Occurrence, Distribution, and Density of Marine Mammals Near Naval Station Norfolk and Virginia Beach, Virginia:

Final Report

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Cover Photo:

Bottlenose dolphins (*Tursiops truncatus*) observed on 05 September 2014, off the Virginia coast in the MINEX W-50 exercise area. Photographed by J. Aschettino. Photo taken under National Marine Fisheries Service Scientific permit no. 16239.

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Abstract

A combination of visual line-transect survey, photo-identification (photo-ID), and automated acoustic monitoring methods was used to gather important baseline information on the occurrence, distribution, and density of marine mammals near Naval Station Norfolk (NSN) and adjacent areas. The study area was designed to cover areas where United States Navy activity is substantial, including Chesapeake Bay waters near NSN and Joint Expeditionary Base Little Creek-Fort Story, as well as a Mine Exercise (MINEX) Area (W-50) in the Atlantic Ocean off the coast of Virginia Beach, Virginia. Sixty-one line-transect surveys were completed in two zones (INSHORE and MINEX) between August 2012 and August 2015, with 6,550 kilometers (km) and 349.6 hours completed on-effort. The majority of sightings were of bottlenose dolphins (*Tursiops truncatus*), although humpback whales (*Megaptera novaeangliae*), harbor porpoises (*Phocoena phocoena*), and short-beaked common dolphins (*Delphinus delphis*) were also sighted in the study area on occasion. In addition, loggerhead sea turtles (*Caretta caretta*), leatherback sea turtles (*Dermochelys coriacea*), and a Kemp's ridley sea turtle (*Lepidochelys kempii*) were sighted during surveys. Conventional line-transect analysis of bottlenose dolphin sightings showed both spatial and seasonal variation in density and abundance, with greatest density in the INSHORE zone during fall months. Densities in the INSHORE zone were calculated as 3.88 individuals per square kilometer (km^2) (abundance[N]=1,203) in fall, 0.63 individuals per km^2 (N=195) in winter, 1.00 individuals per km^2 (N=311) in spring, and 3.55 individuals per km^2 (N=1,101) in summer. Densities in the MINEX zone were calculated as 2.14 individuals per km^2 (N=1,277) in fall, 0.06 individuals per km^2 (N=37) in winter, 1.53 individuals per km^2 (N=913) in spring, and 1.39 individuals per km^2 (N=829) in summer. Twenty-seven photo-ID surveys were completed, and a photo-ID catalog was created using photos taken during both dedicated photo-ID and line-transect surveys through May 2014; it contains 878 identified individuals to date. Subsequent photos will continue to be added and analyzed. One hundred ten individuals were re-sighted; however, most re-sightings were less than 4 months and 30 km apart. Additional survey effort and further analysis will be required before any clear movement patterns can be determined. C-POD acoustic data-loggers were initially deployed at four sites throughout the study area to cover areas of high United States Navy activity. Bottlenose dolphins were detected in each deployment location during all deployments from August 2012 to December 2015. Though deployments did not provide consistent coverage in all seasons for all sites due to loss of gear, results from two deployment sites nearest to NSN showed a greater level of occurrence during fall months, and a diel pattern of occurrence with increased detections during nighttime hours for three deployment sites.

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Acronyms and Abbreviations

°	degree(s)
BSS	Beaufort Sea State
CV	Coefficient of Variation
DPM	detection-positive minutes
FS	Fort Story
hr	hour(s)
ID	identification
JEB	Joint Expeditionary Base
km	kilometer(s)
km^2	square kilometer(s)
LC	Little Creek
m	meter(s)
M/V	Motor Vessel
mm	millimeter(s)
min	minute(s)
MINEX	Mine Neutralization Exercise
MSM	Marine Species Monitoring
NM	nautical mile(s)
NMFS	National Marine Fisheries Service
NSN	Naval Station Norfolk
NVB	Norfolk-Virginia Beach
OPAREA	operating area
PAM	passive acoustic monitoring
Photo-ID	photo-identification
PSD	Perpendicular Sighting Distance
R/V	Research Vessel
U.S.	United States
VACAPES	Virginia Capes

1. Introduction

Bottlenose dolphins (*Tursiops truncatus*) are common in Chesapeake Bay and in waters off the Virginia coastline. These individuals are part of both the Western North Atlantic Southern Migratory Coastal Stock of bottlenose dolphins, which ranges in distribution in summer from Cape Lookout, North Carolina, to central Virginia; and the Western North Atlantic Northern Migratory Coastal Stock, which ranges from the Chesapeake Bay mouth to Long Island, New York, in the summer (Waring et al. 2014). These two stocks are managed by the National Marine Fisheries Service (NMFS). Total abundance of the Southern Migratory Coastal Stock is estimated at 9,173 dolphins (coefficient of variation [CV]=0.46), and the Northern Migratory Coastal Stock is estimated at 11,548 dolphins (CV=0.36, Waring et al. 2014). Significant seasonal fluctuations in bottlenose dolphin distribution and numbers exist in this area, with peak abundance occurring in late summer/early fall when water temperatures peak (Barco et al. 1999). Although previous work investigated metrics to estimate bottlenose dolphin abundance in this region (e.g., Blaylock 1988, Barco et al. 1999, Baker 2000), actual local abundance estimated in parts of this area of overlap between stocks is not thoroughly understood. For example, Blaylock (1988) estimated that there were on average 340 bottlenose dolphins in the Chesapeake Bay mouth and southern Virginia coast, but only one of 10 surveys used to generate this estimate included the Virginia coastline waters.

The waters off the Virginia coast are heavily utilized by the United States (U.S.) Navy due to the proximity of the world's largest naval installation (Naval Station Norfolk [NSN]), as well as Joint Expeditionary Base Little Creek-Fort Story (JEB-LC-FS), all located adjacent to Chesapeake Bay, and the Virginia Capes (VACAPES) operating area (OPAREA) Mine Neutralization Exercise (MINEX) training range (W-50). The VACAPES MINEX area is located in nearshore Atlantic waters, extending from approximately 6 kilometers (km) (3 nautical miles [NM]) to 27 km (15 NM) from shore.

Visual surveys and passive acoustic monitoring (PAM) were initiated in August 2012. The primary goal for the work was to provide a more complete assessment of the seasonal occurrence of bottlenose dolphins in the area (including calculated densities). The information will be used to allow the U.S. Navy to make more informed decisions on proposed training and testing activities in the area. Furthermore, baseline occurrence information can minimize potential effects on the marine mammals utilizing the area. Fieldwork for this project is now complete, and this final report describes the data, progress, and results from August 2012 through August 2015.

1.1 Project Objectives

The HDR Marine Species Monitoring (MSM) Team initiated a monitoring project in coastal waters around NSN, JEB-LC, JEB-FS, and the Virginia Beach waterfront, including the VACAPES MINEX W-50 training area. The main objective was to provide quantitative data and information on the seasonal occurrence, distribution, and density of marine mammals. The team emphasized working with local researchers and employing proven marine mammal monitoring and research techniques to accomplish the following:

1. Monthly systematic line-transect surveys to determine distribution and density/abundance of marine mammals in the vicinity of NSN, JEB-LC, JEB-FS, and the MINEX W-50 area.
2. Monthly photo-identification (photo-ID) surveys to determine site fidelity and distributional patterns of marine mammals using the areas listed above.
3. Supplemental visual surveys by deploying and retrieving four C-POD (www.Chelonia.co.uk) acoustic recording devices to monitor for dolphin echolocation clicks in specific locations.

1.2 Project Tasks

Task 1 – Vessel Line-transect Surveys. Monthly line-transect surveys were conducted (using NMFS' standard Distance sampling protocols, Jackson 2001) in coastal waters near NSN, outside of JEB-LC and JEB-FS, and along the beaches of Virginia Beach (including the VACAPES MINEX W-50 training area). The study area and zones were determined through coordination with the U.S. Navy Contracting Officer Representative.

Task 2 – Photo-identification Surveys. Monthly photo-ID surveys were completed in areas near NSN, JEB-LC, and JEB-FS. Priority was given to maximizing representation of individuals near the naval installations to allow for analysis of movement patterns in those areas.

Task 3 – C-POD Automated Acoustic Monitoring. C-PODs, automated acoustic monitoring detectors for echolocation clicks, were placed in areas of interest. Final locations were adjusted as advised by interested parties during the Virginia Marine Resources Commission permitting process and by the Contracting Officer Representative.

Task 4 – Data Analysis and Reporting. Line-transect survey data were analyzed for bottlenose dolphin density using the software program Distance 6.2 Release 1 (Thomas et al. 2010) to provide density estimates for the study area. An electronic photo-ID catalogue was prepared using images of bottlenose dolphins' dorsal fins to provide insight into stock structure. C-POD acoustic detection data were also analyzed for the relative presence of echolocation clicks.

2. Materials and Methods

2.1 Study Area

Norfolk and Virginia Beach border the southern end of Chesapeake Bay, and the coastline of Virginia Beach extends along the Atlantic Ocean (**Figure 1**). NSN, JEB-LC, JEB-FS, and the VACAPES MINEX W-50 training area (consisting of range boxes A, B, and C) east of Virginia Beach are within or adjacent to these waters. Within the study area: 1) construction is widespread, 2) military, commercial, and recreational vessels transit in large numbers, and 3) U.S. Navy training exercises occur on a regular basis.

Prior to initial surveys in 2012, two primary survey zones were established, as shown in **Figure 1**. Following supplementary information and input, and taking into account results from this study, the offshore zone was adjusted in March 2014 to optimize coverage. The amended zones are shown in **Figure 2**:

1. *COASTAL/INSHORE* – a 310.4-square kilometer (km^2) area covering a strip extending from shore out to 3.7 km (2.0 NM). The COASTAL/INSHORE zone includes the Chesapeake Bay waters near NSN, extends past JEB-LC and JEB-FS, and extends down the Atlantic coast towards the Virginia/North Carolina border.
2. *OFFSHORE/MINEX* – a 596.6-km^2 area covering Atlantic waters from 3.7 km (2.0 NM) to 25.7 km (13.9 NM) from shore. The OFFSHORE/MINEX zone includes nearly the entire VACAPES MINEX W-50a and W-50b training areas.

2.2 Methods – Vessel Line-transect Surveys

Line-transect surveys were scheduled for 2 full days (approximately 8–10 hours [hr]) each month (one for each survey zone) beginning in August 2012. Zig-zag transect lines were created to cover the 3.7-km (2.0-NM) INSHORE strip, and two alternating sets of five parallel transect lines were created to cover the MINEX W-50 range boxes (**Figure 2**). MINEX transect lines are 22 km (12 NM) in length and spaced at a distance of 5.4 km (2.9 NM) apart. Earlier in the study, transects for both survey areas were modified to better align with Navy training activity and address potential biases of the original design. The MINEX transect lines were shifted north and extended inshore to meet the INSHORE zone boundary. The INSHORE boundary did not change; however, the initial zig-zag pattern (**Figure 1**) of the INSHORE transects introduced a potential positive bias along the inside corners when compared to the outside of the corners, and the tighter grouping of lines on the Chesapeake Bay side of the area lead to uneven coverage (see Thomas et al. 2007). Adjustments were made with assistance from experts at the Centre for Research into Ecological and Environmental Modeling, using tools in the program DISTANCE 6.2 to reduce potential bias, while using as much of the earlier-collected data as possible in later analyses (**Figure 2**).

Departures were timed to maximize survey duration in daylight hours (approximately 1 hr after dawn through 1 hr before dusk) and optimal weather conditions (i.e., Beaufort Sea State [BSS] 0–3, no heavy rain, and visibility of greater than 1.8 km [1 NM]). Beginning and end times for the survey days were dependent on weather conditions and daylight available.

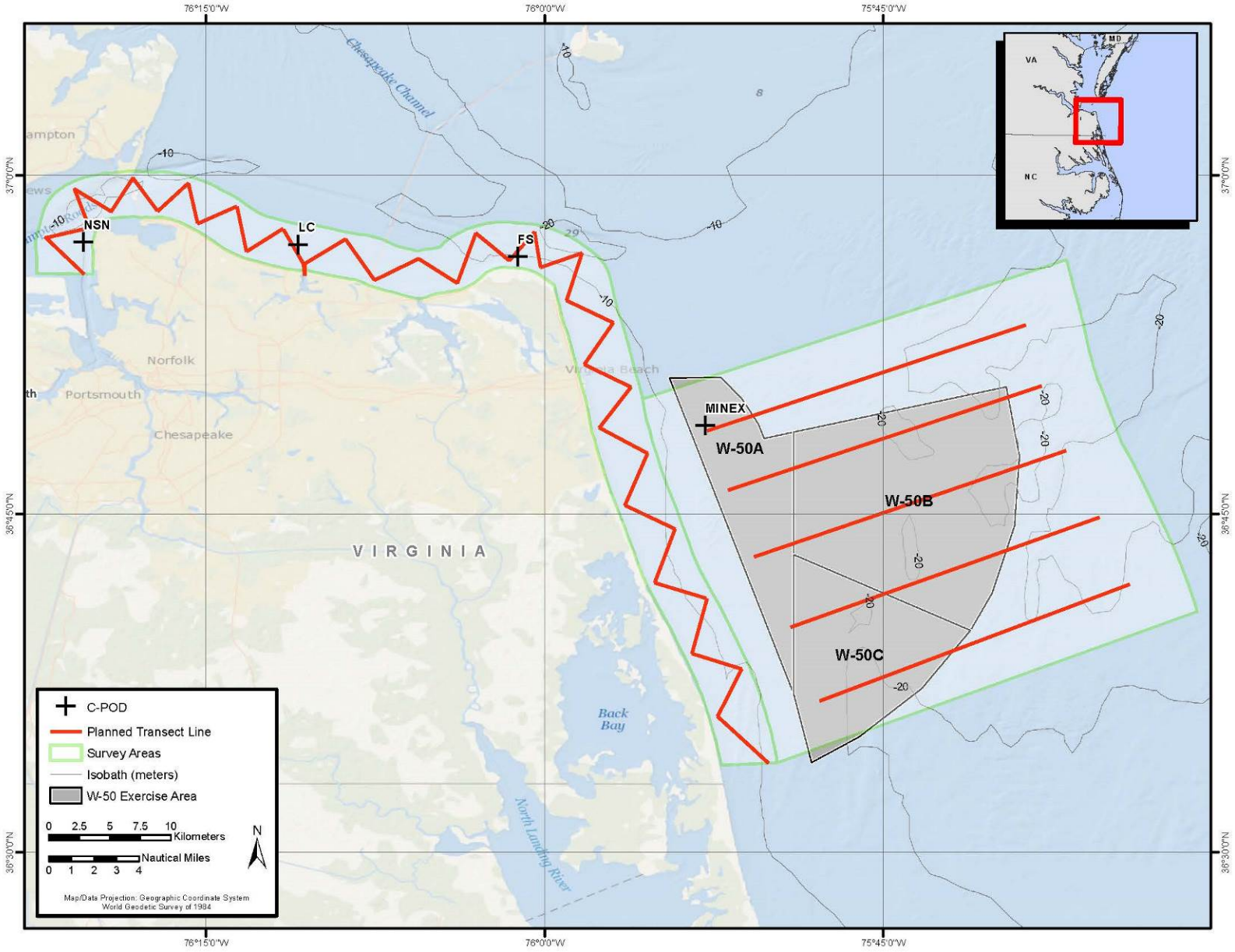

Figure 1. Study area delineated into COASTAL/INSHORE and OFFSHORE/MINEX zones with transect lines used for year 1 of study.

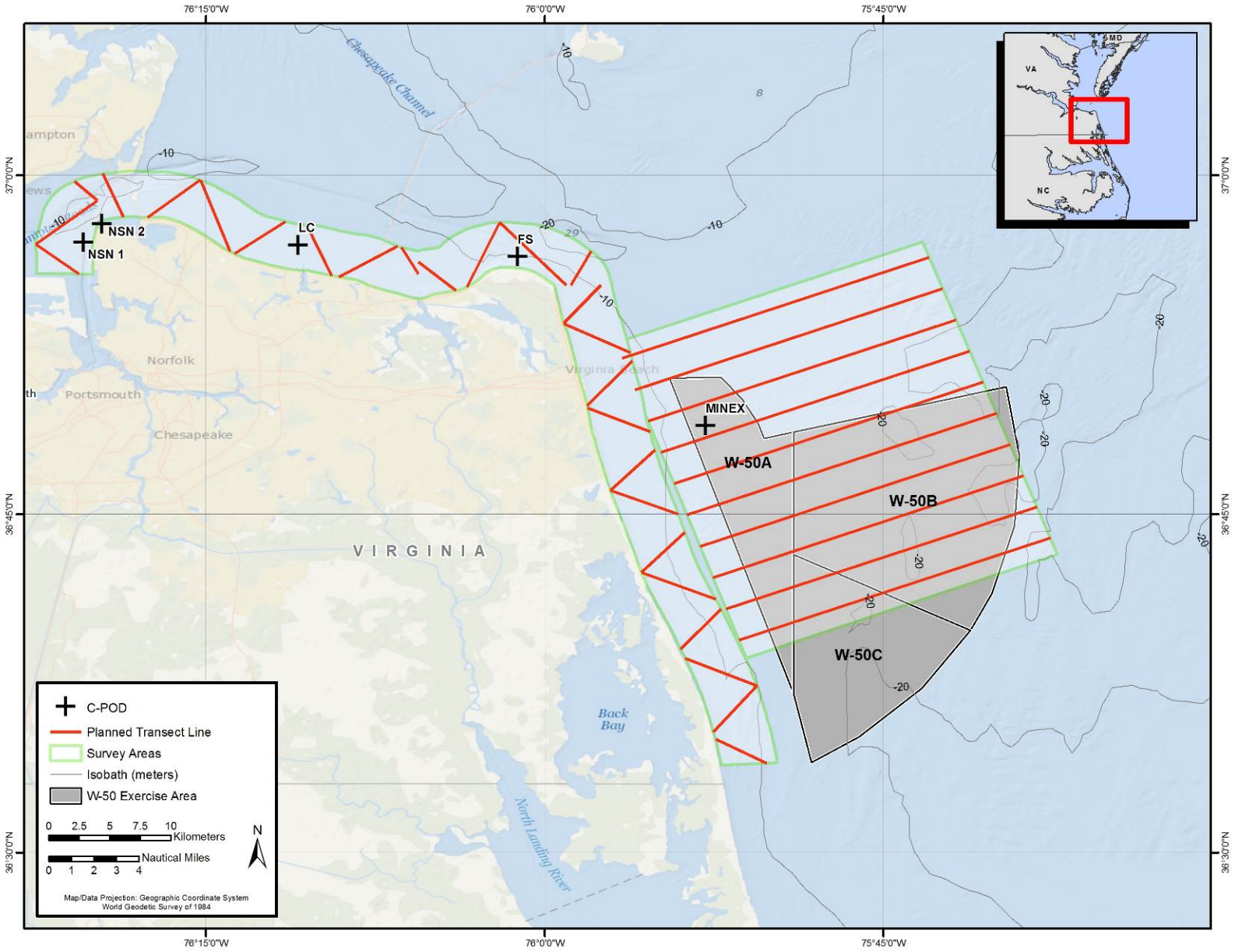

Figure 2. Revised transect lines for COASTAL/INSHORE and OFFSHORE/MINEX zones for years 2 and 3 of study.

Line-transect surveys were conducted using the Research Vessel (R/V) *Ocean Explorer*, Motor Vessel (M/V) *Flat Line*, and M/V *Matador*, which all possess elevated viewing platforms (**Figures 3, 4, and 5**). The height of the observers' eyes above the water's surface was approximately 4 meters (m). Three observers comprised the on-effort survey team. The vessel transited the survey lines at a constant speed of 15 to 19 km per hour (8–10 knots). The port observer searched for marine mammals continuously through Baker Marine 7 × 50 binoculars in the 100 degree (°) arc from 10° to 270° (all angles are given in relation to the bow, which is defined as 0°). The starboard observer searched for marine mammals continuously through 7 × 50 Baker Marine binoculars from 350° to 90°. The third on-effort observer searched primarily with the naked eye, to avoid missing groups near the trackline. This observer also served as the data recorder, logging data on a laptop computer using specialized software (e.g., Mysticetus, VisVessel, or WILD), and on hand-written data sheets as a means of back-up. The resulting search area covered by the three-person team included the bearings ahead of the vessel, between 90° and 270°, with a 20° overlap centered on the trackline. To minimize fatigue, observers rotated positions approximately every 30 minutes (min).

Effort data collected during on-effort survey periods included time and position for the start and end of search effort, BSS, visibility, presence and percentage of glare, and percent cloud cover. Survey software automatically recorded vessel speed and tracked position at 30-second intervals. When marine mammals were sighted, the monitoring team collected associated sighting data and, if necessary, the vessel diverted from its current course to approach the sighting to confirm group size estimates and species identification. A decision was made whether or not to obtain photographs based on time constraints and priority of completing trackline effort for the day. In these instances where the vessel left the track, the data recorder indicated in the software that the team went off-effort. The monitoring team also prioritized completing the tracklines within the available survey time each day over collecting additional ancillary data. Sighting information collected included data on initial sighting angle and distance, initial sighting position, environmental conditions, group size and composition, and behavior (e.g., response to the survey vessel). Sighting distances were calculated using reticles in the binoculars or by estimation if no horizon was visible. Location data and vessel speed were obtained from a Globalsat BU-353 or Garmin 78s global positioning system. Photographs were taken opportunistically during sightings (time permitting) using a Canon 7D digital camera with a 100- to 400-millimeter (mm) zoom lens or a 300-mm lens. Photographs of bottlenose dolphins were added to the photo-ID database described under Task 2. Humpback whale (*Megaptera novaeangliae*) photographs were sent to the Virginia Aquarium & Marine Science Center to contribute to their existing mid-Atlantic catalog through April 2014, and have also been incorporated into HDR's Virginia humpback catalog beginning in December 2014, which is shared with other Atlantic catalogs (e.g., Allied Whale). All sighting data are also uploaded to the Ocean Biogeographic Information System Spatial Ecological Analysis of Megavertebrate Populations database, managed by Duke University.

Figure 3. Transect survey vessel, the R/V *Ocean Explorer*.

Figure 4. Transect survey vessel, the M/V *Flat Line*.

Figure 5. Transect survey vessel, the M/V *Matador.*

2.2.1 Data Analysis

Conventional line-transect methods (also known as Conventional Distance Sampling or CDS) were used to analyze the vessel survey data (Buckland et al. 2001). Estimates of density and abundance (and their associated CV) were calculated using the following formulae:

$$\hat{D} = \frac{n\,\hat{f}(0)\,\hat{E}(s)}{2\,L\,\hat{g}(0)}$$

$$\hat{N} = \frac{n\,\hat{f}(0)\,\hat{E}(s)\,A}{2\,L\,\hat{g}(0)}$$

$$\hat{CV} = \sqrt{\frac{\hat{\text{var}}\,(n)}{n^2} + \frac{\hat{\text{var}}\,[\hat{f}(0)]}{[\hat{f}(0)]^2} + \frac{\hat{\text{var}}\,[\hat{E}(s)]}{[\hat{E}(s)]^2} + \frac{\hat{\text{var}}\,[\hat{g}(0)]}{[\hat{g}(0)]^2}}$$

Where,

D = density (of individuals),

n = number of on-effort sightings,

f(0) = detection function evaluated at zero distance,

E(s) = expected average group size (using size-bias correction in DISTANCE),

L = length of transect lines surveyed on effort,

g(0) = trackline detection probability,

N = abundance,

A = size of the study area,

CV = coefficient of variation, and

var = variance.

The detection function and encounter rates were calculated for bottlenose dolphins (the only species with enough sightings) using the software DISTANCE 6.2 using all on-effort data collected in BSS conditions of 0–3, which was considered acceptable sighting conditions. Estimates were not stratified by BSS or other environmental parameters, due to limited sample sizes. Stratified estimates of density and abundance (in terms of sighting rate and group size) were generated using three different schemes:

1) Stratification by season and main survey zone (producing eight separate estimates).

2) Stratification by warm- and cool-water periods (summer/fall and winter/spring, respectively) and survey zone (producing eight separate estimates).

3) Stratification by die-off time periods (Pre die-off = August 2012–April 2013, During = May 2013–April 2014, and Post die-off = May 2014–April 2015) and main survey area (producing six separate estimates). Categories were based on the peak of stranding numbers shown in July through March 2014 (NOAA Fisheries 2015).

Sighting rates and average group size were calculated separately for each stratum. Due to sample size considerations and the consistency of data collection across all years of the study, data were pooled from all strata to produce a single estimate of the detection function, f(0). The seasons were defined as spring (March–May), summer (June–August), fall (September–November), and winter (December–February).

To avoid potential overestimation of group size, the size-bias-adjusted estimate of average group size was calculated in DISTANCE. Group size for each estimate was calculated using a stratified approach (i.e., only groups from within a particular stratum were used to calculate average group size for that stratum).

Several approaches to truncation of the perpendicular sighting distance (PSD) data were tested and truncation at 0.32 km produced the PSD histogram with the best fit of the ‘shape criterion’ and lowest variance. The data were modeled using hazard rate (with cosine and simple polynomial adjustments) models; the model with the lowest value for Akaike’s Information Criterion was selected and used for the final estimates.

Data were not available to estimate trackline detection probability [g(0)] for this study, thus g(0) was assumed to equal 1.0. While this may not be strictly true, the study area is relatively shallow (< 20 m), and bottlenose dolphins do not normally conduct long, deep dives in such habitats. Therefore, if there is any bias resulting from the assumption of g(0) = 1.0, it should be minimal.

