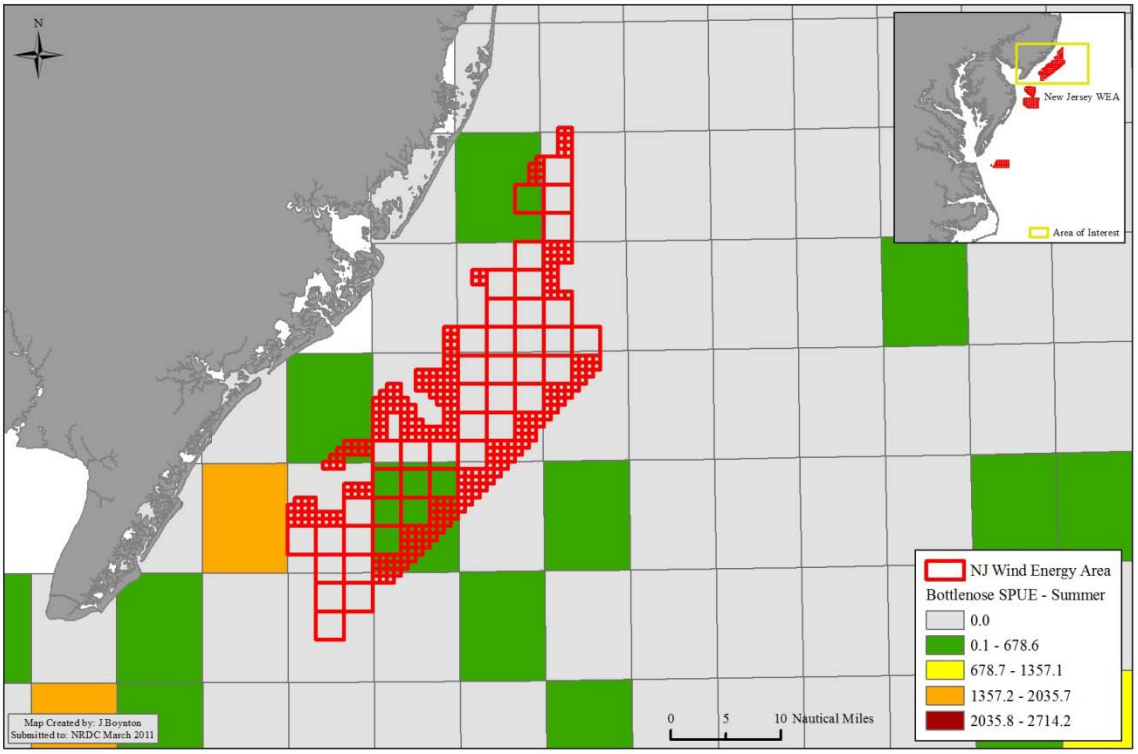

Figure 69: Bottlenose SPUE summer season – New Jersey WEA

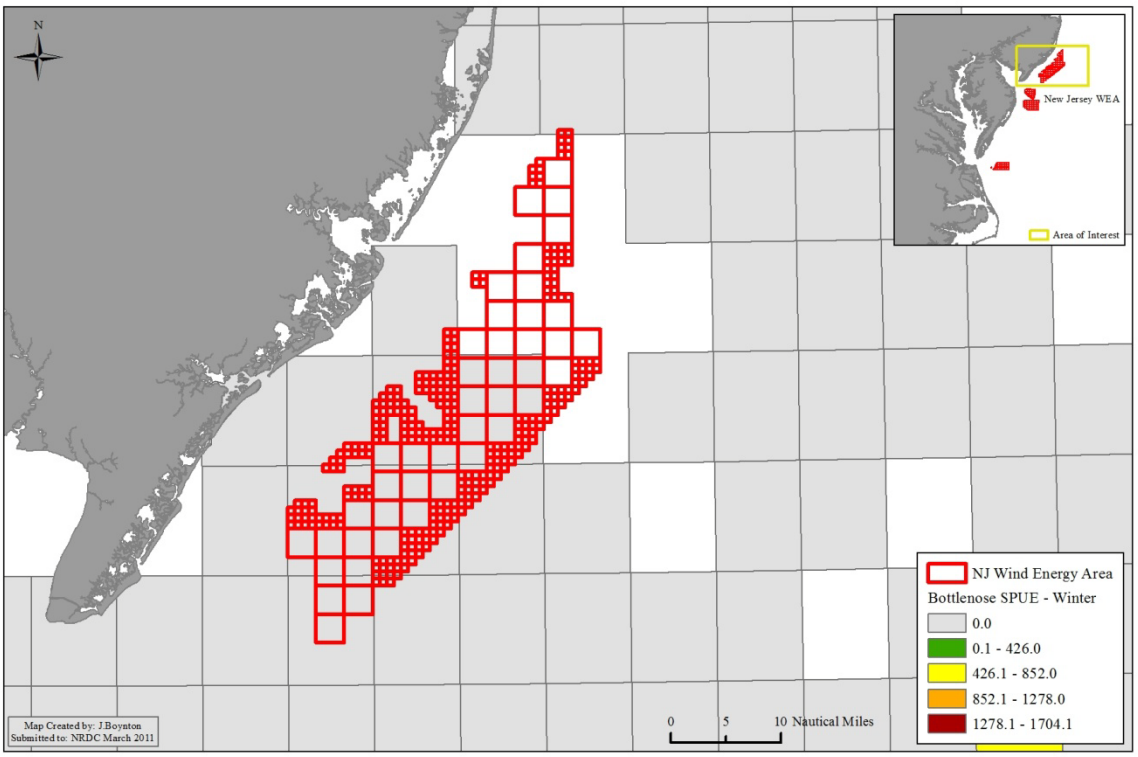

Figure 70: Bottlenose SPUE winter season – New Jersey WEA

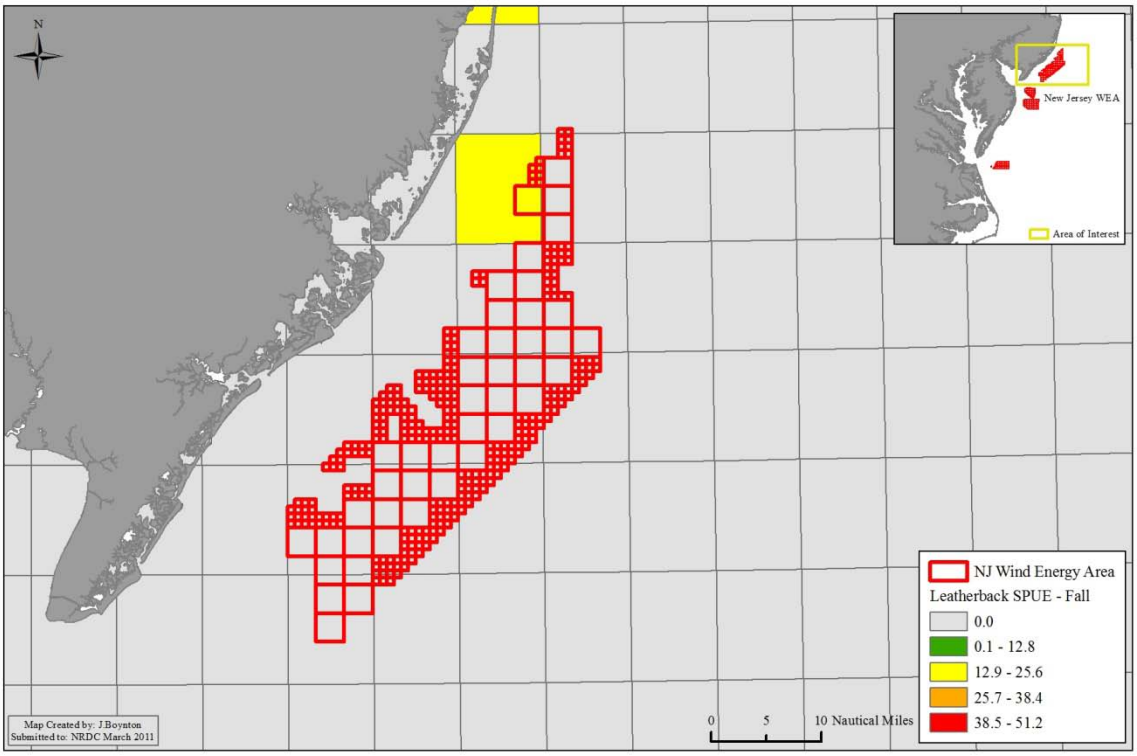

Figure 71: Leatherback SPUE fall – New Jersey WEA

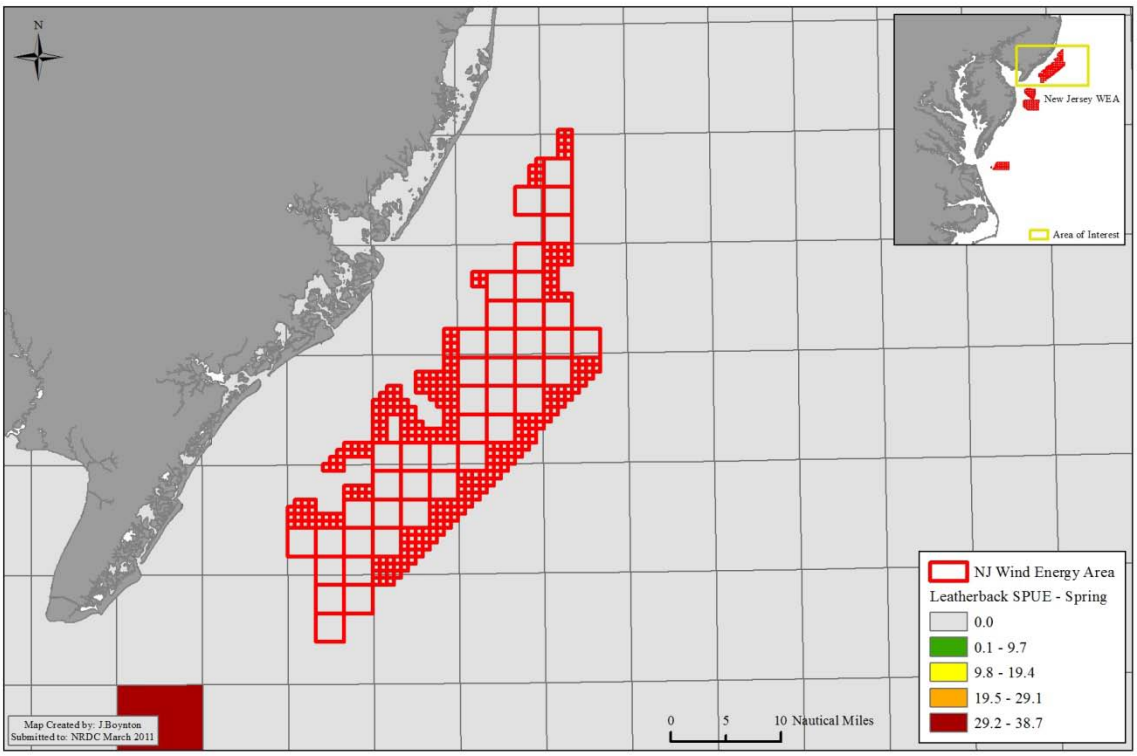

Figure 72: Leatherback SPUE spring season – New Jersey WEA

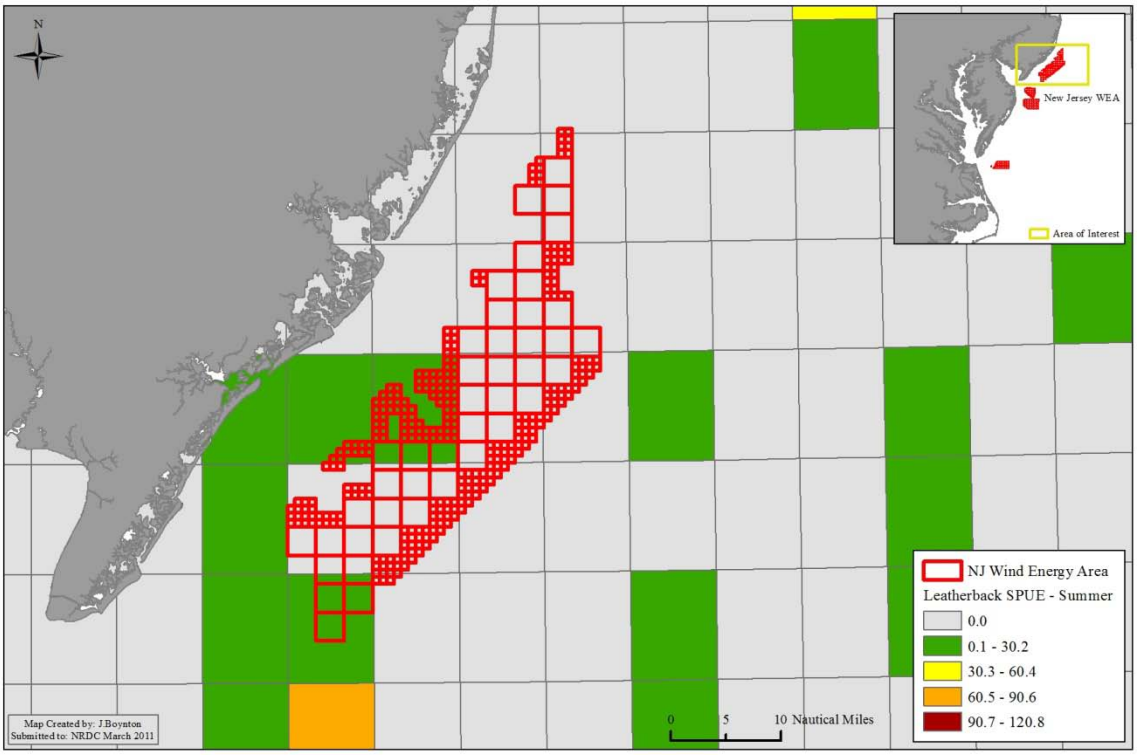

Figure 73: Leatherback SPUE summer season – New Jersey WEA

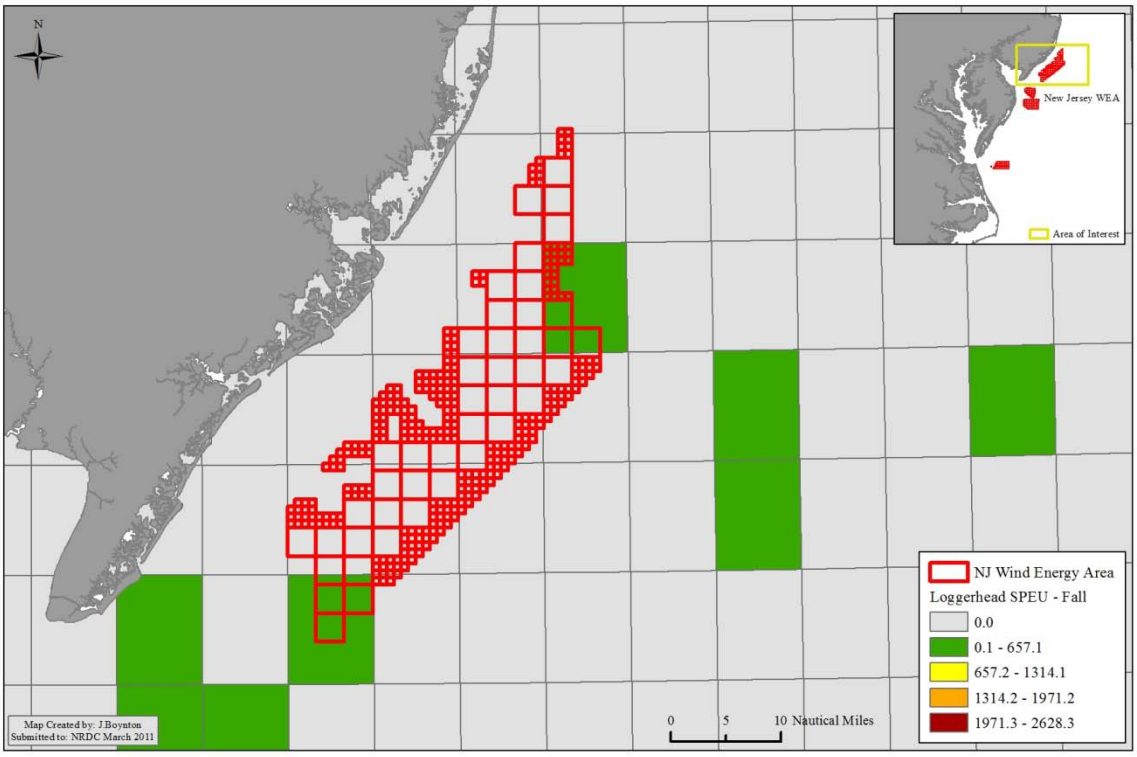

Figure 74: Loggerhead SPUE fall season – New Jersey WEA

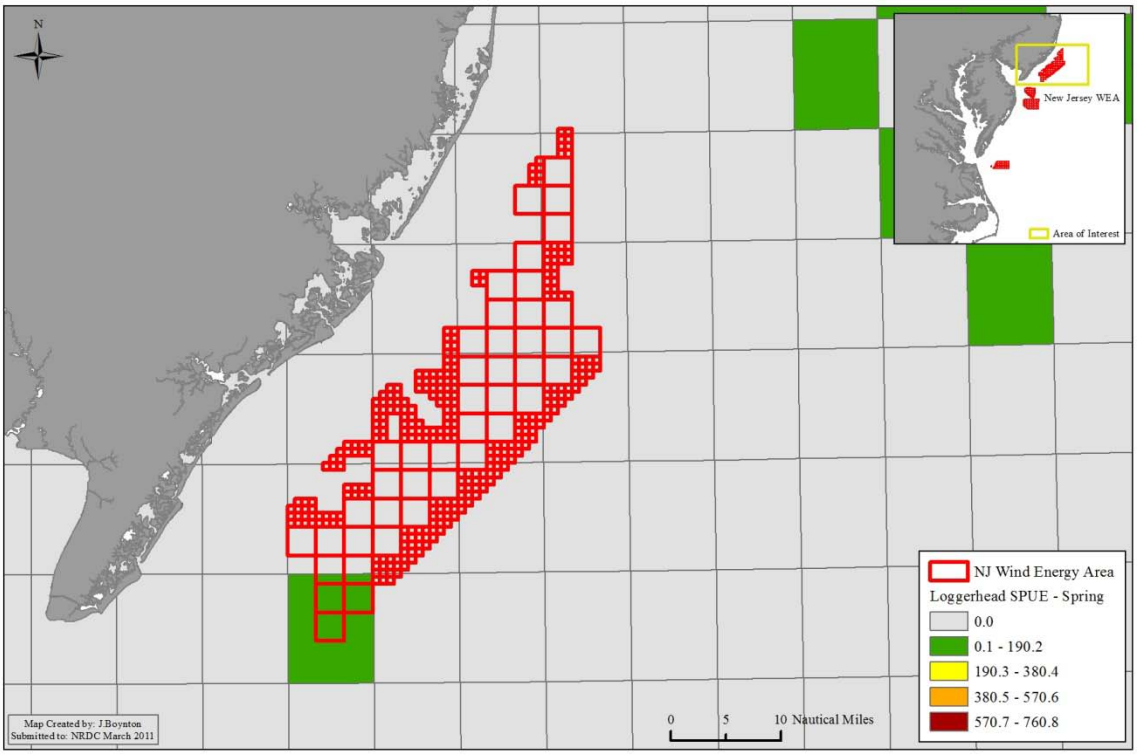

Figure 75: Loggerhead SPUE spring season – New Jersey WEA

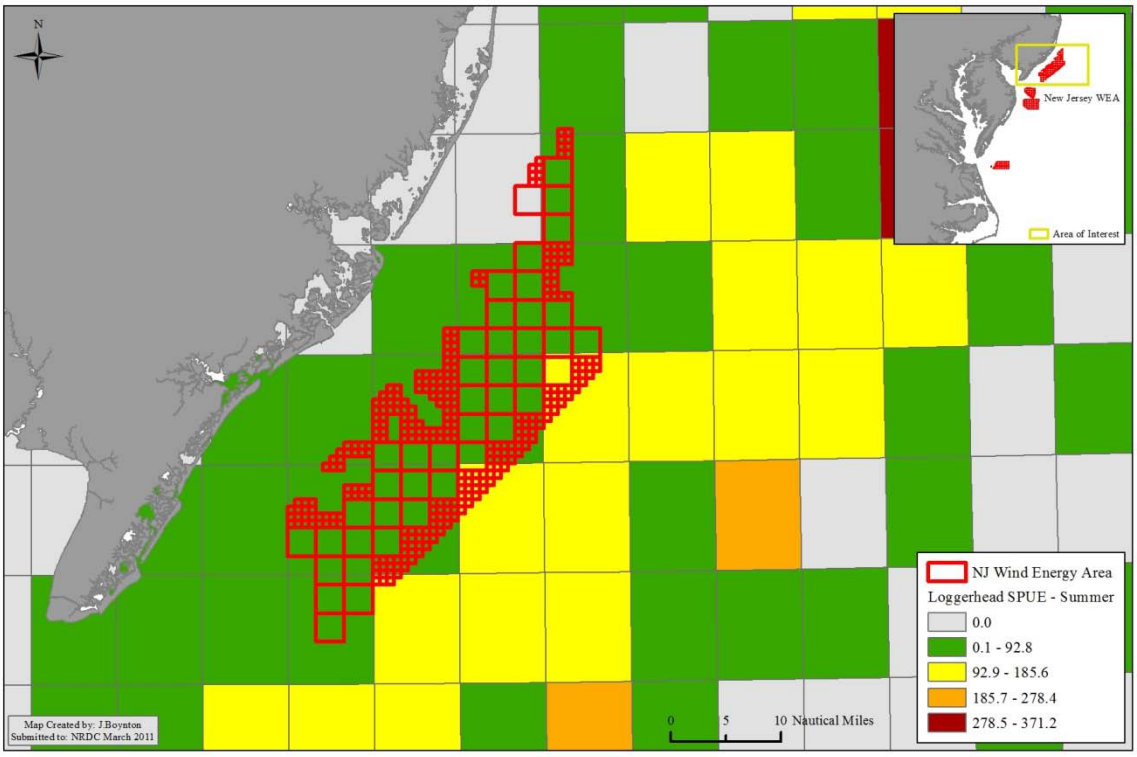

Figure 76: Loggerhead SPUE summer season – New Jersey WEA

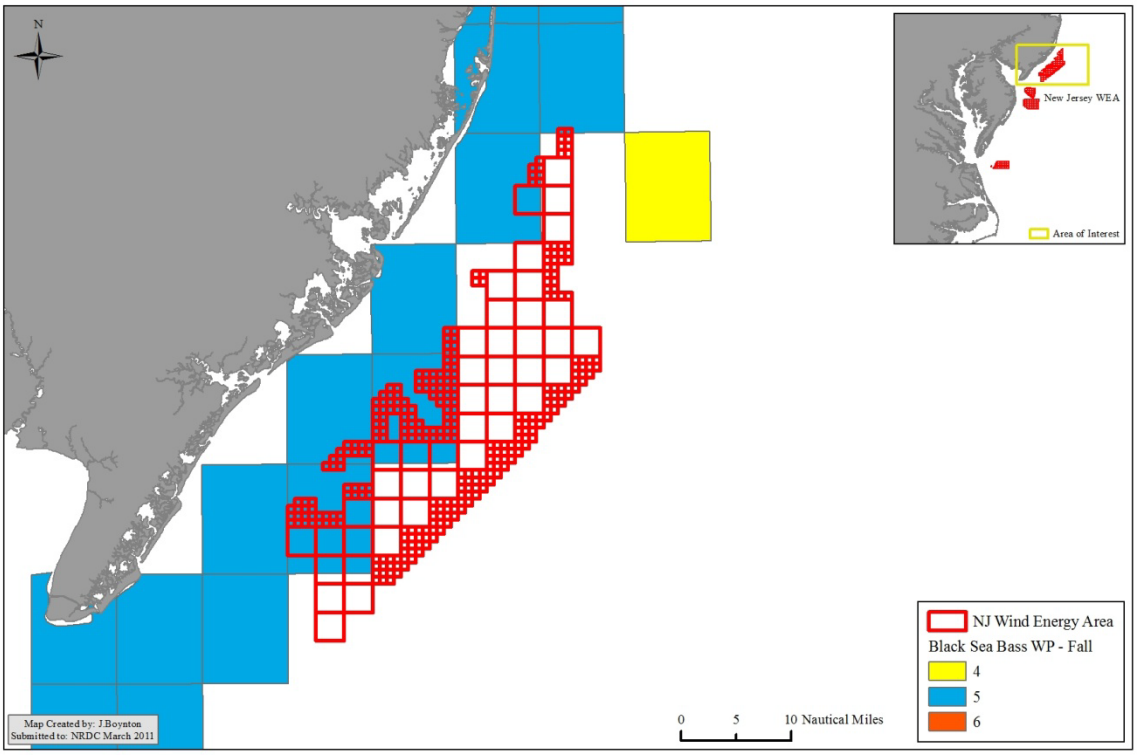

Figure 77: Black sea bass weighted persistence fall season – New Jersey WEA

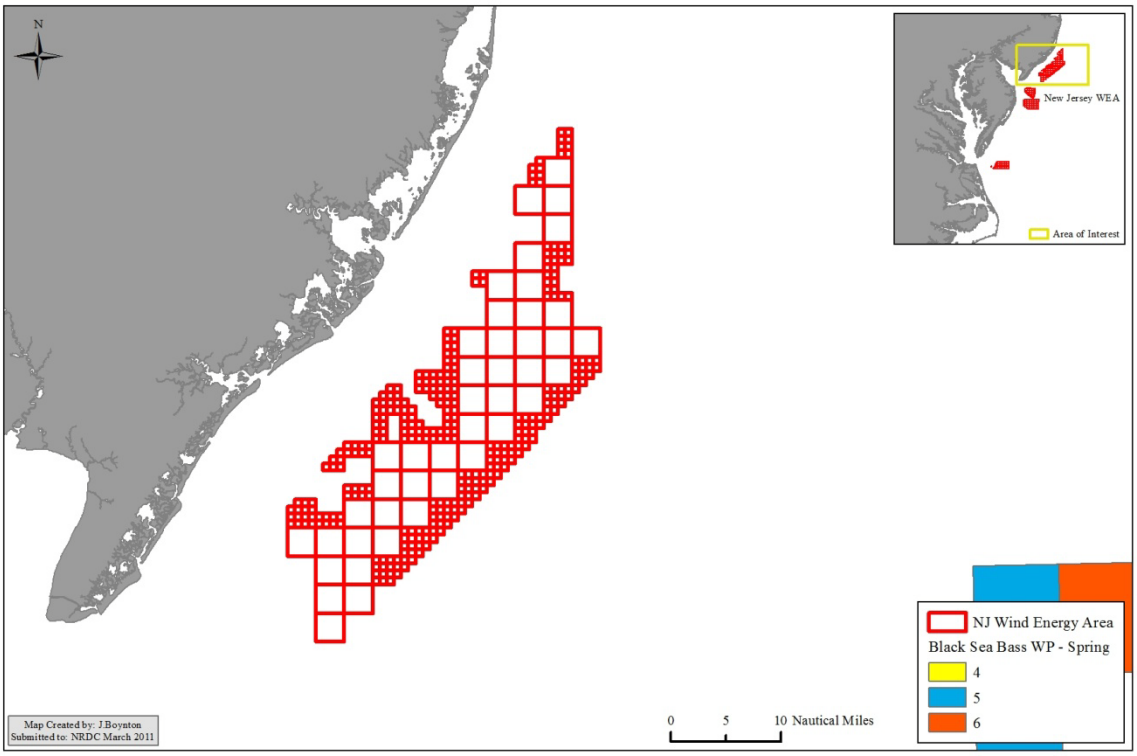

Figure 78: Black sea bass weighted persistence spring season – New Jersey WEA

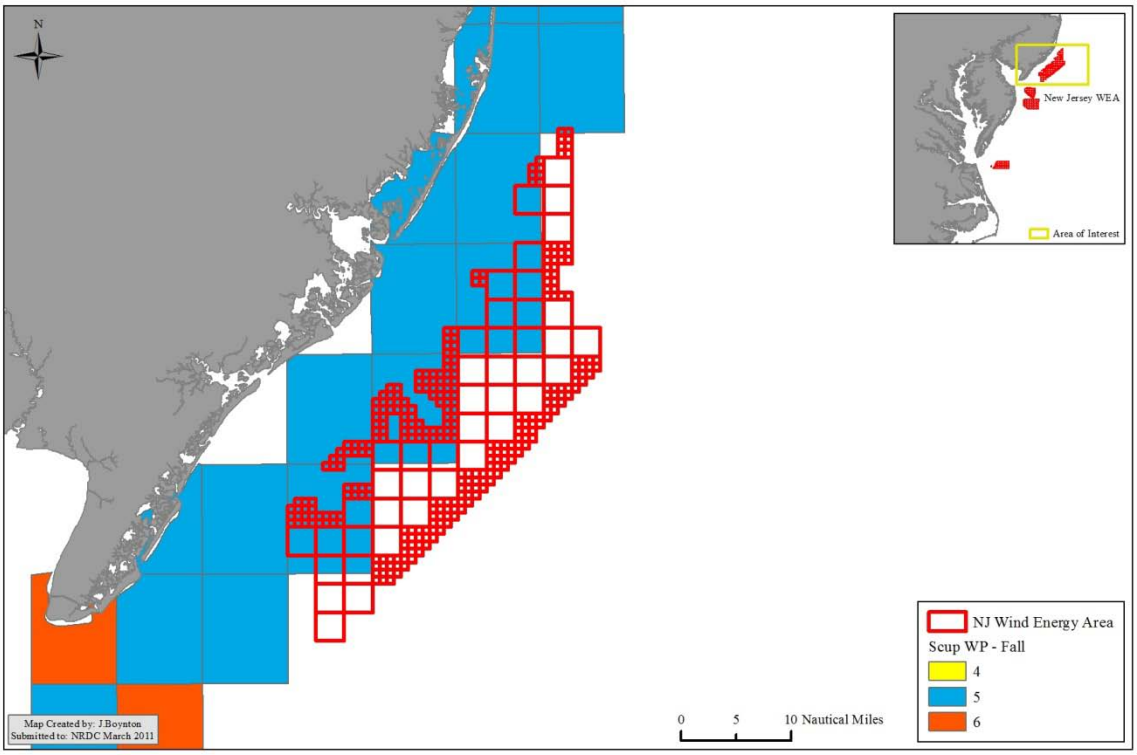

Figure 79: Scup weighted persistence fall season – New Jersey WEA

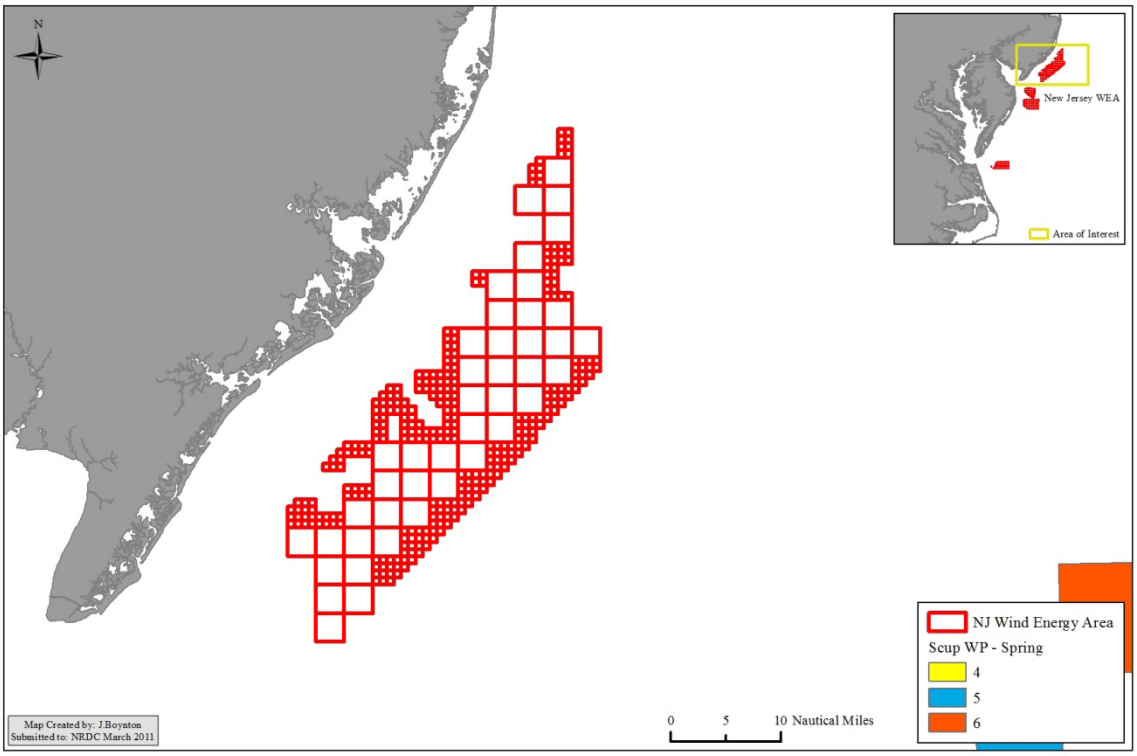

Figure 80: Scup weighted persistence spring season – New Jersey WEA

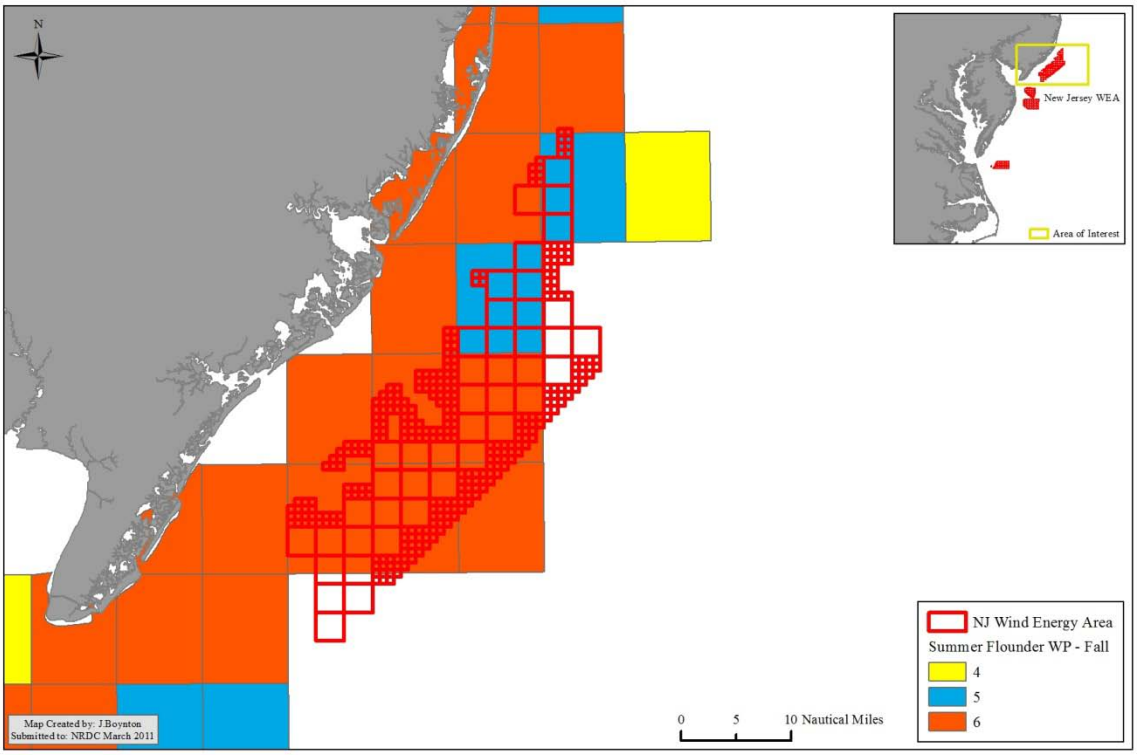

Figure 81: Summer flounder weighted persistence fall season – New Jersey WEA

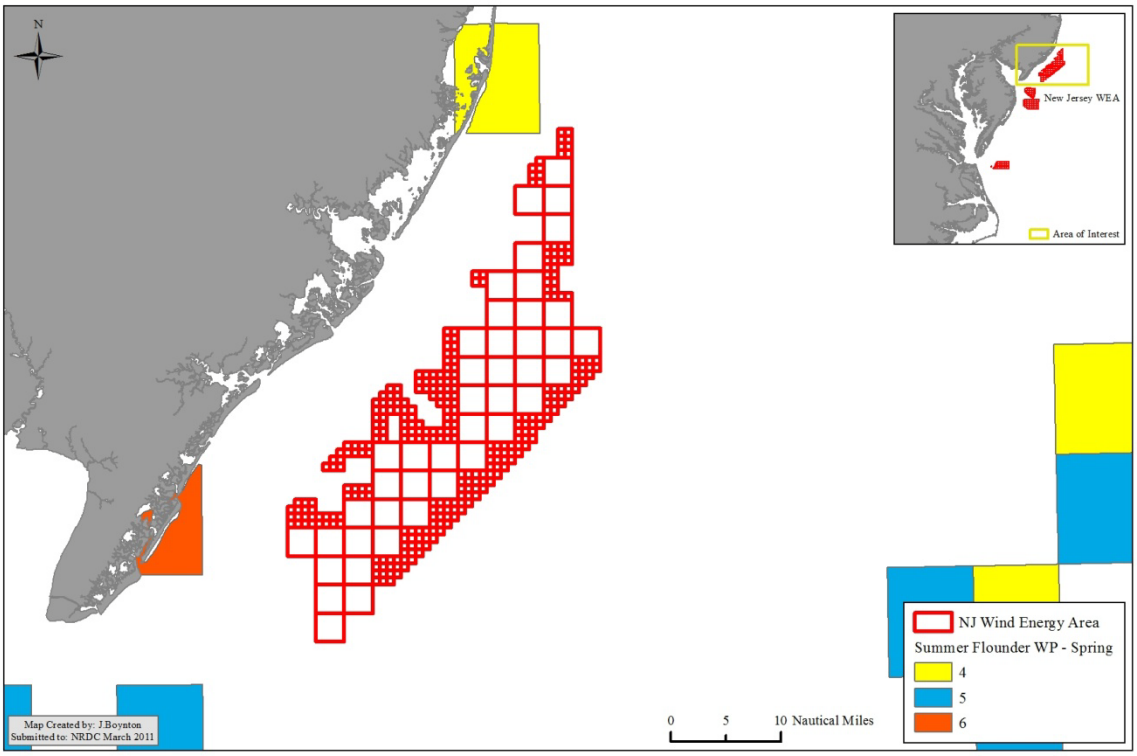

Figure 82: Summer flounder weighted persistence spring season – New Jersey WEA

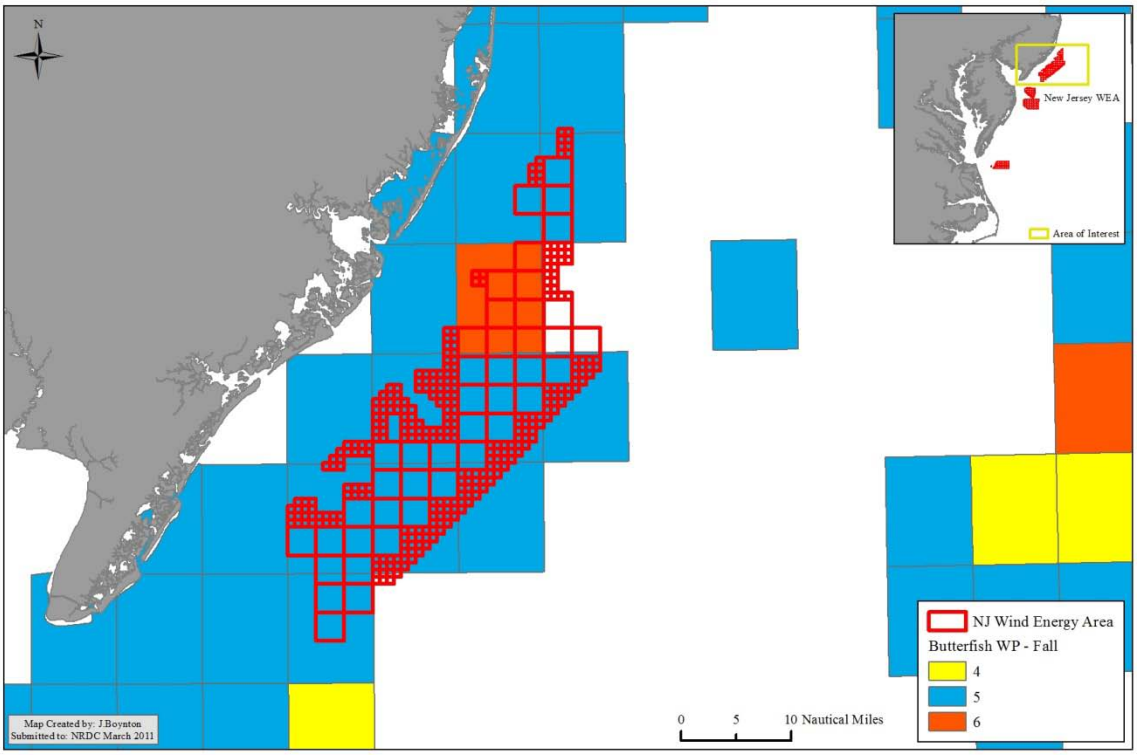

Figure 83: Butterfish weighted persistence fall season – New Jersey WEA

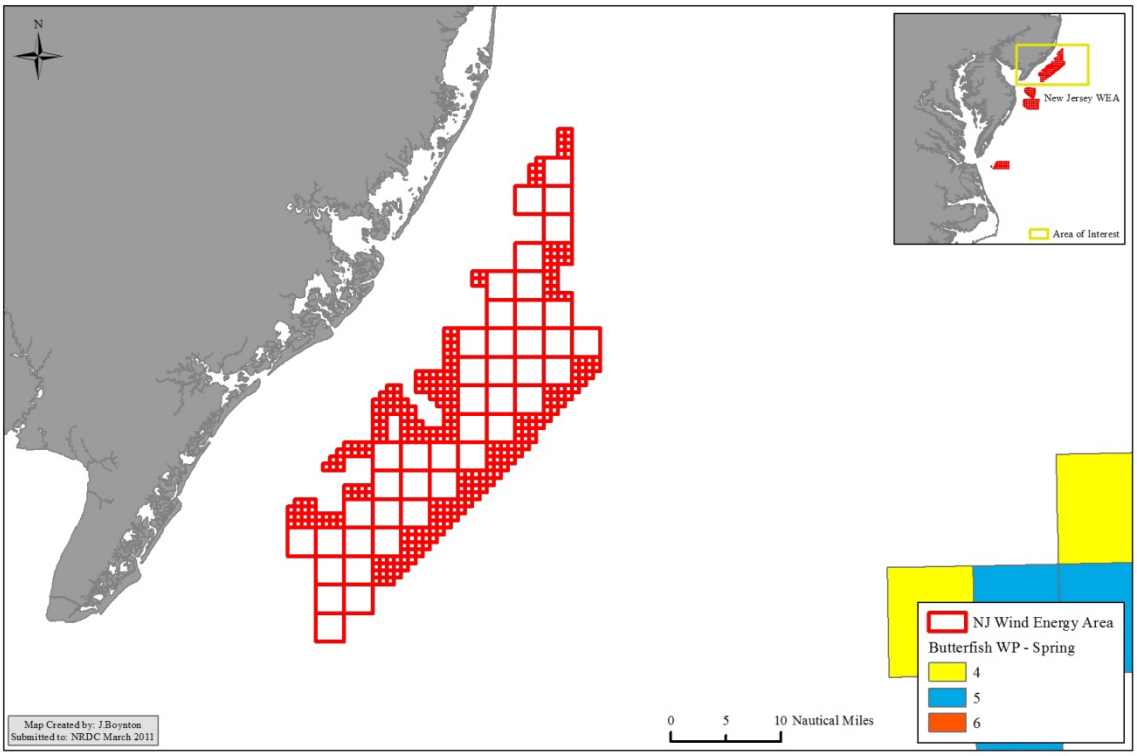

Figure 84: Butterfish weighted persistence spring season – New Jersey WEA

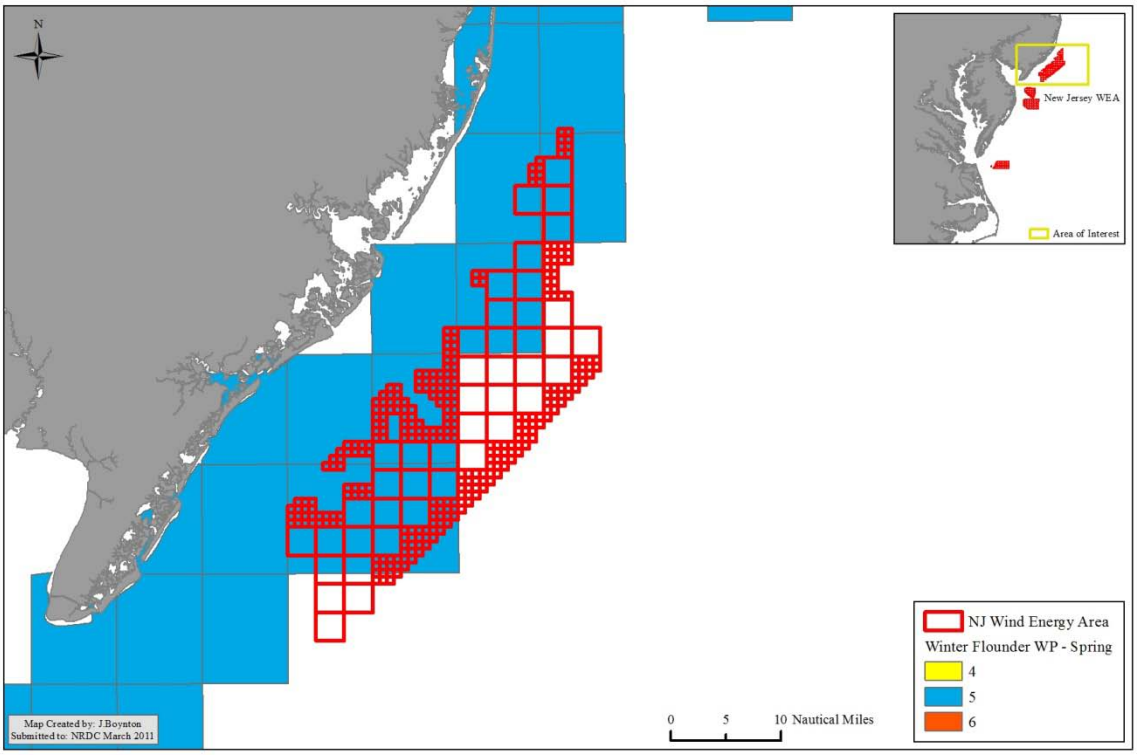

Figure 85: Winter flounder weighted persistence spring season – New Jersey WEA

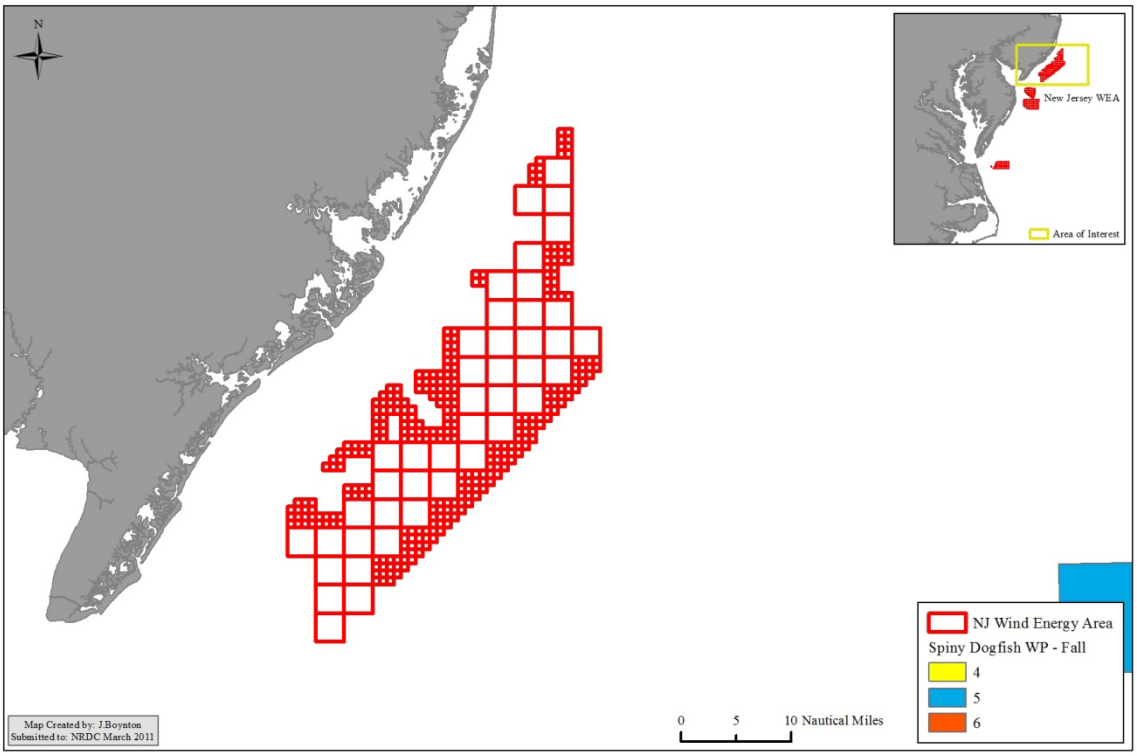

Figure 86: Spiny dogfish weighted persistence fall season – New Jersey WEA

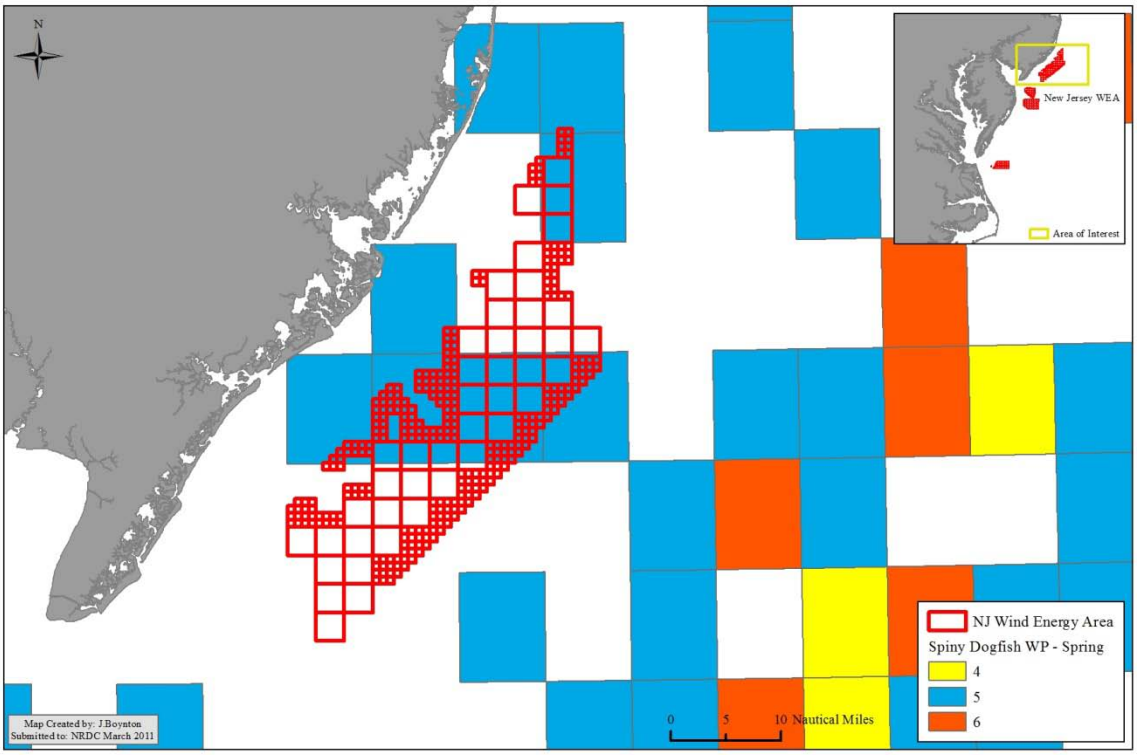

Figure 87: Spiny dogfish weighted persistence spring season – New Jersey WEA

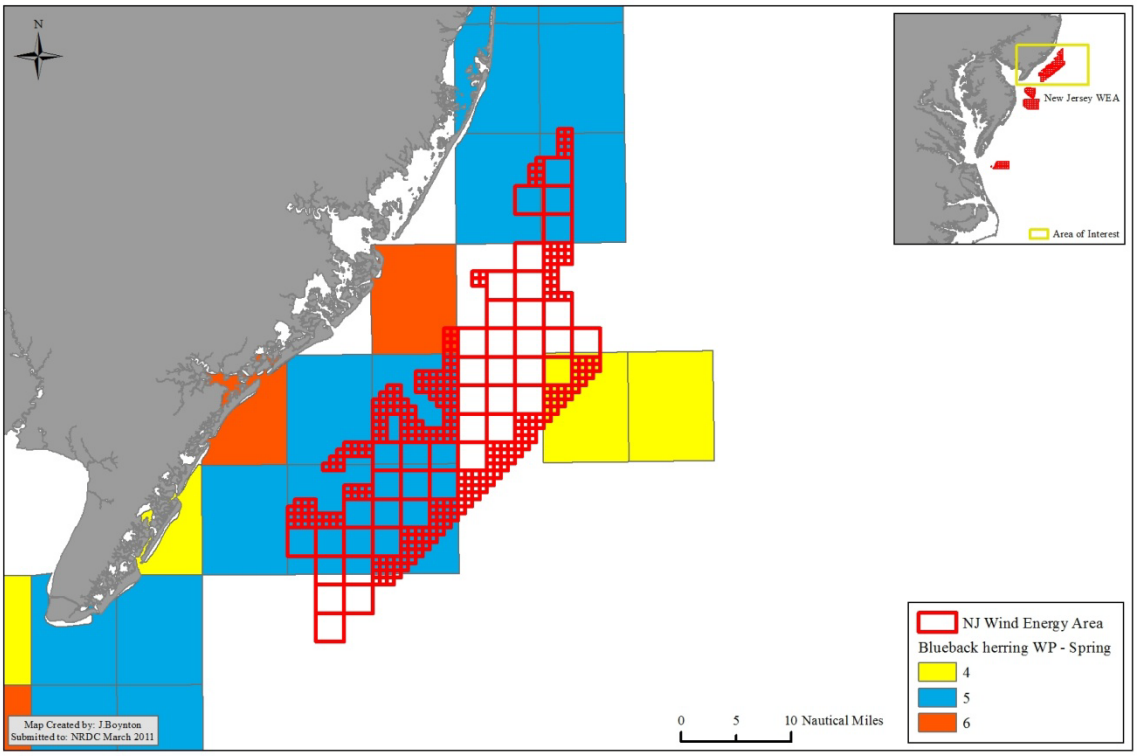

Figure 88: Blueback herring weighted persistence spring season – New Jersey WEA

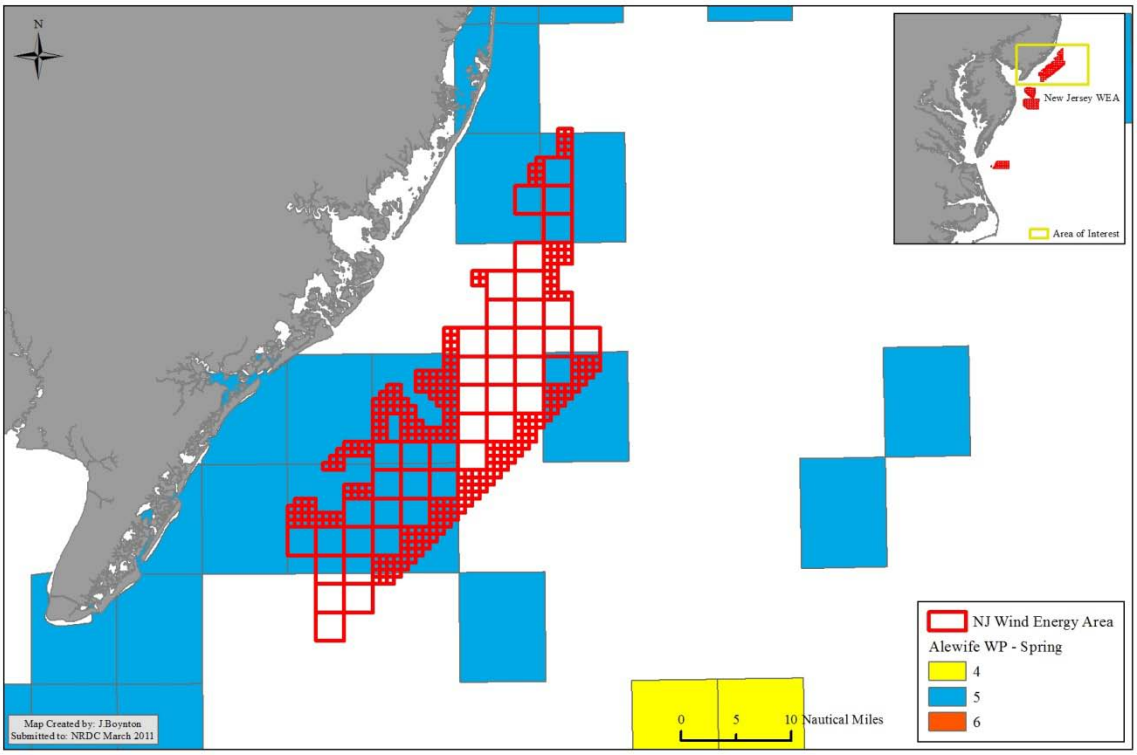

Figure 89: Alewife weighted persistence spring season – New Jersey WEA

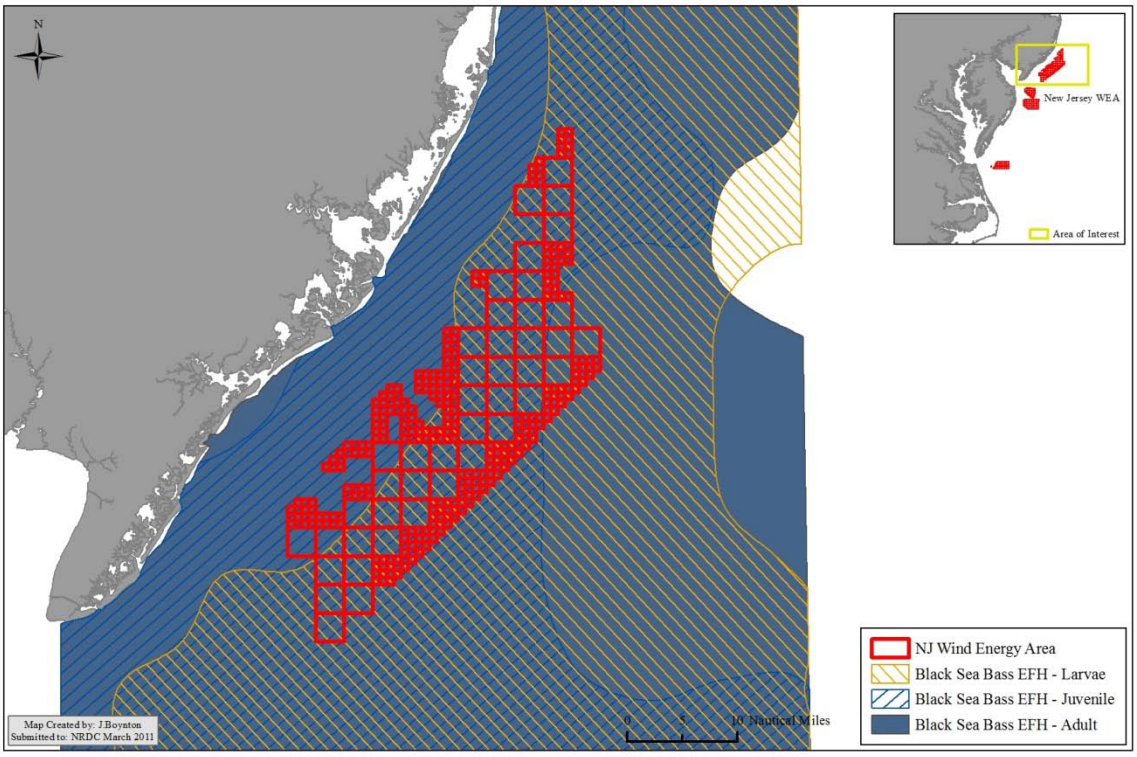

Figure 90: Black sea bass EFH – New Jersey WEA

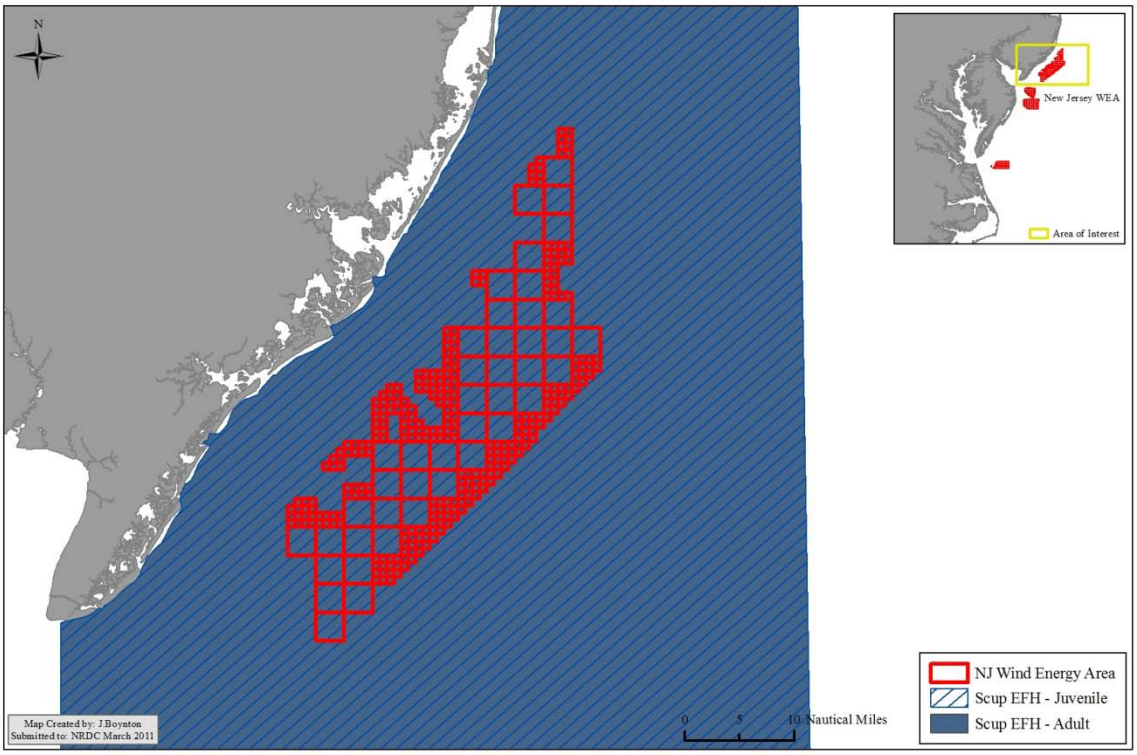

Figure 91: Scup EFH – New Jersey WEA

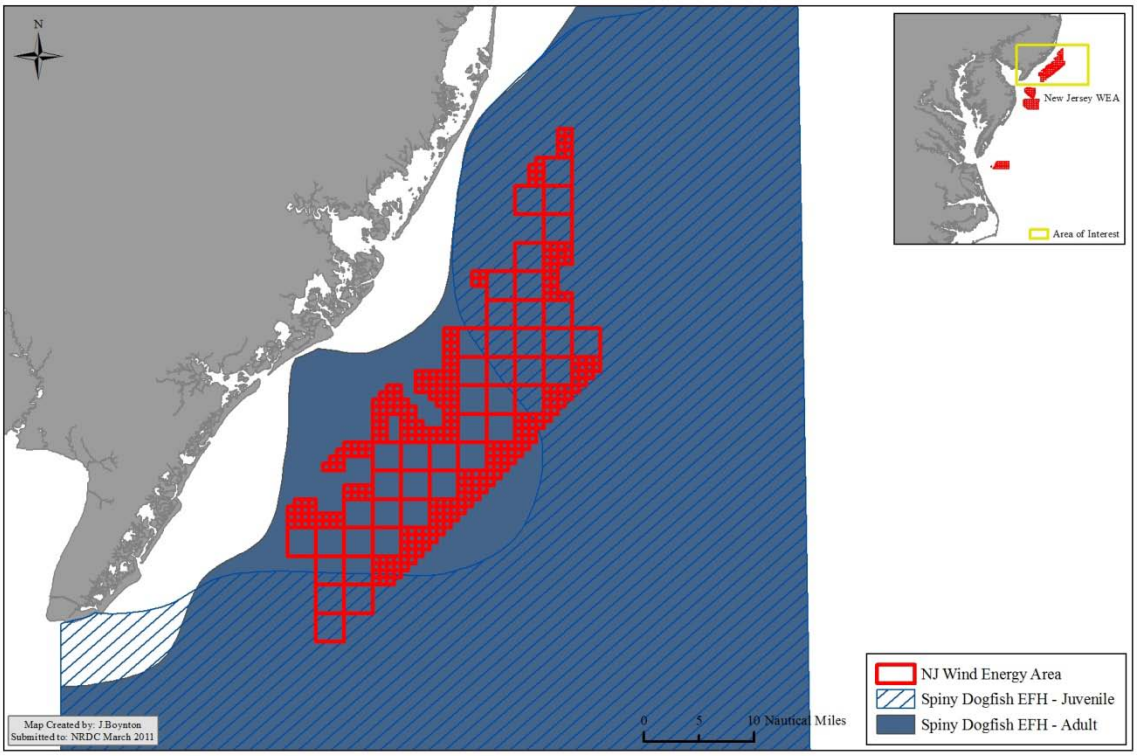

Figure 92: Spiny dogfish EFH – New Jersey WEA

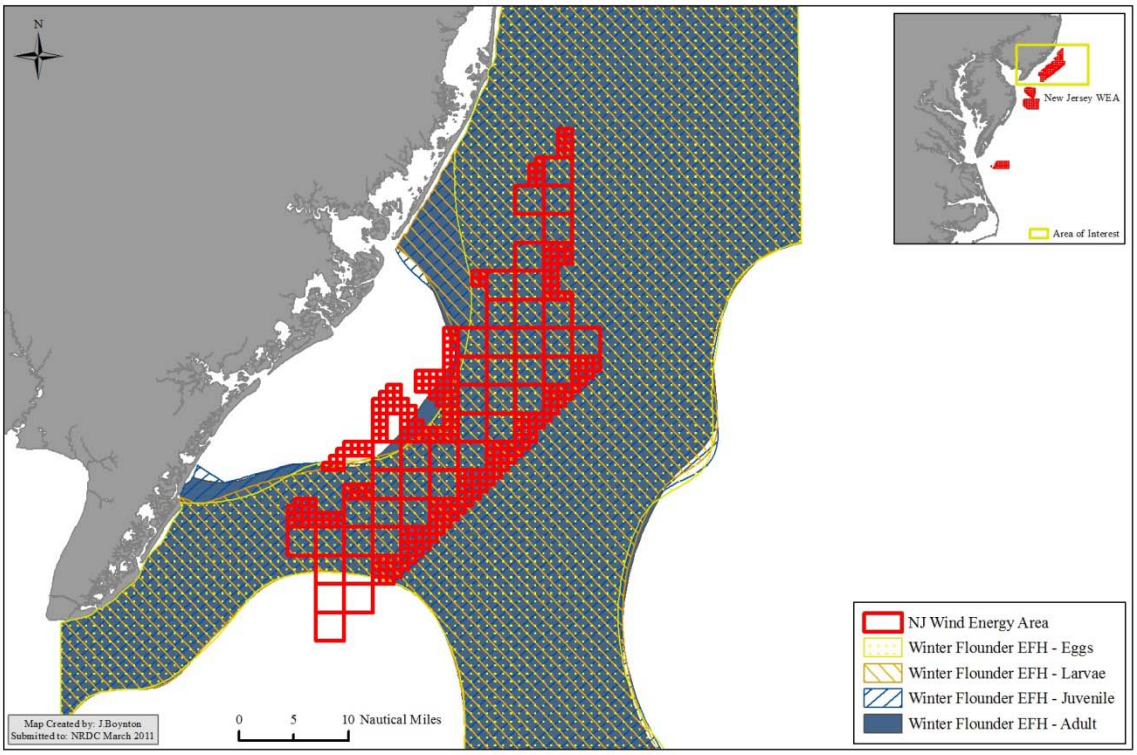

Figure 93: Winter flounder EFH – New Jersey WEA

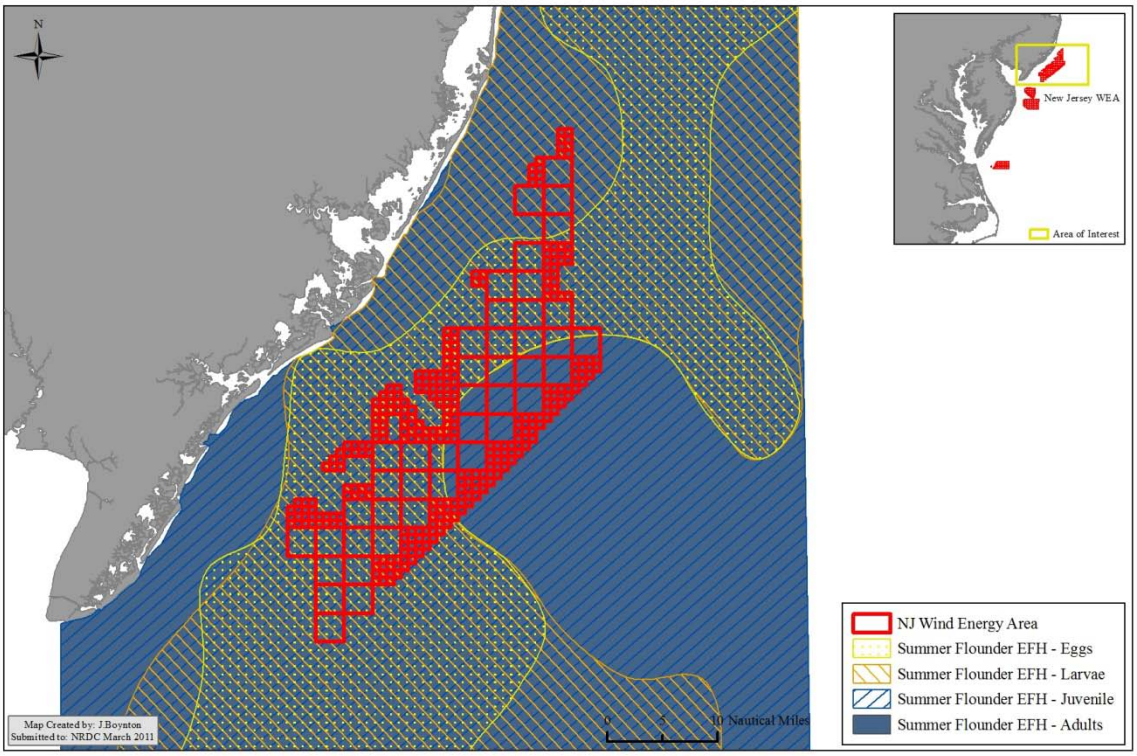

Figure 94: Summer flounder EFH – New Jersey WEA

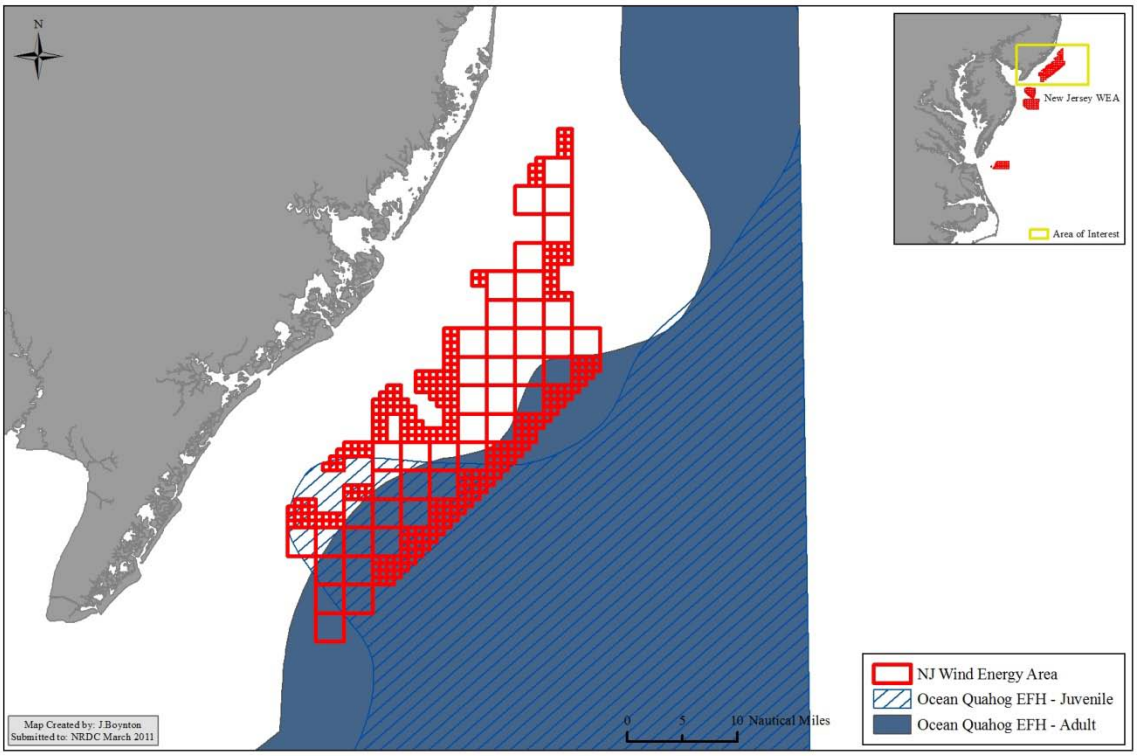

Figure 95: Ocean Quahog EFH – New Jersey WEA

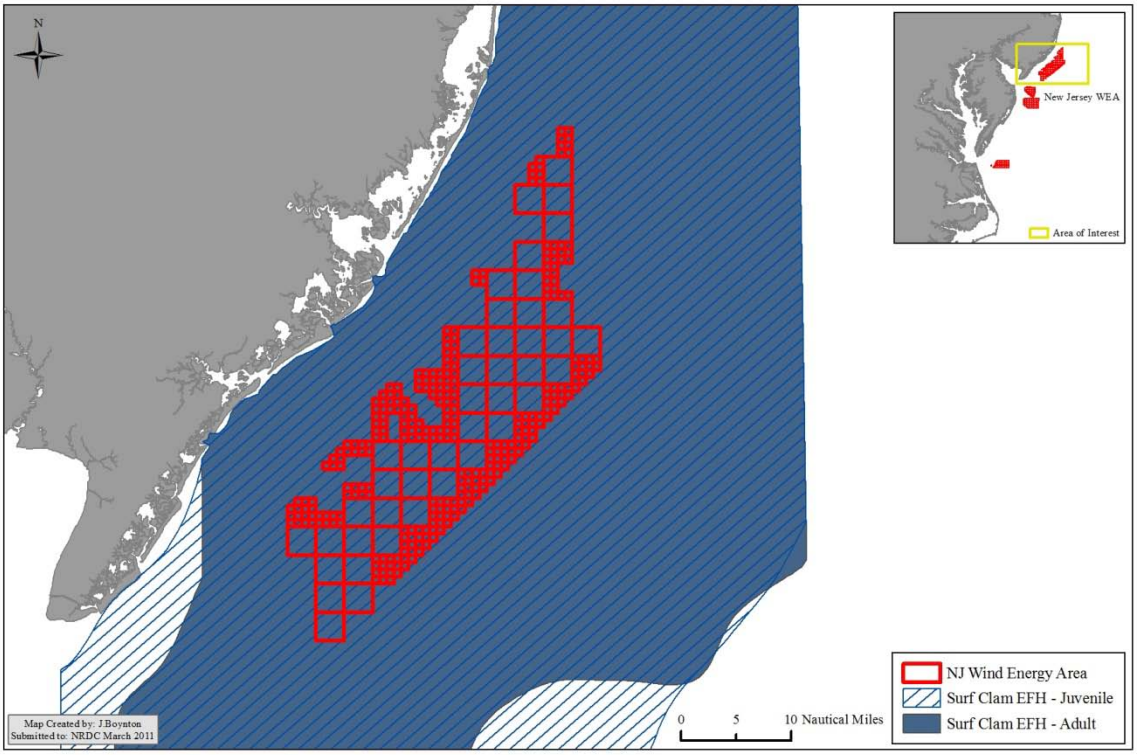

Figure 96: Surf clam EFH – New Jersey WEA

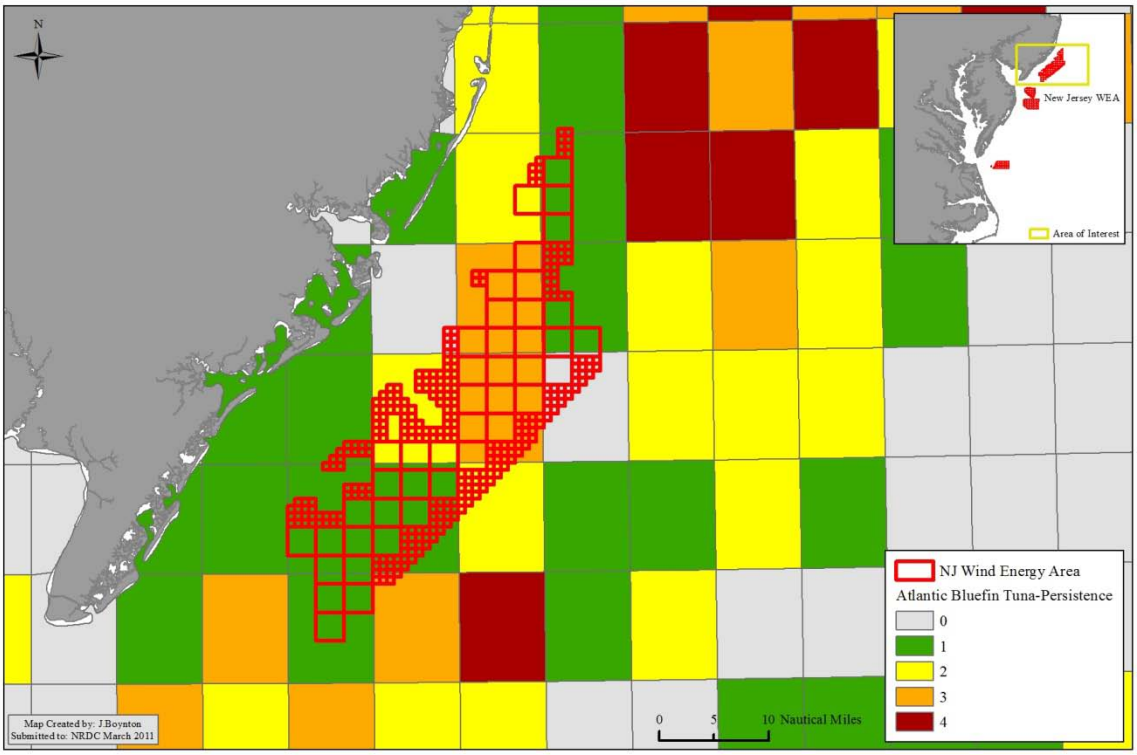

Figure 97: Atlantic bluefin tuna persistence – New Jersey WEA

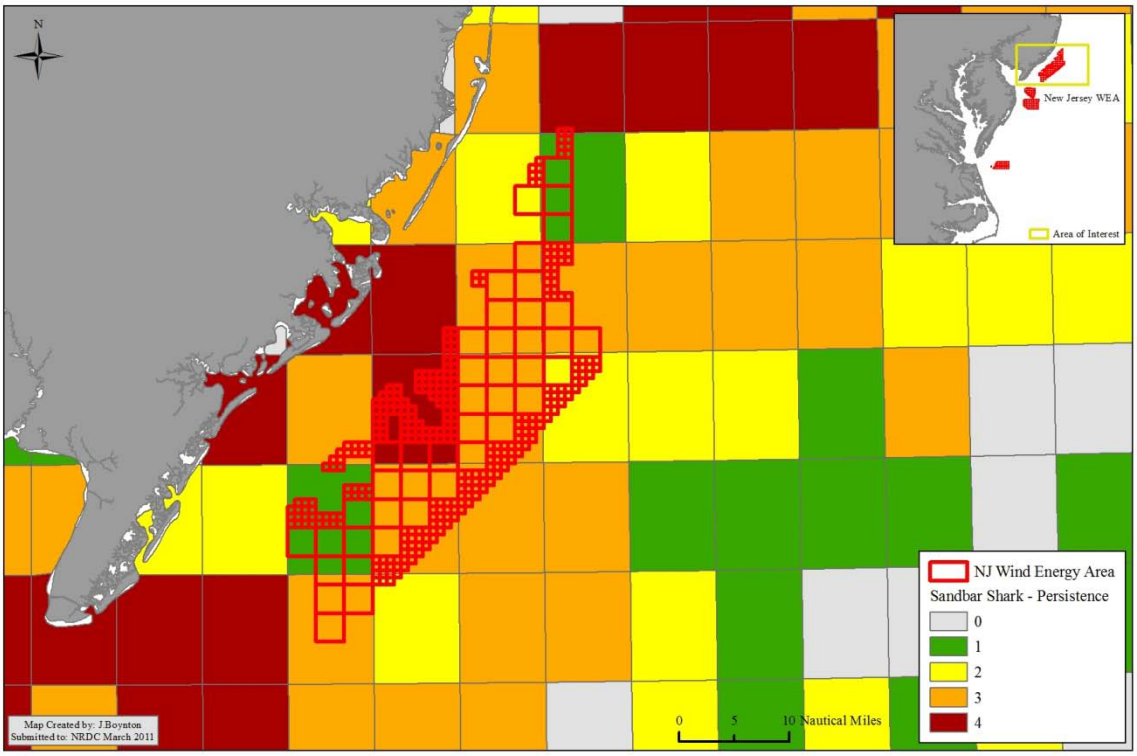

Figure 98: Sandbar shark persistence – New Jersey WEA

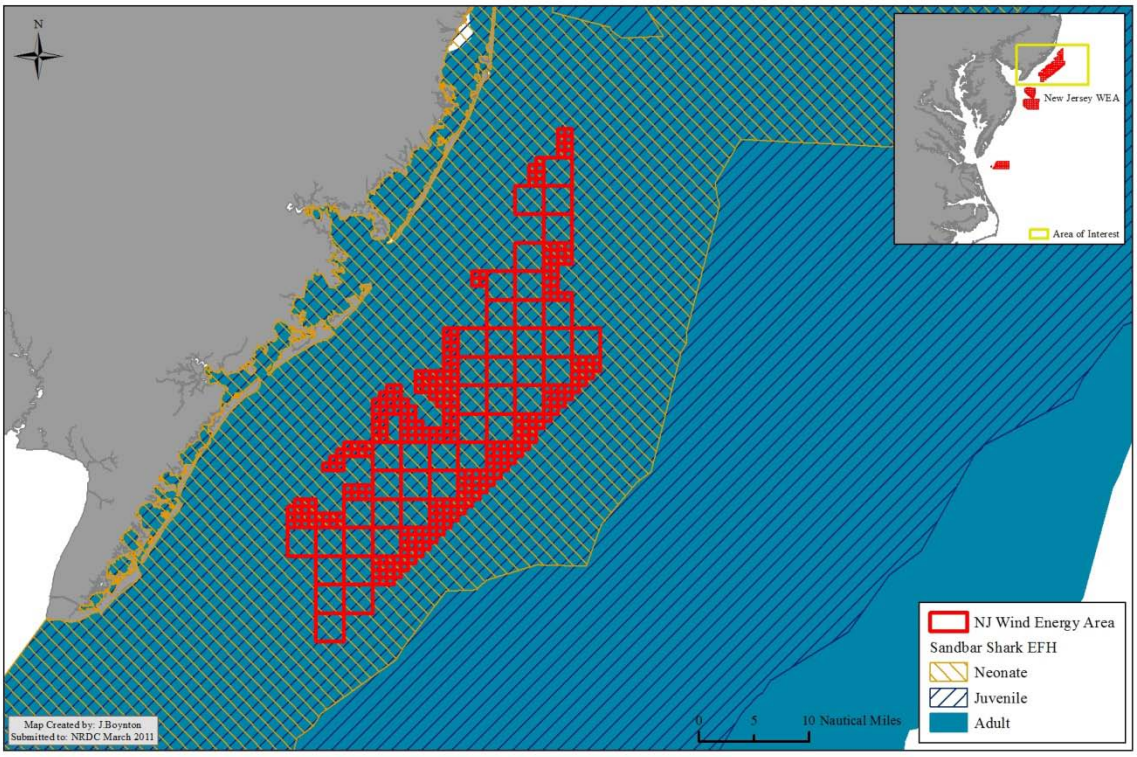

Figure 99: Sandbar shark EFH – New Jersey WEA

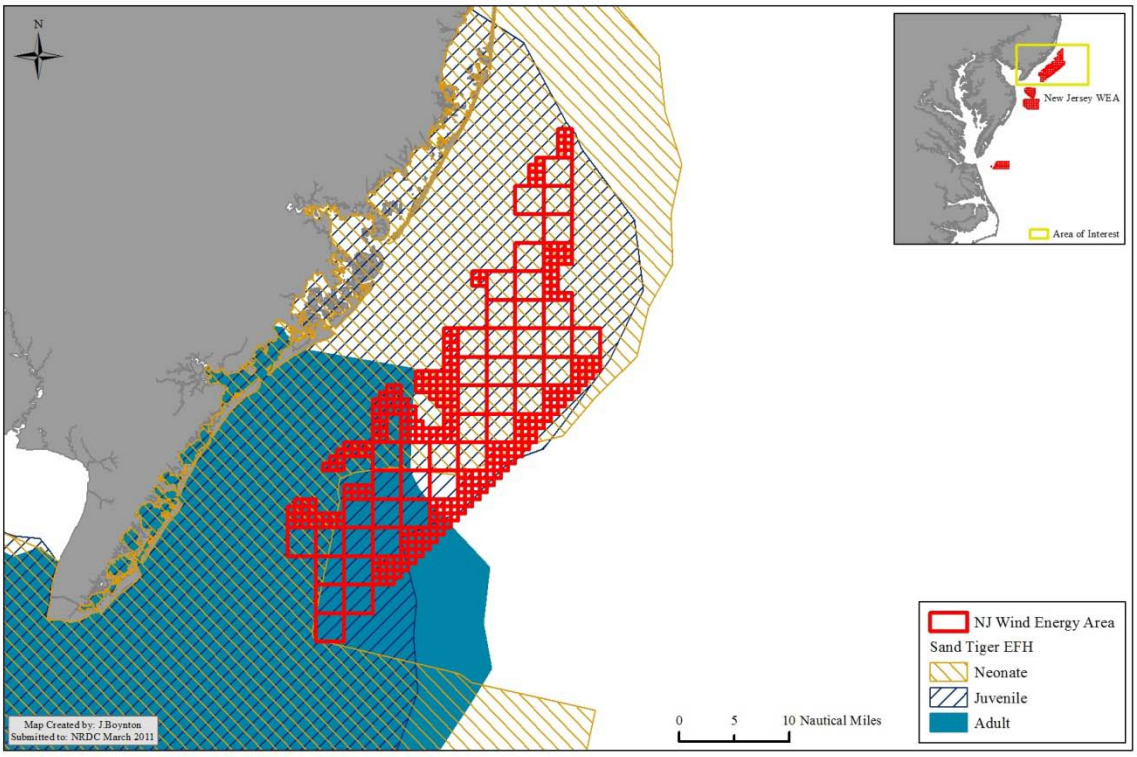

Figure 100: Sand Tiger EFH – New Jersey WEA

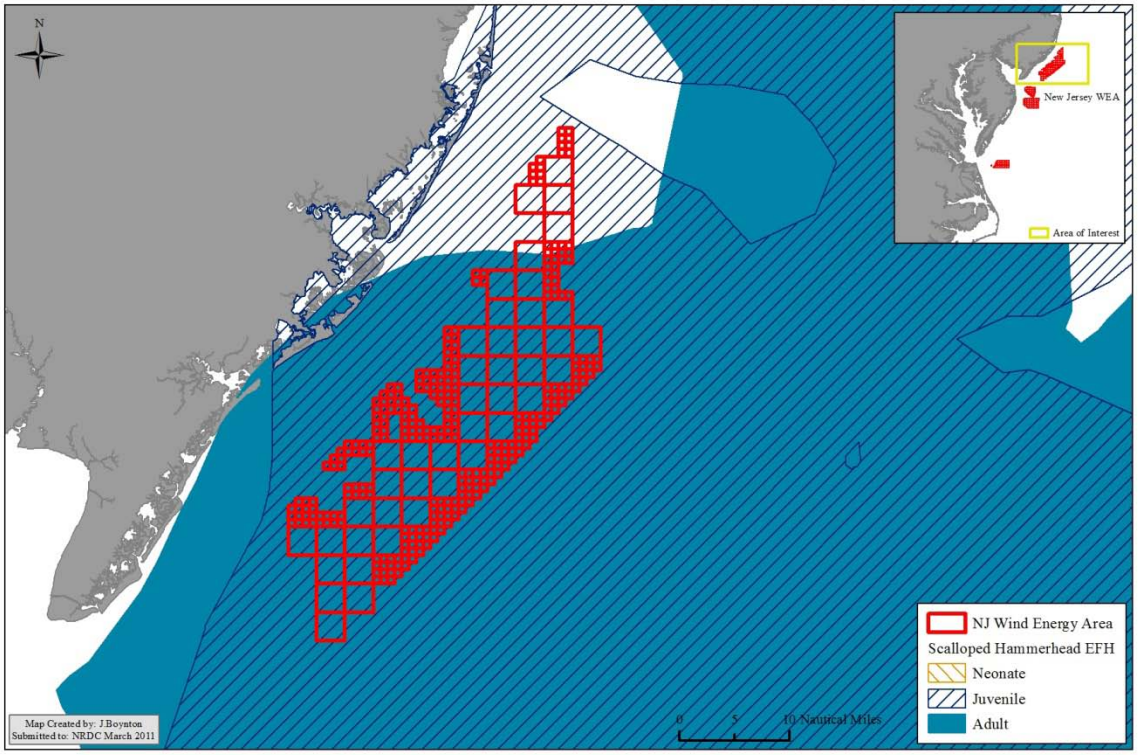

Figure 101: Scalloped hammerhead EFH – New Jersey WEA

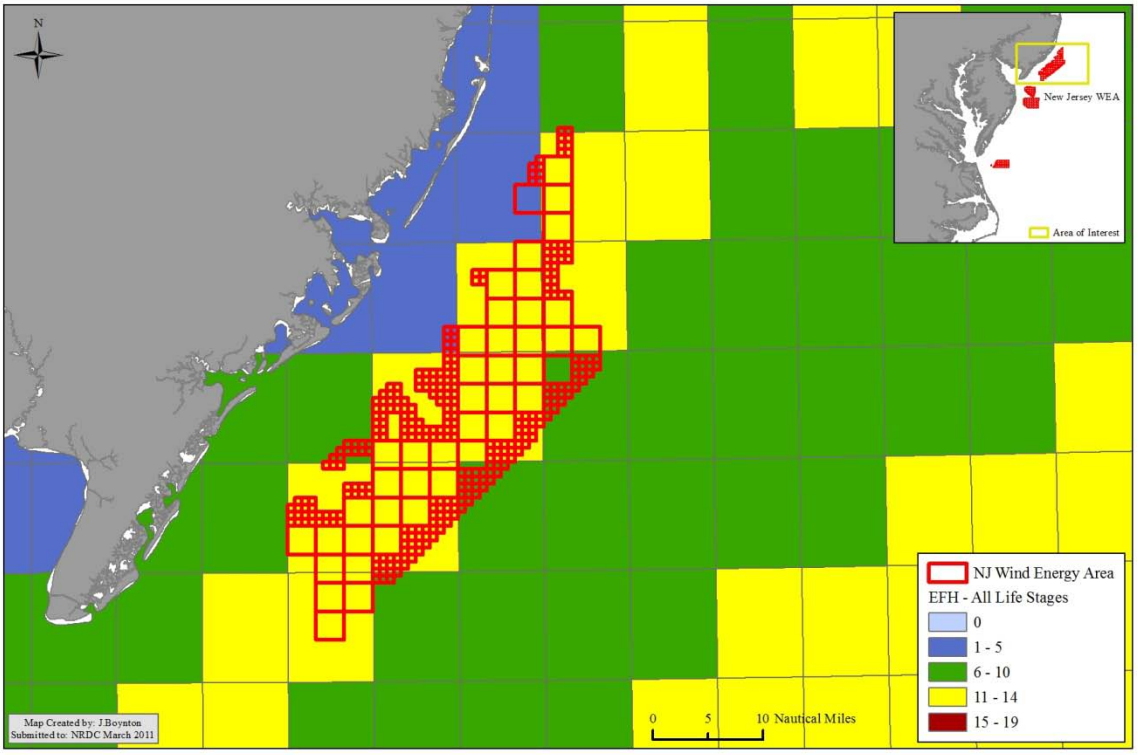

Figure 102: EFH (all species and life stages combined) – New Jersey WEA

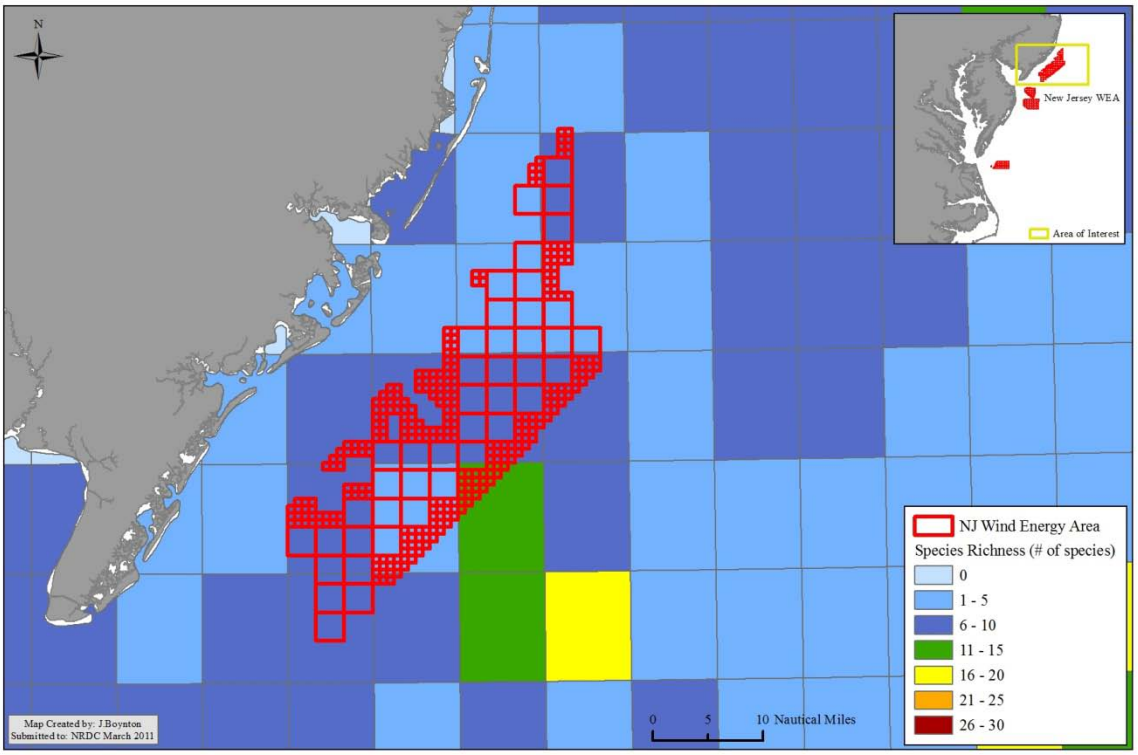

Figure 103: Species richness (all species and life stages combined) – NJ WEA

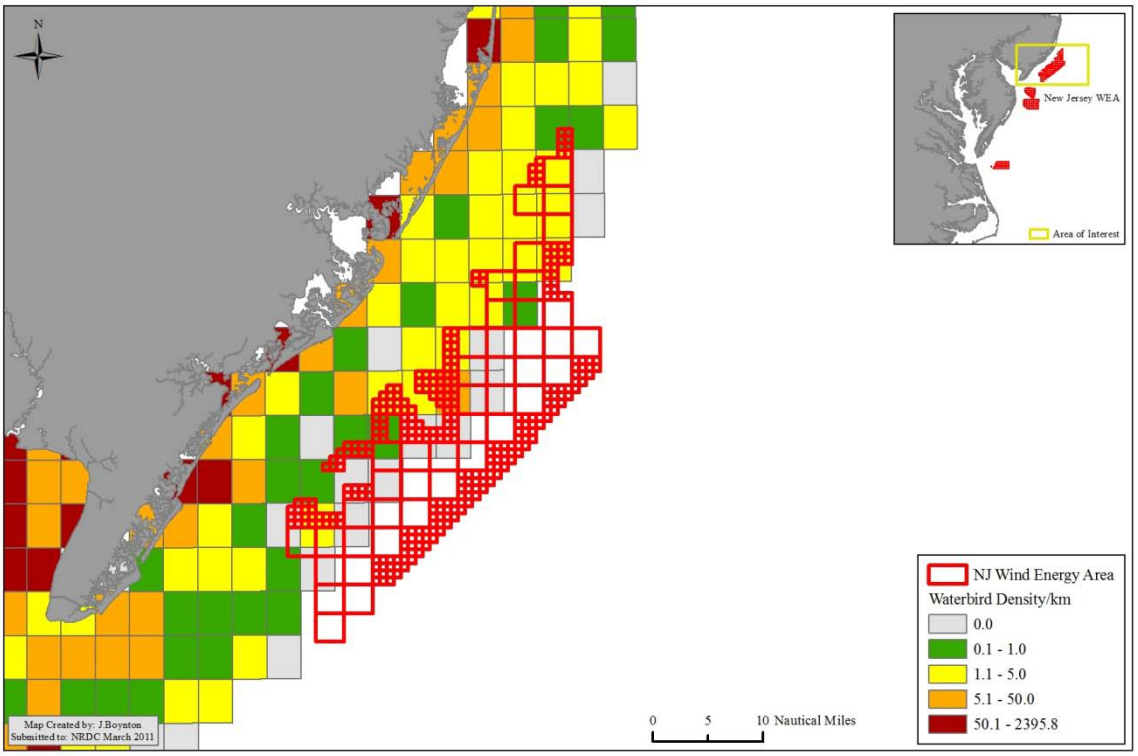

Figure 104: Waterbird density/km – New Jersey WEA

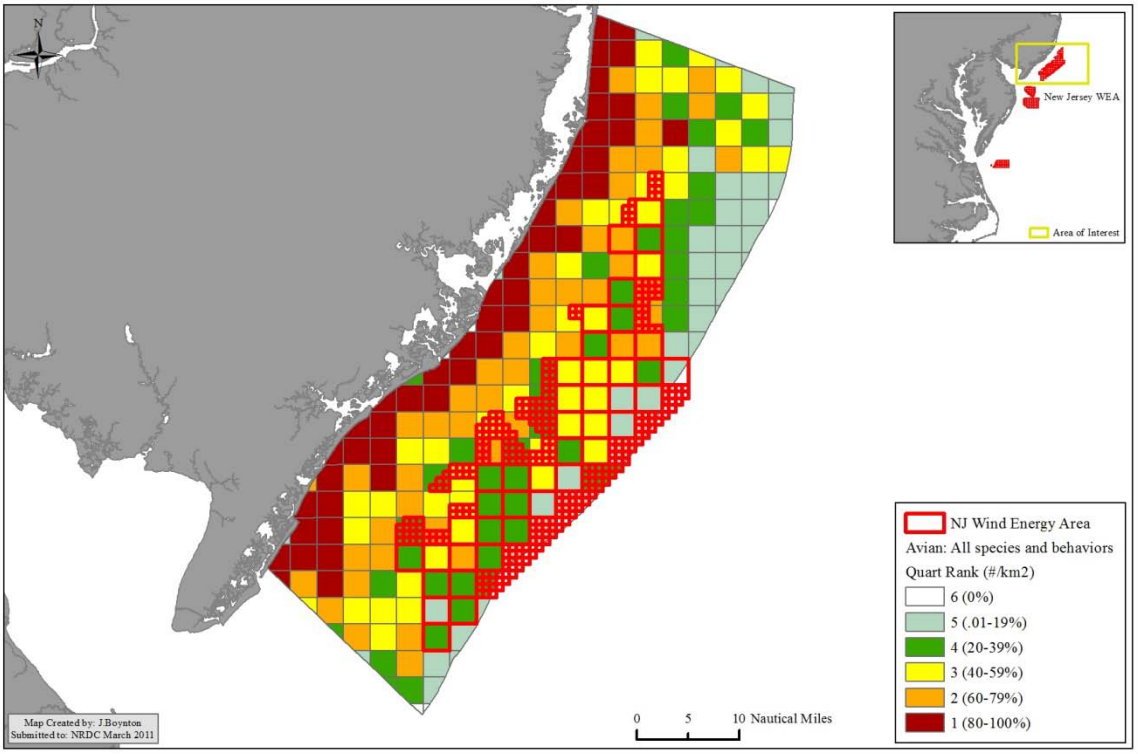

Figure 105: Avian hot spots: All species/years/behaviors – New Jersey WEA

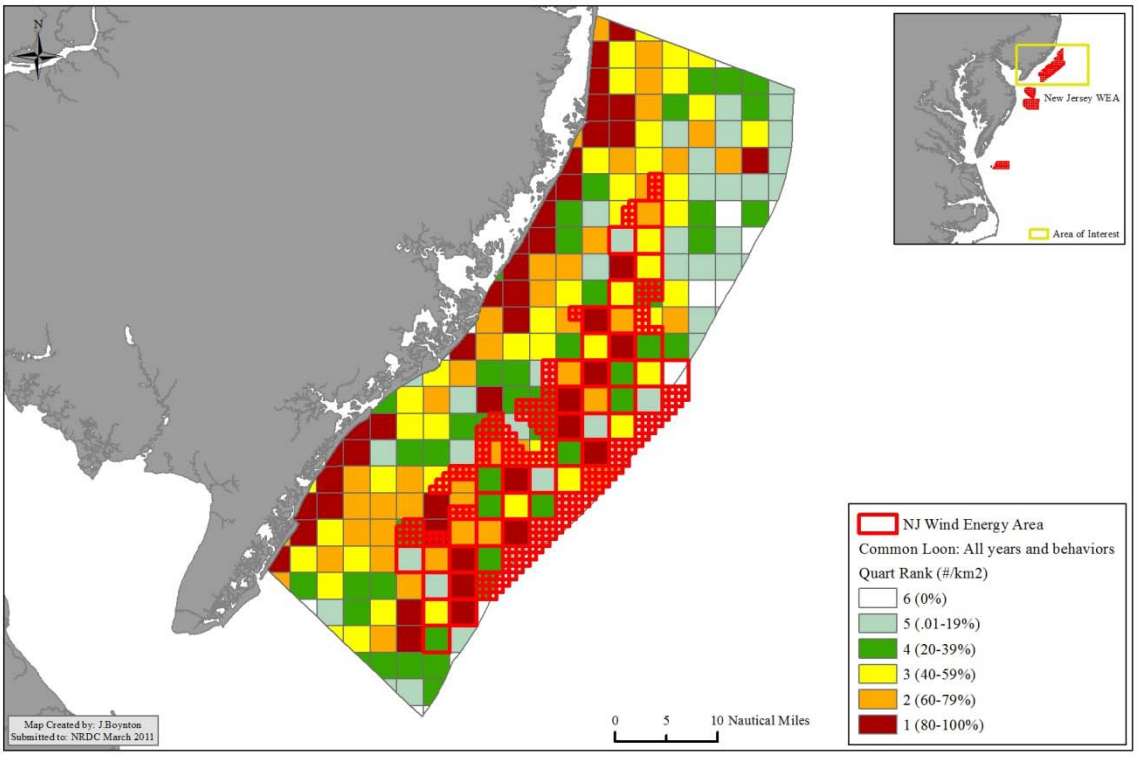

Figure 106: Avian hot spots common loon: All years/behaviors – New Jersey WEA

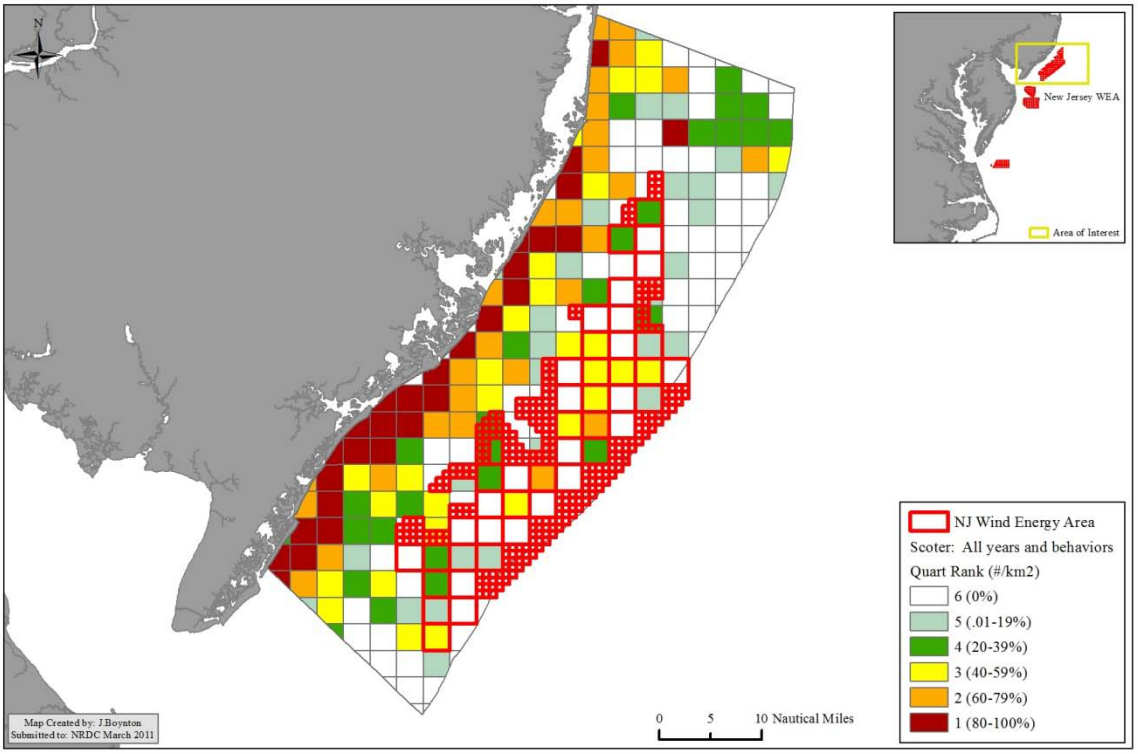

Figure 107: Avian hot spots scoter: All years/behaviors – New Jersey WEA

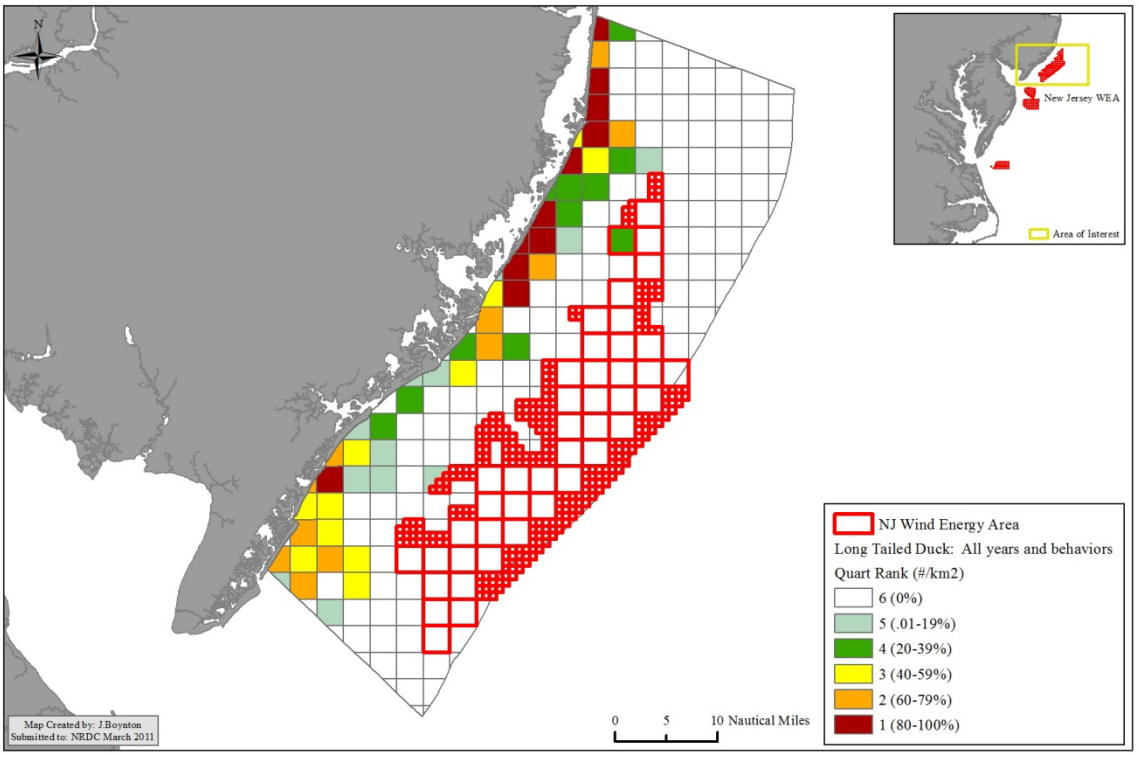

Figure 108: Avian hot spots long-tailed duck: All years/behaviors – New Jersey WEA

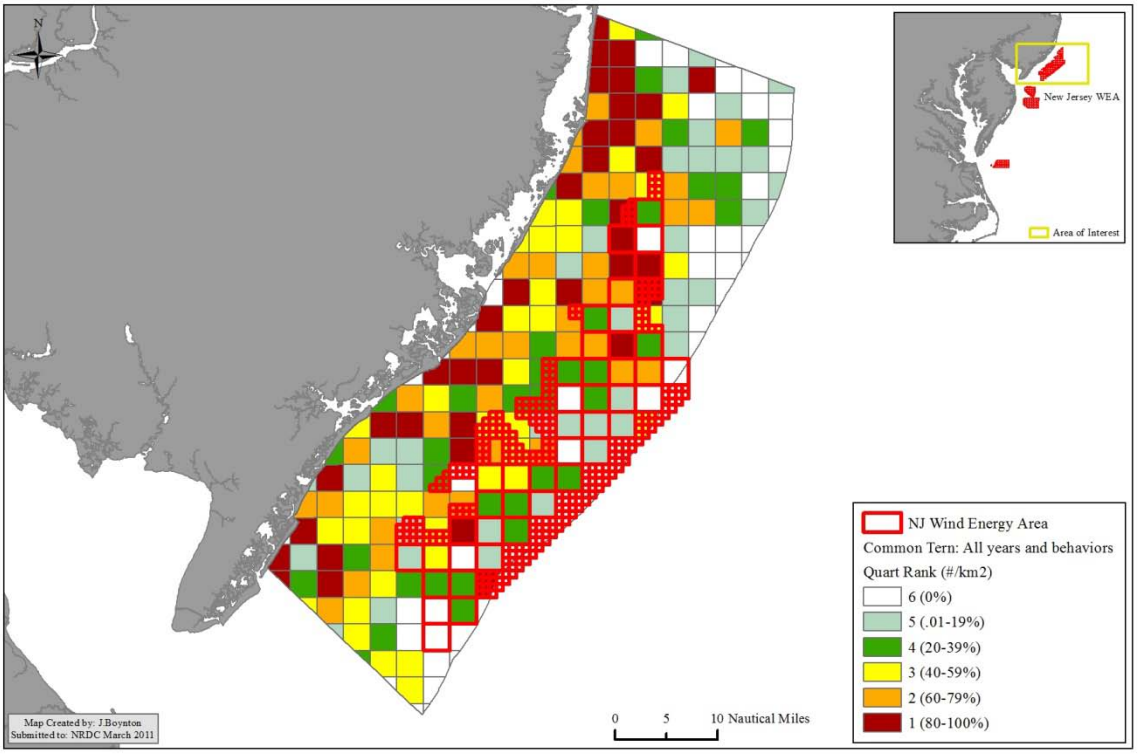

Figure 109: Avian hot spots common tern: All years/behaviors – New Jersey WEA

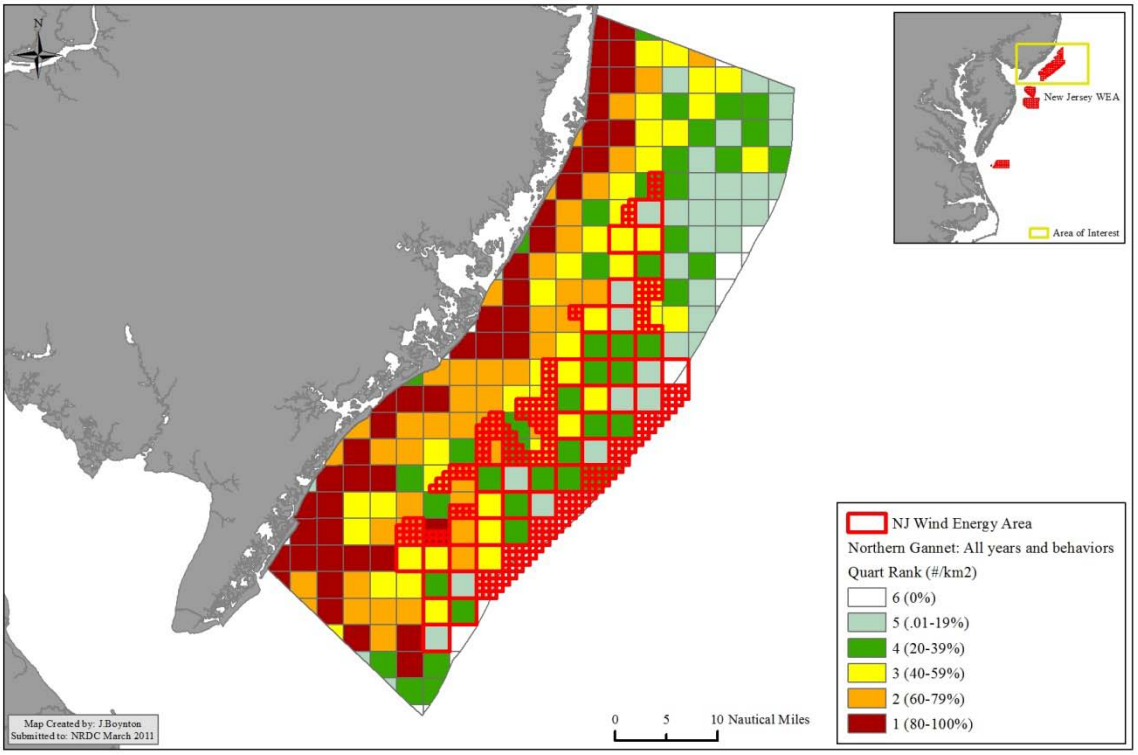

Figure 110: Avian hot spots northern gannet: All years/behaviors – New Jersey WEA

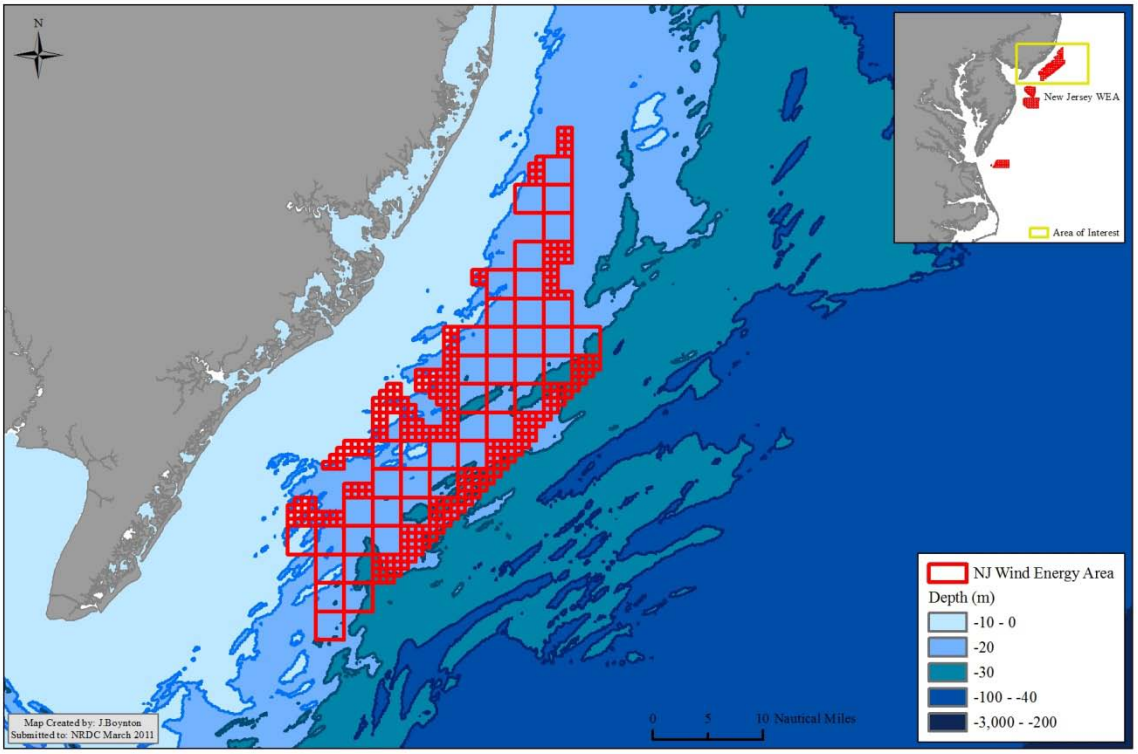

Figure 111: Depth contours – New Jersey WEA

Attachment 2 - PHASE 1 MAPPING METHODOLOGY (Detailed)

Virginia WEA

Study Region

The proposed area offshore of Virginia is made up of 22 Outer Continental Shelf (OCS) lease blocks and 5 partial blocks. The western edge of the area is approximately 20 nautical miles from Virginia Beach, and the eastern edge is approximately 37 nautical miles from Virginia Beach. The area is approximately 165 square nautical miles or 139,855 acres (source: BOEMRE Federal Register).

Data Sources

Spatial data for the Virginia WEA region came from six sources:

