

New Jersey Department of Environmental Protection Baseline Studies

April – June 2009 Quarterly Report



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LIST OF ACRONYMS AND ABBREVIATIONS

°C	Degree(s) Celsius
µW	Microwatt(s)
ADCP	Acoustic Doppler Current Profiler
AM	Amplitude-modulated
ASFA	Aquatic Sciences and Fisheries Abstracts (Cambridge)
BRP	Bioacoustics Research Program
BSS	Beaufort Sea State
CDOM	Colored Dissolved Organic Matter
cm ²	Square Centimeter(s)
CTD	Conductivity-Temperature-Depth
D	Dimension
dB	Decibel(s)
EDT	Eastern Daylight Time
ESA	Endangered Species Act
FM	Frequency-modulated
GMI	Geo-Marine, Inc.
GPS	Global Positioning System
hr	Hour
kHz	Kilohertz
km	Kilometer(s)
km ²	Square Kilometer(s)
kt	Knot
lon-lat	Longitude-Latitude
m	Meter(s)
MARS®	Mobile Avian Radar System
mbar	Millibar(s)
mg/L	Milligram(s) per Liter
mi	Mile(s)
min	Minute(s)
MMS	Minerals Management Service
NJDEP	New Jersey Department of Environmental Protection
nm	Nanometer(s)
NM	Nautical Mile(s)
PAR	Photosynthetically Active Radiation
psu	Practical Salinity Unit(s)
QAWP	Quality Assurance Work Plan
s	Second(s)
SE	Southeast
SMS	Surface Mapping System
SST	Sea Surface Temperature
U.S.	United States
USFWS	United States Fish and Wildlife Service
Xbat	Extensible Bioacoustic Tool

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INTRODUCTION

This quarterly progress report provides an overview of avian, marine mammal, sea turtle, and pinniped studies conducted for the New Jersey Department of Environmental Protection (NJDEP) Baseline Studies Project from April through June 2009. Survey effort and a brief overview of survey results are presented for avian, marine mammals, sea turtles, and pinnipeds. We also discuss the acoustic monitoring task. Dates for the occurrence of each field task are presented in **Table 1.1**.

Table 1-1
Dates and Status of Tasks Conducted during this Reporting Period

Task		April	May	June
Ship Offshore Avian Survey		4/7 – 4/11	5/2 – 5/6	6/2 – 6/6
Ship Offshore Mammal Survey		4/7 – 4/11	5/2 – 5/6	6/2 – 6/6
Aerial Mammal Survey		4/13; 4/18	5/23 – 5/24	6/23 – 6/24
Coastal Avian Survey		4/24	5/21	6/13; 6/23
Radar Sites	Offshore	None Scheduled	Grid 16: 5/11 – 5/12 Grid 22: 5/12 – 5/13	None Scheduled
	Onshore	Island Beach State Park: 3/14 – 4/9	Brigantine Beach: 4/9 – 5/6	Sea Isle City: 5/7 – 6/2
Thermal Sites		None Scheduled	Grid 16: 5/11 – 5/12 Grid 22: 5/12 – 5/13	None Scheduled
Acoustic Surveys		Weather precluded unit recovery Data Analyses	Data Analyses	6/10 – recovery of 2 popups from fishermen; 6/11 – recovery of PU182 via diver; deliver 3 popups to BRP (Ithaca) for processing; 6/22 & 6/23 – meet with BRP staff regarding PU difficulty and QAQC of data; 6/24 to present – data analysis
Oceanographic Surveys		4/7 – 4/11	5/2 – 5/6	6/2 – 6/6

1.0 QUALITY ASSURANCE WORK PLAN

The draft Quality Assurance Work Plan (QAWP) was submitted on 24 October 2007. NJDEP comments on the draft were addressed and a revised QAWP submitted on 04 January 2008 prior to the initiation of field work. Additional comments were addressed and a revised QAWP submitted on 08 February 2008 and then again on 16 June 2008 after secondary revisions.

2.0 LITERATURE REVIEW

An initial literature search was conducted within the Geo-Marine, Inc. (GMI) in-house library for information pertaining to wind-farms, birds, marine mammals, sea turtles, fishes, fisheries, habitats,

oceanography, and other marine resources for the northeast Atlantic. Literature identified as relevant to the Study Area was catalogued and a new keyword identifying it as New Jersey-specific was entered into GMI's master library. An initial thorough and systematic electronic literature search for additional relevant literature was conducted focusing on the same subject areas as the in-house library search; additional searches are conducted periodically to identify and collect new literature throughout the project performance period. These electronic literature searches are conducted using a variety of database search engines (e.g., Library of Congress' First Search and Dissertation Abstracts databases, Ingenta, Web of Science, Blackwell-Science, and Cambridge Abstract's Aquatic Sciences and Fisheries Abstracts [ASFA] database services). General internet searches were conducted through the Google and Google Scholar web search engines to identify additional reports not collected through the previous database searches. **Table 2-1** shows the number of references relevant to the Study Area that have been collected to date. **Appendix A** contains a current bibliography for each category of interest.

Table 2-1
New Jersey Literature Review (as of 02 July 2009)

Categories	Number of References	Appendix
Fishes	309	A-1
Marine Birds	307	A-2
Marine Mammals	763	A-3
Offshore Wind Farms	162	A-4
Sea Turtles	247	A-5
Total	1788	

Prior experience has demonstrated that electronic searches produce a low number of false positive (references produced by a search that are not relevant) and false negative (references not produced by a search that are relevant) results when combinations of search keywords are used. Keywords for this report typically combine a subject matter (e.g., marine mammal, dolphin, whale, porpoise, sea turtle, fish, fishery, bird, seabird, wind farm, benthos, slope, circulation) paired with a geographic descriptor (e.g., western North Atlantic, northwest Atlantic, New Jersey, Delaware Bay, New York, Mid-Atlantic). Irrelevant (false positive) literature is excluded. The relevant results of these electronic searches are supplemented by investigating and acquiring the references gathered that, based on a reading of their titles or abstracts, appear to provide relevant information. This process is repeated on a continuing basis to ensure that a majority of the relevant references cited by the introduction, results, and discussion sections of the gathered references are obtained. More specific searches may be conducted to hand-pick relevant literature where a generalized keyword search does not result in adequate information and to identify any false negative results. Hand searches of published journals are not being conducted.

Results of these searches are obtained in hard or electronic format and reviewed, key-worded, and indexed regularly into GMI's in-house library using commercial bibliographic software for ease of recall for inclusion in all relevant sections of the Quarterly, Interim, and Final Reports to the client. From each document obtained, information relevant to the biological resources in the Study Area is extracted and integrated into the appropriate report.

3.0 DIGITAL DATA COMPILATION

The Principal Investigator for this task has compiled a digital data list from GMI data banks and geospatial data from numerous sources presented in **Appendix B**. These data are currently under review for applicability for this project.

4.0 AVIAN PREDICTIVE/PROBABILITY MODEL

Monthly meetings were conducted with the NJDEP to discuss modeling of project data. A decision was made to use the Minerals Management Service (MMS) grid blocks for presenting predictive/modeling

results. Cumulative yearly avian density and species-specific density mapping was discussed. A model program was developed to illustrate total offshore and nearshore avian density. Kernel smoothing was used to illustrate seasonal (Spring 2009) density for scoters.

4.1 TOTAL AVIAN DENSITY

Total avian density for 2008 was conducted by spatially plotting the percent of total density for the entire study area (for the offshore surveys) or for the entire nearshore region (for the coastal surveys). Spatial maps for total birds in 2008 are shown in **Figures 4.1-1** and **4.1-2** for the offshore and coastal surveys, respectively. This method of spatial mapping identifies local regions of highest avian densities on a normalized or relative (rather than absolute) basis, and the spatial map is analogous to a topographic 3-dimension (D) surface map drawn in 2-D. An inverse relationship exists between the percent scale used on these maps and the magnitude of avian density in a given local region. Thus, the local regions with the highest avian densities are shown on the maps as having five percent (as shown in yellow on the maps) of the total density for the entire offshore (or nearshore, depending on survey type) study area within its spatial realm. That is, five percent of the total avian density in the colored regions on the respective maps occurs within the local region shown in yellow. A series of concentric colored rings extends around the central yellow core in colors progressing from light green to dark green to blue, illustrating an increasing percentage of total avian density contained within an increasing local area. For example, to enclose 10 percent of total avian density requires the local region to be expanded in areal coverage beyond the yellow core; and the resultant enhanced local region is colored either yellow or light green: The yellow portion of the local region contains five percent of total density, and the light green portion (the “annulus”) contains the next five percent of total density. This mapping procedure of expanding the inclusive local region outward to increase area and thereby engulf an increasing percentage of total density is continued for 20 percent, 30 percent, and so on up to >95 percent. Thus, local areas of high, moderate, and low avian densities are shown in yellow, green, and blue, respectively.

Local regions of highest avian density in 2008 occur nearshore between Little Egg Inlet and Great Bay for the offshore surveys (**Figure 4.1-1**). For the coastal nearshore surveys, the highest region of avian density was just off Barnegat Light (**Figure 4.1-2**).

For the offshore surveys (**Figure 4.1-1**), practically the entire nearshore region (extending along the coast from Barnegat Bay to Hereford Inlet) exhibits moderate avian densities (on a relative scale, based on total avian density for the entire study area). In the northern region of the study area, moderate avian densities are maintained along an onshore-offshore transect extending off Barnegat Light (as shown by the green strip). Moderate local avian densities also occur offshore near the extreme northeast and at the extreme southeast corners of the study area (as shown by light green circles surrounded by dark green and blue concentric regions). Local regions of lowest avian densities (shown in shades of dark blue and purple) occur mid-offshore and offshore in the central and southern regions of the study area, with avian densities being lower mid-offshore (purple regions) than offshore (dark blue).

For the coastal surveys (**Figure 4.1-2**), the nearshore region alternates among regions of high, moderate, and low avian densities all along the coastline. Moving southward from the high avian density off Barnegat Light, avian densities are moderate (shown in green) and slowly decrease to low values (shown in blue) off Little Egg Inlet, and then increase to moderate values again off Great Bay (shown in green). Moving south from Great Bay, avian densities alternate between moderate and low values all the way to Hereford Inlet (as shown by local patches of green separated by continuous regions of blue), with local regions of moderate avian densities occurring off Atlantic City, Ocean City, and a region just north of Hereford Inlet; and local regions of low avian densities occur off Brigantine, the region between Atlantic City and Ocean City, and the region about midway between Ocean City and Hereford Inlet. The colored portion of the spatial map represents the spatial extent of coverage of the coastal surveys (i.e., nearshore only); regions further offshore are not colored, reflecting zero bird sightings as a result of zero survey effort.

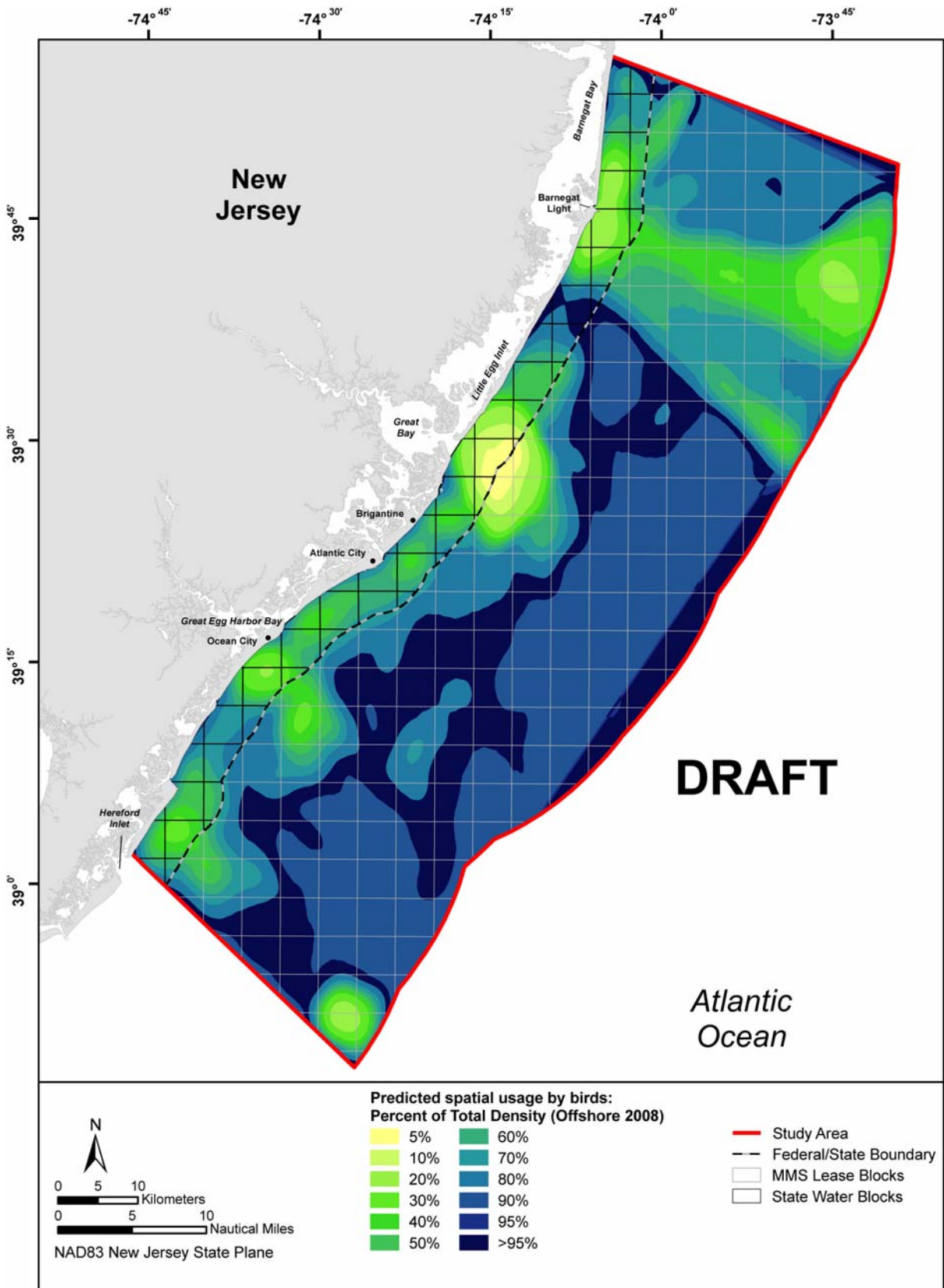


Figure 4.1-1. Percent of total avian density within the entire New Jersey Study Area in 2008. Data reflect total birds from coastal and offshore surveys.

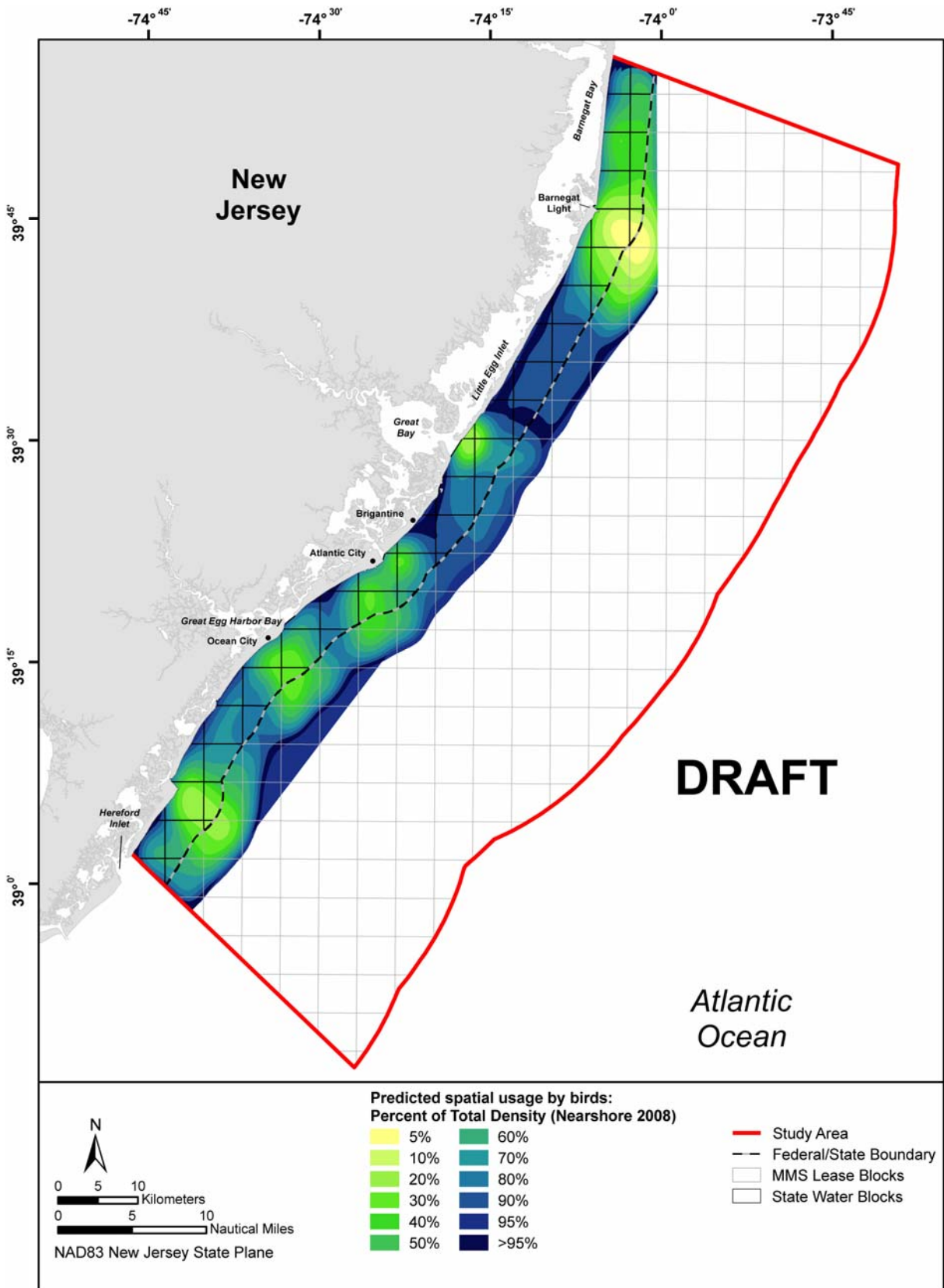


Figure 4.1-2. Percent of total avian density within the New Jersey coastal area in 2008. Data reflect total birds from coastal surveys.

4.2 SCOTER DENSITY – SPRING 2009

The offshore (ship) and coastal (boat) survey data were stratified according to avian species, and all observed bird species were ranked from highest to lowest abundance for the Spring 2009 season (which includes April, May, and June). By this procedure, it was determined that the scoter species exhibited the highest abundance of all species observed. Consequently, spatial distributions of scoter density off the New Jersey coast for spring 2009 were estimated from the offshore (ship) and coastal (boat) surveys using kernel density spatial interpolation. Point estimates of avian densities were generated on the MMS regular longitude-latitude (lon-lat) regular grid system encompassing the entire lon-lat range of avian density data collection, and the spatial resolutions consist of 82 longitude values x 102 latitude values; however, only those points contained within the survey area are shown on the spatial maps.

For the offshore (ship) surveys, scoter density in spring 2009 was highest nearshore in the northern region of the survey area, a relatively small area just south of Barnegat Light (**Figure 4.2-1**). Maximum density for the region as a whole was 141.2 birds per square kilometer (km^2); which occurred off Barnegat Light). Densities were moderate (50-60 birds per km^2) nearshore in the south-central region between Atlantic City and Ocean City. Sharp spatial gradients occurred in both of these small-area regions (as reflected by sharp changes in color on the map), as all other locations in the study area exhibited densities less than 30 birds per km^2 . Densities were generally greater nearshore than offshore, reflecting a decrease in densities with increasing offshore distance.

For the coastal (boat) surveys, the colored portion of the spatial map represents the spatial extent of coverage of the coastal surveys (i.e., nearshore only); regions further offshore are not colored, reflecting zero bird sightings as a result of zero survey effort (**Figure 4.2-2**). Scoter density in Spring 2009 was highest nearshore in the northern region, off Barnegat, with a maximum density of approximately 160 birds per km^2 . These results are in good agreement with the offshore survey results (**Figure 4.2-1**). The high-density region occupied a greater area, and the spatial gradient in density moving away from this area was lower in magnitude, for the coastal surveys compared to the offshore surveys. All other nearshore regions for the coastal surveys (i.e., off Barnegat Bay, and the entire region extending from Little Egg Inlet to Hereford Inlet) showed relatively low scoter densities, approximately less than 30 birds per km^2 , again in good agreement with the offshore survey results.

5.0 BASELINE SURVEYS

5.1 SHIPBOARD OFFSHORE SURVEYS

5.1.1 Avian

5.1.1.1 Survey Effort

Shipboard avian surveys for April through June 2009 were conducted along the same line transects as the marine mammal/sea turtle surveys. Avian surveys may be greater in length and duration because of differing visibility requirements between the avian and marine mammal and sea turtle survey methods. Monthly ship survey transects scheduled for April, May, and June were partially completed due to adverse weather conditions.

5.1.1.1.1 April 2009

Shipboard avian surveys were conducted from 08 to 10 April 2009; all other scheduled survey days (06, 07 and 11 April) were canceled due to inclement weather and/or sea conditions non-conducive to conducting transect surveys (i.e., Beaufort sea state [BSS] >5). The ship transects covered 190.6 nautical miles (NM; 353 kilometers [km]; **Figure 5.1-1**) and on-effort survey time totaled 19.23 hours (hrs).