2.3 Methods – Photo-identification Surveys

Seven photo-identification surveys were conducted during the initial year of study (August, September, and October 2012, and May, June, July, and August 2013). Following the initial year, monthly photo-ID surveys throughout all seasons were planned. Departures by the HDR MSM Survey Team were timed for optimal light conditions for photography and optimal weather conditions (e.g., BSS 0–3, no heavy rain, and visibility of greater than 1.8 km [1 NM]).

The HDR MSM Survey Team first attempted systematic coverage of the NSN and JEB-LC nearshore areas using the small vessel M/V *Double OO's*, a 9.4-m center-console vessel (**Figure 6**) to collect data suited for mark-recapture population estimates. Although it was eventually determined that the significant seasonal fluctuation of dolphins in/out of the study area violates the assumption of geographic closure for conventional capture-recapture models (Wilson et al. 1999), and would not allow such analysis. As a result, it was decided that a more efficient use of time would be to extend the survey area towards JEB-FS and spend more time with dolphin groups rather than focusing on systematic coverage of the NSN and JEB-LC areas for photo-ID surveys. The vessel transited the nearshore waters at a speed of 13 to 15 km per hour (7–8 knots) while observers searched for marine mammals using Canon IS 10 × 30 binoculars and with the naked eye.

Figure 6. Primary photo-ID survey vessel, the *Double OO's*.

Upon sighting a group of dolphins, data were recorded on printed data sheets (see **Appendix A**), including group size estimates, species identification, initial behavioral category, sighting location, bottom depth, sea surface temperature, and frame numbers of photographs taken. Location data were obtained from a handheld Garmin global positioning system receiver. Photographs were taken during all sightings when possible using a Canon 7D digital camera with 100- to 400-mm zoom lens. Observers adjusted the amount of time spent with each group as necessary to obtain photographs of as many individuals within the group as possible, while allowing additional survey time to encounter other groups.

All photos taken were for identification purposes, and the photographer focused on a perpendicular angle of the dolphins' dorsal fins. Unique patterns of nicks and notches on the

trailing edge of the dorsal fins were used to identify individuals, a technique utilized by numerous researchers as first described by Würsig and Würsig (1977). Photos went through a process of digital sorting and cataloging, starting with the initial removal of poor-quality photos (i.e., out of focus, obscured fins, fins too far away, and non-distinguishable fins). The program ACDSee Pro (Versions 3-8) was used to crop, zoom, and sort the dorsal fin photos within each group sighting by matching up all duplicate photos of the same individual and choosing the best image to proceed to cataloging. The Norfolk-Virginia Beach (NVB) catalog was then created (also using ACDSee) by designating an ID number to each individual in a sighting group. For each subsequent group sighting, the images were first compared to each previously cataloged individual to see if it matched any of those fins before designating as a new individual and assigning an ID number. A spreadsheet was used to track additional details, such as latitude and longitude of the sighting; date and time of the sighting; the date the ID was added to the catalog; whether left, right or photos from both sides were obtained; and whether the ID was the original or if it was a within-year or between-year re-sighting.

2.4 Methods – C-POD Automated Acoustic Monitoring

C-PODs (www.chelonia.co.uk) were initially deployed at four locations known as NSN, JEB-LC, JEB-FS, and MINEX (**Figure 1**). Deployment locations were determined based on the likelihood of overlap between dolphin occurrence and Navy activities, including one unit within a relatively high-use portion of the MINEX W-50A area. Each C-POD was connected to a mooring via an EdgeTech (www.edgetech.com) acoustic release transponder (**Figure 7**). The initial deployment only used sand bags for moorings but concrete blocks were added for subsequent deployments. The units were recovered by programming the EdgeTech deck unit and associated hydrophone to communicate a release command down to the acoustic release, triggering a sacrificial block to unscrew, and allowing the unit to rise to the surface via attached flotation. Upon recovery, the memory card was extracted and data were sent to either Chelonia Limited or a recommended consultant for analysis. Units that were to be re-deployed were cleaned of extensive marine growth in addition to installing new batteries and blank memory cards.

The C-POD design aims to achieve fast results from a fully automated detection process, produce low false-positive rates (i.e., detection of a signal that was not actually produced), and possess high sensitivity (within approximately 1 km [0.54 NM]) and long running times of over 4 months. They act as “energy detectors” and do not make actual acoustic recordings, but trigger the instrument to log events occurring between 20 and 160 kilohertz. Finely tuned filters on the processing boards categorize the clicks produced by larger toothed whales, dolphins, and porpoises.

Automated detections are achieved by identifying trains of echolocation clicks. With custom Chelonia C-POD analysis software, sonar activity from triggered events logged on the C-POD can be identified by characteristic frequency components and signal timing. Features such as click duration, peak frequency, inter-click-interval, and spectral characteristics can all be used to classify clicks and click trains, frequently to the species level.

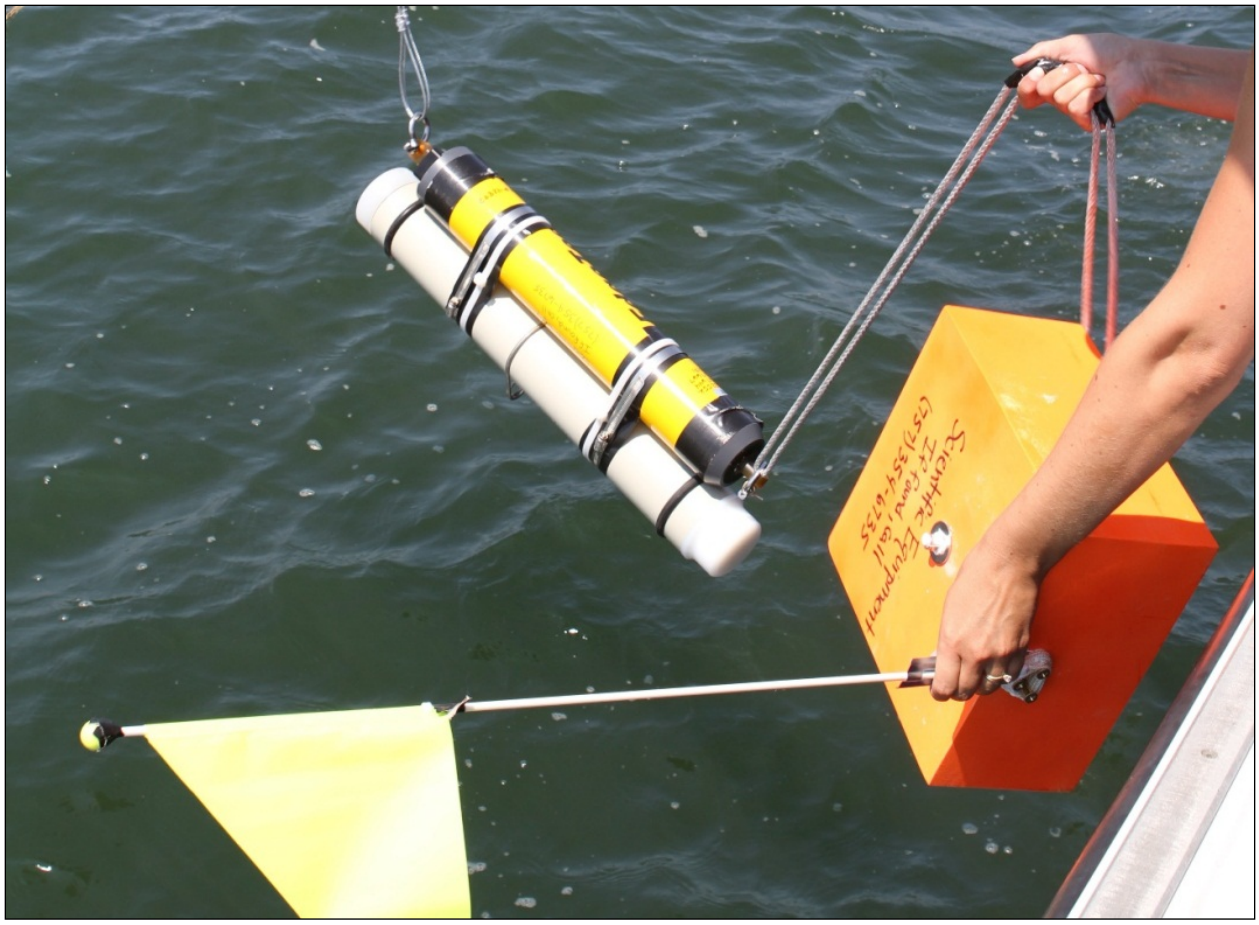

Figure 7. A C-POD unit prepped and in the process of deployment.

As with all automated acoustic techniques, misclassifications and false detections are inevitable, and determining an acceptable error rate is essential. As an additional quality control step, HDR worked with an independent contractor to evaluate the data from each C-POD deployment. It was determined that less than 5 percent of all detection positive-minutes (DPM) had a chance of containing false positives for dolphin classification. Reported values of DPM results are inclusive of both false detections and missed detections given that they are within an acceptable rate of error for both.

3. Line-transect Survey Results

3.1 Visual Survey Effort

Thirty-three INSHORE line-transect surveys and 28 MINEX line-transect surveys were completed between August 2012 and August 2015 covering a total of 6,550 km (3,537 NM) and 20,976 min on-effort. The total on-effort distance and time spent in the INSHORE zone was 3,634 km (1,962 NM) and 11,569 min, respectively (**Table 1**), while 2,916 km (1,575 NM) and 9,407 min of on-effort time was spent in the MINEX zone (**Table 2**). Details on each survey day's track and sightings are provided in **Appendix B**.

Table 1. Summary of INSHORE line-transect surveys, August 2012–August 2015.

Date	Start Time (local)	Stop Time (local)	Total Survey (min)	Total On-Effort (min)	On-Effort Distance (km)
07 Sep 2012	8:08	15:15	428	313	98.1
03 Oct 2012	8:03	15:37	455	428	129.6
27 Nov 2012	6:27	16:16	588	384	118.3
09 Jan 2013	7:06	16:37	571	331	132.4
22 Feb 2013	7:52	16:29	517	373	110.3
01 Apr 2013	8:27	16:16	469	400	123.2
28 Apr 2013	7:45	15:37	471	416	127.1
09 May 2013	9:18	17:46	508	396	124.4
17 Jul 2013	6:40	16:01	560	375	124.7
24 Jul 2013	6:16	16:52	636	415	129.2
13 Aug 2013	6:56	15:54	538	357	111.6
25 Sep 2013	7:08	18:22	674	397	121.3
17 Oct 2013	7:21	17:18	596	389	124.7
16 Nov 2013	6:46	16:40	593	389	123.9
15 Jan 2014	7:47	17:07	560	344	105.7
07 Feb 2014	7:23	17:20	597	367	114.7
23 Feb 2014	7:17	15:54	577	353	109.1
02 Apr 2014	6:44	17:58	674	346	104.0
10 Apr 2014	6:03	17:00	657	342	109.1
03 May 2014	6:14	16:17	603	341	107.4
26 Jun 2014	7:04	17:16	611	346	105.0
30 Jul 2014	6:41	17:14	632	333	104.9
30 Sep 2014	6:14	16:28	608	375	112.1
10 Oct 2014	6:03	15:21	558	334	107.8
23 Nov 2014	6:47	16:24	577	276	87.1
31 Dec 2014	7:14	16:42	568	362	79.7
22 Jan 2015	7:58	16:40	522	214	62.4
09 Feb 2015	6:11	15:27	557	243	80.0
09 Mar 2015	7:03	17:21	618	341	106.9
05 Apr 2015	6:17	16:16	599	353	110.1
04 May 2015	6:33	16:14	581	298	108.6
23 Jul 2015	7:16	17:24	608	301	113.2
14 Aug 2015	6:11	16:12	600	337	107.7
Total			**18,911 (315.2 hr)**	**11,569 (192.8 hr)**	**3,634.3 km**

Table 2. Summary of MINEX line-transect surveys, August 2012 – August 2015.

Date	Start Time (local)	Stop Time (local)	Total Survey (min)	Total On-Effort (min)	Trackline On-Effort Distance (km)
08 Aug 2012	7:37	15:46	488	400	111.2
23 Oct 2012	7:13	14:34	441	343	111.3
10 Nov 2012	7:10	14:15	426	334	108.2
03 Jan 2013	7:55	15:44	469	303	94.9
23 Mar 2013	8:29	16:02	453	330	108.8
31 May 2013	11:18	16:07	289	204	67.2
22 Jul 2013	6:16	16:15	559	331	106.0
27 Jul 2013	6:20	16:26	606	348	112.4
19 Aug 2013	6:19	14:59	520	256	80.3
28 Oct 2013	6:57	15:24	507	361	112.0
30 Oct 2013	7:29	16:18	529	369	112.2
28 Dec 2013	7:06	17:08	602	380	116.2
09 Jan 2014	7:04	16:17	553	362	113.1
25 Feb 2014	7:15	15:38	503	264	77.2
25 May 2014	6:42	15:56	554	371	108.8
16 Jun 2014	6:05	15:29	564	363	111.3
16 Aug 2014	6:40	17:53	673	391	110.0
05 Sep 2014	6:18	15:44	567	359	111.0
20 Oct 2014	6:12	15:18	546	312	89.0
16 Nov 2014	6:31	15:15	525	379	110.8
21 Dec 2014	7:21	16:32	552	345	109.2
11 Jan 2015	8:49	17:31	525	284	89.7
11 Apr 2015	7:07	17:53	646	324	91.2
17 Apr 2015	7:07	16:10	544	350	111.1
18 May 2015	9:08	17:33	505	339	109.1
16 Jun 2015	6:02	14:19	496	352	111.5
05 Jul 2015	6:32	14:38	487	352	110.9
01 Aug 2015	6:05	14:09	483	301	111.4
Total			**14,612 (243.5 hr)**	**9,407 (156.8 hr)**	**2,916.0 km**

3.2 Sightings

A total of 546 sightings of marine mammals and 111 sightings of sea turtles was recorded during transect surveys from August 2012 through August 2015 (**Figures 8 and 9, Table 3, Appendices C and D**). Actual animal locations are calculated by VisVessel, Mysticetus, and WILD software, using the input values for bearing to the individual or group and a measure of distance (either calculated from the reticle reading from the handheld binoculars or estimation of distance when no horizon was visible). The vast majority (94.6 percent; *n*=517 of 546) of marine mammal sightings were of bottlenose dolphins; the other species sighted included 26 sightings of humpback whales, one group of harbor porpoises (*Phocoena phocoena*), one group of short-beaked common dolphins (*Delphinus delphis*), and one group of unidentified dolphins.

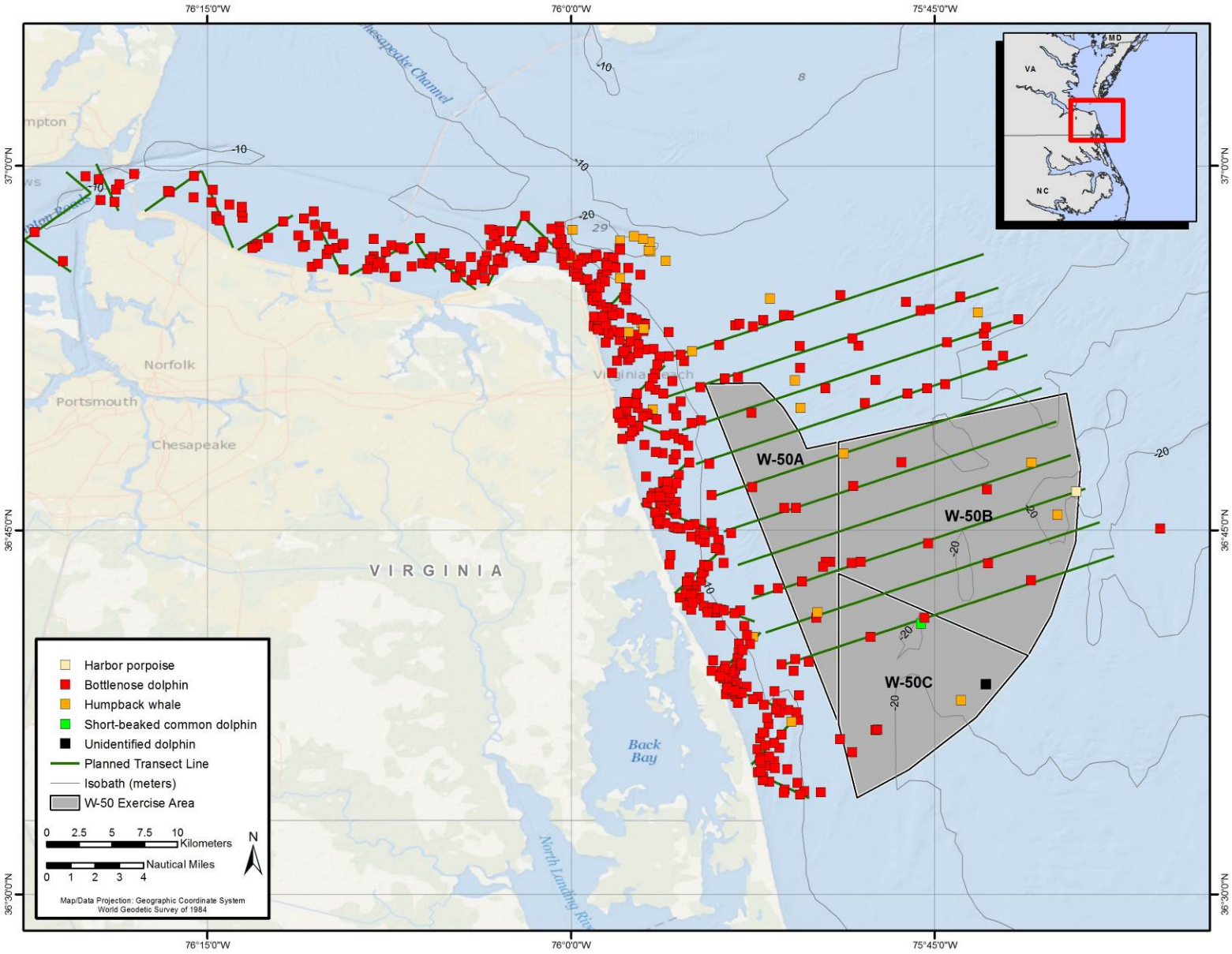

Figure 8. Marine mammal sightings during all line-transect surveys between August 2012 and August 2015.

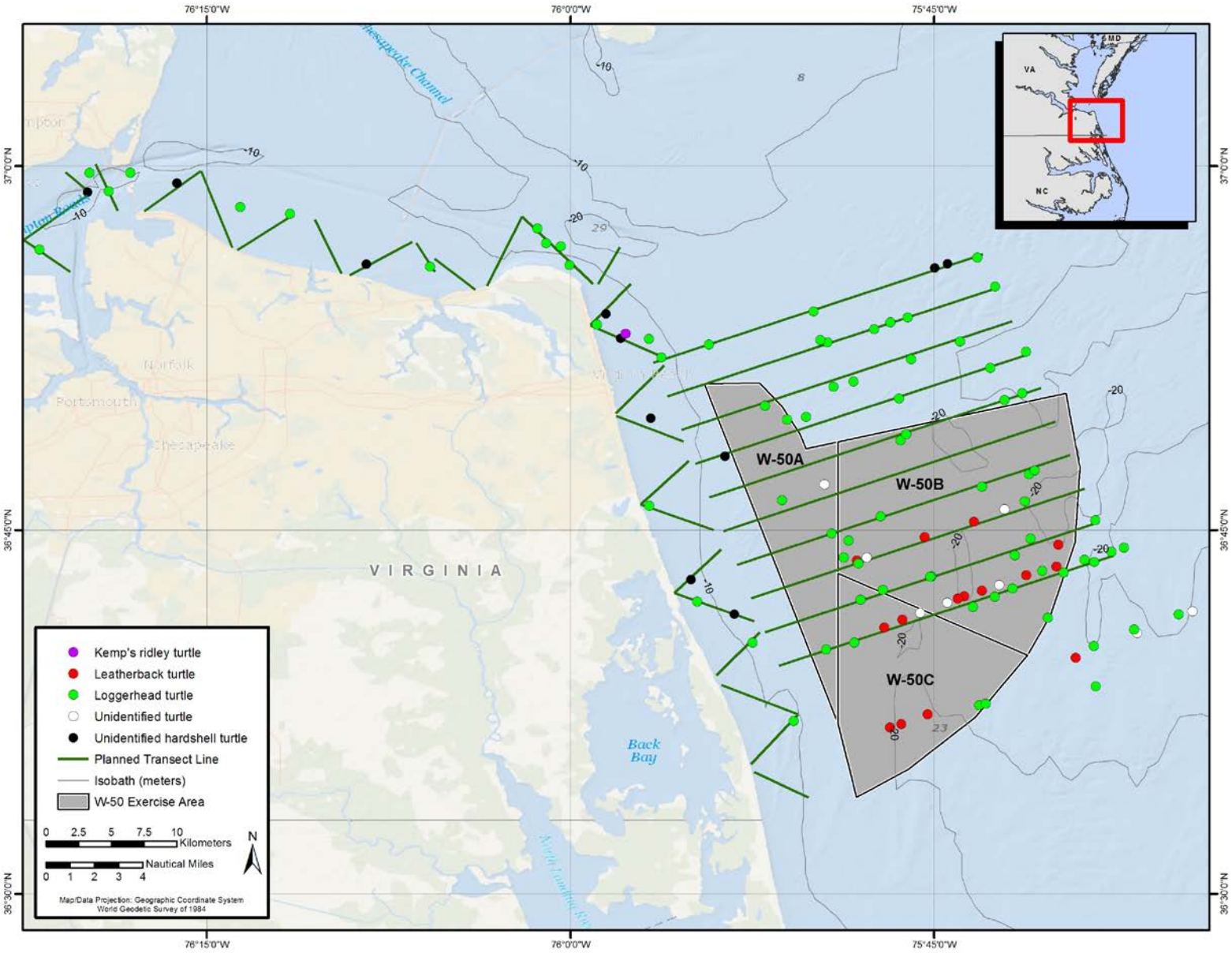

Figure 9. Sea turtle sightings during all line-transect surveys between August 2012 and August 2015.

Table 3. Marine mammal and sea turtle sighting summary – August 2012 through August 2015.

Zone	Season	No. Survey Days	Distance On-Effort (km)	No. Cetacean Sightings	Total No. Cetacean Individuals*	No. Sea Turtle Sightings	Total No. Sea Turtle Individuals*
INSHORE	Fall	9	1022.9	227	2550	9	9
INSHORE	Winter	8	794.3	30	318	0	0
INSHORE	Spring	9	1020.8	65	710	0	0
INSHORE	Summer	7	796.3	133	2198	18	18
MINEX	Fall	7	754.5	26	493	14	14
MINEX	Winter	6	600.3	9	25	0	0
MINEX	Spring	6	596.2	33	366	20	20
MINEX	Summer	9	965.0	23	291	50	50

*Total individuals are sum of best group size estimate

The unidentified dolphins had a similar shape to the short-beaked common dolphins, but the observer team was unable to re-sight the group to confirm species identification. Ninety-one marine mammal groups were sighted in the MINEX zone, while 455 were sighted in the INSHORE zone. Seventy-six of the sea turtle sightings were loggerhead turtles (*Caretta caretta*), 15 were leatherback turtles *(Dermochelys coriacea*), one was a Kemp's ridley turtle (*Lepidochelys kempii*), 8 were unidentified sea turtles (possible leatherbacks), and 11 were unidentified hardshell turtles. Eighty-four sightings were made in the MINEX zone and 27 in the INSHORE zone.

Appendices C and D list all sightings and associated data, including whether ID photos were collected. Photos taken of bottlenose dolphins were added to the NVB bottlenose dolphin catalog, and humpback whale sightings and photographs were added to the Virginia catalog created for the Mid-Atlantic Humpback Whale Project.

3.3 Density Estimates

Estimates of density and abundance were calculated for bottlenose dolphins using 413 sightings and 3,535.3 km (1,909 NM) of line-transect survey effort in the INSHORE zone, and 77 sightings and 2,478.3 km of effort in the MINEX zone. The detection function was modeled using the hazard rate key function, with a cosine adjustment. The calculated value of f(0) was 6.4689 (CV=11.2%), and the effective strip width (1/f(0)) was 155 m. The histogram of perpendicular sighting distances and fitted model are shown in **Figure 10**. Line-transect parameters and resulting estimates for the three stratification schemes are provided in **Tables 4, 5, and 6**.

Sightings of humpback whales (*n*=26; across fall, winter, and spring months), short-beaked common dolphins (*n*=1; spring months only), and harbor porpoises (*n*=1; spring months only) were also made during the surveys, but the sample sizes were too small for these species to produce reliable estimates of density or abundance. **Figures 11 through 18** show the sighting locations of all on-effort bottlenose dolphin sightings for each season in which observations occurred.