1) The Nature Conservancy's Northwest Atlantic Marine Ecological Assessment (NAMERA). Phase I of this assessment gathered spatial natural resource datasets for the Northwest Atlantic region, which stretched from the Gulf of Maine to Cape Hatteras, NC. The resources included marine mammals, sea turtles, fisheries (marine and pelagic), essential fish habitat (pelagic species), species richness (pelagic species), and benthic habitat. This assessment was the source of data for these resources for this wind energy area review. The data from the NAMERA for marine mammals, sea turtles, fisheries (marine and pelagic), essential fish habitat, and species richness were presented in a grid of 10 x 10 minute squares covering the entire region. The data within a 10 x 10 min square were distilled so that there was a single value/ten min square for each species or dataset.
2) U.S. Fish and Wildlife Service (USFWS): The USFWS was the source of the avian data.
3) National Oceanic and Atmospheric Administration (NOAA): NOAA was the source of Essential Fish Habitat/Habitat Areas of Particular Concern.

Biological Data Layers

TNC's NAMERA and NOAA's Office of Sustainable Fisheries were the sources for the biological data layers.

Marine Mammals

There were ten cetacean species included in this review (Table 1). They were originally chosen by TNC for their population status and distribution in the mid-Atlantic and northeast regions. The U.S Navy's Marine Resource Assessments (MRA) were the original source of this data.

Species (common name)	**Species (scientific name)**	**Status**	**Species (common name)**	**Species (scientific name)**	**Status**
Fin Whale	*Balaenoptera physalus*	Endangered	Minke Whale	*Balaenoptera acutorostrata*	None

Humpback Whale	*Megaptera novaeangliae*	Endangered	Atlantic White-sided Dolphin	*Lagenorhynchus acutus*	None
North Atlantic Right Whale	*Eubalaena glacialis*	Endangered	Bottlenose Dolphin	*Tursiops truncatus*	None
Sei Whale	*Balaenoptera borealis*	Endangered	Striped Dolphin	*Stenella coeruleoalba*	None
Sperm Whale	*Physeter macrocephalus*	Endangered	Harbor Porpoise	*Phocoena phocoena*	None

Table 1: Marine mammal species included.

For each species, sightings per unit effort (SPUE) was provided for four seasons: winter, spring, summer, and fall. SPUE was calculated as SPUE = 1000 x number of animals sighted/effort. Sightings data were collected through aerial linear surveys and effort was determined by calculating the average number of sightings per mile of track line. Each season was examined and mapped independently. Maps were included for any species and season in which values above 0 were present within or in the vicinity of the Virginia WEA. For visualization purposes, the SPUE values were symbolized into five categories: 0, 0-25%, 25-50%, 50-75%, 75-100%. Each category was given a set color and descriptive rating: 0 = grey, no presence, 0-25% = green, low, 25-50% = yellow, moderate, 50-75% = orange, moderate-high, 75-100% = red, high. White blocks represented no data collected.

Sea Turtles

Two sea turtle species were included in this data review, leatherbacks (*Dermochelys coriacea*) and loggerheads (*Caretta caretta*). The leatherback is listed as endangered and the loggerhead is listed as threatened. The original source of this data was the U.S. Navy's Marine Resource Assessments (MRA). Sea turtle data was presented as sightings per unit effort (SPUE) for each of the four seasons. As with the marine mammals, this was calculated as follows: SPUE = 1000 x number of animals sighted/effort. As with the marine mammal data, the SPUE values were placed into five categories for display purposes: 0, 0-25%, 25-50%, 50-75%, 75-100%. Each category was given a set color and descriptive rating: 0 = grey, no presence, 0-25% = green, low, 25-50% = yellow, moderate, 50-75% = orange, moderate-high, 75-100% = red, high. White blocks represented no data collected.

Fisheries (Marine)

Ten fisheries species were included in this review (Table 2). For each species, there was a single 'Weighted Persistence' value per/10x10 min block/season. Data was provided for two seasons: fall and spring.

Species (common name)	Species (scientific name)	Species (common name)	Species (scientific name)
Black sea bass	*Centropristis striata*	Alewife	*Alosa pseudoharengus*
Scup	*Stenotomus chrysops*	Blueback herring	*Alosa aestivalis*
Spiny dogfish	*Squalus acanthias*	Atlantic menhaden	*Brevoortia tyrannus*

Summer flounder	*Paralichthys dentatus*	Butterfish	*Peprilus triacanthus*
Winter flounder	*Psuedopleuronectes americanus*	Blue crab	*Callinectes sapidus*

Table 2: Fisheries species included

'Weighted Persistence' was made up of two components: abundance and persistence over time. Abundance was measured in the number of individuals/sampling tow. Abundance values were log-transformed and a mean log abundance was calculated for each decade for each 10 x 10 min grid square. These mean decade values were averaged for all decades into a single value/grid square. This value was normalized to create an abundance value between 0.0 – 1.0, with 0.0 - 0.49 representing low abundance and 0.50 - 0.99 representing high abundance. Persistence was measured by the number of decades that a particular species was found in a single 10 x 10 min grid square. The four decades included were the 1970s, 1980s, 1990s, and 2000's. A grid square had to have at least one survey point in three out of four decades to be included (Northwest Atlantic Marine Ecoregional Assessment Phase 1 Report: Marine Fishes: Introduction & Methods). Abundance and persistence values came together to create 7 categories: 0 = no recorded abundance, 1 = 1 decades, any abundance, 2 = 2 decades, any abundance, 3 = 3 decades, low abundance, 4 = 3 decades, high abundance, 5 = 4 decades, low abundance, 6 = 4 decades, high abundance. For the purpose of this review and mapping project, the three selected categories were 4, 5 and 6, in order to capture the species and locations with high and low abundance and persistence over at least three decades. Areas within and in the vicinity of the WEA that are white do not necessarily indicate no data; those areas simply have values other than 4, 5, or 6.