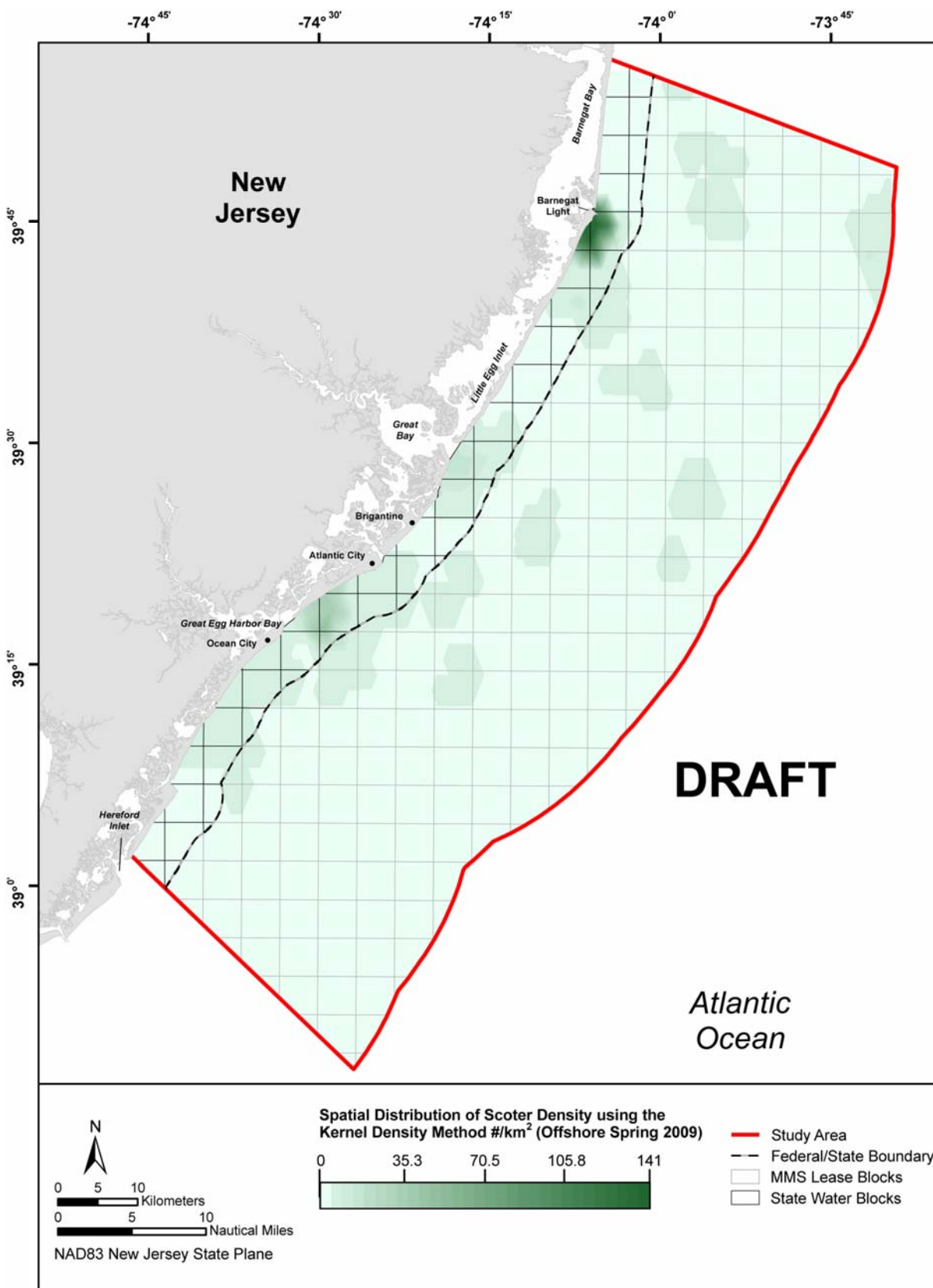


Figure 4.2-1. Scoter kernel density (no./km²) within the entire New Jersey Study Area in Spring 2009. Data reflect scoters from coastal and offshore surveys.

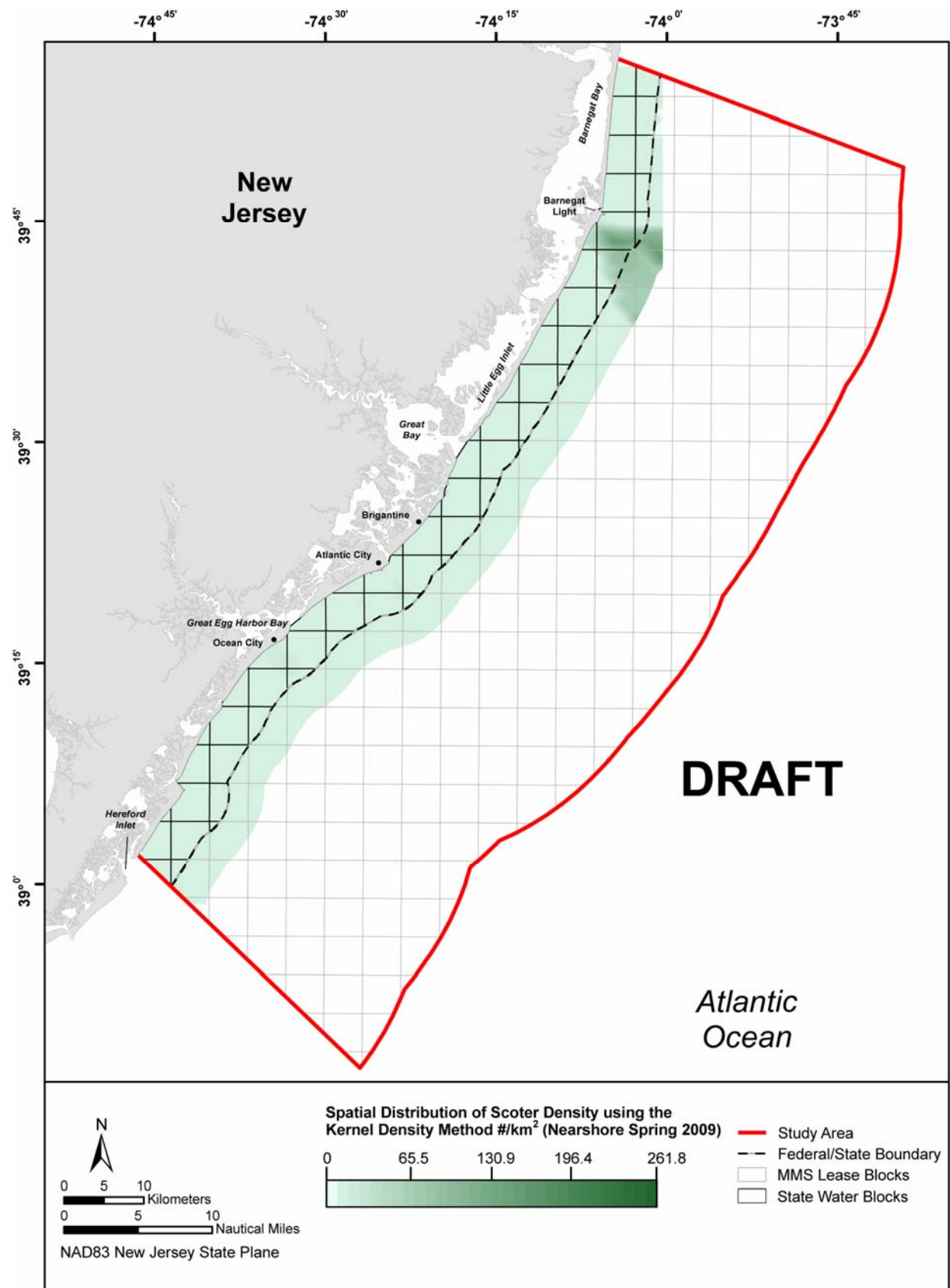


Figure 4.2-2. Scoter kernel density (no./km²) within the New Jersey coastal area in Spring 2009.

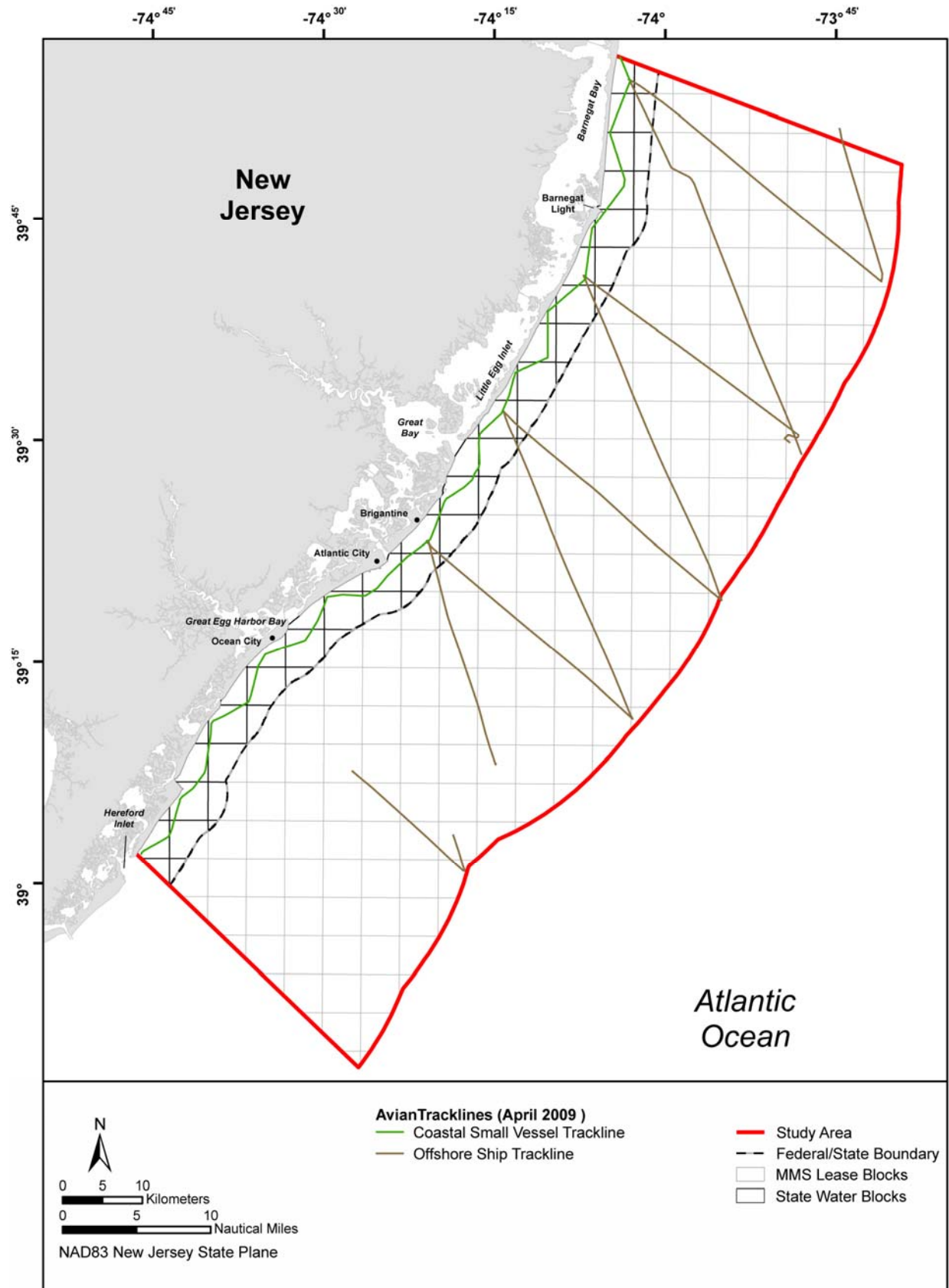


Figure 5.1-1. Avian offshore and coastal survey effort in the New Jersey Study Area in April 2009.

5.1.1.1.2 *May 2009*

Surveys were not conducted on the scheduled start date, 01 May, due to inclement weather and sea conditions. Shipboard avian survey effort commenced 02 May 2009 and ended 06 May. The ship transects covered 429.2 NM (794.9 km; **Figure 5.1-2**), and on-effort survey time totaled 47.66 hrs.

5.1.1.1.3 *June 2009*

Shipboard avian surveys commenced 02 June 2009 and ended 06 June. Surveys were not conducted on 05 June due to dense fog and rain. The ship transects covered 422.2 NM (781.8 km; **Figure 5.1-3**), and on-effort survey time totaled 45.3 hrs.

5.1.1.2 Survey Results

5.1.1.2.1 *Avian species occurrence*

All 58 avian species observed during the April, May, and June 2009 surveys are listed in **Table 5.1-1**. Of these, 20 were sighted in April 2009, 43 in May 2009, and 20 in June 2009. Birds that were not identifiable due to weather/sea state conditions, behavior, and/or distance were identified to the lowest identifiable form or taxon (genus, family, or class).

5.1.1.2.2 *Avian abundance*

The monthly number of individual birds/km (i.e., number of individuals detected on one side of and within 300 meters [m] of the ship) observed on the offshore surveys increased by more than 150 percent from April (1.75) to May (2.67) and then declined in June (1.41) with the completion of spring migration (**Table 5.1-2**). The increase in detected abundance between April and May occurred despite a 90 percent drop in waterfowl numbers. In May, large increases in numbers of loons, Northern Gannets, gulls, and terns more than made up for the decrease in waterfowl numbers. With the end of waterbird (ducks, loons, cormorants, and gannets) migration, the large decrease in detected abundance between May and June was specifically caused by the complete absence of waterfowl and significant decreases in the numbers of loons and Northern Gannets. The arrival of various species of Procellariiformes (shearwaters and storm-petrels) did not compensate for the departure of the mainstay species of spring waterbird migrants through the project area.

The five most abundant (numerous) species for each month of offshore transects were calculated (**Table 5.1-3**). Northern Gannet was one of the top five most numerous species in all three months (April – June 2009). Surf Scoter (0.42/km) was the most numerous species detected in April; Northern Gannet (0.36), Herring Gull (0.20), Black Scoter (0.13), and Common Loon (0.12) were the remaining five most numerous species in April. The top five species in May were similar, with Northern Gannet (0.96), Common Loon (0.69), and Herring Gull (0.27), followed by two migrant New Jersey breeding species, Laughing Gull (0.15) and Common Tern (0.12). In June, Northern Gannet (0.38) was followed by Laughing Gull (0.30), Common Tern (0.28), Wilson's Storm-petrel (0.16), and Herring Gull (0.11).

Six federal (United States [U.S.] Fish and Wildlife [USFWS]) avian species of concern for Bird Conservation Region 30 (New England/Mid-Atlantic Coast) were recorded during the spring and early summer offshore surveys: Red-throated Loon in April and May, Greater Shearwater in June, Lesser Yellowlegs and Short-billed Dowitcher in May, Least Tern in June, and Wood Thrush in May (**Table 5.1-1**).

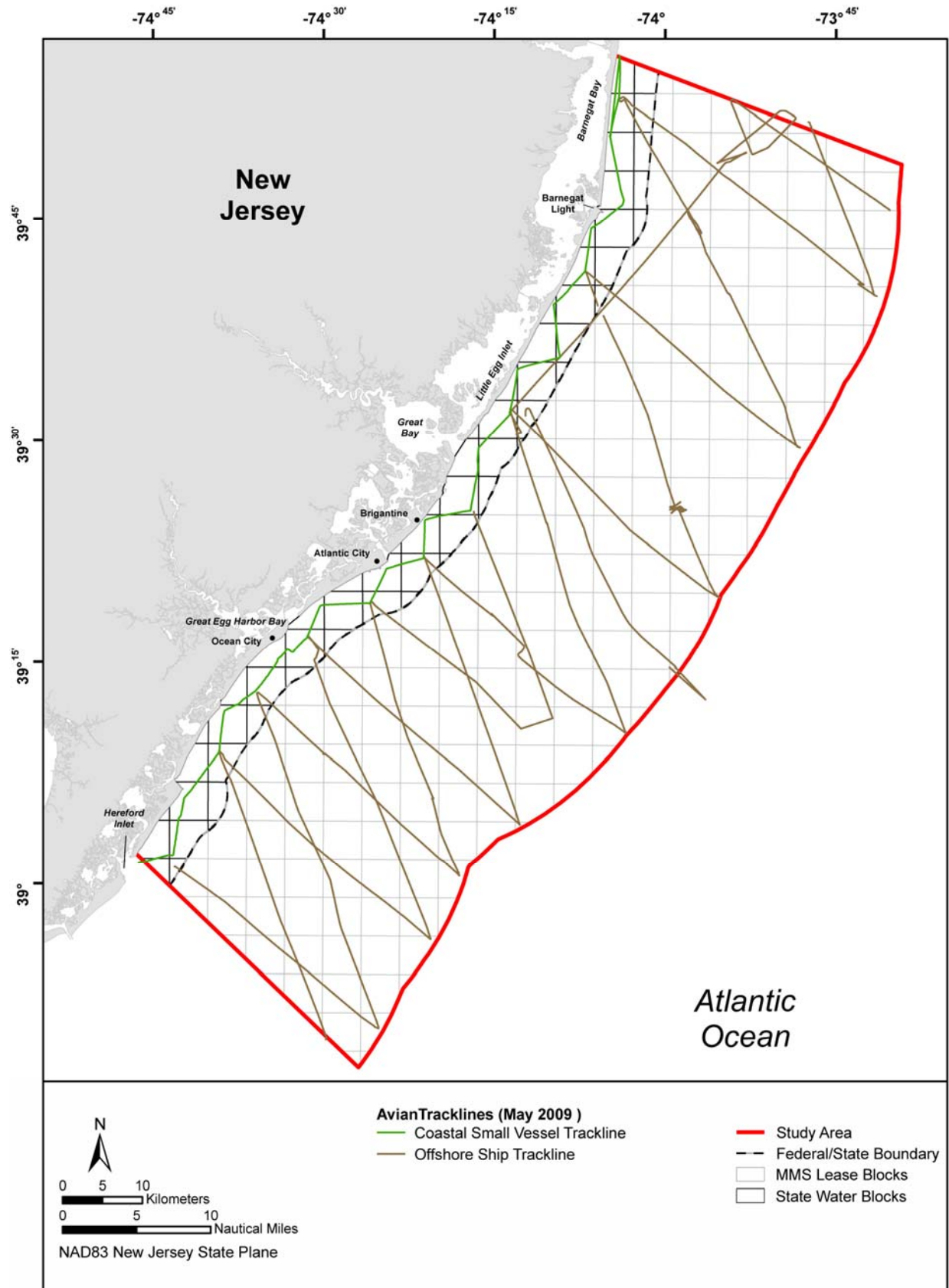


Figure 5.1-2. Avian offshore and coastal survey effort in the New Jersey Study Area in May 2009.

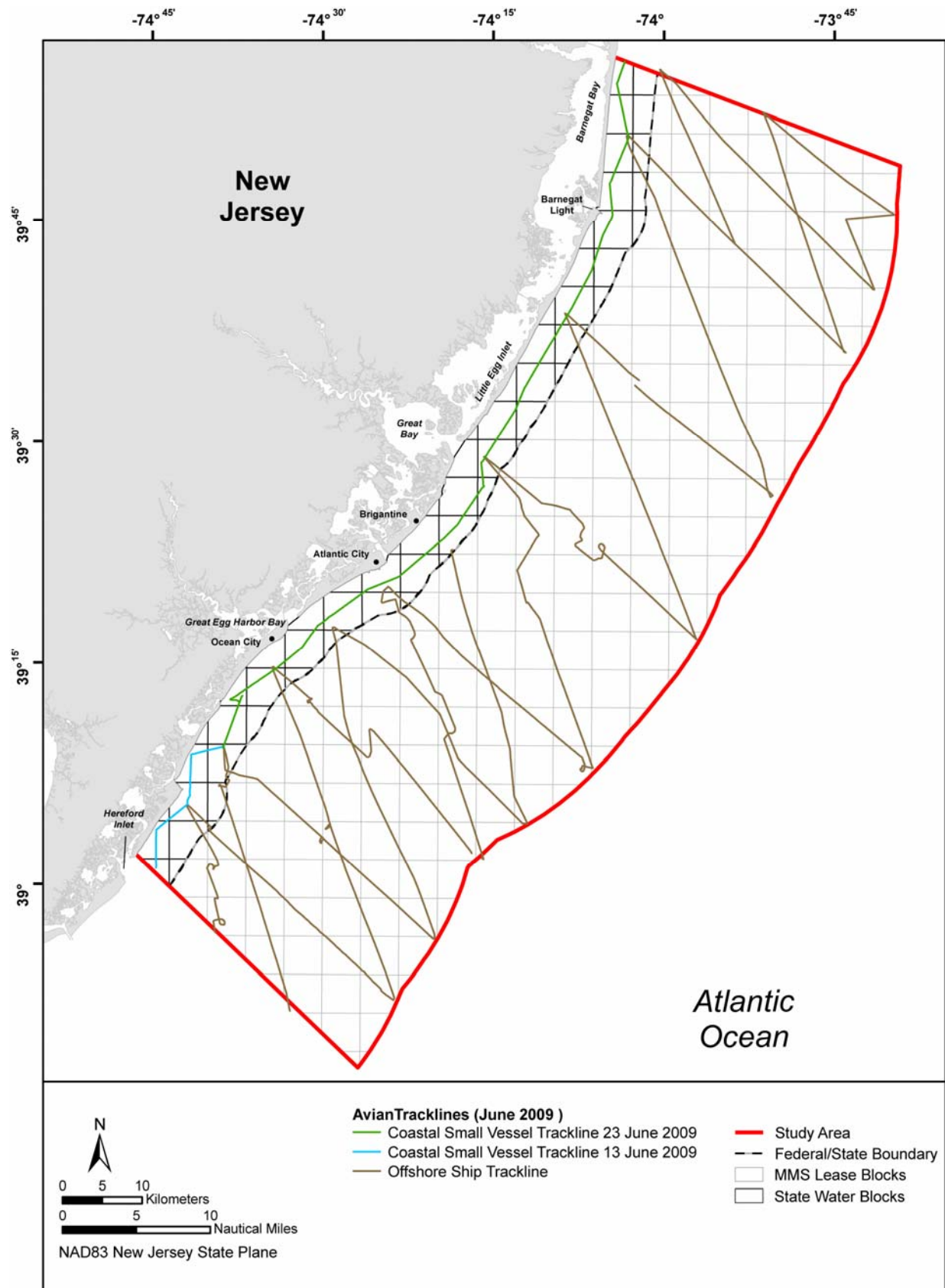


Figure 5.1-3. Avian offshore and coastal survey effort in the New Jersey Study Area in June 2009.

Table 5.1-1
Avian species observed in the April through June 2009 shipboard offshore surveys¹.

Family Common Name, <i>Scientific name</i>	2009		
	April	May	June
Anatidae (geese, swans, and ducks)			
Atlantic Brant, <i>Branta bernicla</i>	X	X	
Surf Scoter, <i>Melanitta perspicillata</i>	X	X	
White-winged Scoter, <i>Melanitta fusca</i>	X	X	
Black Scoter, <i>Melanitta niger</i>	X	X	
Long-tailed Duck, <i>Clangula hyemalis</i>	X		
Gaviidae (loons)			
Red-throated Loon, <i>Gavia stellata</i>	X	X	
Common Loon, <i>Gavia immer</i>	X	X	X
Procellariidae (petrels and shearwaters)			
Cory's Shearwater, <i>Calonectris diomedea</i>			X
Greater Shearwater, <i>Puffinus gravis</i>			X
Sooty Shearwater, <i>Puffinus griseus</i>			X
Manx Shearwater, <i>Puffinus puffinus</i>		X	
Hydrobatidae (storm-petrels)			
Wilson's Storm-petrel, <i>Oceanites oceanicus</i>			X
Sulidae (gannets)			
Northern Gannet, <i>Morus bassanus</i>	X	X	X
Phalacrocoracidae (cormorants)			
Double-crested Cormorant, <i>Phalacrocorax auritus</i>	X	X	X
Ardeidae (egrets and herons)			
Great Egret, <i>Ardea alba</i>	X		
Accipitridae (eagles and hawks)			
Osprey, <i>Pandion haliaetus</i>			X
Northern Harrier, <i>Circus cyaneus</i>		X	
Falconidae (falcons)			
Merlin, <i>Falco columbarius</i>		X	
Charadriidae (plovers)			
Black-bellied Plover, <i>Pluvialis squatarola</i>		X	
Scolopacidae (sandpipers)			
Greater Yellowlegs, <i>Tringa melanoleuca</i>		X	
Lesser Yellowlegs, <i>Tringa flavipes</i>		X	
Sanderling, <i>Calidris alba</i>		X	
Least Sandpiper, <i>Calidris minutilla</i>		X	
Dunlin, <i>Calidris alpina</i>		X	
Short-billed Dowitcher, <i>Limnodromus griseus</i>		X	
Red-necked Phalarope, <i>Phalaropus lobatus</i>			X
Laridae (gulls and terns)			
Bonaparte's Gull, <i>Chroicocephalus philadelphia</i>	X	X	
Little Gull, <i>Hydrocoloeus minutus</i>		X	
Laughing Gull, <i>Leucophaeus atricilla</i>	X	X	X
Herring Gull, <i>Larus argentatus</i>	X	X	X
Lesser Black-backed Gull, <i>Larus fuscus</i>	X		
Great Black-backed Gull, <i>Larus marinus</i>	X	X	X
Least Tern, <i>Sternula antillarum</i>			X
Common Tern, <i>Sterna hirundo</i>		X	X
Forster's Tern, <i>Sterna forsteri</i>	X	X	X
Stercorariidae (skuas and jaegers)			
Parasitic Jaeger, <i>Stercorarius parasiticus</i>		X	X

Table 5.1-1 (continued)
Avian species observed in the April through June 2009 shipboard offshore surveys¹.

