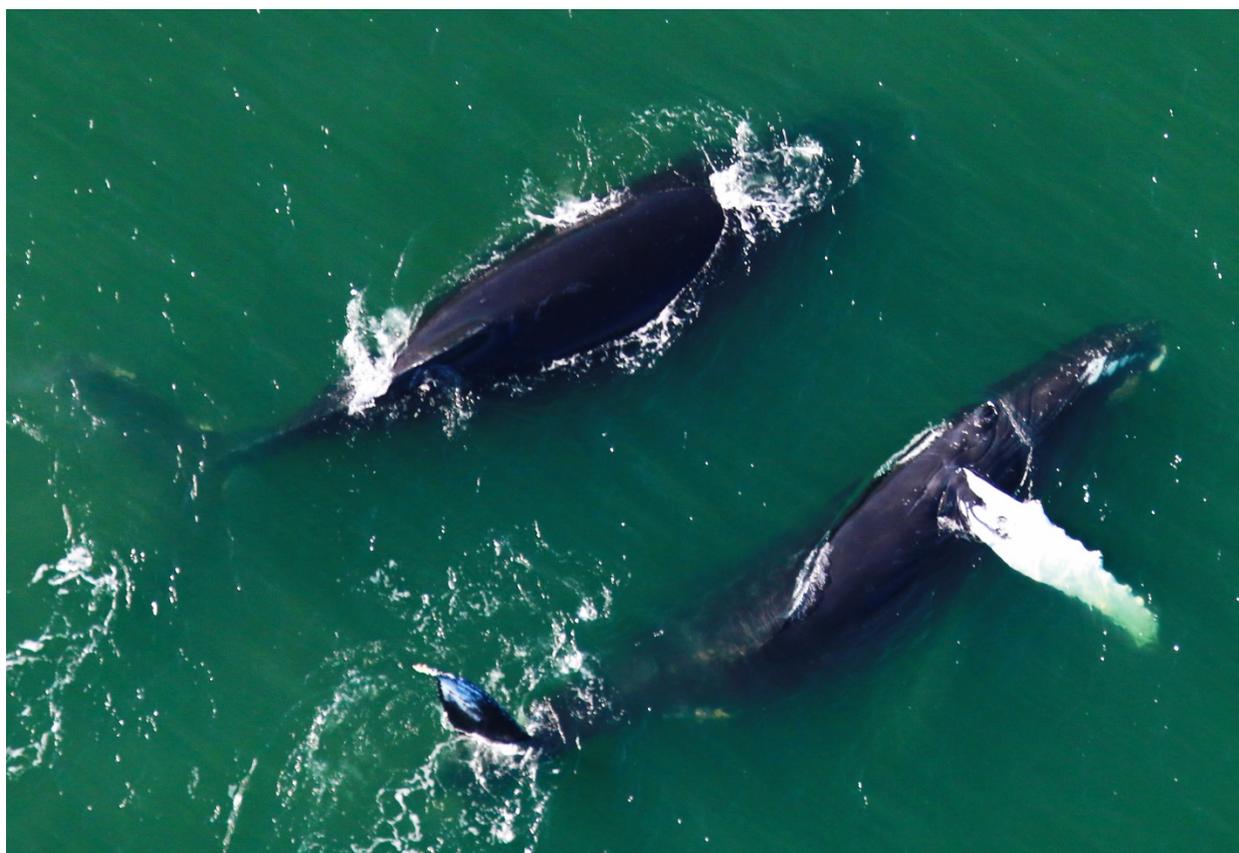


VAQF Scientific Report 2015-02

# **Documenting Whale Migration off Virginia's Coast for Use in Marine Spatial Planning:**

Aerial Surveys in the Proximity of the  
Virginia Wind Energy Area (VA WEA)

Survey/Reporting Period: May 2014 - December 2014



**Sarah D. Mallette, Gwen G. Lockhart, Ryan J. McAlarney, Erin W. Cummings, William A. McLellan, D. Ann Pabst and Susan G. Barco**



# Final Project Summary

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| NOAA Grant #:    | NA13NOS4190135  | Grant Year:    | 2013                          | Task #:       | 1            |
| Agency/Locality: | Virginia Aquarium & Marine Science Center Foundation                                |                |                               |               |              |
| Project Title:   | Documenting Whale Migration off Virginia's Coast for Use in Marine Spatial Planning |                |                               |               |              |
| Name:            | Sarah Mallette  | Email Address: | Smallett@virginiaaquarium.com | Phone Number: | 757-385-7575 |

**PROJECT SUMMARY:** Please confine your summary to the space provided below. Remember to:

- write for the public
- do not use first person
- include an abstract of project results
- provide a brief description, and titles, of publication(s) and/or dataset(s) produced
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We conducted nine surveys during May, June, and September - December. A total of 45 track lines (4830.2 km) were flown over 36.6 hours and covered the approximately 10,000 km<sup>2</sup> Virginia Wind Energy survey area (VA WEA) during the reporting period.

A total of 55 sightings of 553 cetaceans were encountered while on effort (*i.e.* on a designated trackline and actively surveying) during the 9 days of aerial surveys in the study area. Four species of cetaceans were photo-documented, including bottlenose dolphins (*Tursiops truncatus*), common dolphins (*Delphinus delphis*), Atlantic spotted dolphin (*Stenella frontalis*), humpback whales (*Megaptera novaeangliae*).

A total of 183 sightings of 340 sea turtles were recorded during the survey period. Ninety-five percent of the turtle sightings (n=174) were identified as loggerhead sea turtles (*Caretta caretta*). There were nine sightings of 11 turtles where species identification could not be established with 100% certainty, and they are listed as "unidentified turtle".

One sighting of two ocean sunfish (*Mola mola*) was recorded in September. The conservation status of this species has not been evaluated. There were seven sightings of individual manta rays (*Manta birostris*) in June and September. There were 24 sightings of 3,320 cownose rays (*Rhinoptera bonasus*).

A total of 105 large vessels (*e.g.* tankers, car carriers, container, and naval vessels) were observed in the survey area. A total of 69 individual small vessels (*e.g.* recreational vessels- sail, parasail, sport fishing boats) were observed within the study period.

Additional surveys and expansion of the survey area to include offshore waters along the continental slope are highly advised. Approximately a 20 mile extension of the current transect lines would provide coverage of the continental slope where marine mammal species diversity has been documented (McAlarney *et al.* 2013) to be higher along the continental shelf in pelagic waters just south of the VA WE survey area (Cape Hatteras, NC north to southern VA). Research suggests that offshore deep diving species such as beaked whales and blue whales which have been documented in the mid-Atlantic along the continental shelf are particularly sensitive to anthropogenic noise (Goldbogen, 2013, DeRuiter *et al.* 2013, Stimpert *et al.* 2014). Additional surveys would provide a sound baseline, fill temporal and spatial gaps, and could provide coverage of environmental phenomena. Expanding the survey area would provide documentation of species that would likely be impacted by offshore oil and gas leasing, increased shipping, and renewable energy development in the vicinity of the VA WEA.

Continued dedicated survey effort and monitoring over time can provide: 1) sufficient data for density estimates, 2) seasonal patterns of species distribution, 2) changes in distribution and abundance associated with energy development, and 4) the ability to identify preferred and critical habitat. Other opportunistic sightings, especially of large shipping vessels simultaneously collected during surveys can provide accessory human use data that can be incorporated into ecological models and ultimately used to guide ocean planning.

This project has begun to cover gaps in coverage, and we will continue to pursue support for surveys until the area has been surveyed in all seasons over the course of several years. In addition to the baseline data that are being currently being collected, initiation of a multi-platform (*i.e.* aerial, vessel, and acoustic) monitoring plan in the vicinity of the proposed offshore wind energy area is important to consider for the major development phases (*i.e.* construction, operation, maintenance, and eventual decommissioning). Possible changes in patterns of distribution and use of this area by endangered marine species, especially marine mammals and sea turtles, is critical to document especially as oil and gas exploration and leasing in the mid-Atlantic is opened in the near future (<http://www.boem.gov/Five-Year-Program>).



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## Product 1: Spatial Aerial Survey Data for Marine Geospatial Planning:

This project provides spatial data from aerial surveys off the coast of Virginia to OBIS SEAMAP, an online portal, that serves as a clearinghouse making data available to government, NGO's, academic researchers, managers, planners, and coordinators of online portals. Publishing these data on OBIS SEAMAP enables users all over the world to view data from surveys in Virginia and highlights marine mammal, sea turtle, "other sightings", and vessel observations. These data provides stakeholders with a useful tool for research, planning, and management. The data provided were collected as part of the Documenting Whale Migration off Virginia's Coast for Use in Marine Spatial Planning project - funded by the Virginia Coastal Zone Management Program Grant Section 309 Environmental Enhancement Program Strategy Project of Special Merit No. NA12NOS4190135

### Links to spatial data on OBIS SEAMAP:

The original survey data are separated into two datasets, collected from left-side and right-side observers to address variance in environmental and sighting conditions. Both datasets are available on OBIS-SEAMAP in the Virginia CZM Wind Energy Area Survey- May 2014 through December 2014 dataset. The effort data layer, for this project is static transect lines. Off-effort sightings were removed from this dataset.

- Digital data packet emailed to Nick Meade ([nick.meade@deq.virginia.gov](mailto:nick.meade@deq.virginia.gov)) on 16 February 2015 by Gwen Lockhart (glockhar@virginiaaquarium.com)

### (1) May 2014-December 2014

<http://seamap.env.duke.edu/provider/187>

### (2) November 2012-April 2014

- (a) Virginia CZM Wind Energy Area Survey- Left side  
<http://seamap.env.duke.edu/dataset/1194>
- (b) Virginia CZM Wind Energy Area Survey- Right side  
<http://seamap.env.duke.edu/dataset/1194>
- (c) Virginia CZM Wind Energy Area Survey- Vessel Survey Sightings  
<http://seamap.env.duke.edu/dataset/1196>

## Product 2: Final Report to CZM [See Final Report: Documenting Whale Migration off Virginia's Coast for Use in Marine Spatial Planning: Aerial and Vessel Surveys in the Proximity of the Virginia Wind Energy Area (VA WEA)]

### Datasets and Publications:

Mallette S.D., Lockhart G.G., Bort J.E., Rabon A., McAlarney R.J., Cummings E.W., Pabst D. A., McLellan W. A., Barco S.G. A review of large whale survey effort off the coast of Virginia utilizing multiple research platforms. University of North Carolina Wilmington; Virginia Aquarium and Marine Science Center. 2014 (SEAMAMMS). Wilmington, NC.

Mallette S.D., Lockhart G.G., McAlarney R.J., Cummings E.W., Pabst D. A., McLellan W. A., Barco S.G.. 2014. Documenting Whale Migration off Virginia's Coast for Use in Marine Spatial Planning: Aerial and Vessel Surveys in the Proximity of the Virginia Wind Energy Area (VA WEA). VAQF Scientific Report 2014-08. pp. 89

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**Virginia Coastal Zone**  
MANAGEMENT PROGRAM



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## Background

On November 1, 2013, Bureau of Ocean Energy Management (BOEM) announced Dominion Virginia Power was the provisional winner of the commercial lease area offshore of Virginia (VA WEA). The lease area covers approximately 560 km<sup>2</sup> off the coast of Virginia Beach, extending approximately 95 km offshore. Development of offshore wind energy poses potential threats to marine mammals, including direct effects (*i.e.* vessel interactions, collision and entanglement with structures, or injury due to noise from construction or operations) and long-term indirect threats (*i.e.* avoidance of otherwise suitable habitat, effects on prey species, increased risk of fishery and vessel interaction through displacement out of the WEA) (BOEM 2012). Recently, the Virginia Department of Mines, Minerals and Energy (DMME) submitted a research activities plan which described the proposed construction, operation, maintenance, and eventual decommissioning of the Virginia Offshore Wind Technology Advancement Project (VOWTAP). This project will be located approximately 45 km off the coast of Virginia Beach and would inform the future production of offshore wind energy.

Currently, few data exist on large whale species in vicinity of the VA WEA, and there is a crucial gap in our understanding of how the critically endangered North Atlantic right whale (*Eubalaena glacialis*; NARW) uses these waters (Malette *et al.* 2014; Kraus *et al.* 1986; Knowlton *et al.* 2002; Schick *et al.* 2009). This information is important to mitigate the potentially harmful impacts from ocean development, shipping, and other anthropogenic activities. Recent aerial and vessel surveys indicate that many large whale species occur in the waters surrounding the VA WEA, including humpback, fin, minke, and right whales (Malette *et al.* 2014). In fact, one right whale was sighted on the 4<sup>th</sup> of April 2014 in the eastern section of the VA WEA, within the commercial lease area at the cornerstone of block 6064, 6065, 6115, 6116. To address existing data gaps, we started collecting marine mammal sighting data from multiple platforms as well as sea turtle sighting data from aerial surveys off the coast of Virginia beginning in 2012.

This project represents a continuation of those surveys that began in 2012. For this report we conducted aerial surveys in the vicinity of the VA WEA from May to December 2014 to collect data over a large area that will provide insight into seasonal distribution of marine

mammals and sea turtles and contribute to large whale density estimates for the VA WEA and adjacent ocean waters.

## **Aerial Surveys**

### **Introduction**

One of the most basic ecological questions asked is how many animals are there in an area. Abundance estimation can be relatively simple if the area studied is easily surveyed, the animal studied is easy to detect, moves slowly, occurs singly or in small groups, and spends its time out in the open. Abundance estimation becomes more complex, however, when working with highly mobile marine animals, such as cetaceans and sea turtles, which spend a percentage of their time below the surface and thus unavailable to the observer for counting.

For large areas such as the VA WEA, aerial surveys provide the most economical platform for covering the survey area in a timely manner. Line transect distance sampling is preferred over strip transect methodology for marine animals because the primary assumption of strip transects is that all of the animals in a strip are counted. Line transect methods do not require that all animals in the survey area are counted, only that those on the transect line are counted (Buckland *et al.* 2001). In line transect distance sampling, a probability of detection at various distances is developed and abundance is estimated using this detection probability. Because cetaceans and sea turtles dive regularly, this assumption that all animals on the transect line are counted is also violated, but corrections can be applied to surveys post hoc to account for sub-surface time.

This project focused on collecting data for large whale abundance estimation. We report direct sightings here as there has not yet been enough effort to develop reliable detection curves for abundance estimation. In the future, these data will be combined with other aerial survey data to develop abundance estimates in the VA WEA.

## Methodology

### Survey Design and Logistics

Aerial survey effort was initiated in the Atlantic Ocean off the coast of Virginia in November of 2012 to collect data on the location, presence, and seasonality of large whale species in the vicinity of the Virginia Wind Energy Area (VA WEA). The initial effort ended in April of 2014, and we report here, sighting data collected on aerial surveys from May to December 2014. These results provide data on the distribution and occurrence of offshore cetacean species, sea turtles, other marine vertebrates, and vessel sightings. The approximately 10,000 km<sup>2</sup> survey area includes 12 transect lines oriented east-to-west that extend from the beach and run 55 to 96 km offshore (Table 1; Figure 1). The center of the survey area is the VA WEA and transect lines extend to the north, south, inshore and offshore of the WEA.

The survey transect lines were oriented perpendicular to shore, beginning at 36.50° N, and running at 7 km intervals to 37.50°N. Each transect line was approximately 50 nm (90 km) long. Surveys were flown at an altitude of 305 m (1,000 ft) and operational airspeeds of approximately 161 kph (100 mph). Two observers, positioned on each side of the aircraft, carried out the surveys and acted as independent observers. The plane was equipped with a Global Navigation System (GPS) to permit precise transect line fidelity. Each observer used an independent GPS to record precise time and geographic position of all marine mammal and sea turtles sightings. All reported times were in local EST/EDT time (UTC-5/4). Codes were used to identify and document discrete events throughout the survey (Table 2). Environmental parameters including visibility, Beaufort Sea State (BSS), cloud cover, and glare were collected throughout the survey period and each time an event was recorded. When a cetacean sighting occurred, the initial location on the trackline was recorded and the plane broke from the trackline. The sighting cues, vertical and horizontal angles of the initial sighting relative to the observer's vantage point in the plane were recorded at the time of the sighting. When the plane was directly over the animal(s) the location, species identification, reliability of species ID, and group size (minimum, maximum, and best estimate) were collected. Observers also recorded all sea turtle, other marine vertebrate, small and large vessel locations, but did not break track for these sightings.

If a sighting occurred while transiting to or from the survey area or between transect lines it was considered an “off effort” sighting. Any cetaceans encountered while investigating a separate sighting queue were also labeled off effort. If two species were seen associated with the same sighting queue both were considered on effort. Total number of individuals was based upon the best estimate of group size.

When identification could be confidently determined for bottlenose dolphin sightings within 20 miles of shore, track was not broken for nearshore sightings of this species, although sighting data were recorded for each such observation. This approach was established to minimize survey effort in areas where the spatial distribution and relative abundance of coastal bottlenose dolphins has previously been established (Barco *et al.* 1999; Torres *et al.* 2003; Torres *et al.* 2005).

Survey flights typically originated from the Fixed-base Operator (FBO) in Norfolk, VA with additional effort being conducted from the Dare County Regional Airport in Manteo, NC if Virginia surveys were occurring in conjunction with the University of North Carolina Wilmington, Cape Hatteras surveys. Utilizing both airports maximized “on effort” survey time by decreasing transit time to and from the transect lines surveyed.

ESRI®ArcMap™ was used to store all geo-referenced trip, encounter, and sighting information. Data management was based on the Arc Marine data model (Wright, 2007). In addition, tracks and sighting points, from all aerial surveys were incorporated into separate feature classes. We included all sighting data from aerial surveys, plotted group size distributions, and reported numbers of species sighted in tables by date and time. We also plotted group sizes relative to the designated shipping channels, North Atlantic Right Whale Seasonal Management Area, and Virginia Wind Energy Area.

## **Results**

Results presented here include only those sightings from the current reporting period under the current grant (NA12NOS4190135) with effort beginning in May 2014 and continuing to December 2014. We flew 45 tracklines totaling 4830.2 km of effort (Table 3; Figure 2a &

2b). Surveys were conducted in May, June and September-December of 2014. We chose not to conduct surveys in July and August in order to maximize survey time close to and during the predicted large whale utilization period (November to April). Survey conditions during the nine survey days ranged from Beaufort Sea State (BSS) 1 to 4, although effort was predominately conducted in BSS 2 to 3.

### **Marine Mammal Sightings** (Tables 4-9, Figure 3-8)

All identified species sighted (Table 4) are listed in order of decreasing number of sightings (*i.e.* most commonly sighted species first). A total of 55 sightings of 553 individual cetaceans representing four species were observed while on effort. While off effort, we recorded 9 cetacean sightings including 2 humpback (*Megaptera novaeangliae*) whales and 74 bottlenose dolphins (*Tursiops truncatus*). A total of four unique species were encountered while on effort in the survey area, including one large whale species, the humpback (*Megaptera novaeangliae*) whale, three delphinid species, bottlenose dolphin (*Tursiops truncatus*), common dolphin (*Delphinus delphis*), Atlantic spotted dolphin (*Stenella frontalis*), and an unidentified delphinid species. Off effort sightings are included in the sightings tables (Tables 5-9), in maps for each species, but are identified as on/off effort sighting in the text and when totals are reported.

