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<td>Acronym</td>
<td>Definition</td>
</tr>
<tr>
<td>---------</td>
<td>------------</td>
</tr>
<tr>
<td>°C</td>
<td>Degree(s) Celsius</td>
</tr>
<tr>
<td>µW</td>
<td>Microwatt(s)</td>
</tr>
<tr>
<td>ADCP</td>
<td>Acoustic Doppler Current Profiler</td>
</tr>
<tr>
<td>AM</td>
<td>Amplitude-modulated</td>
</tr>
<tr>
<td>ASFA</td>
<td>Aquatic Sciences and Fisheries Abstracts (Cambridge)</td>
</tr>
<tr>
<td>BRP</td>
<td>Bioacoustics Research Program</td>
</tr>
<tr>
<td>BSS</td>
<td>Beaufort Sea State</td>
</tr>
<tr>
<td>CDOM</td>
<td>Colored Dissolved Organic Matter</td>
</tr>
<tr>
<td>cm²</td>
<td>Square Centimeter(s)</td>
</tr>
<tr>
<td>CPU</td>
<td>Computer Processing Unit</td>
</tr>
<tr>
<td>CTD</td>
<td>Conductivity-Temperature-Depth</td>
</tr>
<tr>
<td>dB</td>
<td>Decibel(s)</td>
</tr>
<tr>
<td>EDT</td>
<td>Eastern Daylight Time</td>
</tr>
<tr>
<td>ESA</td>
<td>Endangered Species Act</td>
</tr>
<tr>
<td>FM</td>
<td>Frequency-modulated</td>
</tr>
<tr>
<td>ft</td>
<td>Foot(Feet)</td>
</tr>
<tr>
<td>GMI</td>
<td>Geo-Marine, Inc.</td>
</tr>
<tr>
<td>GPS</td>
<td>Global Positioning System</td>
</tr>
<tr>
<td>hr</td>
<td>Hour</td>
</tr>
<tr>
<td>kHz</td>
<td>KiloHertz</td>
</tr>
<tr>
<td>km</td>
<td>Kilometer(s)</td>
</tr>
<tr>
<td>km²</td>
<td>Square Kilometer(s)</td>
</tr>
<tr>
<td>kt</td>
<td>Knot</td>
</tr>
<tr>
<td>lon-lat</td>
<td>Longitude-Latitude</td>
</tr>
<tr>
<td>m</td>
<td>Meter(s)</td>
</tr>
<tr>
<td>MARS®</td>
<td>Mobile Avian Radar System</td>
</tr>
<tr>
<td>max</td>
<td>Maximum</td>
</tr>
<tr>
<td>mbar</td>
<td>Millibar(s)</td>
</tr>
<tr>
<td>mg/L</td>
<td>Milligram(s) per Liter</td>
</tr>
<tr>
<td>mi</td>
<td>Mile(s)</td>
</tr>
<tr>
<td>min</td>
<td>Minute(s)</td>
</tr>
<tr>
<td>MMS</td>
<td>Minerals Management Service</td>
</tr>
<tr>
<td>NJDEP</td>
<td>New Jersey Department of Environmental Protection</td>
</tr>
<tr>
<td>nm</td>
<td>Nanometer(s)</td>
</tr>
<tr>
<td>NM</td>
<td>Nautical Mile(s)</td>
</tr>
<tr>
<td>NOAA</td>
<td>National Oceanic and Atmospheric Administration</td>
</tr>
<tr>
<td>PAR</td>
<td>Photosynthetically Active Radiation</td>
</tr>
<tr>
<td>psu</td>
<td>Practical Salinity Unit(s)</td>
</tr>
<tr>
<td>PU</td>
<td>Pop-up</td>
</tr>
<tr>
<td>QAWP</td>
<td>Quality Assurance Work Plan</td>
</tr>
<tr>
<td>s</td>
<td>Second(s)</td>
</tr>
<tr>
<td>SMS</td>
<td>Surface Mapping System</td>
</tr>
<tr>
<td>SST</td>
<td>Sea Surface Temperature</td>
</tr>
<tr>
<td>U.S.</td>
<td>United States</td>
</tr>
<tr>
<td>USFWS</td>
<td>United States Fish and Wildlife Service</td>
</tr>
<tr>
<td>Xbat</td>
<td>Extensible Bioacoustic Tool</td>
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</tbody>
</table>
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 July through September 2009. Survey effort and a brief overview of survey results are presented for birds, marine mammals, sea turtles, and pinnipeds. In addition, the acoustic monitoring task is discussed. Dates for the occurrence of each field task are presented in Table 1-1.

Table 1-1

<table>
<thead>
<tr>
<th>Task</th>
<th>July</th>
<th>August</th>
<th>September</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ship Offshore Avian Survey</td>
<td>None Scheduled</td>
<td>08/01-08/05</td>
<td>08/30-09/03</td>
</tr>
<tr>
<td>Ship Offshore Mammal Survey</td>
<td>None Scheduled</td>
<td>08/01-08/05</td>
<td>08/30-09/03</td>
</tr>
<tr>
<td>Aerial Mammal Survey</td>
<td>None Scheduled</td>
<td>None Scheduled</td>
<td>None Scheduled</td>
</tr>
<tr>
<td>Coastal Avian Survey</td>
<td>None Scheduled</td>
<td>08/16</td>
<td>09/15</td>
</tr>
<tr>
<td>Radar Sites</td>
<td>Offshore</td>
<td>None Scheduled</td>
<td>None Scheduled</td>
</tr>
<tr>
<td></td>
<td>Onshore</td>
<td>None Scheduled</td>
<td>None Scheduled</td>
</tr>
<tr>
<td>Thermal Sites</td>
<td>None Scheduled</td>
<td>None Scheduled</td>
<td></td>
</tr>
<tr>
<td>Acoustic Surveys</td>
<td>None Scheduled</td>
<td>8/11: 6 pop-ups deployed</td>
<td>Data analyses</td>
</tr>
<tr>
<td>Oceanographic Surveys</td>
<td>None Scheduled</td>
<td>08/01-08/05</td>
<td>08/30-09/03</td>
</tr>
<tr>
<td>SideScan Surveys</td>
<td>None Scheduled</td>
<td>None Scheduled</td>
<td>08/30-09/03</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Categories</th>
<th>Number of References</th>
<th>Appendix</th>
</tr>
</thead>
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<tr>
<td>Fishes</td>
<td>334</td>
<td>A-1</td>
</tr>
<tr>
<td>Marine Birds</td>
<td>330</td>
<td>A-2</td>
</tr>
<tr>
<td>Marine Mammals</td>
<td>766</td>
<td>A-3</td>
</tr>
<tr>
<td>Offshore Wind Farms</td>
<td>161</td>
<td>A-4</td>
</tr>
<tr>
<td>Sea Turtles</td>
<td>247</td>
<td>A-5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1838</strong></td>
<td></td>
</tr>
</tbody>
</table>

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. 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 which is presented in Appendix B. These data are currently under review for applicability for this project.

### 4.0 AVIAN PREDICTIVE/PROBABILITY MODEL

No modeling meetings were conducted in July, August, or September. The next meetings are scheduled for 01 October and 21 October. Internal work on the avian predictive modeling continued during this period. In addition, new versions of the kernel density maps were developed for August and September. Examples of these revised figures are shown in Figures 4-1 and 4-2. During the next quarter, GMI will compile both the offshore and coastal data into a consolidated dataset in order to project the total kernel density information on a single map.
Figure 4-1. Example of the spatial distribution of total bird density for offshore surveys during August 2009.
Figure 4-2. Example of the spatial distribution of total bird density for coastal surveys during August 2009.
5.0 BASELINE SURVEYS

5.1 SHIPBOARD OFFSHORE SURVEYS

5.1.1 Avian

This section reports on the survey effort and survey results for the scheduled monthly avian shipboard surveys. In addition, supplemental avian shipboard surveys were conducted monthly to collect avian data from transects missed during the scheduled avian shipboard surveys and to supplement the lack of offshore radar data. The survey effort and survey results for the supplemental surveys are currently being analyzed and will be reported in the Final Report.

5.1.1.1 Survey Effort

Shipboard avian surveys for August and September 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. Since the project extension did not begin until August, a July 2009 survey was not conducted. Additionally, the survey listed under September 2009 actually began on 30 August 2009.

5.1.1.1.1 August 2009

Shipboard avian surveys were conducted from 01 to 05 August 2009. Effort was delayed for a couple hours on 02 August due to thunderstorms and briefly on 03 August due to thick patches of fog that hindered visibility. The ship transects covered 537.28 nautical miles (NM; 995.04 kilometers [km]; Figure 5.1-1) and on-effort survey time totaled 56.65 hours (hrs).

5.1.1.1.2 September 2009

Shipboard avian surveys were conducted from 30 August to 03 September 2009. During this entire survey, we experienced unusually rough weather consisting of Beaufort Sea State (BSS) 4-6 and large swells (4-7 feet [ft] high). Therefore, several delays occurred while waiting for winds to minimize the sea state to a BSS of 5 or less and swells to 5 ft or less. The ship transects covered 448.71 NM (831.01 km; Figure 5.1-2), and on-effort survey time totaled 47.24 hrs.

5.1.1.2 Survey Results

5.1.1.2.1 Avian species occurrence

All 41 avian species observed during the August and September 2009 offshore surveys are listed in Table 5.1-1. Of these, 30 were sighted in August 2009 and 27 in September 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).