Fisheries (Pelagic)

Four pelagic fisheries species were included in this review (Table 3). These four species were part of a larger list of targeted pelagic species included by TNC for the NAMERA.

Species (common name)	**Species (scientific name)**	**Species (common name)**	**Species (scientific name)**
Atlantic bluefin tuna	*Thunnus thynnus*	Sand Tiger	*Carcharia taurus*
Sandbar shark	*Carcharhinus plumbeus*	Scalloped hammerhead	*Sphyrna lewini*

Table 3: Pelagic species included

The species were originally chosen based on their level of threat, vulnerability, and population status. The original fisheries data was provided by NMFS through fisheries-dependent sources. Since this data was fisheries-dependent, there was no abundance data available, only persistence. For each species, there was a single persistence values/10 x 10 min grid block. The persistence values were as follows: 0 = no presence, 1 = 1 decade, 2 = 2 decades, 3 = 3 decades, and 4 = 4 decades. The decades were as follows: 1965-1974, 1975-1984, 1985-1994, and 1995-2004 (Northwest Atlantic Marine Ecoregional Assessment Phase 1 Report: Large Pelagic Fish).

Essential Fish Habitat (Individual pelagic species)
Individual EFH data for migratory species were obtained from NOAA's Office of Sustainable Fisheries. The EFHs were divided by life stage including spawning/egg/larvae, neonate, juvenile, and adult. The EFHs were created based on distribution data (level 1) resulting from fisheries-dependent presence/absence sampling. The original source of the data came from several programs, including the Southeast Fisheries Science Center Cooperative Tagging Center and the Northeast Fisheries Science Center Apex Predators Program. The EFHs were published in 2009. (NOAA NMFS) More background information on EFH mapping is available here: http://www.nmfs.noaa.gov/sfa/hms/EFH/Final/FEIS_Amendment_1_Chapter4.pdf.

Essential Fish Habitat (Combined)
Combined EFHs were obtained from TNC. TNC also obtained their EFH data from NOAA's Office of Sustainable Fisheries, but then combined the EFH's by species and life cycle to create a single EFH map. Each 10 x 10 min grid block shows the number of EFH species, including all life stages. This grouped map includes not only the 4 pelagic species chosen for this review, but ALL 14 species included in the TNC NAMERA. These 14 species include: Albacore tuna, Atlantic bluefin tuna, bigeye thresher, blue marlin, dusky shark, great hammerhead, porbeagle, sand tiger, sandbar shark, scalloped hammerhead, shortfin mako, swordfish, thresher shark, and white marlin.

Habitat Area of Particular Concern (Individual species)
HAPC was obtained from NOAA's Office of Sustainable Fisheries, along with the individual EFHs.

Species Richness (Combined)
Species richness was obtained from TNC NAMERA pelagic dataset. All 14 targeted species and all of their life stages were included. The number of targeted pelagic species observed within a 10 x 10 min grid block was summed up based on available species and life stages.

Avian Data
Avian data was obtained from the Mid-Atlantic Regional Council on the Ocean (MARCO). The data's original source was the U.S. Fish and Wildlife Service's aerial survey conducted between 2001 and 2003. The dataset covered an area from New Jersey to Virginia, from the coast out to approximately 15 nautical miles.

The Virginia WEA is outside of the data collection area for this dataset. There were no other avian datasets used in this review. Avian data, in general, is quite limited for the offshore region.

Habitat Data Layers
Depth, slope, sediment type and grain size, seabed form, and benthic habitats came from TNC's NAMERA.

Depth
Bathymetric data was originally collected as a part of the National Geographic Data Center's Coastal Relief Model (CRM). The Virginia WEA is located between depths of 10 – 30m, with the majority between 20-30m. Current offshore wind construction allows for turbines fixed to

the seabed in waters up to 45m. Floating turbine structures allow for construction in deeper waters.

Slope
Slope data was derived from the bathymetry data by calculating the difference in elevation between two adjacent bathymetry cells. The distribution of slopes for the whole region was broken into 5 categories: Level flat (0º – 0.015º), Flat (0.015º – 0.05º), Gentle Slope (0.05º – 0.8º), Slope (0.8º – 8.0º), and Steep (> 8.0º). Slope within the Virginia WEA was predominately Flat, with some Level flat, and a small amount of Gentle Slope.

Sediment Type and grain size
Sediment data originated from the usSEABED system, a database that brings together more than 150 sources of seafloor spatial data for the Continental shelf and slope. Sediment type within the WEA was predominately gravel, followed by sand. Gravel and sand are both suitable sediment types for wind turbine construction.

Seabed Forms