Family Common Name, <i>Scientific name</i>	2009		
	April	May	June
Alcidae (alcids)			
Dovekie, <i>Alle alle</i>	X		
Razorbill, <i>Alca torda</i>	X		
Columbidae (pigeons and doves)			
Mourning Dove, <i>Zenaid macroura</i>	X		
Apodidae (swifts)			
Chimney Swift, <i>Chaetura pelagica</i>		X	X
Trochilidae (hummingbirds)			
Ruby-throated Hummingbird, <i>Archilochus colubris</i>		X	
Tyrannidae (flycatchers)			
<i>Empidonax</i> flycatcher (unknown), <i>Empidonax</i> sp.			X
Hirundinidae (swallows)			
Tree Swallow, <i>Tachycineta bicolor</i>		X	
Barn Swallow, <i>Hirundo rustica</i>		X	X
Turdidae (thrushes)			
Wood Thrush, <i>Hylocichla mustelina</i>		X	
Mimidae (mockingbirds and thrashers)			
Gray Catbird, <i>Dumetella carolinensis</i>		X	
Northern Mockingbird, <i>Mimus polyglottos</i>	X		
Brown Thrasher, <i>Toxostoma rufum</i>		X	
Parulidae (wood-warblers)			
Northern Parula, <i>Parula americana</i>		X	
Magnolia Warbler, <i>Dendroica magnolia</i>		X	
Yellow-rumped Warbler, <i>Dendroica coronata</i>		X	
Ovenbird, <i>Seiurus aurocapilla</i>		X	
Yellow-breasted Chat, <i>Icteria virens</i>		X	
Emberizidae (sparrows)			
Song Sparrow, <i>Melospiza melodia</i>		X	
Cardinalidae (cardinals, grosbeaks, and buntings)			
Rose-breasted Grosbeak, <i>Pheuticus ludovicianus</i>		X	
Indigo Bunting, <i>Passerina cyanea</i>		X	
Icteridae (blackbirds, meadowlarks, and orioles)			
Brown-headed Cowbird, <i>Molothrus ater</i>		X	
Orchard Oriole, <i>Icterus spurius</i>		X	

¹ All birds identified to species during avian surveys are included (in-zone and out-zone).

Table 5.1-2
In-zone avian species abundance during the April through June 2009 shipboard offshore surveys.

Family Common Name, <i>Scientific name</i>	April 2009		May 2009		June 2009	
	No. ¹	Abun. ²	No. ¹	Abun. ²	No. ¹	Abun. ²
Anatidae (geese and ducks)	223	0.64	52	0.07		
Atlantic Brant, <i>Branta bernicla</i>			6	0.01		
Surf Scoter, <i>Melanitta perspicillata</i>	147	0.42	24	0.03		
White-winged Scoter, <i>Melanitta fusca</i>	18	0.05	4	0.01		
Black Scoter, <i>Melanitta niger</i>	44	0.13	18	0.02		
Long-tailed Duck, <i>Clangula hyemalis</i>	10	0.03				
Scoter, dark-winged (unknown)	4	0.01				
Gaviidae (loons)	72	0.20	522	0.71	17	0.02
Red-throated Loon, <i>Gavia stellata</i>	29	0.08	14	0.02		
Common Loon, <i>Gavia immer</i>	43	0.12	508	0.69	17	0.02
Procellariidae (petrels and shearwaters)			2	0.00	5	0.00
Cory's Shearwater, <i>Calonectric diomedea</i>					1	0.00
Greater Shearwater, <i>Puffinus gravis</i>					1	0.00
Sooty Shearwater, <i>Puffinus griseus</i>					1	0.00
Manx Shearwater, <i>Puffinus puffinus</i>			2	0.00		
Hydrobatidae (storm-petrels)					113	0.16
Wilson's Storm-petrel, <i>Oceanites oceanicus</i>					113	0.16
Sulidae (gannets)	127	0.36	708	0.96	274	0.38
Northern Gannet, <i>Morus bassanus</i>	127	0.36	708	0.96	274	0.38
Phalacrocoracidae (cormorants)	30	0.09	40	0.05	2	0.00
Double-crested Cormorant, <i>Phalacrocorax auritus</i>	30	0.09	40	0.05	2	0.00
Ardeidae (egrets and herons)	1	0.00				
Great Egret, <i>Ardea alba</i>	1	0.00				
Accipitridae (eagles and hawks)			1	0.00		
Northern Harrier, <i>Circus cyaneus</i>			1	0.00		
Falconidae (falcons)			2	0.00		
Merlin, <i>Falco columbarius</i>			2	0.00		
Charadriidae (plovers)			5	0.01		
Black-bellied Plover, <i>Pluvialis squatarola</i>			5	0.01		

Table 5.1-2 (continued)
In-zone avian species abundance during the April through June 2009 shipboard offshore surveys.

Family Common Name, <i>Scientific name</i>	April 2009		May 2009		June 2009	
	No. ¹	Abun. ²	No. ¹	Abun. ²	No. ¹	Abun. ²
Scolopacidae (sandpipers)			38	0.05	1	0.00
Greater Yellowlegs, <i>Tringa melanoleuca</i>			4	0.01		
Lesser Yellowlegs, <i>Tringa flavipes</i>			1	0.00		
Sanderling, <i>Calidris alba</i>			1	0.00		
Least Sandpiper, <i>Calidris minutilla</i>			1	0.00		
Dunlin, <i>Calidris alpina</i>			13	0.02		
Short-billed Dowitcher, <i>Limnodromus griseus</i>			18	0.02		
Red-necked Phalarope, <i>Phalaropus lobatus</i>					1	0.00
Laridae (gulls and terns)	151	0.44	545	0.74	590	0.84
Bonaparte's Gull, <i>Chroicocephalus philadelphia</i>	34	0.10	14	0.02		
Laughing Gull, <i>Leucophaeus atricilla</i>	16	0.05	108	0.15	215	0.30
Ring-billed Gull, <i>Larus delawarensis</i>						
Herring Gull, <i>Larus argentatus</i>	69	0.20	198	0.27	75	0.11
Lesser Black-backed Gull, <i>Larus fuscus</i>	1	0.00				
Great Black-backed Gull, <i>Larus marinus</i>	24	0.07	60	0.08	49	0.07
Gull, large (unknown)	3	0.01	13	0.02	1	0.00
Least Tern, <i>Sternula antillarum</i>					4	0.01
Common Tern, <i>Sterna hirundo</i>			91	0.12	200	0.28
Forster's Tern, <i>Sterna forsteri</i>	4	0.01	40	0.05	26	0.04
Tern, small (unknown)			21	0.03	20	0.03
Stercorariidae (skuas and jaegers)			2	0.00	6	0.01
Parasitic Jaeger, <i>Stercorarius parasiticus</i>			2	0.00	5	0.01
Jaeger (unknown)					1	0.00
Alcidae (alcids)	8	0.03				
Dovekie, <i>Alle alle</i>	2	0.01				
Razorbill, <i>Alca torda</i>	6	0.02				
Columbidae (pigeons and doves)	1	0.00				
Mourning Dove, <i>Zenaidura macroura</i>	1	0.00				
Apodidae (swifts)			6	0.01	1	0.00
Chimney Swift, <i>Chaetura pelagica</i>			6	0.01	1	0.00

Table 5.1-2 (continued)
In-zone avian species abundance during the April through June 2009 shipboard offshore surveys.

Family Common Name, <i>Scientific name</i>	April 2009		May 2009		June 2009	
	No. ¹	Abun. ²	No. ¹	Abun. ²	No. ¹	Abun. ²
Tyrannidae (flycatchers)					1	0.00
<i>Empidonax</i> flycatcher (unknown), <i>Empidonax</i> sp.					1	0.00
Hirundinidae (swallows)			13	0.01		
Tree Swallow, <i>Tachycineta bicolor</i>			3	0.00		
Barn Swallow, <i>Hirundo rustica</i>			10	0.01		
Turdidae (thrushes)			1	0.00		
Wood Thrush, <i>Hylocichla mustelina</i>			1	0.00		
Mimidae (mockingbirds and thrashers)	1	0.00	3	0.00		
Gray Catbird, <i>Dumetella carolinensis</i>			2	0.00		
Northern Mockingbird, <i>Mimus polyglottos</i>	1	0.00				
Brown Thrasher, <i>Toxostoma rufum</i>			1	0.00		
Parulidae (wood-warblers)			13	0.01		
Northern Parula, <i>Parula americana</i>			1	0.00		
Magnolia Warbler, <i>Dendroica magnolia</i>			2	0.00		
Yellow-rumped Warbler, <i>Dendroica coronata</i>			3	0.00		
Ovenbird, <i>Seiurus aurocapilla</i>			1	0.00		
Yellow-breasted Chat, <i>Icteria virens</i>			1	0.00		
Warbler (unknown)			5	0.01		
Emberizidae (sparrows)			1	0.00		
Song Sparrow, <i>Melospiza melodia</i>			1	0.00		
Cardinalidae (cardinals, grosbeaks, and buntings)			2	0.00		
Rose-breasted Grosbeak, <i>Pheucticus ludovicianus</i>			1	0.00		
Indigo Bunting, <i>Passerina cyanea</i>			1	0.00		
Icteridae (blackbirds, meadowlarks, and orioles)			3	0.00		
Brown-headed Cowbird, <i>Molothrus ater</i>			2	0.00		
Orchard Oriole, <i>Icterus spurius</i>			1	0.00		
Other			1	0.00		
Passerine (unknown)			1	0.00		
Total	614	1.76	1,960	2.62	1,010	1.41

¹ Includes avian observations within the 300-m x 300-m survey strip transect when the ship was traveling ≥7 kts

² Detected abundance = No. birds/km and within the 300-m x 300-m survey strip transect when the ship was traveling ≥7 kts

Table 5.1-3
The most abundant in-zone avian species during the April through June 2009 shipboard offshore transect surveys.

April 2009 Shipboard Offshore In-zone ¹		
Common Name	Number	Abundance ²
Surf Scoter	147	0.42
Northern Gannet	127	0.36
Herring Gull	69	0.20
Black Scoter	44	0.13
Common Loon	43	0.12
May 2009 Shipboard Offshore In-zone ¹		
Common Name	Number	Abundance ²
Northern Gannet	708	0.96
Common Loon	508	0.69
Herring Gull	198	0.27
Laughing Gull	108	0.15
Common Tern	91	0.12
June 2009 Shipboard Offshore In-zone ¹		
Common Name	Number	Abundance ²
Northern Gannet	274	0.38
Laughing Gull	215	0.30
Common Tern	200	0.28
Wilson's Storm-petrel	113	0.16
Herring Gull	75	0.11

¹ Includes avian observations within the 300-m x 300-m survey strip transect when the ship was traveling ≥ 7 kts

² Detected abundance = No. birds/km and within the 300-m x 300-m survey strip transect when the ship was traveling ≥ 7 kts

Nine species listed by the State of New Jersey as endangered, threatened, and/or of special concern during the breeding or non-breeding seasons were recorded during the spring and early summer offshore surveys. Osprey, listed as threatened as a breeder, was recorded in June. Northern Harrier, listed as endangered as a breeder and of special concern as a non-breeder, was recorded in May. Sanderling, listed as special concern as a non-breeder, was recorded in May. Least Tern, listed as endangered as a breeder, was recorded in June. Common Tern, listed as a special concern species as a breeder, was recorded in May and June; Wood Thrush, Brown Thrasher, Northern Parula, and Yellow-breasted Chat, all listed as special concern as breeders, were recorded in May.

5.1.1.2.3 *Avian density*

Methods

High-density gridboxes were identified based on a ranking procedure, in which the individual gridboxes with non-zero densities (i.e., those gridboxes with at least one bird sighting) were ranked in the order of highest to lowest total density, and those gridboxes that rank in the top 20 percent of all non-zero-density gridboxes were designated as "high-density" gridboxes (i.e., regions of high avian density).

This procedure was conducted for all birds for each individual month (April, May, and June 2009) for both the offshore (ship) and coastal (boat) surveys, using the MMS grid system of 249 gridboxes that are defined on a regular lon-lat grid system that encompasses the entire survey area off the New Jersey

coast. Each square gridbox is defined by a maximum (max) and minimum (min) longitude and a max-min latitude. The area of each gridbox (km^2) is calculated from these min-max lon-lat values.

Input bird sightings data for the purpose of these calculations consist of the following parameters recorded for each observation (sighting): Number of birds sighted, date (month, day, and year) of the observation, and the lon-lat coordinates of the observation. Each observation is identified and binned spatially into the appropriate gridbox as well as temporally according to month. After all bird counts are binned according to month and gridbox, the number of bird counts within each gridbox for each month is summed to yield a total bird count, which is then divided by the area of the specific gridbox to yield total monthly bird density.

To identify the high-density gridboxes, a ranking scale of A-F is adopted, in which “A” indicates the highest density, “E” the lowest positive density, and “F” zero density. For each month the zero-density gridboxes are identified and automatically assigned a rank of “F”. The remaining gridboxes with positive densities are then ranked from highest to lowest density on a scale of A-E. The top 20 percent of these positive-density gridboxes are assigned a rank of “A”, and the gridboxes in the 20-40 percentile range are assigned a rank of “B”. Similarly, the gridboxes in the 40-60, 60-80, and 80-100 percentile ranges are assigned ranks of “C”, “D”, and “E”, respectively.

The above procedure is repeated for each month (April-June 2009), for both the offshore (ship) and coastal (boat) surveys, for total birds. Then, for each month and survey type, color-coded spatial maps of the 249 gridboxes encompassing the survey area are generated, with the ranks of A, B, C, D, E, and F represented by red, orange, yellow, green, blue, and white, respectively. Each of the 249 gridboxes is assigned the appropriate color according to its ranking. By definition, high-density gridboxes are identified by the “red” gridboxes (which are ranked “A”, corresponding to densities in the top 20 percentile).

Results

Monthly color-coded spatial maps illustrating the 249 gridboxes ranked according to avian density are given in **Figures 5.1-4** through **5.1-6** for the offshore (ship) surveys. The gridboxes depicted in red (indicating avian densities in the top 20 percentile among the positive-density gridboxes) are designated as high-density gridboxes. As shown on the color-coded spatial maps, the spatial locations of the high-density gridboxes exhibit monthly variability.

For the offshore surveys, the high-density gridboxes were highly scattered and occurred both nearshore and offshore. Fewer high-density gridboxes were present in April (one; **Figure 5.1-4**) than in May (29; **Figure 5.1-5**) and June (28; **Figure 5.1-6**). The majority of gridboxes in the southern region in April are white, indicating zero bird density (i.e., no bird sightings due to absence of survey effort due to weather conditions). In April, the nearshore high-density gridboxes occurred north-northeast of Barnegat Bay, north-northeast of Little Egg Inlet, and an area just south of Barnegat Light (in relative agreement with the results of the April coastal survey; see **Figure 5.3-1**). High-density gridboxes also occurred consistently along a linear onshore-offshore transect extending off of and just north of Little Egg Inlet. Mid-offshore high-density gridboxes also occurred southeast of Atlantic City in April. In May, the high-density gridboxes were concentrated nearshore and mid-offshore in the central and southern regions of the study area, with only three isolated high-density gridboxes in the northern region (one offshore and two nearshore adjacent to Barnegat Bay). More high-density gridboxes occurred in the northern region in June than in May. Between May and June, the number of high-density gridboxes in the central region decreased, whereas the southern region maintained a relatively high number of high-density gridboxes. A relatively high number of high-density gridboxes occur in both nearshore and mid-offshore areas in May whereas in June there were relatively more high-density gridboxes mid-offshore than nearshore.

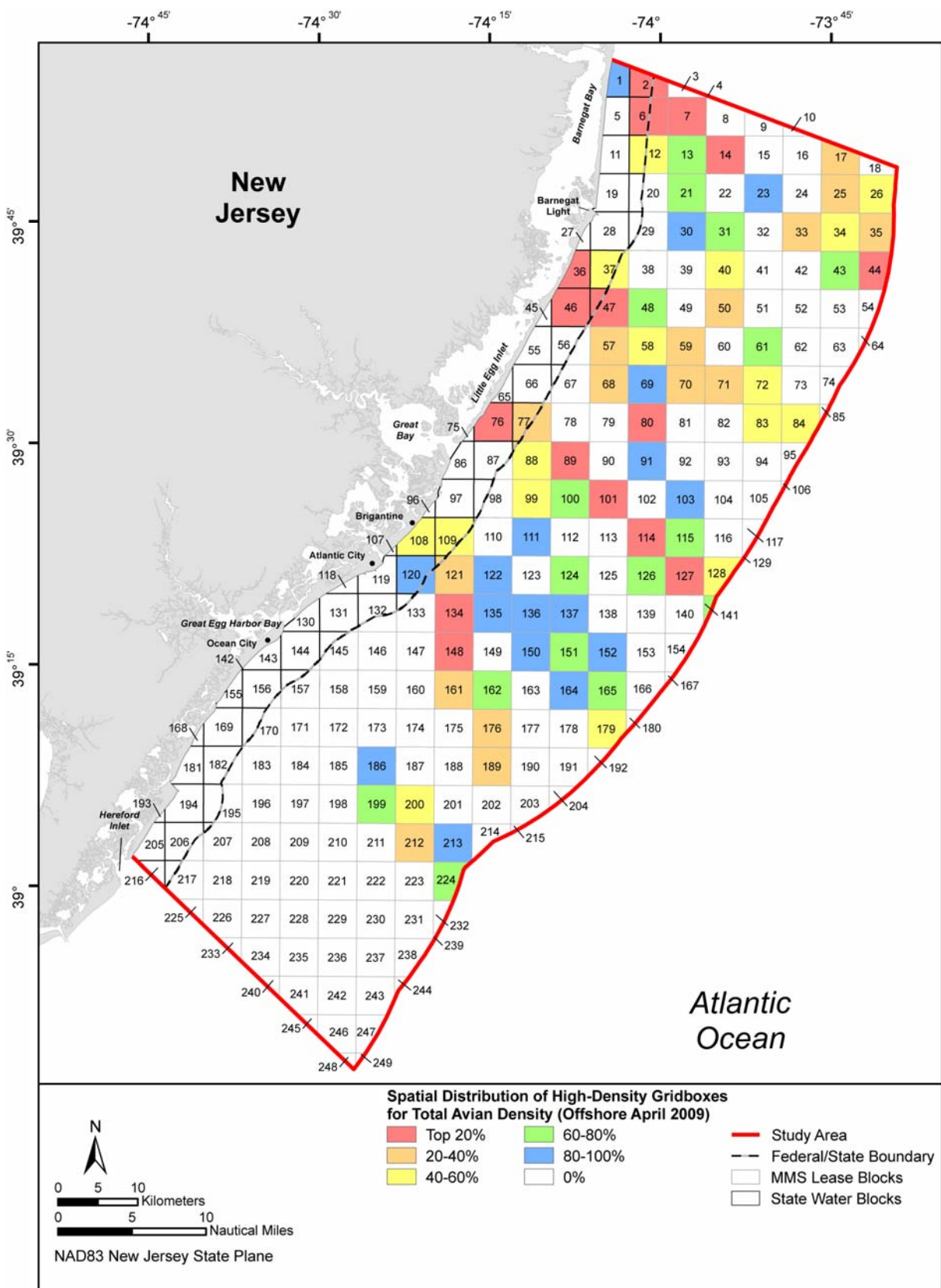


Figure 5.1-4. Avian gridbox densities within the entire New Jersey Study Area in April 2009. Data reflect birds from coastal and offshore surveys.

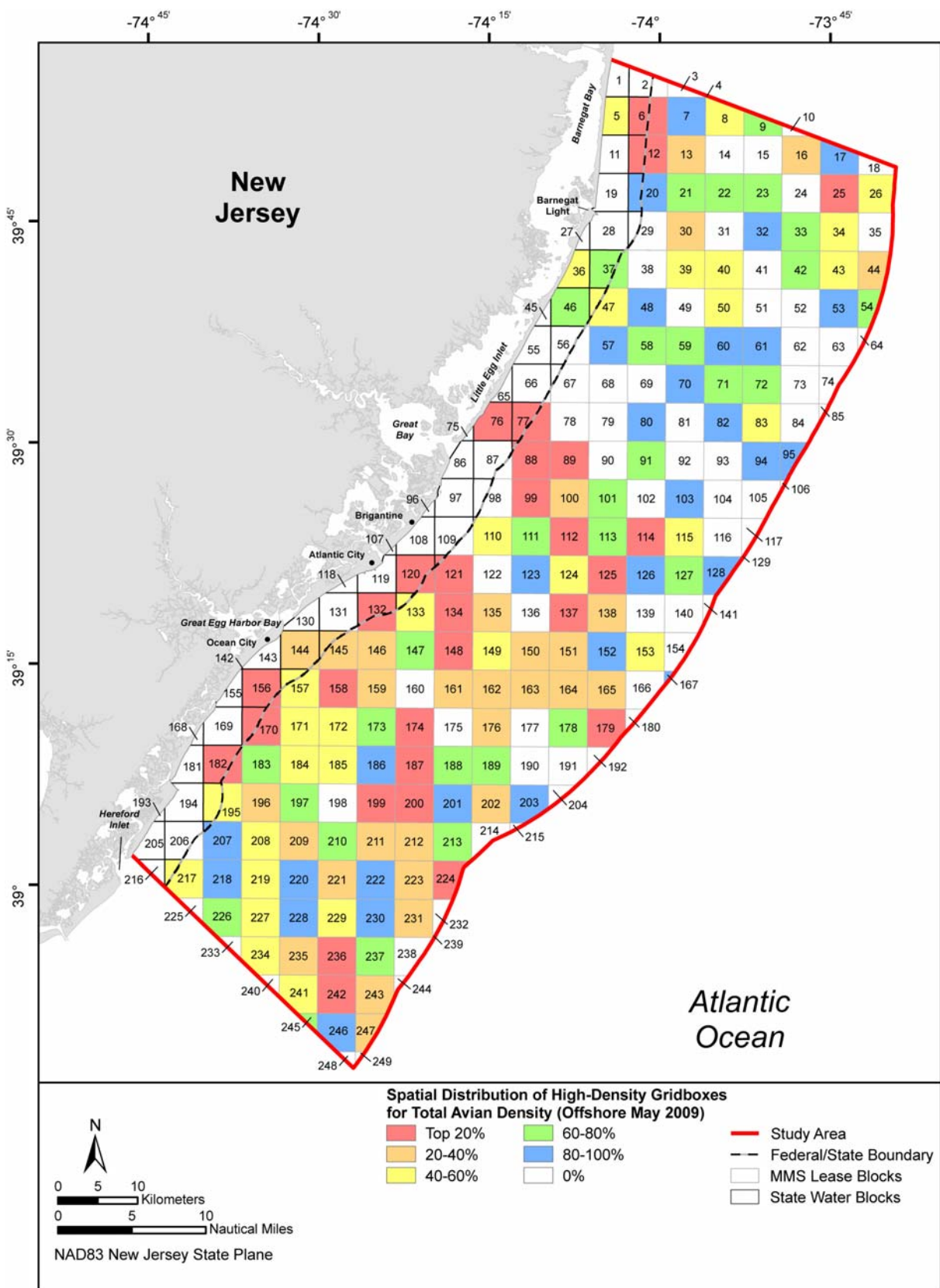


Figure 5.1-5. Avian gridbox densities within the entire New Jersey Study Area in May 2009. Data reflect birds from coastal and offshore surveys.