Four 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 summer 2009 offshore surveys: Red-throated Loon in August, Greater Shearwater in August and September, Whimbrel in August and September, and Semipalmated Sandpiper in September (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 summer 2009 offshore surveys. Osprey, listed as threatened as a breeder, was recorded in August and September. Sanderling, listed as special concern as a non-breeder, was recorded in August. Semipalmated Sandpiper, listed as special concern as a non-breeder, was recorded in September. Common Tern, listed as a special concern species as a breeder, was recorded in August and September. Yellow-breasted Chat, listed as special concern as a breeder, was recorded in September (Table 5.1-1).
Figure 5.1-1. Avian offshore and coastal survey effort for the New Jersey Study Area in August 2009.
Figure 5.1-2. Avian offshore and coastal survey effort in the New Jersey Study Area in September 2009.
Table 5.1-1
Avian species observed during the August and September 2009 shipboard offshore surveys.\(^1\)

<table>
<thead>
<tr>
<th>Family</th>
<th>Common Name, Scientific name</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>August</td>
</tr>
<tr>
<td>Gaviidae (loons)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Red-throated Loon, <em>Gavia stellata</em></td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Common Loon, <em>Gavia immer</em></td>
<td>X</td>
</tr>
<tr>
<td>Procellariidae (petrels and shearwaters)</td>
<td>Cory’s Shearwater, <em>Calonectris diomedea</em></td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Greater Shearwater, <em>Puffinus gravis</em></td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Sooty Shearwater, <em>Puffinus griseus</em></td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Manx Shearwater, <em>Puffinus puffinus</em></td>
<td>X</td>
</tr>
<tr>
<td>Procellariidae (petrels and shearwaters)</td>
<td>Greater Shearwater, <em>Puffinus gravis</em></td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Sooty Shearwater, <em>Puffinus griseus</em></td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Manx Shearwater, <em>Puffinus puffinus</em></td>
<td>X</td>
</tr>
<tr>
<td>Sulidae (gannets)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Northern Gannet, <em>Morus bassanus</em></td>
<td>X</td>
</tr>
<tr>
<td>Pelecanidae (pelicans)</td>
<td>Brown Pelican, <em>Pelecanus occidentalis</em></td>
<td>X</td>
</tr>
<tr>
<td>Phalacrocoracidae (cormorants)</td>
<td>Double-crested Cormorant, <em>Phalacrocorax auritus</em></td>
<td>X</td>
</tr>
<tr>
<td>Sulidae (gannets)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Northern Gannet, <em>Morus bassanus</em></td>
<td>X</td>
</tr>
<tr>
<td>Ardeidae (egrets and herons)</td>
<td>Snowy Egret, <em>Egretta thula</em></td>
<td>X</td>
</tr>
<tr>
<td>Accipitridae (eagles and hawks)</td>
<td>Osprey, <em>Pandion haliaetus</em></td>
<td>X</td>
</tr>
<tr>
<td>Scolopacidae (sandpipers)</td>
<td>Willet, <em>Tringa semipalmata</em></td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Whimbrel, <em>Numenius phaeopus</em></td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Ruddy Turnstone, <em>Arenaria interpres</em></td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Sanderling, <em>Calidris alba</em></td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Least Sandpiper, <em>Calidris minutilla</em></td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Pectoral Sandpiper, <em>Calidris melanotos</em></td>
<td>X</td>
</tr>
<tr>
<td>Laridae (gulls and terns)</td>
<td>Laughing Gull, <em>Leucophaeus atricilla</em></td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Ring-billed Gull, <em>Larus delawarensis</em></td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Herring Gull, <em>Larus argentatus</em></td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Lesser Black-backed Gull, <em>Larus fuscus</em></td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Great Black-backed Gull, <em>Larus marinus</em></td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Sabine’s Gull, <em>Xema sabini</em></td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Royal Tern, <em>Thalasseus maximus</em></td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Common Tern, <em>Sterna hirundo</em></td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Black Tern, <em>Chlidonias niger</em></td>
<td>X</td>
</tr>
<tr>
<td>Hirundinidae (swallows)</td>
<td>Tree Swallow, <em>Tachycineta bicolor</em></td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Purple Martin, <em>Progne subis</em></td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Bank Swallow, <em>Riparia riparia</em></td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Barn Swallow, <em>Hirundo rustica</em></td>
<td>X</td>
</tr>
<tr>
<td>Parulidae (wood-warblers)</td>
<td>Prothonotary Warbler, <em>Protonotaria citrea</em></td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Yellow Warbler, <em>Dendroica petechia</em></td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Yellow-breasted Chat, <em>Icteria virens</em></td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>American Redstart, <em>Setophaga ruticilla</em></td>
<td>X</td>
</tr>
<tr>
<td>Icteridae (blackbirds, meadowlarks and orioles)</td>
<td>Brown-headed Cowbird, <em>Molothrus ater</em></td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Baltimore Oriole, <em>Icterus galbula</em></td>
<td>X</td>
</tr>
</tbody>
</table>

\(^1\) All birds identified to species during avian surveys are included (in-zone and out-zone).
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 from the beam forward) observed on the offshore surveys declined from August (0.79) to September (0.63) (Table 5.1-2). These abundance values are the lowest obtained during the course of the project and are only 27 and 60 percent, respectively, of the abundance values during these months in 2008. This difference was driven largely by a significant decrease in Laughing Gull numbers relative to the same period in 2008. Additionally, Laughing Gull numbers accounted for a substantial proportion of the drop in abundance from August 2009 to September 2009, with a decrease in shearwater numbers accounting for much of the rest of the decline in that time period (Table 5.1-2).

The five most numerous species for each month of offshore transects are presented in Table 5.1-3. Wilson’s Storm-Petrel (0.32/km and 0.31/km, respectively) and Laughing Gull (0.18, 0.15), in that order, were the most numerous species for both months, with Great Black-backed Gull (0.06, 0.04) and Common Tern (0.08, 0.03) as third- and fourth-most numerous, though switching places between the two months. Cory’s Shearwater was the fifth-most numerous species in August (0.05) while Herring Gull replaced it in September (0.03).

5.1.1.2.3 Avian density

Methods

High-density grid boxes were identified based on a ranking procedure, in which the individual grid boxes with non-zero densities (i.e., those grid boxes with at least one bird sighting) were ranked in the order of highest to lowest total density.

This procedure was conducted for all birds for each individual month (August and September 2009) for both the offshore ship surveys, using the MMS grid system of 249 grid boxes that are defined on a regular longitude-latitude (lon-lat) grid system that encompasses the entire survey area off the New Jersey coast. Each square grid box is defined by a maximum (max) and minimum (min) longitude and a max-min latitude. The area of each grid box (square kilometers [km²]) 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 grid box as well as temporally according to month. After all bird counts are binned according to month and grid box, the number of bird counts within each grid box for each month is summed to yield a total bird count, which is then divided by the area of the specific grid box to yield total monthly bird density.

To identify high avian density grid boxes in the Study Area, an alphabetic letter-ranked system (A-F) is used. Rank A is designated as the highest avian density and Rank E is designated as the lowest non-zero density. For each month the zero-density grid boxes are identified and automatically assigned a rank of “F”. The percentile density ranges for each rank are: Rank A: 80-100 percent; Rank B: 60-79 percent; Rank C: 40-59 percent; Rank D: 20-39 percent; Rank E: 0.01-19 percent.

The above procedure is repeated for each month (July-September 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 grid boxes encompassing the survey area are generated, with the ranks of A, B, C, D, E, represented by a progression from darkest to lightest shades of green, and F represented by white. Each of the 249 grid boxes is assigned the appropriate color according to its ranking. By definition, high-density grid boxes are identified by the dark green grid boxes (which are ranked “A”, corresponding to densities in the 80-100 percentile).
### Table 5.1-2

