VACAPES Outer Continental Shelf Cetacean Study, Virginia Beach, Virginia: 2017 Annual Progress Report

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Cover Photo Credit:

Sperm whale (*Physeter macrocephalus*) tag and biopsy approach off the coast of Virginia. Photographed by Todd Pusser. Photograph taken under National Marine Fisheries Service Scientific Research Permit No. 16239, issued to Dan Engelhaupt / HDR.

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Acronyms and Abbreviations

AMAPPS	Atlantic Marine Assessment Program for Protected Species
BSS	Beaufort sea state
GPS	Global Positioning System
hr	hour(s)
km	kilometer(s)
LIMPET	Low-Impact Minimally Percutaneous Electronic Transmitter
m	meter(s)
min	minute(s)
MMO	marine mammal observer
NAVFAC LANT	Naval Facilities Engineering Command Atlantic
NM	nautical mile(s)
NSN	Naval Station Norfolk
OPAREA	Operating Area
PAM	passive acoustic monitoring
photo-ID	photo-identification
sec	second(s)
SPOT	Smart Position and Temperature
U.S.	United States
VACAPES	Virginia Capes

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1. Introduction and Background

The United States (U.S.) Navy routinely conducts training and testing activities in the Virginia Capes (VACAPES) Operating Area (OPAREA) off the mid-Atlantic. Since 2012, HDR has worked with the U.S. Navy to carry out vessel-based line transect visual surveys, photo-identification (photo-ID) surveys, and focal-follow surveys, with the goal of determining common bottlenose dolphin (*Tursiops truncatus*) densities and site fidelity (see Engelhaupt et al. 2014, 2015, 2016, 2017), as well as humpback whale (*Megaptera novaeangliae*) habitat use (see Aschettino et al. 2015, 2016, 2017) within waters adjacent to Naval Station Norfolk (NSN), Joint Expeditionary Base Little Creek-Fort Story, Naval Air Station Oceana Dam Neck Annex, and within and near the W-50 Mine Neutralization Exercise area.

The region encompassing the deeper waters of the continental shelf, shelf break, and continental slope has been recognized as an important habitat for multiple species of cetaceans. Kenney and Winn (1986) showed that the shelf edge from Cape Hatteras to Georges Bank was the second most intensively used cetacean habitat off the northeastern United States based on 3 years of surveys conducted by the Cetacean and Turtle Assessment Program (CETAP 1982). More recent, still on-going, broad-scale surveys by the National Marine Fisheries Service, including the Atlantic Marine Assessment Program for Protected Species (AMAPPS) and marine mammal stock-assessment reports (Waring et al. 2016) show the same pattern. Cetacean species known to be common in some seasons in outer shelf and slope waters include both baleen whales and odontocetes, such as fin whales (*Balaenoptera physalus*), sei whales (*Balaenoptera borealis*), minke whales (*Balaenoptera acutorostrata*), humpback whales, sperm whales (*Physeter macrocephalus*), beaked whales (*Ziphius cavirostris*, *Mesoplodo*n spp.), long-finned and short-finned pilot whales (*Globicephala melas* and *Globicephala macrorhynchus*, respectively), Risso's dolphins (*Grampus griseus*), common bottlenose dolphins, common dolphins (*Delphinus delphis*), Atlantic white-sided dolphins (*Lagenorhynchus acutus*), Atlantic spotted dolphins (*Stenella frontalis*), and striped dolphins (*Stenella coeruleoalba*) (CETAP 1982; Hain et al. 1985, 1992; Kenney and Winn 1986, 1987; Selzer and Payne 1988; Kenney 1990; Payne and Heinemann 1993; Waring et al. 1993, 2001, 2016; Northridge et al. 1997; Palka et al. 1997; Mead 2009; NEFSC and SEFSC 2012, 2013; Jefferson et al. 2014). Fin, sei, and sperm whales are all listed as endangered under the U.S. Endangered Species Act. Recent aerial and vessel surveys and passive acoustic monitoring (PAM) studies for the U.S. Navy Marine Species Monitoring Program (DoN 2013a; McAlarney et al. 2015; Hodge et al. 2016; Mallette et al 2016; Aschettino et al. 2016, 2017) have provided data confirming the overall patterns, and suggesting that the outer shelf area off Virginia in the VACAPES OPAREA would be a good location for more focused research.

Offshore surveys were first conducted in association with the Mid-Atlantic Humpback Whale Monitoring project from April 2015 through June 2016 (Aschettino et al. 2016). A separate study focusing on outer continental shelf cetaceans was initiated in July 2016 (Engelhaupt et al. 2017). This progress report includes all offshore data collected in 2017. The goals of this effort focus on addressing fundamental information gaps related to marine mammal occurrence, exposure, and response as identified the U.S. Navy's Integrated Comprehensive Monitoring Program (DoN 2010) and the follow-up Scientific Advisory Group review (DoN 2011). In order to

address these gaps for offshore waters in the VACAPES OPAREA, a combination of techniques are being used, including: (1) photo-ID and behavioral data collection to provide baseline assessments of animal movement patterns, site fidelity, habitat use, life history, and behavior; (2) biopsy sampling for incorporation into existing genetic studies (where opportunities exist) to identify individuals, determine foraging patterns, and assist in delineating stock boundaries; and (3) satellite-linked tagging techniques to provide information on residency patterns and habitat use across intermediate time scales (weeks to months).

Residency and movement patterns are of particular interest given the potential for repeated exposure to U.S. Navy training and testing activities known to occur within the area. Although supporting information is limited, preliminary findings from work conducted off the coast of Cape Hatteras, North Carolina, to the south suggest a year-round presence of several species of cetaceans near the continental shelf break (Baird et al. 2016, Foley et al. 2016). Tagging efforts will provide longer-term movement patterns to identify extent of overlap with offshore training and testing activities conducted within the VACAPES OPAREA. Given the duration of the tag attachments and experience from previous tagging studies in waters off Cape Hatteras, North Carolina, we would expect the potential to track tagged animals to OPAREAS outside of VACAPES, including the Cherry Point OPAREA to the south and the Atlantic City OPAREA to the north.

Taking into consideration the multiple intermediate scientific objectives in the U.S. Navy's Strategic Planning Process (DoN 2013b), the goals of this study are to assist the U.S. Navy and regulatory agencies with environmental planning and compliance by addressing the following questions:

- Which cetacean species occur over the outer continental shelf to the east of NSN, and how does occurrence fluctuate seasonally?
- What are the baseline behaviors and ecological relationships of offshore cetaceans within the study area?
- Do individual cetaceans exhibit site fidelity within specific regions of the study area over periods of weeks, months, or years?
- What is the seasonal extent of cetacean movements within and around U.S. Navy VACAPES training range boxes?
- Do cetaceans spend significant time within or primarily move through areas of U.S. Navy live-fire or Anti-Submarine Warfare training events?

2. Methods

The primary survey area includes the offshore waters (approximately 90 km (50 nautical miles [NM]) to 160 km (85 NM) off Virginia (**Figure 1**). The offshore study area includes the outer part of the continental shelf, the shelf break, and slope waters, along with Norfolk and Washington Canyons. Depths within the study area range from less than 100 meters (m) to 3,000 m.

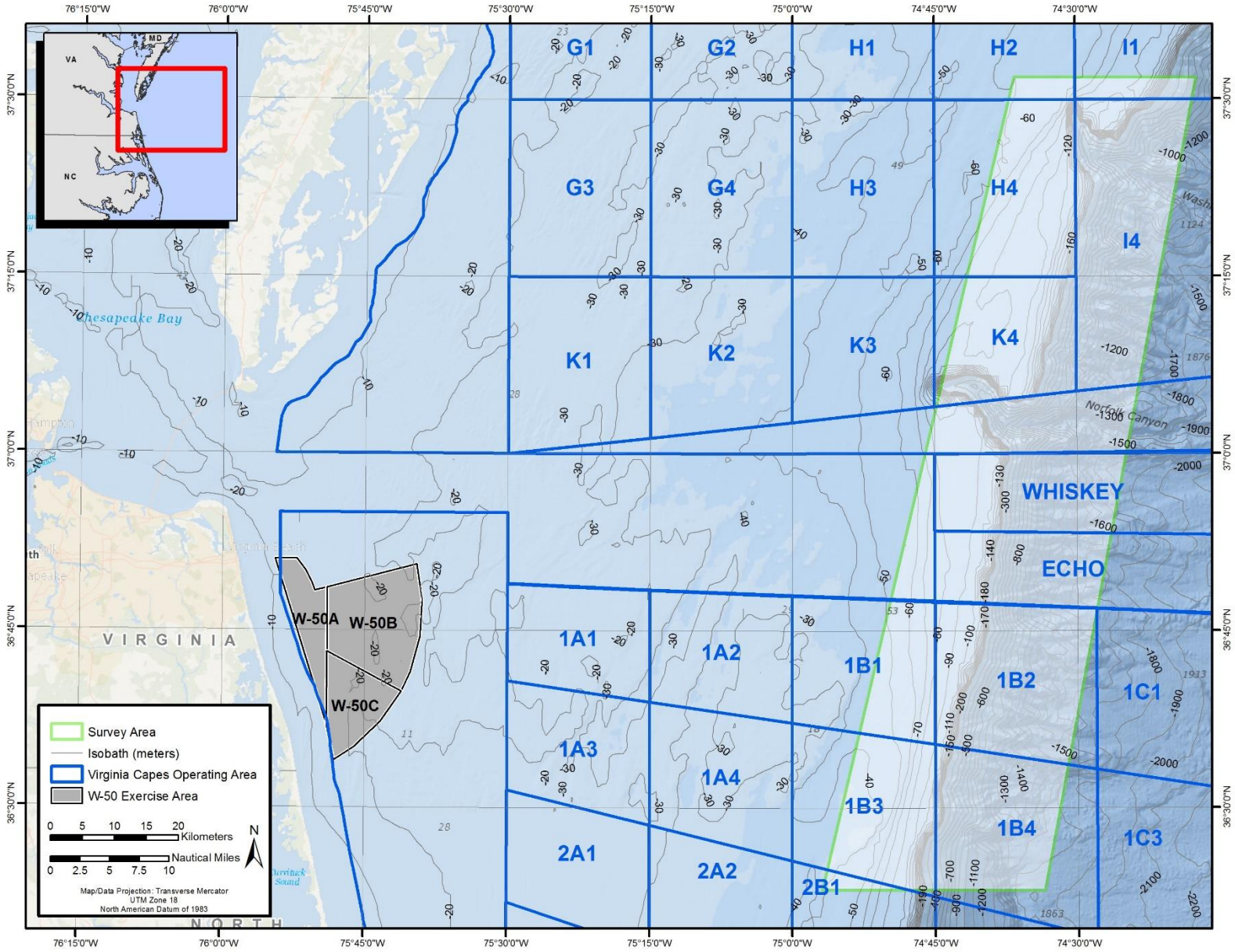

Figure 1. Map of the offshore study area off southeastern Virginia and the VACAPES training range surface grid in the region.

2.1 Survey Operations

Survey departure times were adjusted to maximize weather and clearance windows, and to take into account the long transit time to reach the survey area (approximately 3 hours [hr] each way). Survey days were planned to utilize survey time within the area of interest during optimal weather conditions, including good visibility and a Beaufort sea state (BSS) of 3 or lower when possible, as well as access to the VACAPES OPAREA range boxes within the study area (K3, K4, 1B1, 1B2, 1B3, and 1B4; **Figure 1**) so that the research vessels had clearance to operate when training was not being conducted. However, because of frequent range closures and limited weather windows, it was not always possible to conduct surveys within the desired VACAPES OPAREA boxes.

Multiple vessels were utilized to support surveys. Charter fishing boats have proven to be effective for reaching the study area and therefore have been the primary vessels used. The 17.4 m *Capt. Cheryl* and 16.2 m *Top Notch* (**Figure 2)** were the primary vessels used in 2017. Each vessel was equipped with a Global Positioning System (GPS) receiver, marine radio, emergency beacon, a life raft, depth sounder, and emergency equipment. All captains are familiar with the Virginia Beach waterways and the unique characteristics of the region and hold U.S. Coast Guard-approved 100-ton master's licenses.

Figure 2. One of multiple sport-fishing vessels chartered for use during offshore surveys, the 16.2 m *Top Notch*.

Charter vessels departed from Rudee Inlet in Virginia Beach, Virginia. Efforts were coordinated with the VACAPES range so that the vessel would have clearance in the primary study area as often as possible. The K3 and K4 range boxes, which encompass Norfolk Canyon, require clearance to be obtained on the day of surveys, and therefore there were times that area was

unavailable. Coordination with the University of North Carolina's aerial survey team (see McAlarney et al. 2017) was also attempted, whenever possible, in order to maximize sightings potential.

The scientific crew consisted of a minimum of four marine mammal observers (MMOs), but no more than five, including (at least) one photographer, one data recorder, one tagging specialist, and one biopsy specialist. Roles were interchangeable throughout surveys.

In order to maximize achieving the project objectives, departures from the marina were scheduled at approximately sunrise or earlier. Up to 12 hr were allocated for each survey day. Once departing the marina, transit time was approximately 3 hr to reach the study area. A limited MMO team was on effort during the outbound and inbound transit as long as there was daylight and a BSS of 4 of lower; the full MMO team was deployed on reaching the primary survey area. Because of the distance from shore and overall effort required to complete each survey day, even if sea states were unfavorable (BSS 4 to 6), effort in the primary study area continued until the end of the survey day, unless conditions were deemed to be unsafe. Every effort was made to avoid such circumstances by following weather forecasts closely before commencing a survey day.

The survey area for each day was chosen depending on weather conditions, clearance, and reports of high-priority species (e.g., information from recent aerial or vessel surveys). Areas of high naval use, such as the Norfolk Canyon area (**Figure 1**) were a priority. The survey vessel often followed pre-determined tracks that covered high-priority regions; however, because these surveys were intended to maximize the potential for making observations, surveys did not follow line-transect distance-sampling protocols. The vessel maintained a survey speed of approximately 18 to 22 km/hr (10 to 12 knots) during search efforts that followed a zig-zag pattern to waypoints chosen on the day of survey that would optimize coverage across the depth gradient in the areas that could be accessed that day.

The on-effort MMOs used both 10 × 30 hand-held image-stabilized binoculars and unaided eyes. MMOs covered a 270-degree swath of observation area in front of and to the sides of the survey vessel. Once a sighting was made, one MMO focused on entering data into COMPASS (Richlen et al. 2017), the data-recording application running on an Apple iPad tablet (see **Appendix A**) while others focused on visually tracking and obtaining photo-ID images of the individual or group. In addition to photo-ID, some species were targeted for biopsy, satellite tagging, and/or digital video-recording. Baleen whales, sperm whales, and beaked whales were given highest priority in terms of time and effort spent collecting information and attempting to deploy tags and collect samples. Species not frequently seen in the area, such as killer whales (*Orcinus orca*), false killer whales (*Pseudorca crassidens*), melon-headed whales (*Peponocephala electra*), and pygmy killer whales (*Feresa attenuata*) were also defined as high-priority if encountered. Pilot whales and Risso's dolphins were considered medium-priority species and were worked in the event that higher-priority species were not encountered, although because of the high number of sightings of pilot whales, groups were not always approached for photo-ID, and when they were approached, it was not always possible to determine species unless the animals passed closely to the vessel and the pectoral flippers could be observed underwater. Other delphinid species were the lowest priority and effort spent

collecting data and photographs was limited to group size, initial behavior, and confirmation of species identification.

During a priority marine mammal sighting, or when in the vicinity of a suspected sighting, the research vessel would attempt to approach the animal(s) for the purpose of photographs, biopsy sampling, focal-follow data collection, or tagging. The approach was done in a manner to minimize disturbance to the animals and to maximize the crew's abilities to confirm species, obtain group size estimates, and collect photo-IDs and video. The decision on when to end data collection efforts on a priority species or to switch to a different sighting was made by the Chief Scientist.

2.2 Photography and Data Logging

Once a sighting was made, one observer focused on data recording, while the others focused on obtaining photo-ID images of the individual(s) using a digital SLR camera (Canon 7D, 7D Mark II, or 1DX Mark II) with a zoom lens (Canon 100- to 400-millimeter). Every effort was made to obtain good quality identification photos of the flukes and/or dorsal fins of high-priority species encountered. Following each survey day, photos were cropped and compiled in a format suitable for data sharing with other catalogs. HDR will share their images with known regional and local catalogs, including the Gulf of Maine Humpback Whale Catalog curated by the Center for Coastal Studies, the North Atlantic Humpback Whale Catalog curated by Allied Whale, College of the Atlantic, the Mid-Atlantic Humpback Whale Catalog maintained by the Virginia Aquarium, and multiple cetacean catalogs maintained by Duke University.

During surveys, the data recorder maintained a log of observers, environmental conditions, and sighting information in COMPASS running on an iPad (**Appendix A**). Environmental data were updated whenever sighting conditions changed. When a sighting was made, information regarding the distance and bearing to the sighting, species identification, speed and direction of the animal(s), group size, photographs, and videos was logged when available.

Sighting distances were estimated visually, although laser range finders were used when possible. Location data and vessel speed were obtained from a GPS unit feeding directly into the iPad and logging a location every 30 seconds.

2.3 Biopsy Sample Collection

Biopsy samples were collected from priority species after the survey team finished collecting identification photographs. Biopsy samples were collected with a sampling dart fired from a Paxarms MK24c projector (Paxarms New Zealand Ltd., Cheviot, New Zealand) or Barnett Recurve crossbow (Barnett Outdoors, LLC, Tarpon Springs, FL). Skin samples were placed in a Whirl-Pak® bag after collection and stored in an ice cooler on the vessel. At the end of the day, samples were cross-sectioned, placed in the appropriate Cryovial® storage tube, and stored in a freezer until ready for shipment. Samples for stable-isotope analysis, genetic analysis, and pollutant studies were collected for Duke University (Waples 2017), the University of Groningen, and Southeast Fisheries Science Center (National Marine Fisheries Service), respectively. Analysis of these samples is currently in progress.

