VACAPES Outer Continental Shelf Cetacean Study, Virginia Beach, Virginia: 2020 Annual Progress Report

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Cover Photo Credit:

True's beaked whale (*Mesoplodon mirus*) off the coast of Virginia. Photographed by Amy Engelhaupt. Photograph taken under National Marine Fisheries Service Scientific Research Permit No. 21482, issued to Dan Engelhaupt.

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Acronyms and Abbreviations

ARS	Area Restricted Search
BSS	Beaufort sea state
ESA	Endangered Species Act
GPS	Global Positioning System
hr	hour(s)
km	kilometer(s)
LiDAR	Light Detection and Ranging
LIMPET	Low-Impact Minimally Percutaneous Electronic Transmitter
m	meter(s)
min	minute(s)
MMO	marine mammal observer
NM	nautical mile(s)
OPAREA	Operating Area
photo-ID	photo-identification
SPOT	Smart Position and Temperature
SSM	State Space Modeling
sUAS	small Unmanned Aerial System
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. 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 three (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 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 (ESA).

Recent aerial and vessel surveys and passive acoustic monitoring studies for the U.S. Navy Marine Species Monitoring Program (Foley et al. 2019; Salisbury et al. 2018; Mallette et al. 2017, 2018a; Cotter 2019) have provided data confirming the overall distribution patterns, and suggesting that the outer shelf area off Virginia in the VACAPES OPAREA would be an ideal 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, 2018, 2019a, 2020a). This progress report includes all offshore activities conducted in 2020. The goals of this effort focus on addressing fundamental information gaps related to marine mammal occurrence, exposure, and response as identified by the U.S. Navy's Integrated Comprehensive Monitoring Program (DoN 2010) and recommendations provided by a Scientific Advisory Group review (DoN 2011).

In order to address these informational gaps for offshore waters in the VACAPES OPAREA, a combination of techniques are being used, including: (1) photo-ID, photogrammetry, and behavioral data collection, from vessel and small Unmanned Aerial Systems (sUASs), 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, establish gender, and assist in delineating stock

structure; and (3) satellite-linked tagging techniques to provide information on residency patterns, dive profiles, 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. Findings from work conducted near the continental shelf break off the coast of Southeast Virginia and Cape Hatteras, North Carolina, suggest a year-round presence of several species of cetaceans, including Cuvier's beaked whales and short-finned pilot whales, (McAlarney et al. 2018a, 2018b, Waples and Read 2020). Tagging efforts for this project provide opportunities to assess movement patterns of additional species and may identify the extent of overlap with these animals and 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 (Baird et al. 2018), there is potential to track tagged animals more broadly, 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 2013), 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 Naval Station Norfolk, 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 kilometers [km; 50 nautical miles (NM) to 160 km [85 NM]) off the coast of Virginia (**Figure 1**). The offshore study

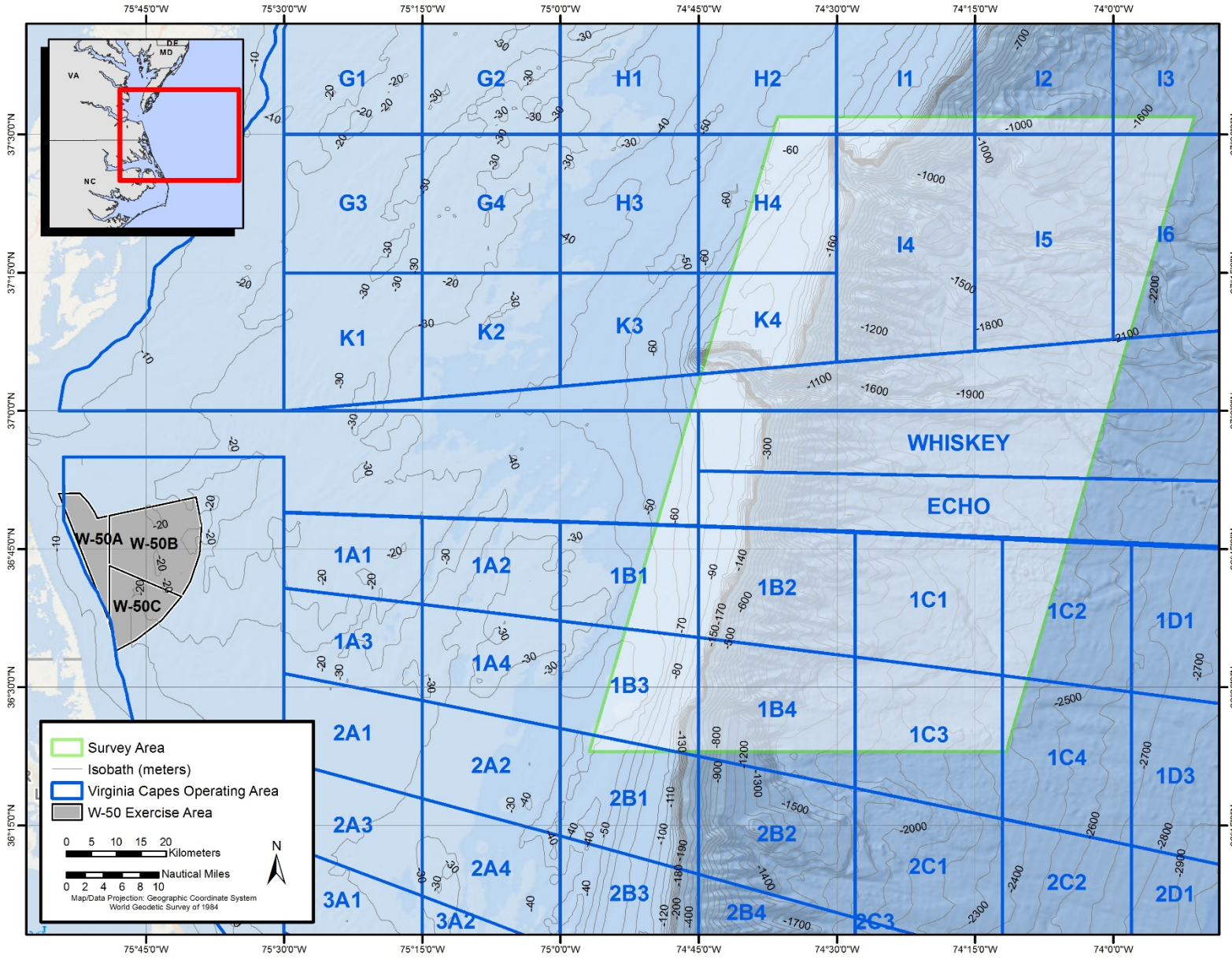

Figure 1. Map of the offshore study area off southeastern Virginia and the VACAPES training range surface grid in the region.

area includes the outer part of the continental shelf, the shelf break, and slope waters, along with Norfolk and Washington Canyons. Depths within the core study area range from > 50 meters (m) to < 2,500 m.

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 three (3) hours [hr] each way when transiting at 20+ knots). 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 three (3) or lower when possible, as well as access to the VACAPES OPAREA range boxes within the study area (K3, K4, I4, 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.

The offshore charter 16.2 m sport-fishing vessel *Top Notch* (**Figure 2)** was the primary vessel used in 2020 to support surveys. The vessel is equipped with a Global Positioning System (GPS) receiver, marine radio, emergency beacon, 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. The primary sport-fishing vessel chartered for use during offshore surveys, the 16.2 m *Top Notch*.

Surveys 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.

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

In order to maximize achievement of the project's core objectives, departures from the marina were scheduled at approximately sunrise or earlier and approximately 12 hrs were allocated for each survey day. Once departing the marina, transit time was approximately 3 hrs to reach the study area. MMOs were on-effort during the outbound and inbound transit as long as there was sufficient daylight and a BSS of four (4) of lower. Due to the distance from shore and overall effort required to complete each survey day, effort in the primary study area continued until the end of the survey day even if sea states turned unfavorable (BSS 4 to 6), 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 U.S. Navy training 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 often 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 in deep water (>400 m), a directional hydrophone was used to listen for sperm whales. If clicks were heard, every effort was made to localize the detections and maneuver the vessel to where the whales were heard. If no clicks were heard, the vessel would continue transiting before stopping approximately 20 to 30 minutes later to listen in a different area.

Once a sighting was made, one MMO focused on data entry using COMPASS (Richlen et al. 2019), the data-recording application running on an Apple iPad tablet (see **Appendix A**), while others focused on visual 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 identification to species and photo-ID. Other delphinid species were the lowest priority and effort spent collecting data and photographs was limited to confirming species identification, estimating group size, and determining initial behavior.

During a high priority marine mammal sighting, the research vessel would attempt to approach the animal(s) for photographs, biopsy sampling, focal-follow data collection, sUAS video collection, and/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, Photogrammetry, and Data Logging

Once a sighting was made, one observer focused on data entry, 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, photographs were cropped and compiled in a format suitable for data sharing with other catalogs. HDR shares images with known regional and local catalogs, including the North Atlantic Right Whale Catalog curated by the New England Aquarium, the North Atlantic Fin Whale Catalog curated by the Center for Coastal Studies, the North Atlantic and Mediterranean Sperm Whale catalog curated by Whale Watch Azores, the Mid-Atlantic Humpback Whale Catalog currently being developed by the Virginia Aquarium (Mallette et al. 2018b, 2019), the Gotham Whale Humpback Whale Catalog, and the Cape Hatteras short-finned pilot whale and Cuvier's beaked whale catalogs maintained by Duke University (Waples and Read 2020, 2021).

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. Location data and vessel speed were obtained from a GPS unit feeding directly into the iPad and logging a location every 30 seconds.

