Transits in the Atlantic Coast Wind Energy Areas and Lease Areas
A. Introduction

The purpose of this analysis is to quantify the number of vessels and transits in each of the Bureau of Ocean Energy Management (BOEM) Wind Energy Areas (WEAs) and Wind Planning Areas along the Atlantic Coast and to visualize conflicts using a series of heat maps by vessel type.

B. Methods

1. Quantify Unique Vessels and Unique Transits:

For this analysis, the 2009 Automatic Identification System (AIS) data was obtained from the Marine Cadastre website (http://marinecadastre.gov/AIS/default.aspx). This data represents one-minute samples of AIS messages. This dataset does not include data from June 5, 2009 through June 30, 2009. The AIS data obtained from the Marine Cadastre is organized in separate files by month and Universal Transverse Mercator (UTM) zone. A master Atlantic Coast dataset was created by merging the data from all twelve months in 2009 in UTM zones 17, 18, and 19.

Fourteen areas along the Atlantic coast were analyzed. The location of each is shown in Figure 1.

Figure 1: WEAs and Wind Planning Areas
The number of unique vessels transiting an area was determined by creating track lines from the AIS messages in the area surrounding the area of interest. See Appendix 1 for an example Python script used in for this analysis. First, a 50 nautical mile (nm) buffer was calculated around the area of interest. An analysis dataset was created by selecting the AIS message points that were within this buffer. Track lines were created by connecting the AIS message points in the analysis dataset by Maritime Mobile Service Identity (MMSI) in date and time order (Figure 2). The MMSI is a unique vessel identifier. However, there are instances of MMSI misuse and multiple vessels could have broadcasted the same MMSI. This AIS dataset has been processed in such a way that each MMSI correlates with one vessel. Because of the processing, it is impossible to determine how many vessels are using the same MMSI. With this dataset, MMSI is the best proxy for unique vessels. However, it is possible that some of the track lines generated do not represent true historical vessel movement and could be the movement of multiple vessels.

Next, the track lines were clipped to the area of interest, as shown in Figure 3, below.

Each track line represents the movement of each MMSI over the entire year. The track lines are multipart features, meaning that multiple transits through the area of interest are drawn as one line feature. The track line was converted to single part features to determine the total number of transits in 2009 in the area of interest.

An example showing the multipart line feature from one vessel and the corresponding unique transits is shown in Figure 4 below.
Appendix IV

For this analysis, a transit is defined as any time a line enters and exits the area of interest. By counting this way, a vessel that is transiting near the edge of the area of interest may enter and exit the area several times, each time being counted separately. Figure 5 shows an example of an MMSI that had ten transits through the WEA in 2009.

The number of features in the multipart line feature class was recorded as the number of unique vessels for the area being investigated. The number of features in the single part line feature class was recorded as the number of unique transits for the area being investigated. The area, in square meters and square km, was calculated for each of the WEAs and lease areas. The number of unique vessels per square km and the number of transits per square km were calculated. This normalizes the number of vessels and transits by unit area and allows for a comparison between different WEAs and lease areas. Maps showing the track lines in the vicinity of the area of interest were created to show the distribution of vessel traffic in the area.
Appendix IV

Summary of Transits Through Wind Energy Areas and Wind Lease Areas
by Summary Vessel type

C. Results of Quantifying Transits through Wind Energy Areas and Wind Lease Areas

The number of unique MMSIs and unique transits for 2009 for all vessel types are summarized below in Table 1 for Wind Energy and lease areas (as of May 2013).