2.4 Satellite Tagging

A combination of Wildlife Computers (Redmond, Washington) Argos-linked location-only Smart Position and Temperature (SPOT6) and Argos-linked time-depth archival (SPLASH292 tags), both in the Low-Impact Minimally Percutaneous Electronic Transmitter (LIMPET) configuration (Andrews et al. 2008), were deployed on priority species. Tags were deployed remotely with a DAN-INJECT J.M.SP.25 CO_2 projector (DAN-INJECT ApS, Børkop, Denmark; www.dan-inject.com). Two surgical-grade titanium darts measuring 6.8 centimeters in length containing six backwards-facing petals were used to attach tags to the dorsal fin. Because of expected attachment durations of LIMPET tags on baleen and sperm whales of less than 60 days, tags were programmed to maximize the number of transmissions and locations received during attachment rather than to extend battery life. Based on satellite availability in the area, all tags were programmed to transmit for 20 hr per day. SPOT6 tags for both fin and sperm whales were programmed with unlimited numbers of transmissions per day. SPLASH tags programmed for fin whales were limited to 350 transmissions per day and limited to 300-600 transmissions per day for sperm whales. In order to constitute a "dive" for the Wildlife Computers generated behavior and time-series data outputs, a 10 m and 30 s dive definition was established for fin whales in which a dive needed to be both deeper than 10 m and longer than 30 s in order to be classified as a dive. Dive definitions for sperm whales were initially set at 10 m and 30 s, adjusted to 30 m and 30 s, and finally changed to 50 m and 5 min in order to reduce gaps in the data. Locations of tagged individuals were approximated by the Argos system using the Kalman filtering location algorithm (Argos User's Manual © 2007-2015 Collective Location Services). Using tools provided within Movebank (www.movebank.org), unrealistic locations (e.g., those on land) were manually removed prior to a further Douglas Argos Filtering step. All dives we manually inspected and unrealistic dive durations were removed from the data that could not be verified by both the time series and behavior file output.

3. Results

We conducted 14 offshore vessel surveys in 2017 covering 4,992 km of trackline during more than 170 hr of effort (**Table 1, Figure 3**). Surveys were conducted at least once per month in all months except September, October, and December in which weather conditions prevented survey effort.

The vessel surveys resulted in 253 marine mammal sightings and 49 sea turtle sightings (**Figures 4 through 6; Tables 2 and 3**). Twelve cetacean taxa were identified (in order of decreasing frequency): unidentified pilot whale (*Globicephala* sp.) (*n*=70), common bottlenose dolphin (*n*=62), short-beaked common dolphin (*n*=46), sperm whale (n=21), fin whale (*n*=11), Risso's dolphin (*n*=5), short-finned pilot whale (*n*=4), minke whale (*n*=4), striped dolphin (*n*=2), humpback whale (*n*=2), Atlantic spotted dolphin (*n*=2), sei whale (*Balaenoptera borealis*) (*n*=1), and harbor porpoise (*Phocoena phocoena*) (*n*=1). In addition, there were 22 sightings of unconfirmed species: unidentified delphinid (*n*=17), unidentified cetacean (*n*=2), unidentified medium whale (*n*=2), and unidentified mesoplodont (*n*=1). Loggerhead turtle (*Caretta caretta*) were the only sighted turtle species (*n*=49). The unidentified mesoplodont was deceased and heavily decomposed however a biopsy sample was collected and subsequent genetic analysis confirmed it was a female True's beaked whale (*Mesoplodon mirus*). Given the study's focus on

priority species that do not include pilot whales combined with the challenge of identifying the genus *Globicephala* down to species from a distance, most pilot whale groups were classed as unidentified pilot whales.

Table 1. Summary of 2017 offshore survey effort off Virginia Beach, Virginia.

Date	Survey Time (min)	Distance surveyed (km)	# Sightings	# Individuals	Priority Species* # Sightings/ # Individuals	Non-priority Species* # Sightings/ # Individuals	Sea Turtles # Sightings/ # Individuals
17-Jan-17	690	350	12	803	2/3	10/800	0/0
27-Feb-17	780	345	23	1031	6/9	17/1,022	0/0
6-Mar-17	714	328	15	499	6/6	9/493	0/0
26-Mar-17	716	357	26	554	3/7	23/547	0/0
5-Apr-17	708	367	20	472	0/0	20/472	0/0
10-May-17	799	394	44	758	3/4	33/740	8/14
16-May-17	700	378	25	605	0/0	17/591	8/14
16-Jun-17	731	358	36	652	3/5	20/622	13/25
27-Jun-17	740	353	17	105	6/10	7/90	4/5
16-Jul-17	729	359	18	252	1/2	15/248	2/2
27-Jul-17	729	344.9	9	237	2/3	7/234	0/0
03-Aug-17	772	379	27	298	5/15	15/269	7/14
17-Aug-17	723	350	18	322	2/14	10/298	6/10
3-Nov-17	725	330	12	864	2/2	9/861	1/1
Total	**10,256**	**4,992**	**302**	**7,452**	**41/80**	**212/7,287**	**49/85**

Key: min = minute(s); km = kilometer(s)

*Priority species include baleen and sperm whales, non-priority species include pilot whales, delphinids, and porpoises

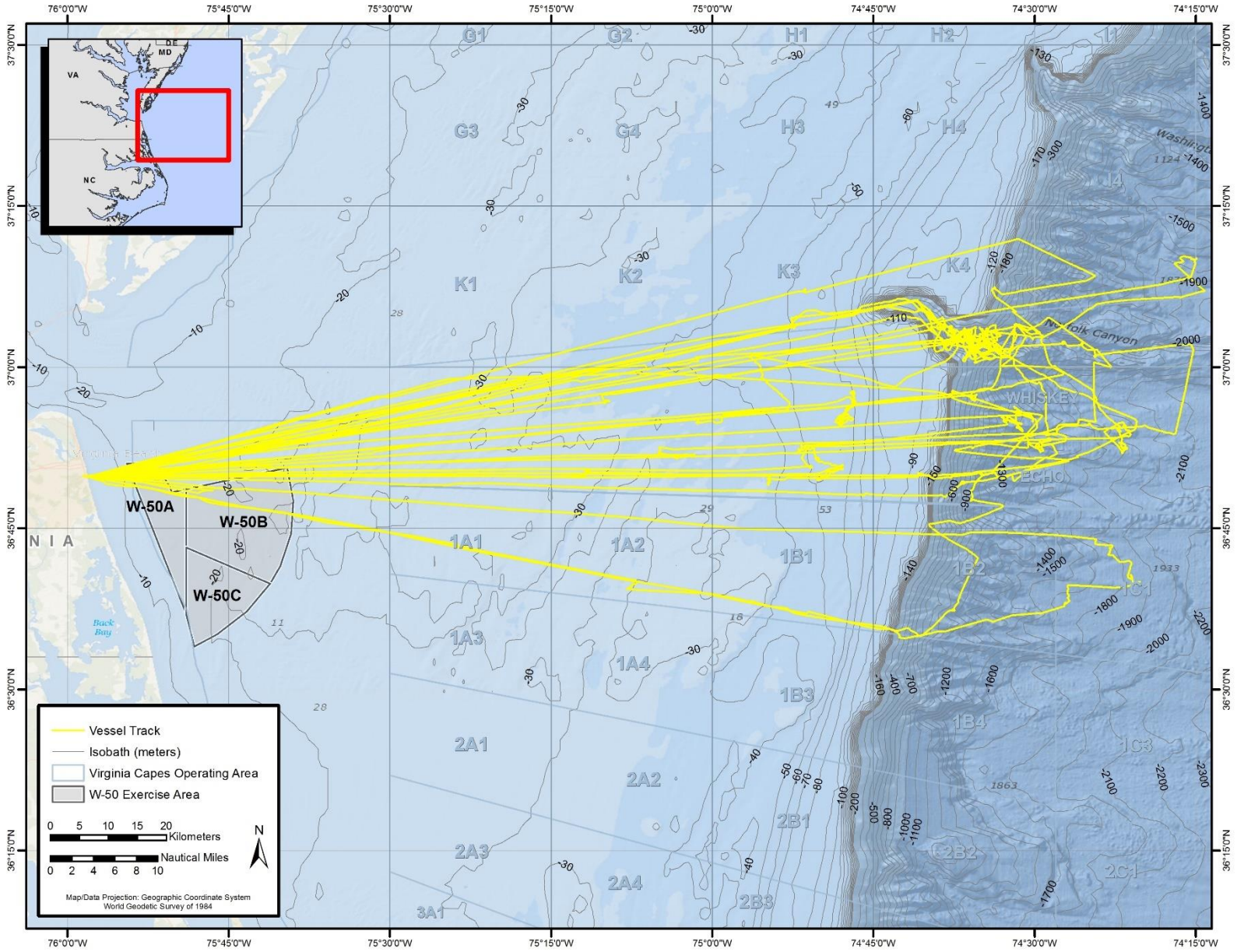

Figure 3. Offshore survey tracks for all surveys conducted in 2017.

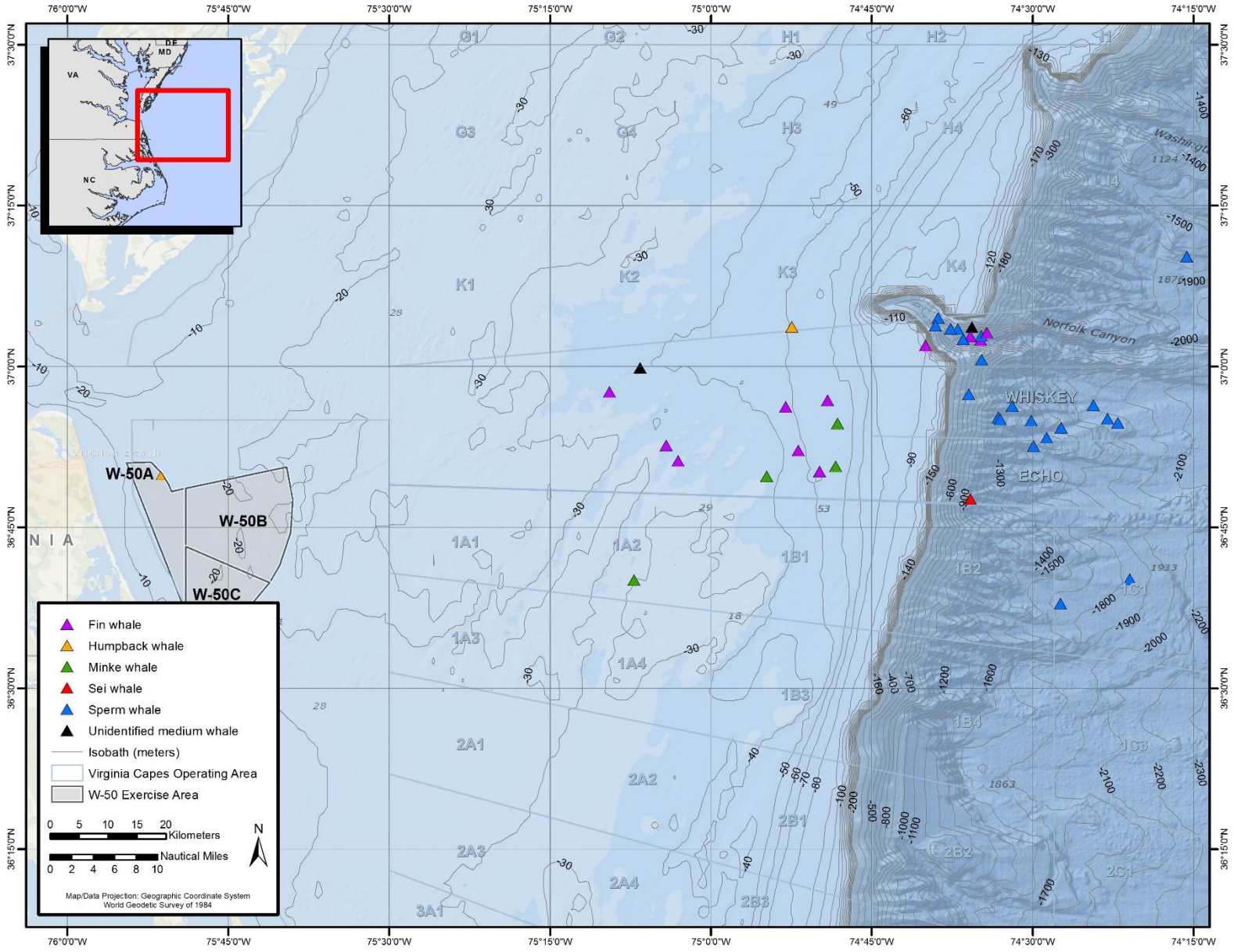

Figure 4. Locations of all baleen and sperm whale sightings (*n*=41) in 2017.

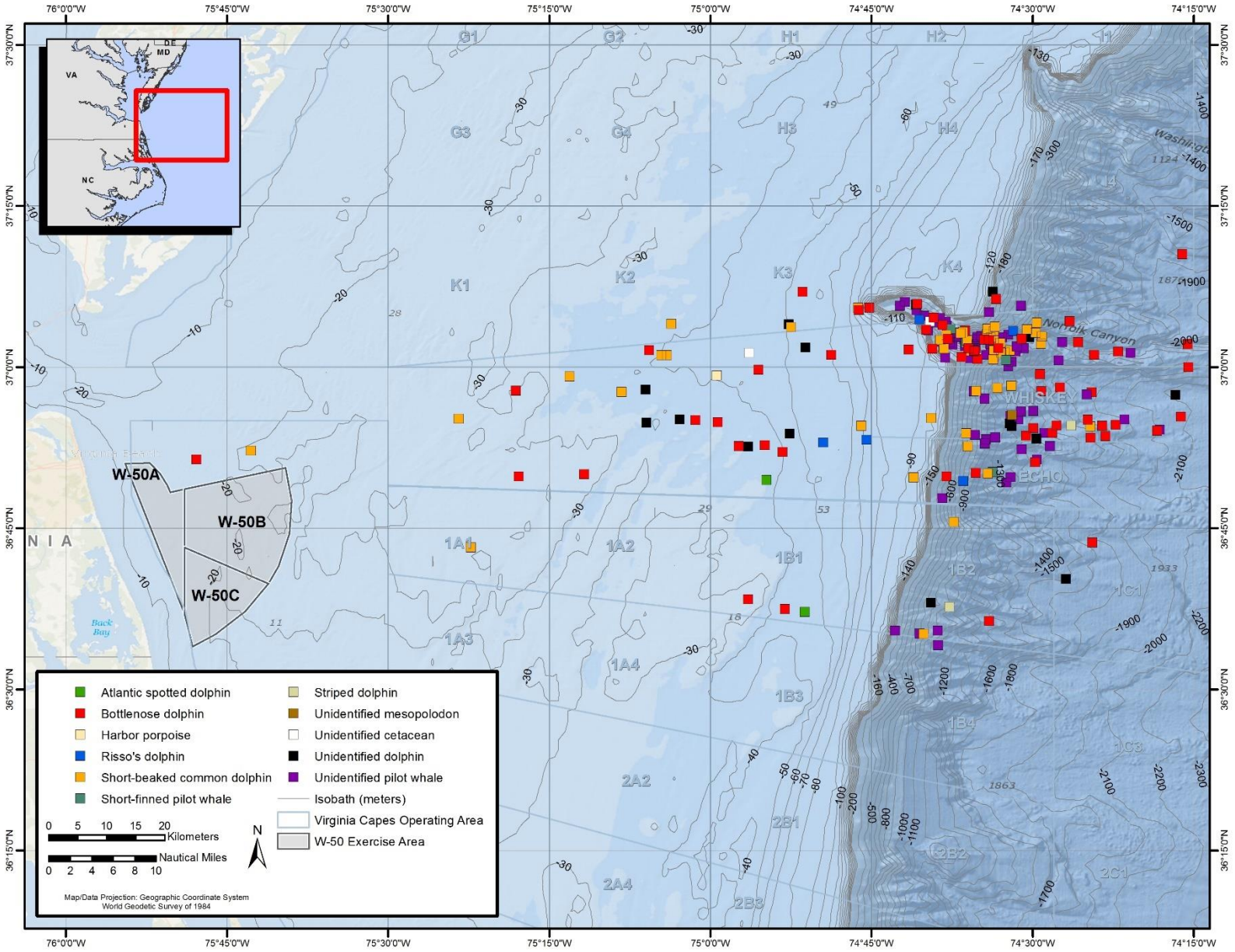

Figure 5. Locations of all pilot whale, dolphin, and porpoise sightings (*n*=212) in 2017.

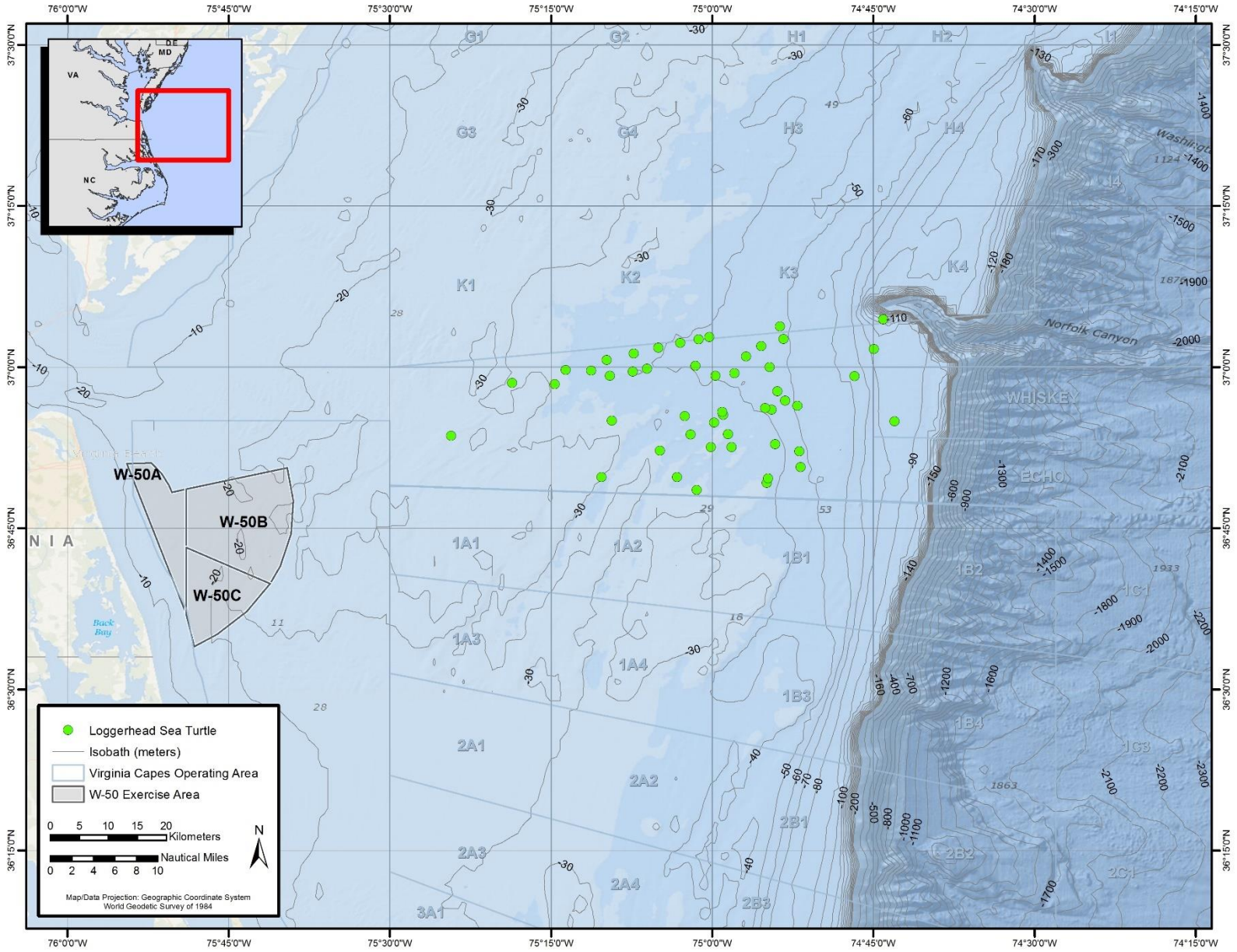

Figure 6. Locations of all sea turtle sightings (*n*=49) in 2017.