### **Bottlenose dolphin** (*Tursiops truncatus*) (Table 5, Figure 4)

During both reporting cycles, bottlenose dolphins were the most commonly observed cetacean species. There were 46 sightings of 466 individuals. *Tursiops* were observed in five of the six months (May, June, September, October, and December) surveyed. Group size ranged from one to 50 individuals (mean=10; SD=11.2). Eight off effort sightings of 74 individuals were recorded and are not included in the above total. Based on the distance from shore (*i.e.* less than 30 km), these bottlenose dolphins were most likely the inshore ecotype (Torres *et al.* 2003; Lynott 2013). The population structure of bottlenose dolphins is complex with an offshore stock located near the continental shelf edge and multiple migratory and resident coastal stocks close to shore and in estuarine waters (Waring *et al.* 2013). The three coastal stocks that may occur in Virginia include approximately 22,000 individuals (Waring *et al.* 2013). Bottlenose dolphins are

consistently seen in Virginia waters from May through October (Barco *et al.* 1999) and are regularly sighted from early spring through late fall with sightings and stranding events in Virginia waters all months of the year (Swingle *et al.* 2010, 2011, 2012, 2013, 2014). An Unusual Mortality Event (UME) for bottlenose dolphins along the Atlantic coast was declared on July 1, 2013, and 415 confirmed dolphin strandings were documented in Virginia, with over 1,500 animals documented during the on-going event. Bottlenose dolphins are not listed as endangered or threatened under the Endangered Species Act (ESA), but the northern coastal migratory stock is listed as depleted under the Marine Mammal Protection Act (MMPA). It is unclear how the recent Unusual Mortality Event will affect stock status but it is unlikely that *Tursiops* will be listed under the ESA.

#### Common dolphin (*Delphinus delphis*) (Table 6, Figure 5)

Three sightings of 65 common dolphins were observed. Group sizes ranged from 11 to 40 individuals (mean = 22; SD = 15.9). There were no off effort sightings. The common dolphin (in the western north Atlantic also called the short-beaked common dolphin) is one of the most widely distributed species worldwide, and they typically occur over the continental shelf in waters 100-2,000 m deep. In the mid-Atlantic, they are often associated with the Gulf Stream (Doksaeter *et al.* 2008; Waring *et al.* 2008). Common dolphins regularly occur north of Cape Hatteras, North Carolina. From January to May they are found as far south as Cape Hatteras and typically spend the warmer water months in the U. S. northeast and Atlantic Canada (Hain *et al.* 1981; CETAP 1982; Payne *et al.* 1984). Abundance for the western north Atlantic stock is estimated to be around 68,000 individuals (Waring *et al.* 2013). The current best estimate of common dolphins in the western Atlantic Ocean combines two geographic estimates. Estimates from the Bay of Fundy to Maryland [90,547 individuals (CV=0.24)] and from Maryland to central Florida [30,196 (CV=0.54)] form a combined estimate of 120,743 (CV=0.23) (Waring *et al.* 2010). Short-beaked common dolphins are not listed as endangered or threatened under the ESA.

Atlantic spotted dolphin (*Stenella frontalis*) (Table 7, Figure 6)

A single sighting of six spotted dolphins was recorded on the 15<sup>th</sup> of May 2014. There are two distinct forms, or ecotypes, of the Atlantic spotted dolphin in the western north Atlantic: a heavily spotted, larger form that typically occurs on the continental shelf and is most often encountered at the 200 m isobath or shallower, and a less spotted and smaller form that occurs further offshore and around islands (Perrin *et al.* 1987, 1994). Although this species has been documented during stranding events in Virginia, this species was not sighted in the previous aerial survey period. It is unclear which ecotype was sighted after examination of photos collected during this sighting and the animals' location 96 km offshore (60 miles). The abundance estimate for *S. frontalis* in the western north Atlantic is 26798 (CV=0.66); the status of the stock(s) is/are unknown (Waring *et al.* 2012). Spotted dolphins are not listed as endangered or threatened under the ESA.

Humpback whale (*Megaptera novaeangliae*) (Table 8, Figure 7)

One sighting of one humpback whale was observed on effort during the survey period. While transiting south from the eastern segment of transect line 12 to transect line 11, a sighting of a single animal was recorded "off effort". Sightings occurred in November and December. This species is listed as endangered under the ESA. There are five stocks described based on feeding ground distribution. The Gulf of Maine stock of humpback whales is estimated to include 823 individuals (Waring *et al.* 2013), but humpbacks that stranded or were observed live in the mid-Atlantic have been identified to three different stocks: primarily the Gulf of Maine stock, but also the Gulf of St. Lawrence and Newfoundland stocks (Barco *et al.* 2002). Currently, humpback whales in the western North Atlantic are treated as a single stock despite genetic evidence identifying smaller sub-stocks (Waring *et al.* 2012). Population estimates range between 7,698 (genetic tagging methods) and 11,570 (photographic mark-recapture methods) depending upon methods utilized (reviewed in Waring *et al.* 2012).

### Unidentified delphinid (Table 9; Figure 8)

On three occasions, species identification could not be established with 100% certainty although the observer was confident of the scientific family classification of the sighting (*i.e.* body size and color pattern suggested these individuals were within the family *Delphinidae*). These sightings typically occurred when the individual or group could not be re-sighted for images to confirm species. These sightings were documented as “unidentified delphinids” and included 14 individuals. Group size ranged from one to eight individuals (mean = 4.7; SD = 3.5).

### Sea Turtle Sightings (Tables 10 - 12, Figure 9)

One hundred eighty-three sightings of 340 sea turtles were observed during the reporting period. Sighting rates were negatively correlated with Beaufort Sea State, with rates declining in sea states greater than a BSS 3. No sightings occurred during December surveys. Loggerhead sea turtles (*Caretta caretta*) represented the majority of sea turtle sightings (n=174, 95%). For the remaining nine sightings, species identification could not be made with 100% certainty and are therefore listed as “unidentified sea turtles”. Sea turtle species are susceptible to vessel strikes and entanglements in fishing gear as they are relatively slow moving and spend time at the surface basking in offshore waters.

### Loggerhead sea turtles (*Caretta caretta*) (Table 11; see Figure 9)

There were 174 sightings of 329 individual loggerhead sea turtles observed in May - June, and Sept - Nov. May (n=54 individuals) and June (n=236 individuals) had the highest numbers of sightings with 88% of the total individuals sighted in the current reporting period. The loggerhead is the most common sea turtle species in Virginia, and loggerheads along the eastern coast of the U. S. Atlantic are considered part of the Northwest Atlantic Ocean distinct population segment (DPS), which is separated into five separate recovery units (NOAA 2011). Loggerhead sea turtles originating from nests from southern Virginia to the Florida/Georgia

border are considered part of the Northern Recovery Unit which is currently listed as threatened under the ESA (NMFS 2008).

#### Unidentified sea turtles (Table 12; see Figure 9)

Turtles labeled as unidentified were typically either of small size, submerged, or too far away for observers to make an accurate identification to species. These unidentified turtles were hard-shelled turtles, not leatherbacks. There were nine on effort sightings of 11 individual turtles listed as unidentified all of which were documented in the months of May and June. One off effort individual was recorded in November.

#### **Other Marine Vertebrate Sightings** (Table 13; Figure 10)

##### Chondrichthyan fishes

Fifteen unidentified shark sightings of 516 individuals were observed during the June and September surveys. Most sightings were individual animals. There was one sighting of a group of three sharks traveling together. One sighting in June is responsible for the high number of individuals. This sighting contained a massive group of sharks estimated to have 500 individuals, 29 miles off the coast of Cape Henry. Fisheries staff at VAQ suggested the large size and observed behavior of the group was likely attributed to a breeding congregation as there was no prey observed during the course of this sighting. There were seven on effort sightings of individual manta rays (*Manta birostris*) and one off effort sighting of an individual, all of which were observed in June and September. This species is globally distributed - inhabiting tropical, subtropical, and temperate waters. *Manta birostris* is seasonally distributed and resident around productive coasts with regular upwelling, in oceanic islands, and in the vicinity of pinnacles and seamounts. There is currently no stock assessment on this species although this species has very low fecundity within the elasmobranchs. There were 24 sightings of 3,320 cownose rays (*Rhinoptera bonasus*). This species is listed as near threatened under the IUCN red list. Group size ranged from one to 700 individuals and was often observed in multiple subgroups within a sighting. The greatest number of cownose ray sightings occurred in June.

## Other fishes

One sighting of two ocean sunfish (*Mola mola*) was recorded in September. The conservation status of this species has not been evaluated.

## **Vessel sightings** (Table 14 - 15; Figure 11)

Vessels were categorized as (1) “other small vessels” (*e.g.* commercial, charter, recreational fishing and other small vessels including powerboats, sailboats or parasail boats), and (2) “large shipping vessels” (*e.g.* commercial cargo, cruise ship, military vessels). Entanglements in fishing gear and vessel strikes are leading causes of mortality for large whales in the Atlantic (Volgenau *et al.* 1995; Knowlton *et al.* 2001; Laist *et al.* 2001; Van der Hoop. *et al.* 2012, 2013). From 2001-2014, 34 large whale carcasses were documented in VA. Anthropogenic mortality could be attributed to 18 of these (14 vessel interactions, 2 entanglements, and 2 vessel interaction and entanglement) (VAQS Unpublished data).

Based on the density of ship traffic, the ocean approach to the Chesapeake Bay presents a pronounced collision threat for whales (Firestone *et al.* 2008) and the region from Cape Hatteras to the mouth of the Chesapeake Bay has the highest number of shipstrike large whales along the entire east coast (van der Hoop *et al.* 2013). For example, Hampton Roads is home to the third largest port on the East coast (BOEM 2012) and the combination of commercial, military and recreational vessel traffic in the Chesapeake Bay approach may make the area the busiest on the east coast of the U.S. To reduce the likelihood of serious injury and death to large whales, particularly the critically endangered North Atlantic right whale (NARW), a Seasonal Management Area (SMA) was established at the entrance of the Chesapeake Bay, requiring commercial vessels 65 ft (19.8 m) or greater to restrict speed to 10 knots or less from November 1-April 30 in VA. The speed reduction does not apply to military or Coast Guard vessels.

## Other small vessels (Table 14, see Figure 11)

A total of 69 individual small vessels (*e.g.* sail, parasail, powerboats) were observed within the study period. On nine occasions more than one vessel (*i.e.* 2-4 vessels) was observed

within a single field of vision. Small vessels were distributed throughout the study area but were most common inshore of the VA WEA.

#### Large vessels (Table 15, see Figure 11)

A total of 105 large vessels (*e.g.* tankers, car carriers, container, and military vessels) were observed in the survey area. On fifteen occasions, two vessels were observed within a single field of vision. Large vessels were sighted throughout the survey area, but were most dense inshore of the VA WEA.

## Aerial Survey Summary

The goal of this project was to collect data on the presence, location, and seasonality of endangered large whale species, especially critically endangered North Atlantic right whales (*Eubalaena glacialis*), in the vicinity of the Virginia Wind Energy Area (VA WEA) designated by the Department of the Interior's Bureau of Ocean Energy Management (BOEM). The aim was to conduct aerial surveys during months that were previously not surveyed to fill existing data gaps. From May 2014 to December 2014, a total of nine surveys were conducted covering 45 transect lines (4830.2 km) over 36.6 hours. The surveys resulted in 55 sightings of 553 cetaceans, 183 sightings of 340 sea turtles, 48 sighting of other marine vertebrates and 174 vessel sightings. These data will be added to previous effort from November 2012 through April 2014 and will be posted on marine spatial planning web portals such as OBIS SEAMap and MARCO.

To date, we have conducted at least one survey in all months except January, July and August. A continuation of this project will increase winter effort and, if funding allows, increase effort in months when whales are expected to be in Virginia waters. BOEM guidelines for providing information on marine mammals and sea turtles for renewable energy development on the Atlantic outer continental shelf (pursuant to 30 CFR Part 585 Subpart F) recommend that a minimum of two annual cycles of surveys be conducted in order to capture inter-annual and seasonal variation in sightings.

Additional surveys and expansion of the survey area to include offshore waters along the continental slope are highly advised. Approximately a 20 mile extension of the current transect lines would provide coverage of the continental slope where marine mammal species diversity has been documented (McAlarney *et al.* 2013) to be higher along the continental shelf in pelagic waters just south of the VA WE survey area (Cape Hatteras, NC north to southern VA). Research suggests that offshore deep diving species such as beaked whales and blue whales which have been documented in the mid-Atlantic along the continental shelf are particularly sensitive to anthropogenic noise (Goldbogen, 2013, DeRuiter *et al.* 2013, Stimpert *et al.* 2014). Additional surveys would provide a sound baseline, fill temporal and spatial gaps, and could provide coverage of environmental phenomena. Expanding the survey area would provide documentation of species that would likely be impacted by offshore oil and gas leasing, increased shipping, and renewable energy development in the vicinity of the VA WEA.

This project has begun to cover gaps in coverage, and we will continue to pursue support for surveys until the area has been surveyed in all seasons over the course of several years. In addition to the baseline data that are being currently being collected, initiation of a multi-platform (*i.e.* aerial, vessel, and acoustic) monitoring plan in the vicinity of the proposed offshore wind energy area is important to consider for the major development phases (*i.e.* construction, operation, maintenance, and eventual decommissioning). Possible changes in patterns of distribution and use of this area by endangered marine species, especially marine mammals and sea turtles, is critical to document especially as oil and gas exploration and leasing in the mid-Atlantic is opened in the near future ( <http://www.boem.gov/Five-Year-Program> ). These data are important for stakeholders to assess likelihood of ‘takes’ (MMPA, ESA) for environmental impact statements, permit applications, and compliance reporting. Additionally, multi-platform monitoring over time can elucidate potential sources of perturbations in distribution, habitat utilization, and ‘takes’ that may not otherwise be possible to distinguish which industry or activities may have elicited a ‘take’ when the mid-Atlantic is opened for multi-use natural resource extraction. Initiating a monitoring plan would also provide a proactive and adaptive approach for business, industry, and managers to utilize near-real time data - serving as a warning signal if substantial perturbations in behavior and habitat-use are documented - offering a mechanism to mitigate negative and potential cumulative impacts to endangered marine species.

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*Table 1.* Coordinates for transect line end points for the Virginia CZM survey area. The transect lines are listed from north to south.

| <b>Transect</b> | <b>Western Waypoint</b> |                 | <b>Eastern Waypoint</b> |                 |
|-----------------|-------------------------|-----------------|-------------------------|-----------------|
|                 | <b>Line</b>             | <b>Latitude</b> | <b>Longitude</b>        | <b>Latitude</b> |
| 12              | 37.268736               | -75.788489      | 37.266861               | -74.823890      |
| 11              | 37.209250               | -75.798006      | 37.207656               | -74.838116      |
| 10              | 37.149764               | -75.857492      | 37.149108               | -74.841439      |
| 9               | 37.087857               | -75.935734      | 37.088869               | -74.856821      |
| 8               | 37.028387               | -75.957473      | 37.030180               | -74.881991      |
| 7               | 36.966509               | -75.978602      | 36.967806               | -74.899736      |
| 6               | 36.907162               | -75.969085      | 36.909441               | -74.893431      |
| 5               | 36.847758               | -75.952705      | 36.849911               | -74.875357      |
| 4               | 36.788890               | -75.937675      | 36.790881               | -74.859249      |
| 3               | 36.729562               | -75.916478      | 36.731035               | -74.840603      |
| 2               | 36.670179               | -75.888754      | 36.672447               | -74.811987      |
| 1               | 36.610843               | -75.861533      | 36.612875               | -74.787569      |

*Table 2.* Event codes used during aerial surveys.

| <b>Event</b> |                              |
|--------------|------------------------------|
| <b>Code</b>  | <b>Value</b>                 |
| 1.1          | start/rejoin track           |
| 1.2          | end of trackline             |
| 2            | location of sighting cue     |
| 2.3          | small vessel                 |
| 2.4          | actual location of cetacean  |
| 2.41         | assumed location of cetacean |
| 2.42         | ending location of cetacean  |
| 2.70         | sea turtle                   |
| 2.8          | large vessel sighting        |
| 2.9          | non cetacean sighting        |
| 3.1          | changing survey conditions   |
| 10.0         | off effort sighting          |

Table 3. Transect lines, km flown, and Hobbs hours (*i.e.* engine hours) during aerial surveys off the Virginia CZM survey area from May 2014 to December 2014. Transect line numbers are listed in the order in which they were flown.

| <b>Date</b>   | <b>Transect lines<br/>flown Am</b> | <b>Transect lines<br/>flown PM</b> | <b>Total km<br/>flown</b> | <b>Hobbs<br/>Hours</b> |
|---------------|------------------------------------|------------------------------------|---------------------------|------------------------|
| 15-May-2015   | 12 to 5                            | 0                                  | 550.8                     | 4.7                    |
| 20-Jun-2014   | 10 to 7                            | 6 to 3                             | 741.0                     | 5.8                    |
| 21-Jun-2014   | 0                                  | 6 to 5                             | 198.8                     | 2.0                    |
| 21-Jun-2014   | 4-8; 3                             | 0                                  | 566.0                     | 4.0                    |
| 15-Sep-2014   | 10 to 7                            | 7 to 4                             | 765.0                     | 5.3                    |
| 8-Oct-2014    | 12 to 9                            | 8 to 5                             | 717.1                     | 5.2                    |
| 30-Nov-2014   | 1 to 2                             | 0                                  | 191.2                     | 1.5                    |
| 15-Dec-2014   | 8 to 5                             | 0                                  | 379.6                     | 2.8                    |
| 16-Dec-2014   | 12 to 7                            | 4 to 3                             | 720.6                     | 5.3                    |
| <b>9 Days</b> | <b>45 Tracklines flown</b>         |                                    | <b>4830.2</b>             | <b>36.6</b>            |

Table 4. Total number of on effort sightings and individuals for each species by month from May 2014 – December 2014

|                               |                  | <b>2014</b> |             |             |            |            |            |              |
|-------------------------------|------------------|-------------|-------------|-------------|------------|------------|------------|--------------|
|                               |                  | <b>May</b>  | <b>June</b> | <b>Sept</b> | <b>Oct</b> | <b>Nov</b> | <b>Dec</b> | <b>Total</b> |
| <i>Tursiops truncatus</i>     | Sightings        | 16          | 21          | 5           | 3          | 0          | 1          | 46           |
|                               | # of individuals | 148         | 212         | 63          | 31         | 0          | 12         | 466          |
| <i>Delphinus delphis</i>      | Sightings        | 0           | 0           | 0           | 0          | 0          | 3          | 3            |
|                               | # of individuals | 0           | 0           | 0           | 0          | 0          | 65         | 65           |
| <i>Stenella frontalis</i>     | Sightings        | 1           | 0           | 0           | 0          | 0          | 0          | 1            |
|                               | # of individuals | 6           | 0           | 0           | 0          | 0          | 0          | 6            |
| <i>Megaptera novaeangliae</i> | Sightings        | 0           | 0           | 0           | 0          | 1          | 1          | 2            |
|                               | # of individuals | 0           | 0           | 0           | 0          | 1          | 1          | 2            |
| Unidentified delphinid        | Sightings        | 0           | 2           | 1           | 0          | 0          | 0          | 3            |
|                               | # of individuals | 0           | 6           | 8           | 0          | 0          | 0          | 14           |
| Total sightings               |                  | 17          | 23          | 6           | 3          | 0          | 5          | 55           |
| Total individuals             |                  | 154         | 218         | 71          | 31         | 0          | 78         | 553          |

Table 5. Bottlenose dolphin (*Tursiops truncatus*) sightings in the Virginia CZM survey area from May 2014 to December 2014. Asterisk denotes off effort sightings.