The use of sUAS (or a drone) was incorporated into the field effort during the 2019 season. A DJI Phantom 4 Pro V2.0 was used to collect morphometric data and to assess overall body condition. Data were typically collected at flight heights between 15 and 30 m, depending on the behavior of the focal animal during the time of the encounter. The sUAS collected 4K UHD video at 30 feet per second. Initial measurements were made from data using altitude values from the stock barometer (DJI Phantom 4 Pro), but to decrease the error HDR recently assembled and installed a custom Light Detection and Ranging (LiDAR) precision altimeter on the drone (described in Dawson et al. 2017). This upgrade improves accuracy of reading to +/- 5 centimeters. Open-source software developed by researchers at Duke University (Torres and Bierlich, 2020) was used to calculate lengths.

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, Florida). Skin samples were placed in a Whirl-Pak® bag after collection and stored in an ice cooler on the vessel. Samples were subsequently cross-sectioned, placed in the appropriate Cryovial® storage tube, and stored in a freezer until ready for shipment. Samples for fin whale genetic analysis studies were collected for the University of Groningen, and samples for sperm whale genetic analyses were collected for Oregon State University.

2.4 Satellite Tagging

A combination of Wildlife Computers (Redmond, Washington) Argos-linked location-only Smart Position and Temperature (SPOT-240), Argos-linked time-depth archival (SPLASH10-292 tags), and Argos-linked time-depth archival with Fastloc® GPS technology (SPLASH10-333-F), all in the Low-Impact Minimally Percutaneous External-electronics 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 or just below the dorsal fin. Tags were programmed to maximize the number of transmissions and locations received during attachment rather than to extend battery life based on expected attachment durations of LIMPET tags on baleen and sperm whales of less than 60 days. Based on satellite availability in the area, tags were programmed to transmit for 16 hours per day and limited to 600 transmissions per day. In order to constitute a “dive” for the Wildlife Computers generated behavior and time-series data outputs of the SPLASH10 tags, a 5-m and 5-minute dive definition was established for sperm whales in which a dive needed to be both deeper than 5 m and longer than 5 minutes in order to be classified as a dive. 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 final Douglas Argos Filtering step. All dives were 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. Additional dive data results were obtained using the statistical software R (R Core Team 2018).

3. Results

We conducted seven offshore vessel surveys in 2020, covering 2,263 km of trackline during more than 88 hr of effort (**Table 1, Figure 3**). Weather conditions and periods of COVID-19 restrictions limited survey opportunities considerably.

Surveys resulted in 140 marine mammal sightings and 8 sea turtle sightings (**Figures 4** through **7; Appendices B** and **C**). Ten cetacean taxa were identified (in order of decreasing frequency):

pilot whale (*Globicephala* sp.) (*n*=54), common bottlenose dolphin (*n*=28), common dolphin (*n*=15), Risso's dolphin (*n*=8), fin whale (*n*=7), sperm whale (*n*=3), Atlantic spotted dolphin (*n*=2), short-finned pilot whale (*n*= 2), Cuvier's beaked whale (*n*=2), True's beaked whale (*n*=1), and minke whale (n=1). In addition, there were 17 sightings of unconfirmed species: unidentified dolphin (*n*=13), unidentified medium whale (*n*=2), unidentified cetacean (*n*=1), and unidentified beaked whale (*n*=2). Two sea turtle taxa were identified: loggerhead turtle (*n*=6) and leatherback turtle (*n*=1), with one unconfirmed species: unidentified hardshell turtle (n=1). Because both short-finned and long-finned pilot whales may occur in this region, most sightings of the genus *Globicephala* were not assigned a species unless they were closely approached and could be definitively identified, which was not typically the case.

3.1 Photo-ID and Photogrammetry

Due to priorities and limited windows of opportunity, photo-ID images were collected from only 38 of the 140 marine mammal sightings. All photographs of baleen, sperm, and beaked whales were added to HDR's existing catalogs (**Appendix D**). The HDR fin whale catalog now contains 89 unique individuals, the minke whale catalog contains 10 individuals, the North Atlantic right whale catalog contains 6 individuals, and the sei whale catalog contains 2 individuals. Of the 89 identified fin whales, 13 (14.6 percent) have been re-sighted; 7 (7.9 percent) of them during different years ranging 247 to 355 days between first and last sightings. Locations of all re-sighted fin whales were in water over the continental shelf, less than 100 m depth for all encounters. Distance between re-sight locations ranged from 20.0 to 46.8 km.

The HDR sperm whale catalog now contains 95 individuals. Fourteen individuals (14.7 percent) were sighted on more than one day, ranging from 9 to 1,062 days between sightings (mean = 391, median = 364). All 14 re-sighted sperm whales were photographed at least once within or offshore of Norfolk Canyon, 7 of those 12 were only re-sighted in that area (less than 20 km apart). The maximum distance between any re-sighted individuals was 65.0 km. Two individuals were re-sighted more than 15 km to the south of initial sighting, which was east of Norfolk Canyon. The whales were together during both sightings, 719 days apart. The minke whale photographed was not sufficiently marked to be identifiable, so was not added to the minke catalog, and the two Cuvier's beaked whale IDs did not match the previous sighting in the catalog.

Although pilot whale photographs collected in 2020 have not yet been provided to Duke University, comparisons of individuals through 2019 with their Cape Hatteras catalog have been completed (Waples and Read 2021). Waples and Read found an additional 16 individuals that matched between areas, making the total 40 matches between Virginia and North Carolina. One individual seen in the study area in 2019 was matched to a sighting 4 years prior (Waples and Read 2021). Images of other odontocete species have been archived for future processing.

Drone video was collected from four individuals during two sightings of sperm whales, which was compared to the photo-ID catalog to match measurement to the correct whale. The average calculated total lengths for each individual ranged from 8.5 to 9.6 m, with both a mean and median of 9.0 m (**Table 2**). All four individuals had been preliminarily

Table 1. Summary of 2020 offshore survey effort in the VAPACES outer continental shelf study area.

Date	Survey Duration (min)	Distance surveyed (km)	# Sightings	# Individuals	Baleen Whales # Sightings/ # Individuals	Deep Diving Whales* # Sightings/ # Individuals	Dolphins # Sightings/ # Individuals	Sea Turtles # Sightings/ # Individuals
09-Feb-20	775	329	28	997	6/8	7/42	15/947	0/0
13-May-20	806	323	23	926	0/0	8/77	12/846	3/3
08-Jun-20	756	309	18	428	0/0	9/220	8/207	1/1
14-Jul-20	751	323	18	367	1/1	13/271	4/95	0/0
19-Aug-20	878	352	32	508	1/1	13/225	16/280	2/2
25-Sep-20	703	330	25	641	0/0	16/427	7/211	2/3
04-Nov-20	656	297	4	173	0/0	0/0	4/173	0/0
Totals	**5,325**	**2,263**	**148**	**4,040**	**8/10**	**66/1,262**	**66/2,759**	**8/9**

Key: min = minute(s); km = kilometer(s); * sperm, pilot, and beaked whales

Table 2. Overall lengths of sperm whales measured using drone photogrammetry.

Animal ID	Overall Length (m)	Total Number of Measurements Used	Age-class Assigned on Visual Assessment
HDRVAPm036	8.5	6	Immature male or adult female
HDRVAPm091	9.6	4	Immature male or adult female
HDRVAPm092	9.4	10	Immature male or adult female
HDRVAPm094	8.6	6	Immature male or adult female