Table 2. Summary of marine mammal sightings during 14 offshore vessel surveys in 2017.

Date	Sighting Time (local)	Scientific Name	Common Name	Group Size	Latitude (°N)	Longitude (°W)
17-Jan-17	7:33	*Delphinus delphis*	Common dolphin	50	36.7200	75.3716
17-Jan-17	8:11	*Balaenoptera acutorostrata*	Minke whale	1	36.6678	75.1191
17-Jan-17	9:00	*Tursiops truncatus*	Common bottlenose dolphin	10	36.6393	74.9413
17-Jan-17	9:09	*Tursiops truncatus*	Common bottlenose dolphin	20	36.6246	74.8845
17-Jan-17	9:41	*Delphinus delphis*	Common dolphin	82	36.5860	74.6693
17-Jan-17	9:47	*Globicephala sp.*	Unidentified pilot whale	8	36.5686	74.6464
17-Jan-17	9:59	*Stenella coeruleoalba*	Striped dolphin	120	36.6280	74.6291
17-Jan-17	10:00	*n/a*	Unidentified dolphin	120	36.6343	74.6577
17-Jan-17	11:13	*Delphinus delphis*	Common dolphin	320	36.7596	74.6219
17-Jan-17	11:48	*Balaenoptera borealis*	Sei whale	2	36.7943	74.5964
17-Jan-17	12:33	*Delphinus delphis*	Common dolphin	60	36.8346	74.5695
17-Jan-17	12:45	*Globicephala sp.*	Unidentified pilot whale	10	36.8206	74.5406
27-Feb-17	7:09	*Delphinus delphis*	Common dolphin	50	36.9856	75.2184
27-Feb-17	8:27	*Globicephala sp.*	Unidentified pilot whale	5	37.0953	74.7056
27-Feb-17	8:33	*Globicephala sp.*	Unidentified pilot whale	60	37.0878	74.6799
27-Feb-17	8:51	*Globicephala sp.*	Unidentified pilot whale	22	37.0763	74.6438
27-Feb-17	8:59	*Physeter macrocephalus*	Sperm whale	2	37.0586	74.6270
27-Feb-17	9:07	*Physeter macrocephalus*	Sperm whale	2	37.0580	74.6159
27-Feb-17	12:19	*Physeter macrocephalus*	Sperm whale	2	37.0105	74.5790
27-Feb-17	13:09	*Tursiops truncatus*	Common bottlenose dolphin	5	37.0243	74.5892
27-Feb-17	13:15	*Globicephala sp.*	Unidentified pilot whale	7	37.0431	74.6057
27-Feb-17	13:24	*Globicephala sp.*	Unidentified pilot whale	12	37.0350	74.5933
27-Feb-17	13:29	*Tursiops truncatus*	Common bottlenose dolphin	4	37.0256	74.5911
27-Feb-17	13:40	*Delphinus delphis*	Common dolphin	700	37.0118	74.5608
27-Feb-17	14:14	*Globicephala sp.*	Unidentified pilot whale	20	37.0357	74.5656
27-Feb-17	14:16	*Balaenoptera physalus*	Fin whale	1	37.0408	74.5802
27-Feb-17	14:36	*Globicephala sp.*	Unidentified pilot whale	45	37.0463	74.5854
27-Feb-17	14:58	*Balaenoptera physalus*	Fin whale	1	37.0325	74.6661
27-Feb-17	15:07	*Tursiops truncatus*	Common bottlenose dolphin	16	37.0272	74.6919
27-Feb-17	15:55	*n/a*	Unidentified dolphin	3	36.9647	75.1008
27-Feb-17	15:59	*Delphinus delphis*	Common dolphin	15	36.9612	75.1377
27-Feb-17	16:01	*Balaenoptera physalus*	Fin whale	1	36.9602	75.1570
27-Feb-17	16:53	*Delphinus delphis*	Common dolphin	25	36.9196	75.3903
27-Feb-17	17:32	*Delphinus delphis*	Common dolphin	30	36.8703	75.7130
27-Feb-17	17:42	*Tursiops truncatus*	Common bottlenose dolphin	3	36.8570	75.7976
06-Mar-17	7:27	*Delphinus delphis*	Common dolphin	24	37.0186	75.0675
06-Mar-17	7:54	*Megaptera novaeangliae*	Humpback whale	1	37.0614	74.8738
06-Mar-17	7:59	*Delphinus delphis*	Common dolphin	26	37.0620	74.8749
06-Mar-17	8:47	*Tursiops truncatus*	Common bottlenose dolphin	10	37.0919	74.7532
06-Mar-17	9:06	*Tursiops truncatus*	Common bottlenose dolphin	8	37.0979	74.6790
06-Mar-17	9:31	*Physeter macrocephalus*	Sperm whale	1	37.0424	74.6077

Date	Sighting Time (local)	Scientific Name	Common Name	Group Size	Latitude (°N)	Longitude (°W)
06-Mar-17	9:36	*Balaenoptera physalus*	Fin whale	1	37.0467	74.5964
06-Mar-17	9:55	*Physeter macrocephalus*	Sperm whale	1	37.0475	74.5794
06-Mar-17	10:14	*Tursiops truncatus*	Common bottlenose dolphin	75	37.0419	74.5673
06-Mar-17	11:52	*n/a*	Unidentified medium whale	1	37.0613	74.5939
06-Mar-17	12:23	*Delphinus delphis*	Common dolphin	90	37.0371	74.5499
06-Mar-17	12:27	*Balaenoptera physalus*	Fin whale	1	37.0527	74.5708
06-Mar-17	12:45	*Tursiops truncatus*	Common bottlenose dolphin	7	37.0423	74.5749
06-Mar-17	13:12	*Delphinus delphis*	Common dolphin	250	37.0458	74.5651
06-Mar-17	14:59	*n/a*	Unidentified dolphin	3	36.9189	75.0474
26-Mar-17	8:18	*Delphinus delphis*	Common dolphin	15	37.0184	75.0760
26-Mar-17	8:45	*n/a*	Unidentified dolphin	150	37.0663	74.8785
26-Mar-17	9:01	*Tursiops truncatus*	Common bottlenose dolphin	11	37.0884	74.7697
26-Mar-17	9:25	*Physeter macrocephalus*	Sperm whale	1	37.0756	74.6465
26-Mar-17	9:28	*Tursiops truncatus*	Common bottlenose dolphin	2	37.0766	74.6536
26-Mar-17	9:44	*Physeter macrocephalus*	Sperm whale	3	37.0637	74.6504
26-Mar-17	11:05	*Tursiops truncatus*	Common bottlenose dolphin	10	37.0284	74.6554
26-Mar-17	11:31	*Tursiops truncatus*	Common bottlenose dolphin	5	37.0568	74.6046
26-Mar-17	11:40	*Tursiops truncatus*	Common bottlenose dolphin	31	37.0292	74.5993
26-Mar-17	11:43	*Globicephala sp.*	Unidentified pilot whale	30	37.0289	74.5882
26-Mar-17	12:06	*Tursiops truncatus*	Common bottlenose dolphin	3	37.0157	74.6100
26-Mar-17	12:20	*Globicephala sp.*	Unidentified pilot whale	12	37.0486	74.5793
26-Mar-17	12:23	*Delphinus delphis*	Common dolphin	45	37.0595	74.5697
26-Mar-17	12:29	*Globicephala sp.*	Unidentified pilot whale	12	37.0569	74.5610
26-Mar-17	12:29	*Delphinus delphis*	Common dolphin	45	37.0553	74.5600
26-Mar-17	12:33	*Globicephala sp.*	Unidentified pilot whale	7	37.0459	74.5473
26-Mar-17	12:35	*Delphinus delphis*	Common dolphin	15	37.0414	74.5599
26-Mar-17	12:40	*n/a*	Unidentified dolphin	22	37.0327	74.5597
26-Mar-17	12:56	*Globicephala sp.*	Unidentified pilot whale	26	37.0508	74.5374
26-Mar-17	13:11	*Delphinus delphis*	Common dolphin	22	37.0588	74.5086
26-Mar-17	13:20	*Delphinus delphis*	Common dolphin	27	37.0476	74.4855
26-Mar-17	13:25	*Delphinus delphis*	Common dolphin	5	37.0361	74.4869
26-Mar-17	14:06	*Delphinus delphis*	Common dolphin	16	36.9711	74.5330
26-Mar-17	14:12	*Delphinus delphis*	Common dolphin	10	36.9677	74.5544
26-Mar-17	14:20	*Delphinus delphis*	Common dolphin	26	36.9627	74.5875
26-Mar-17	14:24	*Physeter macrocephalus*	Sperm whale	3	36.9567	74.5987
05-Apr-17	10:14	*Globicephala sp.*	Unidentified pilot whale	15	37.0980	74.6970
05-Apr-17	10:18	*n/a*	Unidentified dolphin	5	37.0971	74.6809
05-Apr-17	10:27	*Globicephala sp.*	Unidentified pilot whale	4	37.0796	74.6678
05-Apr-17	10:37	*Globicephala sp.*	Unidentified pilot whale	4	37.0689	74.6530
05-Apr-17	10:43	*Globicephala sp.*	Unidentified pilot whale	12	37.0639	74.6332
05-Apr-17	10:50	*Globicephala sp.*	Unidentified pilot whale	11	37.0550	74.6332
05-Apr-17	10:55	*Delphinus delphis*	Common dolphin	30	37.0500	74.6330
05-Apr-17	11:08	*Globicephala sp.*	Unidentified pilot whale	15	37.0290	74.6570

Date	Sighting Time (local)	Scientific Name	Common Name	Group Size	Latitude (°N)	Longitude (°W)
05-Apr-17	11:11	*Delphinus delphis*	Common dolphin	20	37.0283	74.6376
05-Apr-17	11:18	*Globicephala sp.*	Unidentified pilot whale	10	37.0344	74.6240
05-Apr-17	11:28	*Delphinus delphis*	Common dolphin	35	37.0415	74.6014
05-Apr-17	11:56	*Delphinus delphis*	Common dolphin	50	37.0250	74.5964
05-Apr-17	12:19	*Delphinus delphis*	Common dolphin	150	37.0517	74.5711
05-Apr-17	12:30	*Delphinus delphis*	Common dolphin	75	37.0258	74.5597
05-Apr-17	12:44	*Delphinus delphis*	Common dolphin	6	37.0253	74.5350
05-Apr-17	13:15	*Delphinus delphis*	Short-beaked common dolphin	3	37.0528	74.4952
05-Apr-17	13:46	*Tursiops truncatus*	Common bottlenose dolphin	6	37.1056	74.5562
05-Apr-17	14:03	*n/a*	Unidentified dolphin	3	37.1170	74.5614
05-Apr-17	16:15	*Tursiops truncatus*	Common bottlenose dolphin	12	37.1167	74.8567
05-Apr-17	16:45	*Delphinus delphis*	Common dolphin	6	37.0669	75.0606
10-May-17	8:09	*Phocoena phocoena*	Harbor porpoise	2	36.9871	74.9900
10-May-17	8:31	*Tursiops truncatus*	Common bottlenose dolphin	1	36.9958	74.9256
10-May-17	8:50	*Tursiops truncatus*	Common bottlenose dolphin	2	37.0190	74.8121
10-May-17	9:12	*Globicephala sp.*	Unidentified pilot whale	13	37.0396	74.6414
10-May-17	9:14	*Tursiops truncatus*	Common bottlenose dolphin	14	37.0434	74.6314
10-May-17	9:35	*Tursiops truncatus*	Common bottlenose dolphin	15	37.0126	74.5853
10-May-17	9:40	*Globicephala sp.*	Unidentified pilot whale	10	37.0144	74.5602
10-May-17	9:51	*Tursiops truncatus*	Common bottlenose dolphin	8	37.0294	74.5531
10-May-17	9:54	*Delphinus delphis*	Common dolphin	35	37.0221	74.5486
10-May-17	9:59	*Delphinus delphis*	Common dolphin	50	37.0232	74.5428
10-May-17	10:06	*Globicephala sp.*	Unidentified pilot whale	25	37.0290	74.5133
10-May-17	10:11	*Grampus griseus*	Risso's dolphin	8	37.0562	74.5301
10-May-17	10:32	*Delphinus delphis*	Common dolphin	90	37.0689	74.4936
10-May-17	11:02	*Tursiops truncatus*	Common bottlenose dolphin	13	37.0189	74.4041
10-May-17	11:15	*Tursiops truncatus*	Common bottlenose dolphin	105	37.0240	74.3670
10-May-17	11:22	*Globicephala sp.*	Unidentified pilot whale	10	37.0218	74.3477
10-May-17	11:50	*Tursiops truncatus*	Common bottlenose dolphin	40	37.0353	74.2593
10-May-17	12:01	*Tursiops truncatus*	Common bottlenose dolphin	1	36.9998	74.2582
10-May-17	12:15	*n/a*	Unidentified dolphin	12	36.9567	74.2779
10-May-17	12:21	*Tursiops truncatus*	Common bottlenose dolphin	17	36.9229	74.2697
10-May-17	12:29	*Globicephala sp.*	Unidentified pilot whale	10	36.9031	74.3027
10-May-17	12:35	*Tursiops truncatus*	Common bottlenose dolphin	10	36.9011	74.3067
10-May-17	12:59	*Delphinus delphis*	Common dolphin	25	36.9078	74.4102
10-May-17	13:09	*Stenella coeruleoalba*	Striped dolphin	80	36.9093	74.4396
10-May-17	13:14	*Physeter macrocephalus*	Sperm whale	1	36.9050	74.4553
10-May-17	14:36	*n/a*	Unidentified dolphin	40	36.9084	74.5322
10-May-17	14:37	*Globicephala sp.*	Unidentified pilot whale	9	36.8908	74.5580

Date	Sighting Time (local)	Scientific Name	Common Name	Group Size	Latitude (°N)	Longitude (°W)
10-May-17	14:42	*Globicephala sp.*	Unidentified pilot whale	15	36.8946	74.5895
10-May-17	14:48	*Delphinus delphis*	Common dolphin	38	36.8972	74.6032
10-May-17	15:11	*Grampus griseus*	Risso's dolphin	15	36.8872	74.7575
10-May-17	15:24	*Grampus griseus*	Risso's dolphin	7	36.8830	74.8247
10-May-17	15:36	*Tursiops truncatus*	Common bottlenose dolphin	2	36.8789	74.9152
10-May-17	15:38	*n/a*	Unidentified dolphin	12	36.8768	74.9413
10-May-17	15:40	*Tursiops truncatus*	Common bottlenose dolphin	6	36.8771	74.9558
10-May-17	15:55	*Balaenoptera physalus*	Fin whale	2	36.8774	75.0689
10-May-17	16:28	*Balaenoptera physalus*	Fin whale	1	36.8531	75.0508
16-May-17	9:24	*Globicephala sp.*	Unidentified pilot whale	8	36.7967	74.6398
16-May-17	9:37	*Grampus griseus*	Risso's dolphin	35	36.8234	74.6073
16-May-17	11:23	*Delphinus delphis*	Common dolphin	100	36.8769	74.6005
16-May-17	11:51	*Tursiops truncatus*	Common bottlenose dolphin	2	36.8931	74.5097
16-May-17	12:06	*Tursiops truncatus*	Common bottlenose dolphin	11	36.9091	74.4629
16-May-17	12:18	*Tursiops truncatus*	Common bottlenose dolphin	32	36.9183	74.4143
16-May-17	12:37	*Tursiops truncatus*	Common bottlenose dolphin	70	36.9608	74.4082
16-May-17	13:15	*Tursiops truncatus*	Common bottlenose dolphin	50	37.0383	74.4292
16-May-17	13:26	*Globicephala sp.*	Unidentified pilot whale	12	37.0383	74.4535
16-May-17	13:52	*Globicephala sp.*	Unidentified pilot whale	12	37.0239	74.5257
16-May-17	14:00	*Globicephala sp.*	Unidentified pilot whale	20	37.0333	74.5647
16-May-17	14:16	*Globicephala sp.*	Unidentified pilot whale	70	37.0381	74.6287
16-May-17	14:21	*Delphinus delphis*	Common dolphin	15	37.0420	74.6433
16-May-17	14:28	*Globicephala sp.*	Unidentified pilot whale	5	37.0565	74.6621
16-May-17	14:32	*Grampus griseus*	Risso's dolphin	16	37.0734	74.6758
16-May-17	15:09	*Globicephala sp.*	Unidentified pilot whale	43	37.0326	74.5976
16-May-17	16:13	*Tursiops truncatus*	Common bottlenose dolphin	90	36.9633	75.3019
16-Jun-17	8:09	*Balaenoptera acutorostrata*	Minke whale	1	36.8291	74.9131
16-Jun-17	8:12	*Stenella frontalis*	Atlantic spotted dolphin	35	36.8247	74.9128
16-Jun-17	9:13	*Delphinus delphis*	Common dolphin	100	36.8287	74.6845
16-Jun-17	9:31	*Tursiops truncatus*	Common bottlenose dolphin	60	36.8300	74.6334
16-Jun-17	9:45	*Tursiops truncatus*	Common bottlenose dolphin	3	36.8359	74.5880
16-Jun-17	9:56	*Globicephala macrorhynchus*	Short-finned pilot whale	15	36.8373	74.5618
16-Jun-17	10:15	*Globicephala sp.*	Unidentified pilot whale	8	36.8290	74.5339
16-Jun-17	10:27	*Tursiops truncatus*	Common bottlenose dolphin	8	36.8524	74.4959
16-Jun-17	10:32	*Globicephala sp.*	Unidentified pilot whale	6	36.8568	74.4935
16-Jun-17	10:39	*Globicephala sp.*	Unidentified pilot whale	5	36.8774	74.4729
16-Jun-17	10:49	*n/a*	Unidentified dolphin	5	36.8889	74.4937
16-Jun-17	10:53	*Physeter macrocephalus*	Sperm whale	2	36.8891	74.4776
16-Jun-17	11:39	*Physeter macrocephalus*	Sperm whale	2	36.8761	74.4982