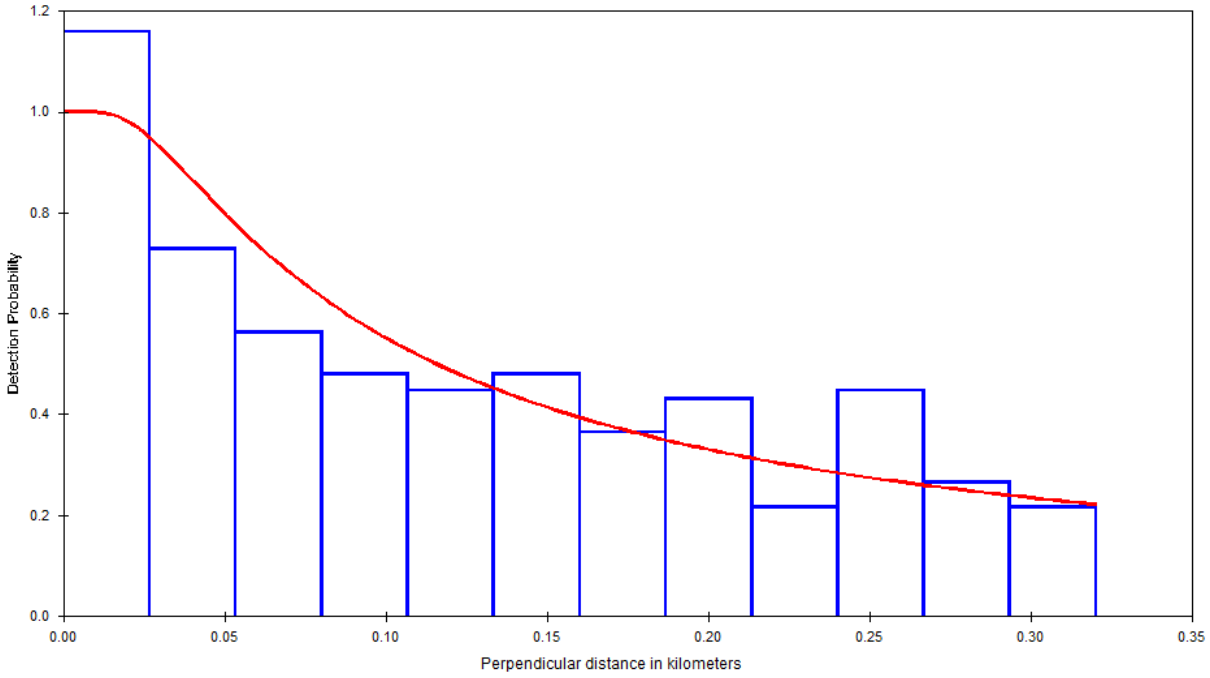

Figure 10. Perpendicular distance histogram and fitted detection function for bottlenose dolphins.

Table 4. Line-transect parameters and estimates of density and abundance for bottlenose dolphins in different zones and seasons.

Zone	Season	No. Sightings*	Effort (km)	Avg. Grp. Size	Stg. Rate§	Density#	Abundance	CV†
INSHORE	Fall	142	989	8.3	0.144	3.88	1,203	25%
INSHORE	Winter	15	792	10.3	0.019	0.63	195	63%
INSHORE	Spring	48	1001	6.4	0.048	1.00	311	32%
INSHORE	Summer	97	748	8.5	0.130	3.55	1,101	22%
MINEX	Fall	12	658	17.7	0.018	2.14	1,277	91%
MINEX	Winter	1	471	9.0	0.002	0.06	37	124%
MINEX	Spring	22	507	10.9	0.043	1.53	913	38%
MINEX	Summer	13	842	13.3	0.015	1.39	829	69%

* After truncation

§ Measured as individuals per linear km

Measured as individuals per km^2

† Coefficient of Variation

Table 5. Line-transect parameters and estimates of density and abundance for bottlenose dolphins in different areas and seasons. CB = Chesapeake Bay, CH = Cape Henry, OC = Outer Coast.

Zone	Season	No. Sightings*	Effort (km)	Avg. Grp. Size	Stg. Rate§	Density#	Abundance	CV†
Inshore-CB	Su/F	28	640	9.8	0.04	1.38	145	43%
Inshore-CH	Su/F	99	474	9.3	0.21	6.26	479	32%
Inshore-OC	Su/F	112	645	7.9	0.17	4.46	576	20%
Inshore-CB	W/Sp	7	659	14.1	0.01	14.37	1,506	123%
Inshore-CH	W/Sp	17	474	6.1	0.04	0.71	54	51%
Inshore-OC	W/Sp	39	747	6.1	0.05	1.03	133	33%
MINEX	Su/F	25	1,500	15.4	0.02	1.31	784	51%
MINEX	W/Sp	23	978	10.3	0.02	0.78	468	43%

* After truncation

§ Measured as individuals per linear km

Measured as individuals per km^2

† Coefficient of Variation

Table 6. Line-transect parameters and estimates of density and abundance for bottlenose dolphins with stratification by die-off time periods (Pre die-off = August 2012-April 2013, During = May 2013-April 2014, and Post die-off = May 2014-April 2015) and main survey area in different zones and seasons.

Zone	Season	No. Sightings*	Effort (km)	Avg. Grp. Size	Stg. Rate§	Density#	Abundance	CV†
Inshore	Pre	69	815	6.0	0.09	1.64	509	32%
Inshore	During	96	1366	13.0	0.07	2.96	920	28%
Inshore	Post	93	1035	7.0	0.09	2.03	629	21%
MINEX	Pre	1	350	5.0	0.00	0.05	28	103%
MINEX	During	4	734	13.0	0.01	0.78	466	133%
MINEX	Post	32	955	15.6	0.03	1.86	1112	40%

* After truncation

§ Measured as individuals per linear km

Measured as individuals per km^2

† Coefficient of Variation

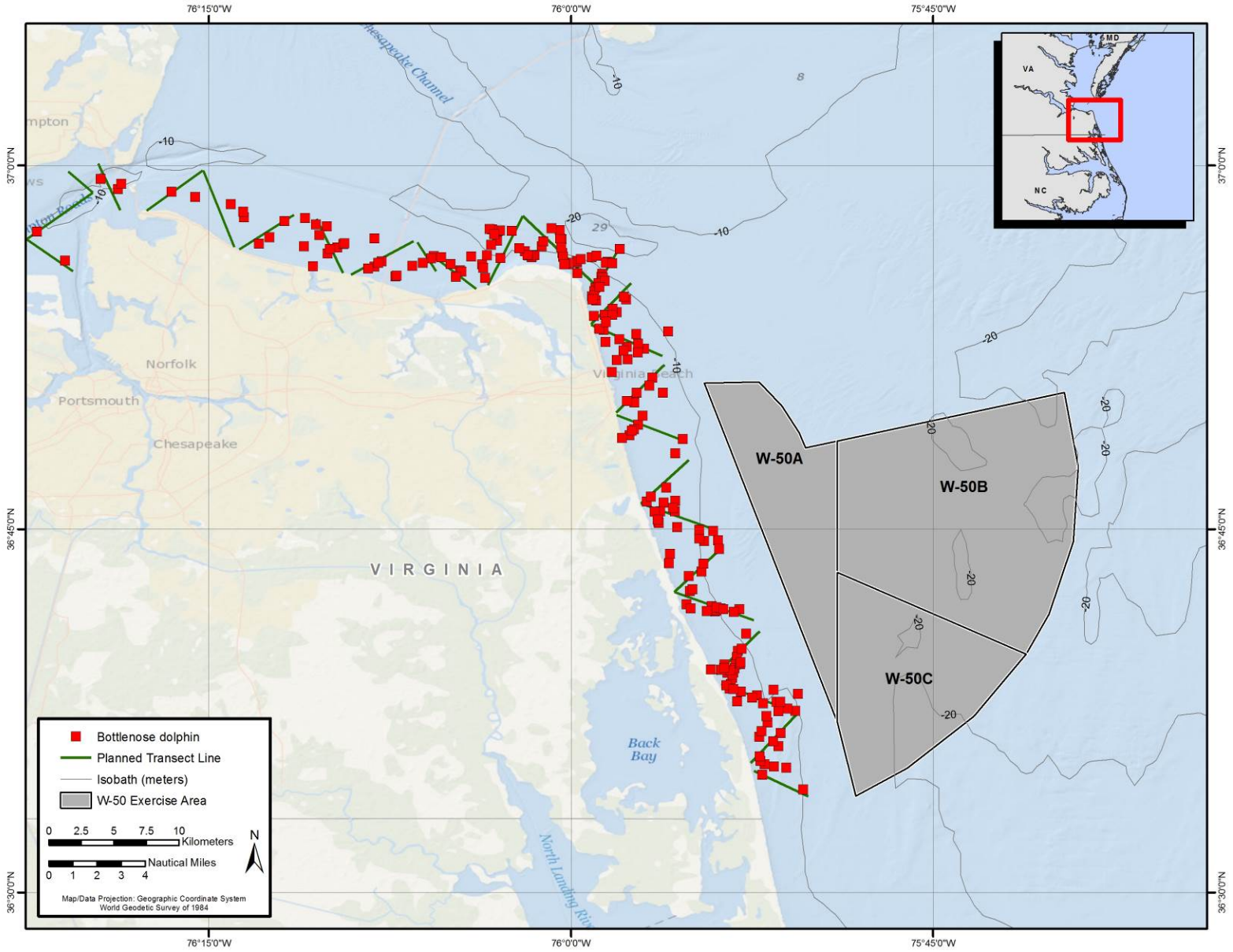

Figure 11. Bottlenose dolphin groups sighted on-effort during fall INSHORE line-transect surveys between August 2012 and August 2015.

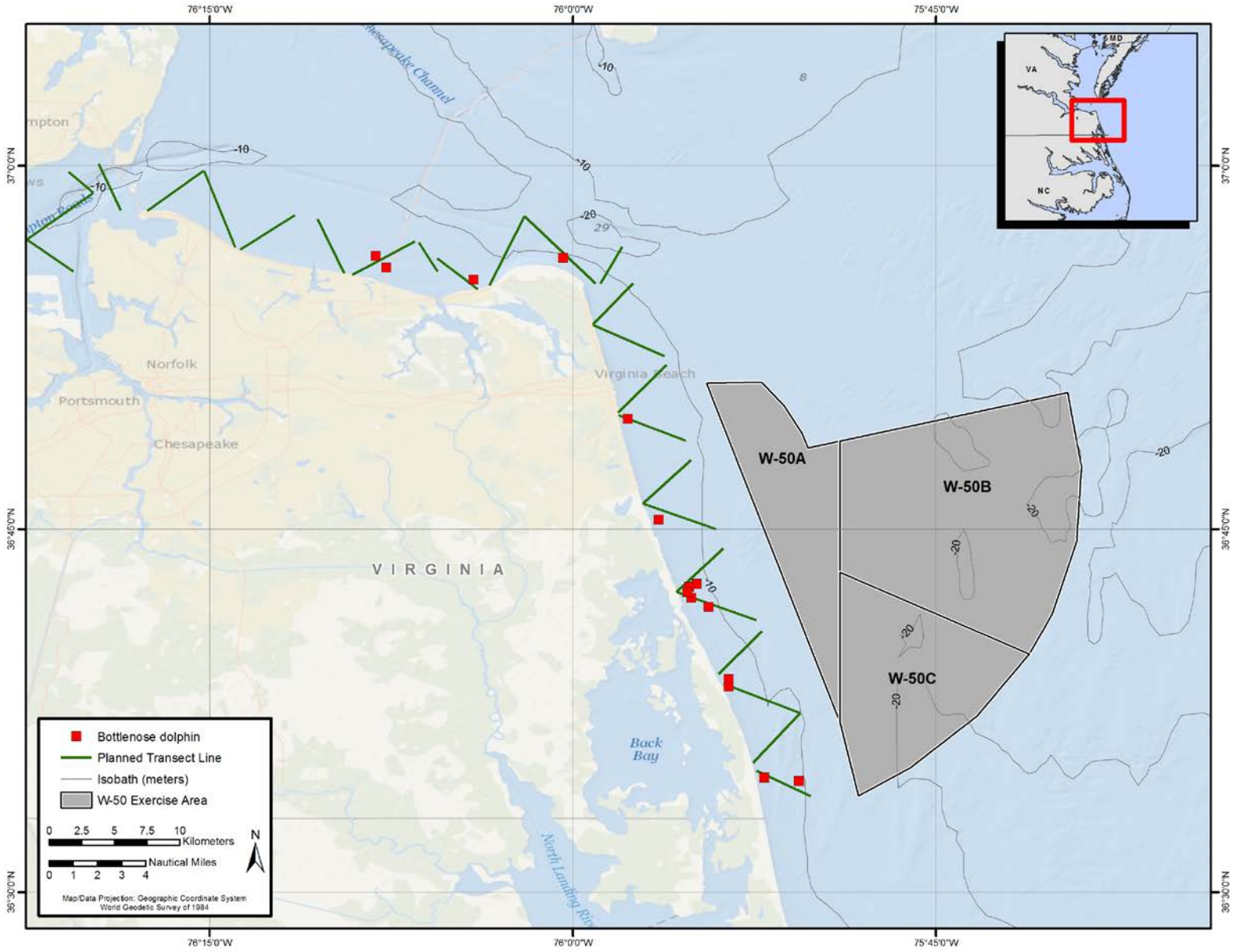

Figure 12. Bottlenose dolphin groups sighted on-effort during winter INSHORE line-transect surveys between August 2012 and August 2015.

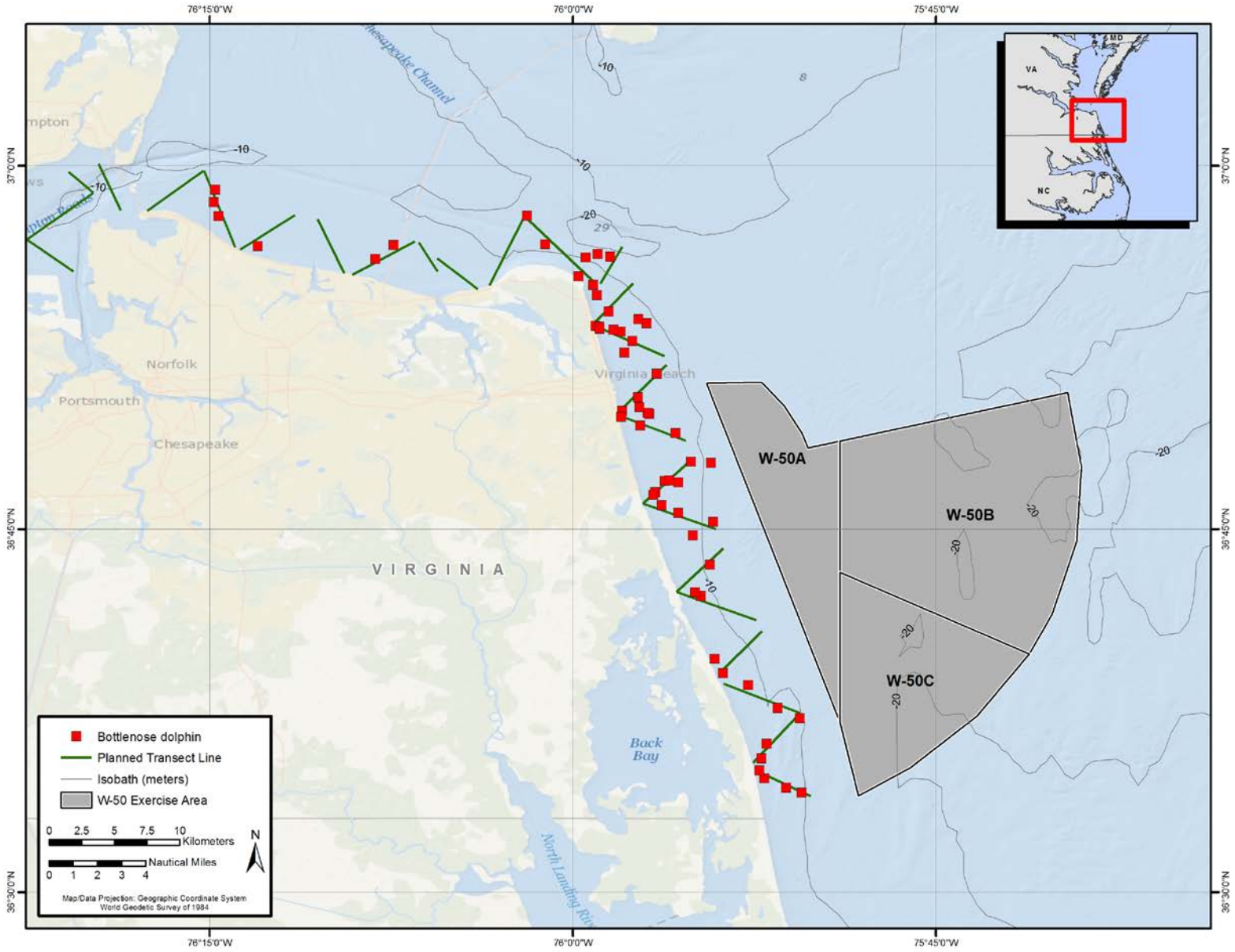

Figure 13. Bottlenose dolphin groups sighted on-effort during spring INSHORE line-transect surveys between August 2012 and August 2015.

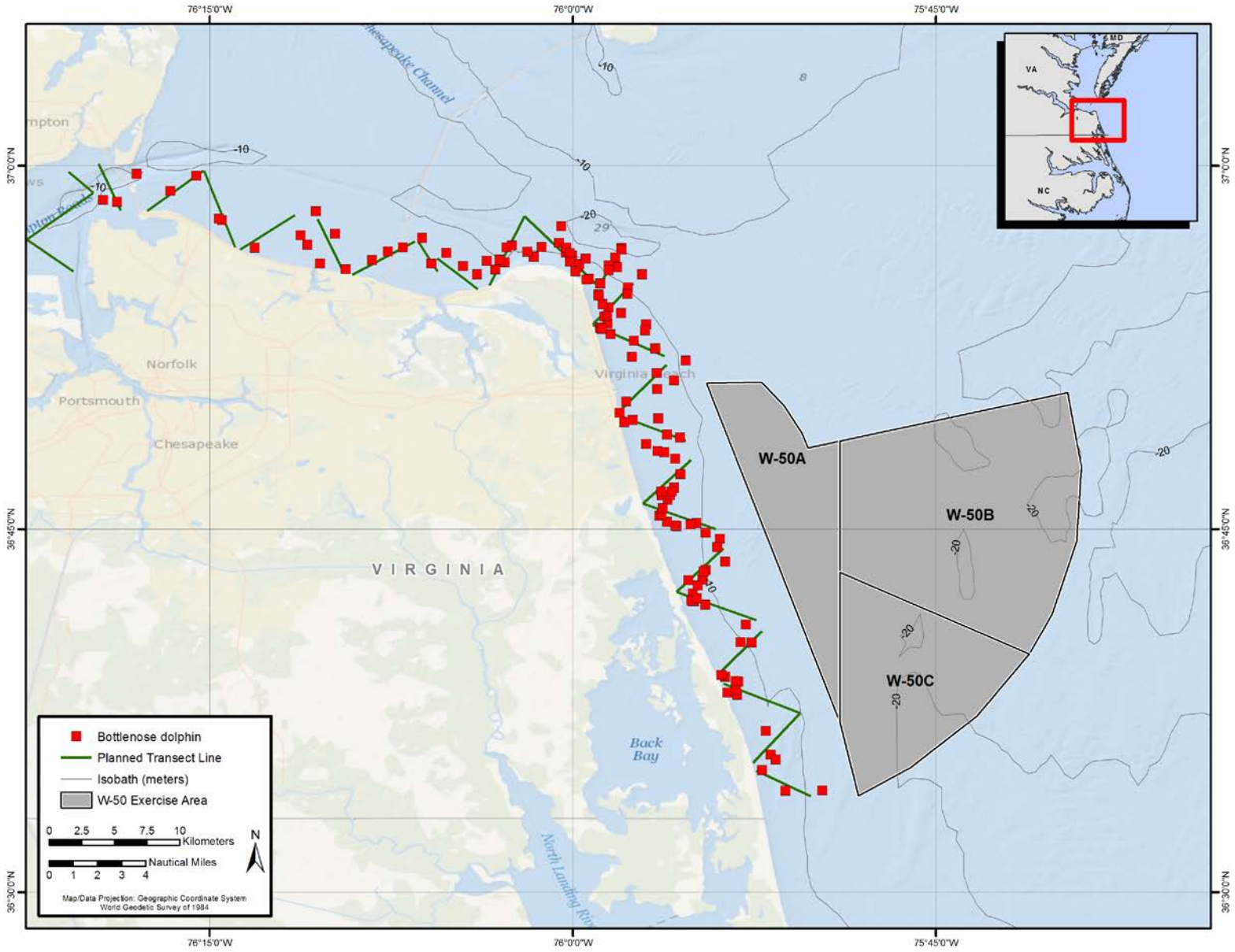

Figure 14. Bottlenose dolphin groups sighted on-effort during summer INSHORE line-transect surveys between August 2012 and August 2015.

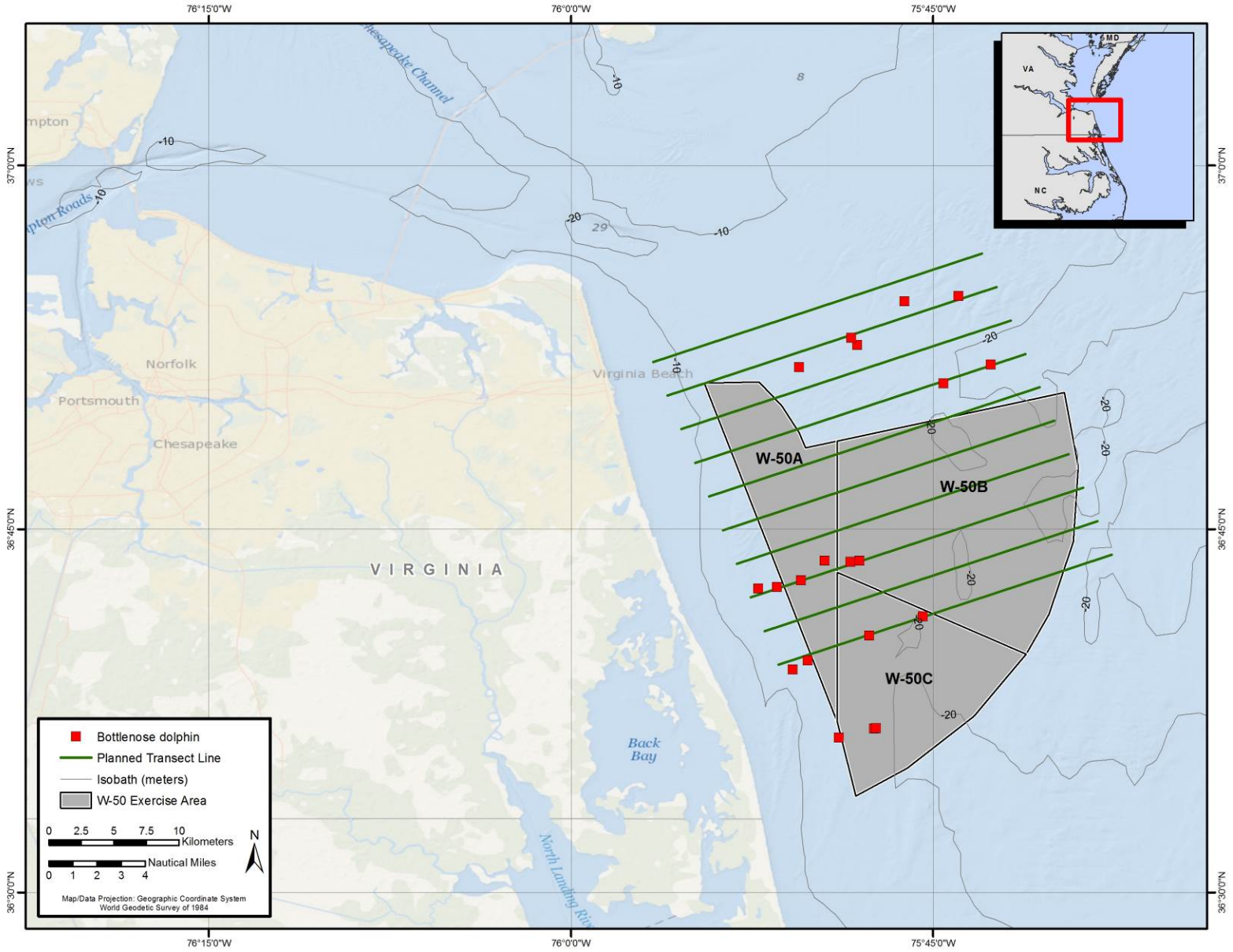

Figure 15. Bottlenose dolphin groups sighted on-effort during fall MINEX line-transect surveys between August 2012 and August 2015.