<table>
<thead>
<tr>
<th>Family</th>
<th>August 2009</th>
<th>September 2009</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. 1</td>
<td>Abun. %</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>765</td>
<td>0.79</td>
</tr>
<tr>
<td><strong>Gaviidae</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Common Loon, <em>Gavia immer</em></td>
<td>1</td>
<td>0.00</td>
</tr>
<tr>
<td>Gaviidae (loons)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Procellariidae</td>
<td>54</td>
<td>0.06</td>
</tr>
<tr>
<td>Cory’s Shearwater, <em>Calonectris diomedea</em></td>
<td>47</td>
<td>0.05</td>
</tr>
<tr>
<td>Greater Shearwater, <em>Puffinus gravis</em></td>
<td>5</td>
<td>0.01</td>
</tr>
<tr>
<td>Sooty Shearwater, <em>Puffinus griseus</em></td>
<td>1</td>
<td>0.00</td>
</tr>
<tr>
<td>Manx Shearwater, <em>Puffinus puffinus</em></td>
<td>1</td>
<td>0.00</td>
</tr>
<tr>
<td>Hydrobatidae (storm-petrels)</td>
<td>300</td>
<td>0.32</td>
</tr>
<tr>
<td>Wilson’s Storm-Petrel, <em>Oceanites oceanicus</em></td>
<td>299</td>
<td>0.32</td>
</tr>
<tr>
<td>Storm-Petrel (unknown)</td>
<td>1</td>
<td>0.00</td>
</tr>
<tr>
<td>Sulidae (gannets)</td>
<td>8</td>
<td>0.01</td>
</tr>
<tr>
<td>Northern Gannet, <em>Morus bassanus</em></td>
<td>8</td>
<td>0.01</td>
</tr>
<tr>
<td>Pelecanidae (pelicans)</td>
<td>2</td>
<td>0.00</td>
</tr>
<tr>
<td>Brown Pelican, <em>Pelecanus occidentalis</em></td>
<td>2</td>
<td>0.00</td>
</tr>
<tr>
<td>Phalacrocoracidae (cormorants)</td>
<td>11</td>
<td>0.01</td>
</tr>
<tr>
<td>Scolopacidae (sandpipers)</td>
<td>15</td>
<td>0.00</td>
</tr>
<tr>
<td>Whimbrel, <em>Numenius phaeopus</em></td>
<td>2</td>
<td>0.00</td>
</tr>
<tr>
<td>Ruddy Turnstone, * Arenaria interpres*</td>
<td>1</td>
<td>0.00</td>
</tr>
<tr>
<td>Sanderling, <em>Calidris alba</em></td>
<td>3</td>
<td>0.00</td>
</tr>
<tr>
<td>Semipalmated Sandpiper, <em>Calidris pusilla</em></td>
<td>3</td>
<td>0.00</td>
</tr>
<tr>
<td>Least Sandpiper, <em>Calidris minitlua</em></td>
<td>3</td>
<td>0.00</td>
</tr>
<tr>
<td>Pectoral Sandpiper, <em>Calidris melanoctos</em></td>
<td>1</td>
<td>0.00</td>
</tr>
<tr>
<td>Red-necked Phalarope, <em>Phalaropus lobatus</em></td>
<td>11</td>
<td>0.00</td>
</tr>
<tr>
<td>Red Phalarope, <em>Phalaropus fulicarius</em></td>
<td>3</td>
<td>0.00</td>
</tr>
<tr>
<td>Shorebird, small (unknown)</td>
<td>2</td>
<td>0.00</td>
</tr>
<tr>
<td>Peep (unknown)</td>
<td>1</td>
<td>0.00</td>
</tr>
<tr>
<td>Laridae (gulls and terns)</td>
<td>314</td>
<td>0.33</td>
</tr>
<tr>
<td>Laughing Gull, <em>Leucophaeus atricilla</em></td>
<td>170</td>
<td>0.18</td>
</tr>
<tr>
<td>Ring-billed Gull, <em>Larus delawarensis</em></td>
<td>2</td>
<td>0.00</td>
</tr>
<tr>
<td>Herring Gull, <em>Larus argentatus</em></td>
<td>4</td>
<td>0.00</td>
</tr>
<tr>
<td>Lesser Black-backed Gull, <em>Larus fuscus</em></td>
<td>1</td>
<td>0.00</td>
</tr>
<tr>
<td>Great Black-backed Gull, <em>Larus marinus</em></td>
<td>53</td>
<td>0.06</td>
</tr>
<tr>
<td>Royal Tern, <em>Thalasseus maximus</em></td>
<td>6</td>
<td>0.01</td>
</tr>
<tr>
<td>Common Tern, <em>Sterna hirundo</em></td>
<td>77</td>
<td>0.08</td>
</tr>
<tr>
<td>Black Tern, <em>Chlidonias niger</em></td>
<td>6</td>
<td>0.01</td>
</tr>
<tr>
<td>Tern, small (unknown)</td>
<td>9</td>
<td>0.01</td>
</tr>
<tr>
<td>Hirundinidae (swallows)</td>
<td>68</td>
<td>0.07</td>
</tr>
<tr>
<td>Tree Swallow, <em>Tachycineta bicolor</em></td>
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<td>0.00</td>
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<tr>
<td>Purple Martin, <em>Progne subis</em></td>
<td>22</td>
<td>0.02</td>
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<tr>
<td>Bank Swallow, <em>Riparia riparia</em></td>
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<td>0.00</td>
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<tr>
<td>Barn Swallow, <em>Hirundo rustica</em></td>
<td>43</td>
<td>0.05</td>
</tr>
<tr>
<td>Parulidae (wood-warblers)</td>
<td>2</td>
<td>0.00</td>
</tr>
<tr>
<td>Yellow Warbler, <em>Dendroica petechia</em></td>
<td>2</td>
<td>0.00</td>
</tr>
<tr>
<td>Yellow-breasted Chat, <em>Icteria virens</em></td>
<td>1</td>
<td>0.00</td>
</tr>
<tr>
<td>American Redstart, <em>Setophaga ruticilla</em></td>
<td>1</td>
<td>0.00</td>
</tr>
<tr>
<td>Warbler (unknown)</td>
<td>1</td>
<td>0.00</td>
</tr>
<tr>
<td>Icteridae (blackbirds, meadowlarks and orioles)</td>
<td>1</td>
<td>0.00</td>
</tr>
<tr>
<td>Brown-headed Cowbird, <em>Molothrus ater</em></td>
<td>1</td>
<td>0.00</td>
</tr>
<tr>
<td>Baltimore Oriole, <em>Icterus galbula</em></td>
<td>1</td>
<td>0.00</td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
<td>0.00</td>
</tr>
<tr>
<td>Passerine (unknown)</td>
<td>3</td>
<td>0.00</td>
</tr>
</tbody>
</table>

1. Includes avian observations within the 300-m x 300-m survey strip transect when the ship was traveling ≥7 knots (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 August and September 2009 shipboard offshore transect surveys.

<table>
<thead>
<tr>
<th>Common Name</th>
<th>August 2009 Shipboard Offshore In-zone¹</th>
<th>Abundance²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wilson’s Storm-Petrel</td>
<td>299</td>
<td>0.32</td>
</tr>
<tr>
<td>Laughing Gull</td>
<td>170</td>
<td>0.18</td>
</tr>
<tr>
<td>Common Tern</td>
<td>77</td>
<td>0.08</td>
</tr>
<tr>
<td>Great Black-backed Gull</td>
<td>53</td>
<td>0.06</td>
</tr>
<tr>
<td>Cory’s Shearwater</td>
<td>47</td>
<td>0.05</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Common Name</th>
<th>September 2009 Shipboard Offshore In-zone¹</th>
<th>Abundance²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wilson’s Storm-Petrel</td>
<td>247</td>
<td>0.31</td>
</tr>
<tr>
<td>Laughing Gull</td>
<td>120</td>
<td>0.15</td>
</tr>
<tr>
<td>Great Black-backed Gull</td>
<td>32</td>
<td>0.04</td>
</tr>
<tr>
<td>Common Tern</td>
<td>26</td>
<td>0.03</td>
</tr>
<tr>
<td>Herring Gull</td>
<td>23</td>
<td>0.03</td>
</tr>
</tbody>
</table>

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

Results

Monthly color-coded spatial maps illustrating the 249 gridboxes ranked according to avian density are given in Figure 5.1-3 through Figure 5.1-6 for the offshore (ship) surveys (Figure 5.1-3: All-behavior birds in August; Figure 5.1-4: All-behavior birds in September; Figure 5.1-5: Sitting birds in August; Figure 5.1-6: Sitting birds in September). The gridboxes depicted in dark green (indicating avian densities from 80 to 100 percent 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.

Offshore (ship) surveys showed a highly scattered spatial distribution of high-density (dark green) gridboxes for both all-behavior and sitting birds, in both August and September 2009 (Figure 5.1-3 through Figure 5.1-6). There were generally a greater number of observations in August than in September (see Section 5.1.1.2.2), as indicated by a higher number of colored gridboxes in August than in September. Among regions where sightings occurred (non-white gridboxes), high-density (dark green) gridboxes were highly interspersed with medium-density (medium green) and low-density (light green) gridboxes in the northern, central, and southern regions of the Study Area, with adjacent dark green and light green gridboxes indicating sharp local spatial gradients in abundance. For all-behavior birds, there were 29 high-density gridboxes in August (Figure 5.1-3) and 14 in September (Figure 5.1-4). Only 3 gridboxes (#6101 at the northern boundary of the Study Area, and #6252 and #6303 in the northern offshore region east of Barnegat Light) were designated as high-density (dark green) gridboxes for both of these months. For sitting birds, the number of high-density gridboxes decreased from 8 in August (Figure 5.1-5) to zero in September (Figure 5.1-6).

For all-behavior birds, sightings and abundances were scattered throughout the Study Area (from northern to southern regions) in August (Figure 5.1-3), whereas sightings were concentrated more in the northern and central regions in September (Figure 5.1-4). That is, there were relatively fewer sightings (more white gridboxes) in the southern region in September than in August. Except for the northwestern tips of gridboxes #6387 (between Little Egg Inlet and Barnegat Light) and #6586 (near Great Bay and Little Egg Inlet), no high-density gridboxes were located nearshore in August (Figure 5.1-3).
Figure 5.1-3. Total offshore bird densities (all behaviors) within the New Jersey Study Area in August 2009.
Figure 5.1-4. Total offshore bird densities (all behaviors) within the New Jersey Study Area in September 2009.
Figure 5.1-5. Total offshore bird densities (sitting) within the New Jersey Study Area in August 2009.
Figure 5.1-6. Total offshore bird densities (sitting) within the New Jersey Study Area in September 2009.
Likewise, in September, portions of only 2 high-density gridboxes (#6288 adjacent to Barnegat Light, and #6436 north of Little Egg Inlet) were located nearshore (Figure 5.1-4).