Date	Sighting Time (local)	Scientific Name	Common Name	Group Size	Latitude (°N)	Longitude (°W)
16-Jun-17	12:44	*Tursiops truncatus*	Common bottlenose dolphin	8	36.8981	74.4692
16-Jun-17	12:53	*Globicephala sp.*	Unidentified pilot whale	8	36.8980	74.4815
16-Jun-17	13:12	*Tursiops truncatus*	Common bottlenose dolphin	70	36.9625	74.4863
16-Jun-17	13:34	*Globicephala sp.*	Unidentified pilot whale	22	37.0079	74.5324
16-Jun-17	13:50	*Globicephala sp.*	Unidentified pilot whale	25	37.0133	74.5959
16-Jun-17	14:06	*Globicephala macrorhynchus*	Short-finned pilot whale	70	37.0375	74.6033
16-Jun-17	14:25	*Globicephala sp.*	Unidentified pilot whale	45	37.0532	74.6187
16-Jun-17	14:44	*n/a*	Unidentified cetacean	4	37.0703	74.6591
16-Jun-17	15:06	*Delphinus delphis*	Common dolphin	120	37.0923	74.7705
16-Jun-17	15:51	*Tursiops truncatus*	Common bottlenose dolphin	5	37.0260	75.0953
27-Jun-17	7:42	*Tursiops truncatus*	Common bottlenose dolphin	10	36.8304	75.2974
27-Jun-17	7:57	*Tursiops truncatus*	Common bottlenose dolphin	8	36.8337	75.1958
27-Jun-17	8:54	*Balaenoptera physalus*	Fin whale	3	36.8367	74.8306
27-Jun-17	10:14	*Balaenoptera acutorostrata*	Minke whale	1	36.8450	74.8059
27-Jun-17	12:24	*n/a*	Unidentified dolphin	50	36.9122	74.5352
27-Jun-17	12:26	*Physeter macrocephalus*	Sperm whale	1	36.9178	74.5500
27-Jun-17	12:28	*Physeter macrocephalus*	Sperm whale	2	36.9208	74.5529
27-Jun-17	14:44	*Physeter macrocephalus*	Sperm whale	2	36.9360	74.5282
27-Jun-17	14:48	*Mesoplodon sp.*	Unidentified Mesoplodont	1	36.9405	74.5334
27-Jun-17	15:16	*Physeter macrocephalus*	Sperm whale	1	36.9157	74.5016
27-Jun-17	15:40	*Delphinus delphis*	Common dolphin	5	36.9209	74.6570
27-Jun-17	15:54	*Delphinus delphis*	Common dolphin	10	36.9088	74.7657
27-Jun-17	16:07	*n/a*	Unidentified dolphin	6	36.8969	74.8767
16-Jul-17	9:10	*Tursiops truncatus*	Common bottlenose dolphin	20	37.0582	74.6651
16-Jul-17	9:20	*Tursiops truncatus*	Common bottlenose dolphin	5	37.0652	74.6394
16-Jul-17	9:25	*Globicephala macrorhynchus*	Short-finned pilot whale	26	37.0591	74.6268
16-Jul-17	9:38	*Globicephala sp.*	Unidentified pilot whale	40	37.0450	74.6288
16-Jul-17	9:51	*Globicephala sp.*	Unidentified pilot whale	18	37.0466	74.6160
16-Jul-17	10:15	*Globicephala sp.*	Unidentified pilot whale	9	37.0268	74.5914
16-Jul-17	10:24	*Globicephala sp.*	Unidentified pilot whale	12	37.0429	74.5858
16-Jul-17	10:50		Unidentified dolphin	1	37.0467	74.5050
16-Jul-17	11:20	*Tursiops truncatus*	Common bottlenose dolphin	35	37.0711	74.4424
16-Jul-17	12:53	*Tursiops truncatus*	Common bottlenose dolphin	8	37.1750	74.2674
16-Jul-17	12:58	*Physeter macrocephalus*	Sperm whale	2	37.1708	74.2602
16-Jul-17	14:52	*Globicephala sp.*	Unidentified pilot whale	18	37.0949	74.5177
16-Jul-17	14:59	*Globicephala sp.*	Unidentified pilot whale	34	37.0849	74.5672
16-Jul-17	15:10	*Globicephala sp.*	Unidentified pilot whale	20	37.0706	74.6347
16-Jul-17	15:41		Unidentified dolphin	1	37.0306	74.8523
16-Jul-17	15:52		Unidentified cetacean	1	37.0221	74.9398
27-Jul-17	8:31	*Stenella frontalis*	Atlantic spotted dolphin	14	36.6200	74.8535

Date	Sighting Time (local)	Scientific Name	Common Name	Group Size	Latitude (°N)	Longitude (°W)
27-Jul-17	8:52	*Globicephala sp.*	Unidentified pilot whale	70	36.5908	74.7132
27-Jul-17	9:08	*Globicephala sp.*	Unidentified pilot whale	22	36.5866	74.6750
27-Jul-17	9:15	*Globicephala sp.*	Unidentified pilot whale	18	36.5907	74.6469
27-Jul-17	9:35	*Tursiops truncatus*	Common bottlenose dolphin	10	36.6062	74.5673
27-Jul-17	10:10	*Physeter macrocephalus*	Sperm whale	1	36.6315	74.4561
27-Jul-17	11:10		Unidentified dolphin	70	36.6710	74.4483
27-Jul-17	12:00	*Physeter macrocephalus*	Sperm whale	2	36.6695	74.3484
27-Jul-17	13:46	*Tursiops truncatus*	Common bottlenose dolphin	30	36.7278	74.4071
03-Aug-17	7:39		Unidentified dolphin	1	36.9138	75.0992
03-Aug-17	7:49	*Tursiops truncatus*	Common bottlenose dolphin	6	36.9176	75.0230
03-Aug-17	7:57	*Tursiops truncatus*	Common bottlenose dolphin	20	36.9144	74.9885
03-Aug-17	8:14	*Balaenoptera physalus*	Fin whale	2	36.9373	74.8834
03-Aug-17	10:30	*Globicephala sp.*	Unidentified pilot whale	70	37.0145	74.6354
03-Aug-17	10:46	*Globicephala sp.*	Unidentified pilot whale	45	37.0325	74.6049
03-Aug-17	10:56	*Globicephala sp.*	Unidentified pilot whale	8	37.0191	74.5721
03-Aug-17	11:03	*Globicephala sp.*	Unidentified pilot whale	18	37.0359	74.5650
03-Aug-17	11:11	*Globicephala sp.*	Unidentified pilot whale	20	37.0013	74.5375
03-Aug-17	11:24	*Tursiops truncatus*	Common bottlenose dolphin	10	36.9890	74.4882
03-Aug-17	11:33	*Tursiops truncatus*	Common bottlenose dolphin	22	36.9684	74.4570
03-Aug-17	11:53	*Physeter macrocephalus*	Sperm whale	1	36.9399	74.4053
03-Aug-17	12:01	*Physeter macrocephalus*	Sperm whale	4	36.9187	74.3832
03-Aug-17	12:09	*Tursiops truncatus*	Common bottlenose dolphin	16	36.9101	74.3706
03-Aug-17	13:52	*Tursiops truncatus*	Common bottlenose dolphin	6	36.8927	74.3868
03-Aug-17	14:01	*Physeter macrocephalus*	Sperm whale	6	36.9121	74.3671
03-Aug-17	15:07	*Tursiops truncatus*	Common bottlenose dolphin	4	36.8901	74.4097
03-Aug-17	15:27	*Globicephala sp.*	Unidentified pilot whale	17	36.8876	74.5722
03-Aug-17	15:57	*Tursiops truncatus*	Common bottlenose dolphin	6	36.9087	74.3917
03-Aug-17	16:00	*Balaenoptera physalus*	Fin whale	1	36.8460	74.8490
17-Aug-17	8:51	*Balaenoptera physalus*	Fin whale	12	36.9476	74.8181
17-Aug-17	10:20	*Balaenoptera acutorostrata*	Minke whale	2	36.9114	74.8029
17-Aug-17	13:34	*Globicephala sp.*	Unidentified pilot whale	15	36.9624	74.5909
17-Aug-17	13:36	*Globicephala sp.*	Unidentified pilot whale	12	36.9510	74.5744
17-Aug-17	13:49	*Globicephala sp.*	Unidentified pilot whale	15	36.9237	74.5342
17-Aug-17	13:57	*Globicephala sp.*	Unidentified pilot whale	12	36.9189	74.5216
17-Aug-17	14:06	*Globicephala sp.*	Unidentified pilot whale	10	36.9318	74.4989
17-Aug-17	14:11	*Tursiops truncatus*	Common bottlenose dolphin	150	36.9054	74.4987
17-Aug-17	14:26	*Globicephala sp.*	Unidentified pilot whale	7	36.8723	74.5169
17-Aug-17	14:45	*Globicephala sp.*	Unidentified pilot whale	31	36.8815	74.5739
17-Aug-17	15:43	*Tursiops truncatus*	Bottlenose dolphin	40	36.8682	74.8880
17-Aug-17	15:56	*Globicephala sp.*	Unidentified pilot whale	6	36.9306	74.5179

Date	Sighting Time (local)	Scientific Name	Common Name	Group Size	Latitude (°N)	Longitude (°W)
03-Nov-17	8:13		Unidentified medium whale	1	36.9979	75.1096
03-Nov-17	10:01	*Delphinus delphis*	Common dolphin	30	37.0523	74.6116
03-Nov-17	11:08	*Delphinus delphis*	Common dolphin	50	37.0624	74.5583
03-Nov-17	11:41	*Tursiops truncatus*	Bottlenose dolphin	15	37.0440	74.5167
03-Nov-17	11:46	*Globicephala sp.*	Unidentified pilot whale	15	37.0322	74.5242
03-Nov-17	11:54	*Globicephala macrorhynchus*	Short-finned pilot whale	30	37.0110	74.5407
03-Nov-17	12:21	*Delphinus delphis*	Common dolphin	700	37.0545	74.6077
03-Nov-17	12:25	*Globicephala sp.*	Unidentified pilot whale	5	37.0106	74.4592
03-Nov-17	12:48	*Globicephala sp.*	Unidentified pilot whale	8	36.9574	74.4157
03-Nov-17	13:09	*Globicephala sp.*	Unidentified pilot whale	8	36.9190	74.3573
03-Nov-17	17:37	*Megaptera novaeangliae*	Humpback whale	1	36.8305	75.8546

Table 3. Summary of sea turtle sightings during 14 offshore vessel surveys in 2017.

Date	Sighting Time (local)	Scientific Name	Common Name	Group Size	Latitude (°N)	Longitude (°W)
10-May-17	8:15	*Caretta caretta*	Loggerhead sea turtle	1	36.9866	74.9952
10-May-17	8:26	*Caretta caretta*	Loggerhead sea turtle	2	36.9903	74.9654
10-May-17	8:36	*Caretta caretta*	Loggerhead sea turtle	1	36.9999	74.9109
10-May-17	8:59	*Caretta caretta*	Loggerhead sea turtle	1	37.0282	74.7494
10-May-17	15:34	*Caretta caretta*	Loggerhead sea turtle	1	36.8804	74.9023
10-May-17	15:43	*Caretta caretta*	Loggerhead sea turtle	2	36.8760	74.9700
10-May-17	15:47	*Caretta caretta*	Loggerhead sea turtle	5	36.8756	75.0018
10-May-17	16:05	*Caretta caretta*	Loggerhead sea turtle	1	36.8700	75.0810
16-May-17	8:26	*Caretta caretta*	Loggerhead sea turtle	1	36.8094	75.0242
16-May-17	14:55	*Caretta caretta*	Loggerhead sea turtle	1	37.0740	74.7348
16-May-17	15:19	*Caretta caretta*	Loggerhead sea turtle	1	37.0433	74.8896
16-May-17	15:21	*Caretta caretta*	Loggerhead sea turtle	1	37.0327	74.9239
16-May-17	15:45	*Caretta caretta*	Loggerhead sea turtle	1	36.9975	75.1011
16-May-17	15:49	*Caretta caretta*	Loggerhead sea turtle	3	36.9930	75.1230
16-May-17	15:53	*Caretta caretta*	Loggerhead sea turtle	4	36.9863	75.1585
16-May-17	16:05	*Caretta caretta*	Loggerhead sea turtle	2	36.9734	75.2445
16-Jun-17	7:36	*Caretta caretta*	Loggerhead sea turtle	1	36.8290	75.1716
16-Jun-17	7:51	*Caretta caretta*	Loggerhead sea turtle	1	36.8294	75.0543
16-Jun-17	8:23	*Caretta caretta*	Loggerhead sea turtle	1	36.8202	74.9152
16-Jun-17	8:31	*Caretta caretta*	Loggerhead sea turtle	1	36.8273	74.9133
16-Jun-17	15:24	*Caretta caretta*	Loggerhead sea turtle	1	37.0632	74.8949
16-Jun-17	15:39	*Caretta caretta*	Loggerhead sea turtle	5	37.0465	75.0047
16-Jun-17	15:41	*Caretta caretta*	Loggerhead sea turtle	2	37.0429	75.0209
16-Jun-17	15:45	*Caretta caretta*	Loggerhead sea turtle	1	37.0374	75.0494
16-Jun-17	15:49	*Caretta caretta*	Loggerhead sea turtle	1	37.0302	75.0838
16-Jun-17	15:55	*Caretta caretta*	Loggerhead sea turtle	1	37.0207	75.1215
16-Jun-17	16:01	*Caretta caretta*	Loggerhead sea turtle	5	37.0107	75.1639
16-Jun-17	16:09	*Caretta caretta*	Loggerhead sea turtle	4	36.9955	75.2273
16-Jun-17	16:21	*Caretta caretta*	Loggerhead sea turtle	1	36.9756	75.3102
27-Jun-17	11:23	*Caretta caretta*	Loggerhead sea turtle	1	36.8695	74.8647
27-Jun-17	15:48	*Caretta caretta*	Loggerhead sea turtle	2	36.9158	74.7173
27-Jun-17	16:23	*Caretta caretta*	Loggerhead sea turtle	1	36.8960	74.9757
27-Jun-17	16:27	*Caretta caretta*	Loggerhead sea turtle	1	36.8953	75.0337
16-Jul-17	15:54	*Caretta caretta*	Loggerhead sea turtle	1	37.0164	74.9473
16-Jul-17	16:05	*Caretta caretta*	Loggerhead sea turtle	1	37.0022	75.0262
03-Aug-17	7:56	*Caretta caretta*	Loggerhead sea turtle	2	36.9138	74.9972
03-Aug-17	8:01	*Caretta caretta*	Loggerhead sea turtle	1	36.9258	74.9830
03-Aug-17	8:11	*Caretta caretta*	Loggerhead sea turtle	3	36.9338	74.9079
03-Aug-17	8:20	*Caretta caretta*	Loggerhead sea turtle	3	36.9480	74.8868
03-Aug-17	8:36	*Caretta caretta*	Loggerhead sea turtle	3	36.9624	74.8990
03-Aug-17	10:05	*Caretta caretta*	Loggerhead sea turtle	1	36.9858	74.7791
03-Aug-17	16:09	*Caretta caretta*	Loggerhead sea turtle	1	36.8445	74.8626
17-Aug-17	7:36	*Caretta caretta*	Loggerhead sea turtle	1	36.8931	75.4048
17-Aug-17	8:08	*Caretta caretta*	Loggerhead sea turtle	1	36.9170	75.1558
17-Aug-17	8:22	*Caretta caretta*	Loggerhead sea turtle	2	36.9241	75.0428
17-Aug-17	8:30	*Caretta caretta*	Loggerhead sea turtle	2	36.9305	74.9843
17-Aug-17	8:39	*Caretta caretta*	Loggerhead sea turtle	3	36.9362	74.9177
17-Aug-17	8:45	*Caretta caretta*	Loggerhead sea turtle	1	36.9397	74.8679
03-Nov-17	8:03	*Caretta caretta*	Loggerhead sea turtle	1	36.9944	75.1877

3.1 Photo-ID

Due to priorities and limited windows of opportunity, photo-ID images were only collected from 142 of the 253 marine mammal sightings. Images collected during pilot whale encounters through 2016 have been shared with Duke University for comparisons with their existing catalog of pilot whales from Cape Hatteras. Matching has been completed and includes 24 matches of the 131 identified Virginia individuals to Cape Hatteras cataloged individuals. Three matches were made within the Virginia catalog, all photographed together both in August of 2015 and July of 2016. Photos of other species of odontocetes have been archived for future processing.