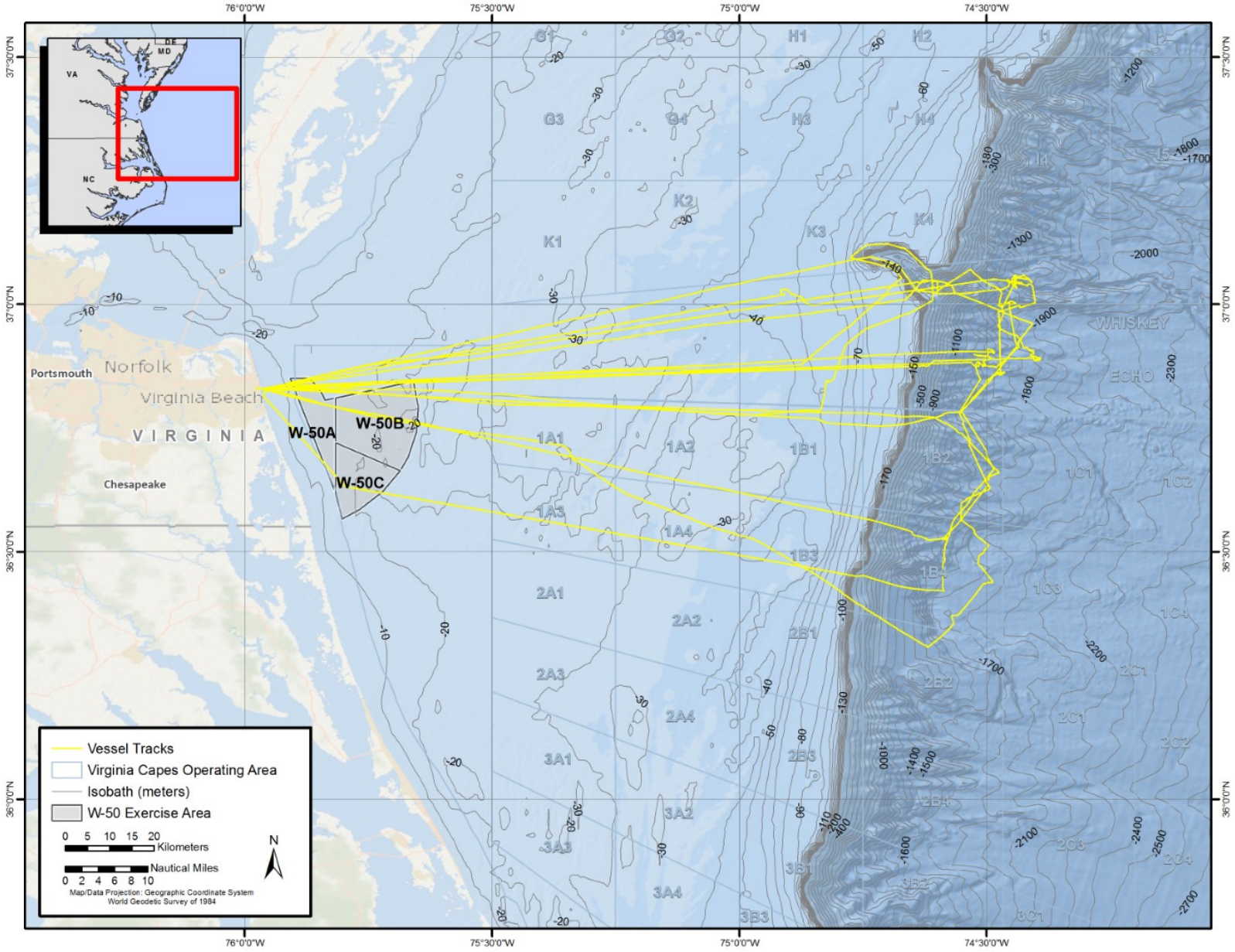

Figure 3. Offshore survey tracks for all surveys conducted in 2020.

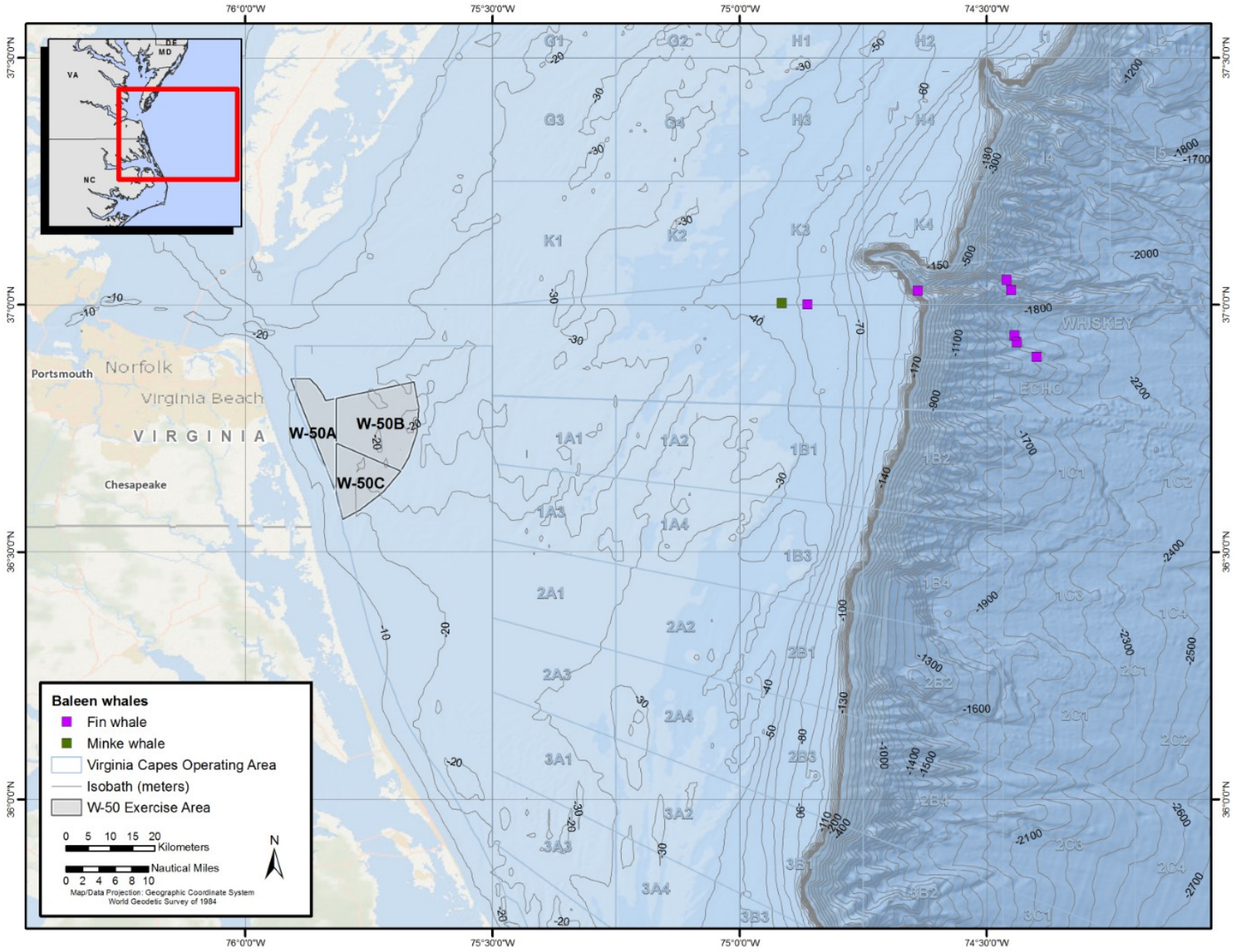

Figure 4. Locations of all baleen whale sightings (*n*=8) in 2020.

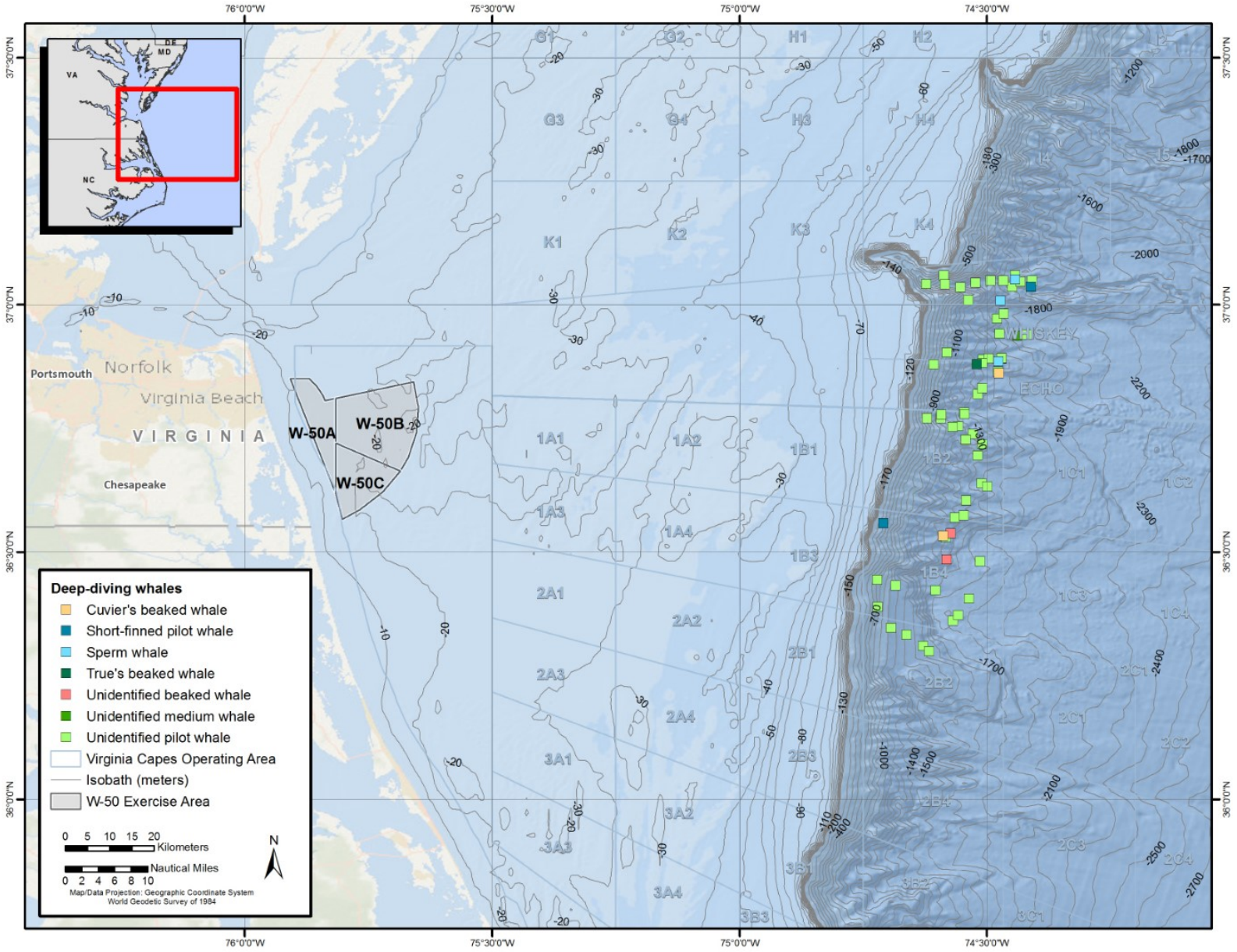

Figure 5. Locations of all deep diving whale sightings (*n*=66) in 2020.