<table>
<thead>
<tr>
<th>Wind Energy and Wind Lease Areas</th>
<th>Unique MMSI</th>
<th>Unique Transits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maine Statoil</td>
<td>44</td>
<td>133</td>
</tr>
<tr>
<td>Massachusetts WEA</td>
<td>373</td>
<td>1206</td>
</tr>
<tr>
<td>Massachusetts Cape Wind</td>
<td>170</td>
<td>1087</td>
</tr>
<tr>
<td>Rhode Island/ Massachusetts Area of Mutual Interest</td>
<td>347</td>
<td>2609</td>
</tr>
<tr>
<td>New York</td>
<td>220</td>
<td>677</td>
</tr>
<tr>
<td>New Jersey</td>
<td>1257</td>
<td>10774</td>
</tr>
<tr>
<td>New Jersey - Fishermens Energy LLC</td>
<td>119</td>
<td>533</td>
</tr>
<tr>
<td>New Jersey - GSOE-I LLC</td>
<td>160</td>
<td>360</td>
</tr>
<tr>
<td>Delaware WEA</td>
<td>459</td>
<td>1508</td>
</tr>
<tr>
<td>Maryland WEA</td>
<td>823</td>
<td>2841</td>
</tr>
<tr>
<td>Virginia</td>
<td>892</td>
<td>2263</td>
</tr>
<tr>
<td>North Carolina - Kitty Hawk WEA</td>
<td>1553</td>
<td>7180</td>
</tr>
<tr>
<td>North Carolina - Wilmington East WEA</td>
<td>1008</td>
<td>4119</td>
</tr>
<tr>
<td>North Carolina - Wilmington West WEA</td>
<td>87</td>
<td>218</td>
</tr>
</tbody>
</table>

Figure 7 - Tracklines for Statoil

Figure 6 - Number of Transits by Summary Vessel Type
Appendix IV

Summary of Transits Through Wind Energy Areas and Wind Lease Areas by Summary Vessel type

Table 1: Summary of Unique Vessels and Unique Transits

<table>
<thead>
<tr>
<th>Vessel Type</th>
<th>Cape Wind</th>
<th>Massachusetts</th>
<th>Rhode Island</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cargo</td>
<td>8</td>
<td>404</td>
<td>272</td>
</tr>
<tr>
<td>Other</td>
<td>525</td>
<td>272</td>
<td>502</td>
</tr>
<tr>
<td>Tanker</td>
<td>20</td>
<td>290</td>
<td>1035</td>
</tr>
<tr>
<td>Tug &amp; Towing</td>
<td>21</td>
<td>33</td>
<td>45</td>
</tr>
<tr>
<td>Unknown</td>
<td>406</td>
<td>223</td>
<td>755</td>
</tr>
</tbody>
</table>

Figure 9 - Number of Transits by Summary Vessel type

Figure 10 - Tracklines for Massachusetts

Figure 11 - Tracklines for Cape Wind

Figure 12 - Number of Transits by Summary Vessel Type

Figure 13 - Number of Transits by Summary Vessel type

Figure 8 - Tracklines for Rhode Island
Appendix IV

Summary of Transits Through Wind Energy Areas and Wind Lease Areas by Summary Vessel type

Figure 14 - Number of Transits by Summary Vessel type

Figure 15 – Tracklines for New Jersey

Figure 16 - Number of Transits by Summary Vessel type

Figure 17 – Tracklines for New York

Figure 18 - Number of Transits by Summary Vessel type

Figure 19 – Tracklines for NJ Fishermans Energy

Figure 20 – Tracklines for NJ GSOE
Appendix IV

Summary of Transits Through Wind Energy Areas and Wind Lease Areas by Summary Vessel type

Figure 18 – Number of Transits by Summary Vessel type

Figure 20 – Number of Transits by Summary Vessel type

Figure 22 - Number of Transits by Summary Vessel type

Figure 19 – Tracklines for Virginia

Figure 21 – Tracklines for Maryland

Figure 23 – Tracklines for Delaware
Appendix IV

Summary of Transits Through Wind Energy Areas and Wind Lease Areas by Summary Vessel type

Figure 26 - Number of Transits by Summary Vessel type

Figure 25 – Number of Transits by Summary Vessel type

Figure 24 - Tracklines for Wilmington West and Wilmington East

Figure 27 – Tracklines for Kitty Hawk