For sitting birds, the 8 sitting-bird high-density gridboxes in August were scattered from the northern through to the southern regions, and were mainly located midshore to offshore (Figure 5.1-5). Except for the northwestern tip of gridbox #6586 (near Great Bay and Little Egg Inlet), no high-density gridboxes were located nearshore. September sightings occurred in only 4 gridboxes (#6101, 6439, 6486, and 6738), located offshore and in the central and northern regions of the Study Area (Figure 5.1-6).

5.1.2 Marine Mammals and Sea Turtles

5.1.2.1 Survey Effort

Shipboard marine mammal/sea turtle survey efforts may differ from avian survey efforts due to specific differences in survey methodologies (e.g., sea state/observation requirements)

5.1.2.1.1 July 2009

No surveys were scheduled for this month.

5.1.2.1.2 August 2009

Marine mammal/sea turtle shipboard surveys were initiated on 01 August and concluded on 05 August. Effort was delayed for a couple hours on 02 August due to thunderstorms and briefly on 03 August due to thick patches of fog that hindered visibility. The survey covered 459.418 NM (850.842 km) of an on-effort trackline (Figure 5.1-7).

5.1.2.1.3 September 2009

Marine mammal/sea turtle shipboard surveys were initiated on 30 August and concluded on 03 September. During this entire survey, we experienced unusually rough weather consisting of Beaufort Sea State (BSS) 4-6 and large swells (4-7 feet [ft] high). Therefore, we had several delays in survey effort while waiting for winds to minimize to a BSS of 5 or less and swells to 5 ft or less. The survey covered 439.505 NM (813.963 km) of on-effort trackline (Figure 5.1-8).

5.1.2.2 Survey Results

Two marine mammal species and two sea turtle species were observed on the ship surveys from August through September 2009. An unidentified rorqual, whale, and dolphin and two unidentified hardshell turtles 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. Three of the four species observed are listed as threatened or endangered under the Endangered Species Act (ESA).

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

Aerial marine mammal and sea turtle surveys were discontinued for the remainder of the project.
Figure 5.1-7. Shipboard Marine Mammal/Sea Turtle Survey for August 2009.
Figure 5.1-8. Shipboard Marine Mammal/Sea Turtle Survey for September 2009.
Table 5.1-4
Summary of Marine Mammal/Sea Turtle Sightings from the Shipboard Surveys from August through September 2009.

<table>
<thead>
<tr>
<th>Common Name, Scientific Name</th>
<th>Sightings by Month*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>August</td>
</tr>
<tr>
<td>Humpback whale, <em>Megaptera novaeangliae</em>**</td>
<td>1</td>
</tr>
<tr>
<td>Unidentified rorqual (<em>Balaenoptera</em> spp.)</td>
<td>1</td>
</tr>
<tr>
<td>Unidentified whale</td>
<td>1</td>
</tr>
<tr>
<td>Bottlenose dolphin, <em>Tursiops truncatus</em></td>
<td>22</td>
</tr>
<tr>
<td>Unidentified dolphin</td>
<td>1</td>
</tr>
<tr>
<td>Loggerhead turtle, <em>Caretta caretta</em>**</td>
<td>2</td>
</tr>
<tr>
<td>Leatherback turtle, <em>Dermochelys coriacea</em>**</td>
<td>2</td>
</tr>
<tr>
<td>Unidentified hardshell turtle</td>
<td>2</td>
</tr>
</tbody>
</table>

* No surveys were conducted in July.
** 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.

5.3 SMALL BOAT COASTAL SURVEYS

5.3.1 Survey Effort

5.3.1.1 August 2009

The small-boat coastal survey was conducted on 16 August 2009, with transects covering 70.3 NM (130 km; Figure 5.1-1). Survey effort began while heading north at 0600 Eastern Daylight Time (EDT) at the southern end of the study area; the survey was completed at the north end of the study area at 1220 EDT. The total daily effort was 6.35 hrs.

5.3.1.2 September 2009

The small boat coastal survey was conducted on 15 September 2009, with transects covering 73.3 NM (136 km; Figure 5.1-2). Survey effort began while heading north at 0653 EDT at the southern end of the study area; transects were completed at the north end of the study area at 1350 EDT. The total daily effort was 6.96 hrs.

5.3.2 Survey Results

5.3.2.1 Avian Species Occurrence

All 22 avian species observed during the August and September 2009 coastal surveys are listed in Table 5.3-1. In the August survey, 16 species were recorded, while there were 18 species recorded in September.

Two federal avian species of concern for Bird Conservation Region 30 (New England/Mid-Atlantic Coast) were recorded during the summer 2009 coastal surveys: Semipalmated Sandpiper in August, and Least Tern, also in August (Table 5.3-1).

Six 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 summer 2009 coastal surveys. Osprey, listed as threatened as a breeder, was recorded in August and September. Sanderling, listed as special concern as a non-breeder, was recorded in May. Semipalmated Sandpiper, listed as special
concern as a non-breeder, was recorded in August. Least Tern, listed as endangered as a breeder, was recorded in August. Caspian Tern, listed as special concern as a breeder, was recorded in September. Common Tern, listed as special concern as a breeder, was recorded in August and September (Table 5.3-1).

Table 5.3-1
Avian species observed during the August and September 2009 small boat coastal surveys.

<table>
<thead>
<tr>
<th>Family</th>
<th>Common Name, Scientific name</th>
<th>16 August</th>
<th>15 September</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrobatidae (storm-petrels)</td>
<td>Wilson's Storm-Petrel, <em>Oceanites oceanicus</em></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Sulidae (gannets)</td>
<td>Northern Gannet, <em>Morus bassanus</em></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Pelecanidae (pelicans)</td>
<td>Brown Pelican, <em>Pelecanus occidentalis</em></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Phalacrocoracidae (cormorants)</td>
<td>Double-crested Cormorant, <em>Phalacrocorax auritus</em></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Great Cormorant, <em>Phalacrocorax carbo</em></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Ardeidae (egrets and herons)</td>
<td>Green Heron, <em>Butorides virescens</em></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Accipitridae (eagles and hawks)</td>
<td>Osprey, <em>Pandion haliaetus</em></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Falconidae (falcons)</td>
<td>Merlin, <em>Falco columbarius</em></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Charadriidae (plovers)</td>
<td>Semipalmated Plover, <em>Charadrius semipalmatus</em></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Scolopacidae (sandpipers)</td>
<td>Sanderling, <em>Calidris alba</em></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Semipalmated Sandpiper, <em>Calidris semipalmatus</em></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Laridae (gulls and terns)</td>
<td>Laughing Gull, <em>Leucophaeus atricilla</em></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Herring Gull, <em>Larus argentatus</em></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Great Black-backed Gull, <em>Larus marinus</em></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Least Tern, <em>Sternula antillarum</em></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Caspian Tern, <em>Hydroprogne caspia</em></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Common Tern, <em>Sterna hirundo</em></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Forster's Tern, <em>Sterna forsteri</em></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Sandwich Tern, <em>Thalasseus sandvicensis</em></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Royal Tern, <em>Thalasseus maximus</em></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Hirundinidae (swallows)</td>
<td>Tree Swallow, <em>Tachycineta bicolor</em></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Barn Swallow, <em>Hirundo rustica</em></td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

*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 August and September 2009 are presented in Table 5.3-2. Species diversity and overall numbers were quite similar in the two months. In the August 2009 survey, 432 individuals of 16 species were recorded, while 435 individuals of 18 species were recorded in September. As is to be expected in summer, gulls and terns dominated both the August and September totals (85 percent of all individuals for both months). In August this was due in large part to Laughing Gulls while in September 3 gull species each comprised roughly 25 percent of the monthly total.

Table 5.3-3 presents the top five most numerous species (no. birds/km) detected in each month. The most numerous species in August was Laughing Gull (2.04/km), accounting for 63 percent of all individuals recorded. The top 5 species – Laughing Gull, Great Black-backed Gull (0.44/km), Common Tern (0.22), Barn Swallow (0.17), and Herring Gull (0.09) - accounted for 88 percent of all individuals recorded in August. This marks only the second time during the course of the project when a landbird was represented in the top five (Purple Martin, another swallow species, was the fifth most numerous species in August 2008). In September numbers were more evenly distributed among all species, with the top five most numerous species accounting for 79 percent of all individuals recorded.

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 Figure 5.3-1 through 5.3-4 for the coastal (boat) surveys (Figure 5.3-1: All-behavior birds in August; Figure 5.3-2: All-behavior birds in September; Figure 5.3-3: Sitting birds in August; Figure 5.3-4: Sitting birds in September). The gridboxes depicted in dark green (indicating avian densities in the 80-100 percentile category 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.

Coastal (boat) surveys showed a northward spatial shift in high-density gridboxes between August and September for both all-behavior birds and sitting birds. For all-behavior birds, 6 high-density gridboxes were identified in both August and September (Figure 5.3-1 and Figure 5.3-2). Only 2 gridboxes (#40 just south of Atlantic City, and #51 between Ocean City and Hereford Inlet) were designated as high-density (dark green) gridboxes for both of these months. In the northern coastal portion of the Study Area (Little Egg Inlet and northward) there was only 1 high-density gridbox (#20, at Little Egg Inlet) in August (Figure 5.3-3), compared to 4 high-density gridboxes (#3, 7, 10, and 15, surrounding Barnegat Bay and Barnegat Light) in September (Figure 5.3-4). Sharp local spatial gradients in abundance were observed at various locations, as indicated by adjacent dark green and light green gridboxes.