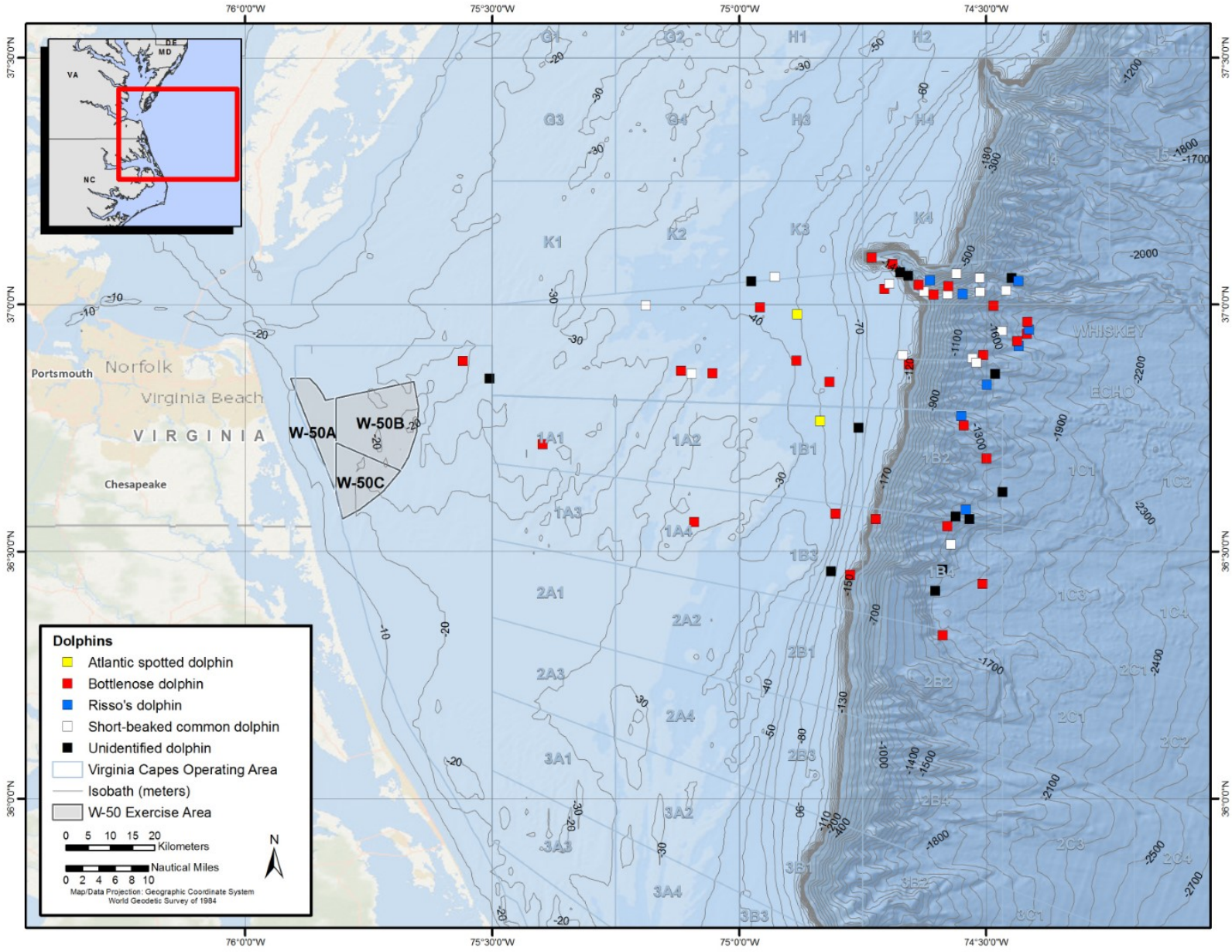

Figure 6. Locations of all dolphin sightings (*n*=66) in 2020.

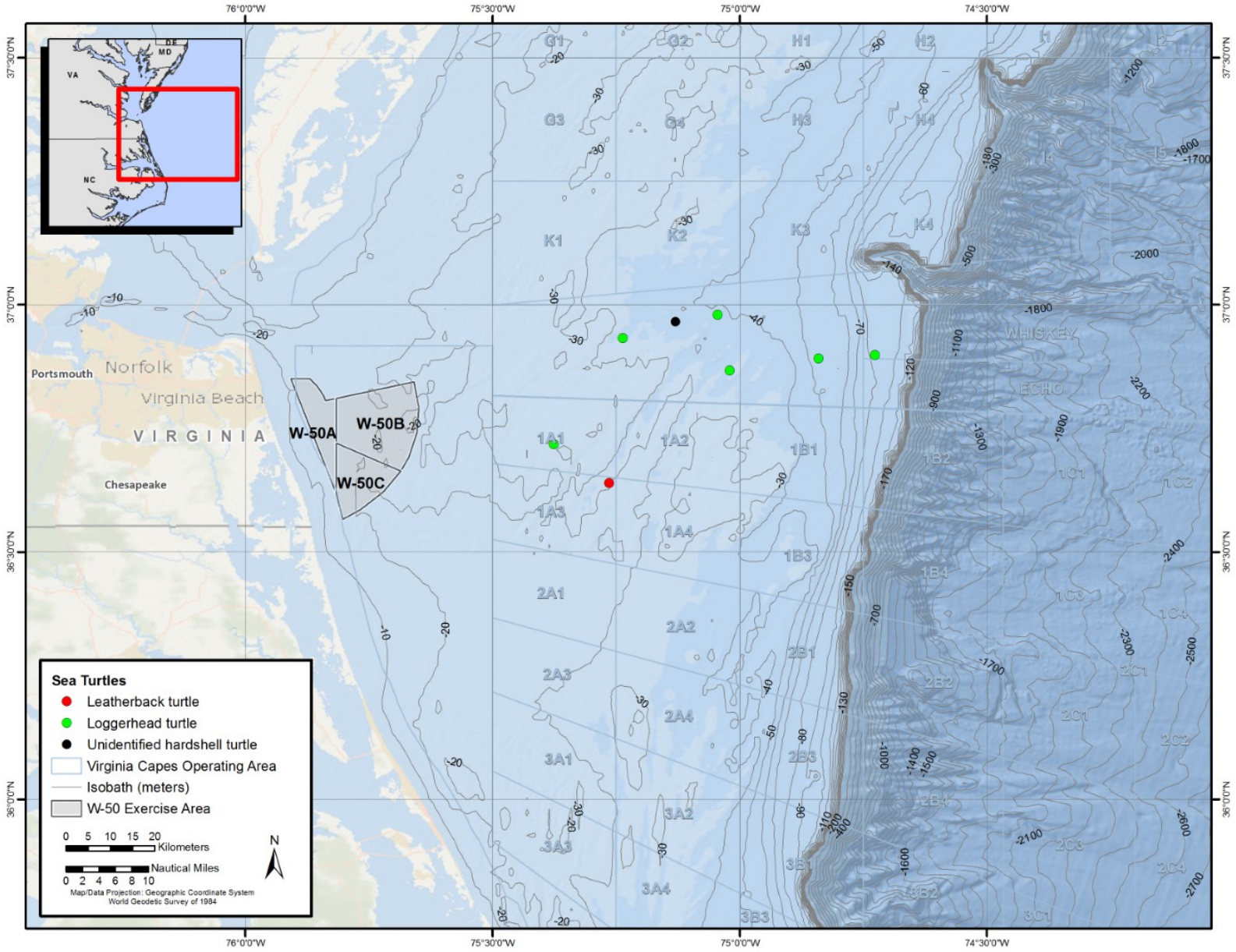

Figure 7. Locations of all sea turtle sightings (*n*=8) in 2020.

Assigned to immature male or adult female age classes in the field, which aligns to the calculated measurements assuming a female sperm whale is approximately 8.3-9.2 m in length when reaching sexual maturity, and males reach maturity at lengths between approximately 11.0 and 12.0 m (Rice 1989).

3.2 Biopsy Sample Collection & Genetic Analysis

Four biopsies were collected from sperm whales in 2020 (**Appendix D**). The 2020 sperm whale samples are currently being processed. Gender results from sperm whale samples collected in 2017 and 2018 showed three (3) were females and 11 were males.

Preliminary mitochondrial DNA results provided by Oregon State University for the 13 sperm whale samples tested to date show all samples were classed into the three most common haplotypes (haplotype A = 9, haplotype B = 3, haplotype C = 1). No whales were confirmed as genetic matches to other whales sampled in this study or elsewhere using microsatellite techniques.

3.3 Satellite Tagging

A total of three satellite tags were successfully deployed in 2020, all on sperm whales (**Tables 3** and **4**). The three tags were SPLASH-10 tags, which collect location and dive depth/duration information (**Table 5**).

Tag duration ranged from 7.1 to 20.5 days (mean=12.4). Locations from satellite-tagged sperm whales showed movements through multiple U.S. Navy OPAREAS, mostly along the continental shelf break and beyond the slope. Movements varied, with two individuals remaining within the VACAPES OPAREA (e.g., **Figures 8 and 10**), and the third moving a greater distance to the northeast, still along the continental shelf edge and slope through the Atlantic City and Narragansett Bay OPAREAs (**Figure 9)**. As in 2019, none of the 2020 tagged whales moved south into the Cherry Point OPAREA waters as individuals had done in previous years (Engelhaupt et al. 2019a, 2018).

Tagged sperm whales traveled up to 322 km away from initial tag deployment location and had 45 to 100 percent of locations within the VACAPES OPAREA depending on the individual (**Table 4**). Maximum dive depth ranged from 1,311 to 1,823 m, and maximum dive duration ranged from 56 to 73 min (**Table 5**).

Table 3. Summary of tag deployment details for all sperm whale tags deployed in 2020.