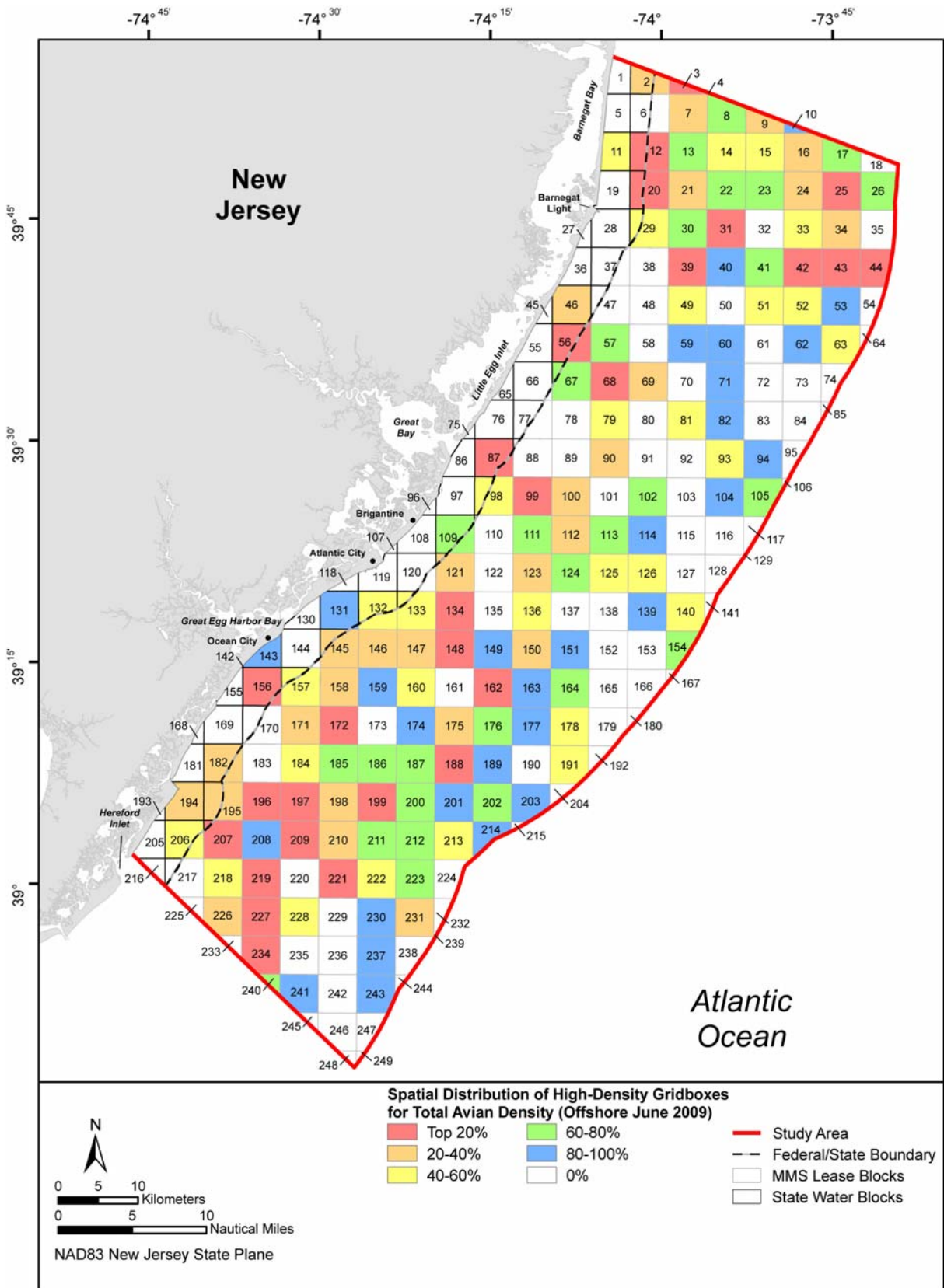


Figure 5.1-6. Avian gridbox densities within the entire New Jersey Study Area in June 2009. Data reflect birds from coastal and offshore surveys.

5.1.2 *Marine Mammals and Sea Turtles*

5.1.2.1 Survey Effort

Shipboard marine mammal/sea turtle survey lines for the April, May, and June surveys differ from avian lines due to varying sea state conditions/observation requirements.

5.1.2.1.1 *April 2009*

Marine mammal/sea turtle shipboard surveys were initiated on 07 April and concluded on 11 April. The start of the survey was delayed due to strong winds (BSS >5). Survey effort on 10 April was cut short due to the increasing winds (BSS >6), and effort was suspended through 11 April due to the strong winds. The survey covered 263.467 NM (479.511 km) of on-effort trackline (**Figure 5.1-7**).

5.1.2.1.2 *May 2009*

Marine mammal/sea turtle shipboard surveys were initiated on 02 May and concluded on 06 May. The beginning of the survey was delayed for a day due to strong winds (gusts up to 30 knots [kts]) and rain. Effort was delayed several times throughout survey due to light to heavy rain and fog. The survey covered 330.866 NM (602.176 km) of on-effort trackline (**Figure 5.1-8**).

5.1.2.1.3 *June 2009*

Marine mammal/sea turtle shipboard surveys were initiated on 02 June and concluded on 06 June. One of the ship's thrusters quit working temporarily during part of the survey on 02 and 03 June so some of the tracklines were a bit "wiggly" during this time. Brief intermittent delays due to light rain and fog were experienced during the morning of 04 June; survey effort was suspended in the afternoon due to the rain. The survey covered 347.528 NM (632.500 km) of on-effort trackline (**Figure 5.1-9**).

5.1.2.2 Survey Results

Four marine mammal species were observed on the ship surveys from April through June 2009. Unidentified dolphins and one unidentified hardshell turtle which could not be identified to species were also observed during these surveys. All sightings from this time period are summarized in **Table 5.1-4**. One of the four species is listed as threatened or endangered under the Endangered Species Act (ESA).

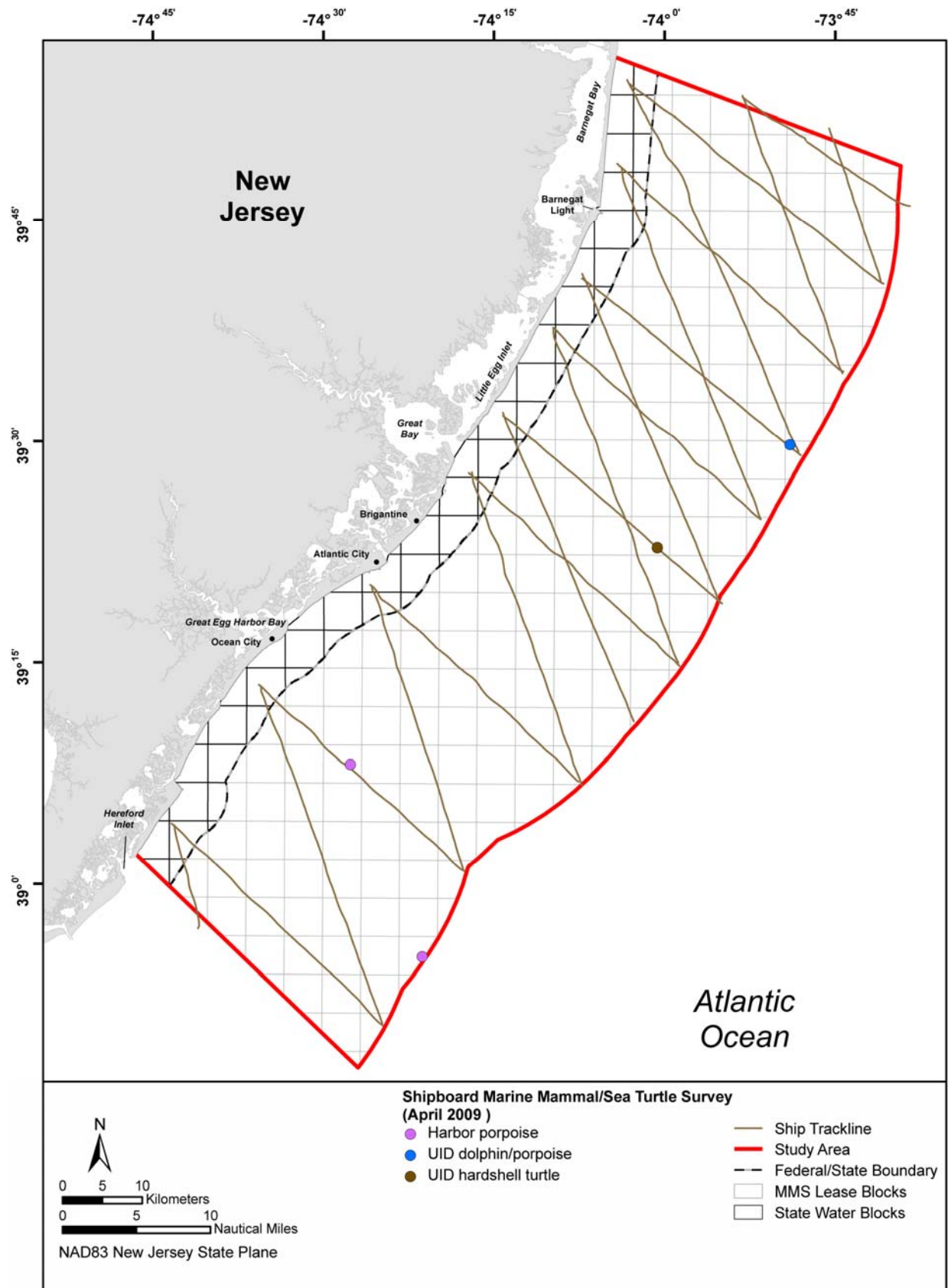


Figure 5.1-7. Shipboard Marine Mammal/Sea Turtle Survey for April 2009.

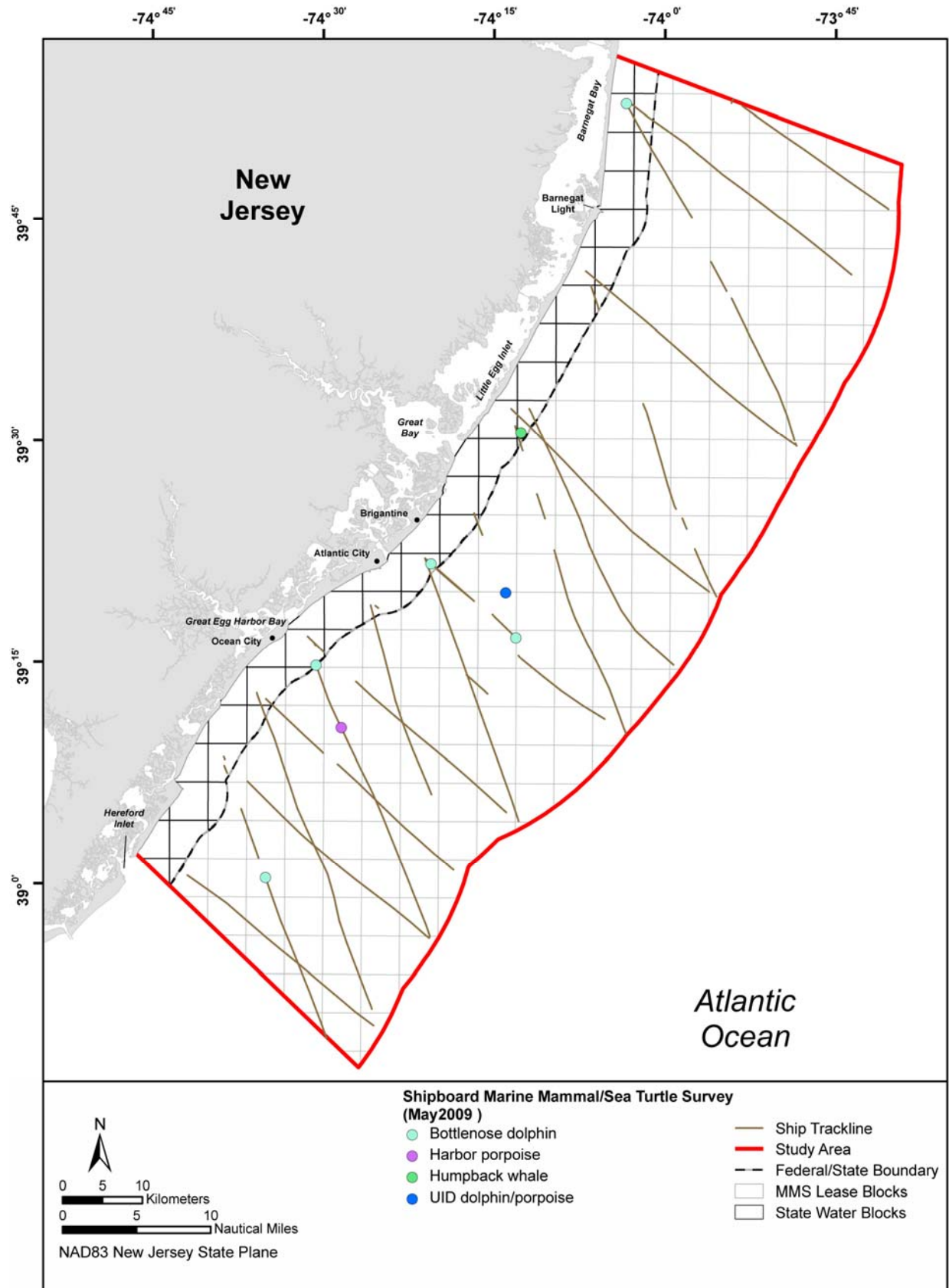


Figure 5.1-8. Shipboard Marine Mammal/Sea Turtle Survey for May 2009.

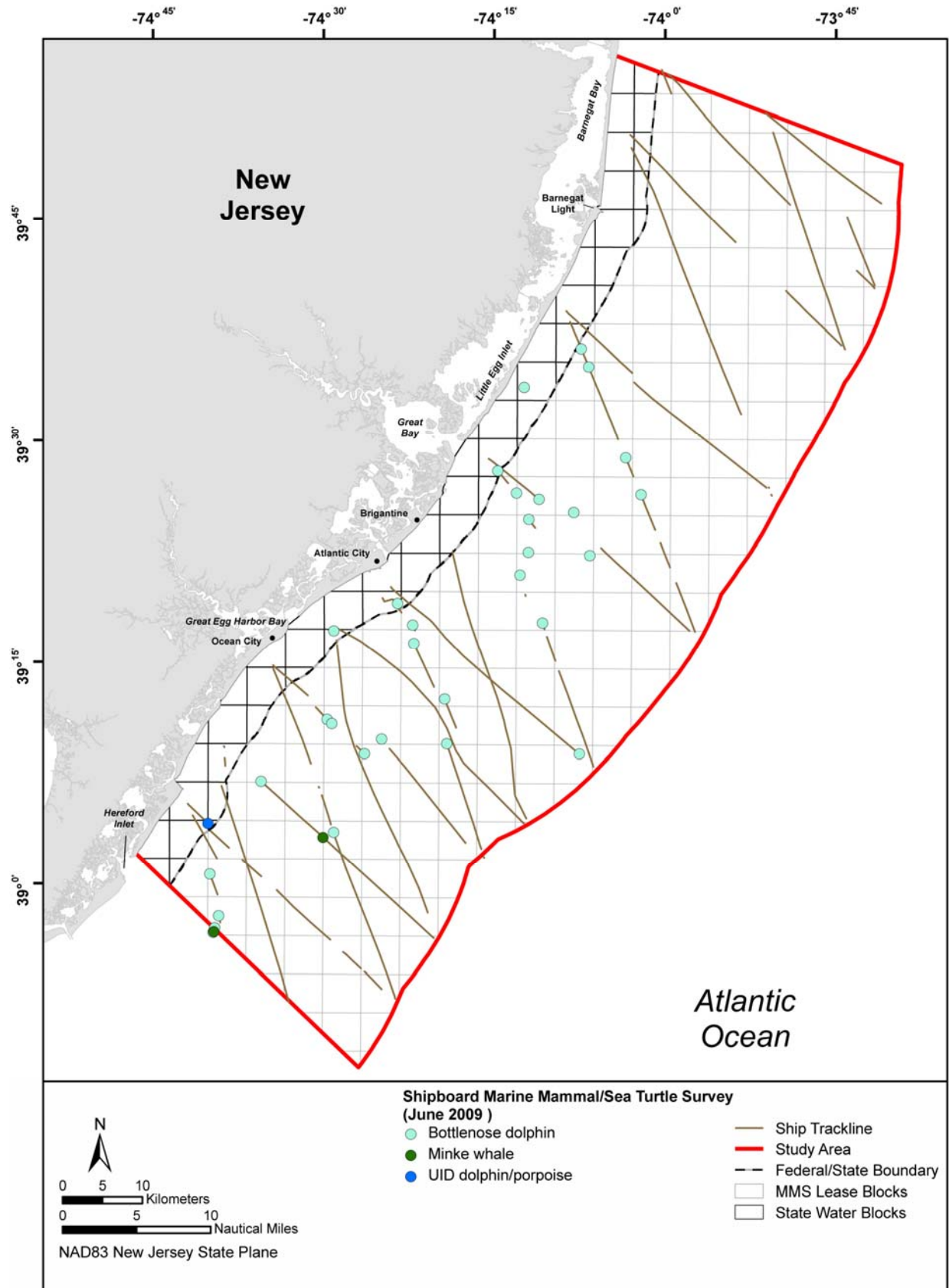


Figure 5.1-9. Shipboard Marine Mammal/Sea Turtle Survey for June 2009.

Table 5.1-4
Summary of Marine Mammal/Sea Turtle Sightings from the Shipboard Surveys from April through June 2009.

Common Name, <i>Scientific Name</i>	Sightings by Month		
	April	May	June
Humpback whale, <i>Megaptera novaeangliae</i> *		1	
Minke whale, <i>Balaenoptera acutorostrata</i>			2
Bottlenose dolphin, <i>Tursiops truncatus</i>		5	32
Harbor porpoise, <i>Phocoena phocoena</i>	2	1	
Unidentified dolphin	1	1	1
Unidentified hardshell turtle	1		

*ESA species

This table is a summary of sightings and not the total number of animals observed. Note that a sighting can include more than one animal.

5.2 AERIAL SURVEYS

5.2.1 Avian

Aerial avian surveys were discontinued for the remainder of the project.

5.2.2 Marine Mammals and Sea Turtles

No marine mammal/sea turtle aerial surveys were conducted during the fourth quarter of 2008. Surveys commenced in January 2009.

5.2.2.1 Survey Effort

5.2.2.1.1 April 2009

Two offshore marine mammal/sea turtle aerial surveys were flown during this month. Surveys were flown on 13 and 18 April, and covered a total of 540.595 NM (1,001.182 km) of on-effort trackline (**Figure 5.2-1**).

5.2.2.1.2 May 2009

The marine mammal/sea turtle offshore surveys were completed on 23 and 24 May. Surveys were scheduled for 06 May but could not be conducted due to low cloud cover (below the minimum required for aerial surveys). The surveys covered a total of 816.552 NM (1,512.254 km) of on-effort trackline (**Figure 5.2-2**).

5.2.2.1.3 June 2009

Offshore surveys were flown on 23 and 24 June. There was a slight delay on the morning of 24 June due to patchy fog. The offshore surveys covered a total of 1,053.215 NM (1,950.555 km) of on-effort trackline (**Figure 5.2-3**).

5.2.2.2 Survey Results

Three species were observed on the aerial surveys from April through June 2009 along with unidentified turtles, an unidentified small cetacean, and an unidentified dolphin which could not be identified to species. All aerial survey sightings from this time period are summarized in **Table 5.2-1**.

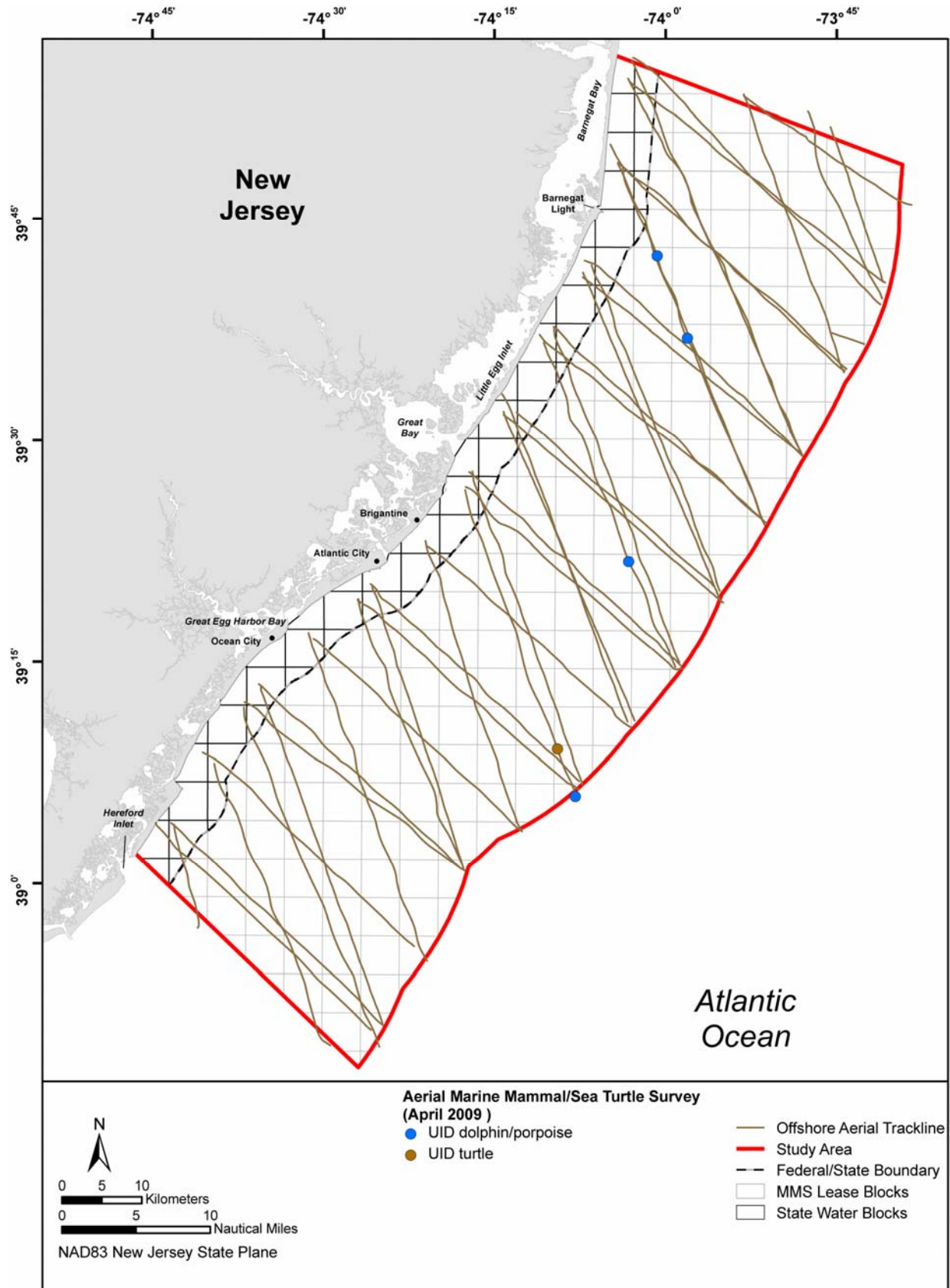


Figure 5.2-1. Aerial Marine Mammal/Sea Turtle Survey for April 2009.