For sitting birds, 4 high-density gridboxes were identified in both August and September (compared to 6 for the all-behavior birds), all of which were unique between the 2 months (i.e., no repeat high-density gridboxes for sitting birds) (Figure 5.3-3 and Figure 5.3-4). Like the all-behavior birds, sitting birds showed a northward shift in high-density gridboxes between August and September. In September, 3 high-density gridboxes (#7, 10, and 15, between Barnegat Light and Little Egg Inlet) occurred north of August's northernmost high-density gridbox (#20, adjacent to Little Egg Inlet). There were fewer observations of sitting birds than of all-behavior birds for both months, and the spatial continuity of gridboxes with at least 1 sighting (non-white) was more fragmented for sitting birds than for all-behavior birds. For example, sitting birds showed an isolation of gridboxes 44, 45, 48, and 51 (around Ocean City) in August (Figure 5.3-3), and isolation of gridbox #33 (near Brigantine) and of #57 and 60 (near Hereford Inlet) in September (Figure 5.3-4).
### Table 5.3-2
In-zone avian species abundance observed during August and September 2009 small-boat coastal surveys.

<table>
<thead>
<tr>
<th>Family</th>
<th>Common Name, Scientific Name</th>
<th>16 August 2009</th>
<th>15 September 2009</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hydrobatidae</strong> (storm-petrels)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wilson’s Storm-Petrel, Oceanites oceanicus</td>
<td>10</td>
<td>0.08</td>
<td>1</td>
</tr>
<tr>
<td><strong>Sulidae</strong> (gannets)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Northern Gannet, Morus bassanus</td>
<td>1</td>
<td>0.01</td>
<td>5</td>
</tr>
<tr>
<td><strong>Pelecanidae</strong> (pelicans)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brown Pelican, Pelecanus occidentalis</td>
<td>9</td>
<td>0.07</td>
<td>19</td>
</tr>
<tr>
<td><strong>Phalacrocoracidae</strong> (cormorants)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Double-crested Cormorant, Phalacrocorax auritus</td>
<td>11</td>
<td>0.09</td>
<td>26</td>
</tr>
<tr>
<td><strong>Ardeidae</strong> (bitterns, egrets and herons)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Green Heron, Butorides virescens</td>
<td>1</td>
<td>0.01</td>
<td>1</td>
</tr>
<tr>
<td><strong>Accipitridae</strong> (eagles and hawks)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Osprey, Pandion haliaetus</td>
<td>3</td>
<td>0.02</td>
<td>3</td>
</tr>
<tr>
<td><strong>Falconidae</strong> (falcons)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Merlin, Falco columbarius</td>
<td>4</td>
<td>0.03</td>
<td>4</td>
</tr>
<tr>
<td><strong>Charadriidae</strong> (plovers)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Semipalmated Plover, Charadrius semipalmatus</td>
<td>1</td>
<td>0.01</td>
<td>1</td>
</tr>
<tr>
<td><strong>Scolopacidae</strong> (sandpipers)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sanderling, Calidris alba</td>
<td>3</td>
<td>0.02</td>
<td>2</td>
</tr>
<tr>
<td>Semipalmated Sandpiper, Calidris pusilla</td>
<td>2</td>
<td>0.02</td>
<td></td>
</tr>
<tr>
<td>Shorebird, small (unknown)</td>
<td>1</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td><strong>Laridae</strong> (gulls and terns)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laughing Gull, Leucophaeus atricilla</td>
<td>369</td>
<td>2.90</td>
<td>370</td>
</tr>
<tr>
<td>Herring Gull, Larus argentatus</td>
<td>260</td>
<td>2.04</td>
<td>93</td>
</tr>
<tr>
<td>Great Black-backed Gull, Larus marinus</td>
<td>12</td>
<td>0.09</td>
<td>96</td>
</tr>
<tr>
<td>Sandwich Tern, Thalasseus sandvicensis</td>
<td>56</td>
<td>0.44</td>
<td>83</td>
</tr>
<tr>
<td>Royal Tern, Thalasseus maxima</td>
<td>11</td>
<td>0.09</td>
<td>30</td>
</tr>
<tr>
<td>Caspian Tern, Hydroprogne caspia</td>
<td>3</td>
<td>0.02</td>
<td></td>
</tr>
<tr>
<td>Forster’s Tern, Sterna forsteri</td>
<td>1</td>
<td>0.01</td>
<td>22</td>
</tr>
<tr>
<td>Common Tern, Serna hirundo</td>
<td>28</td>
<td>0.22</td>
<td>42</td>
</tr>
<tr>
<td>Least Tern, Sternula antillarum</td>
<td>1</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td><strong>Hirundinidae</strong> (swallows)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tree Swallow, Tachycineta bicolor</td>
<td>22</td>
<td>0.17</td>
<td>5</td>
</tr>
<tr>
<td>Barn Swallow, Hirundo rustica</td>
<td>22</td>
<td>0.17</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>432</td>
<td>3.40</td>
<td>435</td>
</tr>
</tbody>
</table>

1 Includes avian observations within the 300-m x 300-m survey strip transect when the ship was traveling \(\geq 7\) kts
2 Detected abundance = No. birds/km and within the 300-m x 300-m survey strip transect when the ship was traveling \(\geq 7\) kts
### Table 5.3-3
The most abundant in-zone avian species during the August and September 2009 small-boat coastal transect surveys.

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Number</th>
<th>Abundance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laughing Gull</td>
<td>260</td>
<td>2.04</td>
</tr>
<tr>
<td>Great Black-backed Gull</td>
<td>56</td>
<td>0.44</td>
</tr>
<tr>
<td>Common Tern</td>
<td>28</td>
<td>0.22</td>
</tr>
<tr>
<td>Barn Swallow</td>
<td>22</td>
<td>0.17</td>
</tr>
<tr>
<td>Herring Gull</td>
<td>12</td>
<td>0.09</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Number</th>
<th>Abundance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Herring Gull</td>
<td>96</td>
<td>0.71</td>
</tr>
<tr>
<td>Laughing Gull</td>
<td>93</td>
<td>0.69</td>
</tr>
<tr>
<td>Great Black-backed Gull</td>
<td>83</td>
<td>0.62</td>
</tr>
<tr>
<td>Common Tern</td>
<td>42</td>
<td>0.31</td>
</tr>
<tr>
<td>Royal Tern</td>
<td>30</td>
<td>0.22</td>
</tr>
</tbody>
</table>

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

5.3.3 Discussion

#### 5.3.3.1 Avian Abundance

In August and September, coastal abundances of birds (Table 5.3-2) were nearly identical (3.40 and 3.23 birds/km, respectively), with total individuals recorded for each month only differing by three birds (432 in August, 435 in September). The compositions for the two months differed, however, mainly in that Laughing Gulls dominated the gull and tern numbers in August (260 of 369 individuals, or 70 percent) whereas the group’s numbers were more evenly distributed amongst the species in September. This evenness was due to a decrease in the number of Laughing Gulls from 260 to 93 coupled with an increase in the number of nearly all other larids from 109 to 277, most notably Herring Gulls (from 12 to 96). The offshore surveys showed less marked differences among months. Although Laughing Gull numbers did decrease by 29 percent from August to September, the species still represented a similar percentage of all larids in each month (55 percent in August, 54 percent in September). While Herring Gull numbers increased, other larid numbers decreased by 31 percent during the same period, contrasting with the upward trend seen on the coastal surveys. This overall decrease is possibly due to poor viewing conditions throughout the September offshore surveys.

The low numbers of gulls and terns on both the offshore and coastal surveys this summer may have had their origins in spring and early summer weather and tide cycles. The spring moon high tide occurred on 07 June 2009, a time when all locally breeding larids are incubating or have very small young in nests. There was apparent widespread nest failure due to inundation (D. Freiday pers. comm.) by this tide event, at least in southern New Jersey. Typically, these species will attempt renesting after such occurrences, and certainly some did and were successful, as the presence of juveniles of all species in August can attest (T. Leukering pers. obs., G. Davis pers. obs.); however, June 2009 was the third wettest June on record at Atlantic City (NOAA 2009), which may have had a negative impact on reproduction in these species. These two factors are suspected to be primarily responsible for the low numbers of larids found in New Jersey waters this summer.
Figure 5.3-1. Total coastal bird densities (all behaviors) within the New Jersey Study Area in August 2009.
Figure 5.3-2. Total coastal bird densities (all behaviors) within the New Jersey Study Area in September 2009.
Figure 5.3-3. Total coastal bird densities (sitting) within the New Jersey Study Area in August 2009.
Figure 5.3-4. Total coastal densities (sitting) within the New Jersey Study Area in September 2009.
5.3.3.2 Avian Density

The high-density gridboxes for all-behavior birds are identified on a month-to-month basis by an “x” in Table 5.3-4 and Table 5.3-5 for the offshore (ship) and coastal (boat) surveys, respectively. Likewise, high-density gridboxes for sitting birds are identified in Tables 5.3-6 and 5.3-7 for the respective ship and boat surveys. Of the 249 gridboxes on the Minerals Management Service (MMS) grid system, 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 to obtain the number of months that the given gridbox is designated as a high-density gridbox (i.e., “A” ranking). 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. Summing the occurrence frequencies over both the total number of months (last row) and total number of gridboxes (last column) gives the total number of high-density gridboxes occurring over the entire quarter.