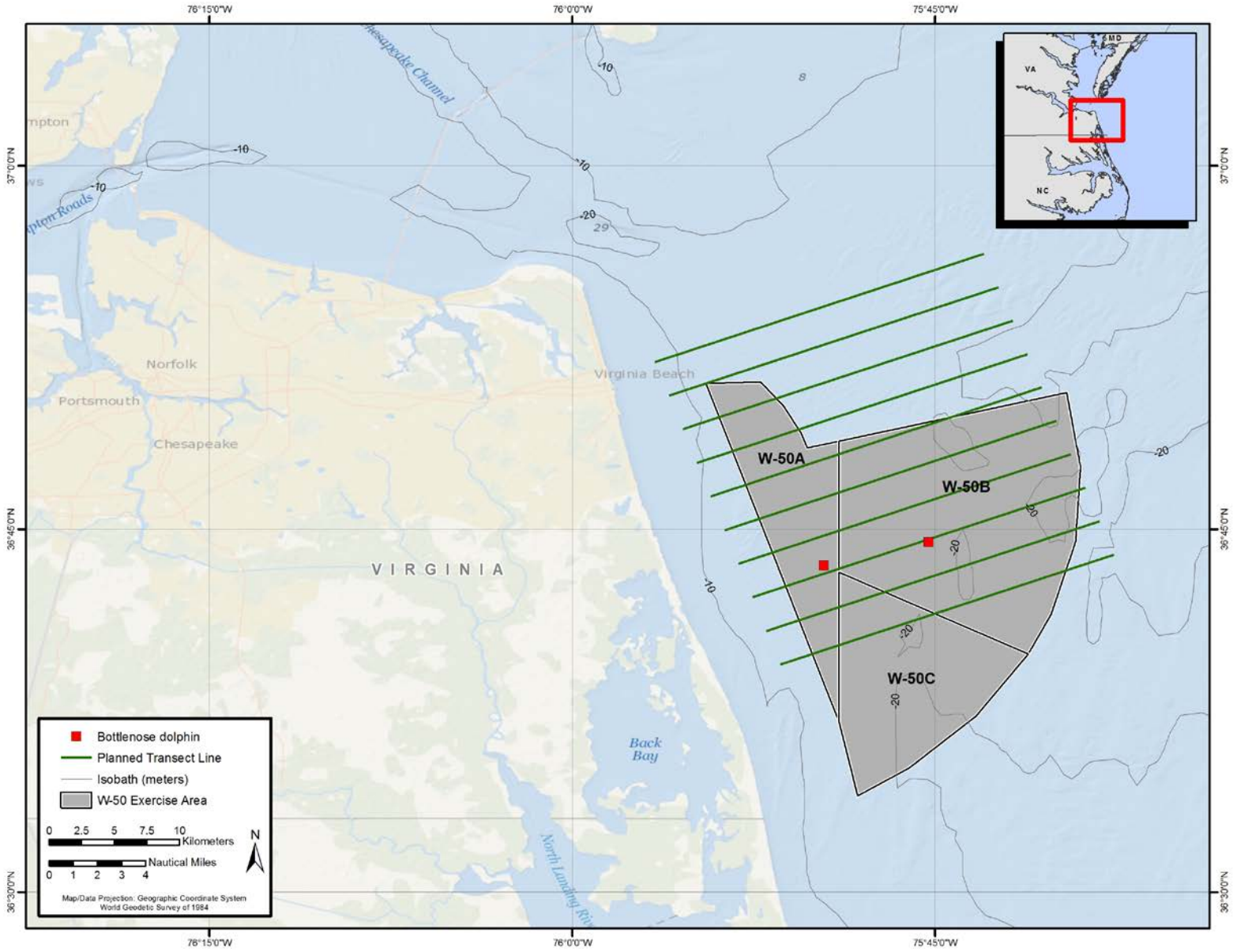

Figure 16. Bottlenose dolphin groups sighted on-effort during winter MINEX line-transect surveys between August 2012 and August 2015.

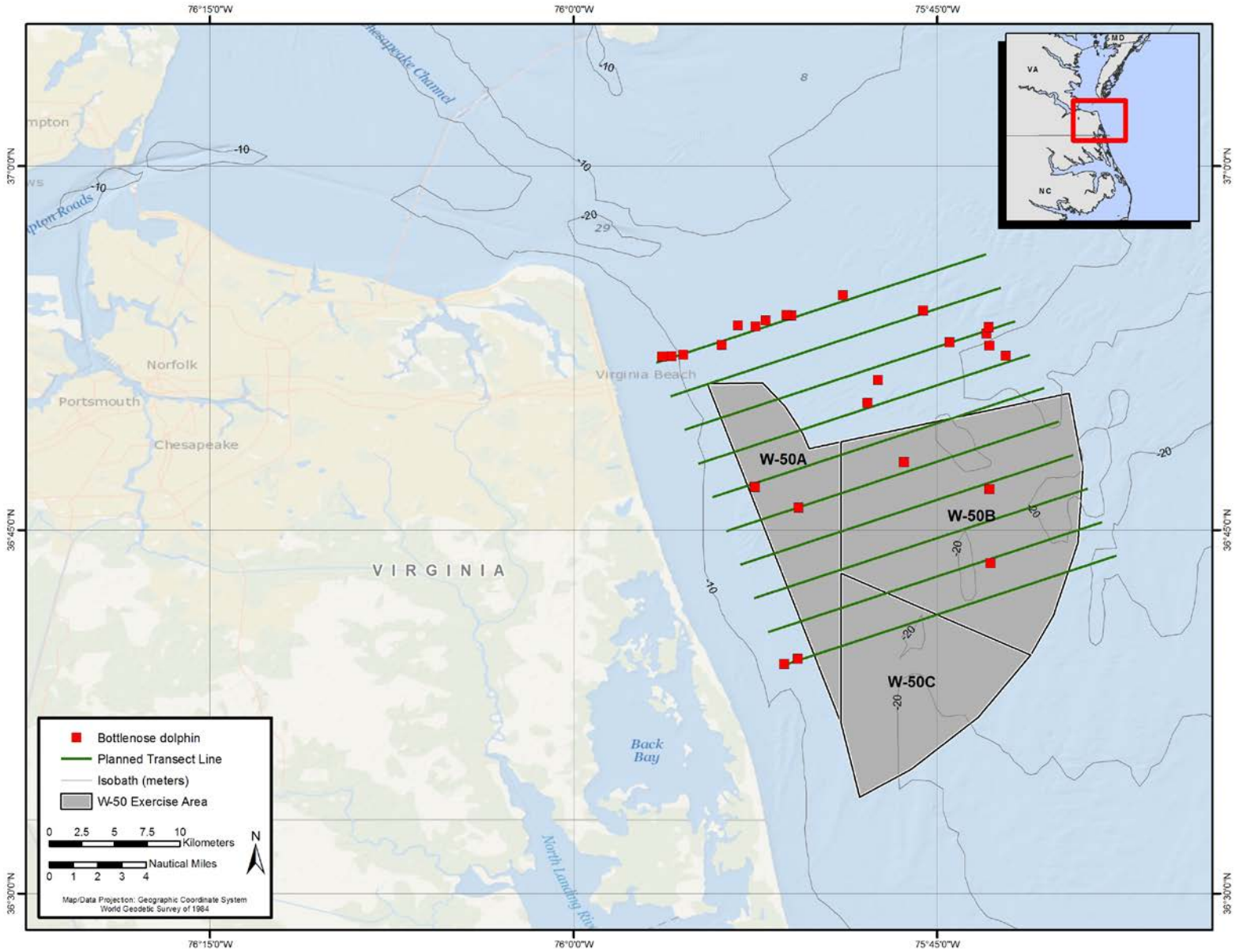

Figure 17. Bottlenose dolphin groups sighted on-effort during spring MINEX line-transect surveys between August 2012 and August 2015.

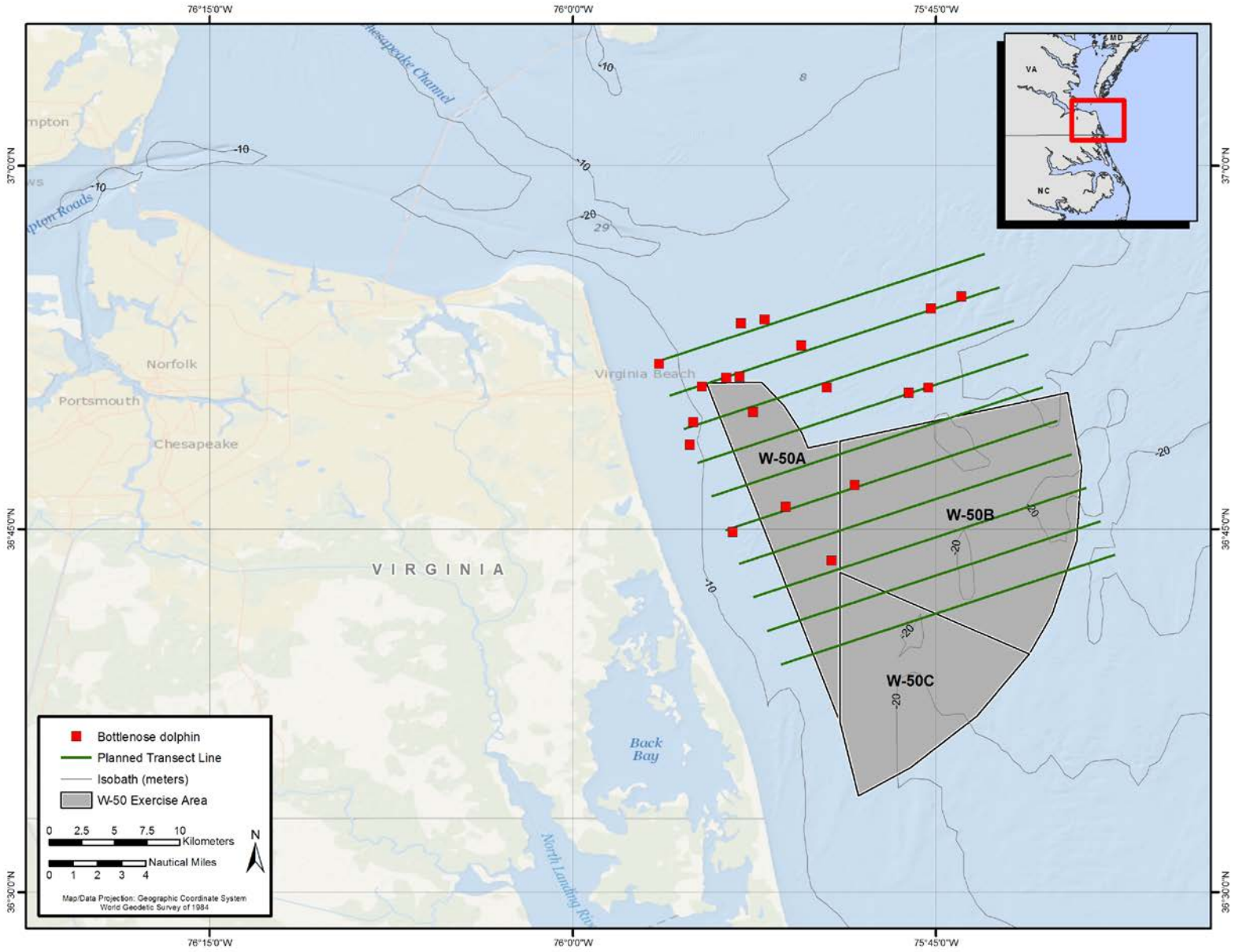

Figure 18. Bottlenose dolphin groups sighted on-effort during summer MINEX line-transect surveys between August 2012 and August 2015.

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4. Photo-identification Survey Results

Twenty-seven photo-ID surveys were completed between August 2012 and August 2015 with a total of 193 groups of bottlenose dolphins sighted (**Table 7**). The surveys were not always completed each month as planned, due to poor weather conditions. Effort was focused on obtaining photographs of as many individuals, within each encountered group, as possible. A catalog was created using photos collected from both photo-ID and transect surveys. The cataloging effort to-date includes photo-ID and transect photographs taken through May 2014. **Figure 19** shows the locations of all sightings used in the catalog. To date, the catalog contains 878 identifiable individuals. The discovery curve (**Figure 20**) shows the addition of new individuals with each month's surveys.

Table 7. Summary of completed photo-ID surveys August 2012 to August 2015.

Date	Start Time	Stop Time	Total Survey Minutes	No. of Bottlenose Dolphin Groups Sighted	Total No. Estimated Individuals
09 Aug 2012	9:12	16:45	453	3	37
25 Sep 2012	7:30	15:37	487	9	136
25 Oct 2012	8:25	16:35	490	2	25
09 Jul 2013	7:06	16:17	551	6	184
16 Jul 2013	7:01	16:22	560	6	160
31 Aug 2013	7:29	15:56	507	8	161
16 Sep 2013	7:10	15:34	504	10	191
02 Oct 2013	7:19	15:41	502	17	395
22 Oct 2013	7:10	14:49	459	7	280
11 Dec 2013	8:46	15:53	428	4	19
22 Feb 2014	7:40	14:41	421	0	0
08 May 2014	8:35	16:24	468	3	39
08 Jun 2014	7:02	14:39	457	7	76
23 Jul 2014	7:24	15:28	484	14	231
20 Aug 2014	9:32	17:07	455	9	356
30 Aug 2014	8:15	15:56	461	13	147
29 Sep 2014	7:39	16:18	519	12	174
08 Nov 2014	7:41	14:47	426	6	80
20 Dec 2014	8:45	15:48	423	0	0
01 Feb 2015	7:45	15:13	448	2	16
19 Mar 2015	8:02	16:18	496	6	69
25 Apr 2015	7:56	11:28	211	0	0
29 May 2015	7:03	14:20	437	5	118
14 Jun 2015	6:41	15:22	520	14	168
22 Jun 2015	9:13	16:53	461	9	123
19 Jul 2015	8:07	16:14	487	8	254
29 Aug 2015	7:11	45:45	513	13	62

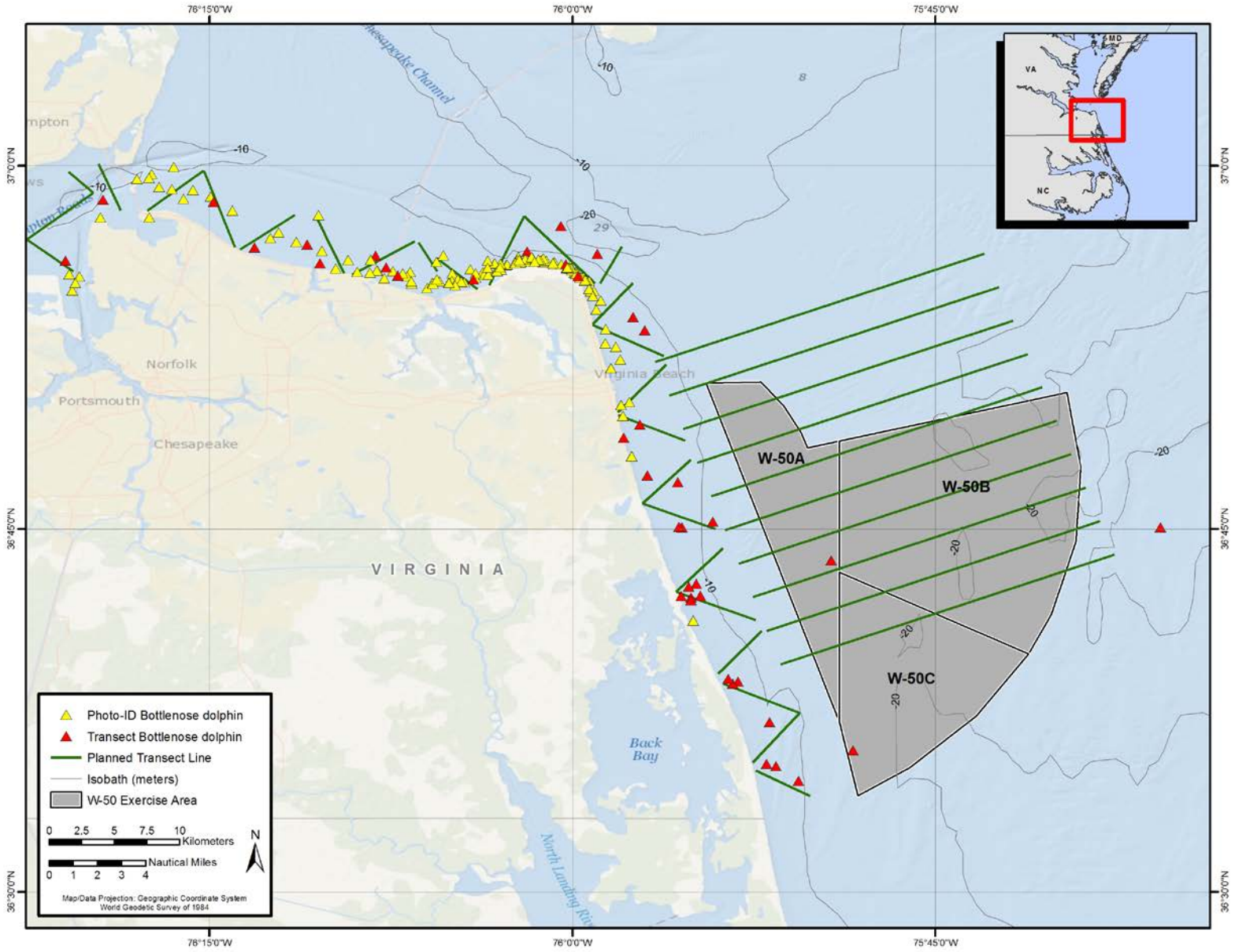

Figure 19. Bottlenose dolphin group sighting locations from all surveys used in photo-ID catalog.

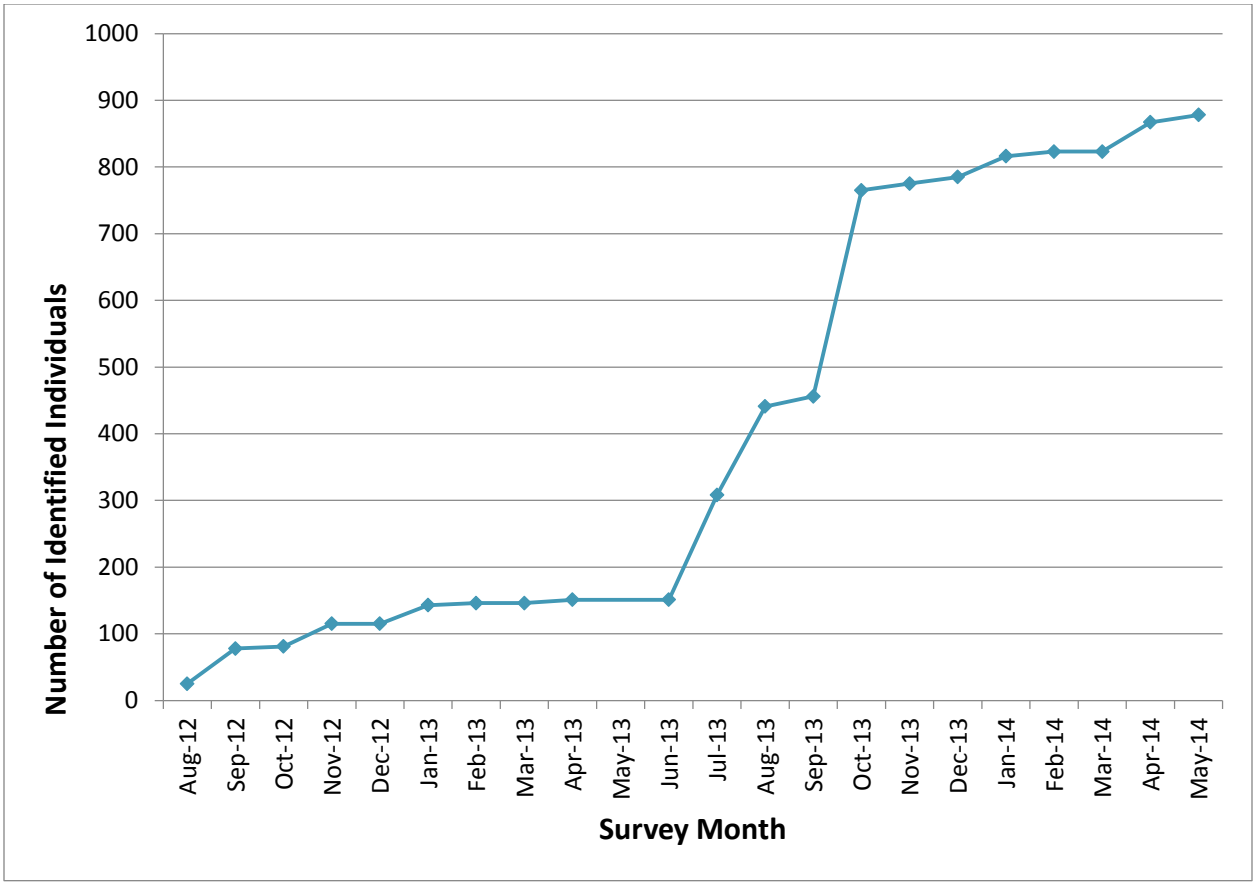

Figure 20. Discovery curve showing the cumulative number of individually identified dolphins as it increased with each survey month.

Re-sighting rates across surveys were low. Of the 878 individuals cataloged to-date, and excluding same day re-sightings, 110 (12.5%) individuals were seen on more than one occasion and 21 of those (2.4% of cataloged individuals) were seen on three or more occasions (**Table 8**). Most (n=98) re-sightings occurred within the same calendar year. Of the 36 re-sightings that were in different calendar years, only two occurred greater than 2 years apart (October 2012 to June 2015 [these matches were made before cataloging efforts reached this date due to exceptionally distinguishing characteristics]), 29 were in a range from 190 to 448 days apart, and 5 were only 3 months apart (November 2012 to January 2013). Ninety-one percent of re-sighted individuals (100 of 110) in the study area were recorded less than 30 km from the initial sighting. As the photo-ID catalog is updated with the remaining data from the survey effort, it is anticipated that further patterns of site fidelity or sub-stock differentiation may emerge.

Photos collected through August 2013 were submitted to the existing Mid-Atlantic Bottlenose Dolphin Catalog established by NMFS (Urian et al. 1999), allowing comparison to catalogs from adjacent study areas. To date, fifteen matches have been made to individuals previously photographed in North Carolina, two of which have since stranded during the 2013–2015 bottlenose dolphin Unusual Mortality Event (UME) (Urian 2016).

Table 8. Sighting details of re-sighted individuals.

Catalog ID No.	Initial Sighting Date/Sighting No./ Grp Size			Last Sighting Date/Sighting No./ Grp Size			Distance Between First and Last Sightings (km)	Days Between: Sightings / First and Last Re-sightings
NVB0002	09 Aug 2012	1	15	16 Sep 2013	6	15	22.6	403
NVB0003	09 Aug 2012	1	15	25 Sep 2012	9	15	4.0	47
NVB0009	09 Aug 2012	1	15	02 Oct 2013	16	170	18.6	419
NVB0014	09 Aug 2012	5	18	25 Sep 2012	1	6	6.6	47
NVB0019	09 Aug 2012	5	18	22 Oct 2013	2	50	5.7	74
NVB0020	09 Aug 2012	5	18	25 Sep 2012	9	15	13.0	47
NVB0033	25 Sep 2012	2	24	16 Jul 2013	1	26	4.2	294
NVB0037	25 Sep 2012	2	24	22 Oct 2013	7	100	11.0	387/392
NVB0050	25 Sep 2012	3	24	02 Oct 2013	2	9	15.4	16/372
NVB0061	25 Sep 2012	3	24	22 Oct 2013	2	50	2.3	356/392*
NVB0073	25 Sep 2012	9	15	02 Oct 2013	17	50	17.6	372
NVB0074	25 Sep 2012	9	15	02 Oct 2013	17	50	17.6	372
NVB0080	25 Oct 2012	2	15	11 Dec 2013	3	5	36.6	412
NVB0081	25 Oct 2012	2	15	22 Jun 2015	9	19	9.2	970
NVB0082	27 Nov 2012	1	40	15 Jan 2014	3	7	3.9	414
NVB0083	27 Nov 2012	1	40	15 Jan 2014	3	7	3.9	43/414
NVB0084	27 Nov 2012	1	40	9 Jan 2013	2	35	6.4	43
NVB0085	27 Nov 2012	1	40	15 Jan 2014	3	7	3.9	414
NVB0086	27 Nov 2012	1	40	15 Jan 2014	3	7	3.9	43/414
NVB0109	27 Nov 2012	5	8	15 Jan 2014	2	65	20.8	414
NVB0111	27 Nov 2012	5	8	9 Jan 2013	1	30	11.2	43
NVB0115	27 Nov 2012	5	8	9 Jan 2013	1	30	11.2	43
NVB0118	09 Jan 2013	1	22	07 Feb 2014	3	46	6.4	394
NVB0119	09 Jan 2013	1	22	07 Feb 2014	3	46	6.4	394
NVB0130	09 Jan 2013	1	22	15 Jan 2014	1	6	31.7	371
NVB0131	09 Jan 2013	1	22	15 Jan 2014	1	6	31.7	371
NVB0132	09 Jan 2013	1	22	07 Feb 2014	3	46	6.4	394
NVB0133	09 Jan 2013	2	35	22 Feb 2013	5	15	1.2	44
NVB0135	09 Jan 2013	2	35	07 Feb 2014	3	46	7.1	394
NVB0142	09 Jan 2013	4	23	02 Apr 2014	5	118	57.5	448
NVB0146	22 Feb 2013	5	15	02 Apr 2014	5	118	41.7	404
NVB0152	09 Jul 2013	1	22	31 Aug 2013	6	13	15.5	7/46
NVB0153	09 Jul 2013	1	22	16 Sep 2013	2	75	8.8	35/69
NVB0155	09 Jul 2013	1	22	16 Sep 2013	2	75	8.8	7/69
NVB0156	09 Jul 2013	1	22	16 Sep 2013	2	33	13.8	69
NVB0161	09 Jul 2013	2	10	22 Oct 2013	5	40	1.8	105
NVB0164	09 Jul 2013	3	25	16 Jul 2013	6	65	3.8	7