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)
HDRVAPm036	SPLASH-10	183915	2020-May-13 18:58	36.8959	74.4978	1521	2020-May-23 13:19	9.6
HDRVAPm090	SPLASH-10	177050	2020-May-13 15:09	36.9996	74.4723	1553	2020-May-21 14:24	7.1
HDRVAPm091	SPLASH-10	183914	2020-May-13 17:00	37.0030	74.4540	1553	2020-Jun-03 22:20	20.5

Table 4. Summary of results from satellite tag data for all sperm whale tags deployed in 2020.

Animal ID	Argos ID	No. of Locations Post Filtering	% Within VACAPES OPAREA	Max Distance from Initial Location (km)	Mean Distance from Initial Location (km)
HDRVAPm036	183915	90	100.0	170.2	68.5
HDRVAPm090	177050	60	45.0	321.8	160.3
HDRVAPm091	183914	255	95.7	174.9	69.5

Table 5. Summary of dive data for all sperm whale SPLASH-10 tags deployed in 2020.

Animal ID	Argos ID	No. Dives Logged	Mean Dive Depth* (m)	Max Dive Depth (m)	Mean Dive Duration* (mm.ss)	Max Dive Duration (mm.ss)
HDRVAPm036	183915	194	1111.7	1823	41.85	56.58
HDRVAPm090	177050	158	708.8	1311	45.97	72.95
HDRVAPm091	183914	514	947.5	1791	41.72	63.38

*mean values calculated from max dive depth and max dive duration values for each tagged individual.

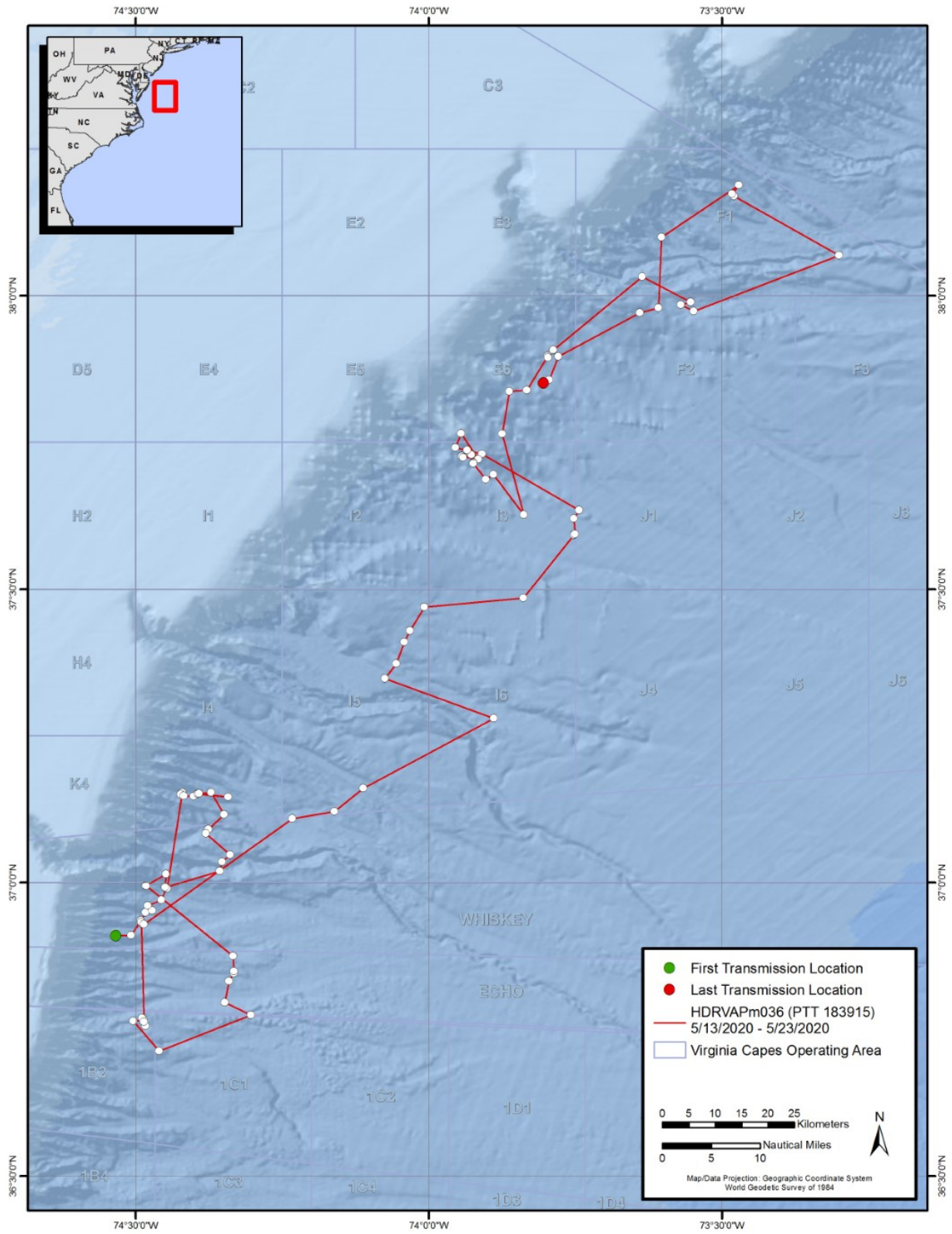

Figure 8. Filtered locations (white dots) and track of sperm whale HDRVAPm036 over 9.6 days.

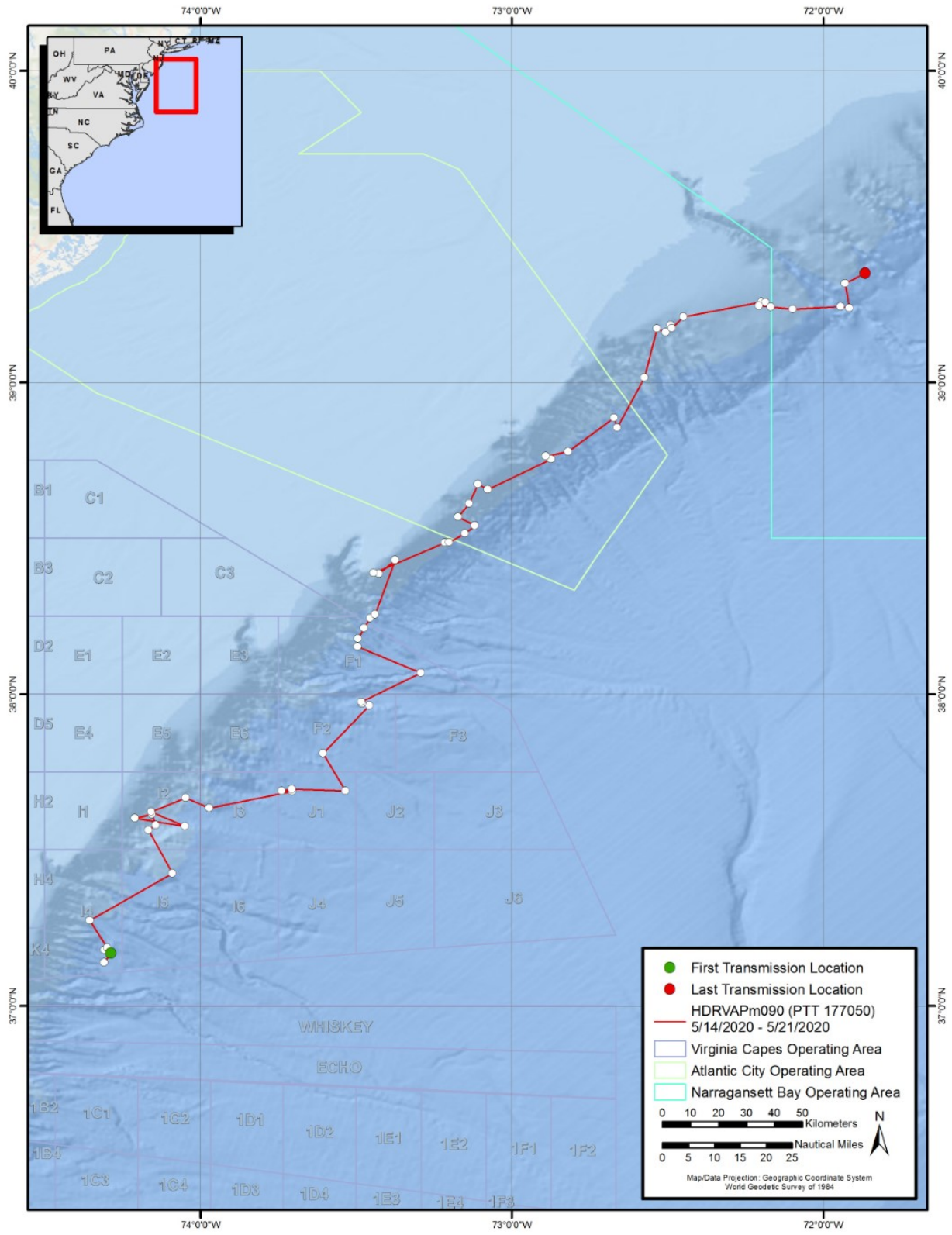

Figure 9. Filtered locations (white dots) and track of sperm whale HDRVAPm090 over 7.1 days.