For example, Table 5.3-4 shows that, for the all-behavior birds on the offshore (ship) surveys, 29 and 14 high-density gridboxes occurred in August and September 2009, respectively, for a total of 43 high-density gridboxes occurring during the quarter (There were no surveys conducted in July 2009). Each listed gridbox exhibited an occurrence frequency of at least 1, with 3 gridboxes (#6101, 6252, and 6303) showing an occurrence frequency of 2 (i.e., designated as a high-density gridbox for 2 months). For the all-behavior birds on the coastal (boat) surveys, 6 high-density gridboxes in each of August and September, for a total of 12 high-density gridboxes occurring during the 2-month period (Table 5.3-5). Two gridboxes (#40 and 51) showed an occurrence frequency of 2, with all other listed gridboxes having an occurrence frequency of 1.

Analogous to Table 5.3-4 and Table 5.3-5 for all-behavior birds, Table 5.3-6 and Table 5.3-7 apply to sitting birds. For the ship surveys, there were 8 high-density gridboxes for sitting birds in August but zero for September (due to insufficient number of sightings and/or zero survey effort) (Table 5.3-3). For the boat surveys, 4 high-density gridboxes occurred in each of August and September, for a total of 8 high-density gridboxes occurring during the 2-month period (Table 5.3-4). Each of these 8 gridboxes were unique in their given month, showing an occurrence frequency of 1 (i.e., no repeat gridboxes over multiple months).

5.4 Radar Surveys

5.4.1 Data Collection

The land-based Mobile Avian Radar System (MARS®) was deployed to Island Beach State Park, New Jersey, on 15 September 2009 where it will remain until 02 October (Figure 5.4-1). Groundtruthing surveys of the land-based coastal avian radar have been conducted at Island Beach State Park daily from 17 September to 21 September 2009.

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 land-based system, recording was conducted at Island Beach State Park on 19 September.

5.5.2 Data Analysis

The thermal imaging data are currently being analyzed at GMI’s Millville, New Jersey office.
Table 5.3-4
Identification of high-density gridboxes (quartile rank=1 or A) by month for the offshore (ship) surveys for TOTAL BIRDS (All-Behaviors).

<table>
<thead>
<tr>
<th>Grid#</th>
<th>Month</th>
<th>Aug-09</th>
<th>Sep-09</th>
<th>Total</th>
</tr>
</thead>
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Table 5.3-5
Identification of high-density gridboxes (quartile rank=1 or A) by month for the coastal (boat) surveys for TOTAL BIRDS (All-Behaviors).

<table>
<thead>
<tr>
<th>Grid#</th>
<th>Month: Aug-09</th>
<th>Sep-09</th>
<th>Total</th>
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<td>29</td>
<td>x</td>
<td></td>
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<td></td>
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</tr>
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<td>x</td>
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</tr>
<tr>
<td>Total</td>
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Table 5.3-6
Identification of high-density gridboxes (quartile rank=1 or A) by month for the offshore (ship) surveys for TOTAL BIRDS (Sitting).

<table>
<thead>
<tr>
<th>Grid#</th>
<th>Month: Aug-09</th>
<th>Sep-09</th>
<th>Total</th>
</tr>
</thead>
<tbody>
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<td></td>
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<td>Total</td>
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<td>8</td>
</tr>
</tbody>
</table>

Table 5.3-7
Identification of high-density gridboxes (quartile rank=1 or A) by month for the coastal (boat) surveys for TOTAL BIRDS (Sitting).

<table>
<thead>
<tr>
<th>Grid#</th>
<th>Month: Aug-09</th>
<th>Sep-09</th>
<th>Total</th>
</tr>
</thead>
<tbody>
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<td>7</td>
<td>x</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>10</td>
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<td></td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>4</td>
<td>4</td>
<td>8</td>
</tr>
</tbody>
</table>
Figure 5.4-1. Radar Grid and Site Location for September 2009.
5.6 **ACOUSTIC SURVEYS**

This report presents an update on the diagnostics for pop-up (PU) PU202 from the December 2008 deployment, on deployment activity for August 2009, and on details regarding the status of data processing and analyses for the duration of the project.

### 5.6.1 June 2009 - Pop-Up Diagnostics Update

PU 202 was part of the December 2008 deployment and responded to the audio burn signals during the 20 March 20 recovery trip; however, the unit did not surface when called. Divers were unavailable for manual recovery; sea and weather conditions prohibited a second attempt at recovery during April or May. The unit was confirmed to have surfaced (determined via data analysis) on 30 March 2009 but was found near Virginia Beach, Virginia by a fisherman on 07 June 2009. By early July, the unit was returned to the Bioacoustics Research program (BRP) for diagnostic review. The hard drive was delivered to GMI in early August 2009. It has not been confirmed as to why the unit did not respond within identified parameters to burn signals.

PU202 was loaded with a 2-kilohertz (kHz) sample rate for continuous recording and continued to record while on the seafloor. Data from 14 December 2008 to 30 March 2009 have been analyzed for baleen whale calls (see Data Analyses/Processing section below).

It was determined by the BRP team that PU171 did not record usable data during the March 2009 deployment. The error was part of the computer processing unit (CPU) processing hardware and an error on the part of BRP. As such, a replacement unit at no charge will be provided for GMI use during the last deployment planned for August 2009.

### 5.6.2 August 2009 - Pop-Up Deployment Update

Initially, four pop-ups were planned for deployment during this final extension of the acoustics monitoring for the project; however, because of a hardware error during the March 2009 deployment, BRP made available at no charge to GMI or NJDEP the use of one additional pop-up. Also, BRP has been unable to confirm the cause of residue buildup on the grounding rod for PU134 from the December 2008 deployment. BRP requested collaboration in adding PU134 to the deployment plan in an attempt to recreate the problem. Thus, six pop-ups were deployed on 11 August 2009, each with an 1/8th stainless steel cable connector between the pop-up and its anchor. On four of the pop-ups (at S#1b, S#3a, and S#2 [two units], see Figure 5.6-1), the acoustic burn unit was bypassed and each pop-up was shackled directly, via the steel cable, to its anchor. As such, these units will require diver-assisted recovery after the deployment. The remaining two pop-ups (S#4 and S#5, see Figure 5.6-1) employed the acoustic burn unit system but were also each affixed with an Argos global positioning system (GPS) tracking beacon. Thus, should one or both of these units surface prior to the planned recovery dates, the GPS beacon will alert the BRP team via email.

The pop-ups deployed at Station (S) number (#) 1b, 3a, and 5 were loaded with a 2-kHz sample rate and continuous duty cycle. PU134, deployed at S#2, was also loaded with a 2-kHz sample rate and continuous duty cycle. The units deployed at S#4 and S#2 (second unit here) were deployed with a 31.25-kHz sample rate and 5 min on/25 min off duty cycle.

All six pop-ups were deployed successfully on August 11, 2009. Recovery of the units is planned for the week of October 26th, with exact dates weather dependent.

### 5.6.3 Data Analyses/Processing

Data analysis details refer to data collected from late March 2008 through 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
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. Units deployed at S#1b and S#3a were shifted from the original location to affect greater distribution converge in assessment of the study area.
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.