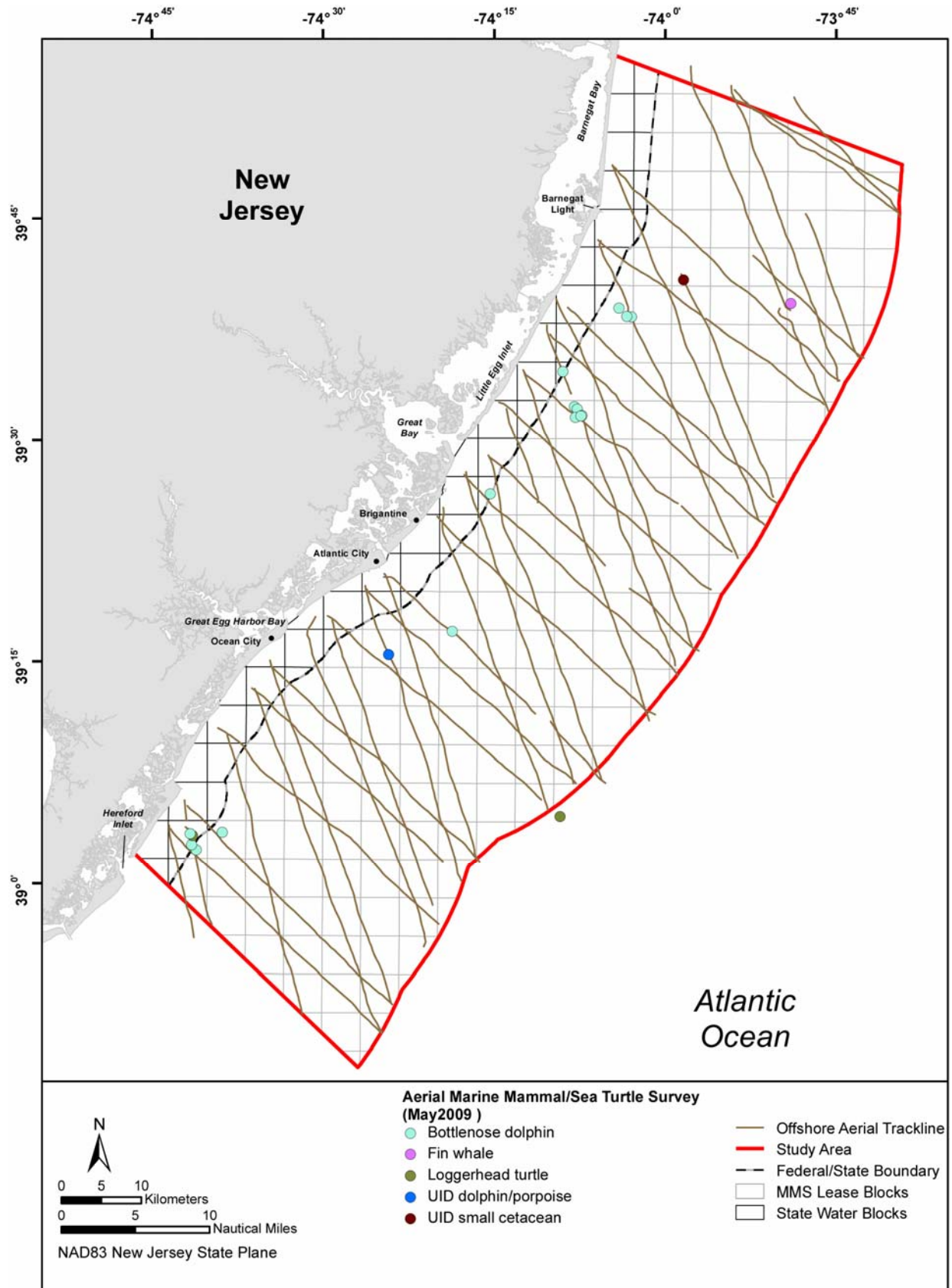


Figure 5.2-2. Aerial Marine Mammal/Sea Turtle Survey for May 2009.

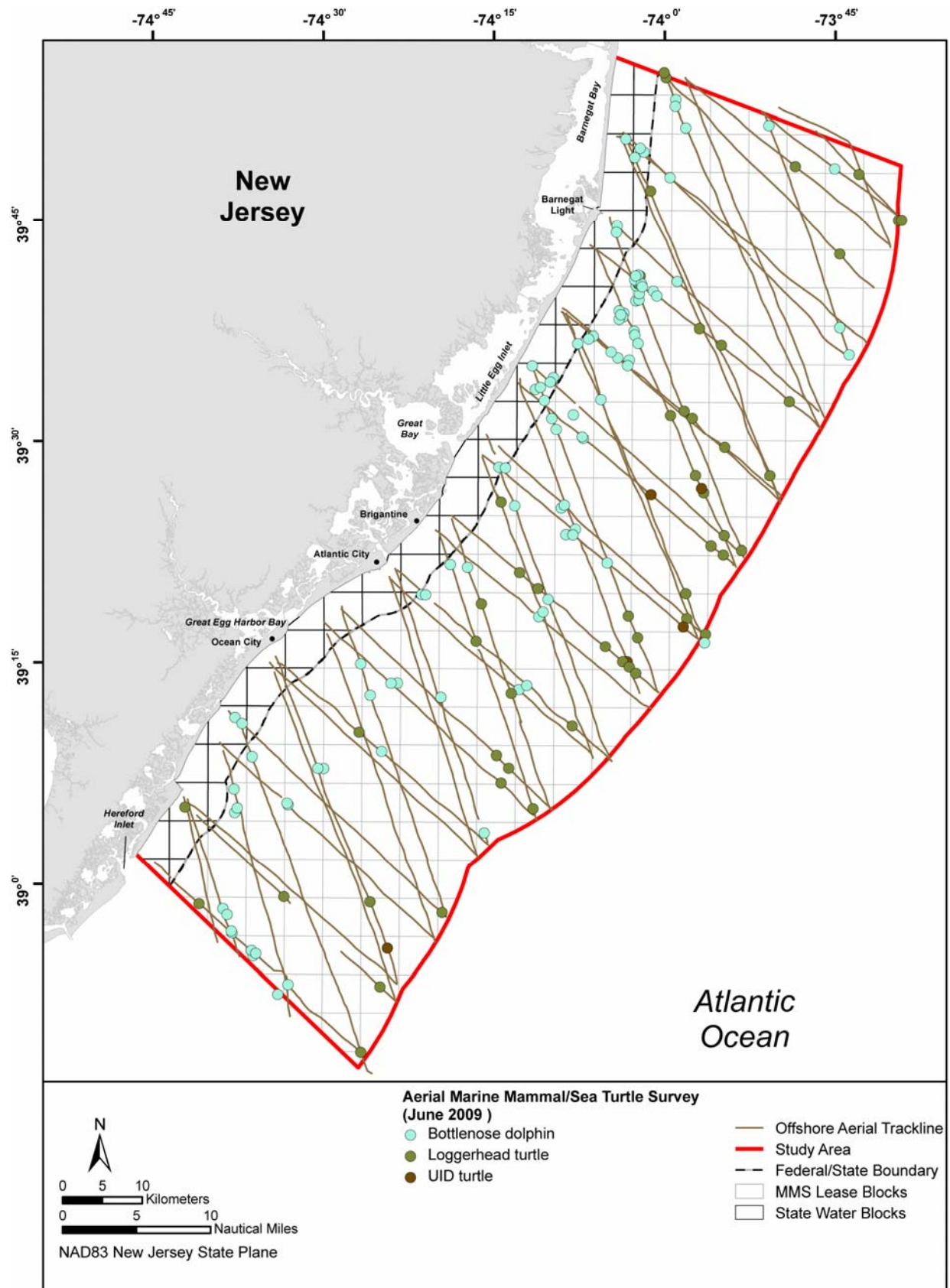


Figure 5.2-3. Aerial Marine Mammal/Sea Turtle Survey for June 2009.

Table 5.2-1
Summary of Marine Mammal/Sea Turtle Sightings from the Aerial Surveys from April through June 2009.

Common Name, <i>Scientific Name</i>	Sightings by Month		
	April	May	June
Fin whale, <i>Balaenoptera physalus</i> *		1	
Bottlenose dolphin, <i>Tursiops truncatus</i>	4	15	99
Loggerhead turtle, <i>Caretta caretta</i> *		2	53
Unidentified small cetacean		1	
Unidentified dolphin		1	
Unidentified turtle	1		5

* ESA species

This table is a summary of sightings and not total number of animals observed. Note that a sighting can include more than one animal.

5.3 SMALL BOAT COASTAL SURVEYS

5.3.1 Survey Effort

5.3.1.1 April 2009

The small boat coastal survey was conducted on 24 April 2009. The small boat transects covered 70.46 NM (130 km; **Figure 5.1-1**). Survey effort began while heading north at 0511 Eastern Daylight Time (EDT) near the northern end of the study area. Survey effort stopped at 0803 EDT when the boat reached the northern end of the study area, then resumed at 1011 EDT in a southerly direction when the boat reached the initial starting point. The total daily effort was 7.29 hrs.

5.3.1.2 May 2009

The small boat coastal survey was conducted on 21 May 2009. The small boat transects covered 73.21 NM (136 km; **Figure 5.1-2**). Survey effort began while heading north at 0513 EDT near the northern end of the study area. Survey effort stopped at 0552 EDT when the boat reached the northern end of the study area, then resumed at 0619 EDT when the boat reached the initial starting point. The total daily effort was 7.46 hrs.

5.3.1.3 June 2009

The small boat coastal survey was initiated on 13 June 2009. Problems with the ship's global positioning system (GPS) forced the survey to end early. The small boat transects covered 11 NM (20.46 km; **Figure 5.1-3**). The total daily effort was 1.55 hrs. The survey resumed on 23 June and covered 59 NM (108.9 km). The total daily effort was 5.40 hrs.

5.3.2 Survey Results

5.3.2.1 Avian Species Occurrence

All 29 avian species observed during the April, May, and June 2009 surveys are listed in **Table 5.3-1**. In the April survey 24 species were recorded, while there were 16 in May, and 9 in June.

Table 5.3-1
Avian species observed during the April through June 2009 small boat coastal surveys¹.

Family Common Name, <i>Scientific name</i>	2009			
	24 April	21 May	13 June	23 June
Anatidae (geese and ducks)				
Atlantic Brant, <i>Branta bernicla</i>	X	X		
Surf Scoter, <i>Melanitta perspicillata</i>	X			
White-winged Scoter, <i>Melanitta fusca</i>	X			
Black Scoter, <i>Melanitta niger</i>	X	X		
Long-tailed Duck, <i>Clangula hyemalis</i>	X			
Red-breasted Merganser, <i>Mergus serrator</i>	X			
Gaviidae (loons)				
Red-throated Loon, <i>Gavia stellata</i>	X	X		
Common Loon, <i>Gavia immer</i>	X	X		
Procellariidae (petrels and shearwaters)				
Sooty Shearwater, <i>Puffinus griseus</i>		X		
Hydrobatidae (storm-petrels)				
Wilson's Storm-petrel				X
Sulidae (gannets)				
Northern Gannet, <i>Morus bassanus</i>	X	X	X	X
Phalacrocoracidae (cormorants)				
Double-crested Cormorant, <i>Phalacrocorax auritus</i>	X	X		
Great Cormorant, <i>Phalacrocorax carbo</i>	X			
Ardeidae (egrets and herons)				
Great Blue Heron, <i>Ardea herodias</i>	X			X
Great Egret, <i>Ardea alba</i>	X			
Accipitridae (eagles and hawks)				
Osprey, <i>Pandion haliaetus</i>	X	X	X	X
Scolopacidae (sandpipers)				
Sanderling, <i>Calidris alba</i>		X		
Dunlin, <i>Calidris alpina</i>	X			
Laridae (gulls and terns)				
Laughing Gull, <i>Leucophaeus atricilla</i>	X	X	X	X
Ring-billed Gull, <i>Larus delawarensis</i>	X			
Herring Gull, <i>Larus argentatus</i>	X	X	X	X
Iceland Gull, <i>Larus glaucooides</i>	X			
Great Black-backed Gull, <i>Larus marinus</i>	X	X	X	X
Least Tern, <i>Sternula antillarum</i>		X		
Common Tern, <i>Sterna hirundo</i>		X	X	X
Forster's Tern, <i>Sterna forsteri</i>	X	X		X
Columbidae (pigeons and doves)				
Rock Pigeon, <i>Columba livia</i>	X			
Hirundinidae (swallows)				
Barn Swallow, <i>Hirundo rustica</i>	X			
Icteridae (blackbirds, meadowlarks, and orioles)				
Boat-tailed Grackle, <i>Quiscalus major</i>	X			

¹ All birds identified to species during avian surveys are included, whether in-zone or out-zone

5.3.2.2 Avian Abundance

Avian numbers and abundances for the coastal surveys of April through June 2009 are presented in **Table 5.3-2**. Species diversity and overall numbers were highest in April, as there were still large numbers of migrants moving through the area. The steep decline of birds detected in May was due primarily to a decline in waterfowl and landbird diversity and numbers. In the April 2009 survey, 24 species were recorded, while there were 16 in May, and 9 in June. **Table 5.3-3** presents the top five most numerous species (no. birds/km) detected in each month. As is typical, there were still reasonable numbers of migrant waterfowl present in April, although diversity and detected abundance were markedly less than in March, which is normally the peak of waterfowl migration in the survey area. The most abundant species was Double-crested Cormorant (1.71/km). Waterfowl (with an overall abundance of 1.96) were dominated by Surf Scoter (1.37), which is the latest spring migrant of the three scoter species. Common Loon (0.52), Herring Gull (0.52), and Laughing Gull (0.43) were the remaining top five most numerous species in April. In May, overall detected abundance declined by over 50 percent (from 6.58 to 3.12) and the top five most numerous species were comprised entirely of locally breeding species, with all of those being members of the Laridae (gulls and terns): Laughing Gull (0.66), followed by Common Tern (0.58), Forster's Tern (0.55), Great Black-backed Gull (0.30), and Herring Gull (0.29).

The 13 and 23 June survey days are considered separately due to the temporal gap (caused by heavy rains and high surf). As a result, the top five species for 13 June 2009, which covered 11 NM (20.46 km), are marked by a large abundance of Laughing Gulls (3.91) followed by Northern Gannet (0.15), and an abundance of 0.05 each for the remaining observed species: Herring Gull, Great Black-backed Gull, Common Tern, and Osprey. The 23 June survey covered 59 NM (108.90 km) and contained more abundance variety, all of which are within the Laridae: Common Tern (0.48) followed by Laughing Gull (0.46), Great Black-backed Gull (0.22), Herring Gull (0.08), and Forster's Tern (0.07).

Two federal avian species of concern for Bird Conservation Region 30 (New England/Mid-Atlantic Coast) were recorded during the spring offshore surveys: Red-throated Loon in April and May, and Least Tern in May (**Table 5-1.1**).

Five species listed by the State of New Jersey as endangered, threatened, and/or of special concern during the breeding or non-breeding seasons were recorded during the spring offshore surveys. Great Blue Heron, listed as special concern as a breeder, was recorded in April and June. Osprey, listed as threatened as a breeder, was recorded in April, May, and June. Sanderling, listed as special concern as a non-breeder, was recorded in May. Least Tern, listed as endangered as a breeder, was recorded in May. Common Tern, listed as special concern as a breeder, was recorded in May and June.

5.3.2.3 Avian Density

Methods

Analysis methods are identical to the methods previously described for the offshore surveys (**Section 5.1.1.2.3**).

Results

Gridboxes ranked according to avian density are given in **Figures 5.3-1** through **5.3-3** for the coastal (boat) surveys. The gridboxes depicted in red (indicating avian densities in the top 20 percentile among the positive-density gridboxes) are designated as high-density gridboxes. As shown on the color-coded spatial maps, the spatial locations of the high-density gridboxes exhibit monthly variability.

Table 5.3-2
In-zone avian species abundance observed during the April through June 2009 small boat coastal surveys.

Family Common Name, <i>Scientific name</i>	24 April 2009		21 May 2009		13 June 2009		23 June 2009	
	No. ¹	Abun. ²	No. ¹	Abun. ²	No. ¹	Abun. ²	No. ¹	Abun. ²
Anatidae (geese and ducks)	251	1.96	1	0.01				
Surf Scoter, <i>Melanitta perspicillata</i>	176	1.37						
White-winged Scoter, <i>Melanitta fusca</i>	1	0.01						
Black Scoter, <i>Melanitta niger</i>	30	0.23	1	0.01				
Long-tailed Duck, <i>Clangula hyemalis</i>	2	0.02						
Scoter, dark-winged (unknown)	42	0.33						
Gaviidae (loons)	110	0.85	5	0.03				
Red-throated Loon, <i>Gavia stellata</i>	43	0.33	3	0.02				
Common Loon, <i>Gavia immer</i>	67	0.52	2	0.01				
Procellariidae (petrels and shearwaters)			3	0.02				
Sooty Shearwater, <i>Puffinus griseus</i>			3	0.02				
Hydrobatidae (storm-petrels)							7	0.06
Wilson's Storm-petrel							7	0.06
Sulidae (gannets)	54	0.42	34	0.25	3	0.15	3	0.03
Northern Gannet, <i>Morus bassanus</i>	54	0.42	34	0.25	3	0.15	3	0.03
Phalacrocoracidae (cormorants)	225	1.75	36	0.27				
Double-crested Cormorant, <i>Phalacrocorax auritus</i>	220	1.71	36	0.27				
Great Cormorant, <i>Phalacrocorax carbo</i>	5	0.04						
Ardeidae (egrets and herons)							2	0.02
Great Blue Heron, <i>Ardea herodias</i>							2	0.02
Accipitridae (eagles and hawks)					1	0.05	5	0.05
Osprey					1	0.05	5	0.05
Scolopacidae (sandpipers)			16	0.12				
Sanderling, <i>Calidris alba</i>			16	0.12				

Table 5.3-2 (continued)
In-zone avian species abundance observed during the April through June 2009 small boat coastal surveys.

Family Common Name, <i>Scientific name</i>	24 April 2009		21 May 2009		13 June 2009		23 June 2009	
	No. ¹	Abun. ²	No. ¹	Abun. ²	No. ¹	Abun. ²	No. ¹	Abun. ²
Laridae (gulls and terns)	204	1.58	323	2.40	84	4.11	146	1.34
Laughing Gull, <i>Leucophaeus atricilla</i>	55	0.43	89	0.66	80	3.91	50	0.46
Ring-billed Gull, <i>Larus delawarensis</i>	3	0.02						
Herring Gull, <i>Larus argentatus</i>	67	0.52	39	0.29	1	0.05	9	0.08
Great Black-backed Gull, <i>Larus marinus</i>	32	0.25	40	0.30	1	0.05	24	0.22
Least Tern, <i>Sternula antillarum</i>			1	0.01				
Common Tern, <i>Sterna hirundo</i>			78	0.58	1	0.05	52	0.48
Forster's Tern, <i>Sterna forsteri</i>	47	0.36	74	0.55			8	0.07
Tern, small (unknown)			2	0.01	1	0.05	3	0.03
Hirundinidae (swallows)	3	0.02						
Barn Swallow, <i>Hirundo rustica</i>	3	0.02						
Total	847	6.58	418	3.10	88	4.31	163	1.50

¹ Includes avian observations within the 300-m x 300-m survey strip transect when the ship was traveling ≥7 kts

² Detected abundance = No. birds/km and within the 300-m x 300-m survey strip transect when the ship was traveling ≥7 kts

Table 5.3-3
The most abundant in-zone avian species during the April through June 2009 small boat coastal transect surveys.

24 April 2009 Small Boat Coastal In-zone¹		
Common Name	Number	Abundance²
Double-crested Cormorant	220	1.71
Surf Scoter	176	1.37
Common Loon	67	0.52
Herring Gull	67	0.52
Laughing Gull	55	0.43
21 May 2009 Small Boat Coastal In-zone¹		
Common Name	Number	Abundance²
Laughing Gull	89	0.66
Common Tern	78	0.58
Forster's Tern	74	0.55
Great Black-backed Gull	40	0.30
Herring Gull	39	0.29
13 June 2009 Small Boat Coastal In-zone¹		
Common Name	Number	Abundance²
Laughing Gull	80	3.91
Northern Gannet	3	0.15
Herring Gull*	1	0.05
Great Black-backed Gull*	1	0.05
Common Tern*	1	0.05
23 June 2009 Small Boat Coastal In-zone¹		
Common Name	Number	Abundance²
Common Tern	52	0.48
Laughing Gull	50	0.46
Great Black-backed Gull	24	0.22
Herring Gull	9	0.08
Forster's Tern	8	0.07

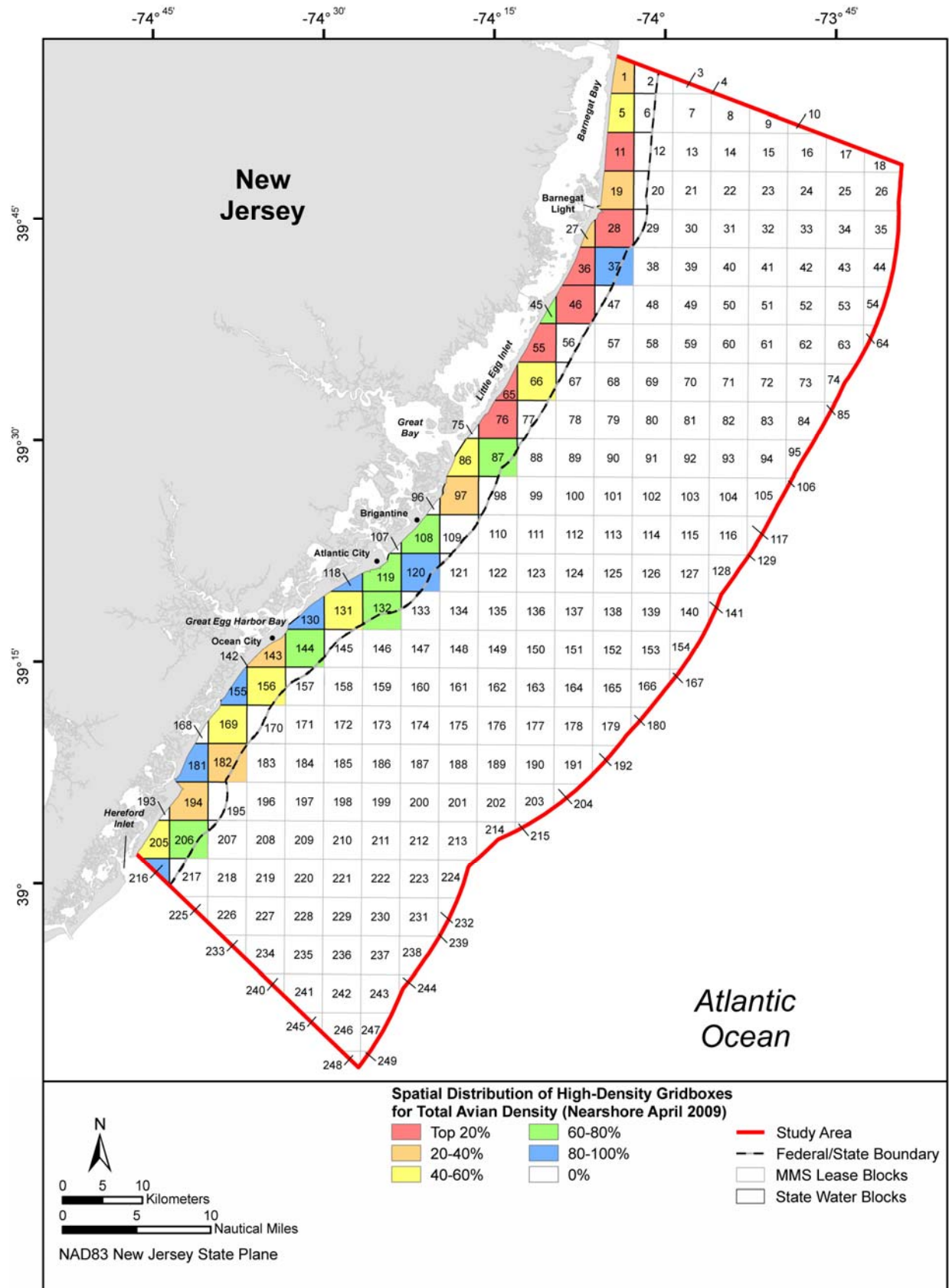


Figure 5.3-1. Avian gridbox densities within the New Jersey coastal area in April 2009.