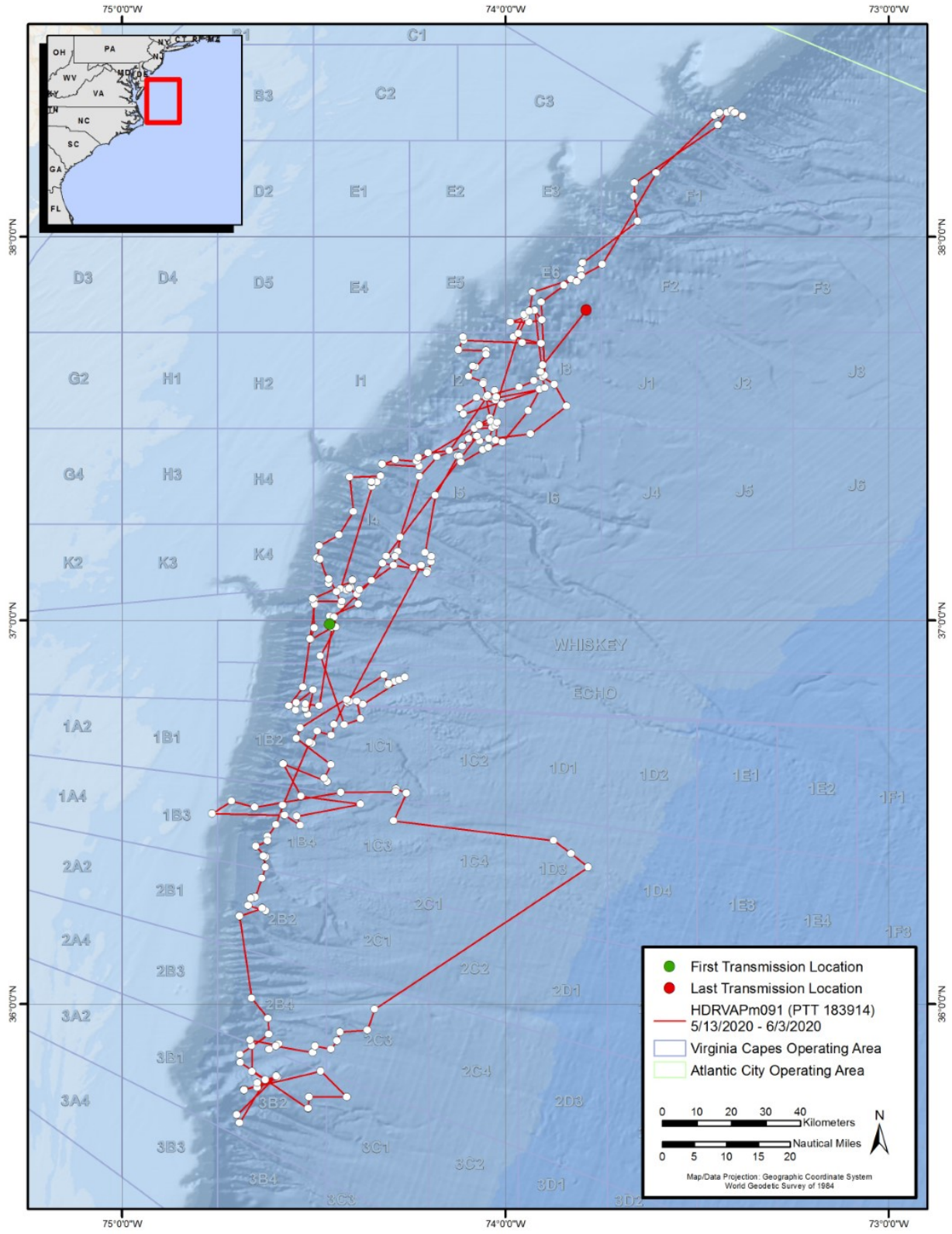

Figure 10. Filtered locations (white dots) and track of sperm whale HDRVAPm091 over 20.5 days.

4. Discussion

Data collection and analyses for this project are ongoing; however, results to-date show a high degree of marine mammal diversity in the study area. Surveys conducted in 2020 continued to provide coverage in the Norfolk Canyon region spread across seasons, but similar to 2018 and 2019 survey coverage extended farther into deeper waters (>1,500 m) past the shelf break than in previous years (see Engelhaupt et al. 2018, Engelhaupt et al. 2017). Sightings of 10 species of marine mammals and two (2) species of sea turtles were made over seven (7) surveys, showing a wide distribution throughout the study area. All species encountered during 2020 had previously been sighted during this study keeping the total number of marine mammal species encountered in the study area over the duration of the project to 20. Aerial survey and passive acoustic monitoring data from the region show similar species diversity (Cotter 2019; McAlarney et al. 2018a, 2018b; Rafter et al. 2018).

As expected, sightings of deep-diving species including sperm whales, pilot whales, and beaked whales were concentrated near the shelf break, in the Norfolk Canyon area, and into deeper offshore waters. While baleen whales were encountered both over the shelf and past the shelf break during previous years of this study, similar to 2019, the majority of 2020 baleen whale sightings were past the shelf break. Dolphin species were sighted throughout the core study and transit areas, and all sea turtles were 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) have been frequent throughout the duration of this multi-year study suggesting a high probability for overlap between these species and U.S. Navy training activities. It should be noted that the Norfolk Canyon is also an area heavily utilized by both recreational and commercial fishing vessels.

The number of individuals in our photo-ID catalogs continue to increase for baleen and sperm whales. Mark-recapture is a valuable technique but requires a multi-year commitment to accumulate sufficient data to produce meaningful contributions towards site-fidelity and ultimately population consequences. However, results are already becoming evident for some species with 14.7 percent (14 of 95) of cataloged sperm whale individuals being re-sighted, two on three occasions, up to 1,062 days after initial encounter. Thirteen (13) fin whales (14.6 percent) were photographed on more than one day (between-season re-sightings ranged from 247 to 355 days from initial encounter). Initial sighting locations and those of re-sighted fin whales are all in water over the continental shelf, not only shows emerging evidence of site-fidelity displayed by an ESA-listed species whose movements were previously poorly understood in this region, but also supports an importance of this habitat to the species. In addition, the importance of the Norfolk Canyon to ESA-listed sperm whales has also become evident through re-sightings, as well as tagged whale movements. Additional effort is now working to compare catalogs to existing catalogs in the Atlantic of several species. HDR will continue to coordinate data sharing with other local and regional researchers and agencies. These comparisons, along with further processing of existing photo-ID data collected to-date for non-priority species, will allow for a better understanding of seasonal movements and residency in the area by some species. Ongoing effort is likely to result in additional re-sightings that, over

time, will continue to 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 multiple VACAPES range boxes beyond the continental slope **(Figures 8** through **10**). Sperm whales continue to show a high percentage of locations within the VACAPES OPAREA range boxes, with two of the three tags deployed in 2020 having greater than 50 percent of locations within VACAPES OPAREA—although this may be biased due to deployment location and tag duration. Individuals show periods of localized movements and of directional travel, with one individual (HDRVAPm090) recorded traveling just over 500 km in seven (7) days but out of the VACAPES OPAREA, through the Atlantic City OPAREA and into the Narragansett Bay OPAREA before the end of transmission, compared to another individual (HDRVAPm091) recorded traveling more than 1,650 km in 20 days mostly within VACAPES OPAREA.

The addition of sUAS video collection has proven valuable to the overall project, not only in collecting data to improve age-class assessments, assess body condition, and document associations of priority species, but often in improving the success rate of satellite tagging efforts by informing the research team of animal movements before they could be detected from the surface. Lengths that were calculated using the Duke University software (Torres and Bierlich 2020) showed a mean total length of nearly nine (9) m for those individuals measured, confirming the designation of immature male or adult female for those sightings estimated in the field.

State Space Modeling (SSM) analysis of 2017 sperm whale tag data showed Area Restricted Search (ARS) behavior centered around marine canyons for several individuals (Engelhaupt et al. 2019). While only seven tags were available for SSM analysis at that time, these results show a strong preference for these environments and are consistent with the known ecology of this species. No ARS home range was identified close to shore for fin whales from 2017 tag data. Variation between animals was high, and few cells were identified where home range overlapped for more than two to three animals, suggesting the possibility that individuals are using ephemeral foraging features or foraging patches may be common where animals can spread out to minimize competition for resources. Further SSM analysis is expected on a larger set of tag data at the end of 2021.

In 2020, the research team continued to make considerable progress on presentations and publications. The sighting of an ESA-listed blue whale in 2018 during this study was the first documented with photographs off the coast of Virginia and a manuscript with details of the sighting was published in May 2020 to *Marine Biodiversity Records* (Engelhaupt et al. 2020b). A manuscript on data collected in 2019 from the first satellite-monitored location dive behavior tag to be deployed on a Sowerby's beaked whale (see Engelhaupt et al. 2020a) is in preparation. Information from this tag provides valuable insight with respect to the behavior of this highly cryptic species potentially at higher risk of influence from anthropogenic noise (Cox et al. 2006, Tyack et al. 2011). Further analysis of these data were presented at the World Marine Mammal Conference in 2019 (Engelhaupt et al. 2019b), and a manuscript is in preparation and expected to be submitted in spring of 2021. A detailed analysis of movement and dive data for both fin and sperm whales is ongoing, with results showing similarities and variability within and between individuals of each species.

Working 60 NM from shore requires exploiting short and infrequent weather window opportunities combined with limited access to restricted U.S. Navy training areas. Completing surveys during certain timeframes in 2020 had additional challenges due to shutdowns associated with COVID-19. With every survey completed, this project provides a more comprehensive understanding of how numerous species (including ESA-listed) utilize this critical offshore habitat. As more surveys are completed and tags are deployed, the HDR team of researchers continues to expand their coverage across multiple seasons which allows us to explore questions of intra- and inter-seasonal species occurrence and variation. Providing a more detailed understanding of both fine- and medium-scale foraging ecology of sperm and beaked whales will be the priority in 2021 and beyond, with the planned addition of Digital Acoustic Recording Tag (DTAG) deployments on these deep-diving species.. This addition will allow us to better detail fine-scale movement, dive patterns, foraging behavior, and acoustic measurements to add to the existing medium-duration telemetry dataset. Understanding fine-scale baseline data and recording subtle changes in behavior (including acoustic activity), will provide valuable insights on animal behavior and potential impacts from anthropogenic stressors. 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 mitigation measures within the survey area as a means to minimize potential impacts on both marine mammals and sea turtles.