Seabed form (or topographic position) data was derived from the bathymetry by comparing elevation changes between bathymetry cells to determine if a given cell was on a ridge, in a depression, or on the side of a slope. This data was comprised of seabed position and slope. The seabed position was classified as low, mid, or high, and slope, as mentioned above, was classified into five categories. These two sets of categories came together to create the seabed form categories: Depression, Mid-flat, High-flat, Low slope, Side slope, High slope, and Steep. The predominate types of seabed forms within the Virginia WEA are Depression, Mid-flat, and High-flat areas. Depression areas were those with low seabed position, with a Level flat or Flat slope. Mid-flat areas were those with mid seabed position and Level flat or Flat slope. High-flat areas were those with high seabed position and Level flat or Flat slope.

Benthic Habitats
Benthic habitats indicate what collection of organisms are expected to be found in a given area based on the physical data, such as depth, slope, sediment type and size, and seabed form. Within and in the vicinity of the Virginia WEA, six benthic habitats accounted for more the 90% of the area. These six habitats, in order from highest to lowest area covered, included: Habitat 7, Habitat 1, Habitat 4, Habitat 32, and Habitat 84, and Habitat 87. For each of these habitats there was an associated collection of organisms (Table 4).

Benthic Habitat (ranked from highest to lowest area covered)	**Associated Organisms**
7	Blood worm, Fringe worm, Hesion worm, Thread worm, Spionid mud worm, Paraonid worm, Syllid worm, Tanaidacea, Frilled anemone, Common sea star
1	Shimmy worm, Astarte, Lunate crassinella, Lancelet

4	Bamboo worm, Chevron worm, Thread worm, Syllid worm, Chestnut astarte
32	Atlantic rock crab, Longnose spider crab, Common northern moon snail, Northern moon shell, Astarte, Blood ark, Common sand dollar
84	Beardworm, Marphysa worm, Paddle worm, Sandbar worm, Cumacea, Heart sea urchin, Sea urchin, Burrowing brittle star, Cross-hatched lucine, Bean mussel, Astarte, Gould's pandora, Hard-shelled clam, Hatchet shell, Lucine clam, Nutclam, Dove shell, Margin shells, Pyramid snail, Ribbed moelleria, Wentletraps
87	Borrowing scale worm, Fringe worm, Mageloni worm, Spionid mud worm, Sphaerod worm, Syllid worm, Glass shrimp, Gammarid amphipods, Tanaidacea, Sand dollar, Atlantic razor, Gould's pandora, Lea's spoon shell, Pandora, Surf Clam, Margin shells

Table 4: Benthic habitats and associated organism collections for the Virginia WEA and surrounding area.

Maryland/Delaware WEAs

Study Region

The proposed area offshore of Delaware rests between the incoming and outgoing shipping routes for Delaware Bay, and is made up of 10 whole OCS blocks and 17 partial blocks. The closest point to shore is approximately 7.5 miles due east from Rehoboth Beach, Delaware (source: BOEMRE Federal Register).

The proposed area offshore of Maryland is made up of 29 whole OCS blocks and 4 partial blocks. The entire area is approximately 207 square nautical miles or 175,069 acres. The western edge is approximately 10 nautical miles from the Ocean City, Maryland, and the eastern edge is approximately 27 nautical miles from the Ocean City, Maryland (source: BOEMRE Federal Register)

Data Sources

Spatial data for the Delaware and Maryland WEAs came from six sources:

1) The Nature Conservancy's Northwest Atlantic Marine Ecological Assessment (NAMERA). Phase I of this assessment gathered spatial natural resources datasets for the Northwest Atlantic region, which stretched from the Gulf of Maine to Cape Hatteras, NC. The resources included marine mammals, sea turtles, fisheries (marine and pelagic), essential fish habitat (pelagic species), species richness (pelagic species), and benthic habitat. This assessment was the source of data for these resources for this wind energy area review. The data from the NAMERA for marine

mammals, sea turtles, fisheries (marine and pelagic), essential fish habitat, and species richness were presented in a grid of 10 x 10 minute squares covering the entire region. The data within a 10 x 10 min square was distilled so that there was a single value/ten min square for each species or dataset.

2) U.S. Fish and Wildlife Service (USFWS): The USFWS was the source of avian data.
3) National Ocean and Atmospheric Administration (NOAA): NOAA was the source of Essential Fish Habitat/Habitat Areas of Particular Concern.

Biological Data Layers

TNC's NAMERA and NOAA's Office of Sustainable Fisheries were the sources for the biological data layers.

Marine Mammals

There were ten cetacean species included in this review (Table 1). They were originally chosen by TNC for their population status and distribution in the mid-Atlantic and northeast regions. The U.S Navy's Marine Resource Assessments (MRA) were the original source of this data.

Species (common name)	**Species (scientific name)**	**Status**	**Species (common name)**	**Species (scientific name)**	**Status**
Fin Whale	*Balaenoptera physalus*	Endangered	Minke Whale	*Balaenoptera acutorostrata*	None
Humpback Whale	*Megaptera novaeangliae*	Endangered	Atlantic White-sided Dolphin	*Lagenorhynchus acutus*	None
North Atlantic Right Whale	*Eubalaena glacialis*	Endangered	Bottlenose Dolphin	*Tursiops truncatus*	None
Sei Whale	*Balaenoptera borealis*	Endangered	Striped Dolphin	*Stenella coeruleoalba*	None
Sperm Whale	*Physeter macrocephalus*	Endangered	Harbor Porpoise	*Phocoena phocoena*	None

Table 1: Marine mammal species included.