Catalog ID No.	Initial Sighting Date/Sighting No./ Grp Size			Last Sighting Date/Sighting No./ Grp Size			Distance Between First and Last Sightings (km)	Days Between: Sightings / First and Last Re-sightings
NVB0165	09 Jul 2013	3	25	16 Sep 2013	8	18	15.9	7/69
NVB0170	09 Jul 2013	4	115	31 Aug 2013	6	13	1.2	53
NVB0171	09 Jul 2013	4	115	08 May 2014	2	25	41.1	303
NVB0172	09 Jul 2013	4	115	24 Jul 2013	2	125	11.8	15
NVB0175	09 Jul 2013	4	115	16 Jul 2013	1	26	6.6	7
NVB0179	09 Jul 2013	4	115	16 Jul 2013	4	30	8.2	7
NVB0183	09 Jul 2013	4	115	16 Jul 2013	3	33	13.8	7
NVB0184	09 Jul 2013	4	115	16 Sep 2013	4	32	2.1	69
NVB0186	09 Jul 2013	4	115	16 Sep 2013	8	18	13.0	69
NVB0188	09 Jul 2013	4	115	16 Jul 2013	3	33	13.8	7
NVB0189	09 Jul 2013	4	115	22 Oct 2013	6	75	2.2	7/105
NVB0190	09 Jul 2013	4	115	16 Sep 2013	8	18	13.0	69
NVB0191	09 Jul 2013	4	115	22 Oct 2013	7	100	1.0	105
NVB0192	09 Jul 2013	4	115	16 Sep 2013	3	24	13.8	35/69
NVB0193	09 Jul 2013	4	115	16 Jul 2013	3	33	13.8	7
NVB0195	09 Jul 2013	4	115	22 Oct 2013	7	100	1.0	7/105*
NVB0199	09 Jul 2013	4	115	16 Jul 2013	6	65	0.4	7
NVB0207	09 Jul 2013	4	115	22 Oct 2013	6	75	2.2	69/105
NVB0208	09 Jul 2013	4	115	16 Sep 2013	2	75	6.2	69
NVB0211	09 Jul 2013	4	115	16 Jul 2013	4	30	8.2	7
NVB0212	09 Jul 2013	4	115	16 Jul 2013	1	26	6.6	7
NVB0214	09 Jul 2013	4	115	16 Jul 2013	4	30	8.2	7
NVB0229	16 Jul 2013	3	33	16 Sep 2013	2	75	5.2	28/62
NVB0230	16 Jul 2013	3	33	16 Sep 2013	2	75	5.2	62
NVB0233	16 Jul 2013	3	33	02 Oct 2013	16	170	2.6	78
NVB0234	16 Jul 2013	3	33	13 Aug 2013	2	40	19.1	28
NVB0235	16 Jul 2013	3	33	31 Aug 2013	6	13	2.4	46
NVB0239	16 Jul 2013	4	33	16 Sep 2013	8	18	12.9	62
NVB0241	16 Jul 2013	4	33	16 Sep 2013	8	18	12.9	62
NVB0242	16 Jul 2013	4	30	31 Aug 2013	4	40	2.7	46
NVB0245	16 Jul 2013	6	65	16 Sep 2013	5	6	0.4	62
NVB0249	16 Jul 2013	6	65	02 Oct 2013	17	50	8.9	78
NVB0252	16 Jul 2013	6	65	31 Aug 2013	7	18	3.8	46
NVB0258	17 Jul 2013	28	5	22 Oct 2013	2	50	8.2	77/96
NVB0274	24 Jul 2013	2	125	16 Sep 2013	3	24	0.2	20/54*
NVB0292	24 Jul 2013	8	100	13 Aug 2013	4	90	10.0	20
NVB0310	13 Aug 2013	1	2	02 Oct 2013	16	170	26.1	50
NVB0311	13 Aug 2013	1	2	02 Oct 2013	16	170	26.1	50

Catalog ID No.	Initial Sighting Date/Sighting No./ Grp Size			Last Sighting Date/Sighting No./ Grp Size			Distance Between First and Last Sightings (km)	Days Between: Sightings / First and Last Re-sightings
NVB0324	13 Aug 2013	2	40	22 Oct 2013	7	100	20.7	70
NVB0329	13 Aug 2013	2	40	22 Oct 2013	7	100	20.7	70
NVB0331	13 Aug 2013	2	40	22 Oct 2013	7	100	20.7	70
NVB0332	13 Aug 2013	2	40	02 Oct 2013	16	170	16.8	18/32
NVB0385	31 Aug 2013	3	60	02 Oct 2013	16	170	0.4	16/32
NVB0386	31 Aug 2013	3	60	16 Sep 2013	2	75	1.9	16
NVB0392	31 Aug 2013	3	60	16 Sep 2013	8	8	15.4	16
NVB0396	31 Aug 2013	3	60	22 Oct 2013	5	40	0.1	52
NVB0397	31 Aug 2013	4	40	22 Oct 2013	6	75	0.3	52
NVB0402	31 Aug 2013	4	40	02 Oct 2013	16	170	1.3	32
NVB0408	31 Aug 2013	4	40	16 Sep 2013	5	6	1.9	16
NVB0409	31 Aug 2013	4	40	16 Sep 2013	6	15	3.1	16
NVB0423	31 Aug 2013	4	40	16 Sep 2013	7	9	14.6	16
NVB0447	16 Sep 2013	2	75	22 Oct 2013	6	75	4.4	16/36
NVB0448	16 Sep 2013	2	75	22 Oct 2013	6	75	4.4	16/36
NVB0463	16 Sep 2013	3	24	22 Oct 2013	5	40	0.3	36
NVB0464	16 Sep 2013	3	24	22 Oct 2013	6	75	0.9	36
NVB0476	16 Sep 2013	6	15	22 Oct 2013	7	100	0.3	36
NVB0498	25 Oct 2012	2	15	22 Jun 2015	9	19	9.2	970
NVB0600	02 Oct 2013	2	9	22 Oct 2013	2	50	17.3	20
NVB0619	02 Oct 2013	13	2	22 Oct 2013	6	75	4.9	20
NVB0620	02 Oct 2013	14	55	22 Oct 2013	5	40	2.4	20
NVB0626	02 Oct 2013	16	170	08 May 2014	2	25	2.6	190/218
NVB0630	02 Oct 2013	16	170	22 Oct 2013	6	75	1.6	20
NVB0635	02 Oct 2013	16	170	08 May 2014	2	25	2.6	218
NVB0660	02 Oct 2013	17	50	22 Oct 2013	7	100	9.7	20
NVB0663	02 Oct 2013	17	50	22 Oct 2013	5	40	6.5	20
NVB0675	02 Oct 2013	17	50	22 Oct 2013	2	50	1.0	20
NVB0684	17 Oct 2013	5	54	22 Oct 2013	6	75	0.8	5
NVB0687	17 Oct 2013	5	54	22 Oct 2013	4	5	4.0	5
NVB0703	17 Oct 2013	10	36	22 Oct 2013	7	100	11.7	5
NVB0712	22 Oct 2013	2	50	16 Nov 2013	3	22	35.4	25
NVB0718	22 Oct 2013	2	50	16 Nov 2013	3	22	35.4	25
NVB0722	22 Oct 2013	4	5	16 Nov 2013	3	22	35.0	25
NVB0736	22 Oct 2013	6	75	16 Nov 2013	3	22	34.1	25

*Individual re-sighted three times. Numbers shown are days between first and last re-sighting.

5. C-POD Automated Acoustic Monitoring Results

Four C-PODs were initially deployed in August of 2012 at four different sites off NSN and Virginia Beach (**Table 9, Figure 1**). The MINEX and JEB-LC C-PODs were recovered in October 2012; however, initial mooring systems were inadequate and the JEB-FS C-POD broke free and drifted from the initial deployment site, and the NSN C-POD was never recovered.

In December 2012, the C-PODs were re-deployed at JEB-LC and NSN using more robust mooring systems. These instruments lasted for the duration of the deployment, and although subsequent deployments were successful at JEB-LC, some NSN deployments were not recovered. Dredging or fishing activity may have interfered with the unit, either damaging or moving it out of range for release. This deployment site (NSN site 1) was abandoned, and as soon as a permit was obtained, the NSN C-POD was deployed attached to a pole marker, thought to be less risky in terms of dredging and fishing damage (NSN site 2, **Figure 2**). In total, there were seven successful deployments at JEB-LC, five deployments at NSN, one at the MINEX site, and one moderately successful deployment at JEB-FS (**Table 9**).

Table 9. Deployment details of C-POD Automated Acoustic Recorders.

Deployment Date	Location	Coordinates	Total Days of Logged Data
06 Aug 2012	MINEX	36º 49.905'N, 75º 52.860'W	67
16 Aug 2012	JEB-FS	36º 56.411'N, 76º 01.165'W	57
16 Aug 2012	NSN	36º 57.061'N, 76º 20.444'W	Not recovered
16 Aug 2012	JEB-LC	36º 56.929'N, 76º 10.937'W	52
07 Dec 2012	NSN	36º 57.056'N, 76º 20.498'W	100
07 Dec 2012	JEB-LC	36º 56.940'N, 76º 10.872'W	130
17 Apr 2013	NSN	36º 57.071'N, 76º 20.510'W	Not recovered
17 Apr 2013	JEB-LC	36º 56.936'N, 76º 10.869'W	151
20 Sep 2013	JEB-LC	36º 56.927'N 76º 10.951'W	142
09 Feb 2014	JEB-LC	36º 56.952'N 76º 10.957'W	Not recovered
15 Aug 2014	JEB-LC	36^0 56.956'N 76^0 10.767'W	181
29 Sep 2014	NSN	36^0 57.900'N 76^0 19.700'W	114
23 Jan 2015	NSN	36^0 57.900'N 76^0 19.700'W	128
25 Apr 2015	JEB-LC	36^0 56.469'N 76^0 10.812'W	130
29 May 2015	NSN	36^0 57.900'N 76^0 19.700'W	87
29 Aug 2015	NSN	36^0 57.900'N 76^0 19.700'W	140
30 Aug 2015	JEB-LC	36^0 56.477'N 76^0 10.807'W	141

Each of the recovered units contained data that were processed using custom software provided by Chelonia Limited. Processed data were sent to a consultant recommended by Chelonia to verify the consistency of the results. The C-POD software contains a suite of classifiers and filter settings to identify click trains from cetaceans as well as those produced by boat sonars (false detections). After additional independent validation, it was determined that

weak vessel sonar, likely fish finders or depth sounders, created false detection rates higher than expected without additional filtering. The recommendation was to use the KERNO classifier, which looks through the entire dataset and identifies trains likely produced by cetaceans, with additional filtering to minimize the false detection rate. Each C-POD had positive detections for 'other cetaceans' (non-narrow-band high-frequency), which are safely assumed to be bottlenose dolphins for this study area. Animal occurrence was defined by the number of detection-positive minutes (DPM) determined by the C-POD software output, which is the number of minutes in which one or more detections were made. The metric is not used to estimate the number of animals present. The DPM values were higher for unfiltered data using an additional classifier built into the software package, but the trends of occurrence and relative distribution of DPM over time were consistent between the two methods.

Naval Station Norfolk C-POD

Five successful deployments were completed near NSN, although the location was changed due to risk of losing equipment at the initial site (site 1 vs. site 2, **Figure 2**) precluding exact comparisons from being made between the two deployments at the NSN site. Results were combined, however, for comparison to other sites, as they are both in the immediate vicinity of an area of interest (NSN). Overall, combined dolphin DPM calculated as a percentage of total minutes logged at NSN was lowest when compared to all other sites (**Table 10**). Relative DPM per week for the deployment at NSN site 1 is shown in **Figure 21**, and relative DPM per month for the deployments at NSN site 2 is shown in **Figure 22**. A general peak in occurrence is shown for fall months. A diel pattern of occurrence for bottlenose dolphins, greater in the nighttime hours, is evident at the NSN site for both deployments (**Figures 23 and 24**).

Table 10. Dolphin DPM and percentage of total minutes logging for all deployments per location. Total days and minutes logged are calculated using recorded data and may not match number of days deployed.

Location	Total Logged Days	Total Logged Minutes	Total DPM	Dolphin DPM as % of minutes on
NSN	609	848,041	11,612	1.37%
JEB-LC	944	1,323,269	29,046	2.20%
JEB-FS	57	82,082	11,963	14.57%
MINEX	67	96,481	7,244	7.51%

JEB-Little Creek C-POD

Although the first C-POD deployed at JEB-LC broke free, it was located within 6 km of the deployment site and assumed to not have drifted for a very long time. Based on this assumption, data collected from the first deployment were included for comparison. Deployments at JEB-LC spanned more than a full year. There was a total of 1,323,269 DPM for bottlenose dolphins throughout the seven deployments. In general, there appears to be a trend indicating an increase in detections in the summer and fall, and a decrease in detections in the winter (**Figure 25**). A diel pattern is also evident for bottlenose dolphins at JEB-LC with the majority of DPM occurring during the nighttime hours (**Figure 26**).

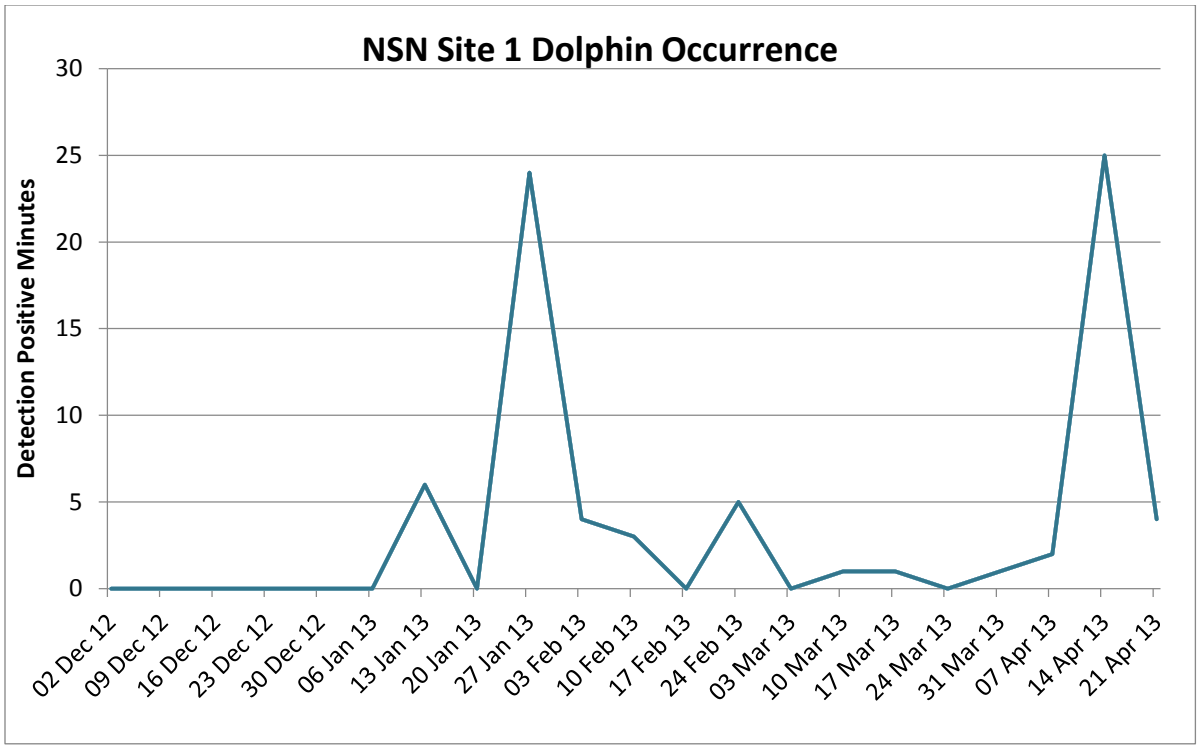

Figure 21. Relative DPM for bottlenose dolphins at the NSN site 1*.
* Weeks at the beginning and end of each deployment may not be a full 7 days.

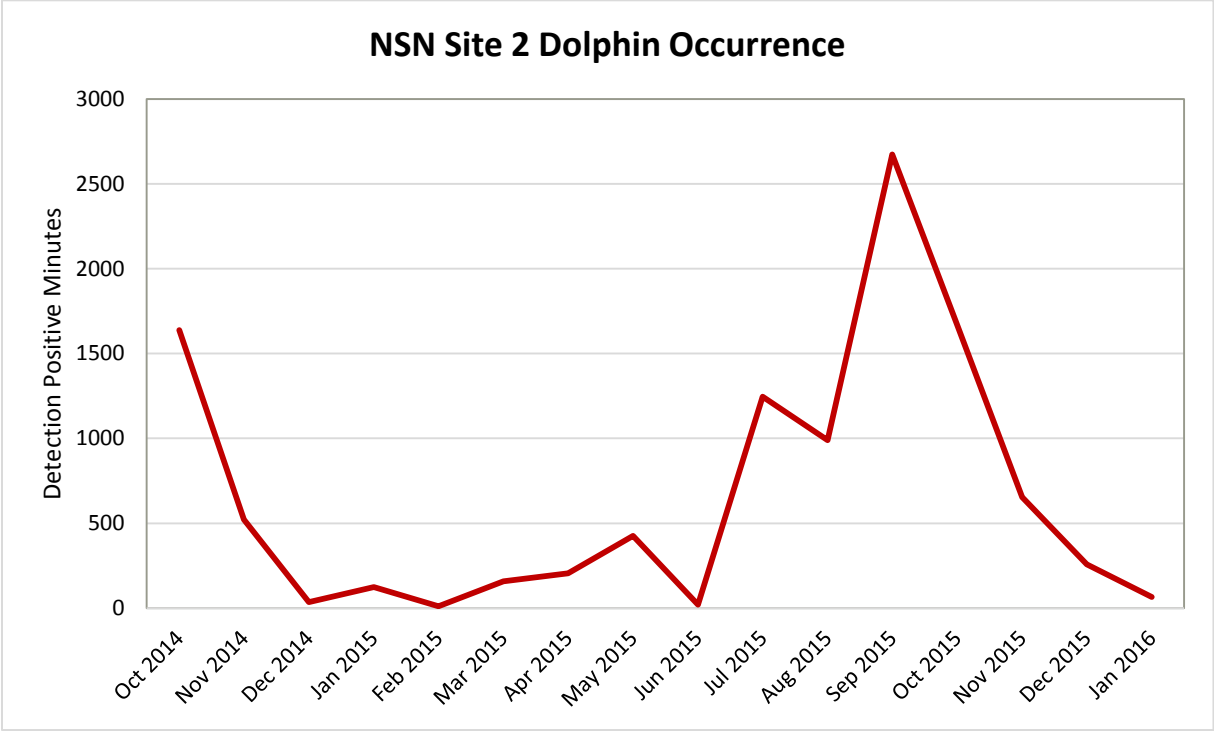

Figure 22. Relative DPM for bottlenose dolphins at the NSN site 2*.
* Units were not recording for 1 day during Nov 2014, 9 days during Aug 2015 and 19 days during Jan 2016.

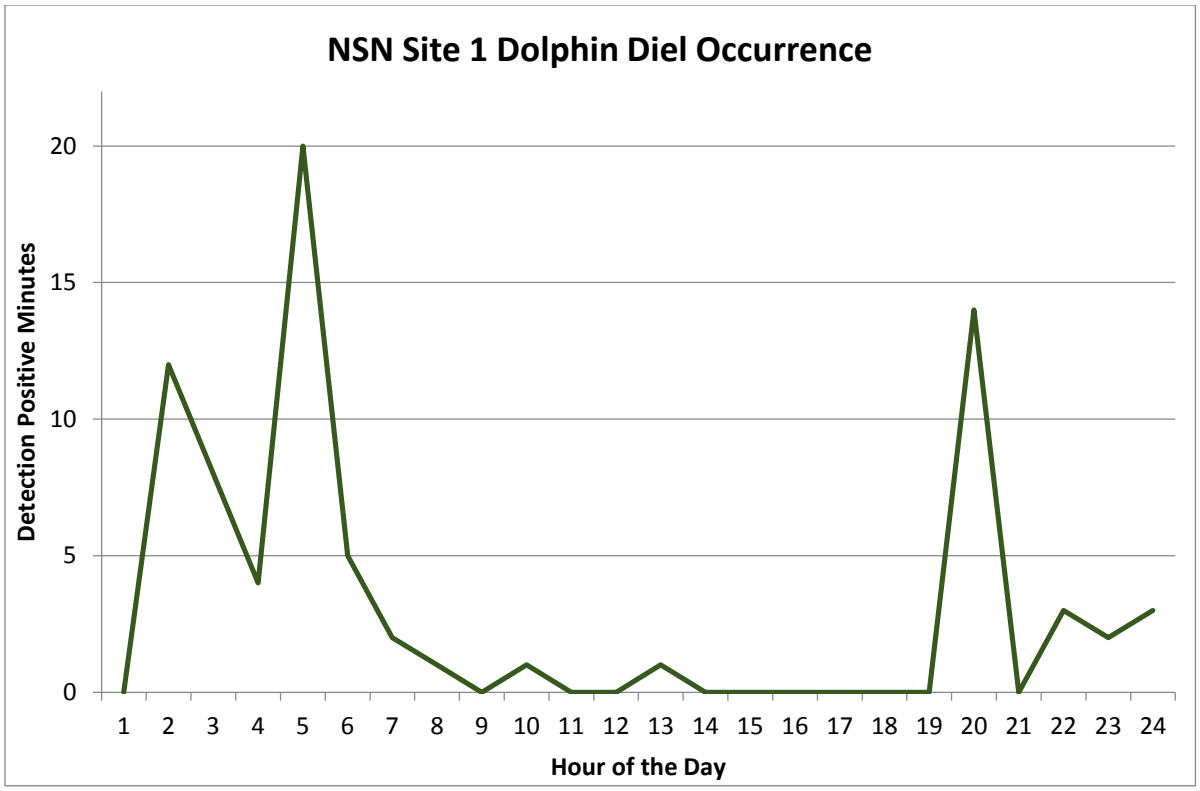

Figure 23. DPM of bottlenose dolphins, binned by hour, to determine diel acoustic activity patterns the NSN site 1.

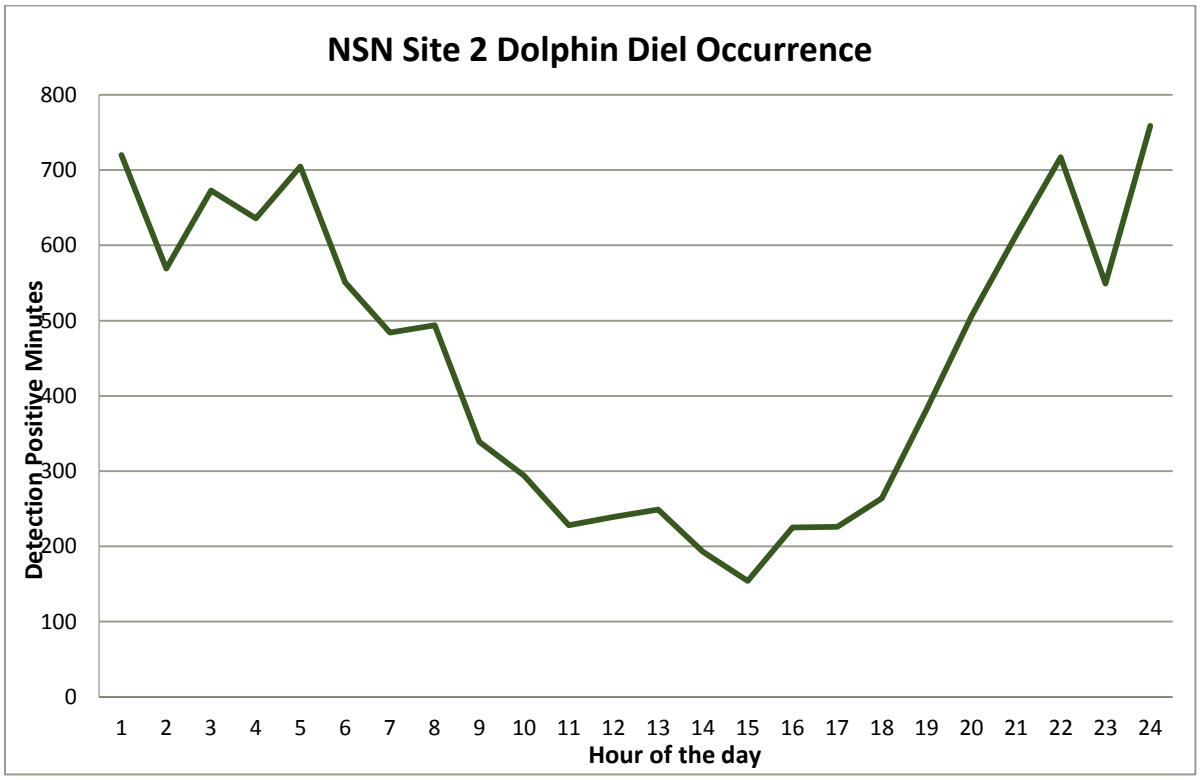

Figure 24. DPM of bottlenose dolphins, binned by hour, to determine diel acoustic activity patterns at NSN site 2.

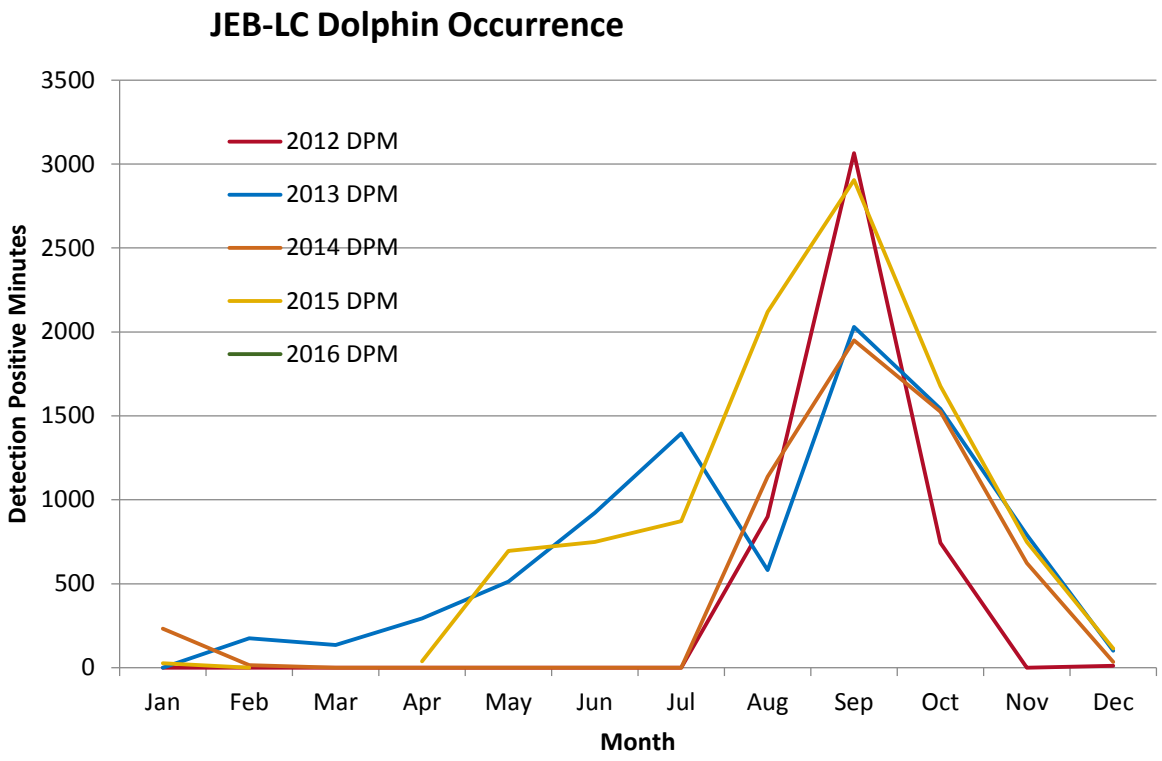

Figure 25. Relative DPM for bottlenose dolphins at the JEB-LC for all deployments*.