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Data Fields Recorded in COMPASS

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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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B

Marine Mammal Sightings
2020

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Date	Sighting Time (local)	Scientific Name	Common Name	Group Size	Latitude (°N)	Longitude (°W)
9-Feb-20	07:27	*Delphinus delphis*	Short-beaked common dolphin	50	36.998337	75.189415
9-Feb-20	07:57		Unidentified dolphin	1	37.046822	74.975395
9-Feb-20	08:03	*Delphinus delphis*	Short-beaked common dolphin	30	37.055920	74.928413
9-Feb-20	08:31	*Tursiops truncatus*	Bottlenose dolphin	5	37.094570	74.731621
9-Feb-20	08:45	*Tursiops truncatus*	Bottlenose dolphin	2	37.081875	74.689583
9-Feb-20	08:48		Unidentified cetacean	1	37.065289	74.673462
9-Feb-20	08:54		Unidentified dolphin	2	37.058411	74.657303
9-Feb-20	09:08	*Balaenoptera physalus*	Fin whale	1	37.028526	74.639244
9-Feb-20	09:34	*Delphinus delphis*	Short-beaked common dolphin	350	37.026131	74.625397
9-Feb-20	09:51	*Delphinus delphis*	Short-beaked common dolphin	300	37.020878	74.577538
9-Feb-20	10:12	*Delphinus delphis*	Short-beaked common dolphin	40	37.025757	74.511940
9-Feb-20	10:37	*Balaenoptera physalus*	Fin whale	1	37.050442	74.459801
9-Feb-20	10:42	*Globicephala sp.*	Unidentified pilot whale	6	37.060020	74.442680
9-Feb-20	11:07	*Balaenoptera physalus*	Fin whale	1	37.030079	74.450455
9-Feb-20	11:27	*Physeter macrocephalus*	Sperm whale	2	37.051758	74.442780
9-Feb-20	11:49		Unidentified delphinid	10	37.054008	74.448380
9-Feb-20	12:19	*Globicephala sp.*	Unidentified pilot whale	5	37.049122	74.408737
9-Feb-20	13:18	*Globicephala sp.*	Unidentified pilot whale	10	36.972317	74.479256
9-Feb-20	13:32	*Delphinus delphis*	Short-beaked common dolphin	130	36.946259	74.467850
9-Feb-20	13:35	*Balaenoptera physalus*	Fin whale	2	36.937828	74.443336
9-Feb-20	13:37	*Balaenoptera physalus*	Fin whale	1	36.924324	74.438995
9-Feb-20	13:40		Unidentified medium whale	1	36.937058	74.438652
9-Feb-20	14:35	*Balaenoptera physalus*	Fin whale	2	36.894367	74.398659
9-Feb-20	15:46	*Globicephala sp.*	Unidentified pilot whale	8	36.889244	74.507622
9-Feb-20	15:49	*Delphinus delphis*	Short-beaked common dolphin	7	36.891205	74.527267
9-Feb-20	15:58	*Globicephala sp.*	Unidentified pilot whale	10	36.879425	74.607132
9-Feb-20	16:55	*Tursiops truncatus*	Bottlenose dolphin	5	36.861076	75.053864
9-Feb-20	17:00	*Delphinus delphis*	Short-beaked common dolphin	14	36.860050	75.096359
13-May-20	07:10	*Tursiops truncatus*	Bottlenose dolphin	12	36.885456	75.559517
13-May-20	08:42	*Stenella frontalis*	Atlantic spotted dolphin	12	36.980862	74.882072
13-May-20	09:21	*Tursiops truncatus*	Bottlenose dolphin	45	37.040276	74.636177
13-May-20	09:42	*Globicephala sp.*	Unidentified pilot whale	30	37.059681	74.586922

Date	Sighting Time (local)	Scientific Name	Common Name	Group Size	Latitude (°N)	Longitude (°W)
13-May-20	09:57	*Tursiops truncatus*	Bottlenose dolphin	6	37.020000	74.605644
13-May-20	10:09	*Tursiops truncatus*	Bottlenose dolphin	6	37.037361	74.576065
13-May-20	10:15	*Delphinus delphis*	Short-beaked common dolphin	200	37.062523	74.559868
13-May-20	10:34	*Globicephala sp.*	Unidentified pilot whale	10	37.044991	74.523018
13-May-20	10:35	*Delphinus delphis*	Short-beaked common dolphin	208	37.053658	74.513092
13-May-20	10:46	*Globicephala sp.*	Unidentified pilot whale	8	37.036400	74.448669
13-May-20	11:01	*Physeter macrocephalus*	Sperm whale	3	37.008110	74.472908
13-May-20	13:13	*Delphinus delphis*	Short-beaked common dolphin	300	37.028790	74.459320
13-May-20	13:37	*Grampus griseus*	Risso's dolphin	22	36.915722	74.433998
13-May-20	13:50	*Physeter macrocephalus*	Sperm whale	6	36.885662	74.476639
13-May-20	14:53	*Globicephala sp.*	Unidentified pilot whale	4	36.891710	74.495842
13-May-20	15:45		Unidentified medium whale	4	36.891827	74.470627
13-May-20	15:53	*Tursiops truncatus*	Bottlenose dolphin	15	36.897827	74.505470
13-May-20	16:40	*Globicephala sp.*	Unidentified pilot whale	12	36.904045	74.580704
13-May-20	16:50	*Delphinus delphis*	Short-beaked common dolphin	14	36.897469	74.668907
13-May-20	17:17	*Tursiops truncatus*	Bottlenose dolphin	6	36.885944	74.883995
8-Jun-20	08:57	*Tursiops truncatus*	Bottlenose dolphin	10	36.576271	74.804512
8-Jun-20	09:10	*Tursiops truncatus*	Bottlenose dolphin	8	36.565140	74.722931
8-Jun-20	09:15	*Globicephala macrorhynchus*	Short-finned pilot whale	120	36.557926	74.709267
8-Jun-20	09:57	*Ziphius cavirostris*	Cuvier's beaked whale	1	36.532715	74.588669
8-Jun-20	10:04	*Delphinus delphis*	Short-beaked common dolphin	80	36.514317	74.571747
8-Jun-20	10:59	*Globicephala sp.*	Unidentified pilot whale	35	36.530003	74.583313
8-Jun-20	11:31	*Globicephala sp.*	Unidentified pilot whale	6	36.568935	74.564781
8-Jun-20	11:46	*Grampus griseus*	Risso's dolphin	5	36.584778	74.540977
8-Jun-20	12:18		Unidentified dolphin	5	36.620251	74.466454
8-Jun-20	12:22	*Globicephala sp.*	Unidentified pilot whale	8	36.638245	74.510910
8-Jun-20	13:01	*Tursiops truncatus*	Bottlenose dolphin	30	36.755161	74.544846
8-Jun-20	13:06	*Globicephala sp.*	Unidentified pilot whale	16	36.754627	74.557892
8-Jun-20	13:33	*Globicephala sp.*	Unidentified pilot whale	20	36.818821	74.518326
8-Jun-20	14:04	*Mesoplodon mirus*	True's beaked whale	2	36.880322	74.520859
8-Jun-20	14:51	*Delphinus delphis*	Short-beaked common dolphin	60	36.882164	74.519714
8-Jun-20	14:53	*Globicephala sp.*	Unidentified pilot whale	12	36.882702	74.508842