For each species, sightings per unit effort (SPUE) was provided for four seasons: winter, spring, summer, and fall. SPUE was calculated as SPUE = 1000 x number of animals sighted/effort. Sightings data were collected through aerial linear surveys and effort was determined by calculating the average number of sightings per mile of track line. Each season was examined and mapped independently. Maps were included for any species and season in which values above 0 were present within or in the vicinity of the Delaware and Maryland WEAs. For visualization purposes, the SPUE values were symbolized into five categories: 0, 0-25%, 25-50%, 50-75%, 75-100%. Each category was given a set color and descriptive rating: 0 = grey, no presence, 0-25% = green, low, 25-50% = yellow, moderate, 50-75% = orange, moderate-high, 75-100% = red, high. White blocks represented no data collected.

Sea Turtles
Two sea turtle species were included in this data review, leatherbacks (*Dermochelys coriacea*) and loggerheads (*Caretta caretta*). The leatherback is listed as endangered and the loggerhead is listed as threatened. The original source of this data was the U.S. Navy's Marine Resource Assessments (MRA). Sea turtle data was presented as sightings per unit effort (SPUE) for each of four seasons. As with the marine mammals, this was calculated as follows: SPUE = 1000 x number of animals sighted/effort. As with the marine mammal data, the SPUE values were placed into five categories for display purposes: 0, 0-25%, 25-50%, 50-75%, 75-100%. Each category was given a set color and descriptive rating: 0 = grey, no presence, 0-25% = green, low, 25-50% = yellow, moderate, 50-75% = orange, moderate-high, 75-100% = red, high. White blocks represented no data collected.

Fisheries (Marine)
Ten fisheries species were included in this review (Table 2). For each species, there was a single 'Weighted Persistence' value per/10x10 min block/season. Data was provided for two seasons: fall and spring.

Species (common name)	Species (scientific name)	Species (common name)	Species (scientific name)
Black sea bass	*Centropristis striata*	Alewife	*Alosa pseudoharengus*
Scup	*Stenotomus chrysops*	Blueback herring	*Alosa aestivalis*
Spiny dogfish	*Squalus acanthias*	Atlantic menhaden	*Brevoortia tyrannus*
Summer flounder	*Paralichthys dentatus*	Butterfish	*Peprilus triacanthus*
Winter flounder	*Psuedopleuronectes americanus*	Blue crab	*Callinectes sapidus*

Table 2: Fisheries species included

'Weighted Persistence' was made up of two components: abundance and persistence over time. Abundance was measured in the number of individuals/sampling tow. Abundance values were log-transformed and a mean log abundance was calculated for each decade for each 10 x 10 min grid square. These mean decade values were averaged for all decades into a single value/grid square. This value was normalized to create an abundance value between 0.0 – 1.0, with 0.0 - 0.49 representing low abundance and 0.50 - 0.99 representing high abundance. Persistence was measured by the number of decades that a particular species was found in a single 10 x 10 min grid square. The four decades included were the 1970s, 1980s, 1990s, and 2000's. A grid square had to have at least one survey point in three out of four decades to be included (Northwest Atlantic Marine Ecoregional Assessment Phase 1 Report: Marine Fishes: Introduction & Methods).

Abundance and persistence values came together to create 7 categories: 0 = no recorded abundance, 1 = 1 decades, any abundance, 2 = 2 decades, any abundance, 3 = 3 decades, low abundance, 4 = 3 decades, high abundance, 5 = 4 decades, low abundance, 6 = 4 decades, high abundance. For the purpose of this review and mapping project, the three selected categories were 4, 5, and 6, in order to capture the species and locations with high or low abundance and

persistence over at least three decades. Areas within and in the vicinity of the WEAs that are white do not necessarily indicate no data; those areas simply have values other than 4, 5, or 6.

Fisheries (Pelagic)
Four pelagic fisheries species were included in this review (Table 3). These four species were part of a larger list of targeted pelagic species included by TNC for the NAMERA.

Species (common name)	**Species (scientific name)**	**Species (common name)**	**Species (scientific name)**
Atlantic bluefin tuna	*Thunnus thynnus*	Sand Tiger	*Carcharia taurus*
Sandbar shark	*Carcharhinus plumbeus*	Scalloped hammerhead	*Sphyrna lewini*

Table 3: Pelagic species included

The species were originally chosen based on their level of threat, vulnerability, and population status. The original fisheries data was provided by NMFS through fisheries-dependent sources. Since this data is fisheries-dependent, there is no abundance data available, only persistence. For each species, there is a single persistence values/10 x 10 min grid block. The persistence values are as follows: 0 = no presence, 1 = 1 decade, 2 = 2 decades, 3 = 3 decades, and 4 = 4 decades. The decades were as follows: 1965-1974, 1975-1984, 1985-1994, and 1995-2004 (Northwest Atlantic Marine Ecoregional Assessment Phase 1 Report: Large Pelagic Fish).

Essential Fish Habitat (Individual pelagic species)
Individual EFH data for migratory species were obtained from NOAA's Office of Sustainable Fisheries. The EFHs were divided by life stage including spawning/egg/larvae, neonate, juvenile, and adult. The EFHs were created based on distribution data (level 1) resulting from fisheries-dependent presence/absence sampling. The original source of the data came from several programs, including the Southeast Fisheries Science Center Cooperative Tagging Center and the Northeast Fisheries Science Center Apex Predators Program. The EFHs were published in 2009. (NOAA NMFS) More background information on EFH mapping is available here: http://www.nmfs.noaa.gov/sfa/hms/EFH/Final/FEIS_Amendment_1_Chapter4.pdf.

Essential Fish Habitat (Combined)
Combined EFHs were obtained from TNC. TNC obtained their EFH data from NOAA NMFS, but then combined the EFH's by species and life cycle to create a single EFH map. Each 10 x 10 min grid block shows the number of EFH species, including all life stages. This grouped map includes not only the 4 pelagic species chosen for this review, but ALL 14 species included in the TNC NAMERA. These 14 species include: Albacore tuna, Atlantic bluefin tuna, bigeye thresher, blue marlin, dusky shark, great hammerhead, porbeagle, sand tiger, sandbar shark, scalloped hammerhead, shortfin mako, swordfish, thresher shark, and white marlin.

Habitat Area of Particular Concern (Individual species)
HAPC was obtained from NOAA NMFS, along with the individual EFHs. This was only available for one species, the sandbar shark.

Species Richness (Combined)
Species richness was obtained from TNC NAMERA pelagic dataset. All 14 targeted species and all of their life stages were included. The number of targeted pelagic species observed within a 10 x 10 min grid block was summed up based on available species and life stages.

Avian Data
Avian data was obtained from the MARCO, however, the data's original source was the U.S. Fish and Wildlife Service's aerial survey conducted between 2001 and 2003. The dataset covered an area from New Jersey to Virginia, from the coast out to approximately 15 nautical miles. The density/km data was placed into five categories for display purposes. Each category was given a set color and descriptive rating: 0 = grey, no presence, 0.1-1.0 = green, low, 1.1-5.0 = yellow, moderate, 5.1-50.0 = orange, moderate-high, 50.1-2395.8 = red, high. White blocks represented no data collected. Only the portions of the Delaware and Maryland WEA closest to the coast were covered by this data. The avian data that overlaid with the BOEMRE blocks showed low, moderate, and moderate-high values for waterbird density/km. Within the Delaware WEA, there were 0 OCS blocks (partial or whole) with low values, 5 with moderate values, and 3 with moderate-high values. Within the Maryland WEA, there were 6 OCS blocks (partial or whole) with low values, 9 with moderate values, and 1 with moderate-high values.

Habitat Data Layers
Depth, slope, sediment type and grain size, seabed form, and benthic habitats came from TNC's NAMERA.

Depth
Bathymetric data was originally collected as a part of the National Geographic Data Center's Coastal Relief Model (CRM). The Delaware and Maryland WEAs are located between depths of 10-30m, with the majority between 20-30m. Current offshore wind construction allows for turbines fixed to the seabed in waters up to 45m. Floating turbine structures allow for construction in deeper waters.

Slope
Slope data was derived from the bathymetry data by calculating the difference in elevation between two adjacent bathymetry cells. The distribution of slopes for the whole region was broken into 5 categories: Level flat (0º – 0.015º), Flat (0.015º – 0.05º), Gentle Slope (0.05º – 0.8º), Slope (0.8º – 8.0º), and Steep (> 8.0º). Slope within the Delaware and Maryland WEAs was predominately Flat with a small amount of Level Flat and Gentle Slope.

Sediment Type and grain size
Sediment data originated from the usSEABED system, a database that brings together more than 150 sources of seafloor spatial data for the Continental Shelf and slope. Sediment type within the Delaware and Maryland WEAs was predominately gravel, followed by sand. Gravel and sand are both suitable sediment types for wind turbine construction.

Seabed Forms
Seabed form (or topographic position) data was derived from the bathymetry by comparing elevation changes between bathymetry cells to determine if a given cell is on a ridge, in a

depression, or on the side of a slope. This data was comprised of seabed position and slope. The seabed position was classified as low, mid, or high, and slope, as mentioned above, was classified into five categories. These two sets of categories came together to create the seabed form categories: Depression, Mid-flat, High-flat, Low slope, Side slope, High slope, and Steep. The predominate types of seabed forms within the Delaware and Maryland WEAs are Depression, Mid-flat, and High-flat areas. Depression areas were those with low seabed position, with a Level flat or Flat slope. Mid-flat areas were those with mid seabed position and Level flat or Flat slope. High-flat areas were those with high seabed position and Level flat or Flat slope.

Benthic Habitats

Benthic habitats indicate what collection of organisms are expected to be found in a given area based on the physical data, such as depth, slope, sediment type and size, and seabed form. Within and in the vicinity of the Delaware and Maryland WEAs, there were 7 benthic habitats that made up more than 90% of the area. These seven habitats, in order from highest to lowest area covered, included: Habitat 7, Habitat 1, Habitat 87, Habitat 4, Habitat 2, Habitat 25, and Habitat 84. For each of these habitats there is an associated collection of organisms (Table 4).

Benthic Habitat (ranked from highest to lowest area covered)	**Associated Organisms**
7	Blood worm, Fringe worm, Hesion worm, Thread worm, Spionid mud worm, Paraonid worm, Syllid worm, Tanaidacea, Frilled anemone, Common sea star
1	Shimmy worm, Astarte, Lunate crassinella, Lancelet
87	Borrowing scale worm, Fringe worm, Mageloni worm, Spionid mud worm, Sphaerod worm, Syllid worm, Glass shrimp, Gammarid amphipods, Tanaidacea, Sand dollar, Atlantic razor, Gould's pandora, Lea's spoon shell, Pandora, Surf Clam, Margin shells
4	Bamboo worm, Chevron worm, Thread worm, Syllid worm
2	Bamboo worm, Burrowing scale worm, Chevron worm, Flabelliger worm, Fringe worm, Spionid mud worm, Paddle worm, Paraonid worm, Shimmy worm, Spaghetti-mouth worm, Thread-like worm, Threadworm, Amphipod, Burrowing anemone, Sea cucumber, Dog welk, False quahog, File yoldia, Hard-shelled clam, Nutclam, Short yoldia, Phoronids, Horeshoe worm
25	Bamboo worm, Bristle worm, Mageloni worm, Spionid mud worm, Orbiniid worm, Shimmy

	worm, Mysid shrimp, Moon snail, Lined anemone
84	Beardworm, Marphysa worm, Paddle worm, Sandbar worm, Cumacea, Heart sea urchin, Sea urchin, Burrowing brittle star, Cross-hatched lucine, Bean mussel, Astarte, Gould's pandora, Hard-shelled clam, Hatchet shell, Lucine clam, Nutclam, Dove shell, Margin shells, Pyramid snail, Ribbed moelleria, Wentletraps

Table 4: Benthic habitats and associated organism collection in the Delaware and Maryland WEAs and surrounding area.

New Jersey WEA

Study Region

The proposed area offshore of New Jersey begins 7 nautical miles from the shore and extends roughly 23 nautical miles seaward and extends 72 nautical miles along the federal/state boundary from Seaside Park south to Hereford Inlet. The entire area is approximately 418 square nautical miles and contains approximately 43 whole OCS blocks and 34 partial blocks (source: BOEMRE Federal Register).

Data Sources

Spatial data for the New Jersey WEA region came from six sources:

1) The Nature Conservancy's Northwest Atlantic Marine Ecological Assessment (NAMERA). Phase I of this assessment gathered spatial natural resource datasets for the Northwest Atlantic region, which stretched from the Gulf of Maine to Cape Hatteras, NC. The resources included marine mammals, sea turtles, fisheries (marine and pelagic), essential fish habitat (pelagic species), species richness (pelagic species), and benthic habitat. This assessment was the main source of data for these resources for this wind energy area review. The data from the NAMERA for marine mammals, sea turtles, fisheries (marine and pelagic), essential fish habitat, and species richness were presented in a grid of 10 x 10 minute squares covering the entire region. The data within a 10 x 10 min square were distilled so that there was a single value/ten min square for each species or dataset.
2) U.S. Fish and Wildlife Service (USFWS): The USFWS was a source of avian data.
3) National Oceanic and Atmospheric Administration (NOAA): NOAA was the source of Essential Fish Habitat/Habitat Areas of Particular Concern.
4) New Jersey Ocean/Wind Power Ecological Baseline Study: This was the source of avian data, and EFH. Between January 2008 and December 2009, Geo-Marine Inc. was contracted by the NJ Department of Environmental Protection to conduct a baseline study on birds, sea turtles, marine mammals, and other natural resources in the study area off of the New Jersey coast. New field data collected, as well as historical data, was processed and put into digital format and GIS files. For the purposes of this review, some of the avian and EFH data were examined.

Biological Data Layers

TNC's NAMERA, NOAA's Office of Sustainable Fisheries, and the New Jersey Ocean/Wind

Power Ecological Baseline Study were the sources for the biological data layers.

Marine Mammals
There were ten cetacean species included in this review (Table 1). They were originally chosen by TNC for their population status and distribution in the mid-Atlantic and northeast regions. The U.S Navy's Marine Resource Assessments (MRA) were the original source of this data.

Species (common name)	**Species (scientific name)**	**Status**	**Species (common name)**	**Species (scientific name)**	**Status**
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North Atlantic Right Whale	*Eubalaena glacialis*	Endangered	Bottlenose Dolphin	*Tursiops truncatus*	None
Sei Whale	*Balaenoptera borealis*	Endangered	Striped Dolphin	*Stenella coeruleoalba*	None
Sperm Whale	*Physeter macrocephalus*	Endangered	Harbor Porpoise	*Phocoena phocoena*	None

Table 1: Marine mammal species included.

For each species, sightings per unit effort (SPUE) was provided for four seasons: winter, spring, summer, and fall. SPUE was calculated as SPUE = 1000 x number of animals sighted/effort. Sightings data were collected through aerial linear surveys and effort was determined by calculating the average number of sightings per mile of track line. Each season was examined and mapped independently. Maps were included for any species and season in which values above 0 were present within or in the vicinity of the New Jersey WEA. For visualization purposes, the SPUE values were symbolized into five categories: 0, 0-25%, 25-50%, 50-75%, 75-100%. Each category was given a set color and descriptive rating: 0 = grey, no presence, 0-25% = green, low, 25-50% = yellow, moderate, 50-75% = orange, moderate-high, 75-100% = red, high. White blocks represented no data collected.

Sea Turtles
Two sea turtle species were included in this data review, leatherbacks (*Dermochelys coriacea*) and loggerheads (*Caretta caretta*). The leatherback is listed as endangered and the loggerhead is listed as threatened. The original source of this data was the U.S. Navy's Marine Resource Assessments (MRA). Sea turtle data were presented as sightings per unit effort (SPUE) for each of the four seasons. As with the marine mammals, this was calculated as follows: SPUE = 1000 x number of animals sighted/effort. As with the marine mammal data, the SPUE values were placed into five categories for display purposes: 0, 0-25%, 25-50%, 50-75%, 75-100%. Each category was given a set color and descriptive rating: 0 = grey, no presence, 0-25% = green, low, 25-50% = yellow, moderate, 50-75% = orange, moderate-high, 75-100% = red, high. White blocks represented no data collected.

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Summer flounder	*Paralichthys dentatus*	Butterfish	*Peprilus triacanthus*
Winter flounder	*Psuedopleuronectes americanus*	Blue crab	*Callinectes sapidus*

Table 2: Fisheries species included

'Weighted Persistence' was made up of two components: abundance and persistence over time. Abundance was measured in the number of individuals/sampling tow. Abundance values were log-transformed and a mean log abundance was calculated for each decade for each 10 x 10 min grid square. These mean decade values were averaged for all decades into a single value/grid square. This value was normalized to create an abundance value between 0.0 – 1.0, with 0.0 - 0.49 representing low abundance and 0.50 - 0.99 representing high abundance. Persistence was measured by the number of decades that a particular species was found in a single 10 x 10 min grid square. The four decades included were the 1970s, 1980s, 1990s, and 2000's. A grid square had to have at least one survey point in three out of four decades to be included (Northwest Atlantic Marine Ecoregional Assessment Phase 1 Report: Marine Fishes: Introduction & Methods).

Abundance and persistence values came together to create 7 categories: 0 = no recorded abundance, 1 = 1 decades, any abundance, 2 = 2 decades, any abundance, 3 = 3 decades, low abundance, 4 = 3 decades, high abundance, 5 = 4 decades, low abundance, 6 = 4 decades, high abundance. For the purpose of this review and mapping project, the three selected categories were 4, 5 and 6, in order to capture the species and locations with high and low abundance and persistence over at least three decades. Areas within and in the vicinity of the WEA that are white do not necessarily indicate no data; those areas simply have values other than 4, 5, or 6.

Fisheries (Pelagic)
Four pelagic fisheries species were included in this review (Table 3). These four species were part of a larger list of targeted pelagic species included by TNC for the NAMERA.

Species (common name)	**Species (scientific name)**	**Species (common name)**	**Species (scientific name)**
Atlantic bluefin tuna	*Thunnus thynnus*	Sand Tiger	*Carcharia taurus*

Sandbar shark	*Carcharhinus plumbeus*	Scalloped hammerhead	*Sphyrna lewini*

Table 3: Pelagic species included

The species were originally chosen based on their level of threat, vulnerability, and population status. The original fisheries data was provided by NMFS through fisheries-dependent sources. Since this data was fisheries-dependent, there was no abundance data available, only persistence. For each species, there was a single persistence value/10 x 10 min grid block. The persistence values were as follows: 0 = no presence, 1 = 1 decade, 2 = 2 decades, 3 = 3 decades, and 4 = 4 decades. The decades were as follows: 1965-1974, 1975-1984, 1985-1994, and 1995-2004 (Northwest Atlantic Marine Ecoregional Assessment Phase 1 Report: Large Pelagic Fish).

Essential Fish Habitat (Individual species)
EFH data for the following species were obtained from the NJ baseline study: black sea bass, scup, spiny dogfish, summer flounder, winter flounder, ocean quahog, and surf clam. EFHs are generally classified into five stages (eggs, larvae, juvenile, adult, and spawning adult); however, for the species included in this review four stages were included: egg, larvae, juvenile, and adult. The EFH layers were obtained by Geo-Marine from NMFS and were scanned in from a hardcopy publication with 10x10 decimal minute grid blocks designating presence or absence. A buffer was applied to the resulting presence features to create a contiguous polygon with the assumption that the fish life stage found had to be connected in order to travel between grid blocks.

Essential Fish Habitat (Individual pelagic species)
Individual EFH data for migratory species were obtained directly from NOAA's Office of Sustainable Fisheries. The EFHs were divided into four life stages including spawning/egg/larvae, neonate, juvenile, and adult. The EFHs were created based on distribution data (level 1) resulting from fisheries-dependent presence/absence sampling. The original source of the data came from several programs, including the Southeast Fisheries Science Center Cooperative Tagging Center and the Northeast Fisheries Science Center Apex Predators Program. The EFHs were published in 2009. (NOAA NMFS) More background information on EFH mapping is available here:
http://www.nmfs.noaa.gov/sfa/hms/EFH/Final/FEIS_Amendment_1_Chapter4.pdf

Essential Fish Habitat (Combined)
Combined EFHs were obtained from TNC. TNC obtained their EFH data from NOAA's Office of Sustainable Fisheries, but then combined the EFH's by species and life cycle to create a single EFH map. Each 10 x 10 min grid block shows the number of EFH species, including all life stages. This grouped map includes not only the 4 pelagic species chosen for this review, but ALL 14 species included in the TNC NAMERA. These 14 species include: Albacore tuna, Atlantic bluefin tuna, bigeye thresher, blue marlin, dusky shark, great hammerhead, porbeagle, sand tiger, sandbar shark, scalloped hammerhead, shortfin mako, swordfish, thresher shark, and white marlin.

Habitat Area of Particular Concern (Individual pelagic species)
The criteria for establishing a HAPC includes: Important ecological function, sensitivity to

human-induced environmental degradation, human development stressing the habitat, and rarity of habitat (NMFS 2002). HAPC information was obtained from NOAA's Office of Sustainable Fisheries, along with the individual EFHs. Of the four pelagic species selected, only one, the sandbar shark, had any HAPC in the vicinity of the New Jersey WEA.

Species Richness (Combined)
Species richness was obtained from TNC NAMERA pelagic dataset. All 14 targeted species and all of their life stages were included. The number of targeted pelagic species observed within a 10 x 10 min grid block was summed up based on available species and life stages.

Avian Data
Avian data was obtained from the U.S. Fish and Wildlife Service (downloaded from MARCO) and the NJ baseline study. The USFWS conducted an aerial survey between 2001 and 2003. The dataset covered an area from New Jersey to Virginia, from the coast out to approximately 15 nautical miles. The density/km data was placed into five categories for display purposes. Each category was given a set color and descriptive rating: 0 = grey, no presence, 0.1-1.0 = green, low, 1.1-5.0 = yellow, moderate, 5.1-50.0 = orange, moderate-high, 50.1-2395.8 = red, high. White blocks represented no data collected. The portions of the New Jersey WEA closest to the coast, 64%, were covered by this data. The avian data that overlaid with the BOEMRE blocks showed low, moderate, and moderate-high values for waterbird density/km. Within the New Jersey WEA, there were 10 OCS blocks (partial or whole) with low values, 24 with moderate values, and 4 with moderate-high values.

The avian data from the NJ baseline study were collected from boat and shipboard surveys performed between 2008-2009, and was collected for different behaviors (*e.g.*, sitting, feeding, flight) for more than 150 species. This data was presented in grid blocks that match the OSC blocks, although it is unknown if that was the intent. Each observation from the surveys was associated with a grid block. All of the observations were summed to produce a single density/km^2 for each grid block. The data from the grid block was displayed with quart ranking, based on the following divisions: Quart 1 = 80-100%, Quart 2 = 60-79%, Quart 3 = 40-59%, Quart 4 = 20-39%, Quart 5 = .01-19%, and Quart 6 = 0%. The quart ranks (1-6) are based on the number of birds/km^2, with the value 1 representing the highest density and value 6 representing zero density. Grid boxes with the highest ranking represented the top 20% and are considered the avian “hot spots” (NJDEP EBS Final Report: Volume III). For the purposes of this review, we focused on the following species: common loon, common tern, scoter, long-tailed duck, and the northern gannet. For each of these species, we examined the data with all the years and all behaviors combined. A combined species/years/behaviors dataset was also included.

Habitat Data Layers
Depth, slope, sediment type and grain size, seabed form, and benthic habitats came from TNC's NAMERA.

Depth
Bathymetric data was originally collected as a part of the National Geographic Data Center's Coastal Relief Model (CRM). The New Jersey WEA is located between depths of 10 – 30m,

with the majority at approximately 20m. Current offshore wind construction allows for turbines fixed to the seabed in waters up to 45m. Floating turbine structures allow for construction in deeper waters.

Slope
Slope data was derived from the bathymetry data by calculating the difference in elevation between two adjacent bathymetry cells. The distribution of slopes for the whole region was broken into 5 categories: Level flat (0º – 0.015º), Flat (0.015º – 0.05º), Gentle Slope (0.05º – 0.8º), Slope (0.8º – 8.0º), and Steep (> 8.0º). Slope within the New Jersey WEA was predominately Flat, with some Level flat, and a small amount of Gentle Slope.

Sediment Type and grain size
Sediment data originated from the usSEABED system, a database that brings together more than 150 sources of seafloor spatial data for the Continental shelf and slope. Sediment type within the WEA was predominately sand, followed by gravel. Gravel and sand are both suitable sediment types for wind turbine construction.

Seabed Forms
Seabed form (or topographic position) data was derived from the bathymetry by comparing elevation changes between bathymetry cells to determine if a given cell was on a ridge, in a depression, or on the side of a slope. This data was comprised of seabed position and slope. The seabed position was classified as low, mid, or high, and slope, as mentioned above, was classified into five categories. These two sets of categories came together to create the seabed form categories: Depression, Mid-flat, High-flat, Low slope, Side slope, High slope, and Steep. The predominate types of seabed forms within the New Jersey WEA were Depression, Mid-flat, and High-flat areas. Depression areas were those with low seabed position, with a Level flat or Flat slope. Mid-flat areas were those with mid seabed position and Level flat or Flat slope. High-flat areas were those with high seabed position and Level flat or Flat slope.

Benthic Habitats
Benthic habitats indicate what collection of organisms are expected to be found in a given area based on the physical data, such as depth, slope, sediment type and size, and seabed form. Within the New Jersey WEA, seven benthic habitats accounted for more the 90% of the area. These seven habitats, in order from highest to lowest area covered, included: Habitat 7, Habitat 1, Habitat 4, Habitat 32, Habitat 2, Habitat 87, and Habitat 25. For each of these habitats there was an associated collection of organisms (Table 4).

Benthic Habitat (ranked from highest to lowest area covered)	**Associated Organisms**
7	Blood worm, Fringe worm, Hesion worm, Thread worm, Spionid mud worm, Paraonid worm, Syllid worm, Tanaidacea, Frilled anemone, Common sea star
1	Shimmy worm, Astarte, Lunate crassinella, Lancelet

4	Bamboo worm, Chevron worm, Thread worm, Syllid worm, Chestnut astarte
32	Atlantic rock crab, Longnose spider crab, Common northern moon snail, Northern moon shell, Astarte, Blood ark, Common sand dollar
2	Bamboo worm, Burrowing scale worm, Chevron worm, Flabelliger worm, Fringe worm, Spionid mud worm, Paddle worm, Paraonid worm, Shimmy worm, Spaghetti-mouth worm, Thread-like worm, Threadworm, Amphipod, Burrowing anemone, Sea cucumber, Dog welk, False quahog, File yoldia, Hard-shelled clam, Nutclam, Short yoldia, Horeshoe worm
87	Borrowing scale worm, Fringe worm, Mageloni worm, Spionid mud worm, Sphaerod worm, Syllid worm, Glass shrimp, Gammarid amphipods, Tanaidacea, Sand dollar, Atlantic razor, Gould's pandora, Lea's spoon shell, Pandora, Surf Clam, Margin shells
25	Bamboo worm, Bristle worm, Mageloni worm, Spionid mud worm, Orbiniid worm, Shimmy worm, Mysid shrimp, Moon snail, Lined anemone,

Table 4: Benthic habitats and associated organism collections for the New Jersey WEA and surrounding area.

Attachment 2 – SUPPLEMENTAL NJ WEA MAPPING: METHODOLOGY& MAPS

New Jersey WEA

Study Region
The proposed area offshore of New Jersey begins 7 nautical miles from the shore and extends roughly 23 nautical miles seaward and extends 72 nautical miles along the federal/state boundary from Seaside Park south to Hereford Inlet. The entire area is approximately 418 square nautical miles and contains approximately 43 whole OCS blocks and 34 partial blocks.[1]

Data Sources
Spatial data for the supplemental maps for the New Jersey WEA region came from three sources:

1) New Jersey Ocean/Wind Power Ecological Baseline Study ("NJ Baseline Study")
   - This was the source of avian hot spot data, avian prediction model data, marine mammal prediction model data, Essential Fish Habitat ("EFH"), the Environmental Sensitivity Index and maps, the waterbird survey, and the bat detection data. Between 2008 and 2009, Geo-Marine Inc. ("GMI") was contracted by the New Jersey Department of Environmental Protection to conduct a baseline study on birds, sea turtles, marine mammals, and other natural resources, with the objective to examine the distribution and usage in the study area off the New Jersey coast. New field data collected, as well as historical data, was processed, analyzed, and put into digital format and GIS files.

2) U.S. Fish and Wildlife Service ("USFWS")
   - The USFWS was a source of avian data.

3) University of Maryland, Center for Environmental Science
   - While the actual bat detections point data came from the NJ Baseline Study project, the source of the data and data analysis was Angela Sjollema, a graduate student at the University of Maryland's Center for Environmental Science. This project was done in conjunction with Frostburg State University and the Maryland Department of Natural Resources. The data is preliminary at this point, but bat locations and distances from shore have been included.

Biological Data Layers
The USFWS and the NJ Baseline Study were the sources for the biological data layers.

Avian Data
Cumulative avian density: Avian data was obtained from the USFWS (downloaded from MARCO) and the NJ Baseline Study. The USFWS conducted an aerial survey between 2001 and 2003. The dataset covered an area from New Jersey to Virginia, from the coast out to approximately 15 nautical miles. The density/km data was placed into five categories for display purposes. Each category was given a set color and descriptive rating: 0 = light blue, no presence, .1 = dark blue, very low, .1-.2 = teal, low, .2-.5 = olive, moderate-low, .6-1.0 = yellow, moderate-low, 1.1-5.0 = light orange, moderate, 5.1-10.0 = orange, moderate-high, 10.1-50.0 = dark orange, moderate-high, 50.1-100.0 = red, high, 100.1-500.0 = dark red, very high. White blocks represented no data collected. This survey

[1] Notice of Intent to Prepare an Environmental Assessment for Mid-Atlantic Wind Energy Areas, 76 Fed. Reg. 7226 (Feb. 9, 2011).

was included in the initial reports; however, there was no separation by species. This addendum examined four species individually: scoters, common loon, northern gannets, and the red-throated loon. See Figures 1-4.

Kernel density analysis: The NJ Baseline Study collected data from bi-monthly boat and shipboard surveys performed between 2008-2009, and was collected for different behaviors (*e.g.*, sitting, feeding, flight) for more than 150 species. The species looked at here were: northern gannets, scoters, long-tailed ducks, herring gull, laughing gull, common terns, common loons, red-throated loons, Wilson's storm petrels, and Cory's shearwaters. This data was presented in grid blocks that match the OCS blocks. Each behavioral observation from the surveys was associated with a grid block. All of the observations were summed to produce a single density/km^2 for each grid block. The data from the grid block was displayed with quart ranking, based on the following divisions: Quart 1 = 80-100%, Quart 2 = 60-79%, Quart 3 = 40-59%, Quart 4 = 20-39%, Quart 5 = .01-19%, and Quart 6 = 0%. The quart ranks (1-6) are based on the number of birds/km^2, with the value 1 representing the highest density and value 6 representing zero density. Grid boxes with the highest ranking represented the top 20% and are considered the avian "hot spots" (NJDEP EBS Final Report: Volume III).

Kernel density analysis: Four maps are presented here. These include an overall map (all species/all behavior/all years), a scoter map (all behavior/all years), a northern gannet map (all behaviors/all years), and a long-tailed duck map (all behaviors/all years). See Figures 5-8.

Avian "hot spot" analysis: For the purposes of this additional review, we focused on the following species: black scoter, red-breasted merganser, red-throated loon, and surf scoter. For each of these species, we examined the data with all the years and all behaviors combined. As data type was not consistent across species, the behavior, month, and/or years are specified on the maps. In instances where a full year or season was available, that was used over individual months or years (*e.g.*, fall 2009 was used instead of Oct 2009 and Nov 2009; All Behaviors 2008 used instead of fall 2008, spring 2008, and summer 2008). See Figures 9-14.

Bat Data

As a part of several of the NJ Baseline Study 2009 shipboard surveys, a bat survey was completed by Angela Sjollema, from the University of Maryland's Center for Environmental Science. Using an Anabat II detector onboard, four species were identified: *Myotis sp*. ("MYSP"), *Eptesicus fuscus/Lasionycteris noctivagans* ("EPFU/LANO"), *Lasiurus borealis* ("LABO"), and *Lasiurus cinereus* ("LACI"). A fifth category, no identification (NOID), was included for those data points with less than the minimum of call pulses. The data from this project is preliminary and still undergoing analysis. See Figure 15.

Marine Mammal Data

The marine mammal data from the NJ Baseline Study were collected from bi-monthly boat and shipboard surveys performed between 2008-2009 and for each species sightings per unit effort ("SPUE") was provided for four seasons: winter, spring, summer, and fall. SPUE was calculated as SPUE = 1000 x number of animals sighted/effort. Maps were included for any species and season in which values above 0 were present within or in the vicinity of the New Jersey WEA.

The data included the following species: North Atlantic right whale, the fin whale, the humpback whale, the minke whale, the bottlenose dolphin, the short-beaked common dolphin, and the harbor porpoise. Only species with 20 or greater sightings were included in the modeling analysis, therefore, density models (and maps) were created for the following: threatened and endangered marine

mammals (year-round), delphinids (short-beaked common dolphin and an unidentified dolphin in winter only), bottlenose dolphin (spring and summer), and the harbor porpoise (winter only). An additional map was generated for fin whales (year-round). For visualization purposes, the SPUE values were symbolized into five categories: 0, 0-25%, 25-50%, 50-75%, 75-100%. Each category was given a set color and descriptive rating: 0 = grey, no presence, 0-25% = green, low, 25-50% = yellow, moderate, 50-75% = orange, moderate-high, 75-100% = red, high. White blocks represented no data collected. See Figures 16-21.