All photos of baleen and sperm whales were added to HDR's existing catalogs (**Table 4**). With the addition of these photos, the HDR fin whale catalog now contains 34 unique individuals, the minke whale catalog contains 8 individuals, and the sei whale catalog contains 2 individuals. The first humpback whale observed during the offshore vessel survey on 06 March was unable to be identified, the second, seen on 03 Nov 17 matched to an individual in the HDR humpback whale catalog, HDRVAMn115, seen the day prior on a nearshore humpback survey, a known individual seen by Rudee Flipper in 2012 (Kristin Rayfield, pers comm). The HDR sperm whale catalog contains 31 individuals. Duke University provided photos of sperm whales photographed in the Cape Hatteras study area (Foley et al. 2017). Fourteen sperm whales were identified, although there have been no matches between the two catalogs.

Table 4. Summary of photo-identified baleen and sperm whale individuals sighted in 2017.

HDR ID #	Species	Sighting Date	Biopsy?	Satellite Tag?
HDRVABa002	*Balaenoptera acutorostrata*	17-Jan-17	No	No
HDRVABa003	*Balaenoptera acutorostrata*	21-Jan-17	No	No
HDRVABa004	*Balaenoptera acutorostrata*	14-Feb-17	No	No
HDRVAPm002	*Physeter macrocephalus*	27-Feb-17	Yes	SPLASH 163792
HDRVAPm003	*Physeter macrocephalus*	27-Feb-17, 26-Mar-17	No	SPLASH 163793
HDRVAPm004	*Physeter macrocephalus*	27-Feb-17	No	No
HDRVAPm005	*Physeter macrocephalus*	27-Feb-17	No	No
HDRVABp014	*Balaenoptera physalus*	27-Feb-17	No	No
HDRVABp015	*Balaenoptera physalus*	27-Feb-17	No	No
HDRVABp016	*Balaenoptera physalus*	27-Feb-17	No	No
HDRVABp017	*Balaenoptera physalus*	06-Mar-17	No	SPLASH 168231
HDRVAPm006	*Physeter macrocephalus*	26-Mar-17	No	SPLASH 168232
HDRVAPm007	*Physeter macrocephalus*	26-Mar-17	No	SPOT6 166684
HDRVAPm008	*Physeter macrocephalus*	10-May-17	No	No
HDRVABp018	*Balaenoptera physalus*	10-May-17	No	SPOT6 168226
HDRVABp019	*Balaenoptera physalus*	10-May-17	Yes	SPOT6 168227
HDRVABp020	*Balaenoptera physalus*	10-May-17	No	No
HDRVAPm009	*Physeter macrocephalus*	16-Jun-17	No	No
HDRVAPm010	*Physeter macrocephalus*	16-Jun-17	Yes	SPLASH 168234
HDRVAPm011	*Physeter macrocephalus*	16-Jun-17	No	No
HDRVAPm012	*Physeter macrocephalus*	16-Jun-17	No	No

HDR ID #	Species	Sighting Date	Biopsy?	Satellite Tag?
HDRVABa005	*Balaenoptera acutorostrata*	16-Jun-17	No	No
HDRVAPm013	*Physeter macrocephalus*	27-Jun-17	No	No
HDRVAPm014	*Physeter macrocephalus*	27-Jun-17	No	No
HDRVAPm015	*Physeter macrocephalus*	27-Jun-17	No	No
HDRVAPm016	*Physeter macrocephalus*	27-Jun-17	No	No
HDRVAPm017	*Physeter macrocephalus*	27-Jun-17	No	No
HDRVAPm018	*Physeter macrocephalus*	27-Jun-17	Yes	SPLASH 171879
HDRVABp021	*Balaenoptera physalus*	27-Jun-17	No	No
HDRVABp022	*Balaenoptera physalus*	27-Jun-17	No	No
HDRVABa006	*Balaenoptera acutorostrata*	27-Jun-17	No	No
HDRVAPm019	*Physeter macrocephalus*	16-Jul-17	No	No
HDRVAPm020	*Physeter macrocephalus*	27-Jul-17	No	No
HDRVAPm021	*Physeter macrocephalus*	27-Jul-17	No	No
HDRVAPm022	*Physeter macrocephalus*	03-Aug-17	No	SPLASH 171880
HDRVAPm023	*Physeter macrocephalus*	03-Aug-17	Yes	SPOT6 168228
HDRVAPm024	*Physeter macrocephalus*	03-Aug-17	No	No
HDRVAPm025	*Physeter macrocephalus*	03-Aug-17	Yes	SPLASH 171881
HDRVAPm026	*Physeter macrocephalus*	03-Aug-17	No	No
HDRVAPm027	*Physeter macrocephalus*	03-Aug-17	No	No
HDRVAPm028	*Physeter macrocephalus*	03-Aug-17	No	No
HDRVAPm029	*Physeter macrocephalus*	03-Aug-17	No	No
HDRVAPm030	*Physeter macrocephalus*	03-Aug-17	No	No
HDRVAPm031	*Physeter macrocephalus*	03-Aug-17	No	No
HDRVABp023	*Balaenoptera physalus*	03-Aug-17, 17-Aug-17	No	No
HDRVABp024	*Balaenoptera physalus*	03-Aug-17	No	No
HDRVABp025	*Balaenoptera physalus*	17-Aug-17	No	SPLASH 163791
HDRVABp026	*Balaenoptera physalus*	17-Aug-17	Yes	SPOT6 168229
HDRVABp027	*Balaenoptera physalus*	17-Aug-17	Yes	SPOT6 168235
HDRVABp028	*Balaenoptera physalus*	17-Aug-17	No	No
HDRVABp029	*Balaenoptera physalus*	17-Aug-17	No	No
HDRVABp030	*Balaenoptera physalus*	17-Aug-17	No	No
HDRVABp031	*Balaenoptera physalus*	17-Aug-17	No	No
HDRVABp032	*Balaenoptera physalus*	17-Aug-17	No	No
HDRVABp033	*Balaenoptera physalus*	17-Aug-17	No	No
HDRVABp034	*Balaenoptera physalus*	17-Aug-17	No	No
HDRVABa007	*Balaenoptera acutorostrata*	17-Aug-17	No	No
HDRVABa008	*Balaenoptera acutorostrata*	17-Aug-17	No	No
HDRVAMn115	*Megaptera novaeangliae*	03-Nov-17	No	No

3.2 Biopsy Sample Collection

Three biopsies were collected from fin whales, and five from sperm whales in 2017 (**Table 4**). Processing of samples is pending.

3.3 Satellite Tagging

A total of fifteen satellite tags were successfully deployed in 2017, nine on sperm whales and six on fin whales (**Tables 5 through 8**). Six of the nine sperm whale tags and two of the six fin whale tags were SPLASH tags, which collected dive depths and durations (**Tables 9 and 10**). Dives were logged that fit criteria of time beneath the surface and depth specific to the species.

Sperm whale tag duration ranged from 3.6 to 30.8 days (mean 18.0), not including one tag that malfunctioned and never transmitted. Movements of tagged individuals were varied, with some showing little movement from the tag deployment location, others moving greater distances to the north or south (or both), generally along the continental shelf slope but some individuals moving into deeper water off North Carolina (**Figures 7 through 14**). Tagged sperm whales traveled up to 582 km from initial tag deployment location and had between 83 and 100% of locations within the VACAPES range (**Table 7**). Sperm whale maximum dive depth ranged from 1063.5 to 1735.5 m and maximum dive duration ranged from 53 to 66 minutes (**Table 9**).

Fin whale tag duration ranged from 6.8 to 39.0 days (mean 21.3). Movements also varied greatly, with one individual (HDRVABp017) tagged east of the continental shelf break but traveling approximately 900 km to the southeast then back close to the tagging location and farther to the north over the continental shelf. Other individuals spent more time on the continental shelf, many moving to the north of tag locations (**Figures 15 through 20**). Distance traveled by fin whales from initial tag location ranged from 25 to 905 km, and the number of locations within the VACAPES range was between 10 and 71% (**Table 8**). Fin whale maximum dive depth ranged from 90.5 to 92.5 m and maximum dive duration ranged from 13 to 20 minutes (**Table 10**).

Table 5. Summary of tag deployment details for all sperm whale tags deployed in 2017.

Animal ID	Tag Type	Argos ID	Deployment (GMT)	Deployment Latitude (°N)	Deployment Longitude (°W)	Depth at Tagging Location (m)	Last Transmission (GMT)	Tag Duration (days)
HDRVAPm002	SPLASH 10	163792	2017-Feb-27 02:53	37.0541	74.6297	472	2017-Mar-20 14:52	21.0
HDRVAPm003	SPLASH 10	163793	2017-Feb-27 17:26	37.0200	74.5924	731	*never transmitted	0.0
HDRVAPm006	SPLASH 10	168232	2017-Mar-26 13:00	37.0606	74.6392	548	2017-Apr-26 13:54	30. 8
HDRVAPm007	SPOT 6	166684	2017-Mar-26 19:00	36.9494	74.5962	670	2017-Apr-25 10:46	29.6
HDRVAPm010	SPLASH 10	168234	2017-Jun-16 20:28	36.8790	74.5060	1524	2017-Jun-29 21:22	13.0
HDRVAPm018	SPLASH 10	171879	2017-Jun-27 19:16	36.9160	74.5026	1249	2017-Jul-01 11:04	3.6
HDRVAPm022	SPLASH 10	171880	2017-Aug-03 16:33	36.9040	74.3709	2133	2017-Aug-19 08:27	15.5
HDRVAPm023	SPOT 6	168228	2017-Aug-03 16:42	36.8997	74.3665	2133	2017-Aug-28 14:28	24.9
HDRVAPm025	SPLASH 10	171881	2017-Aug-03 18:58	36.8924	74.3545	1828	2017-Aug-09 11:44	5.7

Table 6. Summary of tag deployment details for all fin whale tags deployed in 2017.

Animal ID	Tag Type	Argos ID	Deployment (GMT)	Deployment Latitude (°N)	Deployment Longitude (°W)	Depth at Tagging Location (m)	Last Transmission (GMT)	Tag Duration (days)
HDRVABp017	SPLASH 10	168231	2017-Mar-06 16:34	37.0432	74.5860	716	2017-Apr-02 12:33	26.8
HDRVABp018	SPOT 6	168226	2017-May-10 21:30	36.8602	75.0530	41	2017-May-29 09:18	18.5
HDRVABp019	SPOT 6	168227	2017-May-10 21:57	36.8648	75.0274	41	2017-Jun-19 01:11	39.0
HDRVABp025	SPLASH 10	163791	2017-Aug-17 13:13	36.9416	74.7804	56	2017-Aug-24 09:09	6.8
HDRVABp026	SPOT 6	168229	2017-Aug-17 13:35	36.9178	74.7984	56	2017-Sep-16 16:30	30.1
HDRVABp027	SPOT 6	168235	2017-Aug-17 14:08	36.9213	74.8037	56	2017-Aug-24 09:16	6.8

Table 7. Summary of results from satellite tag data for all sperm whale tags deployed in 2017.

Animal ID	Argos ID	No. of Locations Post Filtering	% Within VACAPES OPAREA	Max Distance from Initial Location (km)	Mean Distance from Initial Location (km)
HDRVAPm002	163792	127	99.2	26.1	4.6
HDRVAPm006	168232	274	93.4	357.0	91.8
HDRVAPm007	166684	283	83.4	582.4	120.2
HDRVAPm010	168234	126	87.3	276.1	69.7
HDRVAPm018	171879	18	100	106.3	52.3
HDRVAPm022	171880	137	100	115.6	71.5
HDRVAPm023	168228	184	100	128.0	74.3
HDRVAPm025	171881	79	100	582.5	27.5

Table 8. Summary of results from satellite tag data for all fin whale tags deployed in 2017.

Animal ID	Argos ID	No. of Locations Post Filtering	% Within VACAPES OPAREA	Max Distance from Initial Location (km)	Mean Distance from Initial Location (km)
HDRVABp017	168231	217	53.9	905.3	288.9
HDRVABp018	168226	356	71.3	362.4	156.1
HDRVABp019	168227	503	10.1	374.8	268.2
HDRVABp025	163791	59	15.3	25.5	9.7
HDRVABp026	168229	341	43.4	194.6	36.0
HDRVABp027	168235	38	39.5	48.0	14.5

Table 9. Summary of dive data for all sperm whale SPLASH tags deployed in 2017.

Animal ID	Argos ID	No. Dives Logged	Max Dive Depth (m)	Max Dive Duration (mm:ss)
HDRVAPm002	163792	368	1063.5	60:51
HDRVAPm006	168232	568	1095.5	60:03
HDRVAPm010	168234	321	1735.5	66:23
HDRVAPm018	171879	36	1063.5	53:23
HDRVAPm022	171880	441	1351.5	57:09
HDRVAPm025	171881	208	1095.5	55:55

Table 10. Summary of dive data for all fin whale SPLASH tags deployed in 2017.

Animal ID	Argos ID	No. Dives Logged	Max Dive Depth (m)	Max Dive Duration (mm:ss)
HDRVABp017	168231	198	92.5	20:19
HDRVABp025	163791	125	90.5	13:45

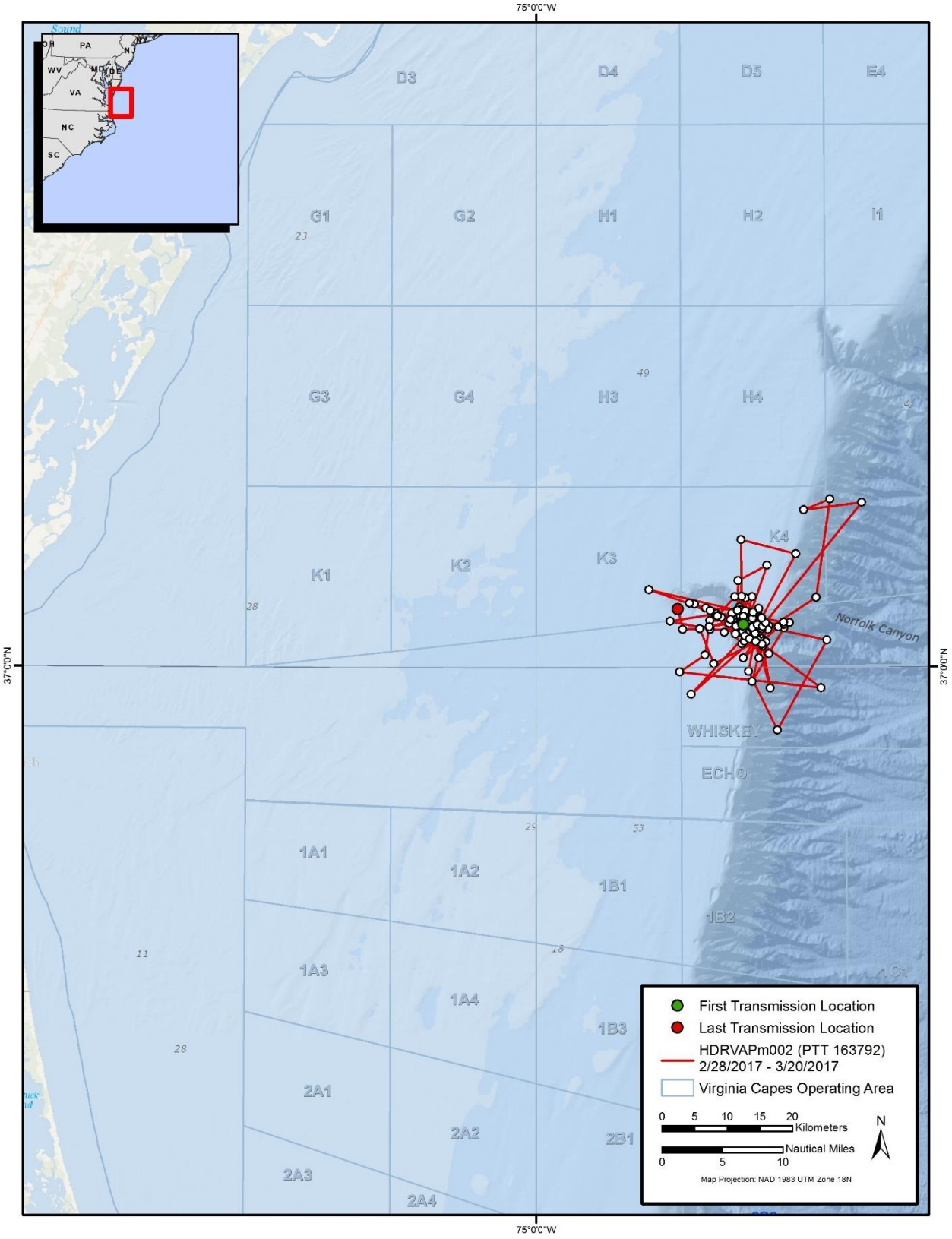

Figure 7. Filtered locations (white dots) and track of sperm whale HDRVAPm002 over 21.0 days of tag-attachment duration.