| Date        | Time     | Way Point | Latitude | Longitude-1 | Track Number | Angle out | Degree Forward | Best # |
|-------------|----------|-----------|----------|-------------|--------------|-----------|----------------|--------|
| 15-May-2014 | 9:58:42  | 21        | 37.2606  | -75.6136    | 12           | 2         | 90°            | 10     |
| 15-May-2014 | 10:15:27 | 24        | 37.0251  | -75.9446    | 8            | 2         | 90°            | 3      |
| 15-May-2014 | 11:02:34 | 37        | 36.9691  | -75.1240    | 7            | 1         | 90°            | 3      |
| 15-May-2014 | 11:21:52 | 45        | 36.9740  | -75.5989    | 7            | 4         | 110            | 11     |
| 15-May-2014 | 9:03:34  | 3         | 37.2643  | -75.6734    | 12           | 2         | 90°            | 6      |
| 15-May-2014 | 9:03:55  | 4         | 37.2646  | -75.6615    | 12           | 2         | 90°            | 17     |
| 15-May-2014 | 9:05:36  | 5         | 37.2644  | -75.6027    | 12           | 2         | 90°            | 1      |
| 15-May-2014 | 9:41:03  | 16        | 37.2706  | -75.1180    | 12           | 4         | 130°           | 23     |
| 15-May-2014 | 9:55:06  | 22        | 37.2618  | -75.4871    | 12           | 1         | 90°            | 1      |
| 15-May-2014 | 9:58:22  | 24        | 37.2608  | -75.6014    | 12           | 2         | 100°           | 7      |
| 15-May-2014 | 10:01:47 | 27        | 37.2594  | -75.7230    | 12           | 2         | 100°           | 1      |
| 15-May-2014 | 10:18:06 | 33        | 37.0254  | -75.8625    | 8            | 3         | 90°            | 2      |
| 15-May-2014 | 11:25:57 | 55        | 36.9698  | -75.7500    | 7            | 3         | 90°            | 17     |
| 15-May-2014 | 11:32:15 | 56        | 36.9677  | -75.9720    | 7            | 3         | 90°            | 15     |
| 15-May-2014 | 12:38:41 | 71        | 36.8485  | -75.2025    | 5            | 2         | 110            | 3      |
| 15-May-2014 | 12:53:59 | 76        | 36.8432  | -75.4518    | 5            | 1         | 120            | 28     |
| 15-May-2014 | 10:03:40 | 29        | 37.2350  | -75.7699    | NA           | 3         | 90°            | 20     |
| 15-May-2014 | 10:14:10 | 30        | 37.0404  | -75.9493    | NA           | 3         | 90°            | 2      |
| 15-May-2014 | 11:35:00 | 58        | 36.9160  | -75.9748    | NA           | 2         | 90°            | 1      |
| 20-Jun-2014 | 11:19:44 | 4         | 37.1425  | -75.7066    | 10           | 1         | 90°            | 4      |
| 20-Jun-2014 | 12:22:48 | 17        | 37.0251  | -75.7611    | 8            | 2         | 110°           | 3      |
| 20-Jun-2014 | 13:46:50 | 54        | 36.9730  | -75.7569    | 7            | 2         | 90             | 5      |
| 20-Jun-2014 | 15:19:58 | 59        | 36.9055  | -75.9454    | 6            | 3         | 110            | 3      |
| 20-Jun-2014 | 15:22:33 | 61        | 36.9058  | -75.8429    | 6            | 2         | 60             | 4      |
| 20-Jun-2014 | 16:15:59 | 85        | 36.8414  | -75.8856    | 5            | 1         | 90             | 2      |
| 20-Jun-2014 | 16:34:07 | 93        | 36.7928  | -75.4146    | 4            | 2         | 90             | 19     |
| 20-Jun-2014 | 17:25:55 | 113       | 36.7236  | -75.8954    | 3            | 2         | 90             | 1      |

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Table 5 continued. Bottlenose dolphin (*Tursiops truncatus*) sightings in the Virginia CZM survey area from May 2014 to December 2014. Asterisk denotes off effort sightings.

| Date        | Time     | Way Point | Latitude | Longitude-1 | Track Number | Angle out | Degree Forward | Best # |
|-------------|----------|-----------|----------|-------------|--------------|-----------|----------------|--------|
| 20-Jun-2014 | 12:11:41 | 18        | 37.0862  | -75.7936    | 9            | 3         | 110°           | 1      |
| 20-Jun-2014 | 12:28:03 | 21        | 37.0289  | -75.6165    | 8            | 3         | 90°            | 25     |
| 20-Jun-2014 | 12:37:49 | 25        | 37.0263  | -75.4693    | 8            | 2         | 90°            | 50     |
| 20-Jun-2014 | 12:44:51 | 26        | 37.0278  | -75.4510    | 8            | 2         | 90°            | 45     |
| 20-Jun-2014 | 13:38:33 | 50        | 36.9903  | -75.4800    | 7            | 2         | 90°            | 4      |
| 20-Jun-2014 | 13:48:10 | 51        | 36.9700  | -75.8050    | 7            | 3         | 90°            | 1      |
| 20-Jun-2014 | 15:20:15 | 59        | 36.9054  | -75.9344    | 6            | 3         | 90             | 5      |
| 20-Jun-2014 | 15:20:38 | 60        | 36.9056  | -75.9190    | 6            | 3         | 90             | 7      |
| 20-Jun-2014 | 15:28:54 | 67        | 36.9064  | -75.5930    | 6            | 3         | 135            | 2      |
| 20-Jun-2014 | 16:13:43 | 105       | 36.8420  | -75.7957    | 5            | 3         | 90             | 5      |
| 20-Jun-2014 | 16:15:53 | 106       | 36.8415  | -75.8817    | 5            | 3         | 100            | 14     |
| 20-Jun-2014 | 16:20:36 | 110       | 36.7872  | -75.9095    | 4            | 3         | 90             | 7      |
| 20-Jun-2014 | 16:20:53 | 111       | 36.7875  | -75.8977    | 4            | 3         | 90             | 5      |
| 20-Jun-2014 | 11:12:01 | 1         | 37.0450  | -75.9724    | NA           | 2         | 100°           | 20     |
| 20-Jun-2014 | 12:16:25 | 20        | 37.0666  | -75.9551    | NA           | 2         | 100°           | 10     |
| 15-Sep-2014 | 14:17:41 | 19        | 36.9076  | -75.9426    | 6            | 3         | 90°            | 7      |
| 15-Sep-2014 | 15:21:04 | 36        | 36.9661  | -75.9561    | 7            | 1         | 90°            | 12     |
| 15-Sep-2014 | 15:28:02 | 40        | 37.0299  | -75.8151    | 8            | 2         | 90             | 3      |
| 15-Sep-2014 | 14:17:01 | 19        | 36.9072  | -75.9659    | 6            | 2         | 175°           | 6      |
| 15-Sep-2014 | 15:26:56 | 42        | 37.0295  | -75.8595    | 8            | 2         | 90°            | 35     |
| 8-Oct-2014  | 13:48:41 | 33        | 36.8418  | -75.8757    | 5            | 2         | 110°           | 8      |
| 8-Oct-2014  | 13:49:43 | 32        | 36.8416  | -75.9158    | 5            | 1         | 90°            | 8      |
| 8-Oct-2014  | 13:51:03 | 35        | 36.8399  | -75.9696    | 4            | 4         | 135°           | 15     |
| 8-Oct-2014  | 14:51:35 | 47        | 36.7937  | -75.9355    | NA           | 3         | 90             | 15     |
| 8-Oct-2014  | 14:53:53 | 48        | 36.8751  | -75.9633    | NA           | 2         | 90             | 1      |
| 8-Oct-2014  | 14:56:43 | 49        | 36.9302  | -76.0682    | NA           | 2         | 90             | 5      |
| 16-Dec-2014 | 11:47:58 | 20        | 37.0351  | -74.8871    | 8            | 2         | 90°            | 12     |

Table 6. Common dolphin (*Delphinus delphis*) sightings in the Virginia CZM survey area from May 2014 to December 2014.

| Date        | Time     | Way Point | Latitude | Longitude-1 | Track Number | Angle out | Degree Forward | Best # |
|-------------|----------|-----------|----------|-------------|--------------|-----------|----------------|--------|
| 15-Dec-2014 | 10:24:54 | 20        | 36.8473  | -74.9633    | 5            | 1         | 90°            | 11     |
| 16-Dec-2014 | 11:57:29 | 26        | 36.9742  | -74.9364    | 7            | 2         | 90°            | 40     |
| 16-Dec-2014 | 12:02:53 | 31        | 36.9720  | -75.1282    | 7            | 1         | 90°            | 14     |

Table 7. Atlantic spotted dolphin (*Stenella frontalis*) sightings in the Virginia CZM survey area from May 2014 to December 2014.

| Date        | Time     | Way Point | Latitude | Longitude-1 | Track Number | Angle out | Degree Forward | Best # |
|-------------|----------|-----------|----------|-------------|--------------|-----------|----------------|--------|
| 15-May-2014 | 12:15:41 | 66        | 36.8258  | -74.8877    | 5            | 2         | 110            | 6      |

Table 8. Humpback whale (*Megaptera novaeangliae*) sightings in the Virginia CZM survey area from May 2014 – December 2014. Asterisk denotes off effort sightings.

| Date        | Time     | Way Point | Latitude | Longitude-1 | Track Number | Angle out | Degree Forward | Best # |
|-------------|----------|-----------|----------|-------------|--------------|-----------|----------------|--------|
| 29-Nov-2014 | 10:08:48 | 7         | 37.2514  | -74.7990    | 12-11        | 2         | 90°            | 1*     |
| 16-Dec-2014 | 11:00:27 | 12        | 37.0906  | -75.6280    | 9            | 3         | 60°            | 1      |

Table 9. Unidentified delphinid sightings in the Virginia CZM survey area from May 2014 – December 2014.

| Date        | Time     | Way Point | Latitude | Longitude-1 | Track Number | Angle out | Degree Forward | Best # |
|-------------|----------|-----------|----------|-------------|--------------|-----------|----------------|--------|
| 20-Jun-2014 | 13:07:49 | 34        | 36.9647  | -74.9753    | 7            | 3         | 90°            | 5      |
| 20-Jun-2014 | 13:13:11 | 41        | 36.9607  | -74.9564    | 7            | 3         | 90             | 1      |
| 15-Sep-2014 | 14:56:19 | 32        | 36.9670  | -75.3108    | 7            | 3         | 110°           | 8      |

Table 10. Total number of on effort sea turtle sightings, including loggerhead (*Caretta caretta*) and unidentified sea turtles by month from May 2014 – December 2014.

|                        |                  | 2014 |      |      |     |     |     |       |
|------------------------|------------------|------|------|------|-----|-----|-----|-------|
|                        |                  | May  | June | Sept | Oct | Nov | Dec | Total |
| <i>Caretta caretta</i> | Sightings        | 36   | 106  | 21   | 8   | 3   | 0   | 174   |
|                        | # of individuals | 54   | 236  | 28   | 8   | 3   | 0   | 329   |
| Unidentified Turtle    | Sightings        | 2    | 7    | 0    | 0   | 0   | 0   | 9     |
|                        | # of individuals | 3    | 8    | 0    | 0   | 0   | 0   | 11    |
| Total sightings        |                  | 38   | 113  | 21   | 8   | 3   | 0   | 183   |
| Total individuals      |                  | 57   | 244  | 28   | 8   | 3   | 0   | 340   |

Table 11. Loggerhead sea turtles (*Caretta caretta*) sightings in the Virginia CZM survey area from May 2014 – December 2014.

| Date        | Time     | Way Point | Latitude | Longitude-1 | Track Number | Angle out | Degree Forward | Best # |
|-------------|----------|-----------|----------|-------------|--------------|-----------|----------------|--------|
| 15-May-2014 | 9:16:17  | 10        | 37.2649  | -75.2404    | 12           | 1         | 90°            | 1      |
| 15-May-2014 | 9:36:52  | 14        | 37.2654  | -75.0331    | 12           | 3         | 90°            | 1      |
| 15-May-2014 | 9:57:52  | 20        | 37.2609  | -75.5840    | 12           | 1         | 90°            | 2      |
| 15-May-2014 | 10:33:21 | 26        | 37.0055  | -75.3791    | 8            | 2         | 90°            | 1      |
| 15-May-2014 | 10:34:08 | 27        | 37.0067  | -75.3524    | 8            | 2         | 90°            | 2      |
| 15-May-2014 | 10:36:41 | 28        | 37.0102  | -75.2639    | 8            | 2         | 90°            | 1      |
| 15-May-2014 | 10:44:23 | 31        | 37.0208  | -74.9917    | 8            | 2         | 90°            | 1      |
| 15-May-2014 | 10:45:13 | 32        | 37.0219  | -74.9618    | 8            | 1         | 90°            | 1      |
| 15-May-2014 | 11:08:27 | 40        | 36.9694  | -75.3284    | 7            | 1         | 90°            | 1      |
| 15-May-2014 | 11:21:11 | 42        | 36.9708  | -75.5751    | 7            | 2         | 90°            | 3      |
| 15-May-2014 | 11:56:35 | 57        | 36.9071  | -75.2998    | 6            | 2         | 90°            | 2      |
| 15-May-2014 | 12:03:06 | 60        | 36.9058  | -75.0870    | 6            | 2         | 60             | 2      |
| 15-May-2014 | 9:35:15  | 13        | 37.2656  | -74.9766    | 12           | 4         | 90°            | 1      |
| 15-May-2014 | 9:36:32  | 14        | 37.2655  | -75.0215    | 12           | 2         | 90°            | 1      |
| 15-May-2014 | 9:47:14  | 20        | 37.2644  | -75.2127    | 12           | 2         | 110°           | 1      |
| 15-May-2014 | 9:49:51  | 21        | 37.2615  | -75.3028    | 12           | 3         | 90°            | 1      |
| 15-May-2014 | 9:59:19  | 25        | 37.2605  | -75.6351    | 12           | 2         | 90°            | 1      |
| 15-May-2014 | 10:28:51 | 34        | 37.0263  | -75.5192    | 8            | 2         | 90°            | 1      |
| 15-May-2014 | 10:33:00 | 35        | 37.0050  | -75.3912    | 8            | 3         | 90°            | 1      |
| 15-May-2014 | 10:35:23 | 37        | 37.0084  | -75.3092    | 8            | 2         | 90°            | 1      |
| 15-May-2014 | 10:39:36 | 38        | 37.0142  | -75.1622    | 8            | 3         | 90°            | 1      |
| 15-May-2014 | 10:44:11 | 39        | 37.0204  | -74.9993    | 8            | 3         | 90°            | 2      |
| 15-May-2014 | 10:45:06 | 40        | 37.0217  | -74.9662    | 8            | 3         | 90°            | 4      |
| 15-May-2014 | 10:46:15 | 41        | 37.0232  | -74.9249    | 8            | 3         | 90°            | 2      |
| 15-May-2014 | 10:59:11 | 46        | 36.9694  | -75.0060    | 7            | 2         | 90°            | 3      |
| 15-May-2014 | 11:03:40 | 47        | 36.9696  | -75.1622    | 7            | 3         | 90°            | 3      |
| 15-May-2014 | 11:07:11 | 48        | 36.9693  | -75.2844    | 7            | 3         | 90°            | 1      |
| 15-May-2014 | 11:08:51 | 50        | 36.9697  | -75.3425    | 7            | 2         | 90°            | 1      |
| 15-May-2014 | 11:09:20 | 51        | 36.9696  | -75.3595    | 7            | 2         | 90°            | 3      |
| 15-May-2014 | 11:52:56 | 60        | 36.9080  | -75.4187    | 6            | 2         | 90             | 1      |
| 15-May-2014 | 11:57:33 | 61        | 36.9074  | -75.2679    | 6            | 4         | 90             | 1      |
| 15-May-2014 | 12:08:11 | 63        | 36.9067  | -74.9105    | 6            | 2         | 90             | 1      |
| 15-May-2014 | 12:31:42 | 68        | 36.8552  | -74.9885    | 5            | 3         | 100            | 1      |

Table 11 continued. Loggerhead sea turtles (*Caretta caretta*) sightings in the Virginia CZM survey area from May 2014 – December 2014.

| Date        | Time     | Way Point | Latitude | Longitude-1 | Track Number | Angle out | Degree Forward | Best # |
|-------------|----------|-----------|----------|-------------|--------------|-----------|----------------|--------|
| 15-May-2014 | 12:33:51 | 69        | 36.8519  | -75.0635    | 5            | 3         | 90             | 1      |
| 15-May-2014 | 12:35:54 | 70        | 36.8486  | -75.1383    | 5            | 2         | 90             | 1      |
| 15-May-2014 | 11:08:08 | 49        | 36.9694  | -75.3177    | 7            | 3         | 90°            | 2      |
| 20-Jun-2014 | 11:52:13 | 8         | 37.0867  | -75.0760    | 9            | 3         | 90°            | 1      |
| 20-Jun-2014 | 12:02:20 | 9         | 37.0869  | -75.4511    | 9            | 2         | 90°            | 1      |
| 20-Jun-2014 | 12:03:23 | 10        | 37.0869  | -75.4893    | 9            | 2         | 90°            | 1      |
| 20-Jun-2014 | 12:22:17 | 16        | 37.0251  | -75.7800    | 8            | 2         | 90°            | 1      |
| 20-Jun-2014 | 12:24:50 | 18        | 37.0253  | -75.6859    | 8            | 2         | 90°            | 1      |
| 20-Jun-2014 | 12:26:25 | 19        | 37.0257  | -75.6286    | 8            | 2         | 90°            | 1      |
| 20-Jun-2014 | 12:46:58 | 28        | 37.0260  | -75.3688    | 8            | 2         | 90°            | 1      |
| 20-Jun-2014 | 12:49:39 | 29        | 37.0260  | -75.2714    | 8            | 3         | 90°            | 1      |
| 20-Jun-2014 | 12:53:36 | 32        | 37.0259  | -75.1257    | 8            | 2         | 90°            | 3      |
| 20-Jun-2014 | 12:55:32 | 33        | 37.0258  | -75.0542    | 8            | 2         | 90°            | 2      |
| 20-Jun-2014 | 12:57:03 | 34        | 37.0256  | -74.9982    | 8            | 2         | 90°            | 2      |
| 20-Jun-2014 | 12:58:11 | 35        | 37.0255  | -74.9564    | 8            | 1         | 90°            | 1      |
| 20-Jun-2014 | 15:23:45 | 62        | 36.9057  | -75.7955    | 6            | 1         | 90             | 1      |
| 20-Jun-2014 | 15:27:07 | 63        | 36.9063  | -75.6637    | 6            | 1         | 90             | 1      |
| 20-Jun-2014 | 15:29:21 | 64        | 36.9065  | -75.5752    | 6            | 2         | 90             | 2      |
| 20-Jun-2014 | 15:31:19 | 65        | 36.9065  | -75.4965    | 6            | 1         | 90             | 2      |
| 20-Jun-2014 | 15:33:59 | 66        | 36.9067  | -75.3885    | 6            | 2         | 90             | 2      |
| 20-Jun-2014 | 15:39:30 | 68        | 36.9069  | -75.1660    | 6            | 2         | 90             | 1      |
| 20-Jun-2014 | 15:45:10 | 71        | 36.9063  | -74.9454    | 6            | 2         | 90             | 3      |
| 20-Jun-2014 | 15:53:16 | 75        | 36.8428  | -74.9870    | 5            | 2         | 90             | 3      |
| 20-Jun-2014 | 15:56:15 | 77        | 36.8431  | -75.1052    | 5            | 1         | 90             | 5      |
| 20-Jun-2014 | 15:57:47 | 78        | 36.8430  | -75.1649    | 5            | 2         | 90             | 4      |
| 20-Jun-2014 | 15:58:43 | 79        | 36.8430  | -75.2012    | 5            | 2         | 90             | 5      |
| 20-Jun-2014 | 16:00:04 | 80        | 36.8432  | -75.2527    | 5            | 2         | 90             | 6      |
| 20-Jun-2014 | 16:07:39 | 83        | 36.8427  | -75.5553    | 5            | 1         | 90             | 1      |
| 20-Jun-2014 | 16:24:06 | 89        | 36.7882  | -75.7705    | 4            | 1         | 90             | 1      |
| 20-Jun-2014 | 16:26:53 | 90        | 36.7885  | -75.6616    | 4            | 2         | 90             | 2      |
| 20-Jun-2014 | 16:29:55 | 91        | 36.7888  | -75.5418    | 4            | 2         | 90             | 2      |
| 20-Jun-2014 | 16:39:12 | 97        | 36.7896  | -75.3348    | 4            | 1         | 90             | 1      |
| 20-Jun-2014 | 16:42:49 | 99        | 36.7892  | -75.1899    | 4            | 1         | 90             | 2      |
| 20-Jun-2014 | 16:51:29 | 103       | 36.7849  | -75.0601    | 4            | 1         | 90             | 1      |