Species (common name)	**Species (scientific name)**	**Status**	**Species (common name)**	**Species (scientific name)**	**Status**
Fin Whale	*Balaenoptera physalus*	Endangered	Minke Whale	*Balaenoptera acutorostrata*	None
Humpback Whale	*Megaptera novaeangliae*	Endangered	Harbor Porpoise	*Phocoena phocoena*	None
North Atlantic Right Whale	*Eubalaena glacialis*	Endangered	Bottlenose Dolphin	*Tursiops truncatus*	None
			Short-beaked Common Dolphin	*Delphinus delphis*	None

Table 1: Marine mammal species included.

Environment Sensitivity Index and Maps

Another task of the NJ Baseline Study was to assemble an environmental sensitivity index (ESI) that incorporated biological, physical, and socioeconomic resources. Environmental sensitivity maps ("ESM") were created for individual datasets (*e.g.*, birds, marine mammals, etc.). This section presents the results from both the individual ESMs and the overall ESI. The individual ESM maps and the ESI had MMS lease block grids overlaid on them. The grids were identified with a letter and number (*e.g.*, A1). This grid system was necessary since the ESI provided an overall index value for each grid block, but not what resources lay behind that index (*i.e.*, avian data vs. turtle data). The grid letter and number allows users to refer to the accompanying tables that indicated the values behind the index rankings (NJDEP EBS Final Report: Volumes I and II).

Avian

ESI avian data included all species and all behaviors. It was generated from the density values (# birds/km^2). The density data was divided into a ranking system, where higher density equaled a higher rank. Avian data had three ranks (2, 4, and 6), which corresponded to the following range of densities: Rank 2 = 0.01-50 birds/km^2, Rank 4 = 51-100 birds/km^2, and Rank 6 = 101+ birds/km^2. Avian data had higher ranks, compared to other biological resources (2, 4, and 6, rather than 1, 2, and 3), because birds are considered more likely to be impacted by wind energy development (NJDEP EBS Final Report: Volumes I and II). See Figure 22.

Sea Turtles

Two sea turtle species were included, leatherbacks (*Dermochelys coriacea*) and loggerheads (*Caretta caretta*). The leatherback is listed as endangered and the loggerhead is listed as threatened. The data was based on SPUE and divided into a ranking system, where higher

SPUE values were associated with a higher index value. For the turtle data there were three ranks (1, 2, and 3), which corresponded to the following range of sightings/km: Rank 1 = 0.0039 – 0.0059 sighting/km, Rank 2 = 0.0060 – 0.0073 sightings/km, and Rank 3 = 0.0074 – 0.0261 sightings/km (NJDEP EBS Final Report: Volumes I). See Figure 23.

Marine Mammals

As mentioned previously, marine mammals were another component of the NJ Baseline Study. The marine mammal data was divided into a ranking system where higher density equaled higher rank. Marine mammal ("MM") data had three ranks (1, 2, and 3), which corresponded to the following range of densities: Rank 1 = 0.000000001-0.0162 MM/km^2, Rank 2 = 0.0163 – 0.1342 MM/km^2, and Rank 3 = 0.1343-.9871 MM/km^2 (NJDEP EBS Final Report: Volumes I). See Figure 24.

The threatened and endangered marine mammal species included in the ESI were the North Atlantic right whale, the fin whale, and the humpback whale. Year round data was included for all of these species. The threatened and endangered marine mammals ("MM T&E") were divided into a three rank system (1, 2, and 3), where higher density equaled higher rank. MM T&E ranks corresponded to the following range of densities: Rank 1 = 0.0000001 – 0.000008 MM T&E/km^2, Rank 2 = 0.000009 – 0.0004 MM T&E/km^2, and Rank 3 = 0.0005 – 0.0165 MM T&E/km^2 (NJDEP EBS Final Report: Volumes I). See Figure 25.

Essential Fish Habitat

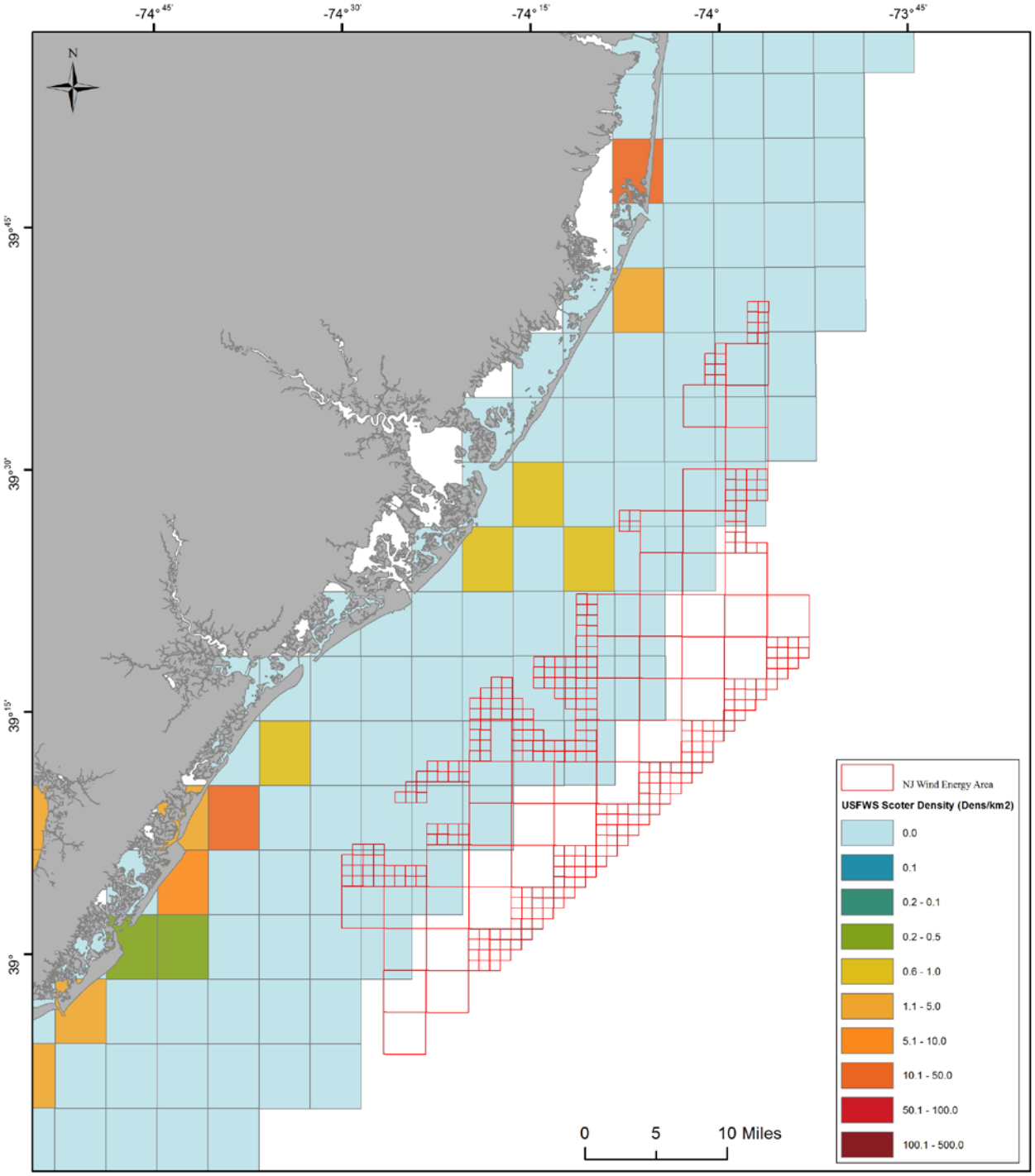
EFHs are formally classified into five stages (eggs, larvae, juvenile, adult, and spawning adult); however, for the species included in this review, four stages were included: egg, larvae, juvenile, and adult. The EFH layers were obtained by Geo-Marine from NMFS and were scanned in from a hardcopy publication with 10x10 decimal minute grid blocks designating presence or absence. A buffer was applied to the resulting presence features to create a contiguous polygon with the assumption that the fish life stage found had to be connected in order to travel between grid blocks. For the ESI and EFH environmental sensitivity map, essential fish habitats for more than 40 species were included. All life stages were included, and the data were divided into a three rank system (1, 2, and 3). The ranks corresponded to the following ranges of EFH designations: Rank 1 = 1-12 EFH, Rank 2 = 13-24 EFH, and Rank 3 = 25-38 (NJDEP EBS Final Report: Volumes I). See Figure 26.

Overall

For the purposes of this report, the grid blocks that matched up with the NJ WEA were examined exclusively for their biological resources, including avian, marine mammal, sea turtle, and fisheries data. There are 75 grid blocks within the NJ WEA. Figure 28 shows all biological rankings within each of the NJ WEA grid blocks. To determine which grids had the most biological resources, each grid with a ranking was given a value of 1. By summing all of the rows, it was possible to determine which grids had more biological resources. However, this assumed that each rank was equal with no weighting. Instead, the grid values (of 1) were weighted by the original ranking system (*e.g.*, Avian 2, 4, and 6 or Marine Mammals 1, 2, and 3), and the top 20 grid blocks for biological resources were calculated. See Table 2. This method gave more weight to avian data, as they are considered the species most likely to be most impacted by offshore development.

These tabled results provided numerical data to clarify the ESI map. It is important to remember that while the ESI map contained all resources and uses, the table calculations only

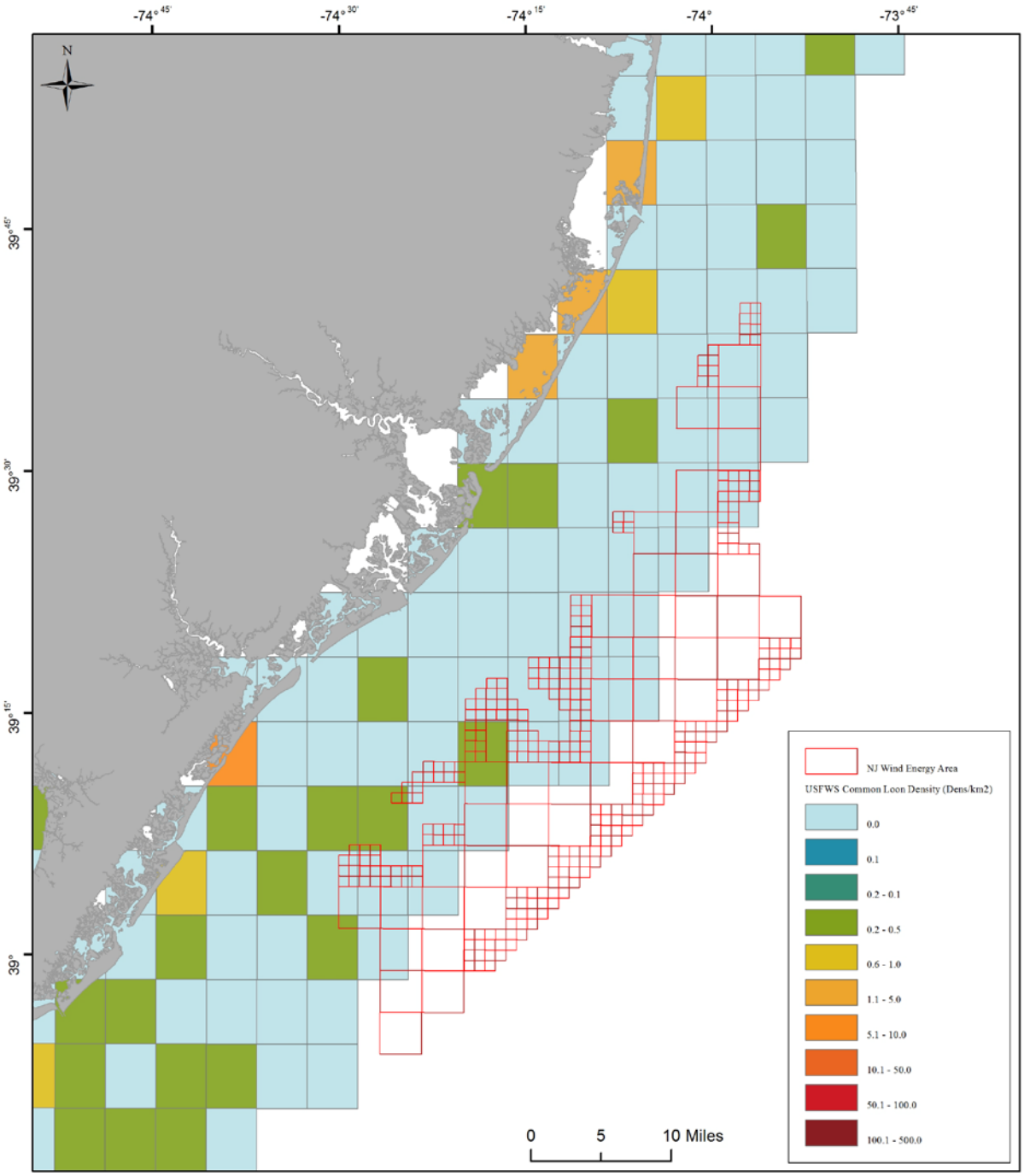
included biological resources. These calculations indicated that the top grid blocks for biological resources were H18, H19, G18, J18, K15, K18, M16, N13, N16, I18, K17, and N15. See Figure 29.



Cumulative Avian Density for Scoters #/km^2 (2001-2003). This map was originally created for the NJ Baseline Study by GeoMarine Inc. It was altered for the purposes of this report by J.Boynton April 2011.

NAD83 New Jersey State Plane

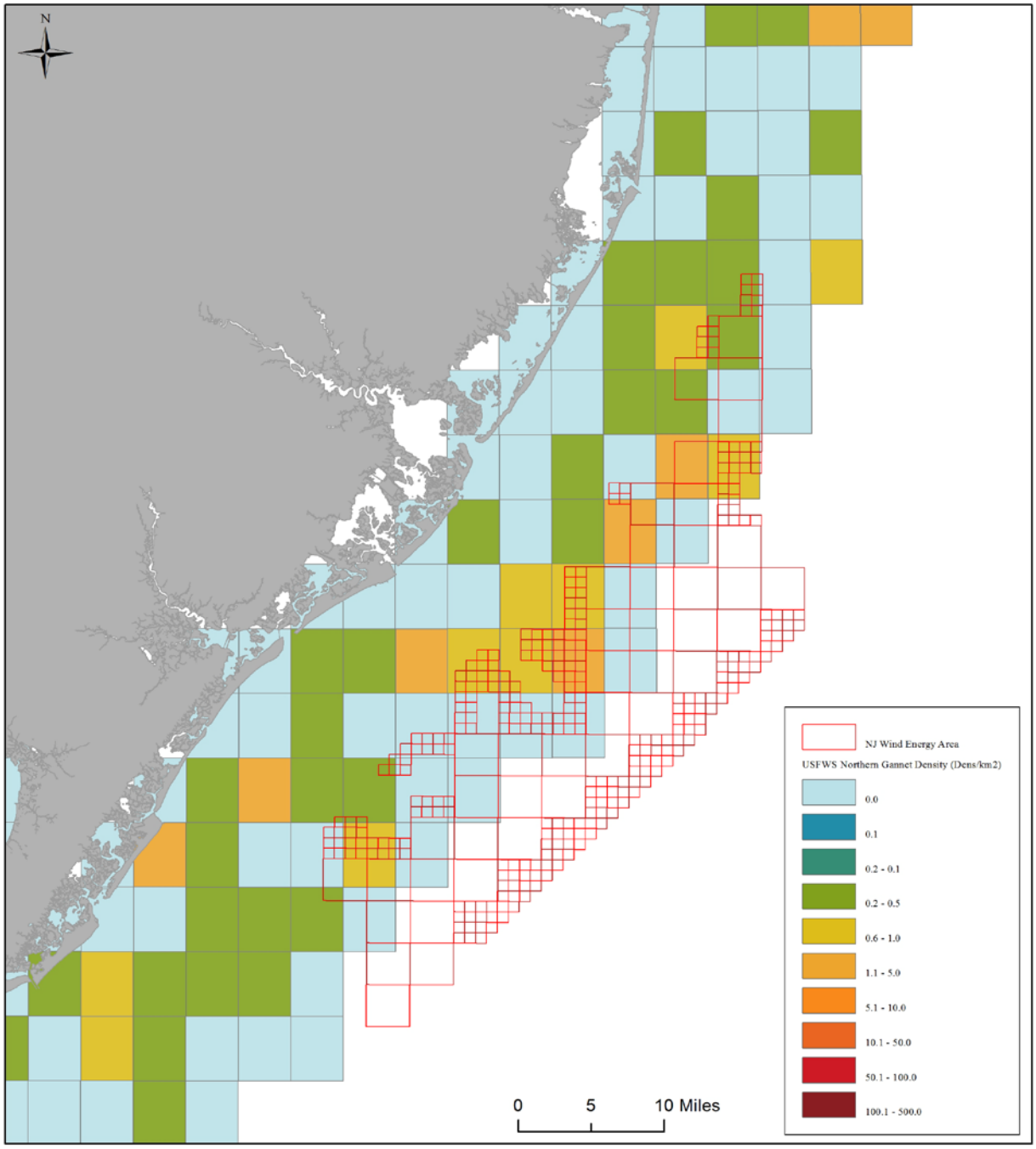
Figure 1: USFWS Scoter Density



Cumulative Avian Density for Common Loon #/km^2 (2001-2003). This map was originally created for the NJ Baseline Study by GeoMarine Inc. It was altered for the purposes of this report by J.Boynton April 2011.

NAD83 New Jersey State Plane

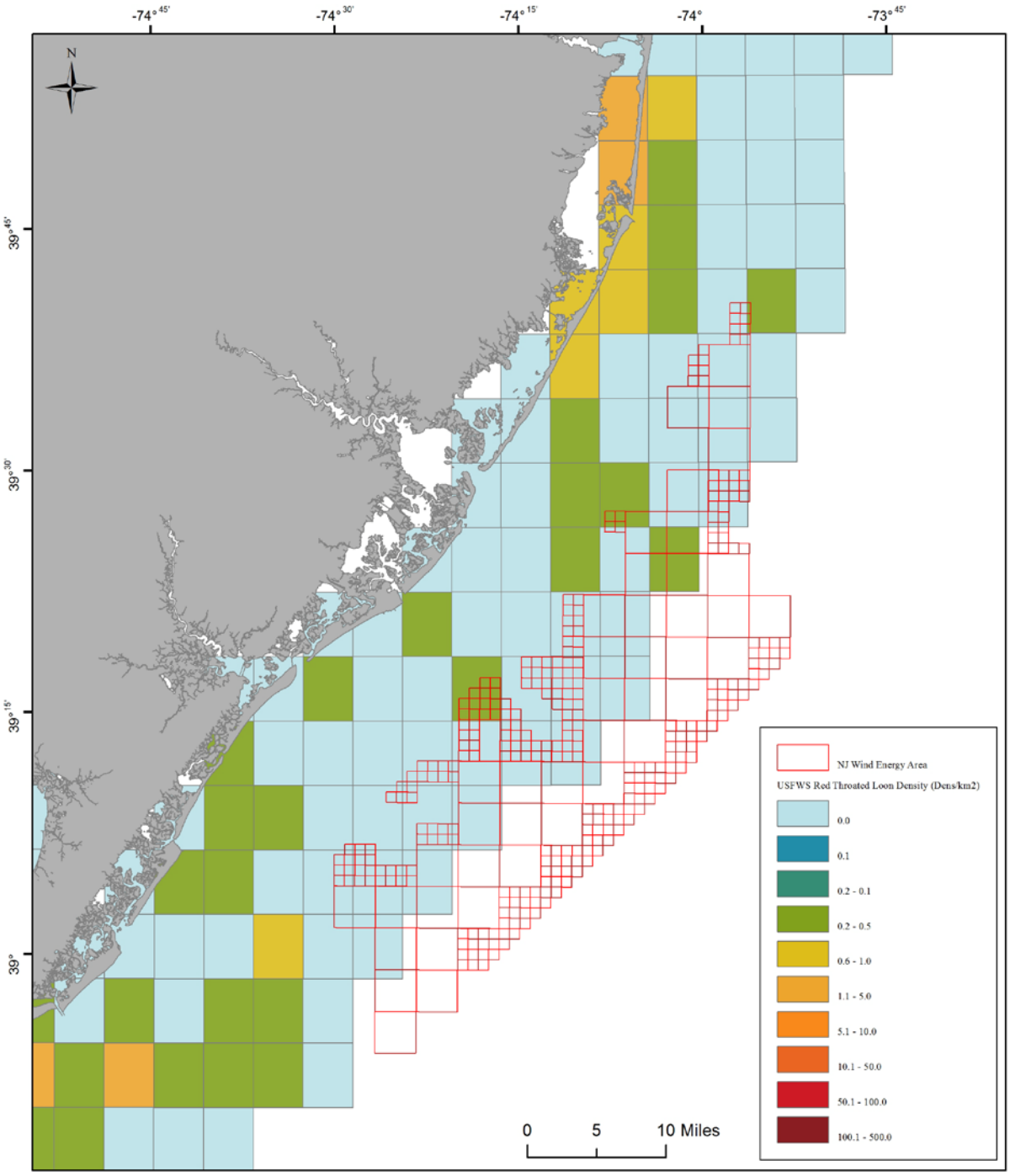
Figure 2: USFWS Common Loon Density



Cumulative Avian Density for Northern Gannet #/km^2 (2001-2003). This map was originally created for the NJ Baseline Study by GeoMarine Inc. It was altered for the purposes of this report by J.Boynton April 2011.

NAD83 New Jersey State Plane

Figure 3: USFWS Northern Gannet Density



Cumulative Avian Density for Red Throated Loon #/km^2 (2001-2003). This map was originally created for the NJ Baseline Study by GeoMarine Inc. It was altered for the purposes of this report by J.Boynton April 2011.

NAD83 New Jersey State Plane

Figure 4: USFWS Red-Throated Loon Density

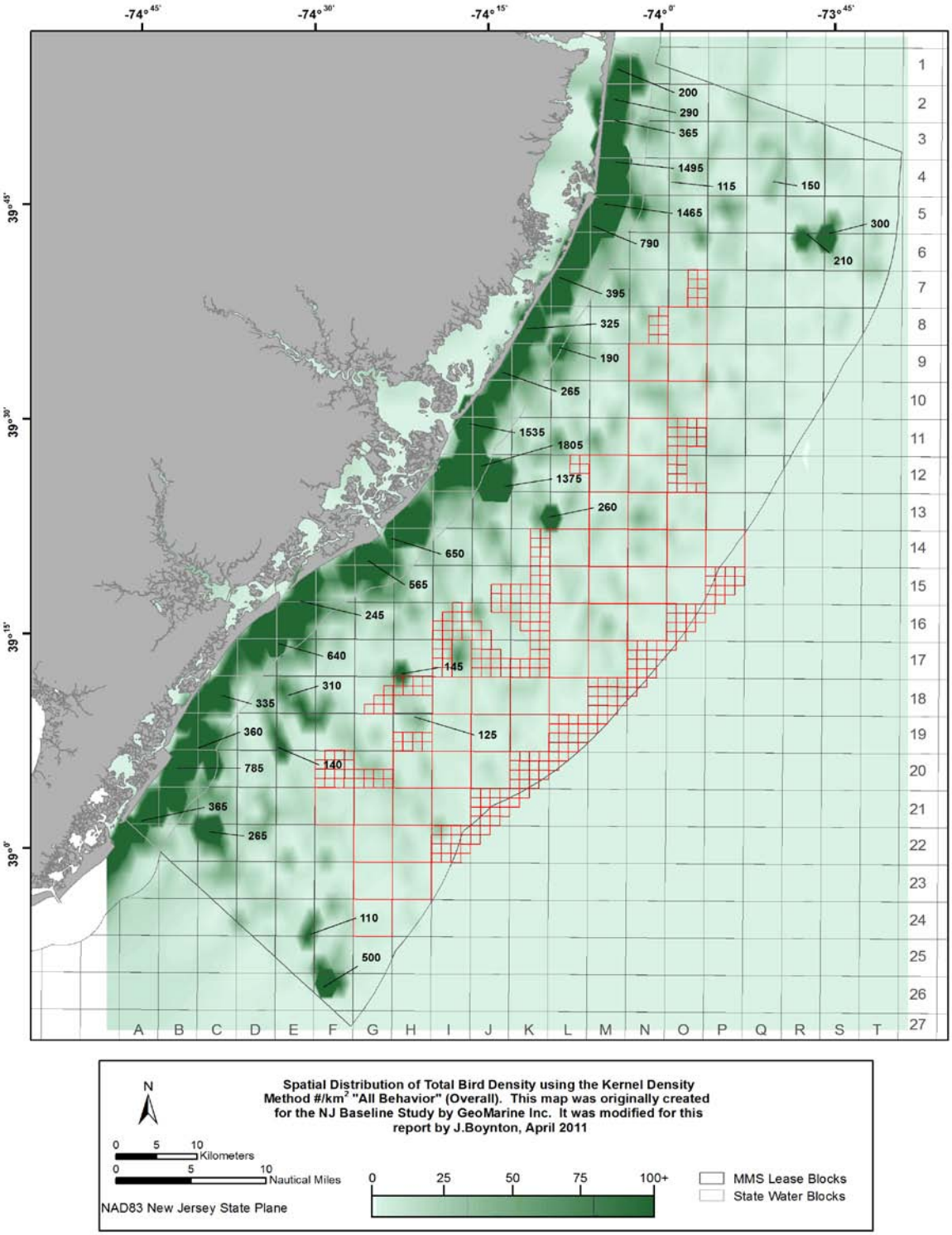


Figure 5: Kernel Density Analysis for All Species, All Behaviors, All Years

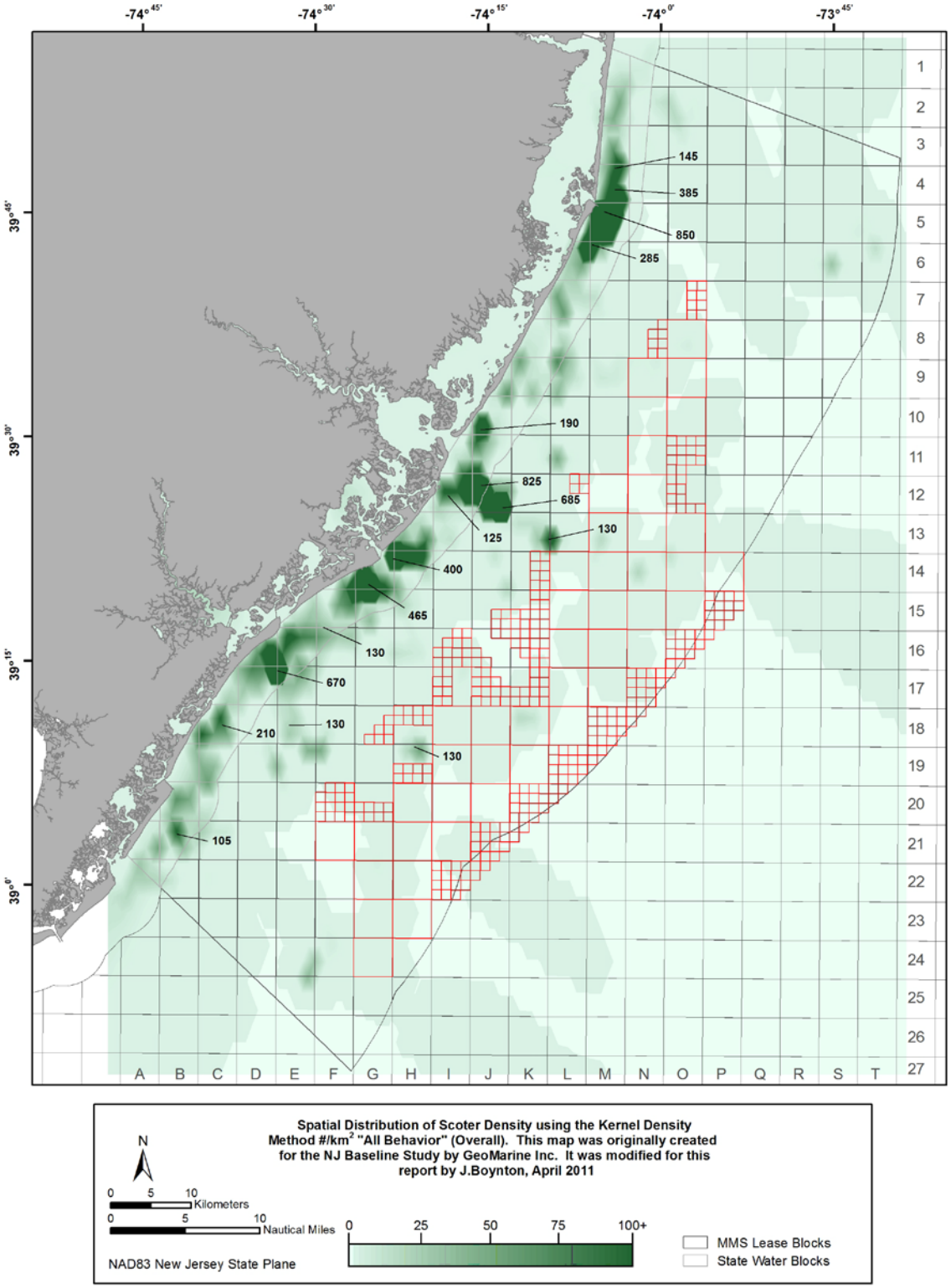


Figure 6: Kernel Density Analysis for Scoters, All Behaviors, All Years

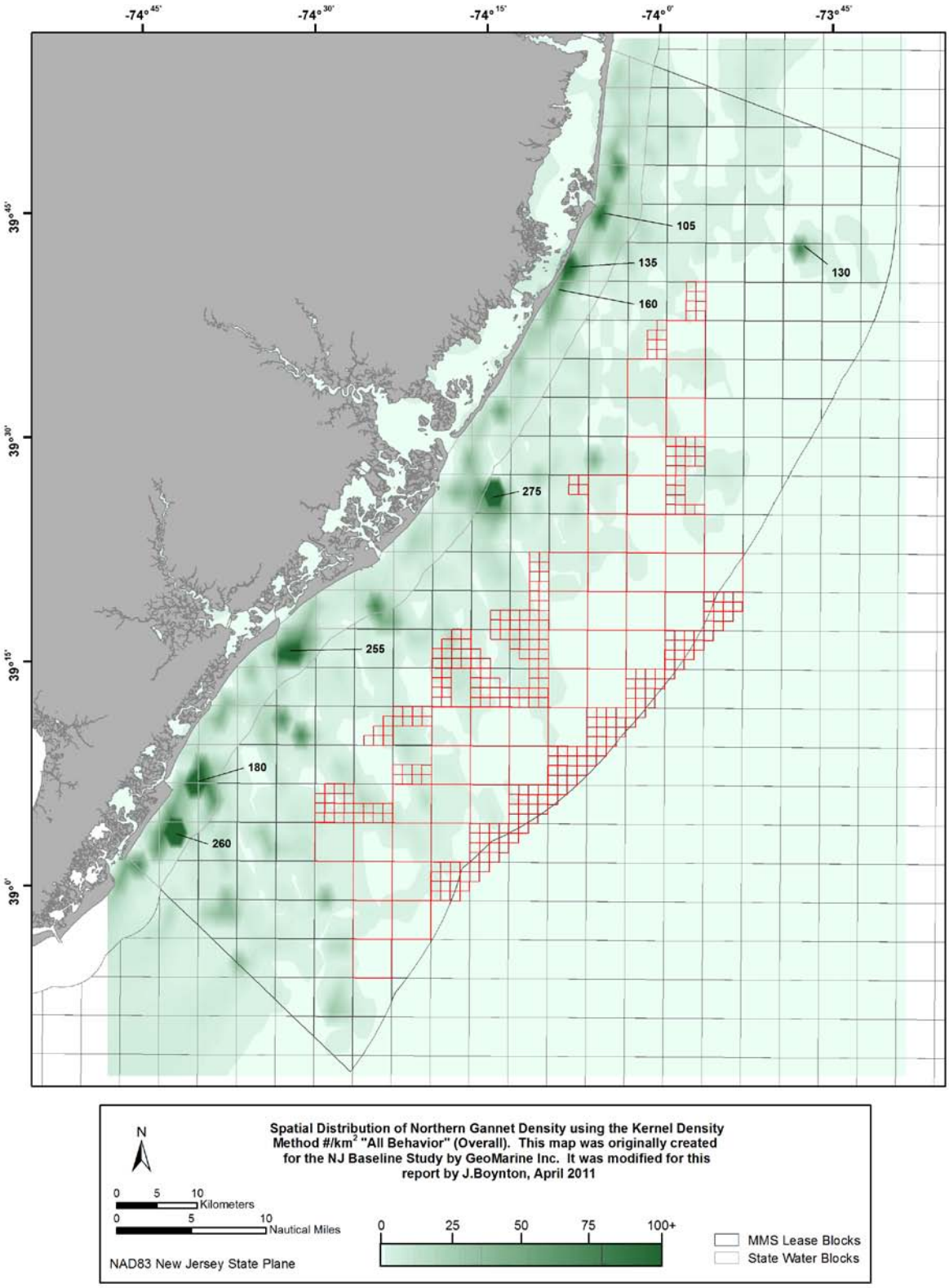


Figure 7: Kernel Density Analysis for the Northern Gannet, All Behaviors, All Years