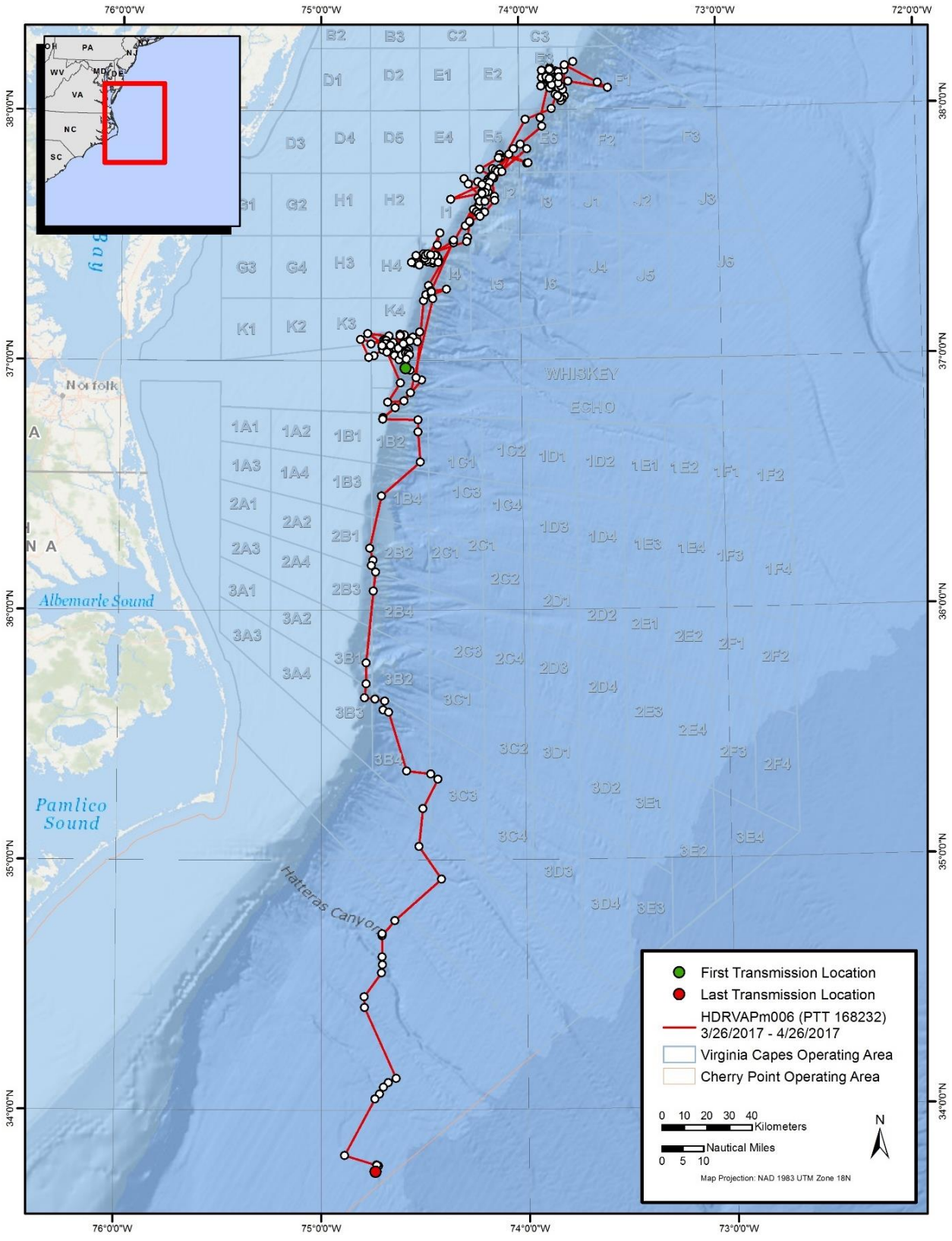

Figure 8. Filtered locations (white dots) and track of sperm whale HDRVAPm006 over 30.8 days of tag-attachment duration.

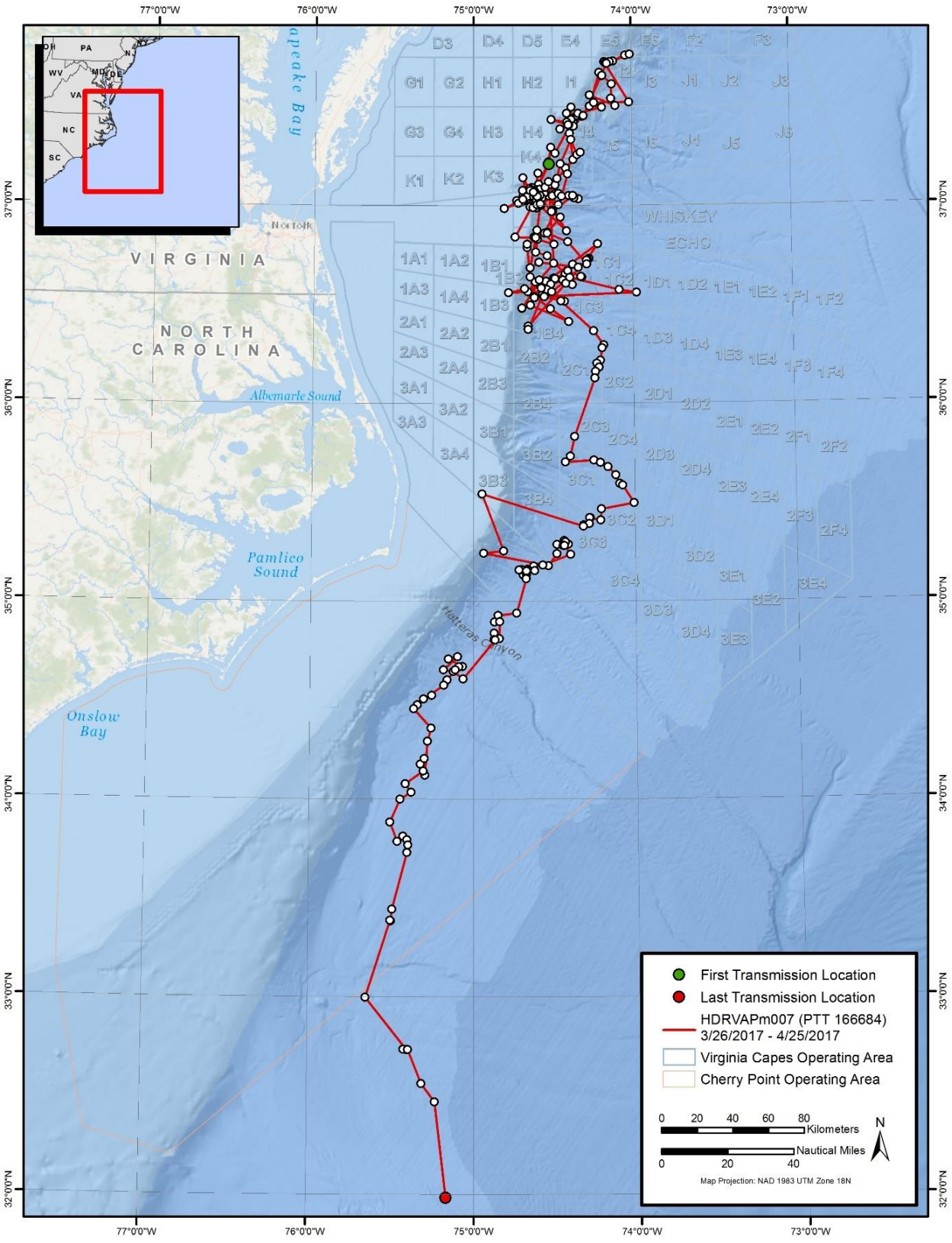

Figure 9. Filtered locations (white dots) and track of sperm whale HDRVAPm007 over 29.6 days of tag-attachment duration.

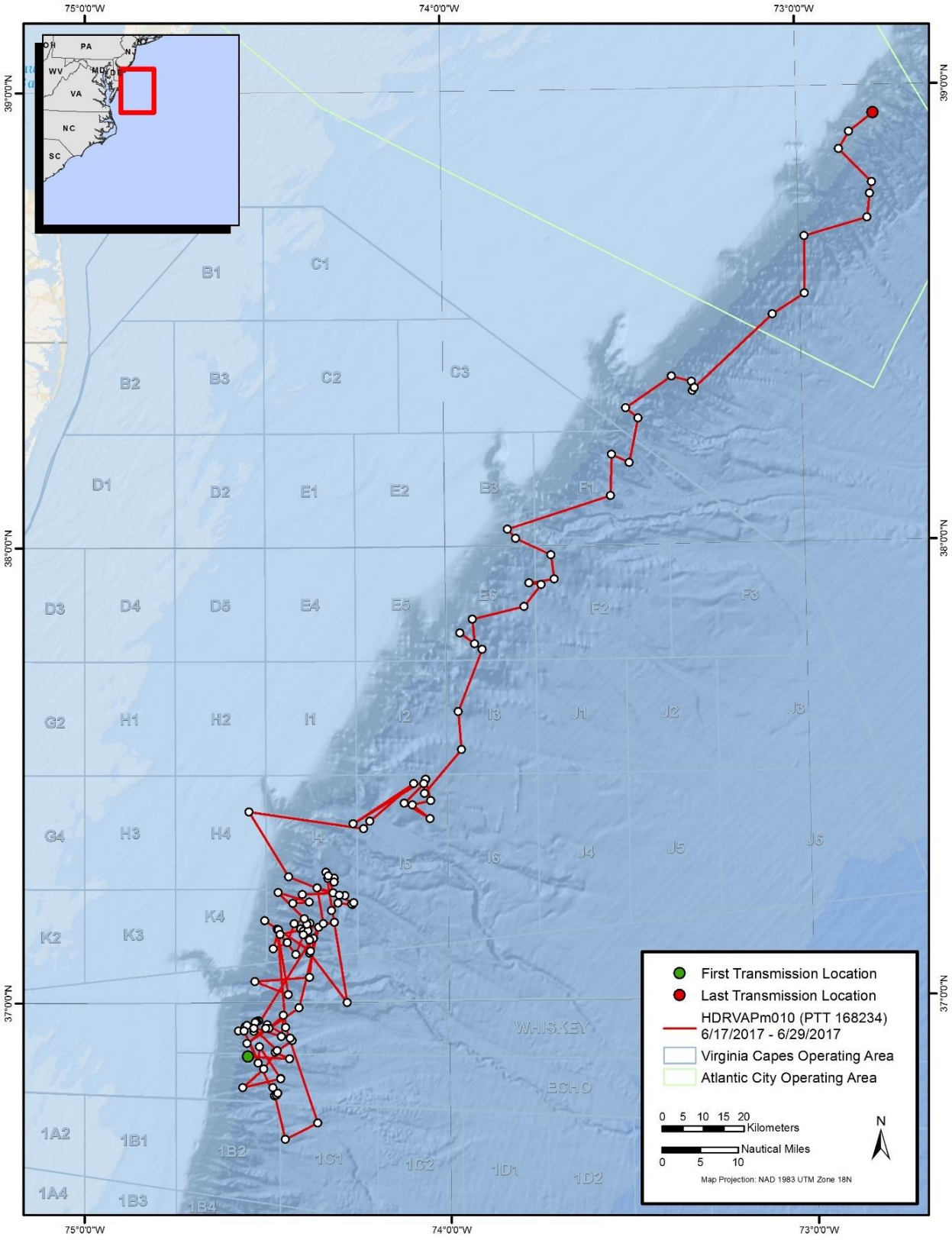

Figure 10. Filtered locations (white dots) and track of sperm whale HDRVAPm010 over 13.4 days of tag-attachment duration.

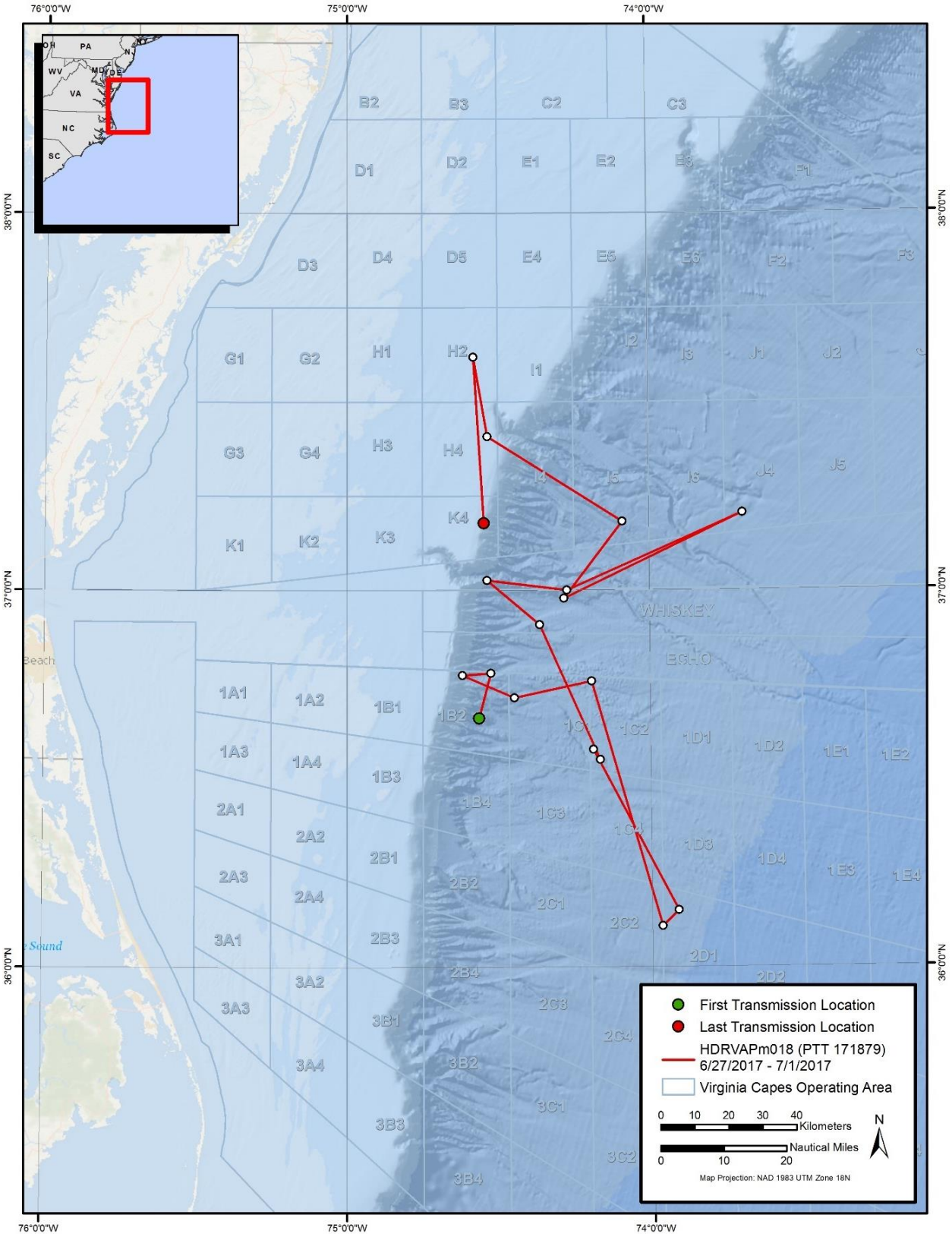

Figure 11. Filtered locations (white dots) and track of sperm whale HDRVAPm018 over 3.6 days of tag-attachment duration.

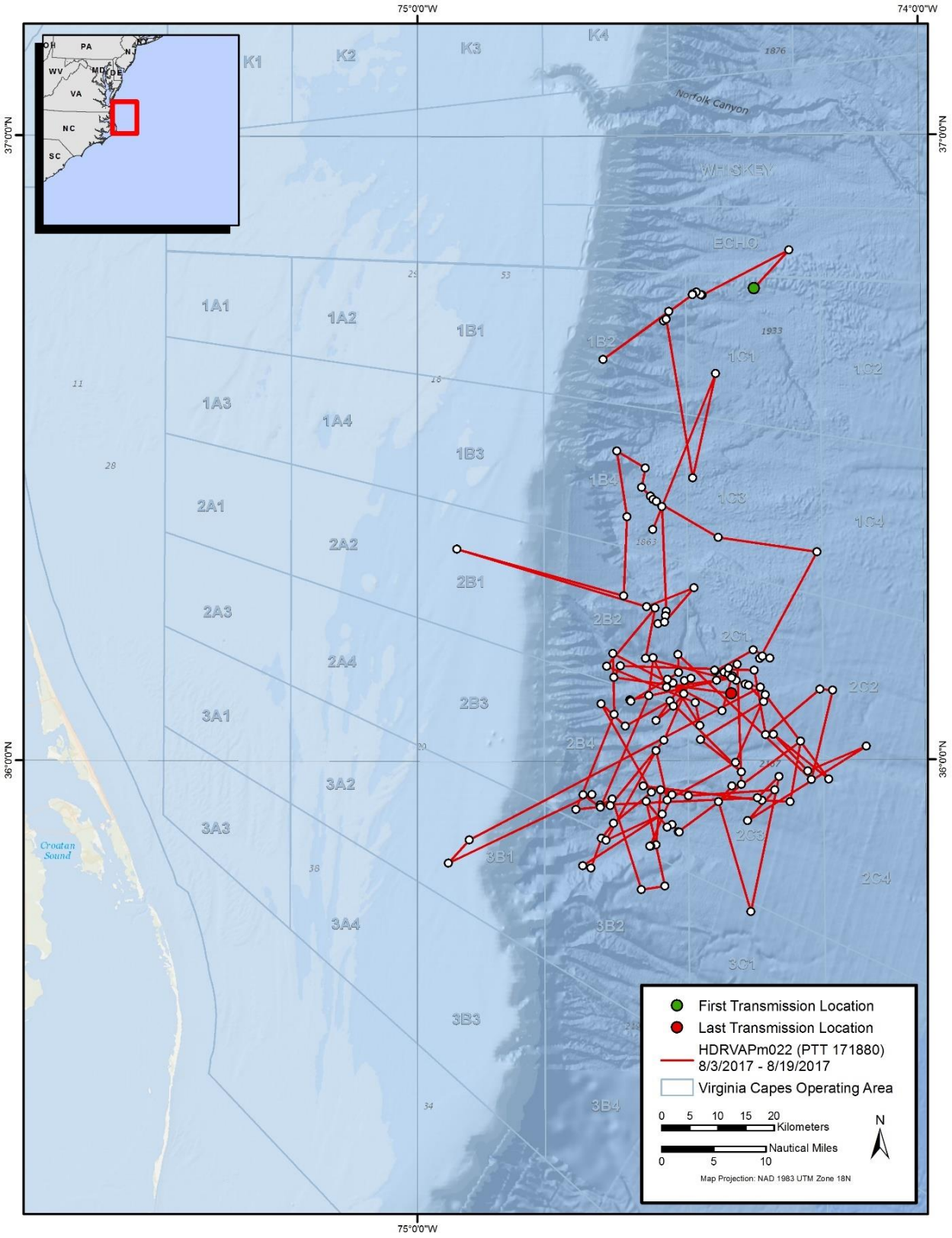

Figure 12. Filtered locations (white dots) and track of sperm whale HDRVAPm022 over 15.5 days of tag-attachment duration.