Table 11 continued. Loggerhead sea turtles (*Caretta caretta*) sightings in the Virginia CZM survey area from May 2014 – December 2014.

| Date        | Time     | Way Point | Latitude | Longitude-1 | Track Number | Angle out | Degree Forward | Best # |
|-------------|----------|-----------|----------|-------------|--------------|-----------|----------------|--------|
| 20-Jun-2014 | 16:52:57 | 104       | 36.7890  | -75.0028    | 4            | 1         | 90             | 1      |
| 20-Jun-2014 | 17:02:23 | 107       | 36.7248  | -74.9480    | 3            | 1         | 90             | 2      |
| 20-Jun-2014 | 17:05:02 | 108       | 36.7252  | -75.0494    | 3            | 1         | 90             | 2      |
| 20-Jun-2014 | 17:06:58 | 109       | 36.7252  | -75.1225    | 3            | 1         | 90             | 6      |
| 20-Jun-2014 | 17:11:12 | 110       | 36.7253  | -75.2898    | 3            | 2         | 90             | 3      |
| 20-Jun-2014 | 11:49:32 | 4         | 37.0865  | -74.9754    | 9            | 2         | 90°            | 1      |
| 20-Jun-2014 | 11:50:14 | 5         | 37.0866  | -75.0013    | 9            | 2         | 90°            | 1      |
| 20-Jun-2014 | 11:50:54 | 6         | 37.0866  | -75.0260    | 9            | 4         | 80°            | 1      |
| 20-Jun-2014 | 11:51:14 | 7         | 37.0867  | -75.0391    | 9            | 3         | 110°           | 1      |
| 20-Jun-2014 | 11:51:49 | 8         | 37.0867  | -75.0609    | 9            | 2         | 90°            | 1      |
| 20-Jun-2014 | 11:55:34 | 9         | 37.0870  | -75.2014    | 9            | 2         | 100°           | 1      |
| 20-Jun-2014 | 11:56:56 | 10        | 37.0869  | -75.2528    | 9            | 3         | 100°           | 1      |
| 20-Jun-2014 | 12:01:35 | 11        | 37.0870  | -75.4239    | 9            | 4         | 90°            | 1      |
| 20-Jun-2014 | 12:02:40 | 12        | 37.0869  | -75.4631    | 9            | 3         | 90°            | 1      |
| 20-Jun-2014 | 12:05:44 | 13        | 37.0867  | -75.5758    | 9            | 3         | 90°            | 1      |
| 20-Jun-2014 | 12:09:22 | 14        | 37.0865  | -75.7090    | 9            | 2         | 90°            | 1      |
| 20-Jun-2014 | 12:10:00 | 15        | 37.0865  | -75.7318    | 9            | 2         | 90°            | 1      |
| 20-Jun-2014 | 12:10:53 | 16        | 37.0862  | -75.7641    | 9            | 2         | 90°            | 1      |
| 20-Jun-2014 | 12:11:27 | 17        | 37.0863  | -75.7846    | 9            | 4         | 90°            | 1      |
| 20-Jun-2014 | 12:57:20 | 27        | 37.0256  | -74.9876    | 8            | 3         | 90°            | 2      |
| 20-Jun-2014 | 13:06:41 | 32        | 36.9660  | -74.9371    | 7            | 3         | 90°            | 2      |
| 20-Jun-2014 | 13:07:13 | 33        | 36.9658  | -74.9554    | 7            | 3         | 100°           | 1      |
| 20-Jun-2014 | 13:14:36 | 36        | 36.9674  | -75.0075    | 7            | 2         | 100°           | 2      |
| 20-Jun-2014 | 13:15:18 | 37        | 36.9665  | -75.0330    | 7            | 3         | 115°           | 2      |
| 20-Jun-2014 | 13:17:20 | 38        | 36.9662  | -75.1059    | 7            | 4         | 85             | 2      |
| 20-Jun-2014 | 13:18:56 | 39        | 36.9659  | -75.1622    | 7            | 3         | 90             | 2      |
| 20-Jun-2014 | 13:21:39 | 40        | 36.9654  | -75.2606    | 7            | 2         | 80             | 1      |
| 20-Jun-2014 | 13:23:23 | 41        | 36.9650  | -75.3234    | 7            | 3         | 90             | 2      |
| 20-Jun-2014 | 13:23:37 | 42        | 36.9646  | -75.3320    | 7            | 2         | 110°           | 1      |
| 20-Jun-2014 | 13:24:52 | 43        | 36.9636  | -75.3779    | 7            | 4         | 80             | 1      |
| 20-Jun-2014 | 13:35:49 | 45        | 36.9735  | -75.4458    | 7            | 3         | 90             | 2      |
| 20-Jun-2014 | 13:43:10 | 49        | 36.9811  | -75.6237    | 7            | 3         | 90             | 1      |
| 20-Jun-2014 | 13:47:49 | 50        | 36.9707  | -75.7923    | 7            | 3         | 90°            | 1      |
| 20-Jun-2014 | 13:49:19 | 52        | 36.9674  | -75.8442    | 7            | 3         | 90             | 1      |

Table 11 continued. Loggerhead sea turtles (*Caretta caretta*) sightings in the Virginia CZM survey area from May 2014 – December 2014.

| Date        | Time     | Way Point | Latitude | Longitude-1 | Track Number | Angle out | Degree Forward | Best # |
|-------------|----------|-----------|----------|-------------|--------------|-----------|----------------|--------|
| 20-Jun-2014 | 13:50:54 | 53        | 36.9639  | -75.8996    | 7            | 3         | 90             | 1      |
| 20-Jun-2014 | 13:51:51 | 55        | 36.9617  | -75.9331    | 7            | 3         | 90             | 2      |
| 20-Jun-2014 | 15:23:09 | 62        | 36.9057  | -75.8190    | 6            | 3         | 90             | 2      |
| 20-Jun-2014 | 15:23:57 | 63        | 36.9056  | -75.7870    | 6            | 3         | 90             | 4      |
| 20-Jun-2014 | 15:24:57 | 64        | 36.9060  | -75.7484    | 6            | 3         | 90             | 1      |
| 20-Jun-2014 | 15:26:30 | 66        | 36.9062  | -75.6880    | 6            | 2         | 90             | 2      |
| 20-Jun-2014 | 15:29:50 | 68        | 36.9064  | -75.5560    | 6            | 3         | 90             | 1      |
| 20-Jun-2014 | 15:30:13 | 69        | 36.9064  | -75.5405    | 6            | 3         | 90             | 1      |
| 20-Jun-2014 | 15:30:46 | 70        | 36.9064  | -75.5183    | 6            | 3         | 90             | 3      |
| 20-Jun-2014 | 15:31:44 | 71        | 36.9066  | -75.4799    | 6            | 3         | 90             | 2      |
| 20-Jun-2014 | 15:32:05 | 72        | 36.9065  | -75.4658    | 6            | 3         | 90             | 5      |
| 20-Jun-2014 | 15:35:04 | 75        | 36.9067  | -75.3448    | 6            | 3         | 100            | 5      |
| 20-Jun-2014 | 15:36:05 | 76        | 36.9066  | -75.3034    | 6            | 3         | 100            | 6      |
| 20-Jun-2014 | 15:39:22 | 77        | 36.9068  | -75.1711    | 6            | 3         | 90             | 1      |
| 20-Jun-2014 | 15:39:41 | 78        | 36.9069  | -75.1585    | 6            | 3         | 90             | 3      |
| 20-Jun-2014 | 15:40:05 | 79        | 36.9067  | -75.1428    | 6            | 1         | 90             | 2      |
| 20-Jun-2014 | 15:41:02 | 80        | 36.9066  | -75.1062    | 6            | 2         | 90             | 1      |
| 20-Jun-2014 | 15:41:51 | 81        | 36.9065  | -75.0739    | 6            | 2         | 90             | 5      |
| 20-Jun-2014 | 15:44:40 | 83        | 36.9063  | -74.9644    | 6            | 1         | 90             | 5      |
| 20-Jun-2014 | 15:45:51 | 84        | 36.9054  | -74.9191    | 6            | 3         | 90             | 5      |
| 20-Jun-2014 | 15:52:12 | 88        | 36.8444  | -74.9444    | 5            | 3         | 90             | 3      |
| 20-Jun-2014 | 15:53:43 | 90        | 36.8429  | -75.0049    | 5            | 3         | 90             | 10     |
| 20-Jun-2014 | 15:55:21 | 91        | 36.8431  | -75.0702    | 5            | 3         | 90             | 5      |
| 20-Jun-2014 | 15:56:19 | 92        | 36.8431  | -75.1077    | 5            | 2         | 90             | 7      |
| 20-Jun-2014 | 15:59:21 | 94        | 36.8432  | -75.2255    | 5            | 3         | 90             | 3      |
| 20-Jun-2014 | 16:00:40 | 96        | 36.8433  | -75.2758    | 5            | 3         | 90             | 2      |
| 20-Jun-2014 | 16:09:10 | 99        | 36.8426  | -75.6165    | 5            | 2         | 90             | 2      |
| 20-Jun-2014 | 16:26:01 | 114       | 36.7883  | -75.6959    | 4            | 3         | 90             | 3      |
| 20-Jun-2014 | 16:26:52 | 115       | 36.7884  | -75.6625    | 4            | 3         | 90             | 2      |
| 20-Jun-2014 | 16:29:26 | 117       | 36.7887  | -75.5609    | 4            | 2         | 90             | 2      |
| 20-Jun-2014 | 16:32:24 | 118       | 36.7889  | -75.4423    | 4            | 3         | 90             | 3      |
| 20-Jun-2014 | 16:40:59 | 123       | 36.7893  | -75.2631    | 4            | 3         | 90             | 3      |
| 20-Jun-2014 | 16:42:47 | 125       | 36.7892  | -75.1907    | 4            | 2         | 90             | 3      |
| 20-Jun-2014 | 16:44:03 | 127       | 36.7892  | -75.1407    | 4            | 3         | 90             | 5      |
| 20-Jun-2014 | 16:44:27 | 128       | 36.7892  | -75.1245    | 4            | 2         | 90             | 2      |

Table 11 continued. Loggerhead sea turtles (*Caretta caretta*) sightings in the Virginia CZM survey area from May 2014 – December 2014.

| Date        | Time     | Way Point | Latitude | Longitude-1 | Track Number | Angle out | Degree Forward | Best # |
|-------------|----------|-----------|----------|-------------|--------------|-----------|----------------|--------|
| 20-Jun-2014 | 16:52:29 | 131       | 36.7887  | -75.0214    | 4            | 2         | 90             | 2      |
| 20-Jun-2014 | 17:07:00 | 136       | 36.7253  | -75.1234    | 3            | 3         | 90             | 2      |
| 20-Jun-2014 | 17:08:01 | 137       | 36.7251  | -75.1639    | 3            | 3         | 90             | 3      |
| 20-Jun-2014 | 17:10:41 | 139       | 36.7253  | -75.2687    | 3            | 3         | 110            | 3      |
| 21-Jun-2014 | 16:52:44 | 156       | 36.9065  | -75.1858    | 6            | 2         | 90°            | 1      |
| 21-Jun-2014 | 16:53:57 | 157       | 36.9066  | -75.1464    | 6            | 2         | 90°            | 1      |
| 15-Sep-2014 | 14:23:34 | 22        | 36.9085  | -75.7271    | 6            | 1         | 90°            | 3      |
| 15-Sep-2014 | 14:42:45 | 25        | 36.9101  | -74.9482    | 6            | 2         | 90°            | 2      |
| 15-Sep-2014 | 15:16:56 | 33        | 36.9664  | -75.7881    | 7            | 1         | 90°            | 1      |
| 15-Sep-2014 | 15:31:17 | 41        | 37.0304  | -75.6855    | 8            | 1         | 90             | 1      |
| 15-Sep-2014 | 15:33:59 | 43        | 37.0306  | -75.5736    | 8            | 1         | 90             | 1      |
| 15-Sep-2014 | 15:39:46 | 44        | 37.0311  | -75.3384    | 8            | 1         | 90             | 2      |
| 15-Sep-2014 | 15:45:54 | 47        | 37.0309  | -75.0894    | 8            | 1         | 90             | 1      |
| 15-Sep-2014 | 15:47:24 | 48        | 37.0309  | -75.0283    | 8            | 2         | 90             | 2      |
| 15-Sep-2014 | 15:48:32 | 49        | 37.0312  | -74.9814    | 8            | 2         | 90             | 2      |
| 15-Sep-2014 | 16:19:08 | 54        | 36.7289  | -75.6480    | 3            | 2         | 90             | 1      |
| 15-Sep-2014 | 13:23:41 | 3         | 36.7901  | -75.7319    | 4            | 3         | 110°           | 1      |
| 15-Sep-2014 | 14:11:27 | 14        | 36.8476  | -75.8210    | 5            | 3         | 90°            | 1      |
| 15-Sep-2014 | 14:26:55 | 24        | 36.9093  | -75.5905    | 6            | 1         | 90°            | 1      |
| 15-Sep-2014 | 14:29:07 | 25        | 36.9093  | -75.5017    | 6            | 3         | 90°            | 1      |
| 15-Sep-2014 | 15:11:32 | 35        | 36.9669  | -75.5647    | 7            | 2         | 90°            | 1      |
| 15-Sep-2014 | 15:16:31 | 36        | 36.9666  | -75.7707    | 7            | 3         | 100°           | 1      |
| 15-Sep-2014 | 15:26:35 | 41        | 37.0295  | -75.8732    | 8            | 2         | 90             | 1      |
| 15-Sep-2014 | 15:43:02 | 46        | 37.0313  | -75.2055    | 8            | 2         | 100            | 1      |
| 15-Sep-2014 | 15:47:49 | 47        | 37.0309  | -75.0114    | 8            | 3         | 90             | 2      |
| 15-Sep-2014 | 16:00:06 | 52        | 36.7296  | -74.8637    | 3            | 3         | 90             | 1      |
| 15-Sep-2014 | 16:01:22 | 53        | 36.7300  | -74.9145    | 3            | 3         | 90             | 1      |
| 8-Oct-2014  | 11:10:37 | 15        | 36.9604  | -75.8782    | 7            | 1         | 90°            | 1      |
| 8-Oct-2014  | 13:36:00 | 26        | 36.8466  | -75.3772    | 5            | 2         | 100°           | 1      |
| 8-Oct-2014  | 13:57:48 | 37        | 36.7887  | -75.7438    | 4            | 1         | 90°            | 1      |
| 8-Oct-2014  | 14:06:15 | 40        | 36.7894  | -75.3874    | 4            | 1         | 90             | 1      |
| 8-Oct-2014  | 14:08:36 | 42        | 36.7896  | -75.2869    | 4            | 1         | 90°            | 1      |
| 8-Oct-2014  | 10:57:06 | 14        | 36.9649  | -75.3614    | 7            | 2         | 100°           | 1      |
| 8-Oct-2014  | 13:44:17 | 30        | 36.8439  | -75.7013    | 5            | 3         | 90°            | 1      |
| 8-Oct-2014  | 14:03:14 | 40        | 36.7892  | -75.5129    | 4            | 2         | 90             | 1      |
| 29-Nov-2014 | 13:27:58 | 27        | 37.0302  | -75.0993    | 8            | 3         | 90°            | 1      |
| 29-Nov-2014 | 10:21:03 | 7         | 37.2102  | -75.1549    | 11           | 2         | 90°            | 1      |
| 29-Nov-2014 | 10:28:48 | 8         | 37.2067  | -75.4723    | 11           | 1         | 90°            | 1      |

*Table 12.* Unidentified sea turtles sightings in the Virginia CZM survey area from May 2014 – December 2014.

| <b>Date</b> | <b>Time</b> | <b>Way Point</b> | <b>Latitude</b> | <b>Longitude-1</b> | <b>Track Number</b> | <b>Angle out</b> | <b>Degree Forward</b> | <b>Best #</b> |
|-------------|-------------|------------------|-----------------|--------------------|---------------------|------------------|-----------------------|---------------|
| 5/15/2014   | 11:21:28    | 43               | 36.9739         | -75.5847           | 7                   | 2                | 90°                   | 2             |
| 5/15/2014   | 11:53:56    | 55               | 36.9076         | -75.3857           | 6                   | 3                | 60                    | 1             |
| 6/20/2014   | 12:51:35    | 30               | 37.0260         | -75.1997           | 8                   | 3                | 90°                   | 1             |
| 6/20/2014   | 12:52:37    | 31               | 37.0259         | -75.1619           | 8                   | 3                | 90°                   | 1             |
| 6/20/2014   | 16:09:17    | 100              | 36.8426         | -75.6216           | 5                   | 2                | 90                    | 2             |
| 6/20/2014   | 16:13:20    | 104              | 36.8419         | -75.7804           | 5                   | 3                | 90                    | 1             |
| 6/20/2014   | 16:43:26    | 126              | 36.7892         | -75.1649           | 4                   | 2                | 90                    | 1             |
| 6/20/2014   | 17:08:09    | 138              | 36.7251         | -75.1687           | 3                   | 3                | 90                    | 1             |
| 6/20/2014   | 17:16:35    | 143              | 36.7251         | -75.5075           | 3                   | 3                | 90                    | 1             |
| 11/29/2014  | 10:07:26    | 5                | 37.2482         | -74.8249           | NA                  | 3                | 90°                   | 1             |

Table 13. Other Marine Vertebrate sightings in the Virginia CZM survey area from May 2014 – December 2014.