* Units were not recording for 60 days from 9 Oct to 8 Dec 2012, 1 day during Apr 2013, 3 days during Sep 2013, 186 days from 10 Feb to 14 Aug 2014, and 71 days from 12 Feb to 23 Apr 2015.

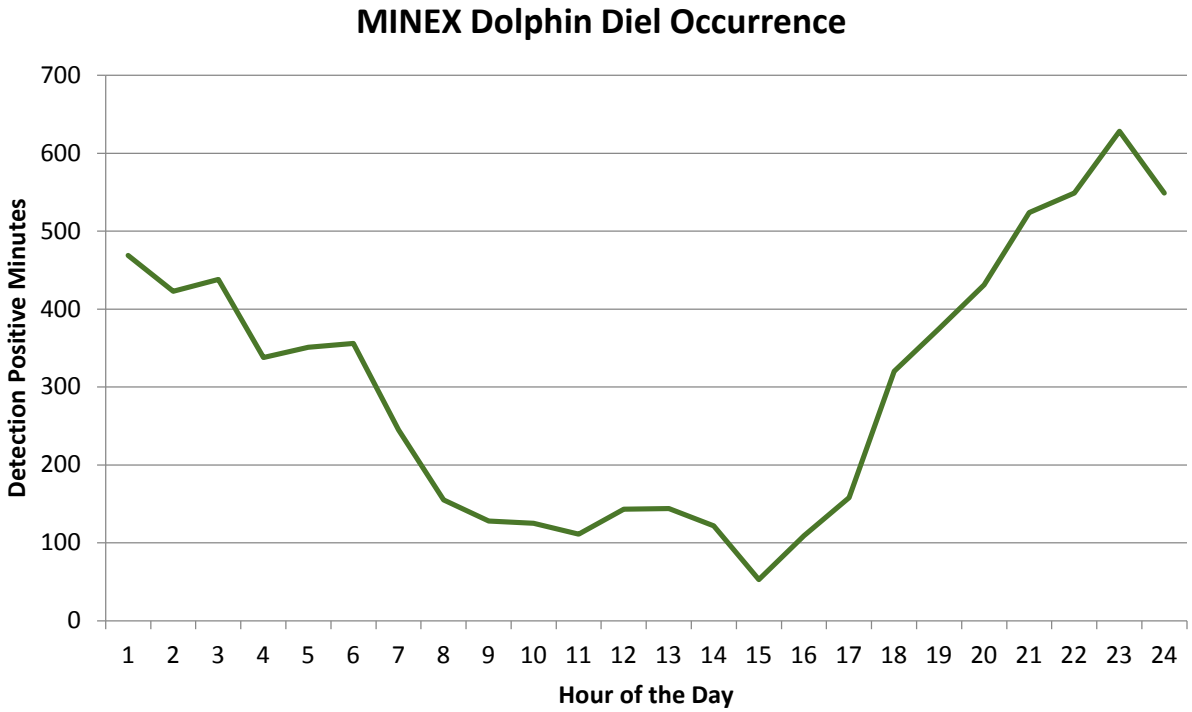

Figure 26. DPM of bottlenose dolphins, binned by hour, to determine diel acoustic activity patterns at the JEB-LC site.

JEB-Fort Story C-POD

The JEB-FS C-POD was deployed on 16 August 2012 and was recovered on shore near Duck, North Carolina, on 15 October 2012. Lack of knowledge of when the unit broke free from the mooring precludes any meaningful analysis, especially in regards to drawing comparisons from units deployed at the same time in different locations. While adrift, the C-POD was still operational and logged data (**Figure 27**). While dolphin DPM calculated as a percentage of total minutes logged at JEB-FS was highest when compared to all other sites (**Table 10**), significance cannot be deduced, as the unit was not at a fixed location; thus, dolphin presence was not in relation to location.

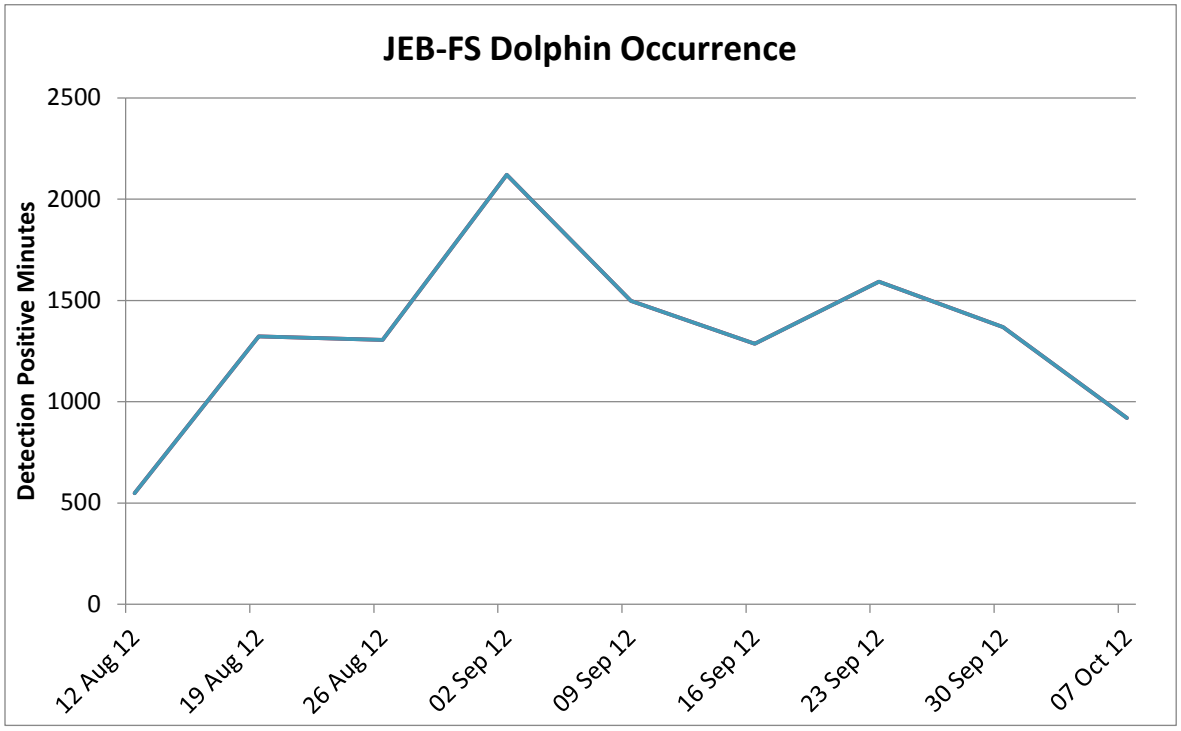

Figure 27. Relative DPM for bottlenose dolphins at the JEB-FS site*°.

* Weeks at the beginning and end of each deployment may not be a full 7 days.

° Note: this unit broke free from its mooring on an unknown date and washed ashore in Duck, North Carolina. All data in this table should be regarded with caution due to unknown location of the C-POD on each date.

Despite the inability to note any temporal trends for dolphin presence, the data indicate that bottlenose dolphins were more vocally active during the daytime hours, opposite of the results from all other sites (**Figure 28**). This particular C-POD had one of the shortest deployment durations and contained the greatest number of dolphin detections, at nearly 15 percent of the time logging.

MINEX C-POD

The single deployment at the MINEX site yielded 67 total days of data from 6 August 2012 through 13 October 2012. There was a total of 7,244 DPM for bottlenose dolphins during the deployment with no significant temporal occurrence trends evident, aside from a slight increase in DPM in mid-August (**Figure 29**). There was also a diel trend with the majority of detections occurring in the nighttime hours (**Figure 30**).

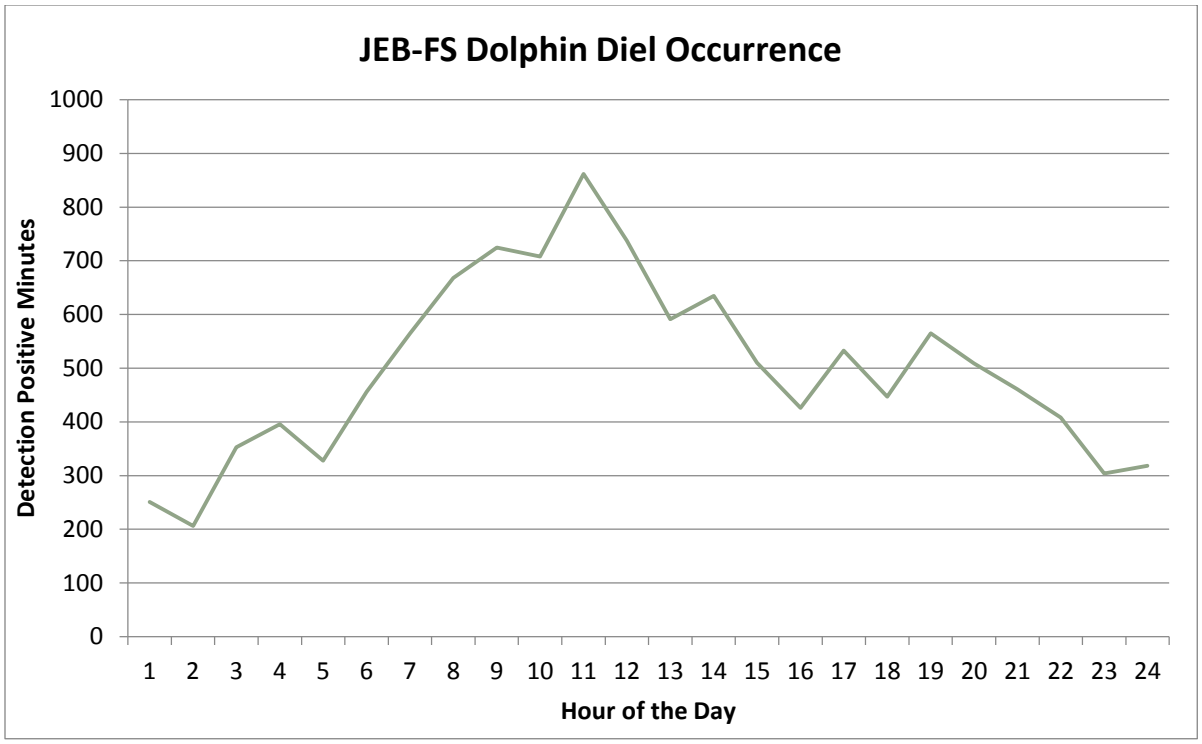

Figure 28. DPM of bottlenose dolphins, binned by hour, to determine diel acoustic activity patterns at the JEB-FS site.

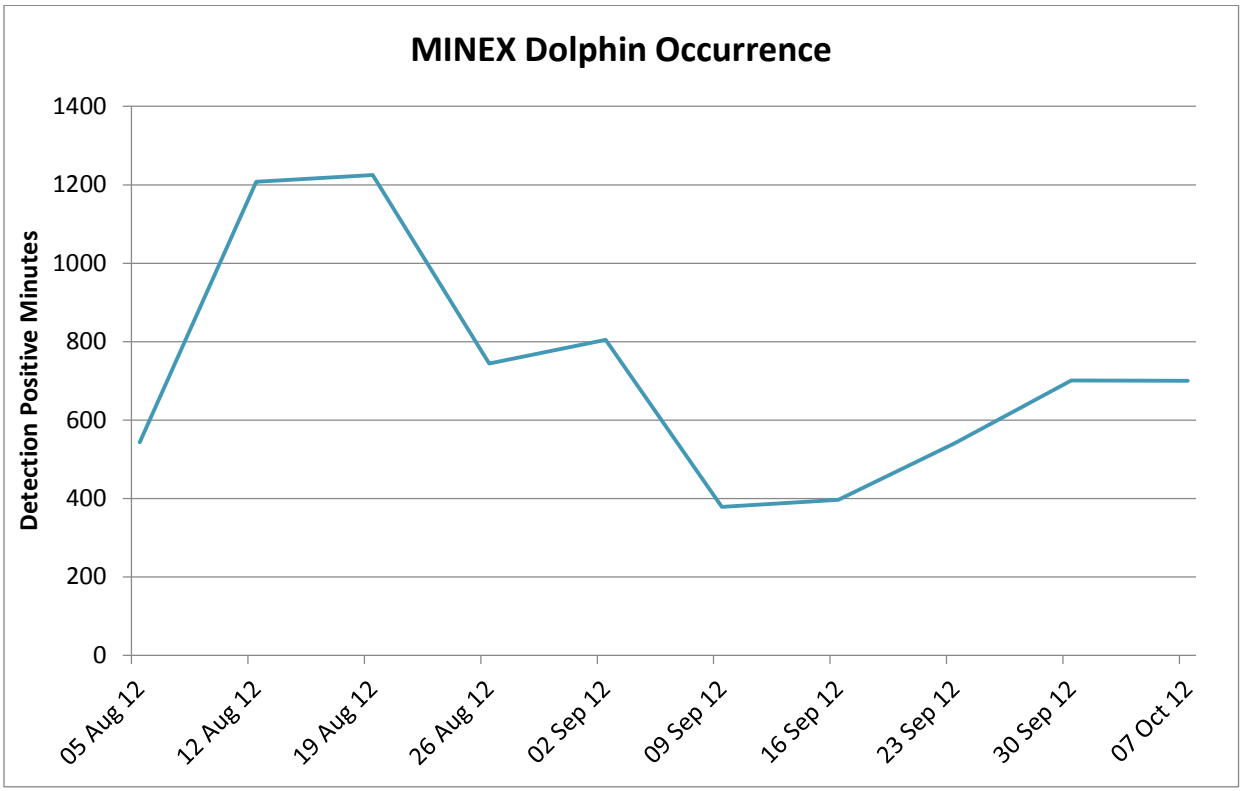

Figure 29. Relative DPM for bottlenose dolphins at the MINEX site*.

* Weeks at the beginning and end of each deployment may not be a full 7 days.

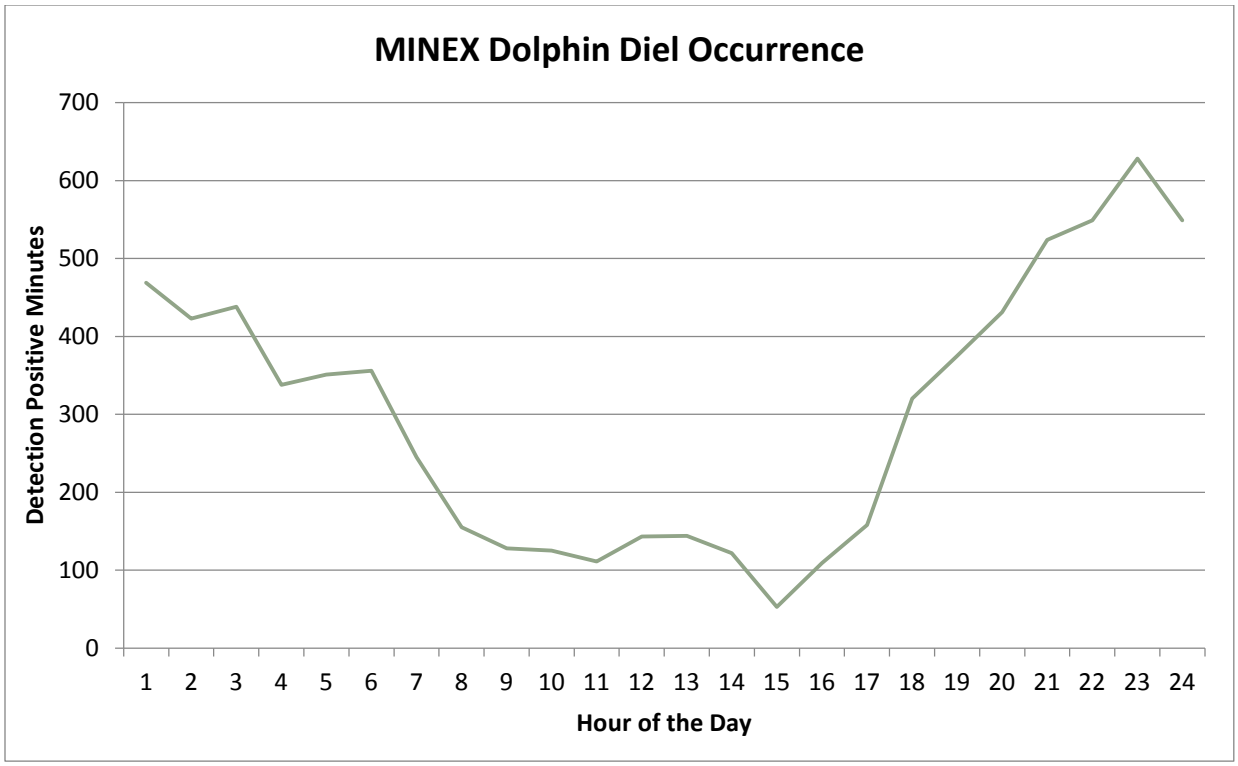

Figure 30. DPM of bottlenose dolphins, binned by hour, to determine diel acoustic activity patterns at the MINEX site.

6. Conclusions

Overall, this study continues to support findings from previous research showing substantial presence of bottlenose dolphins throughout the year in areas heavily utilized by the U.S. Navy, with a level of occurrence that fluctuates seasonally. Density estimates have improved with further effort and show an expected seasonal peak in summer and fall. Patterns of seasonal residency are beginning to emerge, but further study is needed to better describe the level of site fidelity within the study area. The use of C-PODs was a very practical and cost-effective way to supplement the visual and photo-ID studies, especially to show continuous occurrence on days that visual surveys were not possible and during nighttime hours. Application of these seasonal density estimates will allow the U.S. Navy to make more informed decisions, which may result in minimizing potential impacts on the local bottlenose dolphin populations

6.1 Vessel Line-transect Surveys

The final results from this project confirmed earlier findings that bottlenose dolphins are common in the study area, with highest densities in the coastal waters in summer and fall months. Peak estimated abundance in coastal waters of the study area is 1,203 individuals present during the fall (density = 3.88 individuals per km^2), and 1,101 individuals in summer (density = 3.55 individuals per km^2). However, bottlenose dolphins do not completely leave this area during colder months, with approximately 200–300 individuals still present in winter and spring months. These results agree with previous studies that indicate an increased presence of bottlenose dolphins in summer and fall (Barco 1995, Blaylock 1988), although the results from this study provide more detailed and up-to-date information by estimating the abundance throughout the year and providing information for recent years.

Densities in offshore waters of the MINEX zone are generally lower than in the coastal strip, although in some seasons small sample sizes precluded obtaining highly precise estimates. Current indications suggest that density in the MINEX area in fall is reasonably high (D = 2.14 individuals per km^2), and that over 2,400 bottlenose dolphins likely inhabit the entire study area in fall months (**Table 4).** Collecting additional data by continuing the monthly transect surveys improved the precision of the estimates and generally reduced the CVs. A more robust dataset has also allowed for further analyses, including sub-stratification of the survey area to provide density estimates for three sub-areas within the INSHORE zone. This stratification is useful to narrow down bottlenose dolphin densities in specific areas of U.S. Navy activity within the study area, and allow management to reduce potential impacts.

The sub-stratification showed that in the summer/fall season for the inshore area, bottlenose dolphin densities are lower inside Chesapeake Bay than they are around Cape Henry or along the outer coast (**Table 5**). We also examined the data in relation to the bottlenose dolphin Unusual Mortality Event documented in 2013–2015. The researchers attempted to separate the data into three time periods of approximately 12 months each for the pre-, during, and post-die off periods. Although they did not have data for a full 12 months before the die-off began (and this somewhat compromised the analysis), there was no strong evidence of a decline in bottlenose dolphin numbers in the area in relation to the die-off. In fact, in the inshore area, the highest numbers were found during the die-off period (**Table 6**).

When comparing the final estimates presented here with the preliminary estimates from the previous annual progress report (Engelhaupt et al. 2015), many of the final estimates are more precise (and most of the INSHORE estimates are quite precise, with CVs in the 20-30% range). This is likely due to both the improved survey design and also to the increased sample sizes that went into producing the new estimates. The new MINEX spring estimate is much higher than the old one. This may result partly from reduced bias, but it must be remembered that the MINEX estimates are in many cases based on very small sample sizes (and therefore have low precision). Despite this, it is encouraging to see that many of the estimates of density and abundance have not changed much from the older ones (e.g., most of the MINEX, and all INSHORE estimates are at least broadly similar), and this is suggestive that the compromised survey design that was used in the early stages of this project did not produce large biases in the estimates.

6.2 Photo-ID Surveys

Though continued photo-ID analysis is necessary to ascertain the site fidelity and movement patterns of the bottlenose dolphins in the area, early results indicate a very open population, with short-term visits to the area with localized sightings. The majority of dolphins that were re-sighted were in close proximity (within 30 km) to their original sighting locations, and in most cases these re-sights occurred within the same year or during the same season the following year. Only 24 re-sightings were longer than one year apart. As the analysis continues and the catalog grows, researchers can determine if further support of seasonal fidelity is evident, which would support previous studies in the area suggesting seasonal residence (Blaylock 1984, Swingle 1994, Barco 1995). This would suggest the dolphins are migrating through the area, and would also support the described movement of individuals from south to north in the spring and north to south in the fall (Swingle 1994, Waring et al. 2014). Further support of this migration pattern are the matches found to existing North Carolina catalogs found using the Mid-Atlantic Bottlenose Dolphin Catalog, further comparison is planned to investigate added support to these patterns.

There is no evidence thus far of year-round resident dolphins, as seen in some other estuarine areas in North Carolina, South Carolina, and Florida (Wang et al. 1994, Zolman 2002, Mazzoil et al. 2008); however, more time and effort are needed for photo-ID comparisons to determine if there are year-round residents. This study area combines estuarine and coastal habitat, and the NMFS marine mammal stock assessment considers dolphins inhabiting estuarine waters and those inhabiting coastal waters to be distinct populations for management purposes (Waring et al. 2014). The relationship between the dolphins of estuarine waters, often considered more residential in nature, and the coastal dolphins, often considered more migratory/transient, is poorly understood in this area, possibly complicated by the open and seasonally variable nature of Chesapeake Bay. Coverage of additional areas within Chesapeake Bay might produce evidence to support the possibility of resident dolphins, since the area where most sightings occur within the study area, Cape Henry, appears to show seasonal fidelity; possibly an area of overlap of occurrence for both the Northern and Southern Western North Atlantic Migratory Coastal Stocks.

6.3 C-POD Automated Acoustic Monitoring

The C-POD data provided interesting insight into the occurrence of marine mammals in the study area, though coverage was intermittent for some sites, year-round data were collected for the NSN and JEB-LC sites. C-PODs are very versatile tools to augment other methods used to determine animal occurrence, distribution, and temporal patterns over short and long periods. PAM yields valuable data regarding animal occurrence during periods when typical visual survey methods are not feasible. PAM also enables data collection in most weather conditions, around the clock, and without biasing animal behavior by vessel approaches. If a signal is detected, a very high level of certainty exists that animals are relatively close to the acoustic sensor. There are, however, some limitations. The C-POD specifications state that the distance of detection is within 1 km, but there is no known coverage distance (Chelonia Limited Cetacean Monitoring Systems 2014). Also, the number of animals and exact locations cannot be determined from C-PODs alone, and a negative result (no detections) does not mean animals are absent; they may be in the vicinity of a C-POD but not producing echolocation clicks. Read et al. (2012) conducted a ground-truthing exercise during a similar study at three sites in North Carolina and found that the C-PODs produced very few false positive detections, but were conservative in classifying click trains as a positive detection, therefore reporting a lower number of detections than present in actual recordings. Ground-truthing of the C-POD detections in this study area was not a part of the work plan for this project.

Bottlenose dolphin detections were common throughout the four deployment sites, and supported the visual survey data in many ways, with a few exceptions. The C-POD at both NSN sites showed some dolphin detections even in the winter months—in contrast to the visual transect survey results, where no dolphin groups were sighted near the NSN deployment sites in winter (**Figure 12**). The combined dolphin DPM as percentage of minutes logged at this site was the lowest, of interest because NSN houses a large portion of the U.S. Navy's Atlantic fleet, and potential pier construction.

C-POD deployments spanned a full year at both the NSN and JEB-LC sites, allowing for seasonal comparisons. NSN results showed an increased bottlenose dolphin presence, assessed as DPM, in the fall months, while JEB-LC DPM was higher in the summer and fall months. Detections were still made sporadically at both sites as well during winter and spring months, but dolphin presence was only consistent in the summer and fall. Though the number of dolphins in the area cannot be determined using the C-POD detections, the substantial presence of bottlenose dolphins is noteworthy, as the JEB-LC location is also a busy port for the U.S. Navy.