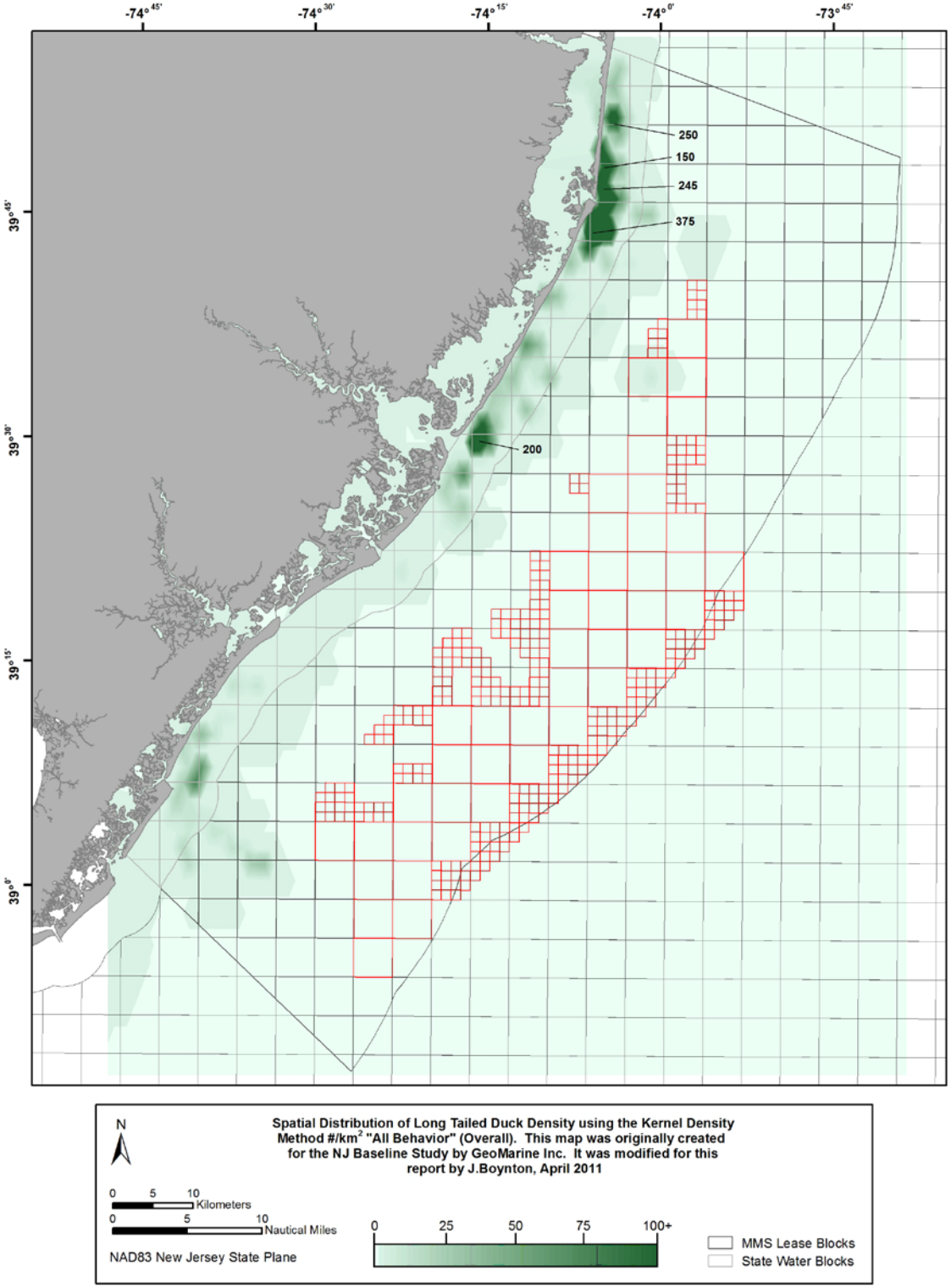


Figure 8: Kernel Density Analysis for the Long Tailed Duck, All Behavior, All Years