| Date        | Time     | Way Point | Latitude | Longitude-1 | Track Number | Angle out | Degree Forward | Species | Best # | Comments  |
|-------------|----------|-----------|----------|-------------|--------------|-----------|----------------|---------|--------|---|
| 15-May-2014 | 11:36:33 | 52        | 36.9061  | -75.9415    | 6            | 3         | 90             | Rbo     | 50     | cownose rays                                    |
| 20-Jun-2014 | 12:36:05 | 25        | 37.0258  | -75.4720    | 8            | 2         | 90°            | Chon    | 500    | sharks, bait, Ttr; huge boiling group of sharks |
| 20-Jun-2014 | 15:32:58 | 73        | 36.9067  | -75.4300    | 6            | 2         | 100            | Rbo     | 100    | cownose; spread out dense                       |
| 20-Jun-2014 | 15:34:05 | 74        | 36.9066  | -75.3845    | 6            | 3         | 90             | Rbo     | 150    | cownose; few groups                             |
| 20-Jun-2014 | 15:43:09 | 82        | 36.9065  | -75.0232    | 6            | 2         | 90             | Mbi     | 1      | manta ray                                       |
| 20-Jun-2014 | 15:43:54 | 70        | 36.9065  | -74.9939    | 6            | 2         | 90             | Mbi     | 1      | manta ray                                       |
| 20-Jun-2014 | 15:46:33 | 85        | 36.9039  | -74.8913    | 6            | 3         | 90             | Chon    | 1      | hammerhead                                      |
| 20-Jun-2014 | 15:50:40 | 74        | 36.8428  | -74.9207    | 5            | 1         | 90             | Mbi     | 1      | manta ray                                       |
| 20-Jun-2014 | 15:52:54 | 89        | 36.8430  | -74.9721    | 5            | 2         | 110            | Mbi     | 1      | manta ray                                       |
| 20-Jun-2014 | 15:55:47 | 76        | 36.8430  | -75.0872    | 5            | 1         | 90             | Chon    | 1      | hammerhead                                      |
| 20-Jun-2014 | 15:58:25 | 93        | 36.8431  | -75.1893    | 5            | 3         | 90             | Chon    | 1      | shark   |
| 20-Jun-2014 | 16:00:02 | 95        | 36.8432  | -75.2517    | 5            | 3         | 90             | Chon    | 1      | shark swimming below turtle                     |
| 20-Jun-2014 | 16:01:02 | 81        | 36.8432  | -75.2905    | 5            | 3         | 90             | Rbo     | 83     | cownose ray                                     |
| 20-Jun-2014 | 16:02:13 | 82        | 36.8431  | -75.3367    | 5            | 2         | 90             | Rbo     | 80     | cownose ray                                     |
| 20-Jun-2014 | 16:05:39 | 97        | 36.8430  | -75.4741    | 5            | 3         | 90             | Rbo     | 75     | cownose   |
| 20-Jun-2014 | 16:06:41 | 98        | 36.8428  | -75.5160    | 5            | 3         | 90             | Rbo     | 75     | cownose   |
| 20-Jun-2014 | 16:12:59 | 103       | 36.8420  | -75.7667    | 5            | 2         | 90             | Chon    | 1      | shark   |
| 20-Jun-2014 | 16:16:38 | 107       | 36.8414  | -75.9111    | 5            | 3         | 90             | Rbo     | 75     | cownose   |
| 20-Jun-2014 | 16:23:51 | 112       | 36.7880  | -75.7800    | 4            | 3         | 90             | Chon    | 1      | shark   |
| 20-Jun-2014 | 16:28:09 | 116       | 36.7886  | -75.6118    | 4            | 2         | 110            | Chon    | 1      | shark   |
| 20-Jun-2014 | 16:32:46 | 119       | 36.7890  | -75.4278    | 4            | 3         | 90             | Rbo     | 5      | cownose   |
| 20-Jun-2014 | 16:38:29 | 122       | 36.7884  | -75.3643    | 4            | 3         | 90             | Rbo     | 700    | cownose; multiple large dense groups            |
| 20-Jun-2014 | 16:38:35 | 96        | 36.7891  | -75.3603    | 4            | 2         | 90             | Rbo     | 125    | cownose ray                                     |
| 20-Jun-2014 | 16:39:43 | 98        | 36.7893  | -75.3144    | 4            | 2         | 90             | Rbo     | 225    | cownose ray                                     |

Table 13 continued. Other Marine Vertebrate sightings in the Virginia CZM survey area from May 2014 – December 2014.

| Date        | Time     | Way Point | Latitude | Longitude-1 | Track Number | Angle out | Degree Forward | Species | Best # | Comments                   |
|-------------|----------|-----------|----------|-------------|--------------|-----------|----------------|---------|--------|----------------------------|
| 20-Jun-2014 | 16:45:42 | 129       | 36.7881  | -75.0751    | 4            | 3         | 90             | Chon    | 1      | broke track shark observed |
| 20-Jun-2014 | 16:50:26 | 101       | 36.7790  | -75.0686    | 4            | 3         | 90             | Chon    | 1      | shark                      |
| 20-Jun-2014 | 16:53:54 | 132       | 36.7889  | -74.9656    | 4            | 2         | 90             | Chon    | 1      | shark                      |
| 20-Jun-2014 | 17:05:08 | 135       | 36.7252  | -75.0529    | 3            | 3         | 90             | Chon    | 1      | shark                      |
| 20-Jun-2014 | 17:12:28 | 140       | 36.7253  | -75.3405    | 3            | 3         | 90             | Chon    | 3      | mako?                      |
| 20-Jun-2014 | 17:12:33 | 141       | 36.7254  | -75.3437    | 3            | 4         | 110            | Rbo     | 300    | cownose                    |
| 20-Jun-2014 | 17:12:35 | 112       | 36.7253  | -75.3449    | 3            | 2         | 90             | Rbo     | 225    | cownose ray                |
| 20-Jun-2014 | 17:13:50 | 142       | 36.7251  | -75.3958    | 3            | 3         | 90             | Rbo     | 300    | cownose                    |
| 20-Jun-2014 | 17:18:05 | 144       | 36.7248  | -75.5689    | 3            | 2         | 110            | Chon    | 1      | hammerhead -large          |
| 21-Jun-2014 | 16:59:29 | 158       | 36.9062  | -74.9677    | 6            | 2         | 90°            | Mbi     | 1      | Manta ray                  |
| 21-Jun-2014 | 17:03:01 | 124       | 36.8848  | -74.8694    | 6            | 3         | 80°            | Mbi     | 1      | Off effort Manta           |
| 21-Jun-2014 | 17:14:07 | 126       | 36.8432  | -75.2568    | 5            | 2         | 90°            | Rbo     | 60     | cownose rays               |
| 21-Jun-2014 | 17:14:46 | 163       | 36.8433  | -75.2837    | 5            | 2         | 90°            | Rbo     | 350    | cownose rays               |
| 21-Jun-2014 | 17:16:26 | 127       | 36.8431  | -75.3526    | 5            | 2         | 90°            | Rbo     | 60     | cownose rays               |
| 15-Sep-2014 | 13:41:56 | 8         | 36.7887  | -75.0089    | 4            | 2         | 90°            | Chon    | 1      | shark                      |
| 15-Sep-2014 | 13:43:23 | 9         | 36.7884  | -74.9503    | 4            | 2         | 90°            | Mbi     | 1      | Manta ray                  |
| 15-Sep-2014 | 13:50:24 | 9         | 36.8492  | -74.9610    | 5            | 3         | 90°            | Mbi     | 1      | single manta ray           |
| 15-Sep-2014 | 14:24:18 | 23        | 36.9089  | -75.6973    | 6            | 1         | 90°            | Rbo     | 1      | cownose rays               |
| 15-Sep-2014 | 14:24:43 | 23        | 36.9089  | -75.6809    | 6            | 2         | 90°            | Rbo     | 75     | cownose rays               |
| 15-Sep-2014 | 15:21:24 | 38        | 36.9659  | -75.9702    | 7            | 2         | 90             | Rbo     | 100    | Three groups               |
| 15-Sep-2014 | 16:00:00 | 51        | 36.7293  | -74.8601    | 3            | 3         | 90°            | Mmo     | 2      | Two Small Mola mola        |
| 8-Oct-2014  | 11:11:12 | 17        | 36.9601  | -75.9013    | 7            | 3         | 90°            | Rbo     | 1      | cownose ray                |
| 8-Oct-2014  | 13:50:02 | 33        | 36.8416  | -75.9286    | 5            | 3         | 90°            | Rbo     | 20     | cownose ray                |
| 8-Oct-2014  | 14:06:50 | 41        | 36.7895  | -75.3620    | 4            | 1         | 90             | Rbo     | 85     | cownose rays               |

\*

Table 14. Small vessel sightings in the Virginia CZM survey area from May 2014 – December 2014. RFV=recreational fishing vessel, CFV=commercial fishing vessel.

| Date        | Time     | Way Point | Latitude | Longitude-1 | Event | Heading | Track Number | Angle out | Degree Forward | Best # | Comments                        |
|-------------|----------|-----------|----------|-------------|-------|---------|--------------|-----------|----------------|--------|---------------------------------|
| 15-May-2014 | 12:01:52 | 59        | 36.9059  | -75.1288    | 2.3   | E       | 6            | 3         | 60             | 1      | sailboat                        |
| 20-Jun-2014 | 12:13:21 | 12        | 37.0858  | -75.8545    | 2.3   | W       | 9            | 3         | 45°            | 2      | larger fishing vessels          |
| 20-Jun-2014 | 15:35:37 | 67        | 36.9067  | -75.3226    | 2.3   | E       | 6            | 2         | 45             | 1      | RFV                             |
| 20-Jun-2014 | 16:17:08 | 86        | 36.8412  | -75.9311    | 2.3   | W       | 5            | 2         | 90             | 2      | RFV and paraglider              |
| 21-Jun-2014 | 17:28:50 | 129       | 36.8420  | -75.8494    | 2.3   | E       | 5            | 4         | 90°            | 1      | charter vessel                  |
| 21-Jun-2014 | 17:31:31 | 131       | 36.8414  | -75.9544    | 2.3   | E       | 5            | 2         | 60°            | 1      | parasail vessel                 |
| 15-Sep-2014 | 13:37:17 | 6         | 36.7893  | -75.1967    | 2.3   | E       | 4            | 3         | 60°            | 1      | RFV                             |
| 15-Sep-2014 | 14:10:10 | 13        | 36.8480  | -75.7700    | 2.3   | W       | 5            | 3         | 60°            | 2      | RFV                             |
| 15-Sep-2014 | 14:13:09 | 16        | 36.8472  | -75.8895    | 2.3   | W       | 5            | 2         | 45°            | 1      | RFV                             |
| 15-Sep-2014 | 14:18:17 | 20        | 36.9077  | -75.9213    | 2.3   | E       | 6            | 3         | 100°           | 1      | RFV                             |
| 15-Sep-2014 | 15:17:56 | 34        | 36.9666  | -75.8296    | 2.3   | W       | 7            | 3         | 90°            | 1      | RFV                             |
| 15-Sep-2014 | 15:32:24 | 42        | 37.0305  | -75.6390    | 2.3   | E       | 8            | 1         | 90°            | 4      | Military                        |
| 15-Sep-2014 | 15:49:33 | 50        | 37.0309  | -74.9412    | 2.3   | E       | 8            | 1         | 45°            | 1      | RFV                             |
| 8-Oct-2014  | 13:53:44 | 36        | 36.7883  | -75.9162    | 2.3   | E       | 4            | 2         | 90°            | 2      | sailboat                        |
| 8-Oct-2014  | 14:47:46 | 49        | 36.7235  | -75.8551    | 2.3   | W       | 3            | 3         | 90             | 1      | sailboat                        |
| 29-Nov-2014 | 14:03:32 | 32        | 36.9671  | -75.9627    | 2.3   | W       | 7            | 3         | 90°            | 1      |                                 |
| 30-Nov-2014 | 9:38:23  | 7         | 36.6734  | -75.1526    | 2.3   | W       | 2            | 3         | 110°           | 1      | RFV                             |
| 30-Nov-2014 | 9:57:48  | 9         | 36.6710  | -75.8397    | 2.3   | W       | 2            | 3         | 80°            | 1      | CFV                             |
| 15-Dec-2014 | 9:49:54  | 12        | 36.9673  | -75.9691    | 2.3   | W       | 7            | 1         | 30°            | 1      | CFV                             |
| 15-Dec-2014 | 10:50:28 | 25        | 36.8492  | -75.8176    | 2.3   | W       | 5            | 3         | 60°            | 1      | small CFV                       |
| 16-Dec-2014 | 10:37:27 | 10        | 37.0899  | -74.9836    | 2.3   | W       | 9            | 4         | 60°            | 1      | small vessel                    |
| 16-Dec-2014 | 12:02:02 | 29        | 36.9687  | -75.1273    | 2.3   | W       | 7            | 1         | 90°            | 1      | Trawling vessel                 |
| 16-Dec-2014 | 14:18:09 | 42        | 36.7909  | -75.0720    | 2.3   | E       | 4            | 2         | 60°            | 1      | RFV                             |
| 15-May-2014 | 9:57:01  | 23        | 37.2613  | -75.5540    | 2.3   | W       | 12           | 1         | 100°           | 1      |                                 |
| 20-Jun-2014 | 16:24:26 | 113       | 36.7881  | -75.7573    | 2.3   | W       | 4            | 3         | 90             | 1      | small recreational vessel       |
| 20-Jun-2014 | 16:41:35 | 124       | 36.7892  | -75.2387    | 2.3   | E       | 4            | 3         | 60             | 1      | recreational vessel 3 outboards |
| 20-Jun-2014 | 17:21:54 | 145       | 36.7245  | -75.7273    | 2.3   | E       | 3            | 3         | 90             | 1      | Tug boat                        |
| 21-Jun-2014 | 16:32:32 | 154       | 36.9057  | -75.8625    | 2.3   | E       | 6            | 2         | 90°            | 2      | Tug and Shrimp vessel           |
| 21-Jun-2014 | 16:36:52 | 155       | 36.9062  | -75.7103    | 2.3   | E       | 6            | 1         | 90°            | 2      | RFV off tower                   |
| 21-Jun-2014 | 17:18:49 | 164       | 36.8430  | -75.4497    | 2.3   | W       | 5            | 3         | 90°            | 1      |                                 |

Table 14 continued. Small vessel sightings in the Virginia CZM survey area from May 2014 – December 2014. RFV=recreational fishing vessel, CFV=commercial fishing vessel.

| Date        | Time     | Way Point | Latitude | Longitude-1 | Event | Heading | Track Number | Angle out | Degree Forward | Best # | Comments                             |
|-------------|----------|-----------|----------|-------------|-------|---------|--------------|-----------|----------------|--------|--------------------------------------|
| 15-Sep-2014 | 14:19:55 | 21        | 36.9081  | -75.8625    | 2.3   | E       | 6            | 4         | 110°           | 1      | small recreational vessel            |
| 15-Sep-2014 | 14:23:29 | 22        | 36.9085  | -75.7305    | 2.3   | E       | 6            | 2         | 95°            | 2      | small recreational vessel with tower |
| 15-Sep-2014 | 15:07:58 | 34        | 36.9669  | -75.4169    | 2.3   | W       | 7            | 3         | 90°            | 1      | Recreational vessel                  |
| 15-Sep-2014 | 15:38:09 | 45        | 37.0310  | -75.4054    | 2.3   | E       | 8            | 4         | 110            | 1      | charter vessel                       |
| 8-Oct-2014  | 9:19:01  | 3         | 37.1427  | -75.7529    | 2.3   | E       | 10           | 4         | 90°            | 1      | sailboat                             |
| 8-Oct-2014  | 13:53:18 | 36        | 36.7881  | -75.9361    | 2.3   | E       | 4            | 3         | 90°            | 1      | sailboat                             |
| 29-Nov-2014 | 10:49:09 | 11        | 37.1411  | -75.3892    | 2.3   | E       | 10           | 3         | 90°            | 1      | small commercial vessel              |
| 29-Nov-2014 | 11:18:52 | 15        | 37.0893  | -75.3990    | 2.3   | W       | 9            | 4         | 90°            | 1      | small commercial vessel              |
| 29-Nov-2014 | 13:16:48 | 20        | 37.0295  | -75.5590    | 2.3   | E       | 8            | 2         | 90°            | 1      | small commercial vessel              |
| 29-Nov-2014 | 13:20:27 | 21        | 37.0294  | -75.4088    | 2.3   | E       | 8            | 4         | 90°            | 1      | small commercial vessel              |
| 29-Nov-2014 | 13:49:18 | 25        | 36.9687  | -75.4068    | 2.3   | W       | 7            | 3         | 90°            | 2      | 2 RFVs                               |
| 29-Nov-2014 | 14:12:23 | 30        | 36.9078  | -75.7240    | 2.3   | E       | 6            | 2         | 140°           | 1      | small fishing vessel                 |
| 15-Dec-2014 | 9:35:01  | 58        | 36.9685  | -75.3643    | 2.3   | W       | 7            | 3         | 90°            | 1      | charter vessel                       |
| 15-Dec-2014 | 9:48:47  | 60        | 36.9676  | -75.9242    | 2.3   | W       | 7            | 3         | 90°            | 1      | commercial gill netter               |
| 15-Dec-2014 | 9:53:47  | 63        | 36.9068  | -75.9161    | 2.3   | E       | 6            | 2         | 110°           | 1      | hover craft                          |
| 15-Dec-2014 | 10:05:22 | 67        | 36.9089  | -75.4432    | 2.3   | E       | 6            | 3         | 90°            | 1      | med USCG vessel 35ft                 |
| 15-Dec-2014 | 10:50:36 | 77        | 36.8493  | -75.8231    | 2.3   | W       | 5            | 3         | 140°           | 1      | charter vessel                       |
| 15-Dec-2014 | 10:53:23 | 79        | 36.8557  | -75.9355    | 2.3   | W       | 5            | 2         | 90°            | 1      | small recreational vessel            |
| 16-Dec-2014 | 9:22:53  | 3         | 37.2656  | -75.4572    | 2.3   | E       | 12           | 4         | 90°            | 1      | small commercial vessel              |
| 16-Dec-2014 | 9:24:40  | 4         | 37.2659  | -75.3844    | 2.3   | E       | 12           | 4         | 90°            | 1      | small commercial vessel              |
| 16-Dec-2014 | 9:54:50  | 7         | 37.2074  | -75.4292    | 2.3   | W       | 11           | 4         | 90°            | 1      | commercial vessel                    |
| 16-Dec-2014 | 10:18:41 | 10        | 37.1350  | -75.3970    | 2.3   | E       | 10           | 2         | 90°            | 1      | commercial vessel                    |
| 16-Dec-2014 | 10:21:04 | 11        | 37.1333  | -75.2995    | 2.3   | E       | 10           | 3         | 90°            | 1      | commercial vessel                    |
| 16-Dec-2014 | 10:29:33 | 12        | 37.1258  | -74.9510    | 2.3   | E       | 10           | 3         | 90°            | 1      | trawling vessel                      |
| 16-Dec-2014 | 11:42:10 | 20        | 37.0301  | -75.0823    | 2.3   | E       | 8            | 3         | 90°            | 1      | commercial vessel                    |
| 16-Dec-2014 | 12:11:42 | 29        | 36.9687  | -75.3710    | 2.3   | W       | 7            | 4         | 100°           | 1      | recreational vessel                  |
| 16-Dec-2014 | 14:01:46 | 34        | 36.7893  | -75.7350    | 2.3   | E       | 4            | 2         | 90°            | 1      | small recreational vessel            |
| 16-Dec-2014 | 14:11:48 | 35        | 36.7906  | -75.3306    | 2.3   | E       | 4            | 3         | 90°            | 1      | charter vessel                       |

Table 15. Large vessel sightings in the Virginia CZM survey area from May 2014 – December 2014. RFV=recreational fishing vessel, CFV=commercial fishing vessel.