The JEB-FS data support the large number of bottlenose dolphin sightings recorded near Cape Henry during visual surveys; however, since the data are compromised by the unit breaking free and traveling, a valid comparison cannot be made. Unfortunately, these data have to be disregarded since the date that it broke free is unknown and the detections are not indicative of dolphin presence around the fixed location of interest.

The number of acoustic dolphin detections logged by the MINEX area C-POD (dolphin DPM percentage = 7.51) supports the updated visual survey results, in which the abundance

estimates for the MINEX transect coverage area has increased to 829 for summer and 1,277 for fall (C-POD monitoring was from 16 August to 13 October 2012).

A strong diel trend was evident at NSN, JEB-LC, and MINEX sites, with more echolocation activity occurring during nighttime hours, as is very common for most odontocete species (Klinowska 1986). It is important to note that an increase in acoustic activity at night may not be indicative of an increased number of dolphins, their behavior state (foraging), or group sizes. While whistles are commonly used for intraspecific communication and coordination, echolocation is used for navigation and when it is dark, and may also be important as animals travel and maintain group communication acoustically during periods of low light.

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8. Literature Cited

Baker, S.L.M. (2000) Population biology, residency status, and management of bottlenose dolphins, *Tursiops truncatus*, in the Eastern Bay and Choptank River areas of Chesapeake Bay. Ph.D. thesis, University of Maryland, College Park, MD. 183 pp.

Barco, S.G. (1995) Population patterns of bottlenose dolphins (*Tursiops truncatus*) in the nearshore waters of Virginia Beach, Virginia. M.S. thesis, James Madison University, Harrisonburg, VA. 80 pp.

Barco, S.G., Swingle, W.M., McLellan, W.A., Harris, R.N., and Pabst, D.A. (1999) Local abundance and distribution of bottlenose dolphins (*Tursiops truncatus*) in the nearshore waters of Virginia Beach, Virginia. Marine Mammal Science, 15, 394-408.

Blaylock, R.A. (1984) The distribution and abundance of the bottlenose dolphin, *Tursiops truncatus*, in Virginia. M.S. thesis, College of William & Mary, Williamsburg, VA. 55 pp.

Blaylock, R.A. (1988) Distribution and abundance of the bottlenose dolphin, *Tursiops truncatus* (Montagu, 1821), in Virginia. Fishery Bulletin, 86, 797-805.

Buckland, S.T., Anderson, D.R., Burnham K.P., Laake, J.L., Borchers, D.L. and Thomas, L. (2001) Introduction to Distance Sampling. Oxford University Press, Oxford, U.K. 432 pp.

Chelonia Limited Cetacean Monitoring Systems (2014) C-pod specification. Retrieved from http://www.chelonia.co.uk/cpod_specification.htm. Accessed 31 January 2014.

Engelhaupt, A., J. Aschettino, T.A. Jefferson, M. Richlen, and D. Engelhaupt. 2015. *Occurrence, Distribution, and Density of Marine Mammals Near Naval Station Norfolk & Virginia Beach, VA: Annual Progress Report. Draft Report.* Prepared for U.S. Fleet Forces Command. Submitted to Naval Facilities Engineering Command Atlantic, Norfolk, Virginia, under Contract No. N62470-10-3011, Task Orders 031 and 043, issued to HDR Inc., Norfolk, Virginia. 06 August 2015.

Jackson, A.R. (2001) Cetacean survey line transect data verification and management. NOAA Technical Memorandum NMFS-SWFSC-305. National Marine Fisheries Service, La Jolla, CA. 43 pp.

Klinowksa, M. (1986) Diurnal rhythms in Cetacea: a review. Reports of the International Whaling Commission, Special Issue 8, 75-88.

Mazzoil, M., Reif, J.S., Youngbluth, M., Murdoch, M.E., Bechdel, S.E., Howells, E., McCulloch, S.D., Hansen, L.J., and Bossart, G.D. (2008) Home ranges of bottlenose dolphins (*Tursiops truncatus*) in the Indian River Lagoon, Florida: Environmental correlates and implications for management strategies. EcoHealth, 5, 278-288

NOAA Fisheries (2015) 2013-2015 Bottlenose Dolphin Unusual Mortality Event in the Mid-Atlantic. Retrieved from http://www.nmfs.noaa.gov/pr/health/mmume/midatldolphins2013.html. Accessed 21 November 2015.

Read, A.J., Urian, K.W., Roberts, B.R., and Waples, D.M. (2012) Occurrence, distribution and density of marine mammals in Camp Lejeune: Final Report. Submitted to Naval Facilities Engineering Command Atlantic, Norfolk, VA, under Contract No. N62470-08-D-1008 Task Order XO49 managed by Tetra Tech. 50 pp.

Swingle, M. (1994) What do we know about coastal bottlenose dolphins in Virginia? Pages 34-40 in Wang, K.R., Payne, P.M., and Thayer, V.G., eds. (1994) Coastal stock(s) of Atlantic bottlenose dolphin: Status review and management. NOAA Technical Memorandum NMFS-OPR-4. National Marine Fisheries Service, Silver Spring, MD. 121 pp.

Thomas, L., Williams, R., and Sandilands, D. (2007) Designing line transect surveys for complex survey regions. Journal of Cetacean Research and Management, 9(1), 1-13.

Thomas, L., Buckland, S.T., Rexstad, E.A, Laake, J. L., Strindberg, S., Hedley, S. L, Bishop, J.R.B., Marques, T.A., and Burnham, K.P. (2010) Distance software: design and analysis of distance sampling surveys for estimating population size. Journal of Applied Ecology, 47, 5-14. doi: 10.1111/j.1365-2664.2009.01737.

Urian, K.W., Hohn, A.A., and Hansen, L.J. (1999) Status of the photo-identification catalog of coastal bottlenose dolphins of the western North Atlantic: Report of a workshop of catalog contributors. NOAA Administrative Report NMFS-SEFSC-425. National Marine Fisheries Service, Miami, FL. 22 pp.

Urian, K. (2016) Determining the stock identity of stranded bottlenose dolphins from the Unusual Mortality Event using the Mid-Atlantic Bottlenose Dolphin Catalog. Presented at the Mid-Atlantic Bottlenose Dolphins meeting in Riverhead, NY, 22-23 February 2016.

Wang, K.R., Payne, P.M., and Thayer, V.G., eds. (1994) Coastal stock(s) of Atlantic bottlenose dolphin: Status review and management. NOAA Technical Memorandum NMFS-OPR-4. National Marine Fisheries Service, Silver Spring, MD. 121 pp.

Waring, G.T., Josephson, E., Maze-Foley, K., and Rosel, P.E., eds. (2014) U.S. Atlantic and Gulf of Mexico marine mammal stock assessments -- 2013. NOAA Technical Memorandum NMFS-NE-228. National Marine Fisheries Service, Woods Hole, MA. 471 pp.

Wilson, B., Hammond, P.S., and Thompson, P.M. (1999) Estimating size and assessing trends in a coastal bottlenose dolphin population. Ecological Applications, 9, 288-300.

Würsig, B. and Würsig, M. (1977) The photographic determination of group size, composition, and stability of coastal porpoises (*Tursiops truncatus*). Science, 198, 755-756.

Zolman, E.S. (2002) Residence patterns of bottlenose dolphins (*Tursiops truncatus*) in the Stono River Estuary, Charleston County, South Carolina, U.S.A. Marine Mammal Science, 18(4), 879-892.

A

Data Sheets

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Event : Norfolk Dolphin Density - Transects   Vessel Name: ____________________   Page ________ of ________

Date: ____________________   Misc. : ____________________   Location: ____________________

Sighting Data

Sighting Number	Time (Start & Stop)	WP	Animal Bearing & Distance	Species	Group Size (min/max/best) # of Calves	Ship Latitude and Longitude	Ship Bearing	Behavior	Reaction to Vessel	Observer Name	Sighting cue	Water Temp	Photos? frames	Effort	Comments
	: : : :		° m/r		/ / ___ calves	Lat: Lon:	°		Positive Negative None Uncertain				Y/N	On Off	
	: : : :		° m/r		/ / ___ calves	Lat: Lon:	°		Positive Negative None Uncertain				Y/N	On Off	
	: : : :		° m/r		/ / ___ calves	Lat: Lon:	°		Positive Negative None Uncertain				Y/N	On Off	
	: : : :		° m/r		/ / ___ calves	Lat: Lon:	°		Positive Negative None Uncertain				Y/N	On Off	
	: : : :		° m/r		/ / ___ calves	Lat: Lon:	°		Positive Negative None Uncertain				Y/N	On Off	
	: : : :		° m/r		/ / ___ calves	Lat: Lon:	°		Positive Negative None Uncertain				Y/N	On Off	

Event : Norfolk Dolphin Density - Transect Vessel Name: _____ Page _____ of _____

Date: _____ Misc. : _____ Start Location: _____

Effort Log

Time	Line/WP	Effort	Ship Latitude and Longitude	Comments
: :			Lat: Lon:	
: :			Lat: Lon:	
: :			Lat: Lon:	
: :			Lat: Lon:	
: :			Lat: Lon:	
: :			Lat: Lon:	
: :			Lat: Lon:	
: :			Lat: Lon:	
: :			Lat: Lon:	

Event : Norfolk Dolphin Density - Photo-ID Vessel Name: _____ Page _____ of _____

Date: _____ Misc. : _____ Start Location: _____

Sighting Data

Sighting Number	Time (Start & Stop)	WP	Species	Group Size (min/max/best) # of Calves	Ship Latitude and Longitude	Behavior	Depth	Observer Name	Water Temp	Photos? Frames	Comments
	: : : :			/ / ___ calves	Lat: Lon:					Y/N	
	: : : :			/ / ___ calves	Lat: Lon:					Y/N	
	: : : :			/ / ___ calves	Lat: Lon:					Y/N	
	: : : :			/ / ___ calves	Lat: Lon:					Y/N	