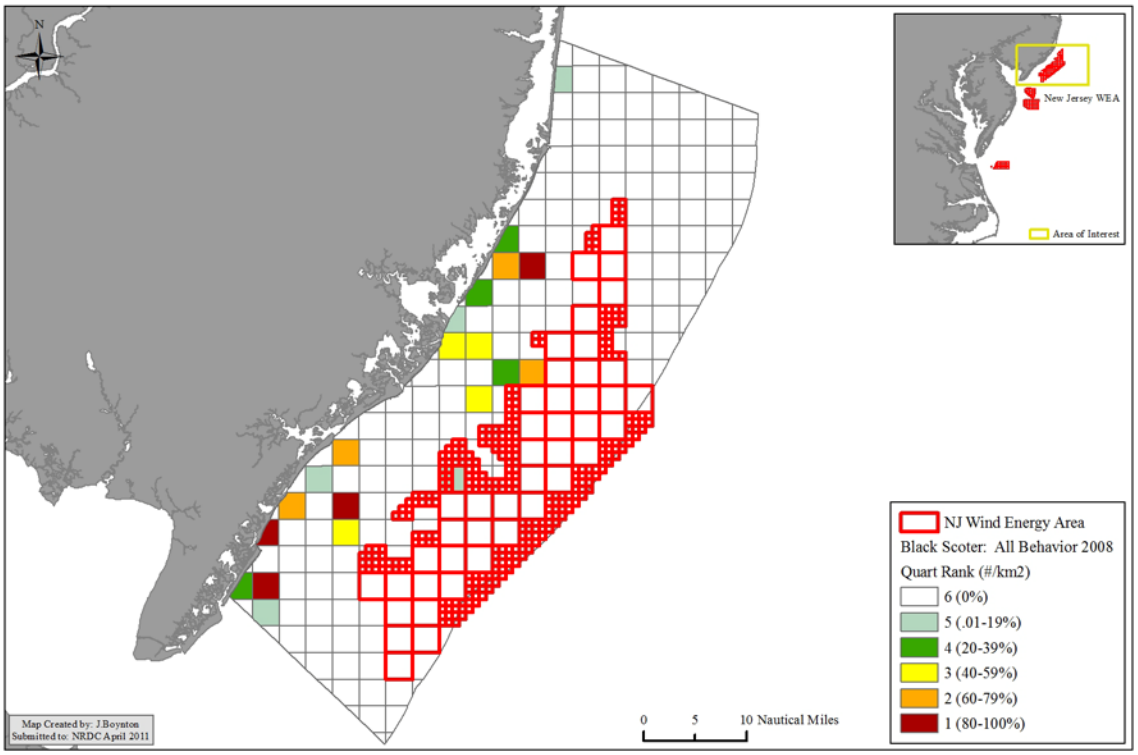


Figure 9: Black Scoter Hot Spot Analysis; All Behavior 2008

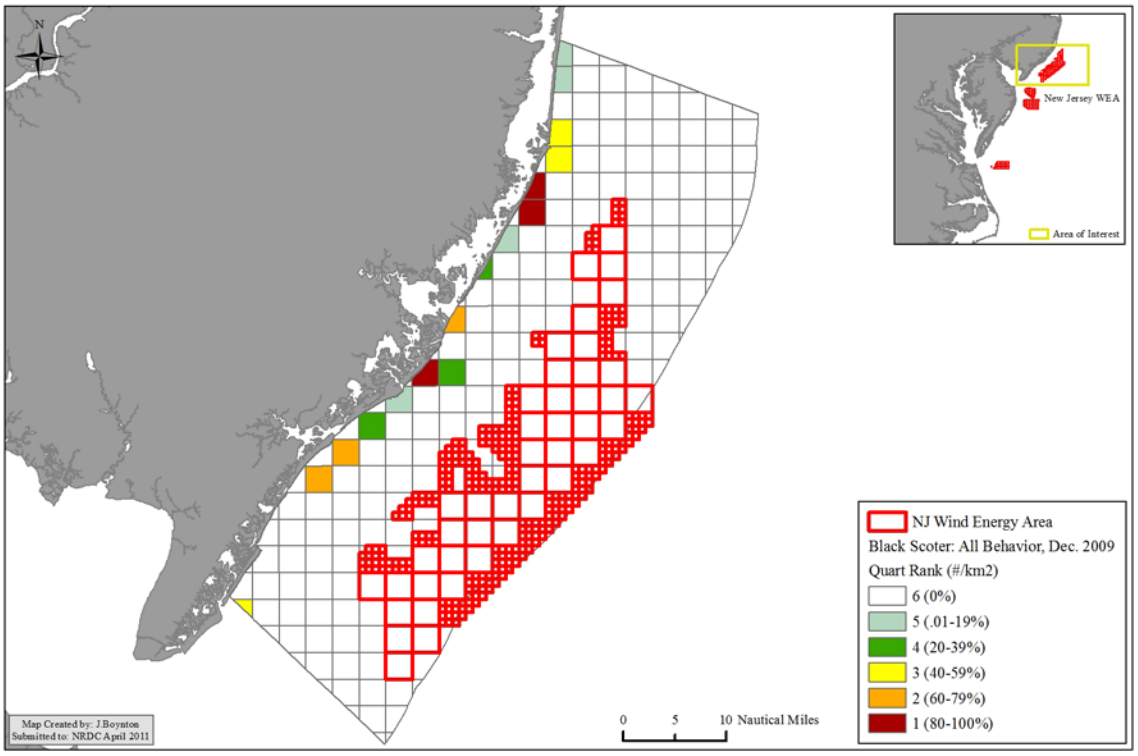


Figure 10: Black Scoter Hot Spot Analysis; All Behaviors, Dec. 2009

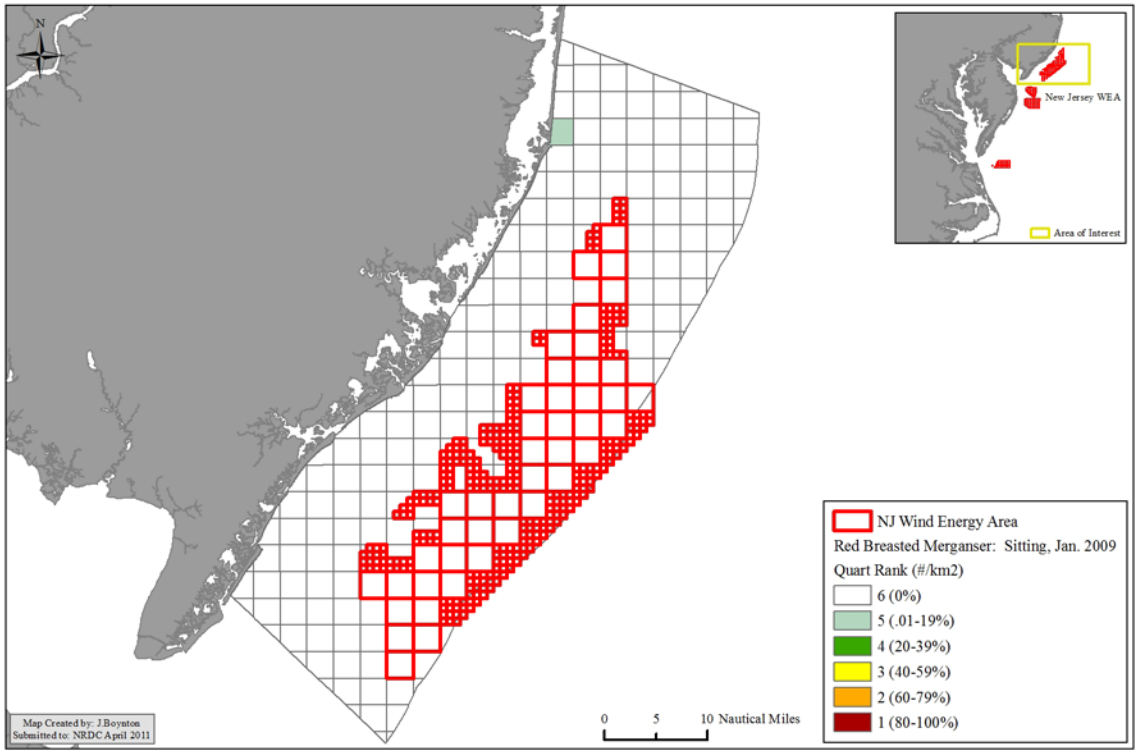


Figure 11: Red-Breasted Merganser Hot Spot Analysis; Sitting Behavior, Jan. 2009

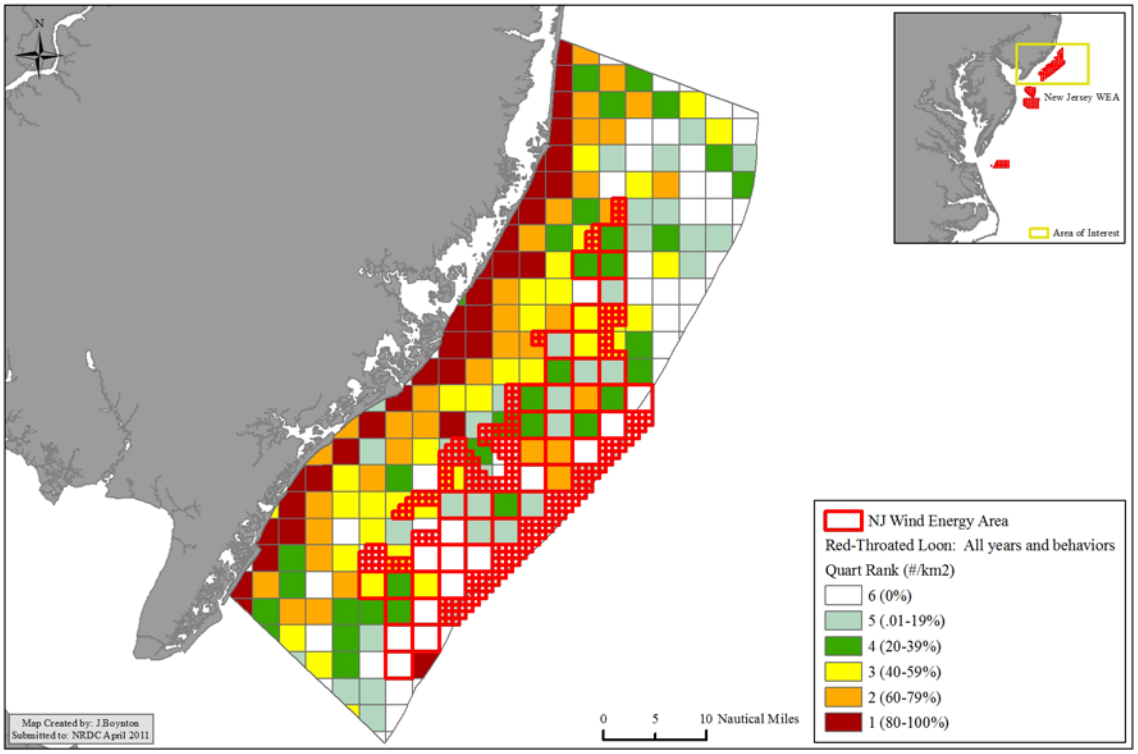


Figure 12: Red-Throated Loon Hot Spot Analysis; All Behaviors, All Years

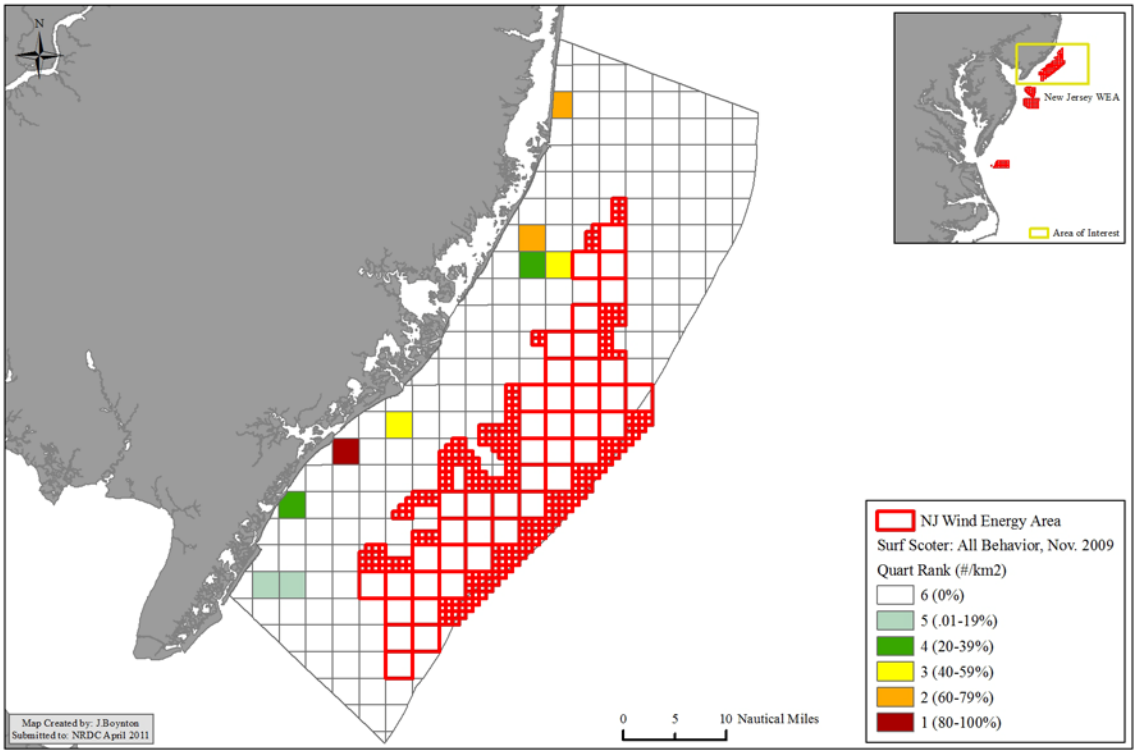


Figure 13: Surf Scoter Hot Spot Analysis; All Behavior, Nov 2009

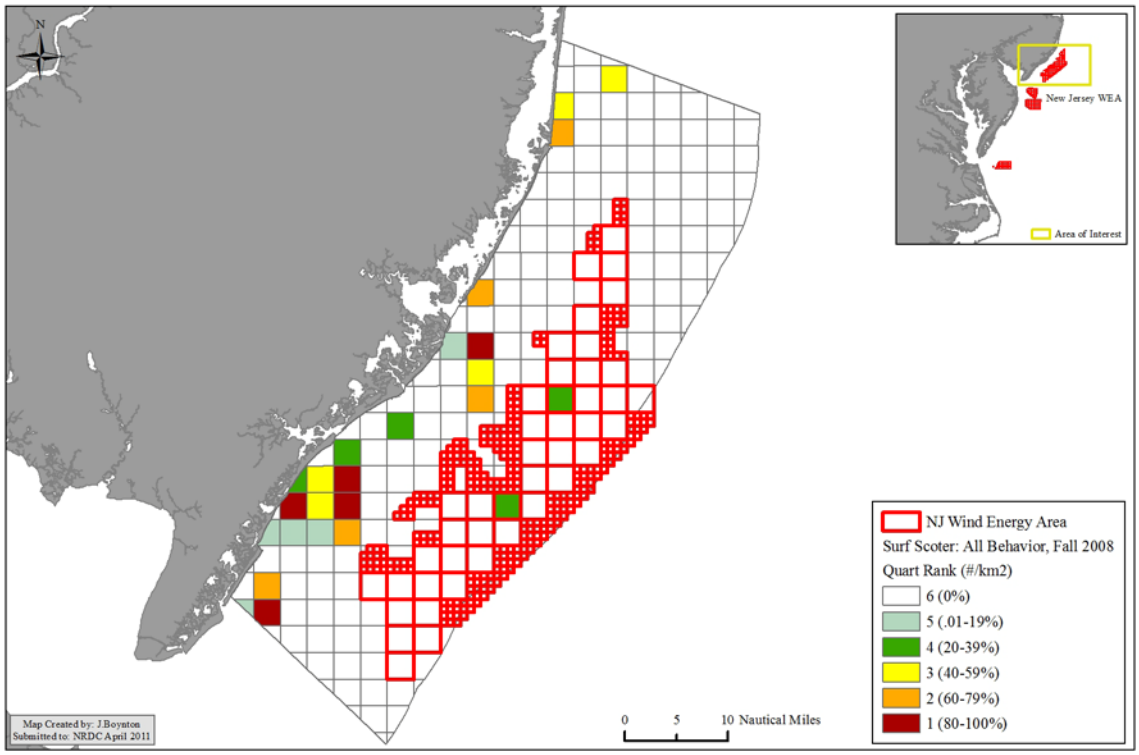


Figure 14: Surf Scoter Hot Spot Analysis; All Behavior, Fall 2008

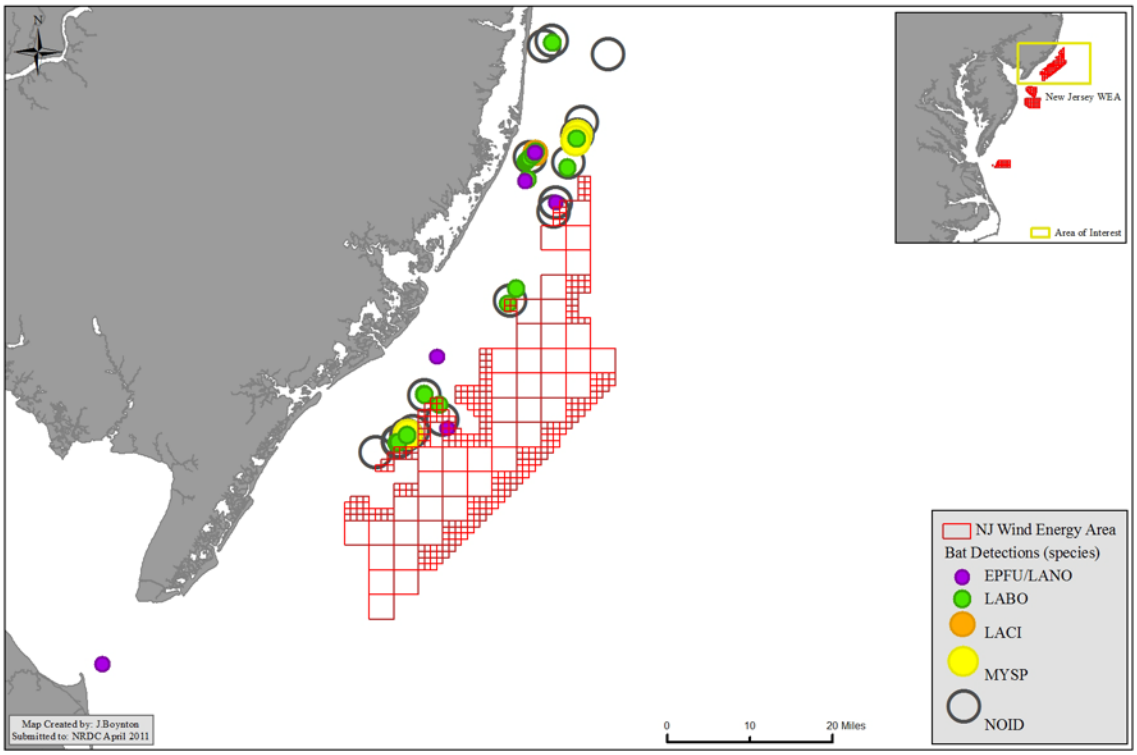


Figure 15: Bat Detections

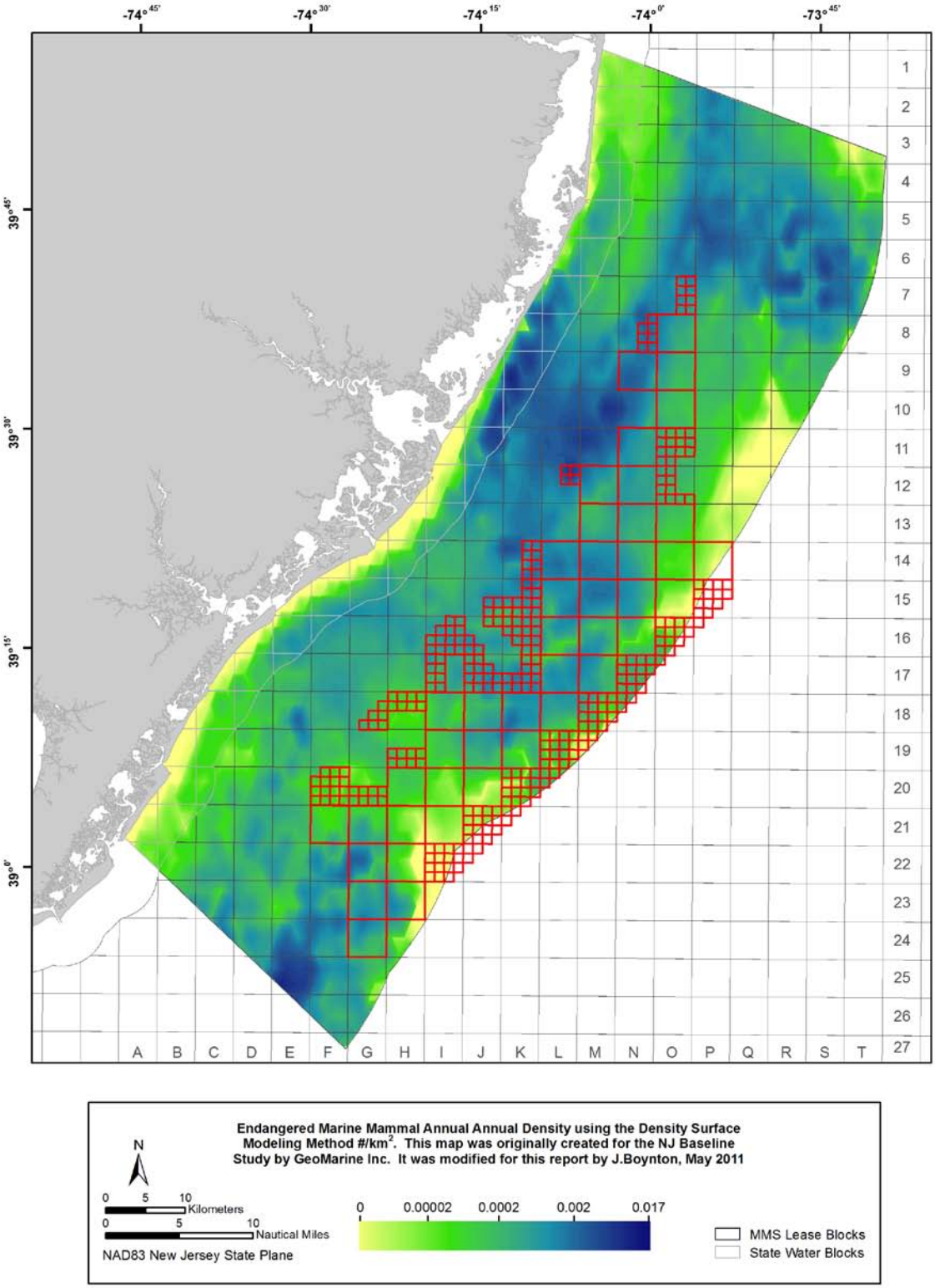


Figure 16: Density Surface Modeling for Endangered Marine Mammals

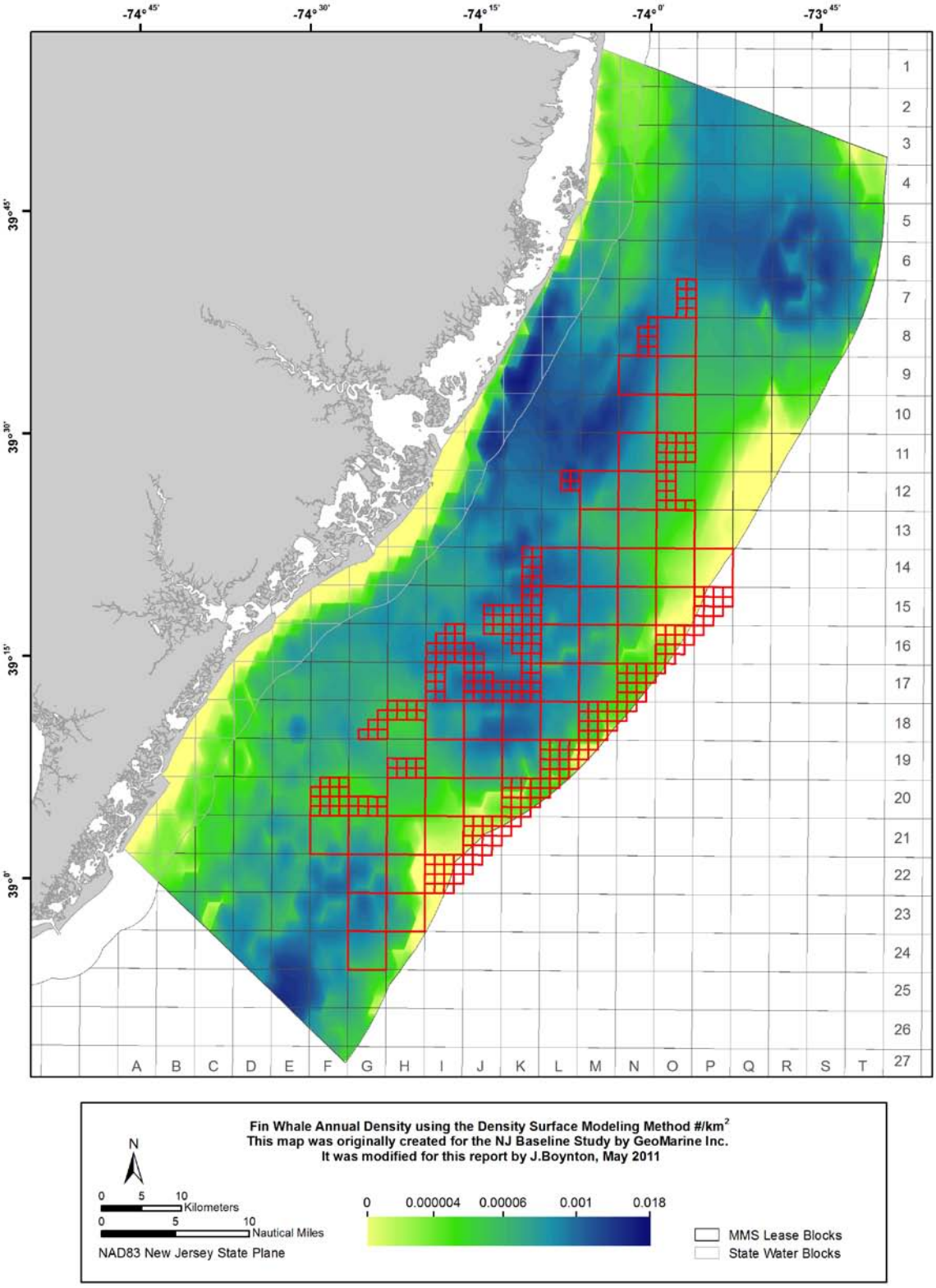


Figure 17: Density Surface Modeling for Fin Whales

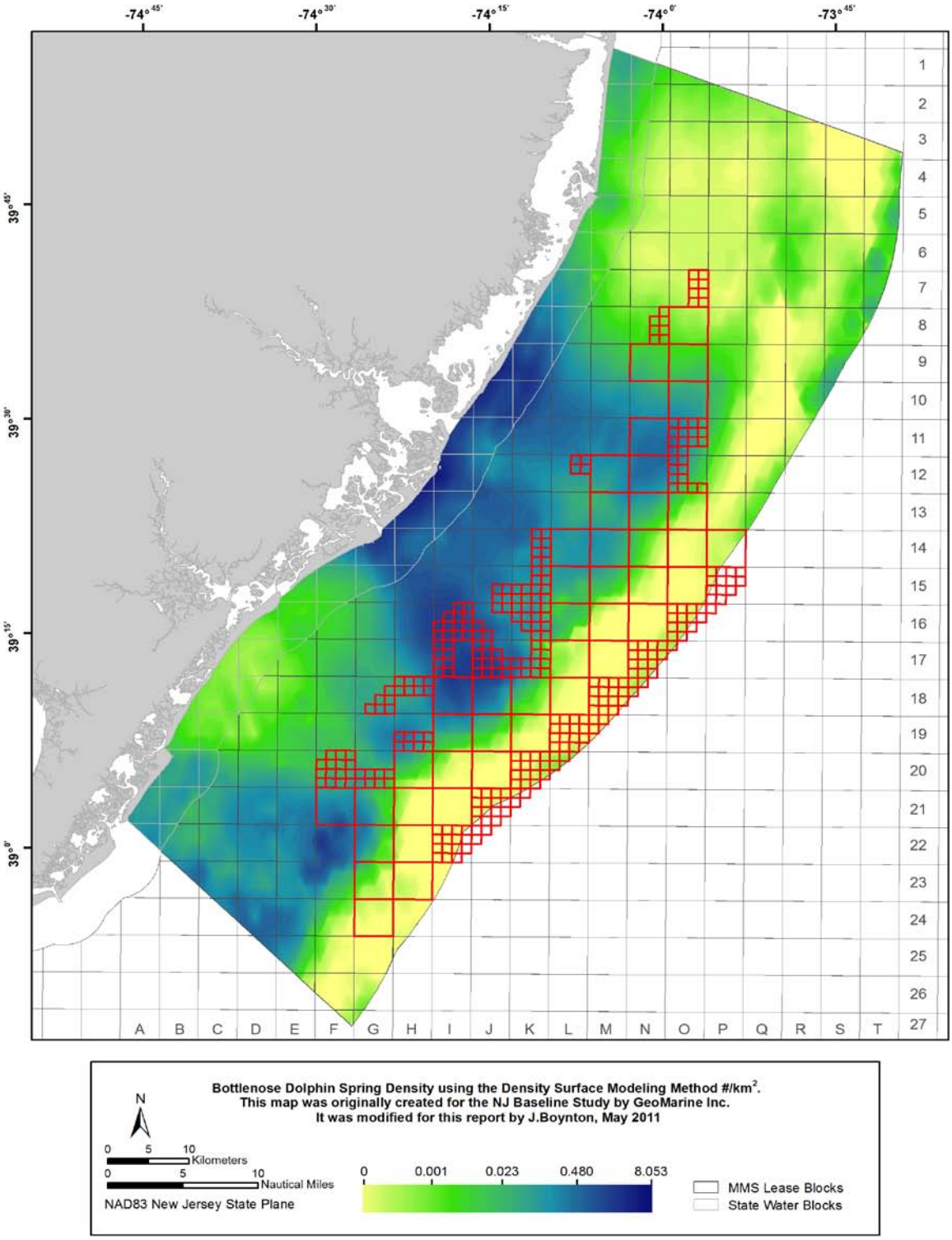


Figure 18: Density Surface Modeling for Bottlenose Dolphin: Spring

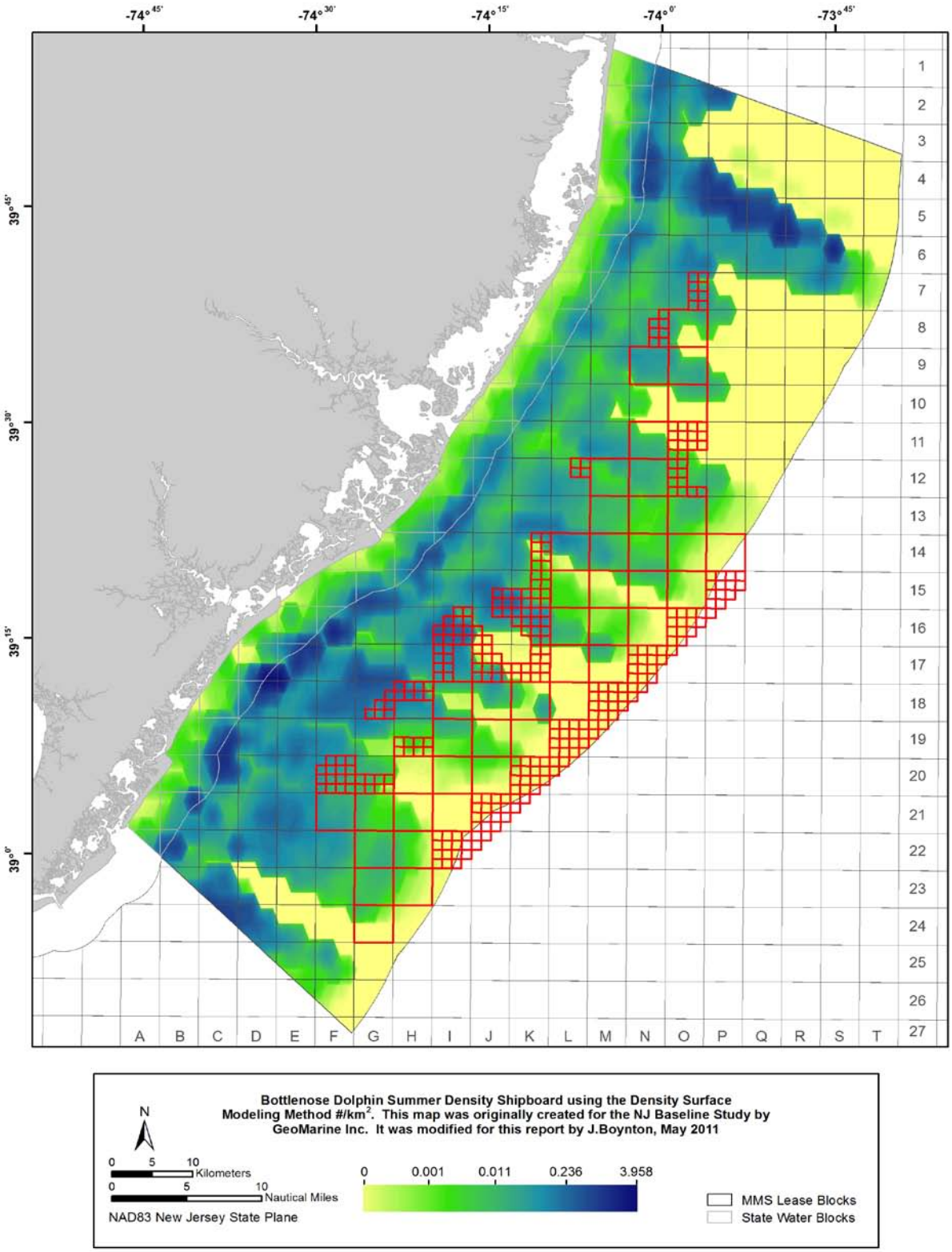


Figure 19: Density Surface Modeling for Bottlenose Dolphin: Summer

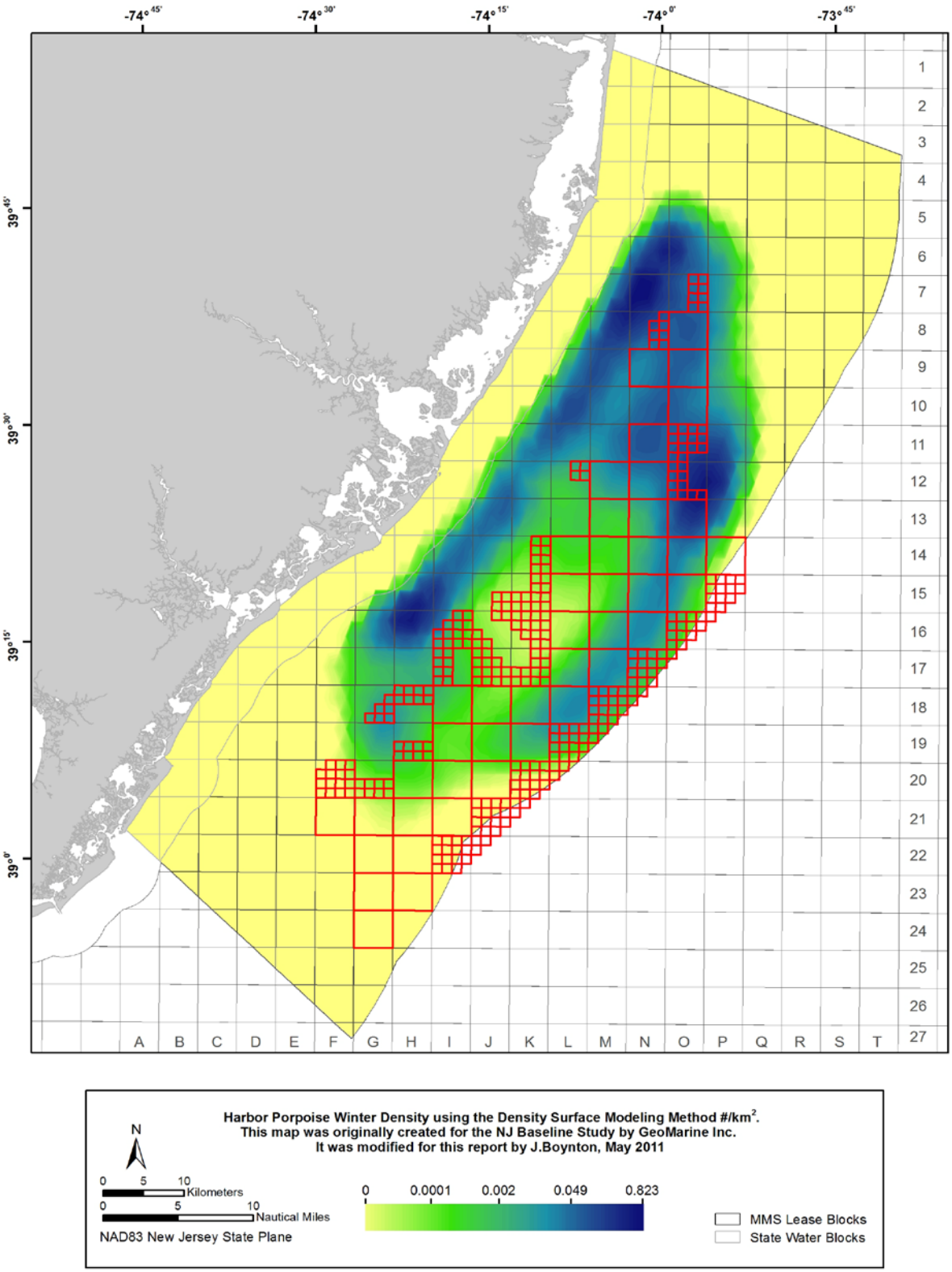


Figure 20: Density Surface Modeling for Harbor Porpoise

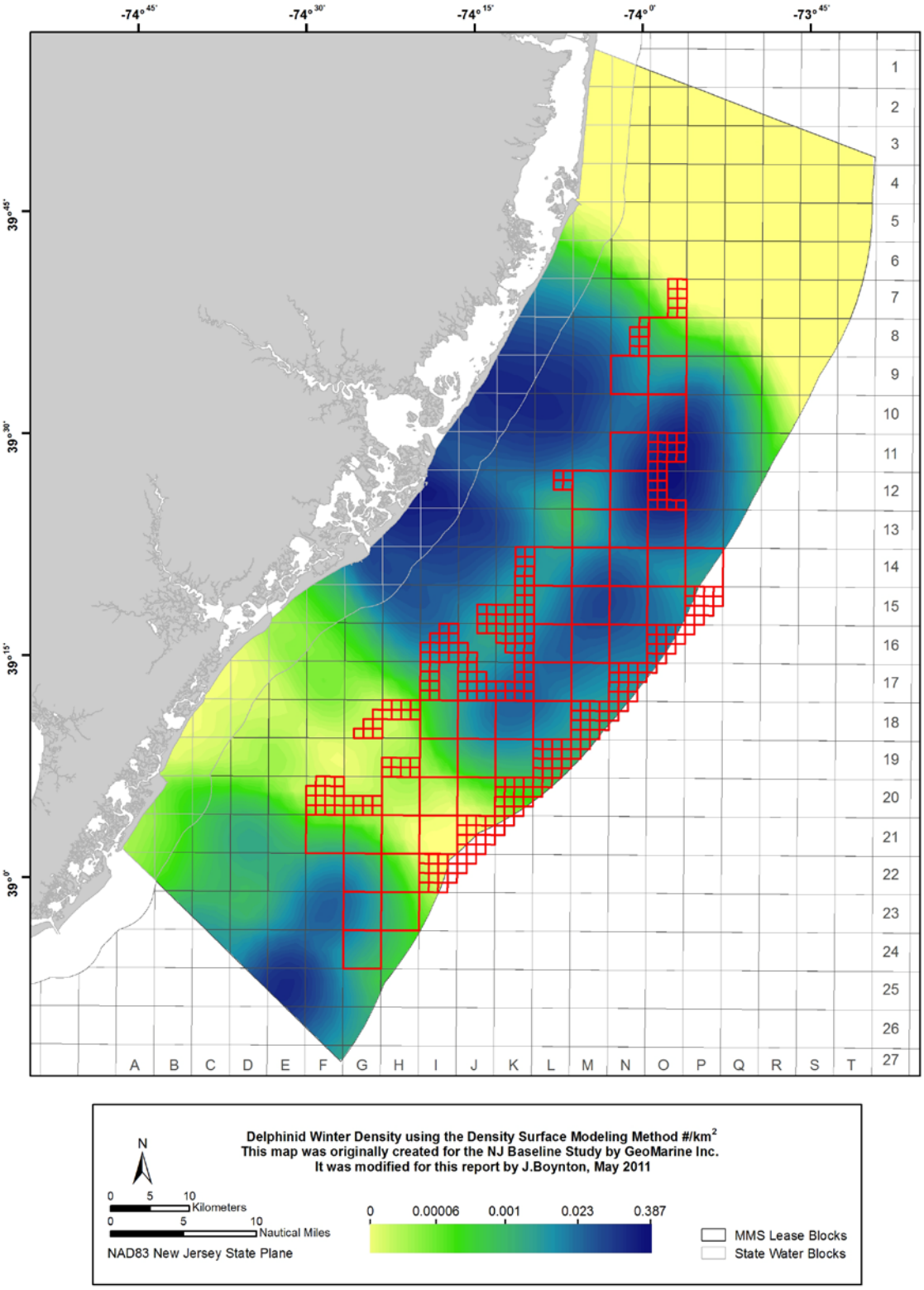


Figure 21: Density Surface Modeling for Delphinids: Winter

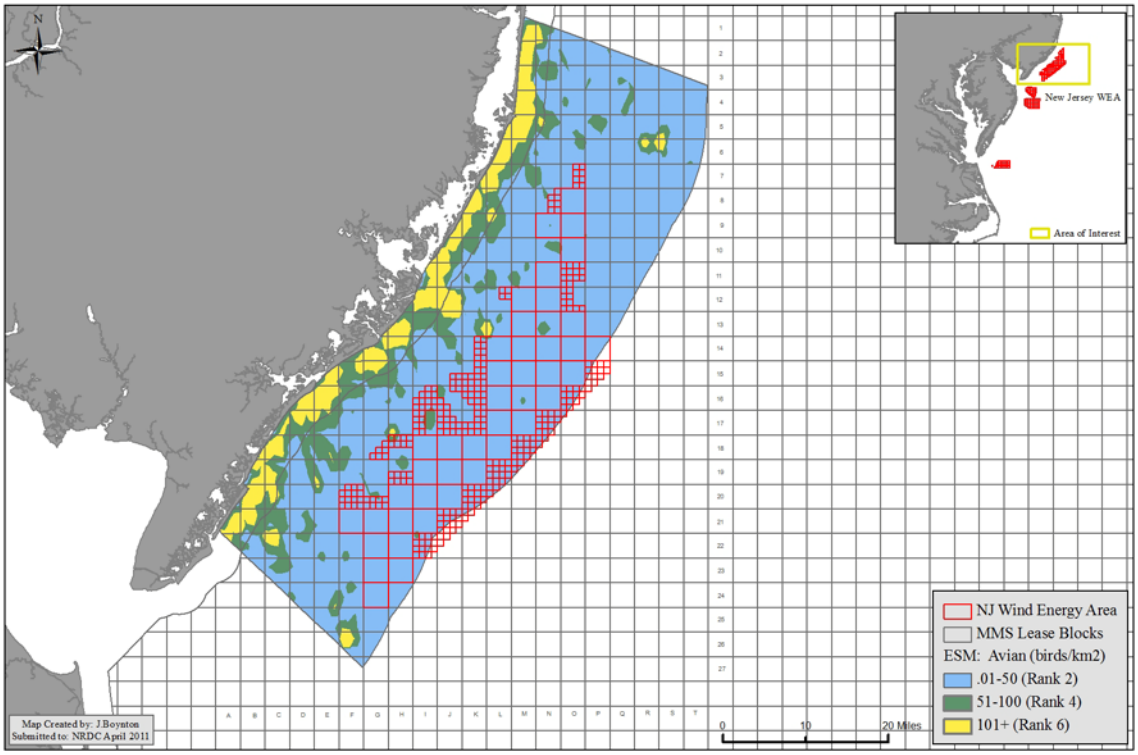


Figure 22: Avian Environmental Sensitivity Map

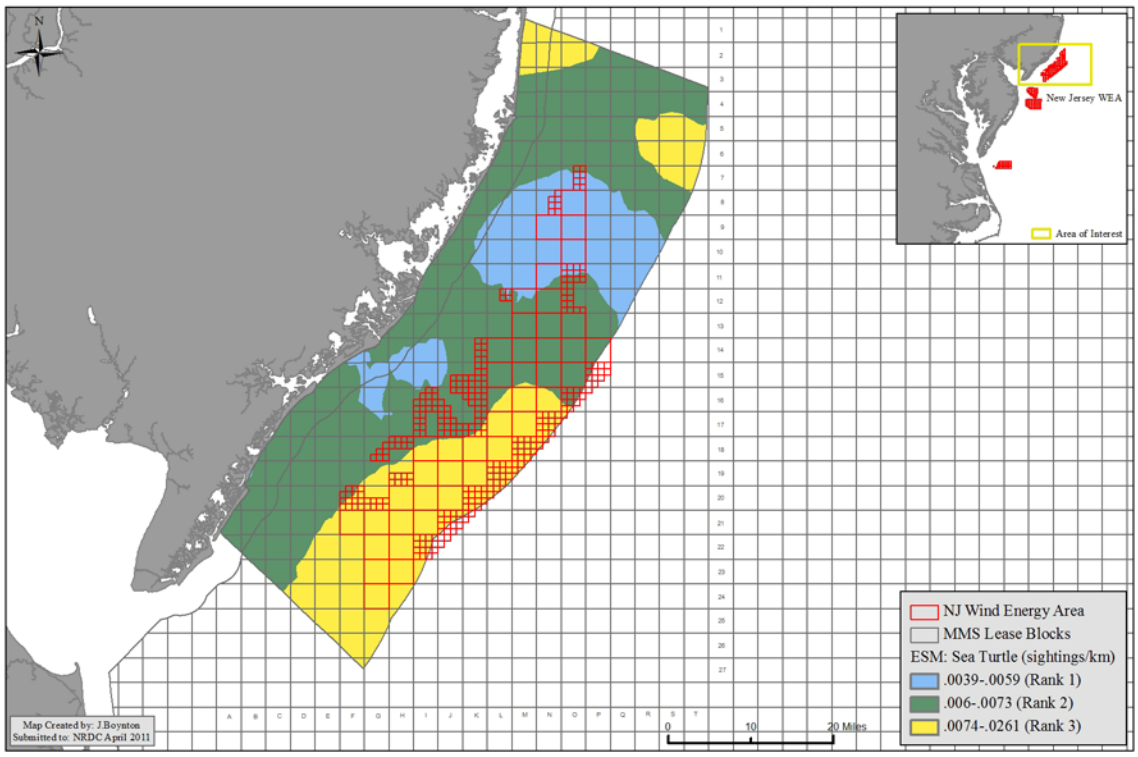


Figure 23: Sea Turtle Environmental Sensitivity Map

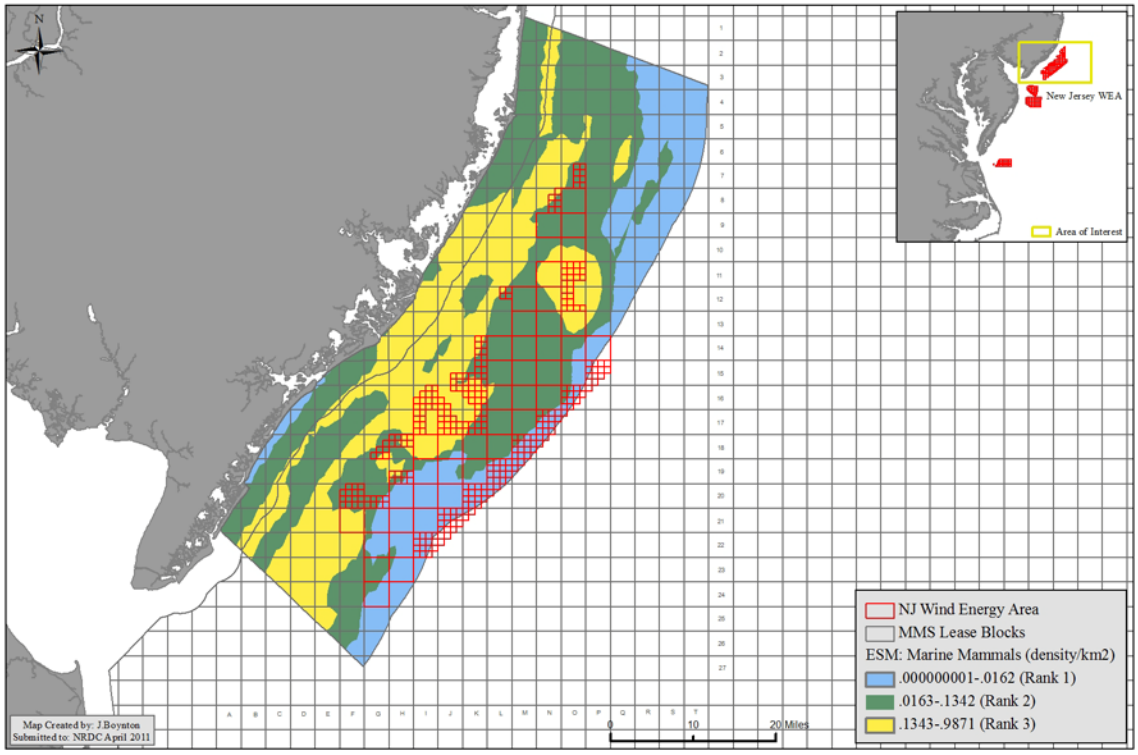


Figure 24: Marine Mammal Environmental Sensitivity Map

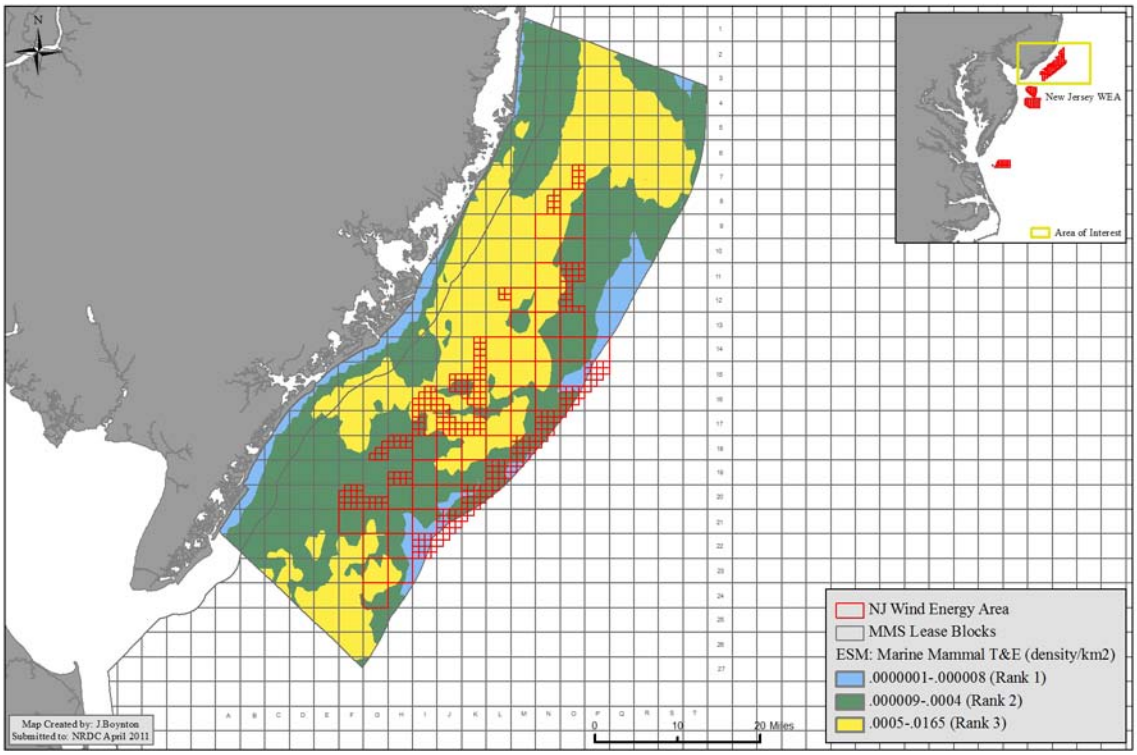


Figure 25: Marine Mammal (Threatened and Endangered) Environmental Sensitivity Map

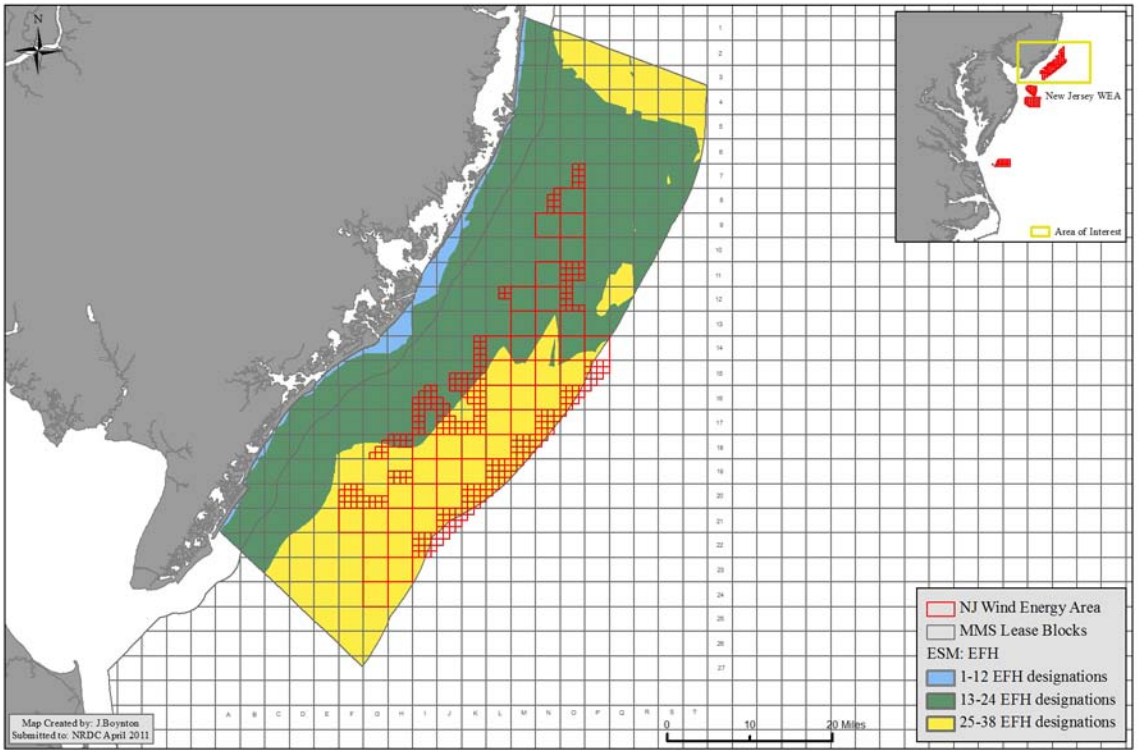


Figure 26: Essential Fish Habitat Environmental Sensitivity Map

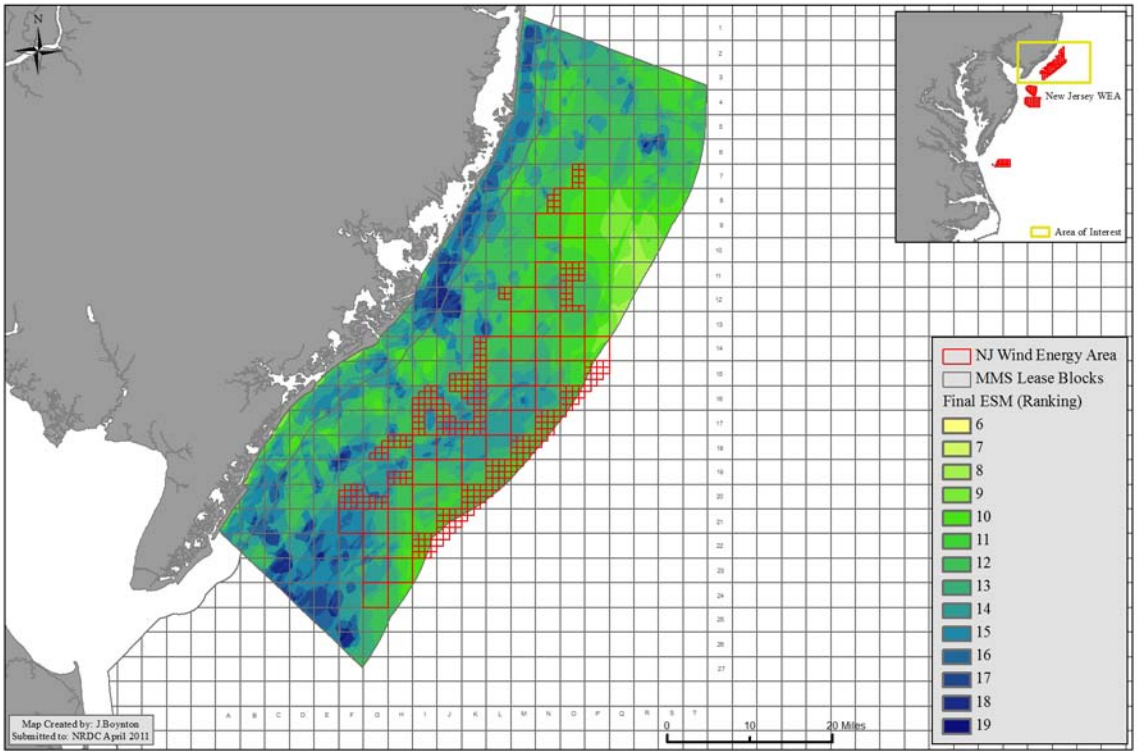


Figure 27: Overall Environmental Sensitivity Index

Column	Row	AV Den 2	AV Den 4	AV Den 6	EFH 2	EFH 3	MM Den 1	MM Den 2	MM Den 3	MM T&E Den 1	MM T&E Den 2	MM T&E Den 3	Turtles Den 1	Turtles Den 2	Turtles Den 3
F	**20**	X				X	X	X			X			X	X
	21	X				X	X	X			X				X
G	**18**	X	X		X	X	X	X			X	X		X	
	20	X	X			X		X	X		X				X
	21	X				X	X	X	X		X	X			X
	22	X				X	X	X	X		X	X			X
	23	X				X		X	X		X	X			X
	24	X				X		X	X		X	X			X
H	**18**	X	X	X	X	X	X	X			X			X	X
	19	X	X			X	X	X	X		X			X	X
	20	X				X		X	X		X				X
	21	X				X			X	X	X				X
	22	X				X		X	X	X	X	X			X
	23	X				X		X	X	X	X	X			X
I	**16**	X	X		X		X				X	X	X	X	
	17	X	X		X	X	X				X	X		X	
	18	X			X	X	X	X			X	X		X	X
	19	X				X	X	X	X		X	X			X
	20	X				X			X	X	X				X
	21	X	X			X			X	X	X				X
	22	X	X			X			X	X					X
J	**15**	X	X		X		X	X			X	X	X	X	
	16	X	X		X	X	X				X	X		X	
	17	X			X	X	X	X			X	X		X	
	18	X				X	X	X	X		X	X		X	X
	19	X				X			X		X	X			X
	20	X				X			X	X	X				X
	21	X				X			X	X	X				X
K	**14**	X	X				X	X				X		X	
	15	X	X		X	X	X	X			X	X		X	
	16	X			X	X	X	X			X	X		X	
	17	X			X	X	X	X			X	X		X	X
	18	X				X	X	X	X		X	X		X	X
	19	X				X		X	X	X	X	X			X
	20	X				X			X	X	X				X
	21	X				X			X		X				X
L	**12**	X	X			X		X			X	X	X	X	
	14	X	X			X	X	X				X		X	
	15	X			X	X	X	X			X	X		X	

Column	Row	AV. Den 2	Av. Den 4	Av. Den 6	EFH 2	EFH 3	MM Den 1	MM Den 2	MM Den 3	MM T&E Den 1	MM T&E Den 2	MM T&E Den 3	Turtle Den 1	Turtle Den 2	Turtle Den 3
	16	X				X	X	X			X	X		X	X
	17	X				X		X			X	X		X	X
	18	X				X		X	X		X	X			X
	19	X				X		X	X	X	X				X
	20	X				X			X		X				X
M	**12**	X	X		X			X			X	X	X	X	
	13	X			X			X			X	X		X	
	14	X			X	X		X				X		X	
	15	X			X	X		X			X	X		X	X
	16	X	X			X		X			X	X		X	X
	17	X				X		X	X		X	X			X
	18	X				X		X	X	X	X	X			X
	19	X				X			X	X	X				X
N	**8**	X	X		X		X	X			X	X	X		
	9	X	X		X		X	X				X	X		
	11	X			X		X	X			X	X	X	X	
	12	X			X		X	X			X	X	X	X	
	13	X	X		X	X	X	X			X	X		X	
	14	X			X	X		X			X	X		X	
	15	X			X	X		X		X	X	X		X	X
	16	X				X		X	X	X	X	X		X	X
	17	X				X		X	X		X				X
	18	X				X			X		X				X
O	**7**	X			X		X	X			X	X	X	X	
	8	X			X		X	X			X	X	X		
	9	X	X		X			X			X	X	X		
	10	X	X		X		X	X			X	X	X		
	11	X			X		X				X	X	X	X	
	12	X			X		X				X	X		X	
	13	X			X		X	X			X			X	
	14	X			X	X		X	X		X			X	
	15	X			X	X		X	X	X	X			X	
	16	X				X		X	X	X	X			X	X
	17	X				X			X		X				X
P	**14**	X			X	X		X	X	X	X			X	
	15	X				X			X	X	X			X	
Total		**75**	**21**	**1**	**33**	**59**	**34**	**56**	**37**	**19**	**70**	**49**	**13**	**41**	**43**
% (x/75)		**100**	**28**	**1.3**	**44**	**78.6**	**45.3**	**74.7**	**49.3**	**25.3**	**93.3**	**65.3**	**17.3**	**54.7**	**57.3**

Figure 28: Presence of avian, marine mammal, EFH, and sea turtle rankings within NJ WEA based on overlaid MMS lease block grids in the final ESI map.

Row #	13	15	16	17	18	19	20	21	22	23
Column										
G					21		19	19	19	
H					27	22			19	19
I				19	20	19				
J		19			21					
K		21		20	21					
M			21							
N	21	20	21							

Figure 29: Top 20 grid blocks with the highest number of occurrences of avian, marine mammal, EFH, and sea turtle ranking data. Number indicates the weighted sum across all resources for that grid block (e.g. G18). Weighted sums for the 75 grid blocks ranged from 11-27.