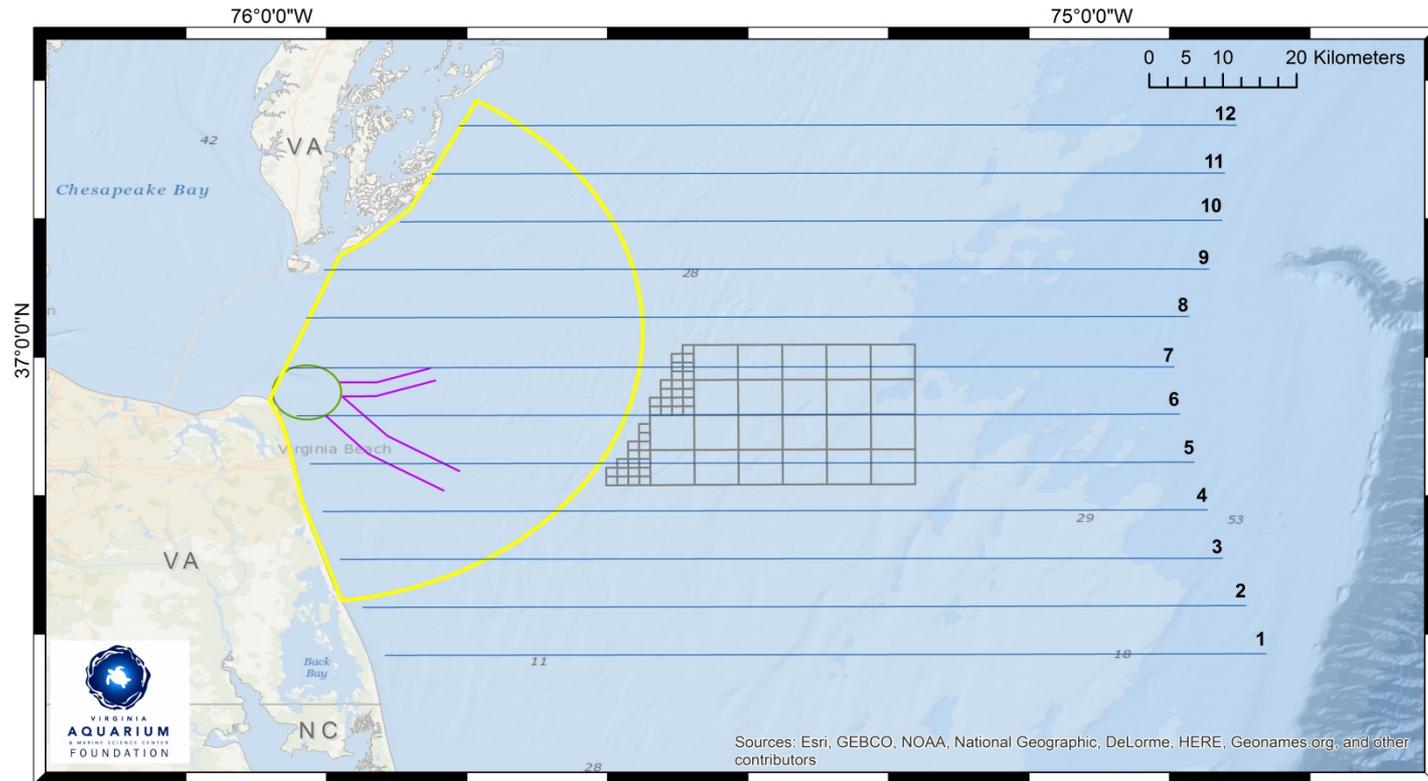
| Date        | Time     | Way Point | Latitude | Longitude-1 | Event | Heading | Track | Number | Angle out | Degree Forward | Best # | Comments                       |
|-------------|----------|-----------|----------|-------------|-------|---------|-------|--------|-----------|----------------|--------|--------------------------------|
| 15-May-2014 | 10:23:59 | 25        | 37.0260  | -75.6800    | 2.8   | E       | 8     | 3      | 60°       | 1              |        | Navy Frigate - speed wide open |
| 15-May-2014 | 10:52:08 | 35        | 36.9686  | -74.9607    | 2.8   | W       | 7     | 3      | 60°       | 1              |        | cargo vessel                   |
| 15-May-2014 | 11:31:59 | 49        | 36.9676  | -75.9616    | 2.8   | W       | 7     | 3      | 90°       | 1              |        | cargo vessel                   |
| 15-May-2014 | 11:40:23 | 53        | 36.9069  | -75.8240    | 2.8   | E       | 6     | 3      | 90°       | 1              |        | Navy support vessel            |
| 15-May-2014 | 11:59:50 | 58        | 36.9063  | -75.1950    | 2.8   | E       | 6     | 3      | 60°       | 1              |        | cargo vessel inbound           |
| 15-May-2014 | 12:05:58 | 61        | 36.9066  | -74.9862    | 2.8   | E       | 6     | 1      | 90°       | 1              |        | cargo vessel heading S         |
| 20-Jun-2014 | 11:18:54 | 3         | 37.1422  | -75.7399    | 2.8   | E       | 10    | 3      | 60°       | 1              |        | Coast Guard Vessel             |
| 20-Jun-2014 | 12:04:16 | 11        | 37.0869  | -75.5212    | 2.8   | W       | 9     | 2      | 45°       | 2              |        | cargo vessel                   |
| 20-Jun-2014 | 13:15:24 | 43        | 36.9664  | -75.0366    | 2.8   | W       | 7     | 3      | 60°       | 1              |        | military helicopter deck       |
| 20-Jun-2014 | 13:46:07 | 53        | 36.9746  | -75.7307    | 2.8   | W       | 7     | 2      | 30°       | 2              |        | cargo vessels                  |
| 20-Jun-2014 | 15:20:37 | 60        | 36.9056  | -75.9194    | 2.8   | E       | 6     | 3      | 60°       | 1              |        | cargo vessel                   |
| 20-Jun-2014 | 16:11:50 | 84        | 36.8425  | -75.7217    | 2.8   | W       | 5     | 3      | 45°       | 1              |        | cargo vessel                   |
| 20-Jun-2014 | 17:11:48 | 111       | 36.7251  | -75.3134    | 2.8   | W       | 3     | 3      | 60°       | 1              |        | cargo vessel                   |
| 21-Jun-2014 | 17:20:11 | 128       | 36.8430  | -75.5057    | 2.8   | E       | 5     | 3      | 90°       | 1              |        | cargo vessel                   |
| 15-Sep-2014 | 13:25:03 | 3         | 36.7899  | -75.6787    | 2.8   | E       | 4     | 3      | 90°       | 1              |        | Military                       |
| 15-Sep-2014 | 13:26:45 | 4         | 36.7878  | -75.6132    | 2.8   | E       | 4     | 2      | 45°       | 2              |        | Military                       |
| 15-Sep-2014 | 13:39:38 | 7         | 36.7889  | -75.1022    | 2.8   | E       | 4     | 3      | 45°       | 1              |        | tanker                         |
| 15-Sep-2014 | 14:10:39 | 14        | 36.8478  | -75.7894    | 2.8   | W       | 5     | 2      | 45°       | 1              |        | tanker                         |
| 15-Sep-2014 | 14:11:32 | 15        | 36.8475  | -75.8245    | 2.8   | W       | 5     | 1      | 90°       | 1              |        | Military                       |
| 15-Sep-2014 | 14:19:32 | 21        | 36.9080  | -75.8766    | 2.8   | E       | 6     | 4      | 45°       | 1              |        | tanker                         |
| 15-Sep-2014 | 14:53:50 | 28        | 36.9665  | -75.2091    | 2.8   | W       | 7     | 4      | 100°      | 1              |        | cargo                          |
| 15-Sep-2014 | 15:19:40 | 35        | 36.9662  | -75.8992    | 2.8   | W       | 7     | 4      | 90°       | 1              |        | cargo                          |
| 15-Sep-2014 | 15:26:54 | 39        | 37.0295  | -75.8607    | 2.8   | E       | 8     | 4      | 90°       | 1              |        | CFV                            |
| 8-Oct-2014  | 13:03:25 | 22        | 36.9071  | -75.6091    | 2.8   | E       | 6     | 2      | 45°       | 1              |        | cargo                          |
| 8-Oct-2014  | 13:40:31 | 28        | 36.8451  | -75.5526    | 2.8   | W       | 5     | 3      | 45°       | 1              |        | tanker                         |
| 8-Oct-2014  | 13:42:39 | 29        | 36.8445  | -75.6364    | 2.8   | W       | 5     | 4      | 60°       | 1              |        | cargo                          |
| 8-Oct-2014  | 13:43:54 | 30        | 36.8440  | -75.6857    | 2.8   | W       | 5     | 3      | 60°       | 1              |        | cargo                          |
| 8-Oct-2014  | 13:45:37 | 32        | 36.8433  | -75.7535    | 2.8   | W       | 5     | 2      | 45°       | 1              |        | cargo                          |
| 8-Oct-2014  | 13:58:32 | 38        | 36.7888  | -75.7119    | 2.8   | E       | 4     | 2      | 60°       | 1              |        | tanker                         |

Table 15 continued. Large vessel sightings in the Virginia CZM survey area from May 2014 – December 2014. RFV=recreational fishing vessel, CFV=commercial fishing vessel.

| Date        | Time     | Way Point | Latitude | Longitude-1 | Event | Heading | Track Number | Angle out | Degree Forward | Best # | Comments                              |
|-------------|----------|-----------|----------|-------------|-------|---------|--------------|-----------|----------------|--------|---------------------------------------|
| 8-Oct-2014  | 14:16:48 | 44        | 36.7895  | -74.9355    | 2.8   | E       | 4            | 4         | 90             | 1      | cargo                                 |
| 29-Nov-2014 | 9:41:09  | 3         | 37.2620  | -75.4490    | 2.8   | E       | 12           | 1         | 90°            | 1      | CFV                                   |
| 29-Nov-2014 | 10:48:45 | 14        | 37.1411  | -75.4054    | 2.8   | E       | 10           | 1         | 90°            | 1      | CFV                                   |
| 29-Nov-2014 | 11:20:53 | 20        | 37.0892  | -75.4798    | 2.8   | W       | 9            | 3         | 60°            | 1      | CFV                                   |
| 29-Nov-2014 | 13:58:56 | 31        | 36.9677  | -75.7811    | 2.8   | W       | 7            | 2         | 90°            | 2      | 1 tug and 1 barge                     |
| 29-Nov-2014 | 14:13:55 | 35        | 36.9082  | -75.6632    | 2.8   | E       | 6            | 1         | 90°            | 2      | 1 tug and 1 barge                     |
| 29-Nov-2014 | 14:54:50 | 39        | 36.8499  | -75.6431    | 2.8   | W       | 5            | 2         | 45             | 2      | cargo vessels                         |
| 30-Nov-2014 | 9:45:21  | 8         | 36.6727  | -75.4015    | 2.8   | W       | 2            | 3         | 90°            | 2      | tug/barge                             |
| 15-Dec-2014 | 9:11:47  | 4         | 37.0300  | -75.2388    | 2.8   | E       | 8            | 1         | 90°            | 1      | container vessel directly under plane |
| 15-Dec-2014 | 9:43:10  | 10        | 36.9683  | -75.6980    | 2.8   | W       | 7            | 2         | 45°            | 1      | USCG vessel                           |
| 15-Dec-2014 | 9:45:16  | 11        | 36.9681  | -75.7823    | 2.8   | W       | 7            | 2         | 45°            | 1      | USCG vessel (bigger)                  |
| 15-Dec-2014 | 10:13:41 | 16        | 36.9093  | -75.1017    | 2.8   | E       | 6            | 2         | 45°            | 1      | cargo vessel                          |
| 15-Dec-2014 | 10:47:06 | 24        | 36.8497  | -75.6806    | 2.8   | W       | 5            | 4         | 60°            | 1      | tanker vessel                         |
| 16-Dec-2014 | 12:14:27 | 34        | 36.9709  | -75.4886    | 2.8   | W       | 7            | 1         | 90°            | 1      | Navy catamaran                        |
| 16-Dec-2014 | 13:57:00 | 39        | 36.7893  | -75.9303    | 2.8   | E       | 4            | 3         | 30             | 1      | Navy vessel                           |
| 16-Dec-2014 | 14:00:17 | 40        | 36.7891  | -75.7948    | 2.8   | E       | 4            | 3         | 45             | 2      | cargo vessels                         |
| 16-Dec-2014 | 14:07:08 | 41        | 36.7904  | -75.5187    | 2.8   | E       | 4            | 2         | 60             | 1      | cargo vessel heading E                |
| 15-May-2014 | 10:16:54 | 32        | 37.0253  | -75.8984    | 2.8   | E       | 8            | 4         | 90°            | 2      | CFV                                   |
| 20-Jun-2014 | 12:21:48 | 22        | 37.0250  | -75.7979    | 2.8   | E       | 8            | 4         | 90°            | 1      | Tug boat                              |
| 20-Jun-2014 | 13:41:53 | 48        | 36.9839  | -75.5774    | 2.8   | W       | 7            | 3         | 90             | 1      | large vessel                          |
| 20-Jun-2014 | 13:51:24 | 54        | 36.9625  | -75.9177    | 2.8   | W       | 7            | 2         | 90             | 1      | Tug pulling barge                     |
| 20-Jun-2014 | 15:20:53 | 61        | 36.9057  | -75.9094    | 2.8   | E       | 6            | 3         | 90             | 1      | large cargo ship                      |
| 20-Jun-2014 | 15:25:33 | 65        | 36.9060  | -75.7249    | 2.8   | E       | 6            | 3         | 90             | 1      | cargo ship                            |
| 20-Jun-2014 | 16:10:25 | 101       | 36.8424  | -75.6663    | 2.8   | E       | 5            | 2         | 90             | 1      | cargo ship                            |
| 20-Jun-2014 | 16:12:18 | 102       | 36.8423  | -75.7405    | 2.8   | E       | 5            | 3         | 90             | 1      | cargo ship                            |
| 21-Jun-2014 | 13:23:59 | 148       | 36.9057  | -75.9269    | 2.8   | E       | 6            | 3         | 90°            | 1      |                                       |
| 21-Jun-2014 | 17:06:04 | 161       | 36.8426  | -74.9306    | 2.8   | W       | 5            | 2         | 30°            | 1      | container vessel                      |
| 15-Sep-2014 | 13:33:15 | 5         | 36.7898  | -75.3566    | 2.8   | E       | 4            | 4         | 120°           | 1      | Navy vessel                           |
| 15-Sep-2014 | 13:39:26 | 6         | 36.7890  | -75.1103    | 2.8   | E       | 4            | 3         | 90°            | 1      | cargo vessel                          |
| 15-Sep-2014 | 13:55:38 | 10        | 36.8498  | -75.1714    | 2.8   | W       | 5            | 4         | 90°            | 1      | cargo ship                            |

Table 15 continued. Large vessel sightings in the Virginia CZM survey area from May 2014 – December 2014. RFV=recreational fishing vessel, CFV=commercial fishing vessel.

| Date        | Time     | Way Point | Latitude | Longitude-1 | Event | Heading | Track Number | Angle out | Degree Forward | Best # | Comments                       |
|-------------|----------|-----------|----------|-------------|-------|---------|--------------|-----------|----------------|--------|--------------------------------|
| 15-Sep-2014 | 14:07:45 | 12        | 36.8485  | -75.6708    | 2.8   | W       | 5            | 3         | 90°            | 1      | large vessel container         |
| 15-Sep-2014 | 14:37:10 | 27        | 36.9099  | -75.1780    | 2.8   | E       | 6            | 1         | 90°            | 1      | cargo vessel                   |
| 15-Sep-2014 | 15:30:46 | 44        | 37.0303  | -75.7057    | 2.8   | E       | 8            | 3         | 90             | 2      | Purse seine 2 vessels          |
| 15-Sep-2014 | 16:11:56 | 55        | 36.7296  | -75.3538    | 2.8   | W       | 3            | 4         | 110            | 1      | Navy vessel                    |
| 15-Sep-2014 | 16:16:21 | 56        | 36.7293  | -75.5328    | 2.8   | W       | 3            | 4         | 90             | 2      | Navy vessel                    |
| 15-Sep-2014 | 16:23:23 | 57        | 36.7278  | -75.8215    | 2.8   | W       | 3            | 2         | 100            | 1      | Navy vessel                    |
| 8-Oct-2014  | 13:03:06 | 21        | 36.9070  | -75.6218    | 2.8   | E       | 6            | 4         | 110°           | 1      | tanker                         |
| 8-Oct-2014  | 13:09:52 | 24        | 36.9072  | -75.3412    | 2.8   | E       | 6            | 3         | 90°            | 1      | cargo "China Shipping Line"    |
| 8-Oct-2014  | 13:39:17 | 28        | 36.8456  | -75.5047    | 2.8   | W       | 5            | 3         | 90°            | 1      | Container ship "D"             |
| 8-Oct-2014  | 13:42:34 | 29        | 36.8446  | -75.6335    | 2.8   | W       | 5            | 3         | 90°            | 1      | large vessel                   |
| 8-Oct-2014  | 13:49:06 | 31        | 36.8418  | -75.8916    | 2.8   | W       | 5            | 3         | 90°            | 1      | large vessel                   |
| 8-Oct-2014  | 13:54:10 | 37        | 36.7884  | -75.8982    | 2.8   | E       | 4            | 3         | 145°           | 1      | Rudee Tours head vessel        |
| 8-Oct-2014  | 14:15:11 | 41        | 36.7894  | -75.0051    | 2.8   | E       | 4            | 3         | 90             | 1      | cargo vessel                   |
| 8-Oct-2014  | 14:44:10 | 45        | 36.7243  | -75.7149    | 2.8   | W       | 3            | 3         | 90             | 1      | Medical Navy vessel? All white |
| 29-Nov-2014 | 13:44:28 | 24        | 36.9692  | -75.2192    | 2.8   | W       | 7            | 3         | 90°            | 2      | 1 cargo ship 1 head vessel     |
| 29-Nov-2014 | 14:08:45 | 29        | 36.9063  | -75.8719    | 2.8   | E       | 6            | 3         | 110°           | 1      | cargo ship                     |
| 29-Nov-2014 | 14:13:50 | 31        | 36.9081  | -75.6664    | 2.8   | E       | 6            | 4         | 90°            | 2      | cargo ships                    |
| 29-Nov-2014 | 14:53:55 | 36        | 36.8502  | -75.6052    | 2.8   | W       | 5            | 4         | 120            | 1      |                                |
| 29-Nov-2014 | 15:00:12 | 37        | 36.8490  | -75.8649    | 2.8   | W       | 5            | 3         | 100            | 1      | cargo ship                     |
| 30-Nov-2014 | 9:12:25  | 4         | 36.6119  | -75.4090    | 2.8   | E       | 1            | 3         | 45°            | 2      | tug and barge                  |
| 15-Dec-2014 | 9:32:25  | 57        | 36.9688  | -75.2578    | 2.8   | W       | 7            | 4         | 90°            | 1      | msc cargo ship                 |
| 15-Dec-2014 | 9:54:18  | 64        | 36.9068  | -75.8946    | 2.8   | E       | 6            | 2         | 90°            | 1      | navy warship                   |
| 15-Dec-2014 | 9:56:35  | 65        | 36.9073  | -75.7994    | 2.8   | E       | 6            | 4         | 100°           | 1      | navy destroyer                 |
| 15-Dec-2014 | 9:59:07  | 66        | 36.9081  | -75.6972    | 2.8   | E       | 6            | 4         | 120°           | 1      | tanker large vessel            |
| 15-Dec-2014 | 10:06:06 | 68        | 36.9094  | -75.4134    | 2.8   | E       | 6            | 3         | 90°            | 1      | NYK line cargo                 |
| 15-Dec-2014 | 10:11:46 | 69        | 36.9094  | -75.1806    | 2.8   | E       | 6            | 4         | 80°            | 1      | fast moving large vessel       |
| 15-Dec-2014 | 10:35:12 | 75        | 36.8499  | -75.2109    | 2.8   | W       | 5            | 3         | 90°            | 1      | MQL cargo vessel               |
| 15-Dec-2014 | 10:39:30 | 76        | 36.8505  | -75.3795    | 2.8   | W       | 5            | 4         | 90°            | 1      | MQL cargo vessel               |
| 15-Dec-2014 | 10:52:12 | 78        | 36.8546  | -75.8876    | 2.8   | W       | 5            | 2         | 80°            | 1      | navy destroyer                 |
| 16-Dec-2014 | 10:30:09 | 13        | 37.1253  | -74.9263    | 2.8   | E       | 10           | 3         | 90°            | 2      | 2 Navy vessels                 |
| 16-Dec-2014 | 14:51:31 | 38        | 36.7308  | -75.8769    | 2.8   | E       | 3            | 3         | 90             | 1      | Navy vessel                    |



### Virginia CZM Aerial Surveys (May 2014 - December 2014)

*This map was created on January 26, 2015 - using coordinates recorded in World Geodetic System 1984.*



*Figure 1.* Transect lines flown for Virginia CZM aerial surveys from May 2014 to December 2014. Coordinates for these 12 transect lines are listed in *Table 3*. The Virginia wind energy area (grey), right whale ship strike reduction rule seasonal management area (yellow), pilot area (green), and shipping channels (pink) are also displayed.