Date	Sighting Time (local)	Scientific Name	Common Name	Group Size	Latitude (°N)	Longitude (°W)
8-Jun-20	15:57	*Tursiops truncatus*	Bottlenose dolphin	9	36.878193	74.655830
14-Jul-20	08:13	*Stenella frontalis*	Atlantic spotted dolphin	5	36.764492	74.835648
14-Jul-20	08:30		Unidentified delphinid	25	36.750427	74.758369
14-Jul-20	08:59	*Globicephala sp.*	Unidentified pilot whale	10	36.770584	74.592773
14-Jul-20	09:00	*Globicephala sp.*	Unidentified pilot whale	35	36.777779	74.592079
14-Jul-20	09:17	*Globicephala sp.*	Unidentified pilot whale	10	36.782570	74.545517
14-Jul-20	09:58	*Ziphius cavirostris*	Cuvier's beaked whale	2	36.862099	74.475609
14-Jul-20	11:26	*Globicephala sp.*	Unidentified pilot whale	60	36.864498	74.477310
14-Jul-20	12:19		Unidentified medium dolphin	60	36.859364	74.481949
14-Jul-20	12:28	*Globicephala sp.*	Unidentified pilot whale	16	36.892128	74.470177
14-Jul-20	12:42	*Globicephala sp.*	Unidentified pilot whale	15	36.941494	74.473923
14-Jul-20	13:00	*Globicephala sp.*	Unidentified pilot whale	4	36.982048	74.465622
14-Jul-20	13:42	*Globicephala macrorhynchus*	Short-finned pilot whale	16	37.035930	74.410625
14-Jul-20	13:58	*Grampus griseus*	Risso's dolphin	5	37.047741	74.434631
14-Jul-20	14:06	*Globicephala sp.*	Unidentified pilot whale	8	37.046616	74.432297
14-Jul-20	14:14	*Globicephala sp.*	Unidentified pilot whale	35	37.048851	74.466614
14-Jul-20	14:26	*Globicephala sp.*	Unidentified pilot whale	28	37.049465	74.492714
14-Jul-20	14:36	*Globicephala sp.*	Unidentified pilot whale	32	37.035702	74.553535
14-Jul-20	15:18	*Balaenoptera physalus*	Fin whale	1	37.000881	74.862854
19-Aug-20	08:24		Unidentified dolphin	10	36.459785	74.813820
19-Aug-20	08:29	*Tursiops truncatus*	Bottlenose dolphin	10	36.454826	74.772911
19-Aug-20	08:37	*Globicephala sp.*	Unidentified pilot whale	40	36.443462	74.721649
19-Aug-20	08:42	*Globicephala sp.*	Unidentified pilot whale	13	36.436581	74.682487
19-Aug-20	08:58		Unidentified dolphin	1	36.419739	74.602478
19-Aug-20	09:03	*Globicephala sp.*	Unidentified pilot whale	6	36.433895	74.595390
19-Aug-20	09:25		Unidentified dolphin	10	36.469212	74.577065
19-Aug-20	09:29		Unidentified beaked whale	1	36.484592	74.581277
19-Aug-20	10:01		Unidentified beaked whale	1	36.537262	74.573354
19-Aug-20	10:13	*Tursiops truncatus*	Bottlenose dolphin	35	36.551204	74.578404
19-Aug-20	11:20	*Globicephala sp.*	Unidentified pilot whale	22	36.717728	74.508833
19-Aug-20	11:29	*Globicephala sp.*	Unidentified pilot whale	14	36.738352	74.527817
19-Aug-20	11:40	*Grampus griseus*	Risso's dolphin	6	36.774427	74.550274

Date	Sighting Time (local)	Scientific Name	Common Name	Group Size	Latitude (°N)	Longitude (°W)
19-Aug-20	11:42	*Globicephala sp.*	Unidentified pilot whale	50	36.778767	74.545279
19-Aug-20	12:03	*Globicephala sp.*	Unidentified pilot whale	12	36.831313	74.508800
19-Aug-20	12:10	*Grampus griseus*	Risso's dolphin	30	36.837061	74.498362
19-Aug-20	12:47	*Tursiops truncatus*	Bottlenose dolphin	40	36.925491	74.436777
19-Aug-20	13:00	*Globicephala sp.*	Unidentified pilot whale	5	36.939530	74.419150
19-Aug-20	13:01	*Tursiops truncatus*	Bottlenose dolphin	10	36.941287	74.416966
19-Aug-20	13:04	*Grampus griseus*	Risso's dolphin	6	36.949298	74.413350
19-Aug-20	13:17	*Tursiops truncatus*	Bottlenose dolphin	18	36.964376	74.416167
19-Aug-20	13:35	*Tursiops truncatus*	Bottlenose dolphin	8	36.997507	74.484606
19-Aug-20	13:48	*Globicephala sp.*	Unidentified pilot whale	15	37.009673	74.537580
19-Aug-20	13:54	*Grampus griseus*	Risso's dolphin	25	37.021931	74.547478
19-Aug-20	14:13	*Globicephala sp.*	Unidentified pilot whale	26	37.041555	74.584439
19-Aug-20	14:18	*Globicephala sp.*	Unidentified pilot whale	20	37.042296	74.622609
19-Aug-20	14:22	*Grampus griseus*	Risso's dolphin	25	37.049137	74.613688
19-Aug-20	14:47	*Tursiops truncatus*	Bottlenose dolphin	45	37.031786	74.705349
19-Aug-20	15:53	*Balaenoptera acutorostrata*	Minke whale	1	37.003479	74.914520
19-Aug-20	16:04	*Tursiops truncatus*	Bottlenose dolphin	1	36.994652	74.957649
25-Sep-20	07:16	*Tursiops truncatus*	Bottlenose dolphin	35	36.716946	75.398232
25-Sep-20	08:09	*Tursiops truncatus*	Bottlenose dolphin	7	36.559147	75.091217
25-Sep-20	09:07	*Globicephala sp.*	Unidentified pilot whale	16	36.388771	74.720779
25-Sep-20	09:18	*Globicephala sp.*	Unidentified pilot whale	15	36.346214	74.693176
25-Sep-20	09:22	*Globicephala sp.*	Unidentified pilot whale	24	36.332775	74.661880
25-Sep-20	09:29	*Globicephala sp.*	Unidentified pilot whale	12	36.309826	74.628799
25-Sep-20	09:39	*Globicephala sp.*	Unidentified pilot whale	55	36.298931	74.616646
25-Sep-20	09:50	*Tursiops truncatus*	Bottlenose dolphin	5	36.330303	74.587784
25-Sep-20	09:58	*Globicephala sp.*	Unidentified pilot whale	35	36.360767	74.568611
25-Sep-20	10:05	*Globicephala sp.*	Unidentified pilot whale	17	36.372234	74.558258
25-Sep-20	10:20	*Globicephala sp.*	Unidentified pilot whale	55	36.405651	74.535568
25-Sep-20	10:30	*Tursiops truncatus*	Bottlenose dolphin	22	36.434185	74.506950
25-Sep-20	11:02	*Globicephala sp.*	Unidentified pilot whale	35	36.480835	74.514023
25-Sep-20	11:42		Unidentified dolphin	28	36.565708	74.533348
25-Sep-20	11:45		Unidentified dolphin	100	36.571056	74.561455

Date	Sighting Time (local)	Scientific Name	Common Name	Group Size	Latitude (°N)	Longitude (°W)
25-Sep-20	11:49	*Globicephala sp.*	Unidentified pilot whale	25	36.574165	74.546707
25-Sep-20	12:02	*Globicephala sp.*	Unidentified pilot whale	28	36.604473	74.541870
25-Sep-20	12:20	*Globicephala sp.*	Unidentified pilot whale	15	36.632412	74.498878
25-Sep-20	12:59	*Tursiops truncatus*	Bottlenose dolphin	14	36.688358	74.498886
25-Sep-20	13:06	*Globicephala sp.*	Unidentified pilot whale	20	36.695011	74.518013
25-Sep-20	13:20	*Globicephala sp.*	Unidentified pilot whale	35	36.726788	74.542992
25-Sep-20	13:35	*Globicephala sp.*	Unidentified pilot whale	25	36.752613	74.569656
25-Sep-20	13:52	*Globicephala sp.*	Unidentified pilot whale	15	36.770222	74.621292
4-Nov-20	06:47		Unidentified dolphin	5	36.850044	75.505302
4-Nov-20	07:39	*Tursiops truncatus*	Bottlenose dolphin	30	36.865936	75.117554
4-Nov-20	09:20	*Delphinus delphis*	Short-beaked common dolphin	120	37.042076	74.696022
4-Nov-20	13:00	*Tursiops truncatus*	Bottlenose dolphin	18	36.843254	74.816811

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Sea Turtle Sightings 2020

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Date	Sighting Time (local)	Scientific Name	Common Name	Group Size	Latitude (°N)	Longitude (°W)
13-May-20	07:54	*Caretta caretta*	Loggerhead turtle	1	36.932274	75.236565
13-May-20	16:57	*Caretta caretta*	Loggerhead turtle	1	36.898273	74.726524
13-May-20	17:12	*Caretta caretta*	Loggerhead turtle	1	36.891262	74.840218
8-Jun-20	16:43	*Caretta caretta*	Loggerhead turtle	1	36.867039	75.020111
19-Aug-20	16:30	*Caretta caretta*	Loggerhead turtle	1	36.980143	75.044253
19-Aug-20	16:56		Unidentified hardshell turtle	1	36.966248	75.130287
25-Sep-20	07:19	*Caretta caretta*	Loggerhead turtle	2	36.717876	75.375908
25-Sep-20	07:41	*Dermochelys coriacea*	Leatherback turtle	1	36.639210	75.263832

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D

Photo-identified Priority Species Individuals 2020

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HDR ID #	Species	Sighting Date(s)	Biopsy?	Satellite Tag? / Argos ID
HDRVABp087	*Balaenoptera physalus*	09-Feb-20	No	No
HDRVABp088	*Balaenoptera physalus*	09-Feb-20	No	No
HDRVABp089	*Balaenoptera physalus*	09-Feb-20	No	No
HDRVABp090	*Balaenoptera physalus*	09-Feb-20	No	No
HDRVAPm090	*Physeter macrocephalus*	13-May-20	Yes	SPLASH-10 / 177050
HDRVAPm091	*Physeter macrocephalus*	13-May-20	Yes	SPLASH-10 / 183914
HDRVAPm092	*Physeter macrocephalus*	13-May-20	No	No
HDRVAPm012	*Physeter macrocephalus*	13-May-20	Yes	Previously tagged (2018) 171884
HDRVAPm036	*Physeter macrocephalus*	13-May-20	Yes	SPLASH-10 / 183915
HDRVAPm037	*Physeter macrocephalus*	13-May-20	No	No
HDRVAPm093	*Physeter macrocephalus*	13-May-20	Yes	No
HDRVAPm094	*Physeter macrocephalus*	13-May-20	No	No
HDRVAPm095	*Physeter macrocephalus*	13-May-20	No	No
HDRVAZc002	*Cuvier's beaked whale*	8-Jun-20	No	No
HDRVAMm003	*True's beaked whale*	8-Jun-20	No	No
HDRVA Zc003	*Cuvier's beaked whale*	14-Jul-20	No	No
HDRVABp091	*Balaenoptera physalus*	14-Jul-20	No	No

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