<table>
<thead>
<tr>
<th>Month deployed</th>
<th>PU081 (S#4)</th>
<th>PU063 (S#3)</th>
<th>PU134 (S#5)</th>
<th>PU086 (S#2)</th>
<th>PU202 (S#3)</th>
<th>PU203 (S#5)</th>
<th>PU002 (S#1a)</th>
<th>PU171 (S#2)</th>
<th>PU182 (S#4)</th>
</tr>
</thead>
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<td>29&lt;sup&gt;th&lt;/sup&gt;</td>
<td>29&lt;sup&gt;th&lt;/sup&gt;</td>
<td>29&lt;sup&gt;th&lt;/sup&gt;, 30&lt;sup&gt;th&lt;/sup&gt;</td>
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<td>Not in use</td>
<td>Not in use</td>
<td>Not in use</td>
<td>Not in use</td>
</tr>
<tr>
<td>April 2008</td>
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<td>4&lt;sup&gt;th&lt;/sup&gt;, 9&lt;sup&gt;th&lt;/sup&gt;</td>
<td>4&lt;sup&gt;th&lt;/sup&gt;, 9&lt;sup&gt;th&lt;/sup&gt;</td>
<td>13&lt;sup&gt;th&lt;/sup&gt;</td>
<td>5&lt;sup&gt;th&lt;/sup&gt;</td>
<td>7&lt;sup&gt;th&lt;/sup&gt;, 8&lt;sup&gt;th&lt;/sup&gt;, 15&lt;sup&gt;th&lt;/sup&gt;</td>
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<td>Not in use</td>
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<td>4&lt;sup&gt;th&lt;/sup&gt;</td>
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<td>4&lt;sup&gt;th&lt;/sup&gt;</td>
<td>6&lt;sup&gt;th&lt;/sup&gt;</td>
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<td>Not in use</td>
<td>Not in use</td>
<td>Not in use</td>
<td>Not in use</td>
</tr>
<tr>
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<td>1&lt;sup&gt;st&lt;/sup&gt;–12&lt;sup&gt;th&lt;/sup&gt;, 17&lt;sup&gt;th&lt;/sup&gt;, 18&lt;sup&gt;th&lt;/sup&gt;, 23&lt;sup&gt;rd&lt;/sup&gt;, 24&lt;sup&gt;th&lt;/sup&gt;, 25&lt;sup&gt;th&lt;/sup&gt;</td>
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<td>6&lt;sup&gt;th&lt;/sup&gt;</td>
<td>7&lt;sup&gt;th&lt;/sup&gt;, 12&lt;sup&gt;th&lt;/sup&gt;, 13&lt;sup&gt;th&lt;/sup&gt;</td>
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<td>Not in use</td>
<td>Not in use</td>
<td>Not in use</td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>Month deployed</th>
<th>PU081 (S#4)</th>
<th>PU063 (S#3)</th>
<th>PU134 (S#5)</th>
<th>PU086 (S#2)</th>
<th>PU202 (S#3)</th>
<th>PU203 (S#5)</th>
<th>PU002 (S#1a)</th>
<th>PU171 (S#2)</th>
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<td>Not in use</td>
<td>Not in use</td>
<td>Not in use</td>
</tr>
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<td>lost</td>
<td>deployed</td>
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<td>High frequency code</td>
<td>Lost</td>
<td>1st 2nd 4th 6th 9th – 31st</td>
<td>Not in use</td>
<td>Not in use</td>
<td>Not in use</td>
<td>Not in use</td>
</tr>
<tr>
<td>February 2009</td>
<td>N/A</td>
<td>N/A</td>
<td>High frequency code</td>
<td>Lost</td>
<td>1st to 5th 8th 9th 13th – 17th 22nd 25th 26th</td>
<td>Not in use</td>
<td>Not in use</td>
<td>Not in use</td>
<td>Not in use</td>
</tr>
<tr>
<td>March 2009</td>
<td>N/A</td>
<td>N/A</td>
<td>High frequency code</td>
<td>Lost</td>
<td>1st 4th 6th – 8th 10th – 14th 20th 22nd</td>
<td>30th 31st</td>
<td>hardware error</td>
<td>29th – 31st</td>
<td></td>
</tr>
<tr>
<td>April 2009</td>
<td>N/A</td>
<td>N/A</td>
<td>Not in use</td>
<td>N/A</td>
<td>maybe</td>
<td>N/A</td>
<td>1st 2nd 8th – 19th</td>
<td>hardware error</td>
<td>8th 19th</td>
</tr>
<tr>
<td>May 2009</td>
<td>N/A</td>
<td>N/A</td>
<td>Not in use</td>
<td>N/A</td>
<td>Not in use</td>
<td>N/A</td>
<td>8th – 11th</td>
<td>hardware error</td>
<td>11th – 16th</td>
</tr>
<tr>
<td>June 2009</td>
<td>N/A</td>
<td>N/A</td>
<td>Not in use</td>
<td>N/A</td>
<td>Not in use</td>
<td>N/A</td>
<td>none</td>
<td>hardware error</td>
<td>none</td>
</tr>
</tbody>
</table>
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.

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

<table>
<thead>
<tr>
<th>Month deployed</th>
<th>PU081 (S#4)</th>
<th>PU063 (S#3)</th>
<th>PU134 (S#5)</th>
<th>PU086 (S#2)</th>
<th>PU202 (S#3)</th>
<th>PU203 (S#5)</th>
<th>PU002 (S#1a)</th>
<th>PU171 (S#2)</th>
<th>PU182 (S#4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>January 2009</td>
<td>N/A</td>
<td>N/A</td>
<td>High frequency code</td>
<td>High frequency code</td>
<td>Analyses ongoing</td>
<td>Lost</td>
<td>Not in use</td>
<td>Not in use</td>
<td>Not in use</td>
</tr>
<tr>
<td>February 2009</td>
<td>N/A</td>
<td>N/A</td>
<td>High frequency code</td>
<td>High frequency code</td>
<td>Analyses ongoing</td>
<td>Lost</td>
<td>Not in use</td>
<td>Not in use</td>
<td>Not in use</td>
</tr>
<tr>
<td>March 2009</td>
<td>N/A</td>
<td>N/A</td>
<td>High frequency code</td>
<td>High frequency code</td>
<td>Analyses ongoing</td>
<td>Lost</td>
<td>none</td>
<td>hardware error</td>
<td>25th</td>
</tr>
<tr>
<td>April 2009</td>
<td>N/A</td>
<td>N/A</td>
<td>Not in use</td>
<td>N/A</td>
<td>maybe</td>
<td>N/A</td>
<td>none</td>
<td>hardware error</td>
<td>13th 23rd</td>
</tr>
<tr>
<td>May 2009</td>
<td>N/A</td>
<td>N/A</td>
<td>Not in use</td>
<td>N/A</td>
<td>Not in use</td>
<td>N/A</td>
<td>none</td>
<td>hardware error</td>
<td>10th 12th 19th 21st</td>
</tr>
<tr>
<td>June 2009</td>
<td>N/A</td>
<td>N/A</td>
<td>Not in use</td>
<td>N/A</td>
<td>Not in use</td>
<td>N/A</td>
<td>none</td>
<td>hardware error</td>
<td>none</td>
</tr>
</tbody>
</table>
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 not recovered and is not presented in the table below.

<table>
<thead>
<tr>
<th>Month deployed</th>
<th>PU081 (S#4)</th>
<th>PU063 (S#3)</th>
<th>PU134 (S#5)</th>
<th>PU086 (S#2)</th>
<th>PU202 (S#3)</th>
<th>PU203 (S#5)</th>
<th>PU002 (S#1a)</th>
<th>PU171 (S#2)</th>
<th>PU182 (S#4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 2008</td>
<td>25&lt;sup&gt;th&lt;/sup&gt; – 30&lt;sup&gt;th&lt;/sup&gt;</td>
<td>low frequency code</td>
<td>low frequency code</td>
<td>26&lt;sup&gt;th&lt;/sup&gt; 27&lt;sup&gt;th&lt;/sup&gt; 29&lt;sup&gt;th&lt;/sup&gt; 30&lt;sup&gt;th&lt;/sup&gt;</td>
<td>Not in use</td>
<td>Not in use</td>
<td>Not in use</td>
<td>Not in use</td>
<td>Not in use</td>
</tr>
<tr>
<td>July 2008</td>
<td>All files examined, calls present every day</td>
<td>low frequency code</td>
<td>low frequency code</td>
<td>1&lt;sup&gt;st&lt;/sup&gt; to 7&lt;sup&gt;th&lt;/sup&gt; 9&lt;sup&gt;th&lt;/sup&gt; to 25&lt;sup&gt;th&lt;/sup&gt; 27&lt;sup&gt;th&lt;/sup&gt; – 31&lt;sup&gt;st&lt;/sup&gt;</td>
<td>Not in use</td>
<td>Not in use</td>
<td>Not in use</td>
<td>Not in use</td>
<td>Not in use</td>
</tr>
<tr>
<td>August 2008</td>
<td>All files examined, calls present every day</td>
<td>low frequency code</td>
<td>low frequency code</td>
<td>1&lt;sup&gt;st&lt;/sup&gt; – 16&lt;sup&gt;th&lt;/sup&gt; (unit stopped early)</td>
<td>Not in use</td>
<td>Not in use</td>
<td>Not in use</td>
<td>Not in use</td>
<td>Not in use</td>
</tr>
<tr>
<td>September 2008</td>
<td>Up early, no data</td>
<td>low frequency code</td>
<td>low frequency code</td>
<td>none</td>
<td>Not in use</td>
<td>Not in use</td>
<td>Not in use</td>
<td>Not in use</td>
<td>Not in use</td>
</tr>
<tr>
<td>October 2008</td>
<td>lost</td>
<td>lost</td>
<td>Not in use</td>
<td>6&lt;sup&gt;th&lt;/sup&gt; 8&lt;sup&gt;th&lt;/sup&gt; 22&lt;sup&gt;nd&lt;/sup&gt; 24&lt;sup&gt;th&lt;/sup&gt; 30&lt;sup&gt;th&lt;/sup&gt;</td>
<td>low frequency code</td>
<td>low frequency code</td>
<td>Not in use</td>
<td>Not in use</td>
<td>Not in use</td>
</tr>
<tr>
<td>November 2008</td>
<td>lost</td>
<td>lost</td>
<td>Not in use</td>
<td>1&lt;sup&gt;st&lt;/sup&gt; 6&lt;sup&gt;th&lt;/sup&gt; 12&lt;sup&gt;th&lt;/sup&gt; 17&lt;sup&gt;th&lt;/sup&gt; 24&lt;sup&gt;th&lt;/sup&gt; 27&lt;sup&gt;th&lt;/sup&gt; 29&lt;sup&gt;th&lt;/sup&gt; 30&lt;sup&gt;th&lt;/sup&gt;</td>
<td>low frequency code</td>
<td>low frequency code</td>
<td>Not in use</td>
<td>Not in use</td>
<td>Not in use</td>
</tr>
<tr>
<td>December 2008</td>
<td>lost</td>
<td>lost</td>
<td>14&lt;sup&gt;th&lt;/sup&gt; 18&lt;sup&gt;th&lt;/sup&gt; 19&lt;sup&gt;th&lt;/sup&gt; 21&lt;sup&gt;st&lt;/sup&gt; 24&lt;sup&gt;th&lt;/sup&gt; 26&lt;sup&gt;th&lt;/sup&gt; 27&lt;sup&gt;th&lt;/sup&gt; 29&lt;sup&gt;th&lt;/sup&gt; – 31&lt;sup&gt;st&lt;/sup&gt;</td>
<td>1&lt;sup&gt;st&lt;/sup&gt; 2&lt;sup&gt;nd&lt;/sup&gt; 3&lt;sup&gt;rd&lt;/sup&gt;</td>
<td>low frequency code</td>
<td>low frequency code</td>
<td>Not in use</td>
<td>Not in use</td>
<td>Not in use</td>
</tr>
<tr>
<td>January 2009</td>
<td>N/A</td>
<td>N/A</td>
<td>1&lt;sup&gt;st&lt;/sup&gt; – 6&lt;sup&gt;th&lt;/sup&gt; 10&lt;sup&gt;th&lt;/sup&gt; 12&lt;sup&gt;th&lt;/sup&gt; 13&lt;sup&gt;th&lt;/sup&gt; 25&lt;sup&gt;th&lt;/sup&gt; 26&lt;sup&gt;th&lt;/sup&gt;</td>
<td>lost</td>
<td>low frequency code</td>
<td>lost</td>
<td>Not in use</td>
<td>Not in use</td>
<td>Not in use</td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>Month deployed</th>
<th>PU081 (S#4)</th>
<th>PU063 (S#3)</th>
<th>PU134 (S#5)</th>
<th>PU086 (S#2)</th>
<th>PU202 (S#3)</th>
<th>PU203 (S#5)</th>
<th>PU002 (S#1a)</th>
<th>PU171 (S#2)</th>
<th>PU182 (S#4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>February 2009</td>
<td>N/A</td>
<td>N/A</td>
<td>2\textsuperscript{nd} 5\textsuperscript{th} – 17\textsuperscript{th} 22\textsuperscript{nd}</td>
<td>lost</td>
<td>low frequency code</td>
<td>lost</td>
<td>Not in use</td>
<td>Not in use</td>
<td>Not in use</td>
</tr>
<tr>
<td>March 2009</td>
<td>N/A</td>
<td>N/A</td>
<td>7\textsuperscript{th} 14\textsuperscript{th}</td>
<td>lost</td>
<td>low frequency code</td>
<td>lost</td>
<td>low frequency code</td>
<td>System error</td>
<td>low frequency code</td>
</tr>
<tr>
<td>April 2009</td>
<td>N/A</td>
<td>N/A</td>
<td>Not in use</td>
<td>N/A</td>
<td>low frequency code</td>
<td>N/A</td>
<td>low frequency code</td>
<td>System error</td>
<td>low frequency code</td>
</tr>
<tr>
<td>May 2009</td>
<td>N/A</td>
<td>N/A</td>
<td>Not in use</td>
<td>N/A</td>
<td>Not in use</td>
<td>N/A</td>
<td>low frequency code</td>
<td>System error</td>
<td>low frequency code</td>
</tr>
<tr>
<td>June 2009</td>
<td>N/A</td>
<td>N/A</td>
<td>Not in use</td>
<td>N/A</td>
<td>Not in use</td>
<td>N/A</td>
<td>low frequency code</td>
<td>System error</td>
<td>low frequency code</td>
</tr>
</tbody>
</table>
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.