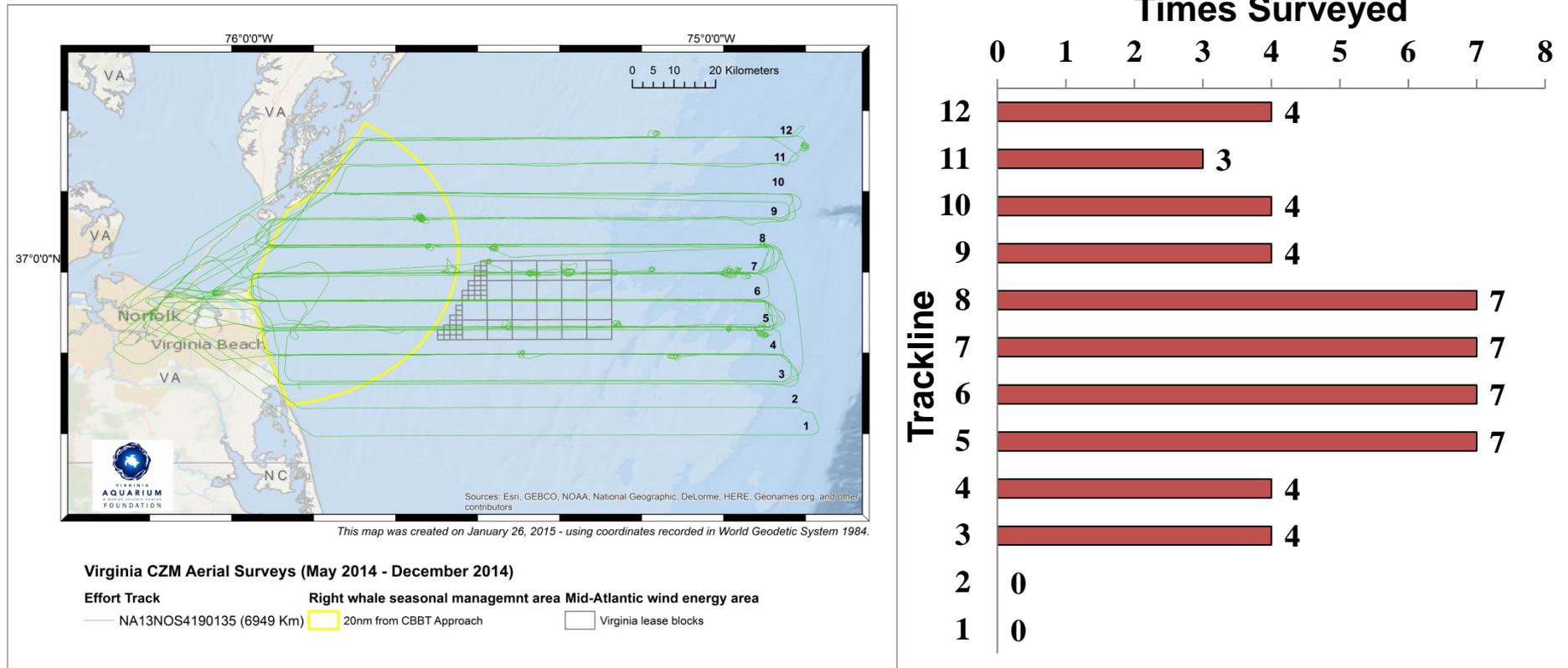


Figure 2: Survey tracklines (2a) and realized effort in the survey area were summed and then divided by the total distance flown that month (2b).

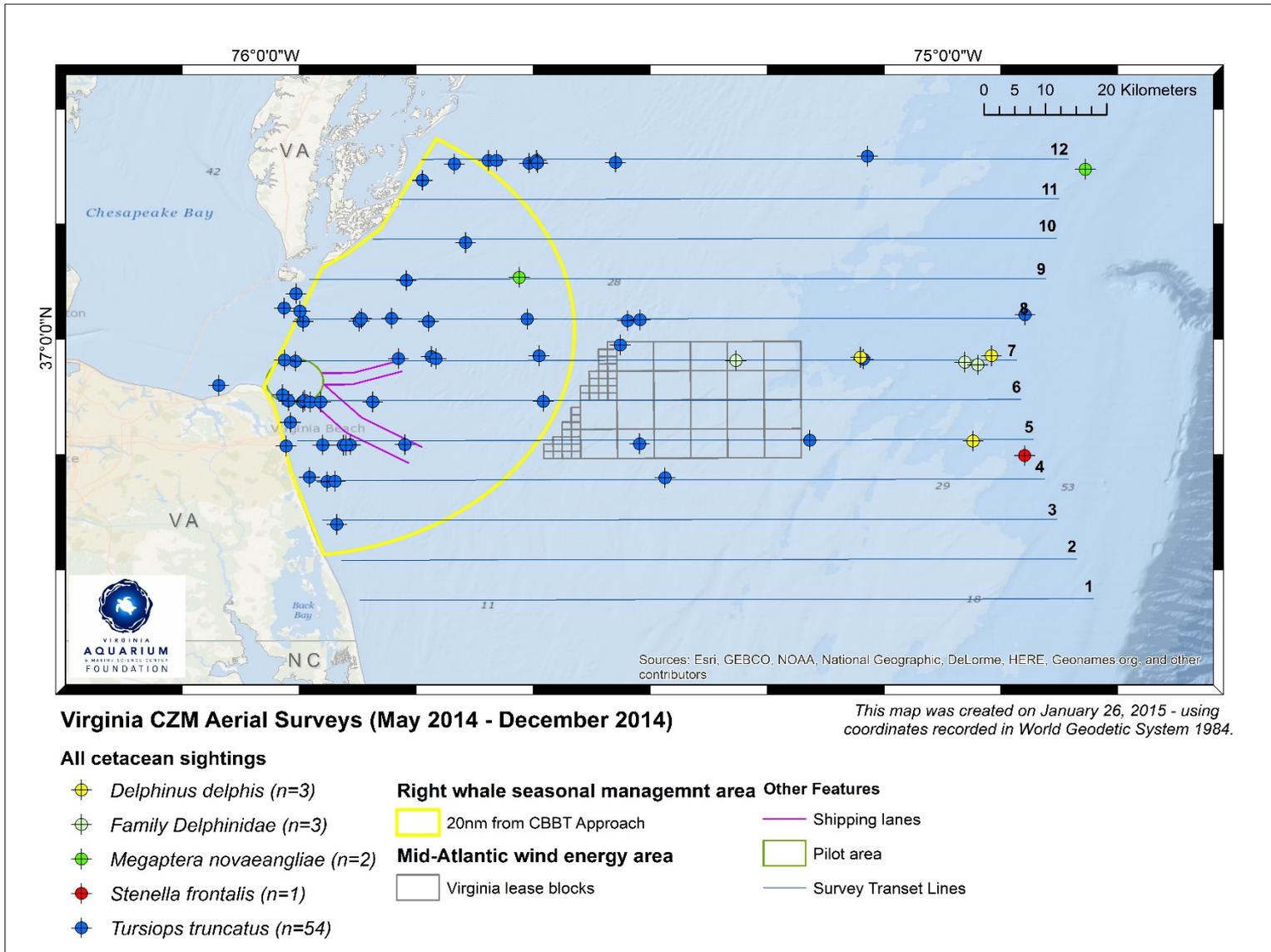


Figure 3. All cetacean sightings during aerial surveys conducted in Virginia from May 2014 to December 2014. Each point represents a sighting of 1 or more cetaceans.

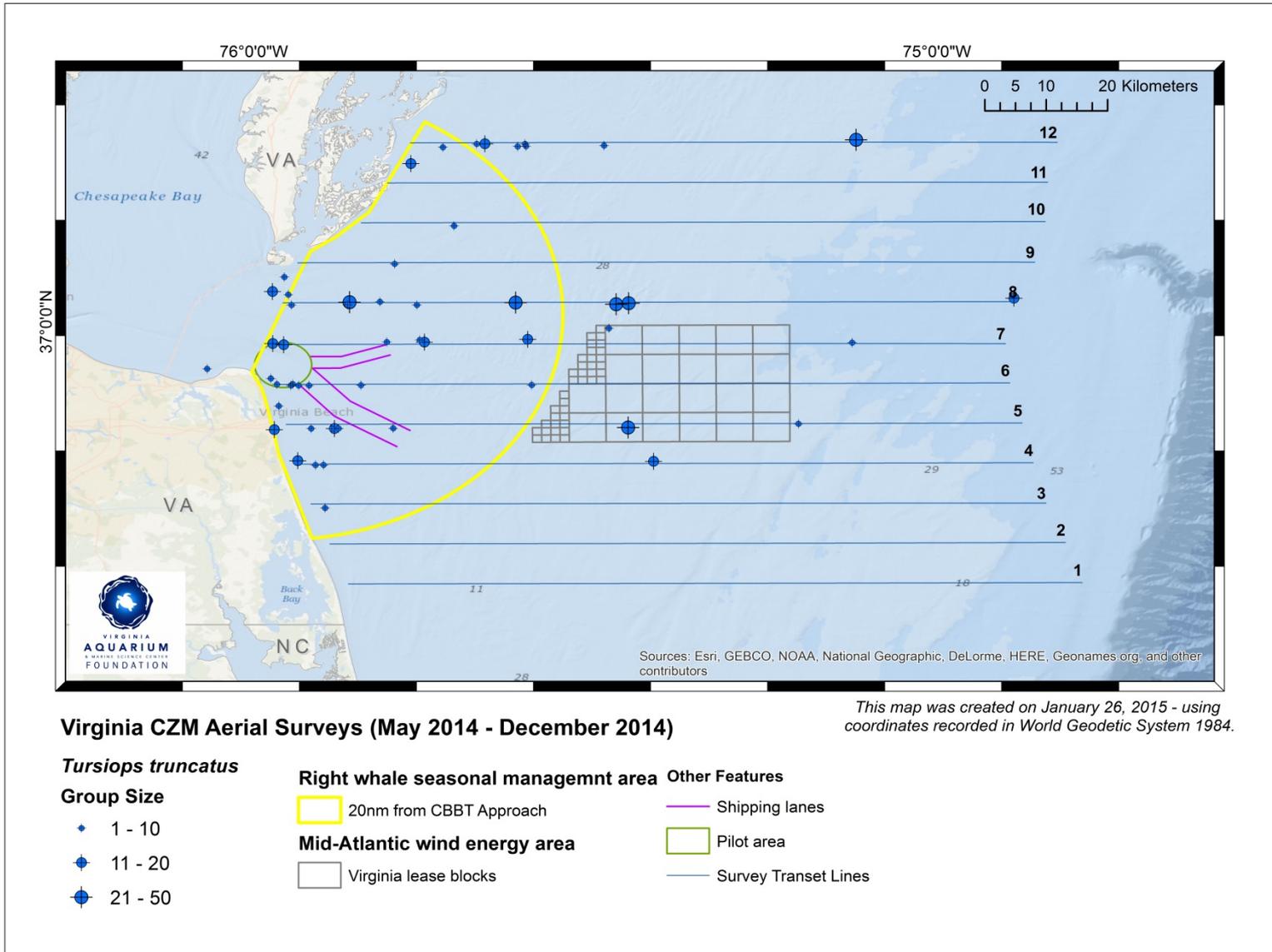


Figure 4. Bottlenose dolphin (*Tursiops truncatus*) sightings indicating group size

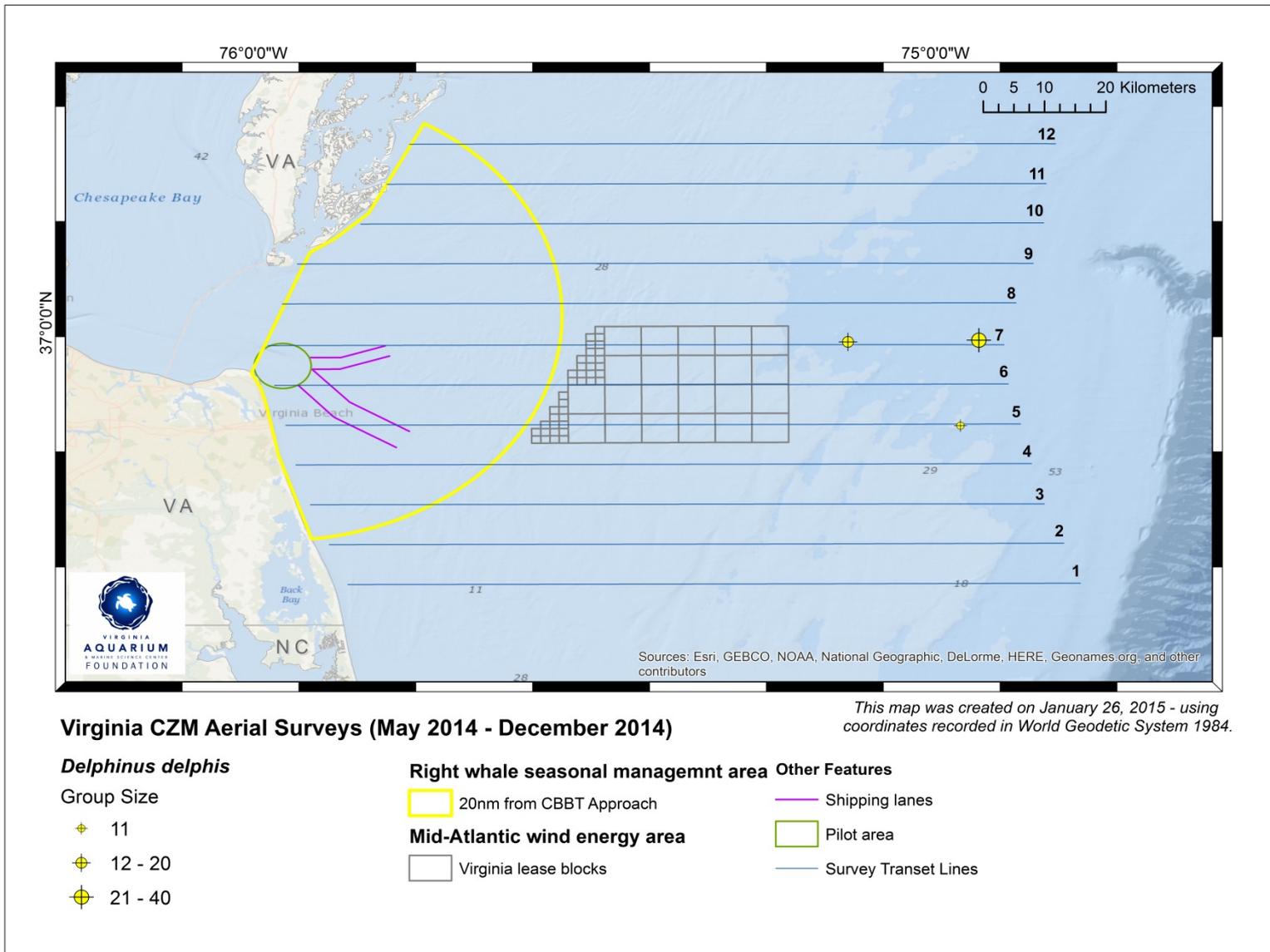


Figure 5. Common dolphin (*Delphinus delphis*) sightings indicating group size

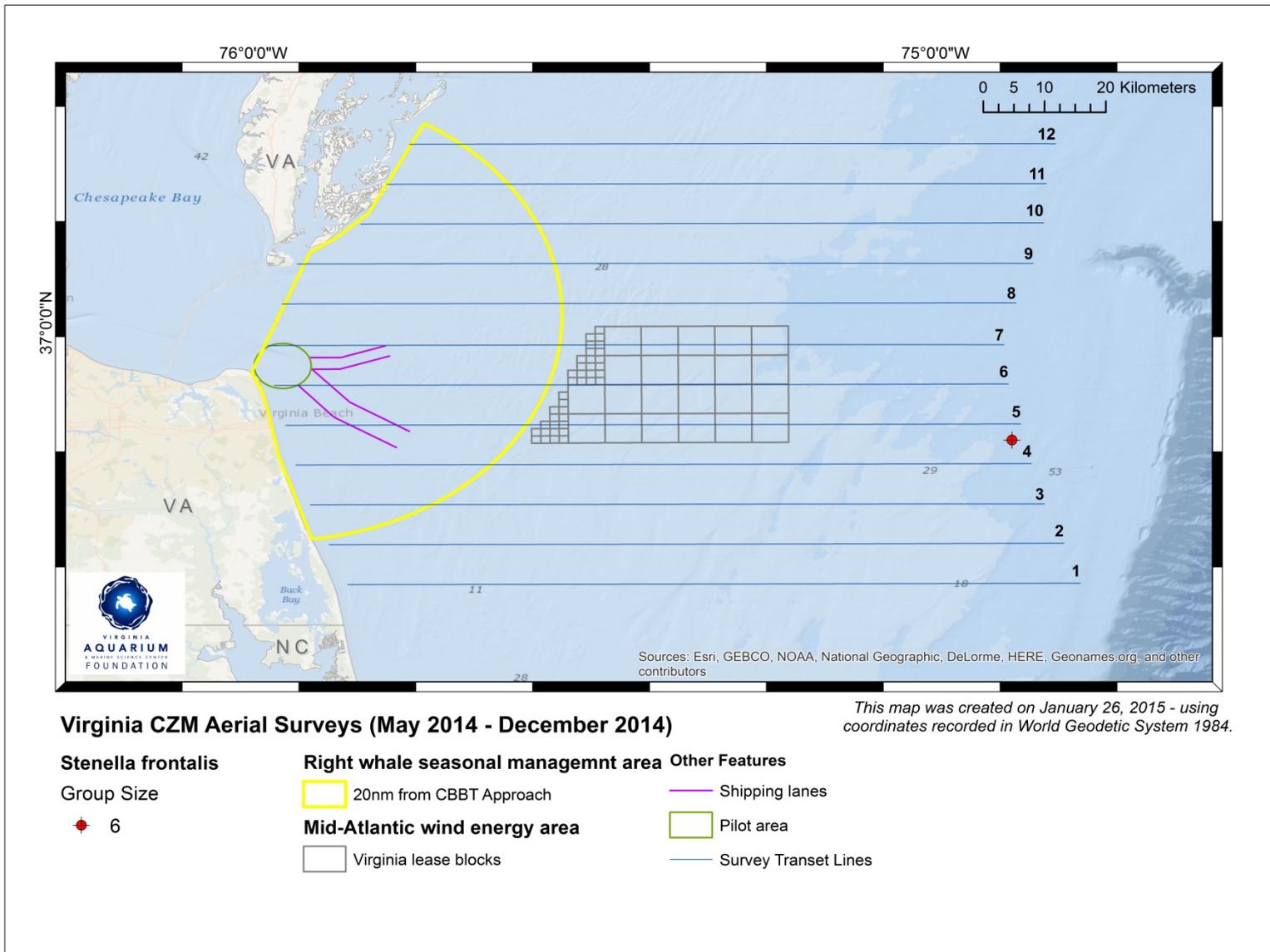


Figure 6. Atlantic spotted dolphin (*Stenella frontalis*) sightings indicating group size