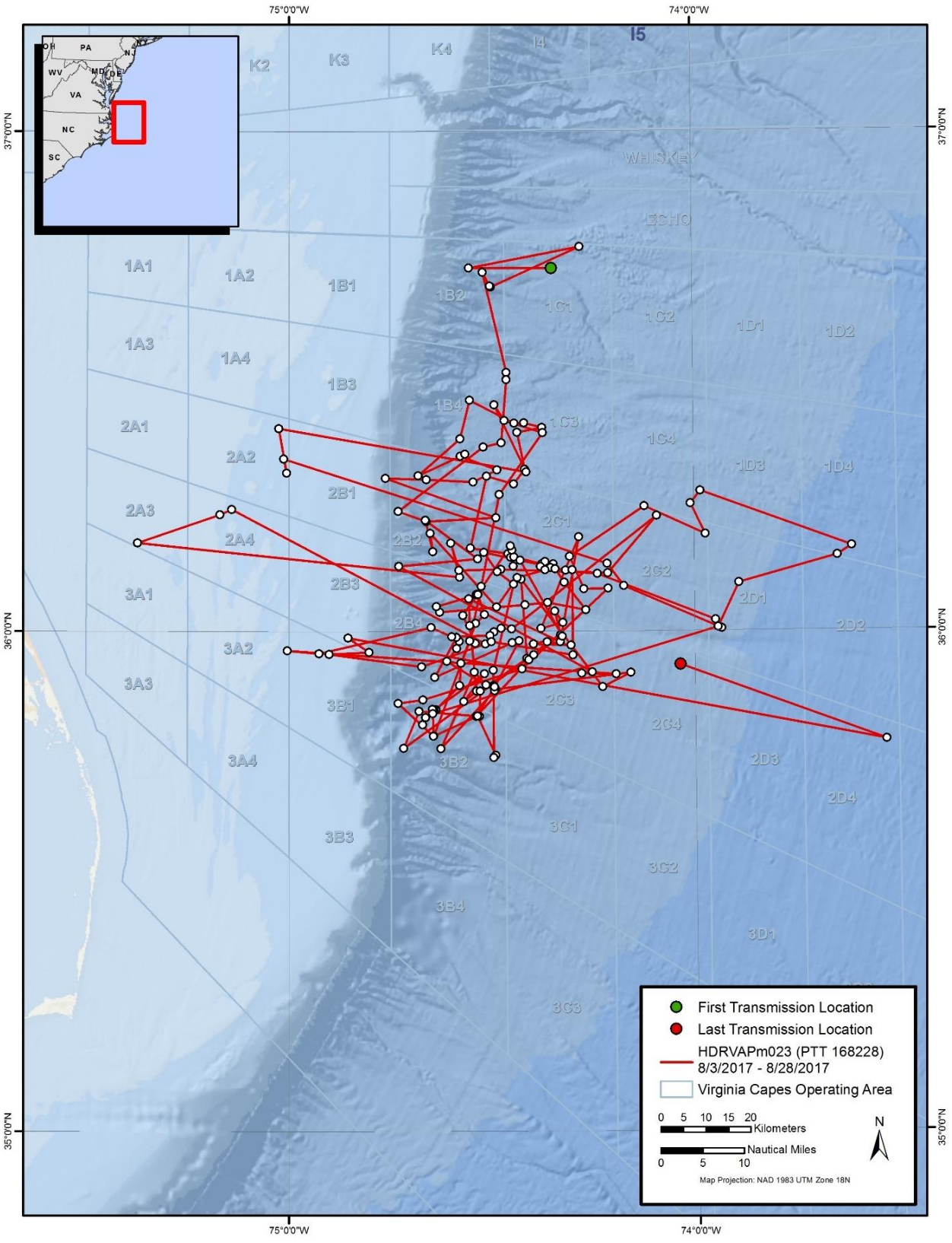

Figure 13. Filtered locations (white dots) and track of sperm whale HDRVAPm023 over 24.9 days of tag-attachment duration.

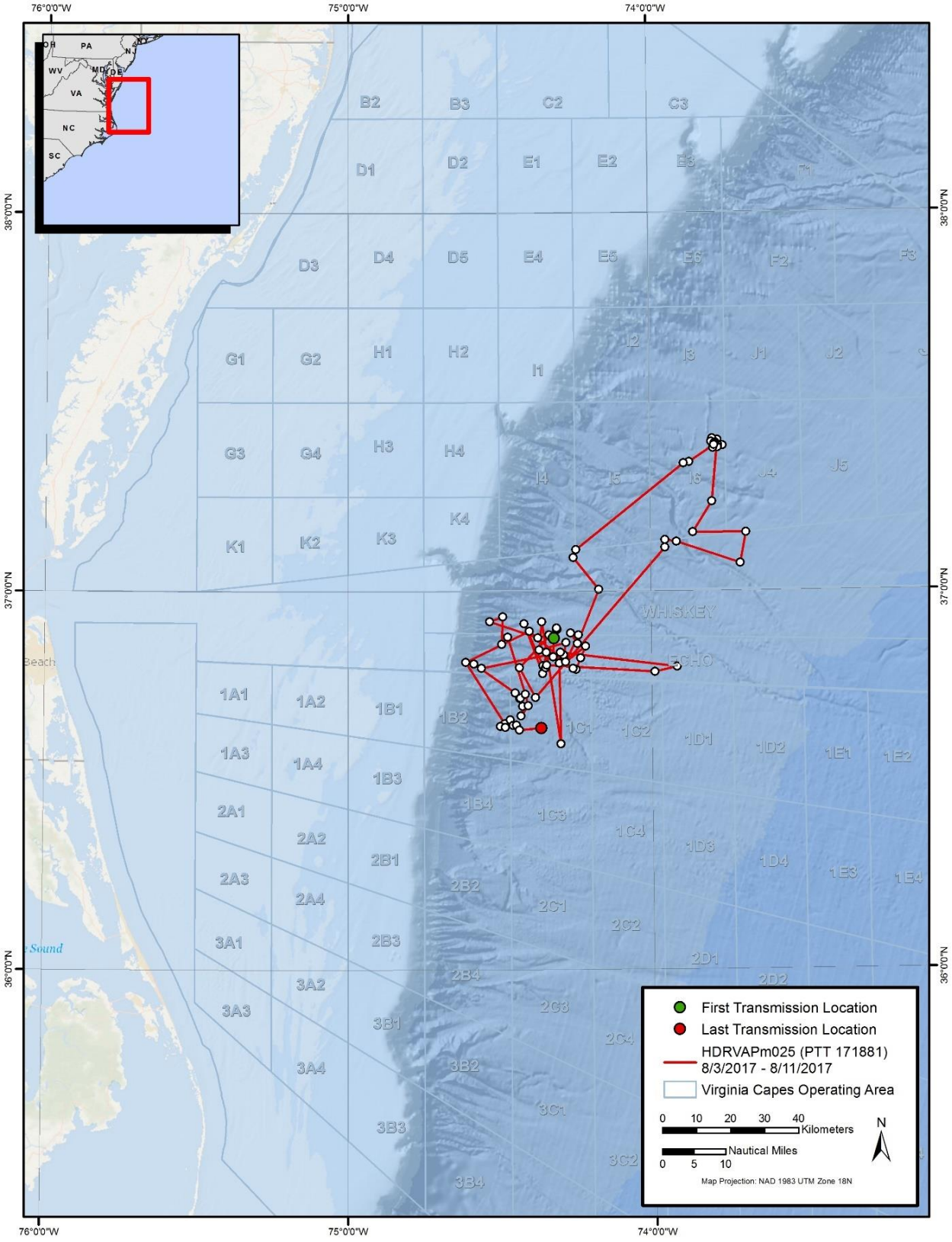

Figure 14. Filtered locations (white dots) and track of sperm whale HDRVAPm025 over 5.7 days of tag-attachment duration.

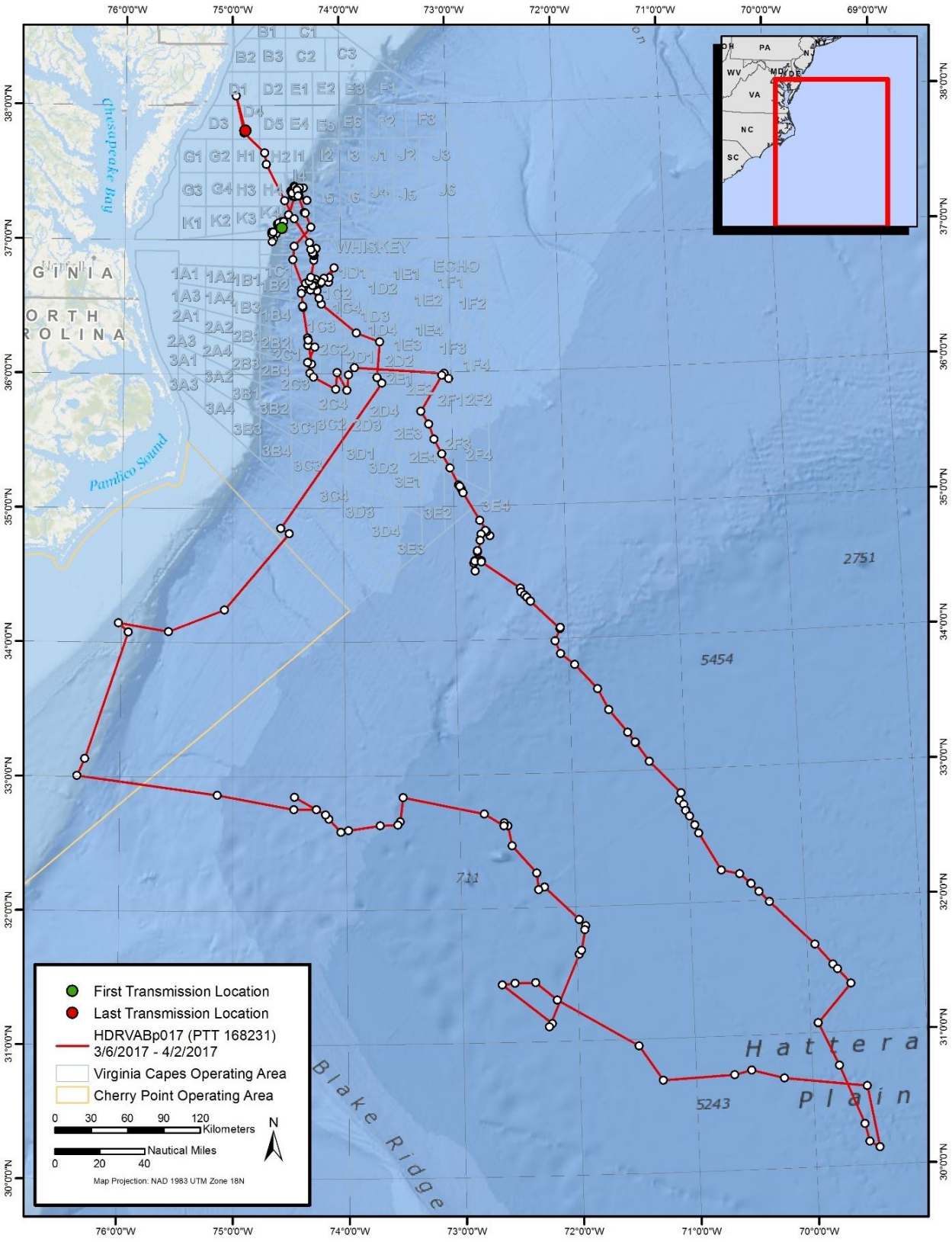

Figure 15. Filtered locations (white dots) and track of fin whale HDRVABp017 over 26.8 days of tag-attachment duration.

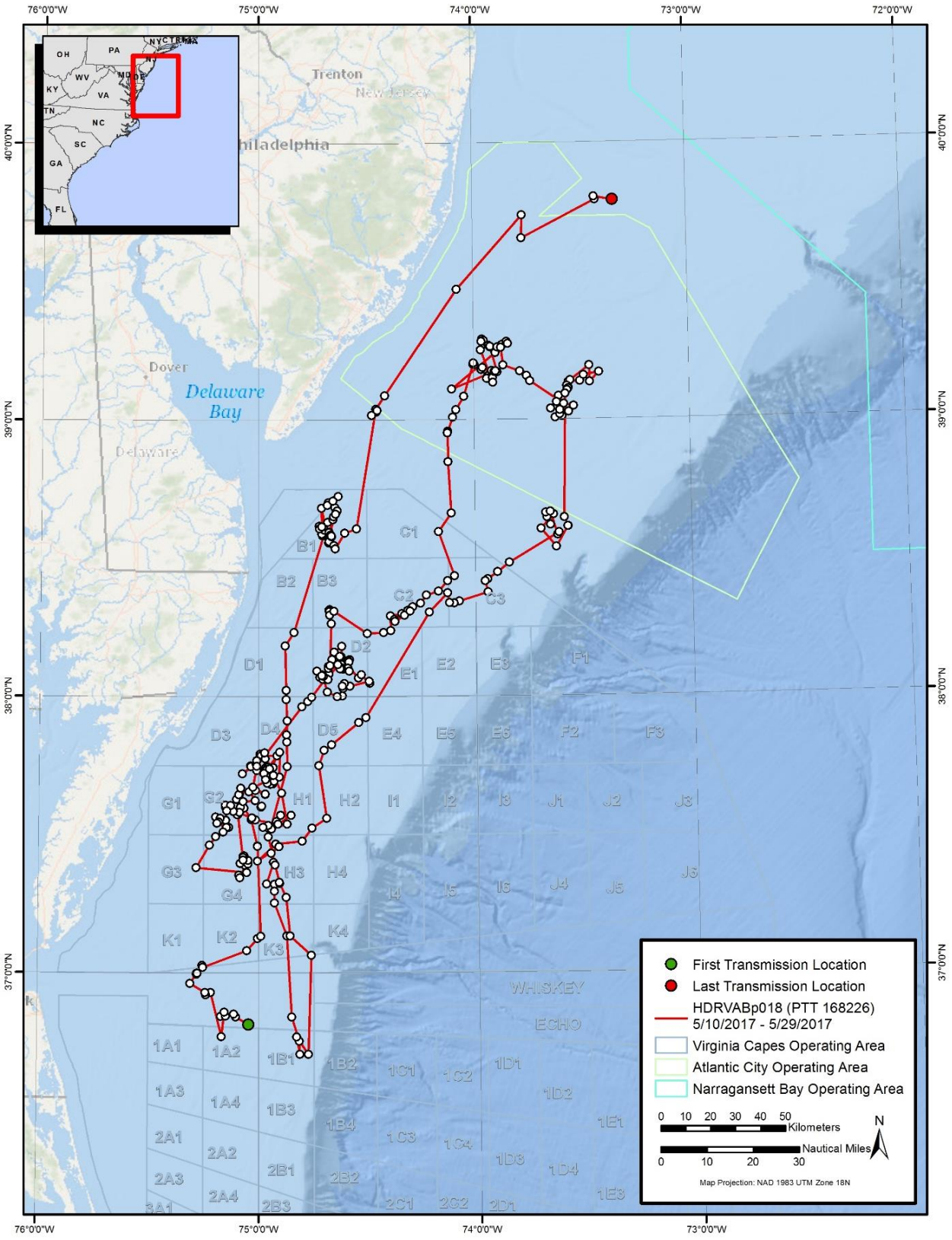

Figure 16. Filtered locations (white dots) and track of fin whale HDRVABp018 over 18.5 days of tag-attachment duration.

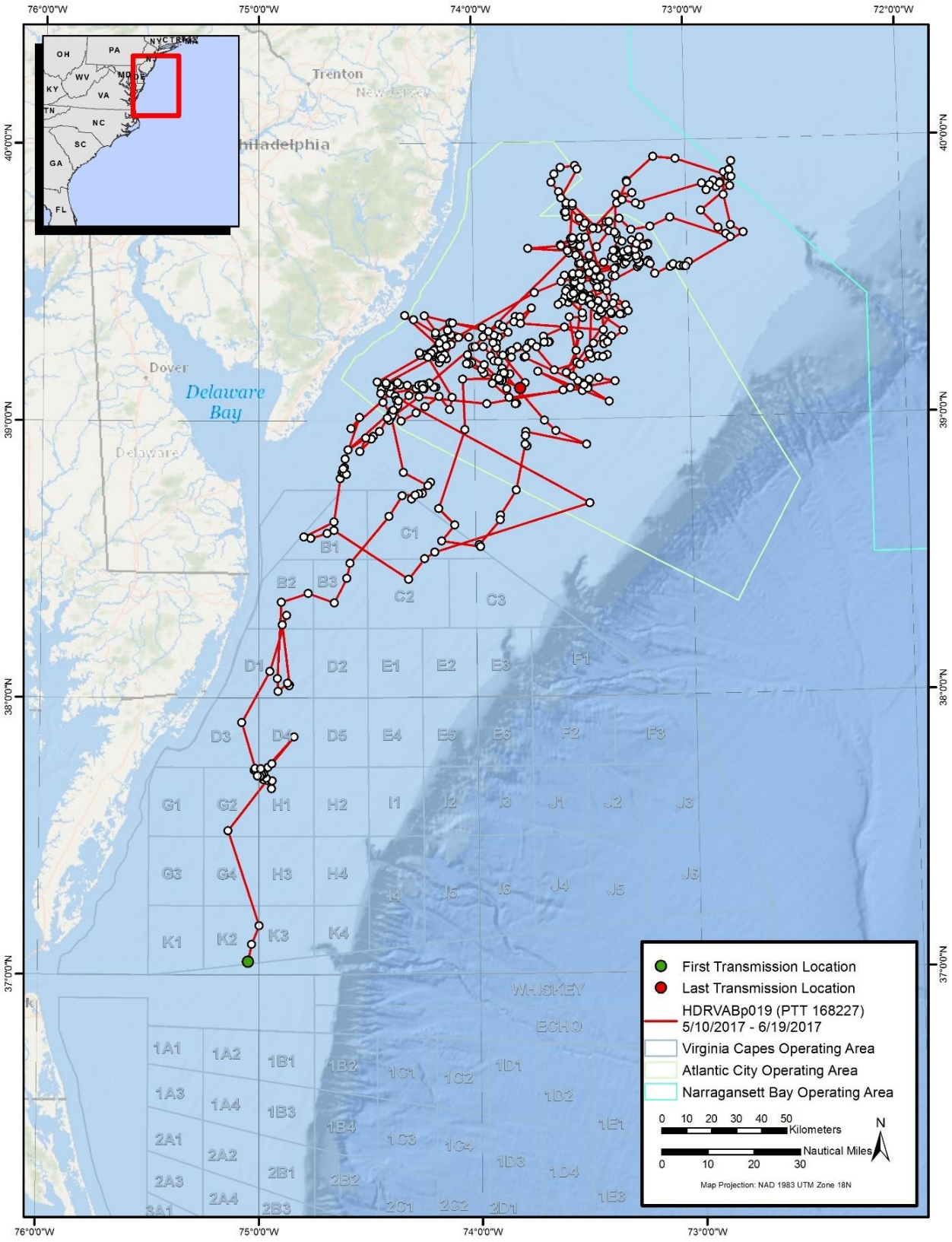

Figure 17. Filtered locations (white dots) and track of fin whale HDRVABp019 over 39.0 days of tag-attachment duration.