5.6.3.1 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.

5.6.3.2 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 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 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.

5.6.3.3 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.

5.6.3.4 December 2008 Deployment

Data from two pop-ups 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. The hard drive with the data from PU134 was retrieved from BRP, Ithaca, New York, on 23 June 2009; while the hard drive for PU202 was received in early August 2009. These data represent both sample rates and duty cycles: PU134 at the higher frequency sample rate and PU202 at the low frequency sample rate. Fin whales were observed each month during this winter deployment (Table 5.6-1) while North Atlantic right whales were not observed during the mid-winter months (Table 5.6-2). Dolphins were observed infrequently during the winter months (Table 5.6-3), which supports previous studies suggesting that smaller delphinids are not in the area with colder water temperatures.

5.6.3.5 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. Fin whales continued to be observed acoustically during each month of deployment (Table 5.6-1), while North Atlantic right whales were not documented by the southern-most pop-up (PU002) but were observed on six days for the eastern-most pop-up (PU182, see Table 5.6-2).

5.6.3.6 August 2009 Deployment

Because the six pop-ups deployed on 11 August 2009 have not yet been recovered, no data are available for analyses. The planned recovery of all units is set for the last week in October 2009. Additional details on the analyses of the data recovered will be included in the next quarterly report.

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 third quarter (July-September) 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 (ft or m), and lon-lat location. Measured climatic parameters include windspeed (knots [kt]), wind direction (deg), air temperature (degrees Celsius [°C]), relative humidity (%), and atmospheric barometric pressure (millibars [mbar]). Measured dynamic oceanographic parameters include water temperature (sea surface temperature [SST], °C), salinity (practical salinity units [psu]), fluorometric chlorophyll and CDOM (Turner raw), and Photosynthetically Active Radiation (PAR; quanta second [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 Colored Dissolved Organic Matter (CDOM) absorbs strongly in the blue region (412 nm) and has a broad fluorescent peak at green-yellow wavelengths (530 nm). 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 (uW) per square centimeter (cm²) per nanometer (nm)).

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

- July 2009: None.
- August 2009: 8:46 AM on 8-1 through 9:09 PM on 8-5.
- September 2009: 8:36 AM on 8-30 through 10:10 PM on 9-3

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 8th hour on 01 August 2009 were recorded to the text file "09080108.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 (°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.csv” (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.
Figure 5.7-1. SMS and ADCP Measurements Conducted during Shipboard Surveys in the NJDEP Study Area off the Coast of New Jersey in August 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 September 2009.
Figure 5.7-3. CTD Measurements Conducted at Point Locations in the NJDEP Study Area off the Coast of New Jersey from August through September 2009.
The CTD measurements were conducted at 20 sites in January, 6 sites in February, and 32 sites in March. 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:

- July 2009: None.
- August 2009 (36 sites): 8-1 through 8-5.
- September 2009 (36 sites): 8-30 through 9-3.

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 "eeeee" = 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:

July 2009: None.

August 2009:
- 8-1 (09:51:42 to 23:59:59)
- 8-2 (00:00:00 to 23:59:59)
- 8-3 (00:00:00 to 23:59:59)
- 8-4 (00:00:00 to 23:59:59)
- 8-5 (00:00:00 to 17:01:21)

September 2009:
- 8-27 (16:53:08 to 17:09:54)
- 8-28 (15:34:03 to 15:35:07)
- 8-30 (08:30:45 to 23:59:59)
- 9-1 (00:00:00 to 23:59:59)
- 9-2 (00:00:00 to 23:59:59)
- 9-3 (00:00:00 to 22:09:35)

5.8 Side-scan Surveys

5.8.1 August – September 2009 Survey

Side-scan sonar and magnetometer surveys were conducted during the shipboard offshore survey cruise (31 August – 04 September 2009).

5.8.2 Area Surveyed and Transect Parameters

The area surveyed was a section of the Atlantic Ocean within the proposed New Jersey Wind Farm area located off the New Jersey coastline. Transect lines were created to begin eight miles (mi) off of the Col Regs line and to run parallel to the shore. Multiple transects were completed as conditions allowed and were spaced on 0.5-NM parallel lines. A total of 73,480 m (39.7 NM) were surveyed. Additional transect lines on future cruises will run parallel to the lines completed and on similar intervals. All transect lines were run using ship speeds ranging from 3 to 5 kts. Speed was determined by environmental conditions,
boat traffic, and towfish altitude. Towfish altitude was a function of ship speed, depth of the water, known obstructions within the tow path, and depth of the pycnocline.

5.8.3 Equipment

- Klein 300 dual frequency Towfish with a K-2 K-Wing Depressor and Transceiver Processing Unit
- Geometrics 882 Cesium Magnetometer
- Hypack and Navigational software

5.8.4 Discussion

Side-scan and magnetometer surveys were completed across seven transects. One unmarked wreck (a bow section approximately 30 ft long with little altitude) was located. Other known wrecks were located in the approximate position as they are charted. The bottom topography is uniform with alternating areas of sand, sand waves, shell, and silt/mud. A strong pycnocline/thermocline, found between 10 and 17 m deep, made it difficult to obtain clear survey records out to the full 100-m range (200-m swath) of the towfish. The nature of the ships wake interfered with the magnetometer signal but did not prevent the magnetometer from providing adequate data to detect any ferrous anomalies. There were no ferrous signals of note with the exception being areas of the known wrecks.

5.9 REFERENCES


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 fifth quarterly report was presented to NJDEP on 02 July 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
APPENDIX A-1

FISHES


GMFMC (Gulf of Mexico Fishery Management Council). 1998. Generic amendment for addressing essential fish habitat requirements in the following fishery management plans of the Gulf of Mexico: shrimp fishery of the Gulf of Mexico, United States waters; red drum fishery of the Gulf of Mexico; reef fish fishery of the Gulf of Mexico; coastal migratory pelagic resources (mackerels) in the Gulf of Mexico and South Atlantic; stone crab fishery of the Gulf of Mexico; spiny lobster in the Gulf of Mexico and South Atlantic; coral and coral reefs of the Gulf of Mexico (includes environmental assessment). Tampa, Florida: Gulf of Mexico Fishery Management Council.

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APPENDIX A-4

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APPENDIX A-5

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APPENDIX B

DIGITAL DATA COMPILATION
### Table B-1
#### Digital Data Compilation from Multi-Source Data Banks

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