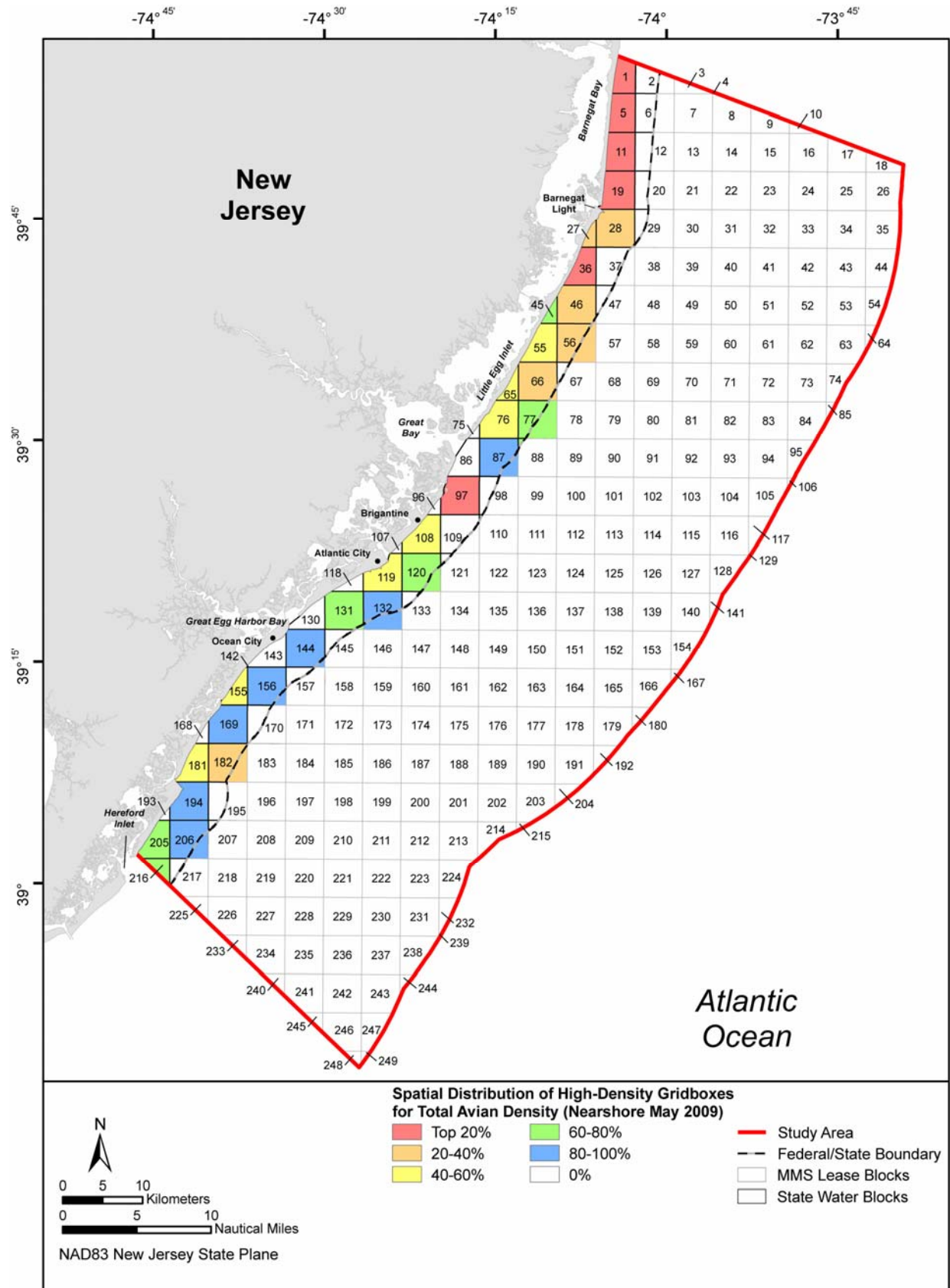


Figure 5.3-2. Avian gridbox densities within the New Jersey coastal area in May 2009.

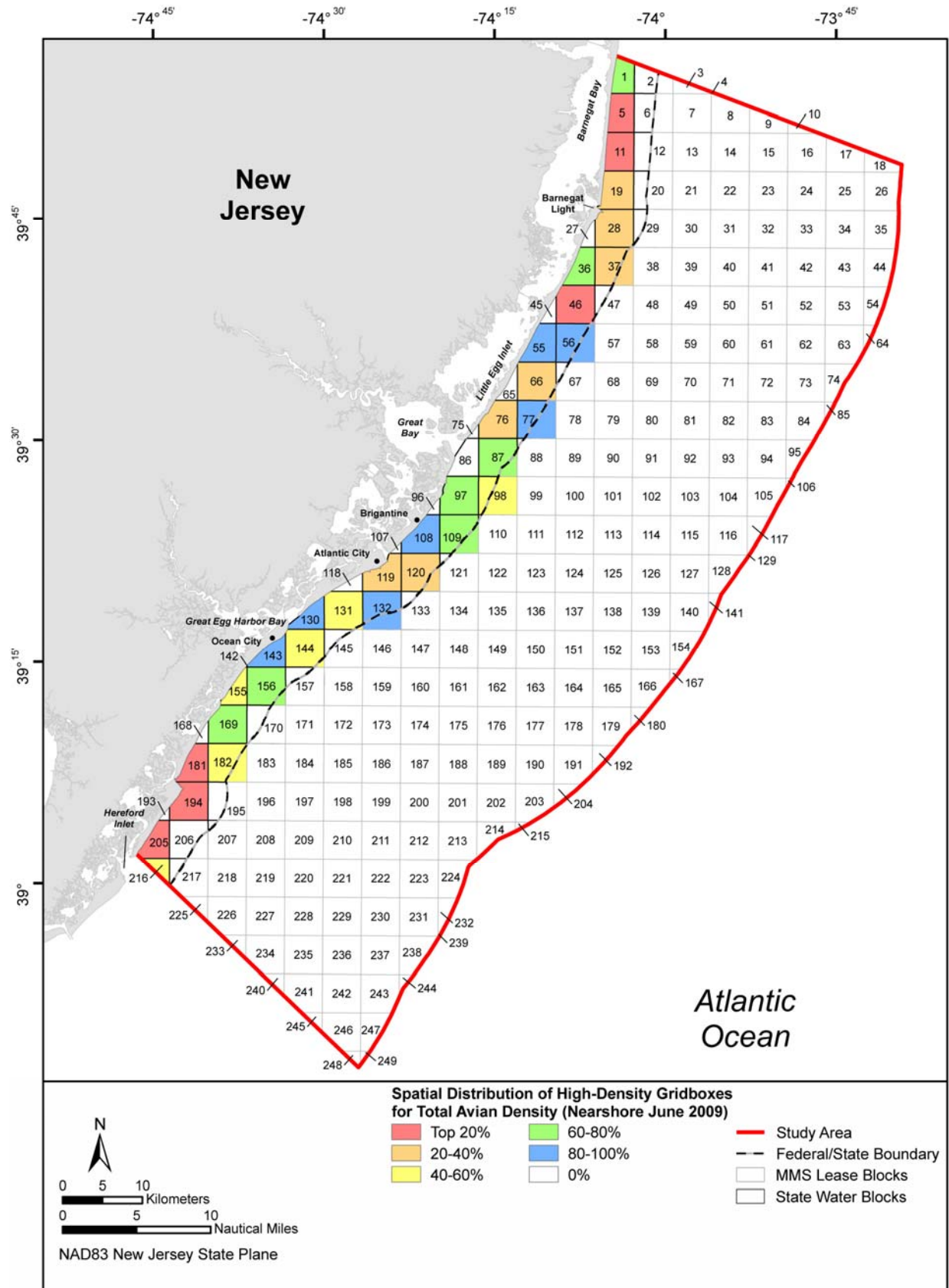


Figure 5.3-3. Avian gridbox densities within the New Jersey coastal area in June 2009.

For the coastal surveys, most of the high-density gridboxes (colored red) occurred nearshore in the northern region of the study area (adjacent to Barnegat Bay and Barnegat Light), on average, for all 3 months (**Figure 5.3-1** through **Figure 5.3-3**). Because of the limited spatial range of the coastal survey effort (concentrated nearshore), all offshore gridboxes on the spatial maps for the coastal surveys are white, indicating zero avian density (i.e., no bird sightings, due to zero survey effort offshore). In April, high-density gridboxes also occurred nearshore between Barnegat Light and Great Bay (**Figure 5.3-1**); in May between Brigantine and Great Bay and north of Barnegat Light (**Figure 5.3-2**). A cluster of 3 high-density gridboxes occurred nearshore in the southern region (adjacent to and just north of Hereford Inlet during June (**Figure 5.3-3**). Low-density gridboxes (colored blue and green) predominated in the central and southern regions (from Brigantine to Hereford Inlet) in April and May and in the central region (from Little Egg Inlet to just south of Ocean City) in June.

5.3.3 Discussion

5.3.3.1 Avian Abundance

In April 2009, coastal abundance of birds (6.58; **Table 5.3-2**) was nearly 400 percent of that detected during the shipboard survey that month (1.76; **Table 5.1-2**), although May abundances were nearly equal (3.10 compared to 2.62). Although some of these differences may be due to timing of the respective surveys in those months, the large difference in abundance noted between the two survey types in April are probably due to the following: waterbird migration tends to be concentrated coastally; only a small percentage of the length of any of the offshore transect lines can, in this sense, be considered coastal; and there is still significant movement of waterbirds in April. With the arrival of two common migrant breeding species (Laughing Gull and Common Tern) and the departure of most migrant and wintering waterfowl, the similarity in May detected abundances between coastal and offshore efforts is also probably realistic. The 13 June 2009 coastal survey abundance (4.31) was far greater than the June offshore survey abundance (1.41) but only due to the large number of Laughing Gulls (80) within the short coastal transect distance. The 23 June coastal survey, with its longer transect distance, has an abundance (1.50) that is nearly identical to that of the offshore survey, and better reflects the comparison between the offshore and coastal surveys.

5.3.3.2 Avian Density

The high-density gridboxes are identified on a month-to-month basis by an “x” in **Tables 5.3-4** and **5.3-5**, respectively for the offshore and coastal surveys, respectively. Only those gridboxes that exhibited an occurrence frequency of 1 or greater (i.e., at least 1 month as a high-density gridbox) are listed in the tables. Each row, corresponding to a particular gridbox, is summed over the total number of months in the quarter (April-June 2009) to obtain the number of months that the given gridbox is designated as a high-density gridbox (i.e., “A” ranking). Gridboxes 113 and 126 (located adjacent to each other and mid-offshore in the central region of the study area, southeast of Atlantic City) were designated as a high-density gridbox in all 3 months (**Figures 5.1-5** through **5.1-7**), giving these gridboxes the highest monthly occurrence frequency among all 249 gridboxes covering the survey area. For the coastal surveys, Gridbox 247 (located nearshore in the northern region of the study area, adjacent to Barnegat Bay) exhibited the highest monthly occurrence frequency (3 months) as a high-density gridbox (**Figure 5.1-4**; **Figures 5.3-1** through **5.3-3**).

Likewise, each column, corresponding to a particular month, is summed over the number of gridboxes to obtain the total number of high-density gridboxes occurring in the given month. For example, in April, Gridboxes 1, 4, 5, 11, 38, 39, 47, 69, 76, 87, 97, 108, 113, 126, 242, and 244 (16 gridboxes total) were high-density gridboxes for the offshore surveys, and Gridboxes 30, 47, 240, 241, 242, 244, and 247 (7 gridboxes total) were high-density gridboxes for the coastal surveys. For the offshore surveys, there were more high-density gridboxes in May and June (29 and 28, respectively) than in April (16). For the coastal surveys, the number of high-density gridboxes was relatively constant (6 or 7) across these three months.

Summing the occurrence frequencies over both the total number of months (last row) and total number of gridboxes (last column), there were a total of 73 and 19 monthly high-density gridbox occurrences for the

offshore and coastal surveys, respectively. Because of the restricted spatial range of the survey effort, there were significantly fewer high-density gridboxes for the coastal surveys than for the offshore surveys. As shown on the color-coded monthly spatial maps, all of the offshore gridboxes for the coastal surveys are colored white, indicating zero avian density (i.e., no bird sightings, due to zero survey effort offshore). Among the gridboxes with positive densities, the top 20 percent with the highest densities are designated as high-density gridboxes. Thus, the number of high-density gridboxes generally decreases as the number of gridboxes with zero densities increases.

Table 5.3-4
Identification of high-density gridboxes (quartile rank=1 or A) by month for the offshore (ship)
surveys for TOTAL BIRDS.

Grid# \ Month:	April 2009	May 2009	June 2009	Total
1	x			1
2			x	1
4	x	x		2
5	x			1
9		x	x	2
11	x			1
16			x	1
21		x	x	2
25			x	1
33			x	1
36			x	1
37			x	1
38	x		x	2
39	x			1
47	x			1
48			x	1
58			x	1
66		x		1
69	x			1
75		x		1
76	x	x		2
83			x	1
85		x	x	2
87	x			1
95		x		1
97	x	x		2
102		x		1
106		x		1
108	x			1
111		x		1
113	x	x	x	3
116		x		1
121		x		1
126	x	x	x	3
135		x		1
139			x	1
145		x	x	2

Table 5.3-4 (continued)
Identification of high-density gridboxes (quartile rank=1 or A) by month for the offshore (ship) surveys for TOTAL BIRDS.

Grid# \ Month:	April 2009	May 2009	June 2009	Total
147			x	1
149		x		1
154		x		1
160		x		1
161			x	1
162		x		1
168			x	1
169			x	1
171		x	x	2
172		x		1
177			x	1
179			x	1
189			x	1
191			x	1
194		x		1
197			x	1
204			x	1
206		x		1
212		x		1
220		x		1
242	x	x		2
244	x			1
Total	16	29	28	73

Table 5.3-5
Identification of high-density gridboxes (quartile rank=1 or A) by month for the coastal (boat) surveys for TOTAL BIRDS.

Grid# \ Month:	April 2009	May 2009	June 2009	Total
30	x			1
47	x		x	2
222			x	1
224			x	1
225			x	1
237		x		1
240	x			1
241	x			1
242	x			1
244	x	x		2
246		x		1
247	x	x	x	3
248		x	x	2
249		x		1
Total	7	6	6	19

5.4 RADAR SURVEYS

5.4.1 Data Collection

The liftboat accident in October 2008 resulted in the owner operating under additional wind, wave, and weather forecast guidelines established by the U.S. Coast Guard. The daily rate for the liftboat also increased significantly. For this reason, there were no boat-based radar surveys scheduled for April or June 2009. There were 20 days of boat-based radar surveys scheduled for May 2009. Given that only 20 days of survey scheduled, it was decided to concentrate the surveys on Grids 16 and 22 only.

The Mobile Avian Radar System (MARS®) was loaded on the liftboat in New York harbor on 02 May. The liftboat transited to Atlantic City on 03 May, at which time the radar system was made ready for deployment at the first suitable weather window. Due to weather conditions and forecasts which did not fall within the new operating guidelines, surveys were only conducted at Grid 16 during the night of 11-12 May, and at Grid 22 during the night of 12-13 May (**Figure 5.4-1**). Two groundtruthing events were also conducted from the liftboat on 11 and 12 May.

On 13 May, the liftboat had to return to Atlantic City as a result of an inclement weather forecast for the next several days. Less than 48 hours of radar data were able to be collected during the previous 10 days, and the next several days were also forecast to be worse than allowed by the new operating guidelines. For these reasons, the liftboat-based platform was determined to no longer be effective and the remainder of the boat-based radar surveys were canceled. The liftboat returned to New York Harbor on 13 May and MARS® was removed 15 May.

The land-based MARS® was deployed to Island Beach State Park, New Jersey, from 14 March to 09 April. The system was then deployed to the Brigantine Beach location from 09 April to 06 May. The land-based system was deployed last to the Sea Isle City site from 07 May to 02 June.

Groundtruthing surveys of the land-based coastal avian radar were conducted at Island Beach State Park on 25 March. Groundtruthing surveys were conducted at Brigantine Beach on 10, 23, and 28 April. For Sea Isle City, groundtruthing surveys were conducted on 11, 12, 13, and 30 May; and 01 June.

5.4.2 Data Analysis

The radar and groundtruthing data are currently being processed and analyzed at GMI's Plano, Texas, office.

5.5 THERMAL SURVEYS

5.5.1 Data Collection

For the liftboat-based thermal system, recording was conducted at Grid 16 for approximately 10 hrs over the night of 11-12 May, and at Grid 22 for approximately 8 hours over the night of 12-13 May.

For the land-based system, recording was conducted at Island Beach State Park on 21, 22, and 27 March.

5.5.2 Data Analysis

The thermal imaging data are currently being analyzed.

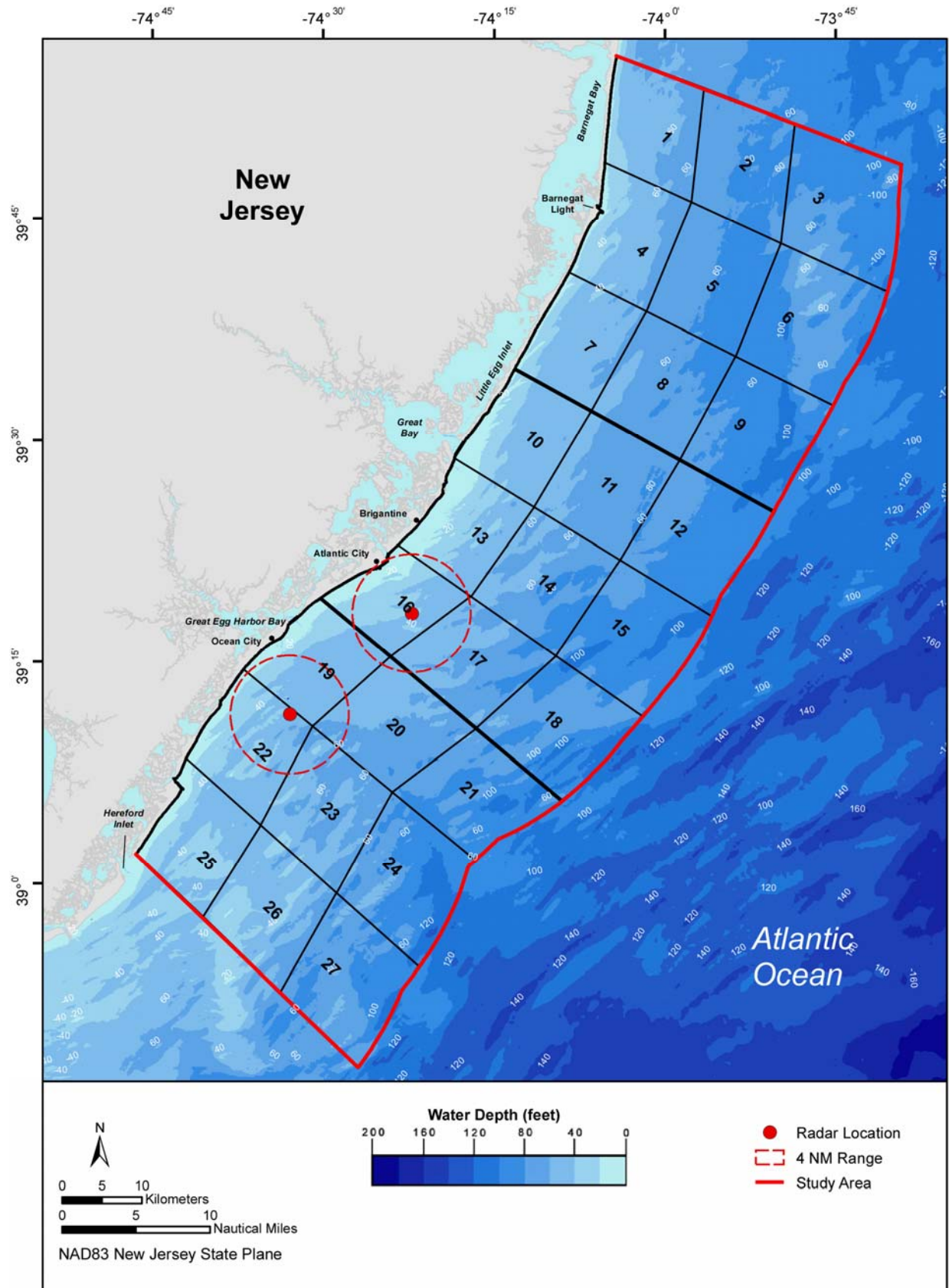


Figure 5.4-1. Radar Grid and Site Locations for May 2009.

5.6 ACOUSTIC SURVEYS

This report presents an update on deployment and recovery activity for March 2009 and June 2009. Details regarding the status of data processing and analyses are also included for the duration of the project.

5.6.1 *March 2009 - Pop-Up Recovery Update*

5.6.1.1 Pop-up 134

Diagnostics to investigate why PU134's acoustic burn release functioned slower than expected are ongoing by technicians at the Bioacoustics Research Program (BRP), Cornell Lab of Ornithology. The unit's grounding rod was coated with magnesium hydroxide, a non-conductive substance, which is the likely root cause for lack of conductivity for the burn unit to facilitate a swift release from the unit's anchor. The source of the magnesium hydroxide is unknown. The other deployed units (during the course of this study) have not presented this substance to the degree identified on PU134.

5.6.1.2 Pop-up 202

This unit responded acoustically to hello and burn signals but did not pop to the surface during the 20 March recovery trip. PU202 was still in place on 26 March when the popups for the June 2009 deployment were placed. Severe weather conditions precluded a recovery of PU202 during April. The unit was recovered by a fisherman on 07 June 2009 off Virginia Beach, Virginia. The unit is being shipped to BRP for diagnostic tests of the burn unit. Once processed, the data drive will be given to Geo-Marine staff for data processing.

5.6.2 *March 2009 - Deployment Summary*

Three pop-ups were deployed in the southern half of the array configuration (S#1, S#2, S#4) for the final deployment scheduled on this project. S#1, the southern-most station in the array was moved southeast (SE) by 5-6 miles (mi) from the original configuration plan. Pop-ups deployed at S#1 (PU002) and S#2 (PU171) were shackled to their anchors; that is, the burn unit was bypassed. The unit deployed to S#4 (PU182) had the burn unit intact.