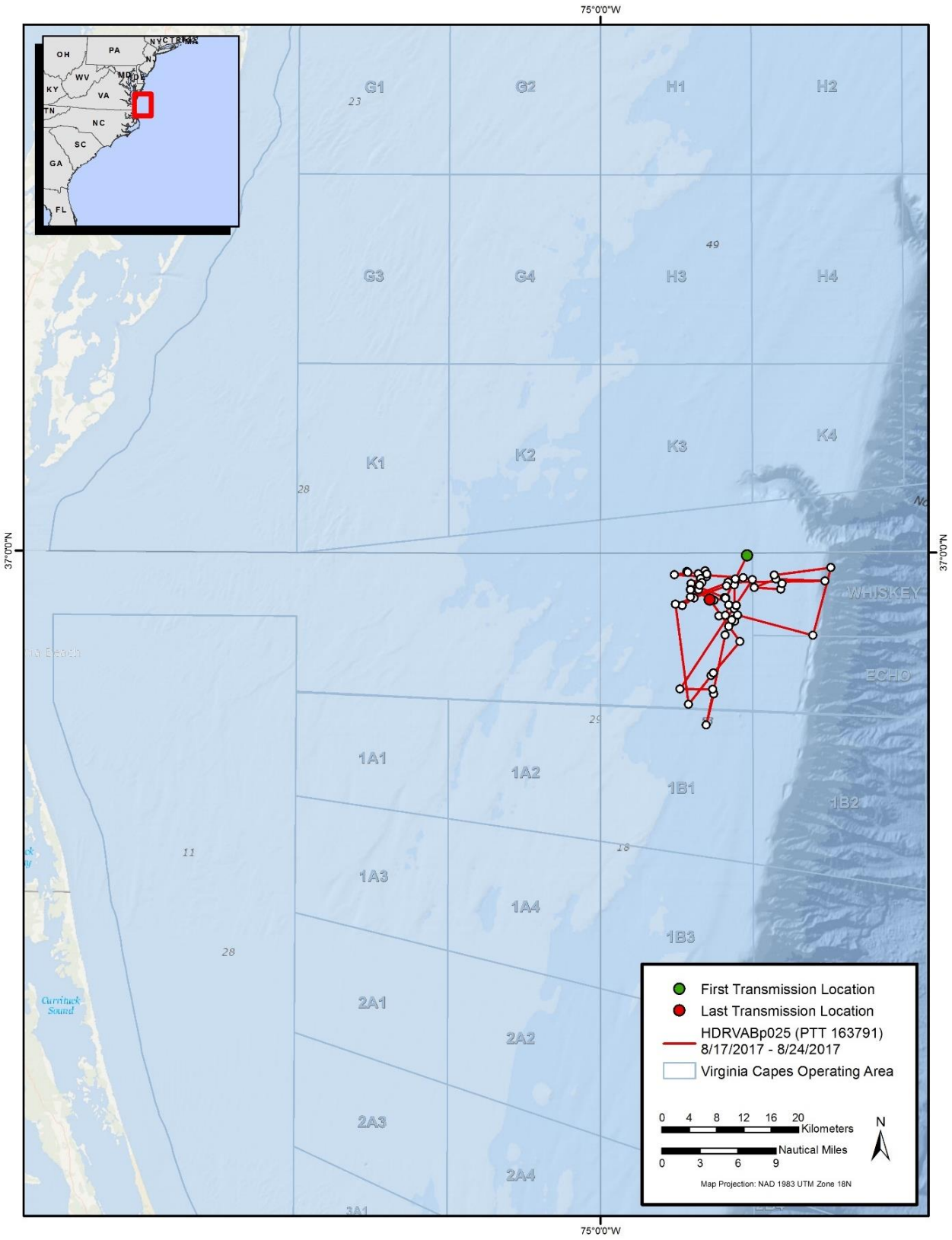

Figure 18. Filtered locations (white dots) and track of fin whale HDRVABp025 over 6.8 days of tag-attachment duration.

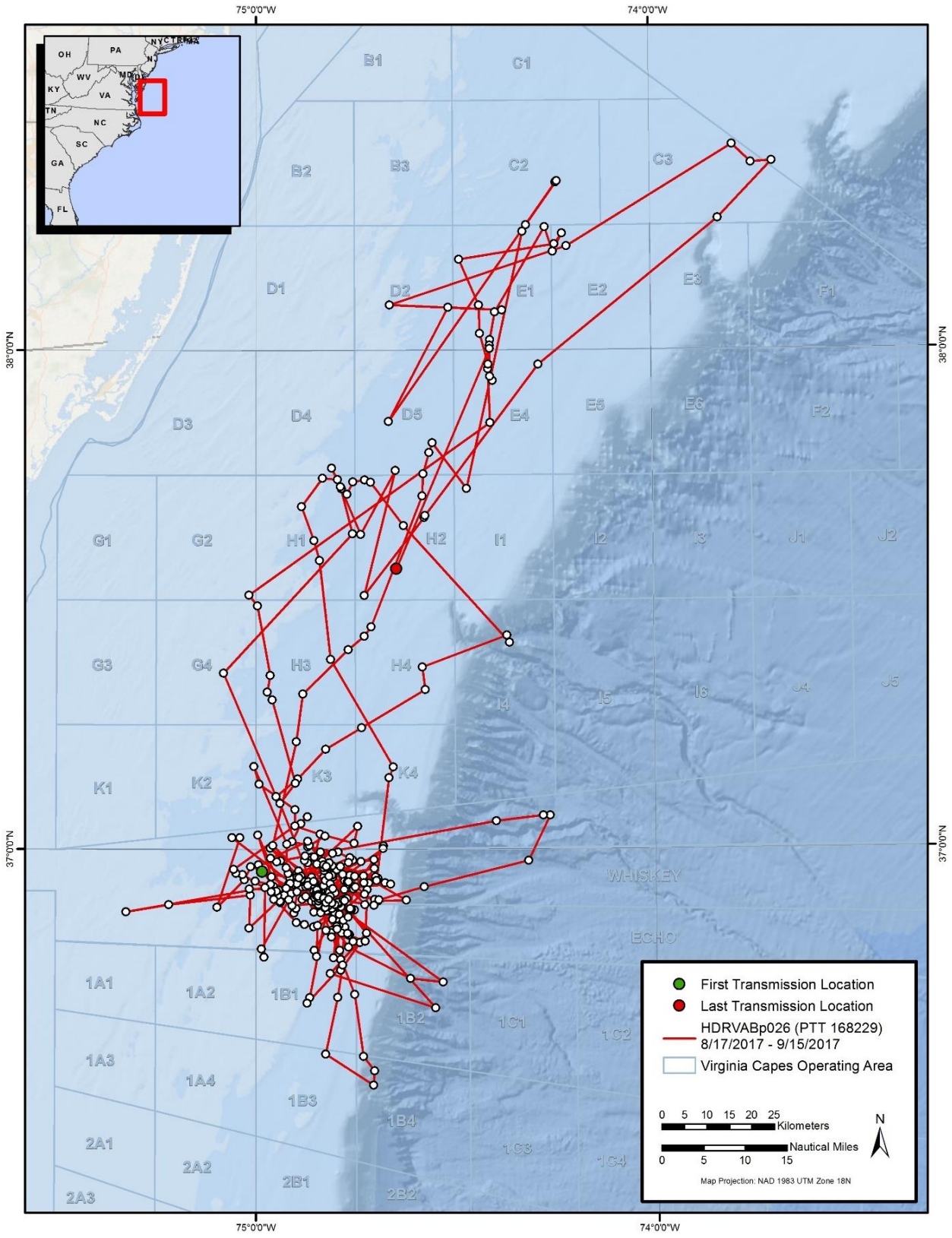

Figure 19. Filtered locations (white dots) and track of fin whale HDRVABp026 over 30.1 days of tag-attachment duration.

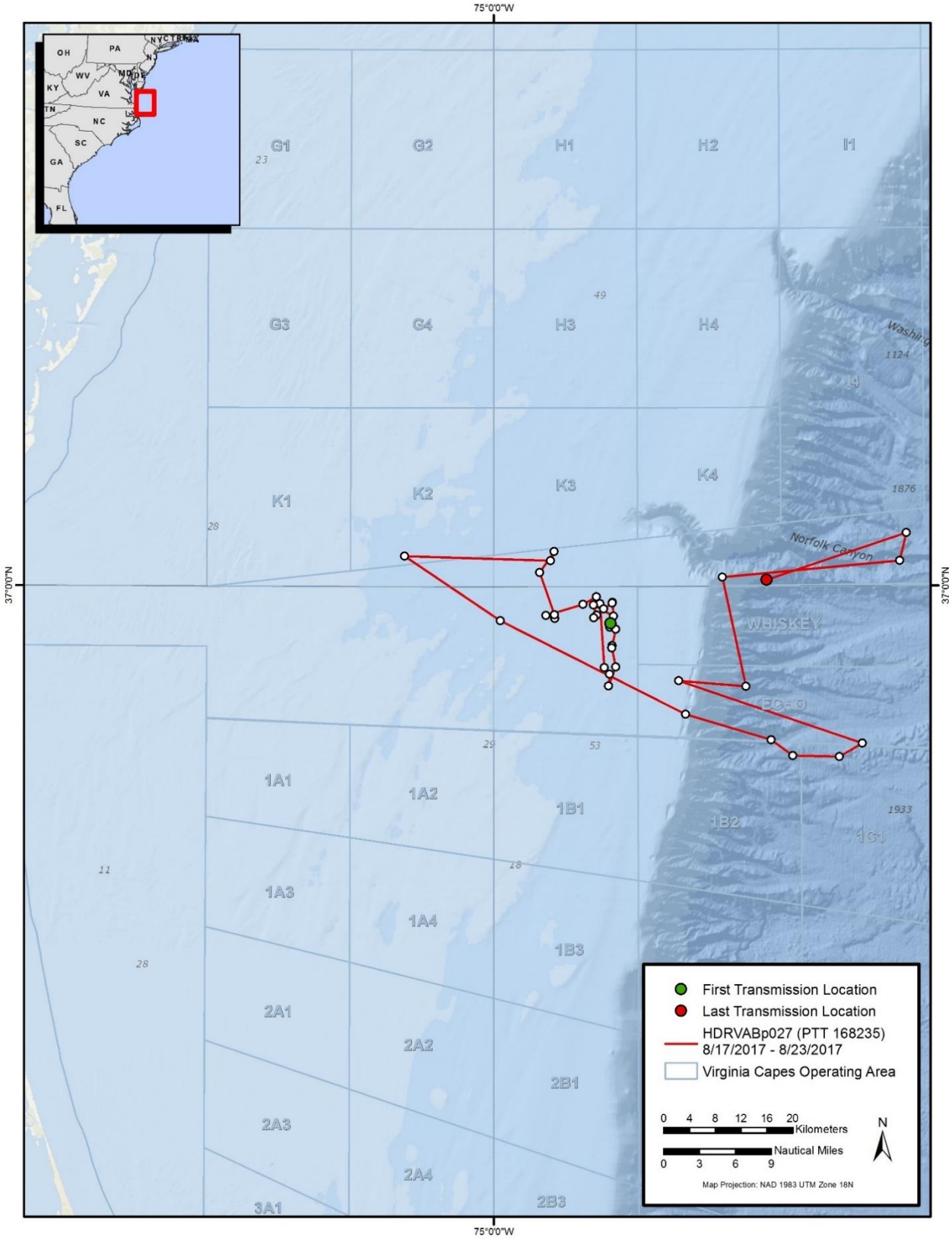

Figure 20. Filtered locations (white dots) and track of fin whale HDRVABp027 over 6.8 days of tag-attachment duration.

4. Discussion

Analysis and collection of data for this project are still in the early stages; however, preliminary results show a high degree of marine mammal diversity in this U.S. Navy high-use area. Surveys conducted in 2017 provided more coverage in the Norfolk Canyon area and deeper waters (>1,000 m) past the shelf break than in previous seasons (see Engelhaupt et al. 2017 and Aschettino et al. 2016). Sightings of twelve identified species of marine mammals and one species of sea turtle were made over fourteen surveys, showing a wide distribution throughout the study area. Aerial survey and PAM data from the region show similar species occurrence (McAlarney et al. 2016, 2017; Hodge et al. 2016, 2017).

As expected, there was a concentration of sightings near and farther east (offshore) of the continental shelf break for deep-diving species, including sperm whales and pilot whales; while baleen whales were encountered both over and east of the shelf. Dolphin species were sighted throughout the core study and transit areas, and loggerhead sea turtles were only sighted over the shelf in waters less than 150 m.

Sightings of marine mammal species in U.S. Navy range boxes in and around the Norfolk Canyon (K3, K4, and I4) were frequent, showing the potential for overlap between these species and U.S. Navy training activities. It should be noted based on our personal observations that the Norfolk Canyon is also an area heavily utilized by both recreational and commercial fishing vessels. Based on limited effort to date, additional focus of this area is required to make further conclusions about species composition.

Pilot whale photo-ID results have also yielded interesting findings on both travel patterns and social affiliations. Although numbers are small, and results are preliminary, there are examples of long term associations between individuals and movements between Virginia and Cape Hatteras. Eighteen percent of pilot whales photographed in Virginia were also photographed in the Cape Hatteras region. Pilot whales are not considered a priority species of this study and minimal effort is used to collect images from any pilot whale encounter. Additional focus/effort on that genus would likely result in a substantial increase in re-sighting rates between the two geographic areas.

The number of individuals in our photo-identification catalogs continue to increase for baleen and sperm whales. Further effort, resulting in additional photos collected is required to investigate site fidelity by specific individuals within the study area. One sperm whale of the 31 identified individuals was re-sighted 27 days after initial encounter. Interestingly, this individual had been satellite-tagged, although the tag never transmitted (**Table 5**), and photos from the re-sighting showed the tag was still attached. One fin whale of the 34 identified individuals was re-sighted 14 days after first photographed. HDR will continue to coordinate data sharing with other local and regional researchers and agencies. To date, only the preliminary fin whale catalog with 12 individuals has been compared to that of the Center for Coastal Studies in Provincetown, Massachusetts, but did not yield any matches (Scott Landry, pers. comm.). Further comparisons will occur as the catalogs grow and additional data become available. Such comparisons, along with further processing of existing photo-ID data collected to date, will allow for a better understanding of residency in the area by some species. Increased effort is

likely to result in additional re-sightings that over time may help address questions of seasonal variation, social affiliations, and may eventually address questions related to population-level consequences.

Locations from satellite-tagged whales show movements through numerous VACAPES range boxes, both over the continental shelf and beyond the slope **(Figures 7-20**). Sperm whales show a high percentage of locations within the range boxes. Both fin and sperm whales show periods of localized movements and of directional travel; but as expected differ in their primary depth of occurrence. Preliminary analysis of dive data collected to date, on a species-specific basis, shows variability within individual sperm and fin whales. Additional tag deployments continue to be a priority for future surveys. With the recent integration of Fastloc® GPS into Wildlife Computer's LIMPET-F SPLASH tags, we will be able to provide increased accuracy relative to location information combined with dive profile data for fast-moving fin whales. Future efforts will incorporate switching state space modeling as a means to examine patterns of foraging and traveling within and between individuals.

Working 60 NM from shore requires exploiting short and infrequent weather window opportunities combined with limited access to restricted U.S. Navy training areas. With every survey completed, this project provides a more comprehensive understanding of how numerous species (including Endangered Species Act-listed) utilize this critical offshore habitat. As more surveys are completed and tags are deployed, the HDR team continues to expand their coverage across multiple seasons which allows us to explore questions of intra and inter-seasonal species occurrence and variation. The results of this multi-year effort are expected to provide the U.S. Navy with the level of detailed information required to make informed decisions with regards to future training and testing within the survey area as a means to minimize potential impacts on marine mammals and sea turtles.

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A

Data Fields to be Recorded

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Data fields to be recorded

Placement	Field / Attribute	
Survey/ Environmental	• Date/Time • Platform • Survey ID • Beaufort Scale • Visibility • Wind Direction	• Swell • Percent Cloud Cover • Effort Status • Personnel • Leg Notes
Sighting	• Sighting Number • Date/Time • Latitude/Longitude • Relative Bearing • Angle to Sighting • Distance to Animal • Animal's Heading • Species Name (Common) • Species Name (Scientific) • Min Group Size • Max Group Size • Best Group Size • Count (Calves) • Count (Juveniles) • Behavior State • Multiple Sightings • Recorder • Observer • Reaction • Depth • Temperature	• Navy Ship within 500 m? (Y/N) • Cargo Ship within 500 m? (Y/N) • Fishing/Rec Boat within 500 m? (Y/N) • Within 500 m of Shipping Channel? (Y/N) • Notes • Photos Taken (Y/N) (If Yes – Frame numbers, camera, photographer) • Video (Y/N) (If Yes – Frame numbers, camera, photographer) • Biopsy (Y/N) (If Yes – Shooter, hit/miss, sample location, reaction, others present/reacting, sample, sample name, comments) • Tagging (Y/N) (If Yes – Shooter, hit/miss, tag location, reaction, others present/reacting, tag number, tag type, comments) • Maximum Distance between Nearest Neighbor • Minimum Distance between Nearest Neighbor
Focal (Related to Focal Individual Only)	• Date/Time • Latitude/Longitude • Group ID • Behavioral State (Travel; Feed; Mill; Social; Rest; Log; Unknown) • Behavioral Event (Blow; Dive/Peduncle arch; FUD; FDD; Side fluke; Lunge; Tail slap; Pec slap; Spy hop; Breach; Bubbles; Start follow; Stop follow; Footprint WP; First surfacing; Head slap; Peduncle slap; Chase; Brood side display; Head lunge; Linear bubble trail; charge)	• Bearing • Distance to Sighting • Heading of the Animal • Relative Movement of Vessel and Animal's Bearing • Sighting Notes

***** Upon each entry and time stamp and GPS coordinate is recorded for the position of the vessel. Variables may be modified as deemed necessary by the Chief Scientist.

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