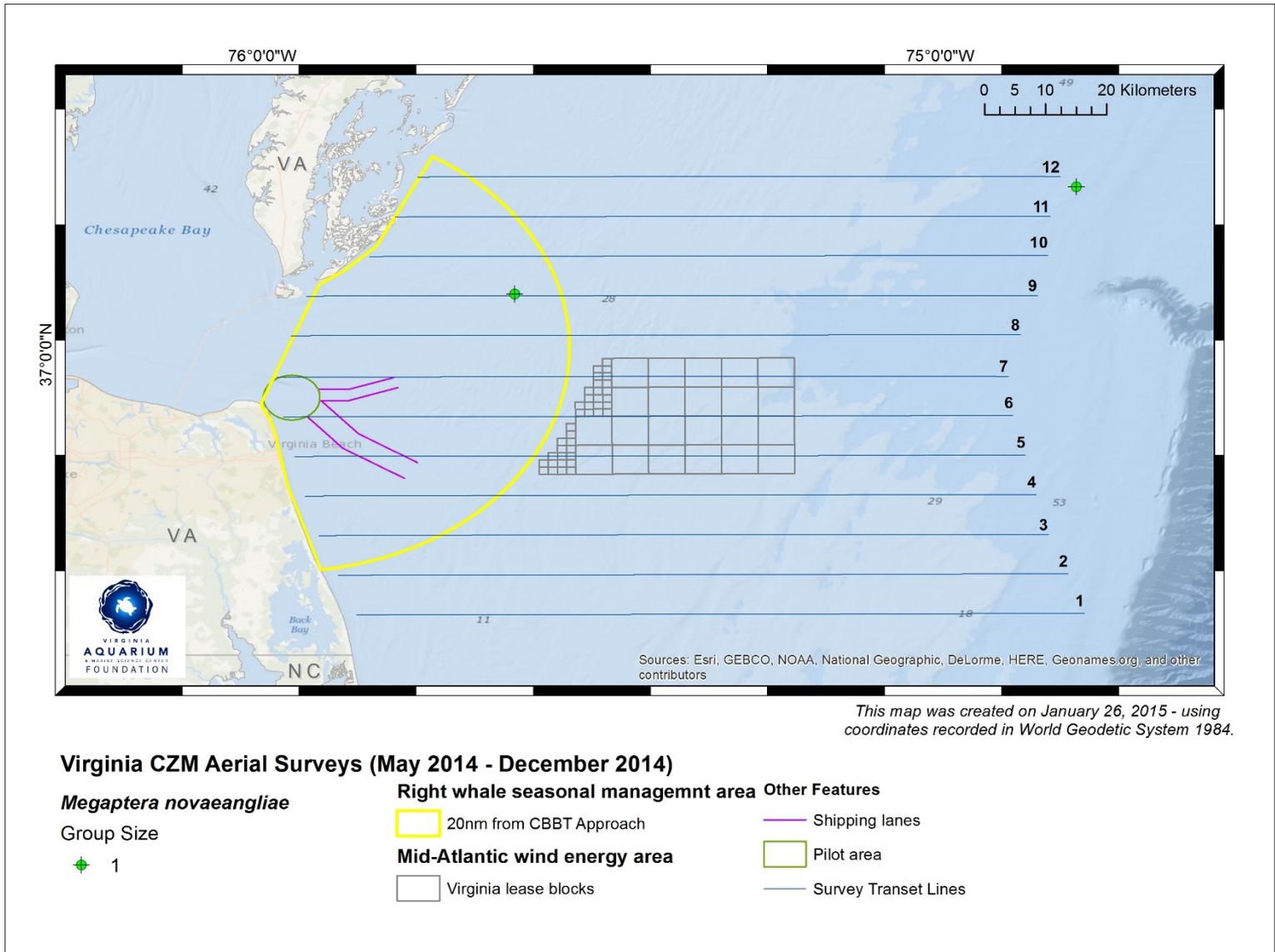


Figure 7. Humpback whale (*Megaptera novaeangliae*) sightings indicating group size

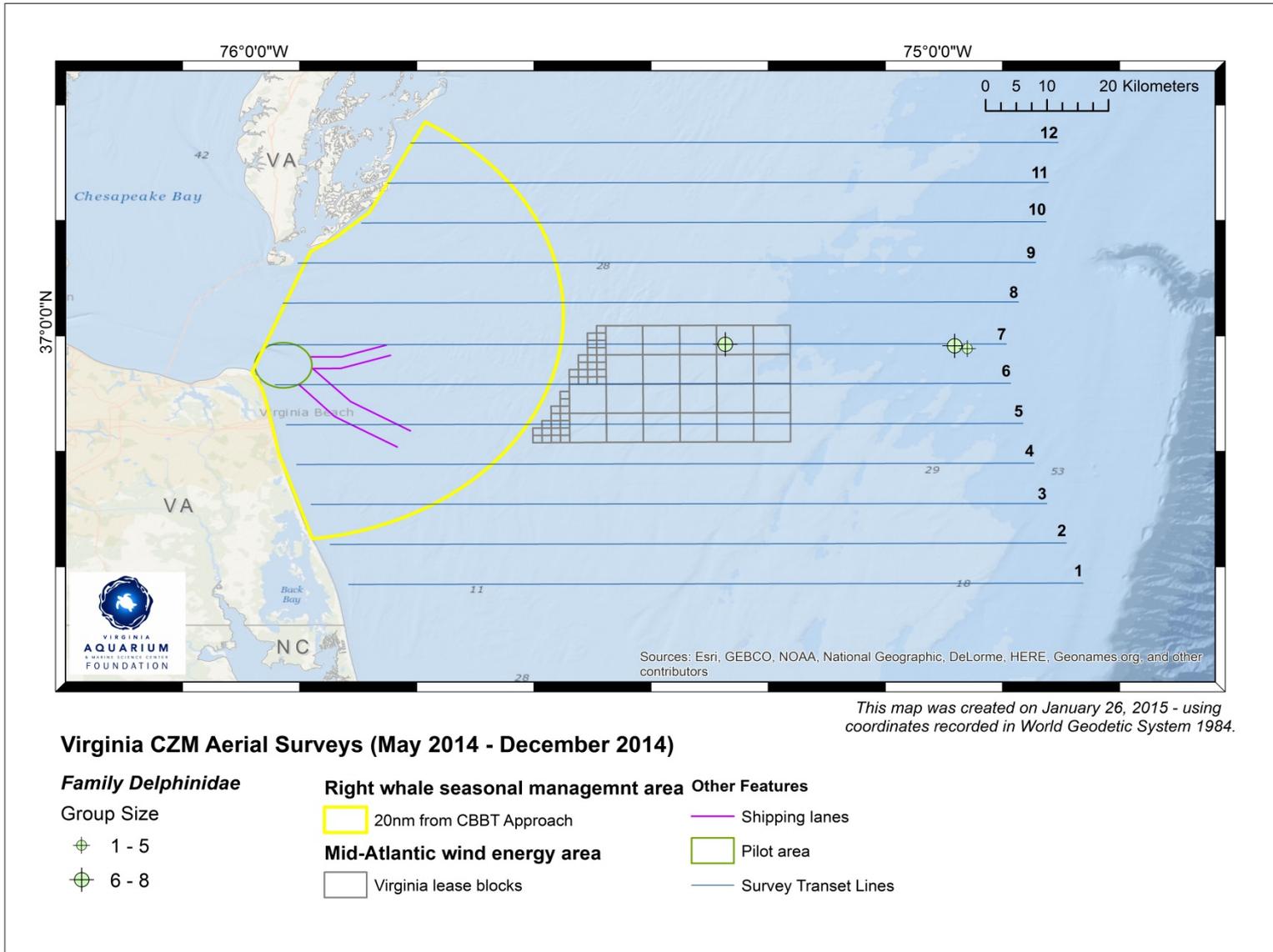


Figure 8. Unidentified delphinid sightings indicated by group size

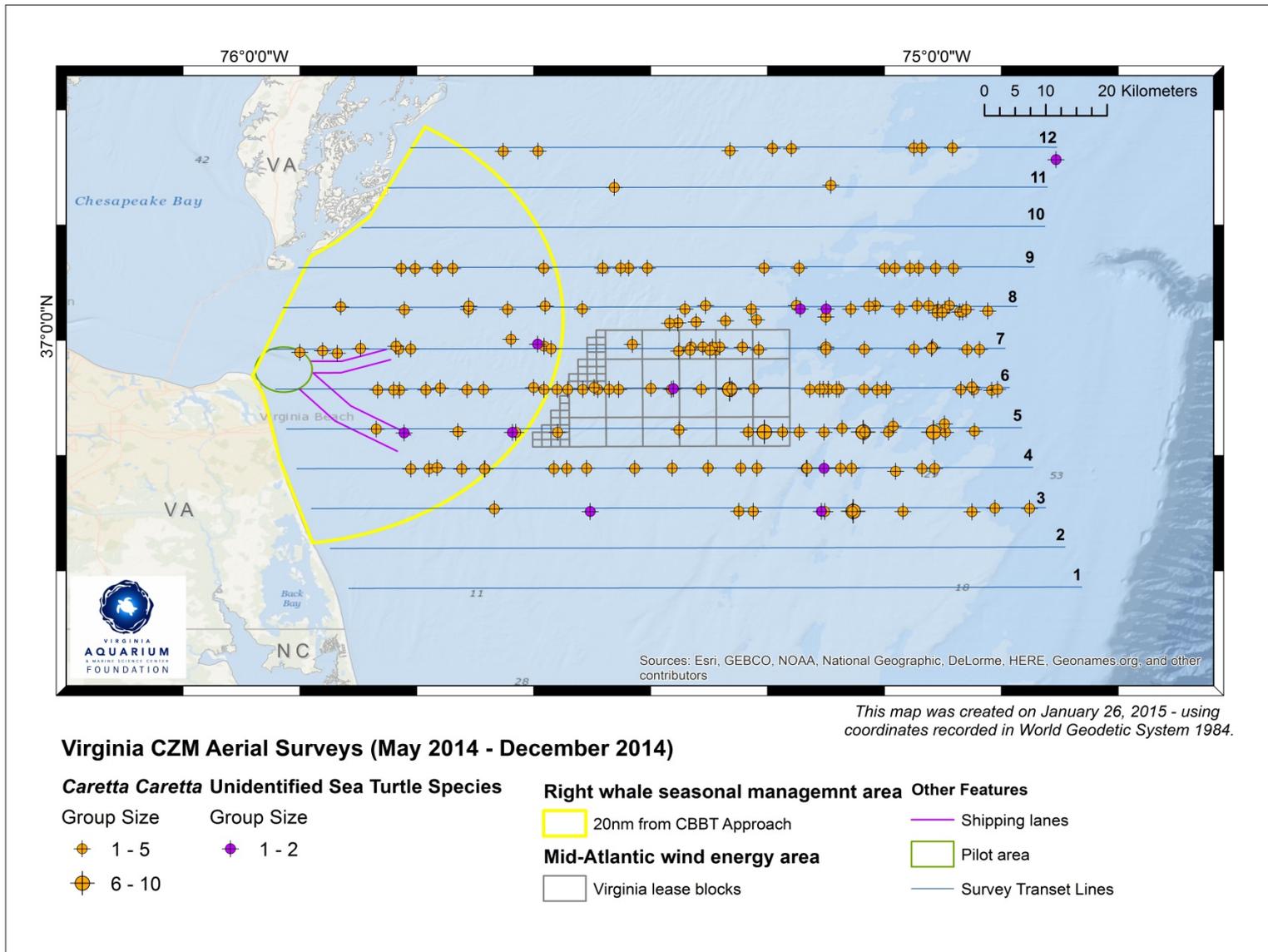


Figure 9. All sea turtle sightings indicated by group size, including: loggerhead (*Caretta caretta*) and unidentified sea turtle sightings

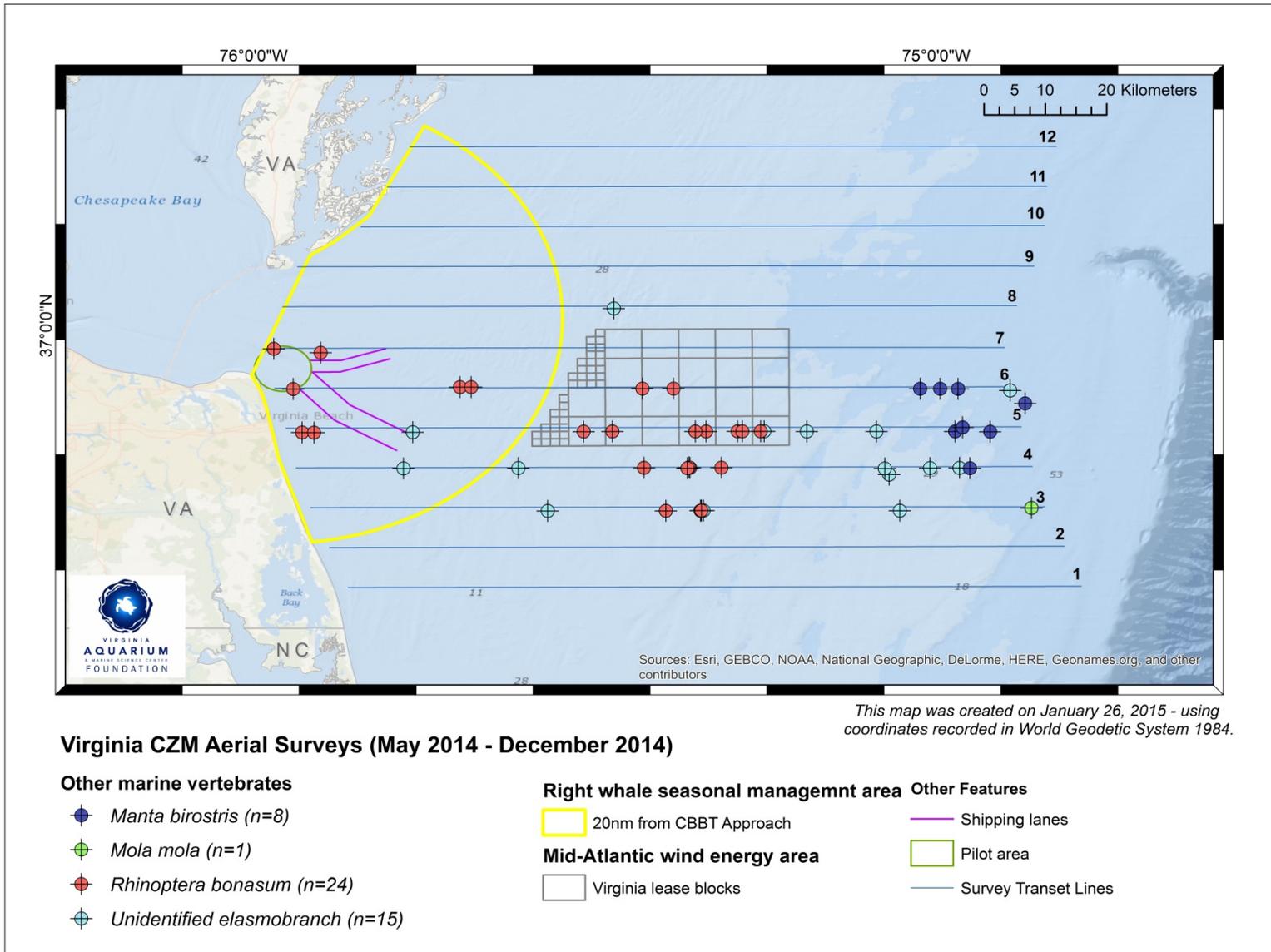


Figure 10. Other marine vertebrate sightings in the Virginia. Points reflect sightings not total number of individuals.

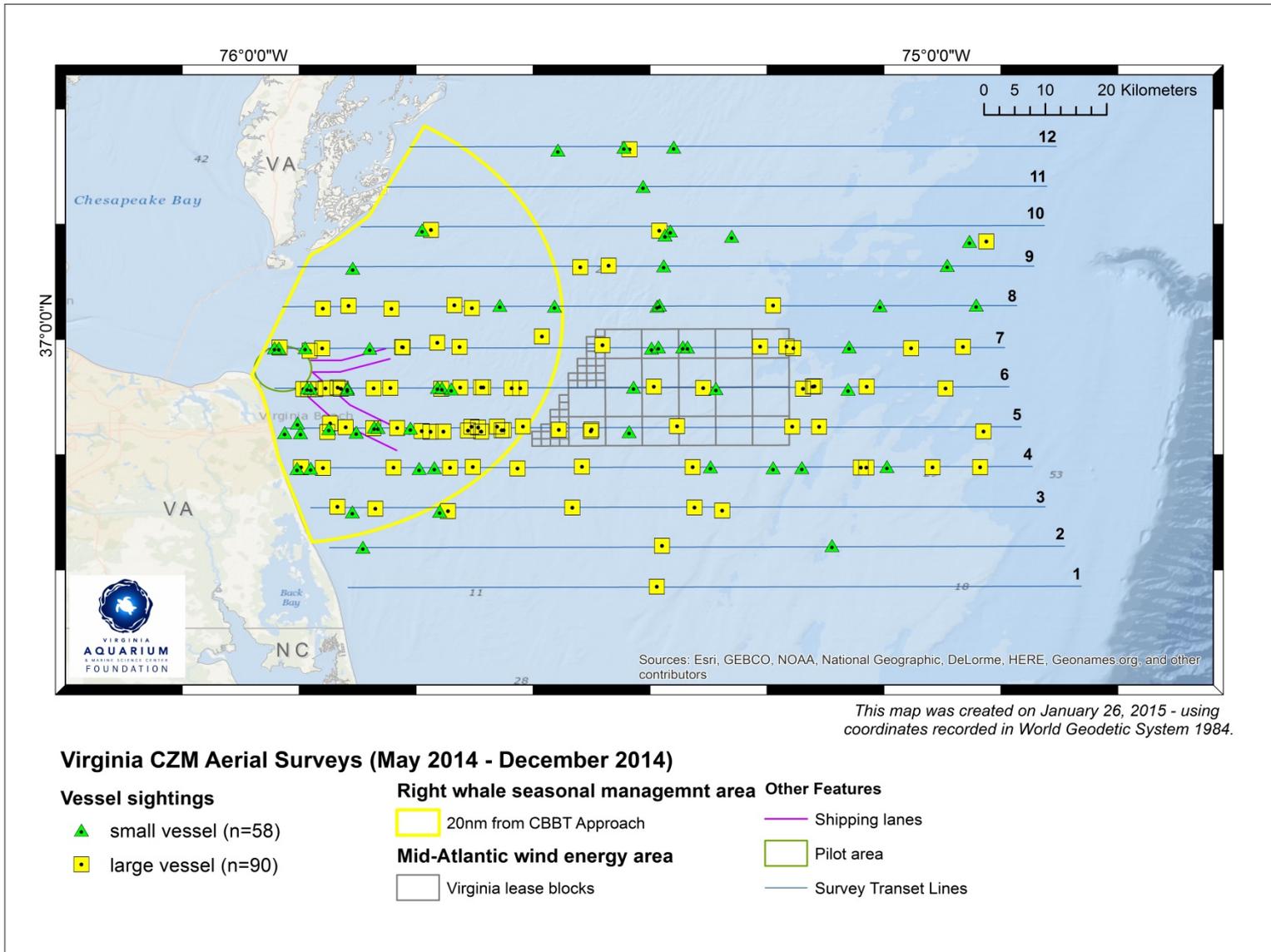


Figure 11. Large and small vessel sightings in the Virginia. Points reflect sightings not total number of vessels.