5.6.3 *June 2009 - Recovery Summary*

Recovery of the three March-deployed pop-ups was planned for 11 June 2009. BRP received a call from three different fishermen on Monday, 8 June: PU202, PU002 and PU171 had all been found on Sunday, 07 June at three different locations. PU202, from the December (4th) 2008 deployment and which had not surfaced in March 2009 for recovery, was found floating offshore of Virginia Beach, Virginia. Both PU002 and PU171 had been shackled to their anchors but were found off New Jersey on 07 June. PU002 was found floating about 10 mi east of Cap May while PU171 was collected about 7 mi east of Beach Haven. PU002 and PU171 were retrieved on 10 June from each fisherman. PU202 will be sent from Virginia by the fisherman to BRP for diagnostics. (Names and contact information for the fishermen are available upon request.)

The last pop-up, PU182 (S#4), was recovered on 11 June 2009 by divers. The unit responded to all audio cues sent from the surface but did not return to the surface. A diver (from the Rutgers University Marine Field Station team) was sent to release the unit from its anchor connection. (A side note: this unit was readily visible on the fish-finding sonar aboard the R/V *Arabella*.)

5.6.4 *Pop-up Diagnostics*

Each of the five pop-ups recovered/deployed in March/June 2009 were subjected to system diagnostics. Each encountered different logistical problems as outlined below. PU134 was discussed above. PU202 has yet to be diagnosed; details of the examination for PU202 will be included in the next report.

5.6.4.1 Pop-ups 002 and 171

PU002 was deployed in the modified southern location (Station #1a, **Figure 5.6-1**), PU171 was deployed at the western-most coordinates for the center line of three (Station #2, **Figure 5.6-1**). Both popups came to the surface before their scheduled times and were apparently subjected to severe current, weather and environmental conditions. These conditions affected the tether between the anchors and the pop-ups and the tethers broke. These tethers had been examined previously (September 2008 single unit diver recovery) and had shown no significant wear. Winter and late spring sea/weather conditions likely caused a different stress to the tethers. While PU182's (S#4) tether had some wear, it was not to the same degree as for PU002 and PU171. Still, all future deployments will use a 1/8th stainless steel cable in double to connect each pop-up to its anchor.

PU002 was loaded with a 2-kHz sample rate and collected data as expected (see analysis section below). PU171 was loaded with a high frequency (31.25 kilohertz [kHz]) sample rate but experienced mechanical problems with one of the internal boards. Thus, PU171 did not record usable data for the duration of the deployment. During the August 2009 study extension, BRP will provide a 5th pop-up for deployment at no cost to GMI or the project budget as replacement for the loss of data from the malfunction of PU171. Specific details of the malfunction are available upon request.

5.6.4.2 Pop-up 182

Pop-up 182 was deployed at the eastern-most location for the center line of three units (Station #4, **Figure 5.6-1**) for the 5th deployment of this project. Diagnostics are ongoing in an attempt to determine why the burn unit did not function as expected: the burn time was significantly slower than expected. PU182 was loaded with a 2-kHz sample rate and collected data as expected during the deployment (see analysis section below).

5.6.5 Data Analyses/Processing

Data analysis details refer to data collected from late March 2008 through early June 2009, unless otherwise noted and for comparison purposes. Data analysis details are presented per deployment for ease of reference. Daily presence of fin whales (**Table 5.6-1**), North Atlantic right whales (**Table 5.6-2**), and delphinid species (**Table 5.6-3**) are presented for all deployments. Only presence of identified species and date of presence have been documented for these analyses. Data from each deployment are being opportunistically examined for vocalizations of species other than North Atlantic right whales, fin whales and delphinid species, as guided by survey data for other species identified during transect surveys.

5.6.5.1 March 2008 Deployment

Data from four pop-ups were collected at a 2-kHz sample rate facilitating an examination of baleen whale vocalizations that might have been made from late March 2008 through 16 June 2008. Data from each popup were examined using automated detection algorithms for Fin whale and North Atlantic right whale calls.

5.6.5.2 June 2008 Deployment

Data from four pop-ups were collected: two at a 2-kHz sample rate (continuous duty cycle) facilitating an examination of baleen whale vocalizations and two at a 31.25-kHz sample rate (5 minutes [min] on/25 min off duty cycle) facilitating an examination of toothed whale calls. The lower sample rate data have been analyzed for presence of fin and North Atlantic right whale calls using a preset data template detector in Xbat (Extensible Bioacoustic Tool) and BRP's ISRAT call detection, respectively. Results for species presence and date of presence are presented in **Tables 5.6-1** and **5.6-2**, respectively. Toothed whale (likely a dolphin species) vocalizations have been detected in the data from both high-frequency data sets (**Table 5.6-3**). Little research has been conducted to definitively identify different delphinid

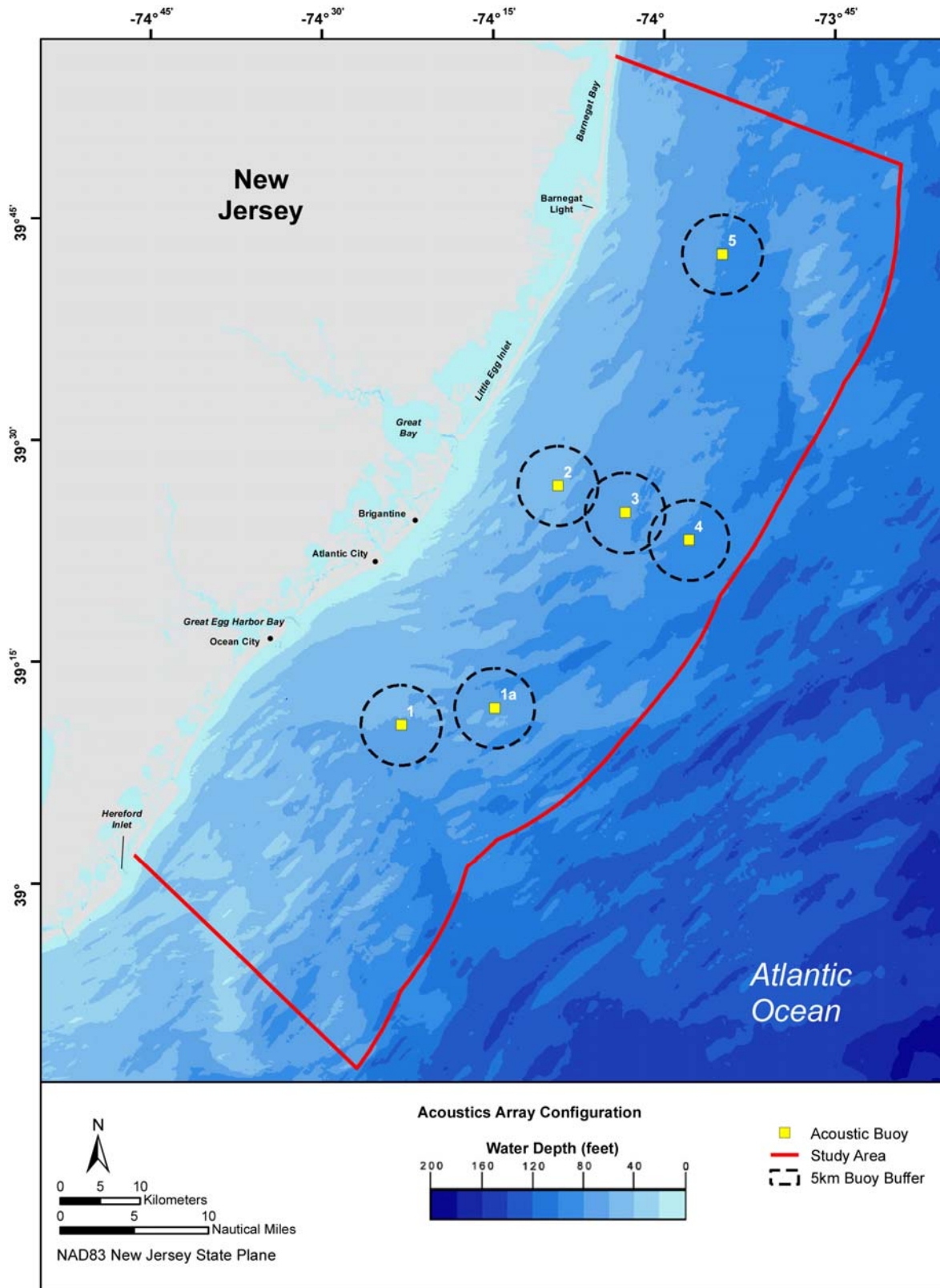


Figure 5.6-1. The array configuration for acoustic data collection with passive acoustic monitoring. The yellow squares represent a recording unit and station numbers are indicated next to each yellow square.

Table 5.6-1

Fin whale pulses detected by date and station are presented in chronological order. Pop-up ID (PU###) and Station (S#) within array configuration are provided. Dates of detection are presented per month per popup. PU179 was deployed only in December 2008, but was not recovered. Thus, this unit is not presented in the table below.

Month deployed	PU081 (S#4)	PU063 (S#3)	PU134 (S#5)	PU086 (S#2)	PU202 (S#3)	PU203 (S#5)	PU002 (S#1a)	PU171 (S#2)	PU182 (S#4)
March 2008	29 th	29 th	29 th	29 th , 30 th	Not in use	Not in use	Not in use	Not in use	Not in use
April 2008	4 th 6 th 7 th 9 th 10 th 12 th 27 th	4 th 9 th	4 th 9 th 13 th 15 th 27 th	1 st 5 th 7 th 8 th 15 th	Not in use	Not in use	Not in use	Not in use	Not in use
May 2008	19 th 20 th 21 st 22 nd 23 rd	None	2 nd	4 th 5 th 9 th 18 th 19 th 22 nd	Not in use	Not in use	Not in use	Not in use	Not in use
June 2008	4 th 10 th 11 th 15 th 16 th	2 nd 4 th	6 th 8 th 9 th 10 th 11 th 12 th 13 th 14 th 16 th 17 th 24 th – 30 th	No data	Not in use	Not in use	Not in use	Not in use	Not in use
July 2008	High frequency code	None	1 st 6 th 11 th 13 th 16 th 17 th 19 th 20 th 21 st 22 nd 26 th – 31 st	High frequency code	Not in use	Not in use	Not in use	Not in use	Not in use
August 2008	High frequency code	6 th 8 th – 14 th 18 th 19 th 24 th 28 th 31 st	1 st – 12 th 17 th 18 th 23 rd 24 th 25 th 27 th – 31 st	High frequency code	Not in use	Not in use	Not in use	Not in use	Not in use
September 2008	High frequency code	3 rd 10 th – 12 th 14 th	1 st – 4 th 6 th 7 th 12 th 13 th	High frequency code	Not in use	Not in use	Not in use	Not in use	Not in use
October 2008	Lost	Lost	Not in use	High frequency code	4 th 5 th 8 th 10 th 12 th 13 th 18 th 23 rd 27 th 28 th	19 th 27 th	Not in use	Not in use	Not in use

Table 5.6-1 (continued)

Fin whale pulses detected by date and station are presented in chronological order. Pop-up ID (PU###) and Station (S#) within array configuration are provided. Dates of detection are presented per month per popup. PU179 was deployed only in December 2008, but was not recovered. Thus, this unit is not presented in the table below.

Month deployed	PU081 (S#4)	PU063 (S#3)	PU134 (S#5)	PU086 (S#2)	PU202 (S#3)	PU203 (S#5)	PU002 (S#1a)	PU171 (S#2)	PU182 (S#4)
November 2008	lost	Lost	Not in use	High frequency code	3 rd 4 th 7 th 8 th 13 th 14 th 16 th	2 nd 14 th	Not in use	Not in use	Not in use
December 2008	lost	lost	deployed	High frequency code	1 st	1 st 2 nd	Not in use	Not in use	Not in use
January 2009	N/A	N/A	High frequency code	Lost	Analyses ongoing		Not in use	Not in use	Not in use
February 2009	N/A	N/A	High frequency code	Lost	Analyses ongoing		Not in use	Not in use	Not in use
March 2009	N/A	N/A	High frequency code	Lost	Analyses ongoing		Analyses ongoing	High frequency code	Analyses ongoing
April 2009	N/A	N/A	Not in use	N/A	maybe	N/A	Analyses ongoing	High frequency code	Analyses ongoing
May 2009	N/A	N/A	Not in use	N/A	Not in use	N/A	Analyses ongoing	High frequency code	Analyses ongoing
June 2009	N/A	N/A	Not in use	N/A	Not in use	N/A	Analyses ongoing	High frequency code	Analyses ongoing

Table 5.6-2

North Atlantic right whale calls detected by date and station are presented in chronological order. Pop-up ID (PU####) and Station (S#) within array configuration also provided. Dates of detection are presented per month per popup. PU179 was deployed only in December 2008, but was not recovered. Thus, this unit is not presented in the table below.

Month deployed	PU081 (S#4)	PU063 (S#3)	PU134 (S#5)	PU086 (S#2)	PU202 (S#3)	PU203 (S#5)	PU002 (S#1a)	PU171 (S#2)	PU182 (S#4)
March 2008	27 th 28 th 29 th	27 th 28 th	27 th	26 th 27 th 28 th	Not in use	Not in use	Not in use	Not in use	Not in use
April 2008	6 th 20 th 25 th 27 th 28 th	20 th 21 st 25 th 26 th 27 th	20 th 22 nd 26 th 27 th	1 st 2 nd 3 rd 19 th 20 th 29 th	Not in use	Not in use	Not in use	Not in use	Not in use
May 2008	5 th 6 th 15 th 17 th	2 nd 6 th 15 th 17 th	1 st 2 nd 5 th 6 th 15 th 16 th 17 th	2 nd 3 rd 6 th 10 th 11 th 15 th 21 st 22 nd 28 th 29 th	Not in use	Not in use	Not in use	Not in use	Not in use
June 2008	11 th	11 th	10 th	No data	Not in use	Not in use	Not in use	Not in use	Not in use
July 2008	High frequency code	27 th ?	20 th 24 th	High frequency code	Not in use	Not in use	Not in use	Not in use	Not in use
August 2008	High frequency code	None	3 rd 5 th 24 th 28 th	High frequency code	Not in use	Not in use	Not in use	Not in use	Not in use
September 2008	High frequency code	None	14 th – 17 th	High frequency code	Not in use	Not in use	Not in use	Not in use	Not in use
October 2008	Lost	Lost	Not in use	High frequency code	None	None	Not in use	Not in use	Not in use
November 2008	Lost	Lost	Not in use	High frequency code	16 th 17 th 19 th 26 th	11 th 12 th	Not in use	Not in use	Not in use
December 2008	Lost	Lost	deployed	High frequency code	1 st	none	Not in use	Not in use	Not in use

Table 5.6-2 (continued)

North Atlantic right whale calls detected by date and station are presented in chronological order. Pop-up ID (PU####) and Station (S#) within array configuration also provided. Dates of detection are presented per month per popup. PU179 was deployed only in December 2008, but was not recovered. Thus, this unit is not presented in the table below.

Month deployed	PU081 (S#4)	PU063 (S#3)	PU134 (S#5)	PU086 (S#2)	PU202 (S#3)	PU203 (S#5)	PU002 (S#1a)	PU171 (S#2)	PU182 (S#4)
January 2009	N/A	N/A	High frequency code	High frequency code	Analyses ongoing	Lost	Not in use	Not in use	Not in use
February 2009	N/A	N/A	High frequency code	High frequency code	Analyses ongoing	Lost	Not in use	Not in use	Not in use
March 2009	N/A	N/A	High frequency code	High frequency code	Analyses ongoing	Lost	Analyses ongoing	High frequency code	Analyses ongoing
April 2009	N/A	N/A	Not in use	N/A	maybe	N/A	Analyses ongoing	High frequency code	Analyses ongoing
May 2009	N/A	N/A	Not in use	N/A	Not in use	N/A	Analyses ongoing	High frequency code	Analyses ongoing
June 2009	N/A	N/A	Not in use	N/A	Not in use	N/A	Analyses ongoing	High frequency code	Analyses ongoing

Table 5.6-3

Toothed whale calls detected by date and station are presented in chronological order. No calls identified for first deployment (26 March 08 – 17 June 08) since the sample rate was too low to detect toothed whale calls. Pop-up ID (PU####) and Station (S#) within array configuration also provided. Dates of detection are presented per month per popup. PU179 was deployed only in December 2008, but was not recovered. Thus, this unit is not presented in the table below.

Month deployed	PU081 (S#4)	PU063 (S#3)	PU134 (S#5)	PU086 (S#2)	PU202 (S#3)	PU203 (S#5)	PU002 (S#1a)	PU171 (S#2)	PU182 (S#4)
June 2008	25 th – 30 th	low frequency code	low frequency code	26 th 27 th 29 th 30 th	Not in use	Not in use	Not in use	Not in use	Not in use
July 2008	All files examined, calls present every day	low frequency code	low frequency code	1 st to 7 th , 9 th to 25 th , 27 th – 31 st	Not in use	Not in use	Not in use	Not in use	Not in use
August 2008	All files examined, calls present every day	low frequency code	low frequency code	1 st – 16 th (unit stopped early)	Not in use	Not in use	Not in use	Not in use	Not in use
September 2008	Up early, no data	low frequency code	low frequency code	none	Not in use	Not in use	Not in use	Not in use	Not in use
October 2008	lost	lost	Not in use	6 th 8 th 22 nd 24 th 30 th	low frequency code	low frequency code	Not in use	Not in use	Not in use
November 2008	lost	lost	Not in use	1 st 8 th 12 th 17 th 24 th 27 th 29 th 30 th	low frequency code	low frequency code	Not in use	Not in use	Not in use
December 2008	lost	lost	Not in use	1 st 2 nd 3 rd	low frequency code	low frequency code	Not in use	Not in use	Not in use
January 2009	N/A	N/A	Analyses ongoing	lost	low frequency code	lost	Not in use	Not in use	Not in use

Table 5.6-3 (*continued*)

Toothed whale calls detected by date and station are presented in chronological order. No calls identified for first deployment (26 March 08 – 17 June 08) since the sample rate was too low to detect toothed whale calls. Pop-up ID (PU####) and Station (S#) within array configuration also provided. Dates of detection are presented per month per popup. PU179 was deployed only in December 2008, but was not recovered. Thus, this unit is not presented in the table below.

Month deployed	PU081 (S#4)	PU063 (S#3)	PU134 (S#5)	PU086 (S#2)	PU202 (S#3)	PU203 (S#5)	PU002 (S#1a)	PU171 (S#2)	PU182 (S#4)
February 2009	N/A	N/A	Analyses ongoing	lost	low frequency code	lost	Not in use	Not in use	Not in use
March 2009	N/A	N/A	Analyses ongoing	lost	low frequency code	lost	low frequency code	System error	low frequency code
April 2009	N/A	N/A	Not in use	N/A	low frequency code	N/A	low frequency code	System error	low frequency code
May 2009	N/A	N/A	Not in use	N/A	Not in use	N/A	low frequency code	System error	low frequency code
June 2009	N/A	N/A	Not in use	N/A	Not in use	N/A	low frequency code	System error	low frequency code

species via frequency-modulated (FM) or amplitude-modulated (AM) calls alone; thus, identification to species based on call detection has been reserved although survey data suggest these calls to be from either bottlenose dolphins or common dolphins. Whistles, squawks, chirps, clicks, whines, brays, pops, and claps were all detected from various days of recordings.

5.6.5.3 September 2008 Deployment

Data from three pop-ups were collected: two at a 2-kHz sample rate (continuous duty cycle) for baleen whale vocalizations and one at a 31.25-kHz sample rate (5 min on/25 min off duty cycle) for toothed whale calls. The lower sample rate data have been analyzed for presence of fin and North Atlantic right whale calls using a preset data template detector in Xbat and BRP's ISRAT call detection, respectively. Results for species presence and date of presence are presented in **Tables 5.6-1** and **5.6-2**, respectively. Toothed whale (likely a dolphin species) vocalizations have been detected in the data from the high-frequency data set (**Table 5.6-3**), though fewer days presented delphinid calls for this third deployment as compared with the second (summer) deployment. A resident group of bottlenose dolphins frequents the waters of the New Jersey coastline during the summer months (Brown 2007), suggesting that these calls are likely from bottlenose dolphins.

5.6.5.4 December 2008 Deployment

Data from two popups were recovered, though much later than planned (in June 2009 as opposed to the March recovery dates, see explanation above). Data from two pop-ups have been extracted: one at the high frequency (31.25 kHz) sample rate and one at the low frequency (2 kHz) sample rate. Hard drives with the data were retrieved from BRP, Ithaca, New York, on 23 June 2009; analyses of these data are ongoing. Preliminary comments are available in **Tables 5.6-1** to **5.6-3**.

5.6.5.5 March 2009 Deployment

Three pop-ups were deployed and recovered; however, data from the high frequency unit were not recorded with proper gain to facilitate analysis. Thus, only data from two pop-ups (PU002, PU182), both with the 2-kHz sample rate, are available for analysis. These analyses are ongoing (preliminary comments available in **Tables 5.6-1** and **5.6-2**).

Sample sound files (.wav or mp3) are available on request for any listed sound type (e.g., North Atlantic right whale, fin whale, or delphinid calls).

5.7 OCEANOGRAPHIC SURVEYS

Surface Mapping System (SMS), Conductivity-Temperature-Depth (CTD), and Acoustic Doppler Current Profiler (ADCP) measurements were conducted at point locations in the NJDEP Study Area off the coast of New Jersey during the second quarter (April-June) of 2009 (**Figures 5.7-1** through **5.7-4**).

5.7.1 Surface Mapping System (SMS)

For the SMS, measured static parameters include the measurement date and time, water depth (feet or meter), and lon-lat location. Measured climatic parameters include wind speed (kts), wind direction (degree), air temperature (degrees Celsius [°C]), relative humidity (percent), and atmospheric barometric pressure (millibars [mbar]). Measured dynamic oceanographic parameters include water (sea surface) temperature (SST, °C), salinity (practical salinity units [psu]), fluorometric chlorophyll and colored dissolved organic matter (CDOM; Turner raw), and photosynthetically active radiation (PAR; quanta per second [quanta/s⁻¹]). Turner units are a spectral measurement of fluorescent material in the water at specific wavelengths. Chlorophyll has an absorption peak in the blue spectral region (440 nanometers [nm]) and a strong fluorescent peak at red wavelengths (670 nm), whereas CDOM absorbs strongly in the blue region (412 nm) and has a broad fluorescent peak at green-yellow wavelengths (530 nm).

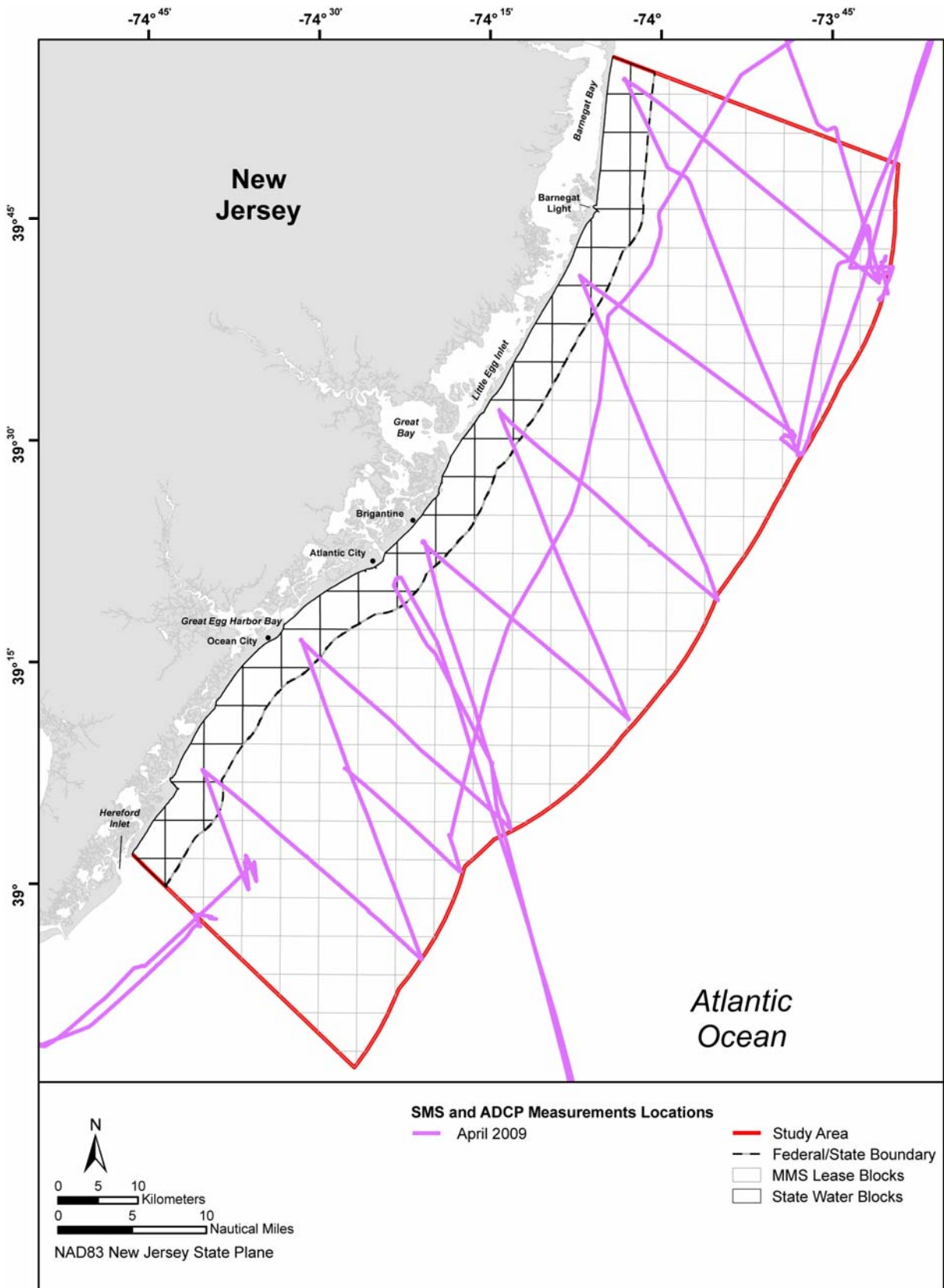


Figure 5.7-1. SMS and ADCP Measurements Conducted during Shipboard Surveys in the NJDEP Study Area off the Coast of New Jersey in April 2009.

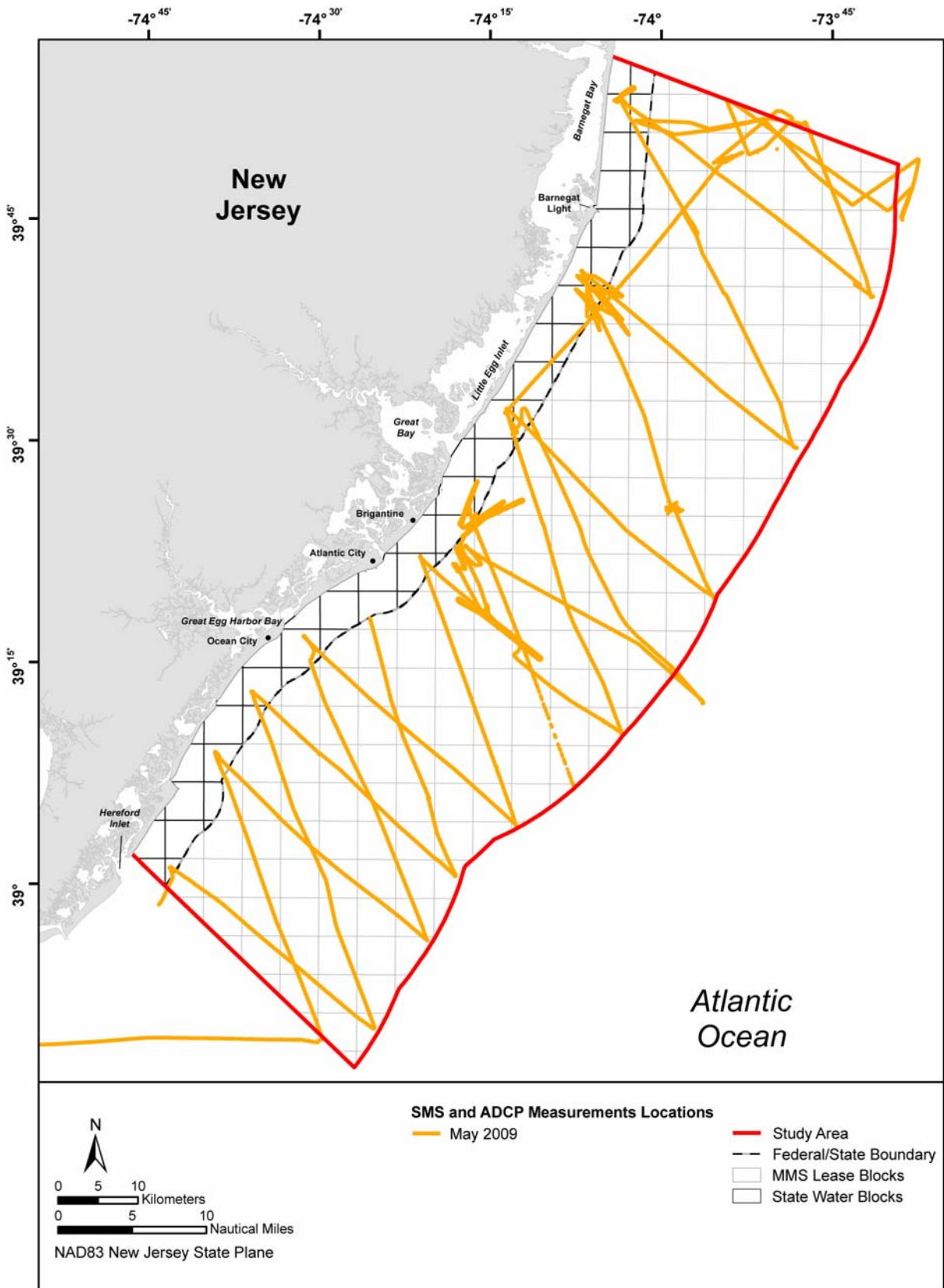


Figure 5.7-2. SMS and ADCP Measurements Conducted during Shipboard Surveys in the NJDEP Study Area off the Coast of New Jersey in May 2009.

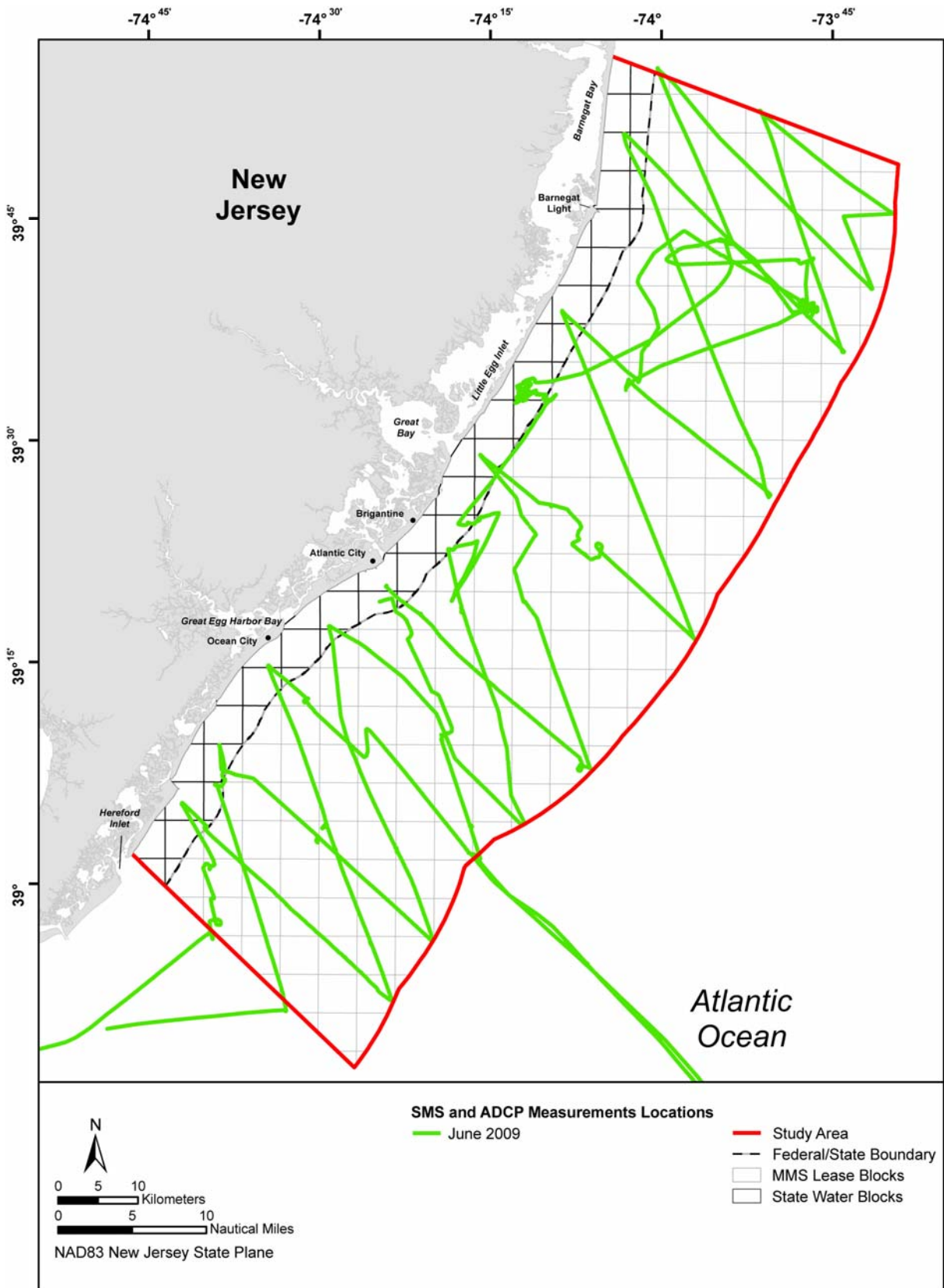


Figure 5.7-3. SMS and ADCP Measurements Conducted during Shipboard Surveys in the NJDEP Study Area off the Coast of New Jersey in June 2009.

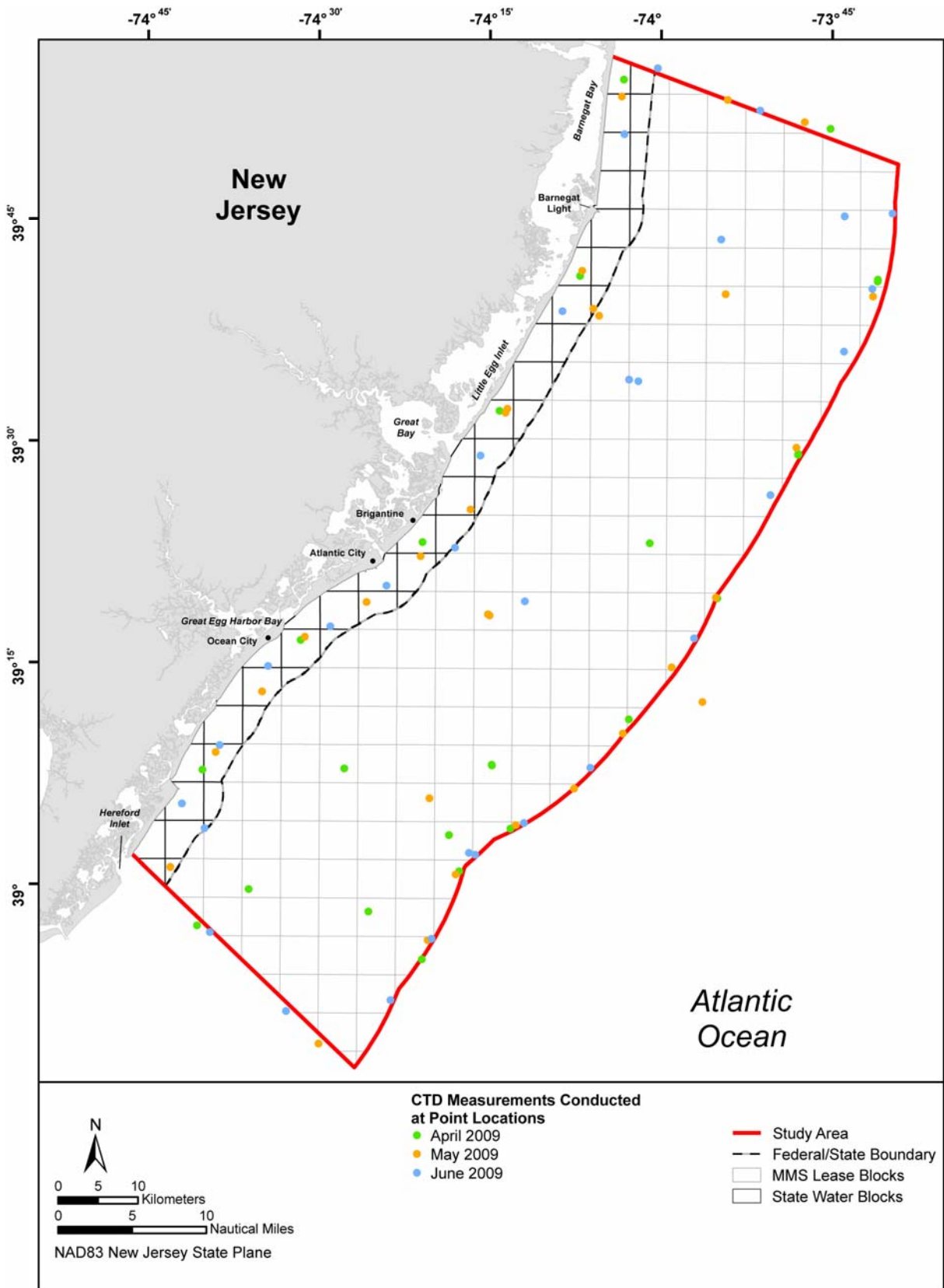


Figure 5.7-4. CTD Measurements Conducted at Point Locations in the NJDEP Study Area off the Coast of New Jersey from April through June 2009.

The PAR is measured with a PRR-600 light meter (spectral photometer) and is calculated from the spectral integration of light intensity measured at the following wavelengths: 443, 490, 510, 555, and 656 nm (spectral units: microwatts [μW] per square centimeter [cm^{-2}] per nm^{-1}).

These SMS measurements were conducted and recorded every 10 s on the following dates:

- April 2009: 3:15 PM on 4-6 through 11:30 PM on 4-10.
- May 2009: 12:00 AM on 5-2 through 11:47 PM on 5-6.
- June 2009: 7:00 AM on 6-2 through 9:39 PM on 6-6.

Data values of these parameters for each 10-s interval were written to text files (“yymmddhh.txt”), and separate text files were generated for each hour (“hh”) of data collection. For example, data collected during the 15th hour on 06 April 2009 were recorded to the text file “09040615.txt”.

5.7.2 Conductivity-Temperature-Depth (CTD) Measurements

In addition to water surface properties, water depth profiles (extending from the surface down to a depth corresponding to 30 decibels [dB] pressure) were generated for water temperature ($^{\circ}\text{C}$), salinity (psu), dissolved oxygen (milligrams per liter [mg/L]), and conductivity (voltage) using CTD instruments. Depth profiles of these four parameters were combined into a single plot for each set of measurements. Graphical plots of these depth profiles were saved as Excel files “CTDxxx.cnv” (where “xxx” = site number: “001”, “002”, etc.). Other CTD data files that were generated include BL files (“*.bl”), CON files (“*.con”), HDR files (“*.hdr”), HEX files (“*.hex”), ROS files (“*.ros”), and WMF Image files (“*.wmf”). The CON files contain the sensor calibrations: Voltage: 0 = fluorometer (Wetlabs ECO), 1=transmissometer, 2=oxygen (SEB 43), 3=free, 4=transmissometer (C-Star), 5=free, 6=altimeter, 7=free.

The CTD measurements were conducted at 24 sites in April, 32 sites in May, and 31 sites in June. The enclosed map shows the lon-lat locations of the sites of the CTD casts at which data collection occurred. The CTD measurements were conducted on the following dates:

- April 2009 (24 sites): 4-7 through 4-10.
- May 2009 (32 sites): 5-2 through 5-6.
- June 2009 (31 sites): 6-2 through 6-5.

5.7.3 Acoustic Doppler Current Profiler (ADCP) Measurements

In addition to SMS and CTD, ADCP measurements were conducted at various site locations. The ADCP data were collected and processed using the VM-DAS or WIN-RIVER software programs. The raw ADCP data (generated in files “*.enr”) were screened for RSSI and correlated by VM-DAS or WIN-RIVER (files “*.ens”) and then bin-mapped and transformed to Earth coordinates. The single-ping ADCP data after this transformation are in the files “*.enx”. The text files “*.vmo” contain the option settings for collecting the ADCP data. The general ADCP file format “*” = “ADCPxxx_eeeeee.”, where “xxx” = sequence of data collection files (initially “001” at the beginning of the cruise, and then increases by 1 every time the system is turned on and off), and “eeeeee” = ensemble number. The additional labels “yyyymmdd” = date of ADCP pinging, and “hhmmss.ss” = time of ADCP pinging.

The ADCP measurements were conducted on the following dates and times:

April 2009:

- 4-7 (11:09:04 to 23:59:59)
- 4-8 (00:00:00 to 23:59:59)
- 4-9 (00:00:00 to 23:59:59)
- 4-10 (00:00:00 to 23:30:34)

May 2009:

- 4-30 (17:52:34 to 23:59:59)
- 5-1 (00:00:00 to 23:59:59)
- 5-2 (00:00:00 to 23:59:59)
- 5-3 (00:00:00 to 23:59:59)
- 5-4 (00:00:00 to 23:59:59)
- 5-5 (00:00:00 to 23:59:59)
- 5-6 (00:00:00 to 23:46:48)

June 2009:

- 6-1 (15:48:27 to 23:59:59)
- 6-2 (00:00:00 to 23:59:59)
- 6-3 (00:00:00 to 23:59:59)
- 6-4 (00:00:00 to 23:59:59)
- 6-5 (00:00:00 to 23:59:59)
- 6-6 (00:00:00 to 21:38:51)

6.0 INITIAL ASSESSMENT OF POTENTIAL ENVIRONMENTAL IMPACTS FROM OFFSHORE WIND POWER FACILITIES

No activity was initiated on this task during this reporting period.

7.0 REPORTING

The fourth quarterly report was presented to NJDEP on 06 April 2009. Responses to comments on the draft QAWP were prepared. The Year 1 Interim Report was submitted on 20 January 2009. Comments were received and addressed in a revised version submitted on 03 March 2009.

APPENDIX A
REVIEWED LITERATURE

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APPENDIX A-1

FISHES

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APPENDIX A-2

MARINE BIRDS

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APPENDIX A-3

MARINE MAMMALS

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APPENDIX A-4

OFFSHORE WIND FARMS

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APPENDIX A-5

SEA TURTLES

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APPENDIX B

DIGITAL DATA COMPILATION

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New Jersey Department of Environmental Protection Baseline Studies
April – June 2009 Quarterly Report

Table B-1
Digital Data Compilation from Multi-Source Data Banks

Agency	Data
NOAA National Geophysical Data Center	Bathymetry
New Jersey Department of Environmental Protection NJDEP	Earthquakes Epicentered In New Jersey
	New Jersey Tidal Benchmark Network
	Bedrock-Surface Topography of New Jersey (1:100,000-scale)
	Bedrock Outcrops of New Jersey
	Surficial Geology of New Jersey
NOAA ENC®	Electronic navigational chart
Environmental Protection Agency	Geospatial Data Download Relational Feature Class
Minerals Management Service	Baseline tangent lines and bay closing lines/points
	Preliminary Federal Outer Continental Shelf (OCS) Administrative Boundaries
	OCS block outlines
	Continental Shelf Boundary
	Submerged Lands Act boundary line
	Limit of '8(g) Zone'
	Marine Sanctuaries
	MMS Planning Area outlines
	Official Protraction Diagram
NOAA's Marine Protected Areas Center	MPA Inventory
National Pipeline Mapping System	Commercially Navigable Waterways
National Atlas	Hydrography
New Jersey Highlands Water Protection and Planning Council	Conservation Priority Areas
	Critical Habitat (Final Draft)
	Conservation Priority Areas (Final Draft)
	Critical Habitat Resource Area (Draft)
	Highlands Open Waters (Draft) - Water Bodies
	New Jersey Highlands Council Final Draft Land Use Capability
	Highlands Open Waters (Draft) - Wetlands
	New Jersey Highlands Water Protection and Planning Council
	Low Density Residential Land Use (Final Draft)
	Open Space
	Source Water Protection Area (Draft)
	Baseline Transportation & Transit (Final Draft)
NJDEP	2002 Landuse
	2002 Streams Update
	2003 Aerials
	Bald Eagle Foraging
	Beach
	Coastal Area Facilities Review Act Boundary
	Coastal Centers
	Coastal Flooding
	Counties
	Dedicated Open Space
	10-meter Digital Elevation Grid
	Emergent Wetland
	Forest
	Forested Wetland
	Grassland
	Habitat Delineation
	Historical Shorelines
	Known Contaminated Sites
	Lakes
	Landscape Project Endangered Species Habitat

Table B-1 (continued)
Digital Data Compilation from Multi-Source Data Banks

Agency	Data
NJDEP	Natural Heritage Priority Sites
	Natural Heritage Program Priority Sites
	Hydrography
	NJPDES Ground Water Discharges
	NJPDES Surface Water Discharges
	Open Space
	Place Name Locations
	Roads
	Sewer Service Status
	Shellfish Classification 2007
	Shoreline Structures
	Shoreline Type
	Soil
	South Jersey Marsh
	STORET Water Quality Monitoring Stations
	Stormwater Rule Areas Affected by 300 Foot Buffers
	Streams
	Surface Water Quality Standards
	Tidelines
	Upper Wetlands Boundary
	Urban Peregrine
	USGS Quarter Quad Index
	Water Bodies
	Water Supply Planning Areas
	Watershed Management Areas
	Watersheds
	Wetlands
NJDOT	Roadway Network.
NOAA	National Geodetic Survey's Vector Shoreline
U.S. Fish and Wildlife Service, Region 5, National Wildlife Refuge System	E.B. Forsythe National Wildlife Refuge Boundary
	Great Swamp NWR
	Cape May
	Supawna Meadows
	Walkill River NWR
Pinelands Management Areas	Pinelands Management Area Boundaries
NOAA Raster Navigational Chart	Raster Navigational Charts
U.S. Department of Agriculture, Natural Resources	Soil
USGS Coastal and Marine Geology Program	Coastal Vulnerability
	Erosion and Accretion Rates
	Geology
	Geomorphology
	Sediment Distribution