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B

Transect Survey Tracks and Sightings

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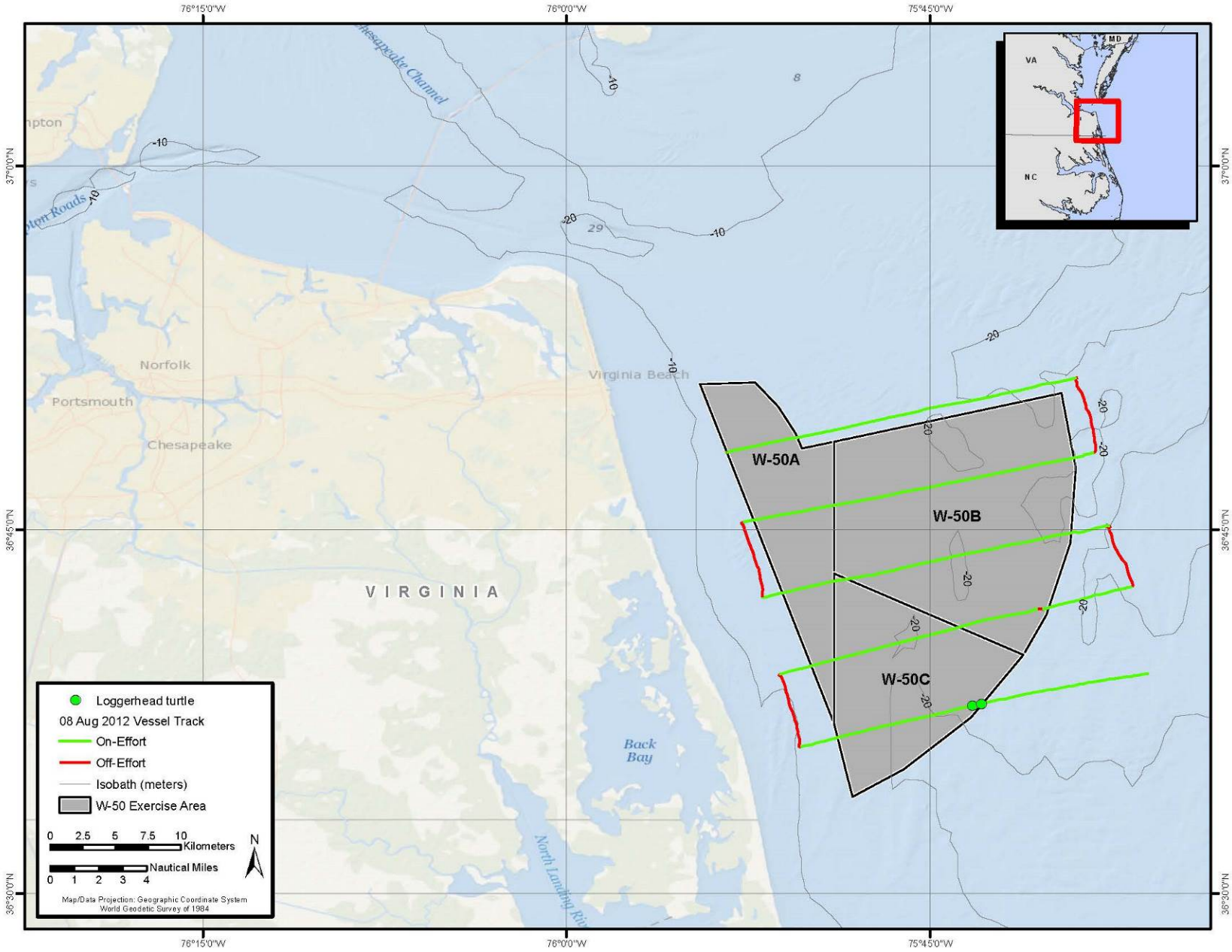
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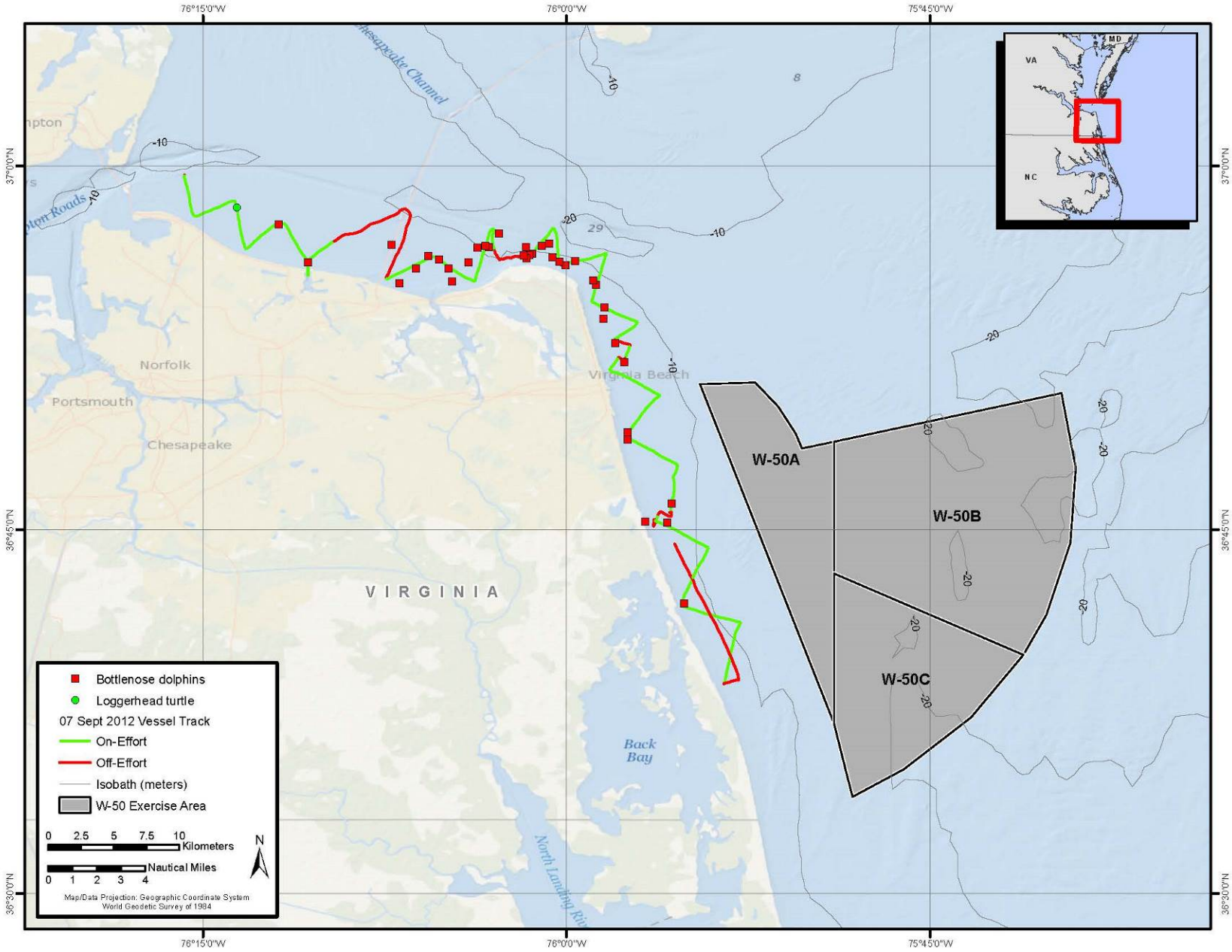
Hampton Roads
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
MD
VA
NC
Loggerhead turtle
08 Aug 2012 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
W-50A
W-50B
W-50C
MD
VA
NC
Bottlenose dolphins
Loggerhead turtle
07 Sept 2012 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
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0 1 2 3 4 Nautical Miles
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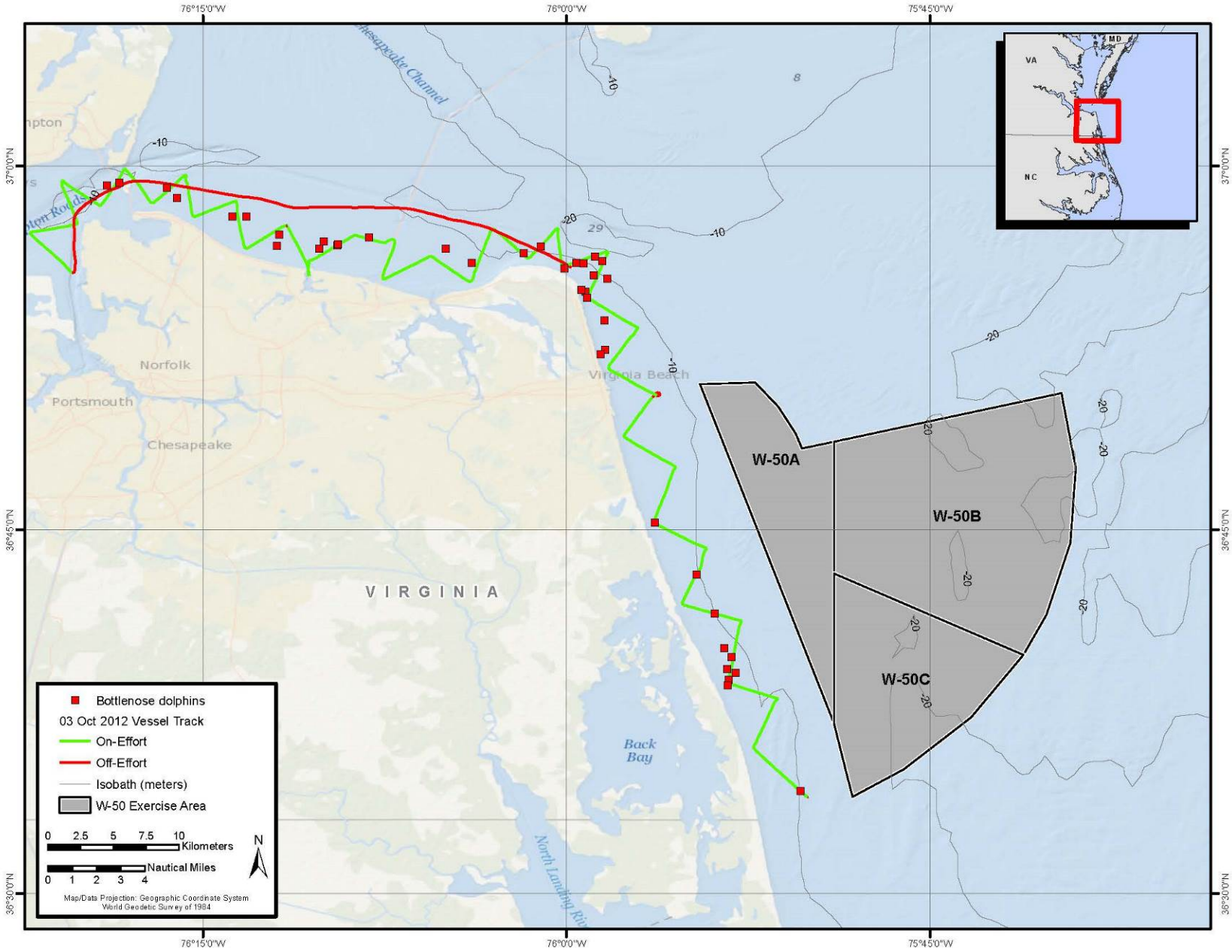
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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Virginia Beach
VIRGINIA
Back Bay
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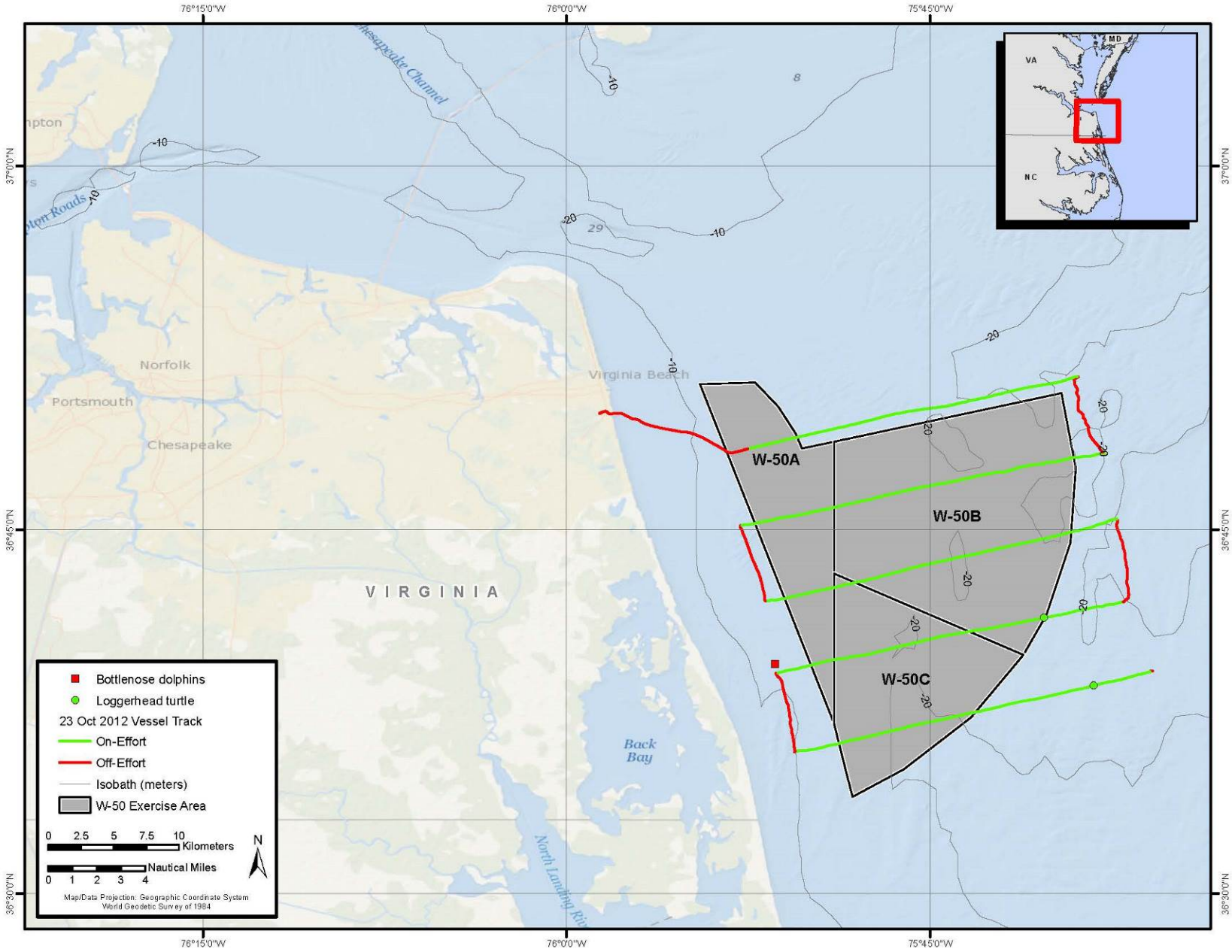
W-50B
W-50C
MD
VA
NC
Bottlenose dolphins
03 Oct 2012 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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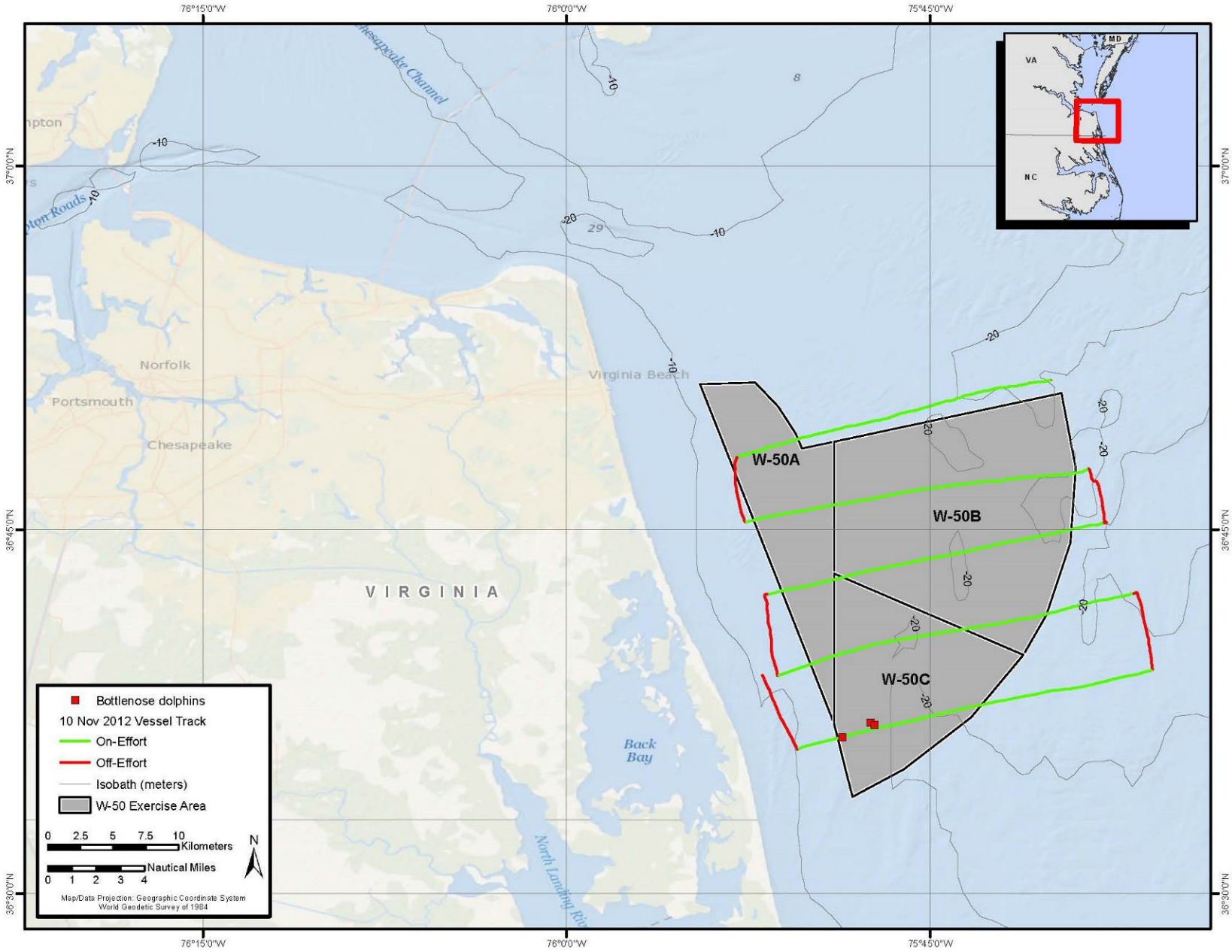
Hampton Roads
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
MD
VA
NC
Bottlenose dolphins
Loggerhead turtle
23 Oct 2012 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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Hampton Roads
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
MD
VA
NC
Bottlenose dolphins
10 Nov 2012 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
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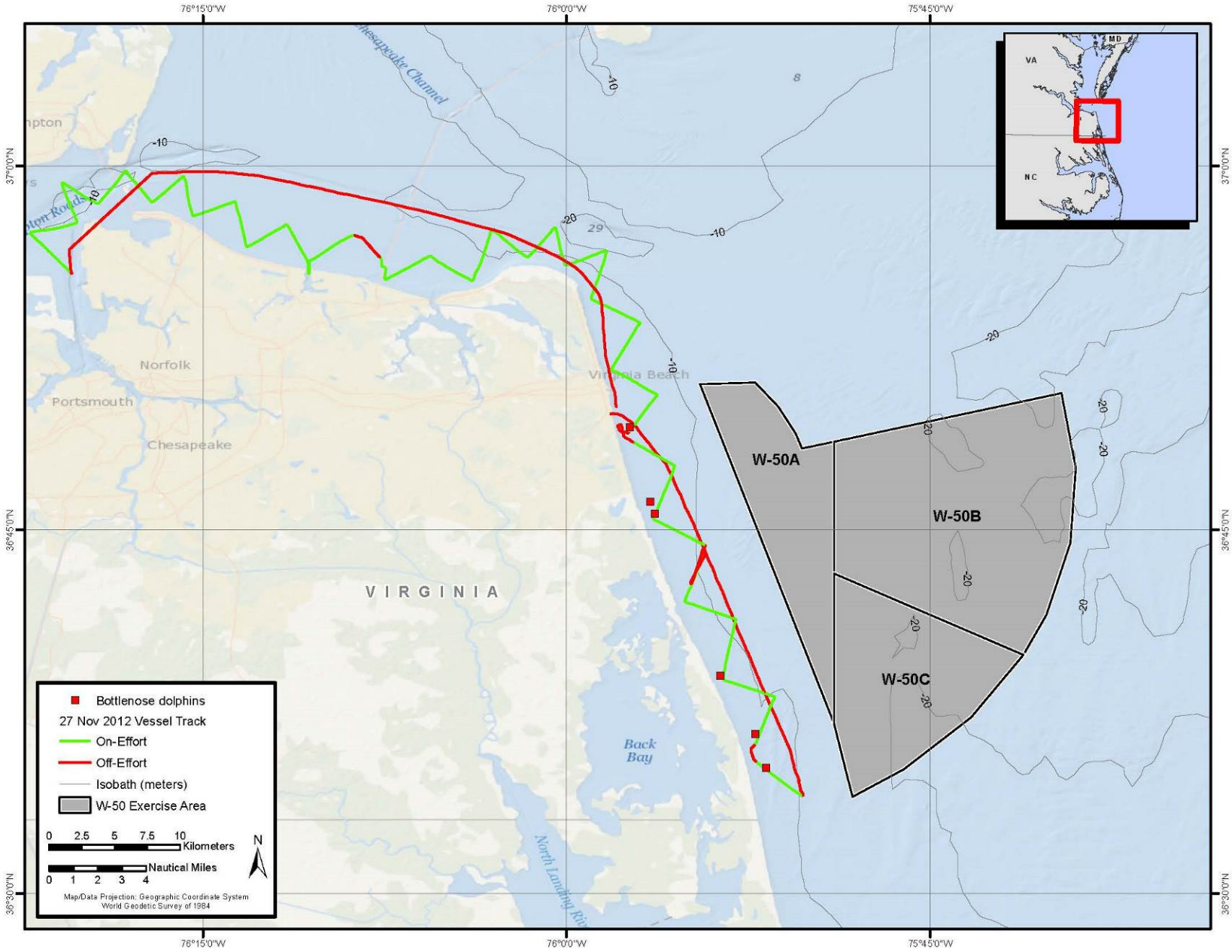
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
W-50A
W-50B
W-50C
VA
MD
NC
Bottlenose dolphins
27 Nov 2012 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
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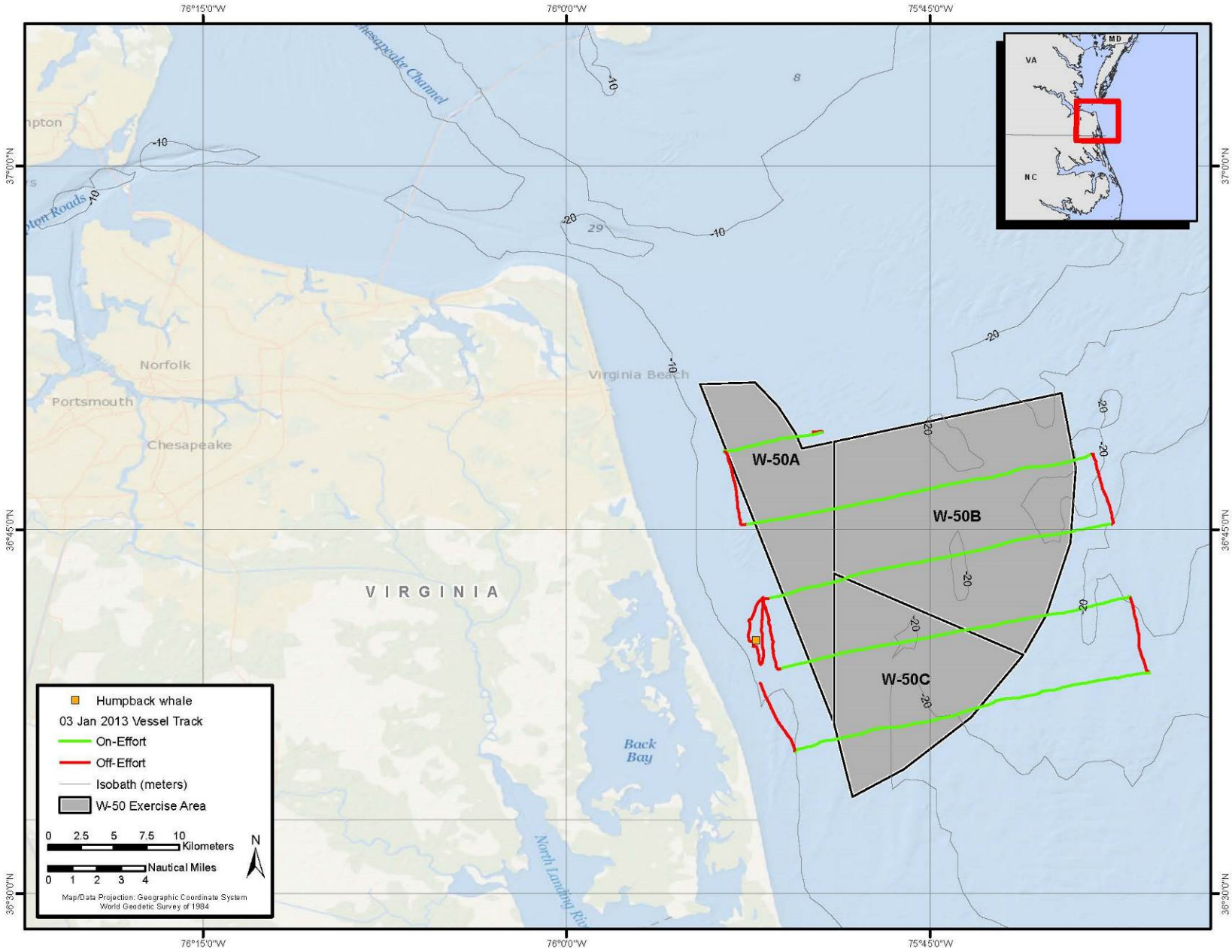
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
MD
VA
NC
Humpback whale
03 Jan 2013 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
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0 1 2 3 4 Nautical Miles
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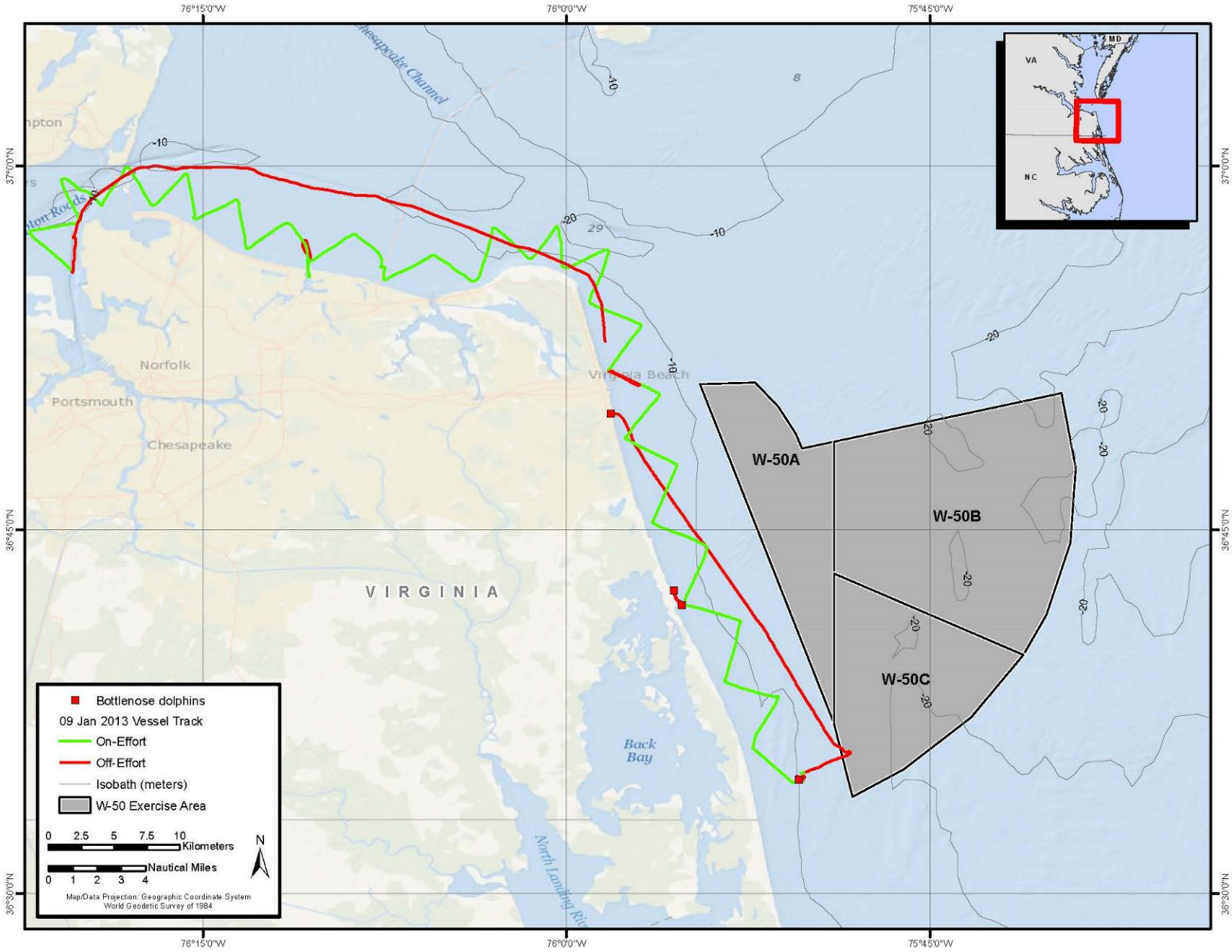
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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Bottlenose dolphins
09 Jan 2013 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
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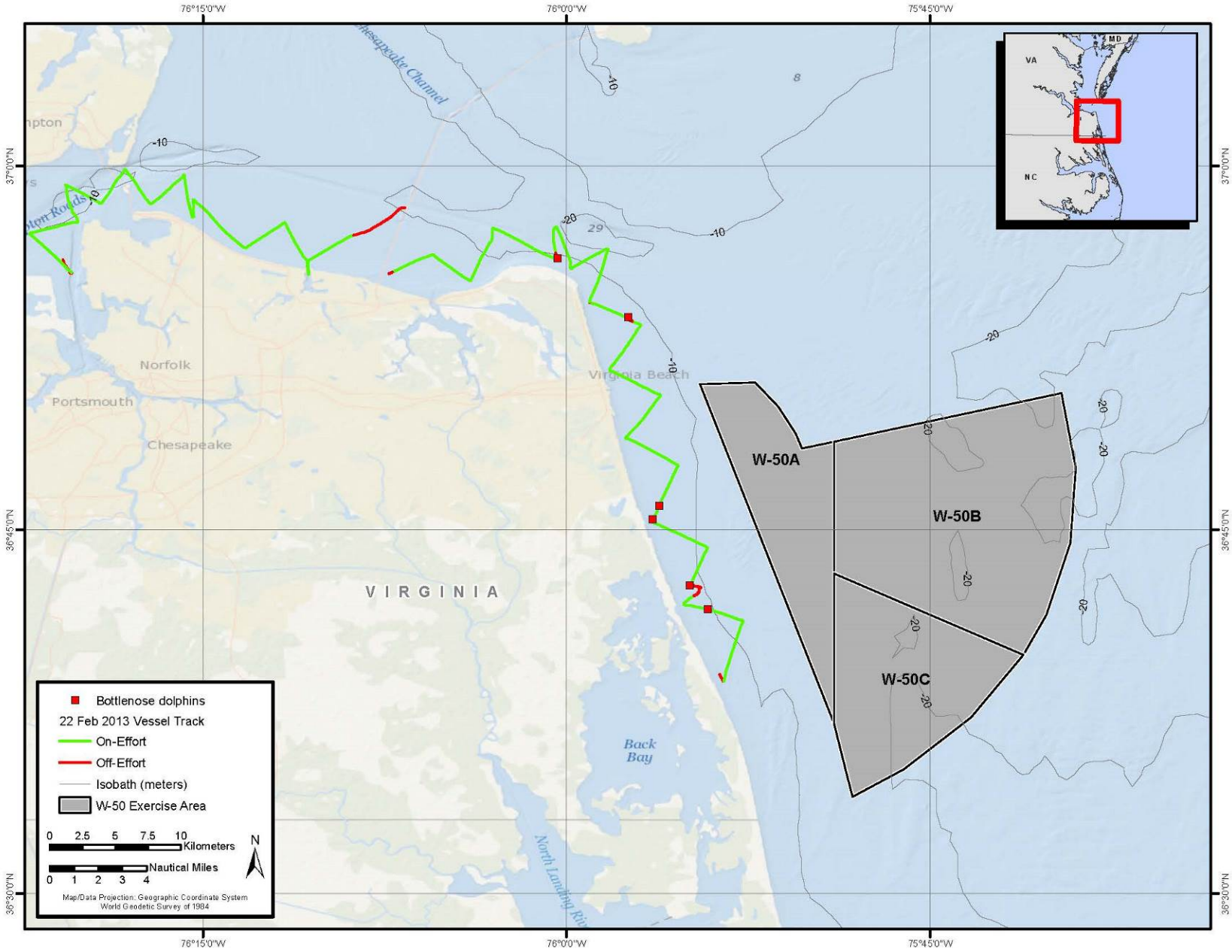
World Geodetic Survey of 1984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Bottlenose dolphins
22 Feb 2013 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
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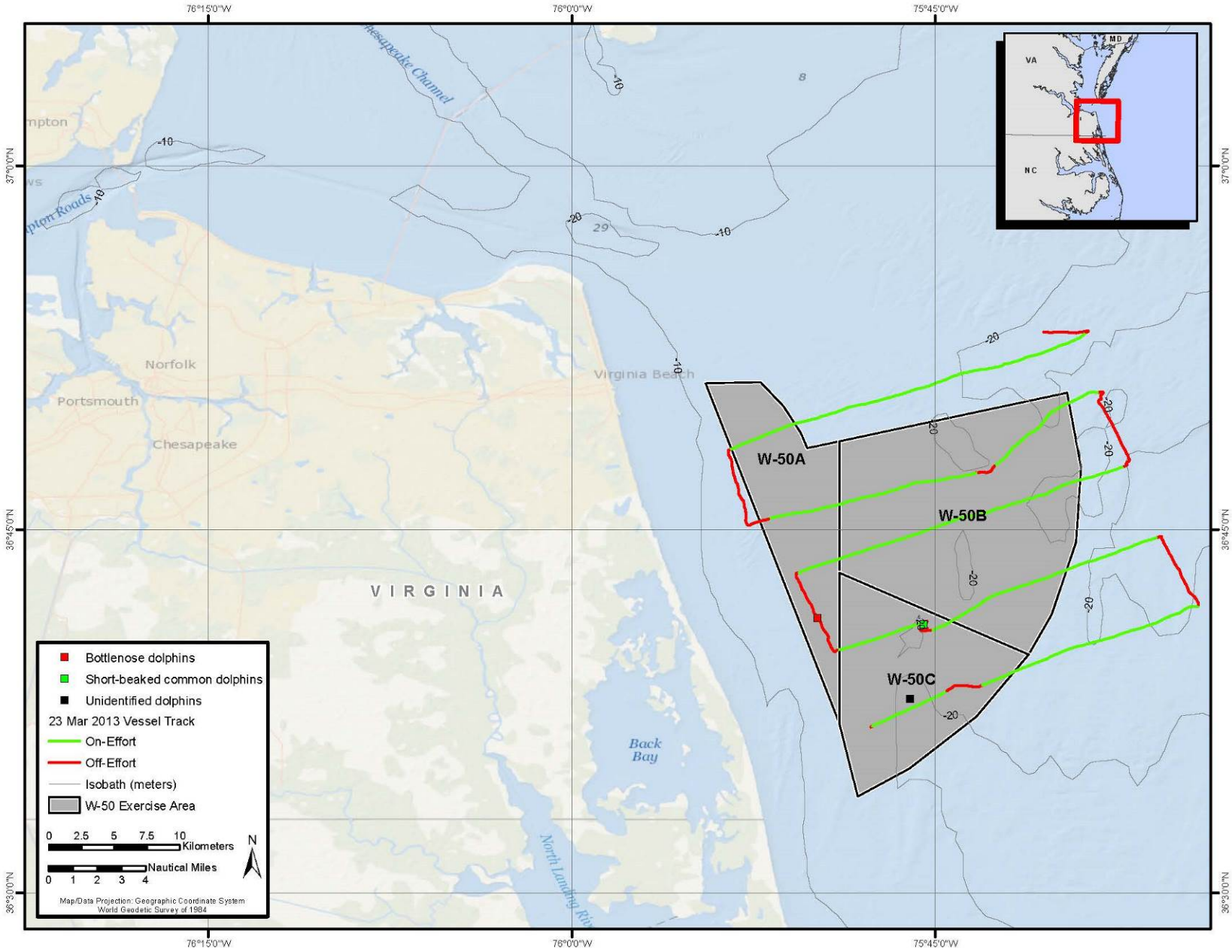
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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Back Bay
North Landing River
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MD
VA
NC
Bottlenose dolphins
Short-beaked common dolphins
Unidentified dolphins
23 Mar 2013 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
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0 1 2 3 4 Nautical Miles
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Map/Data Projection: Geographic Coordinate System
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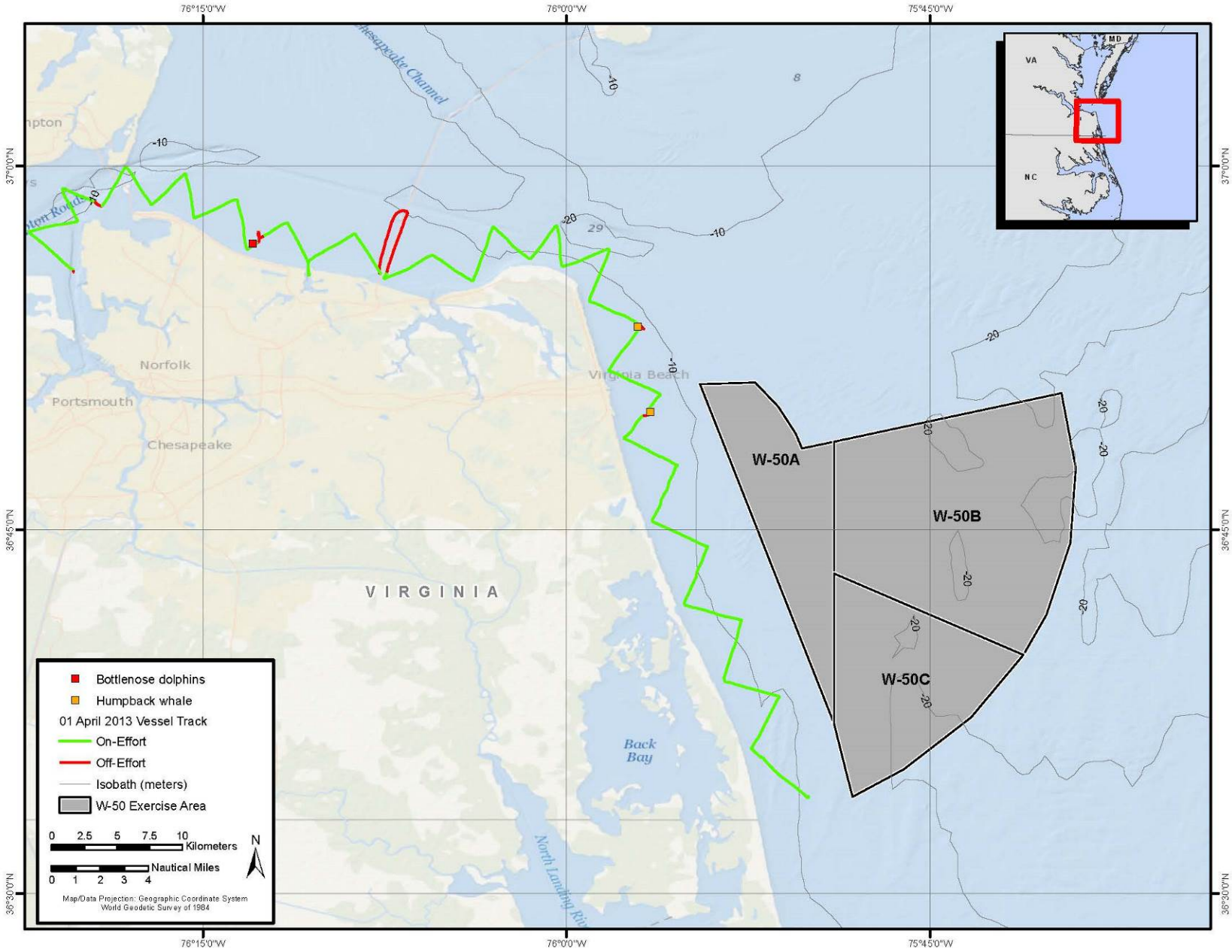
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Bottlenose dolphins
Humpback whale
01 April 2013 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
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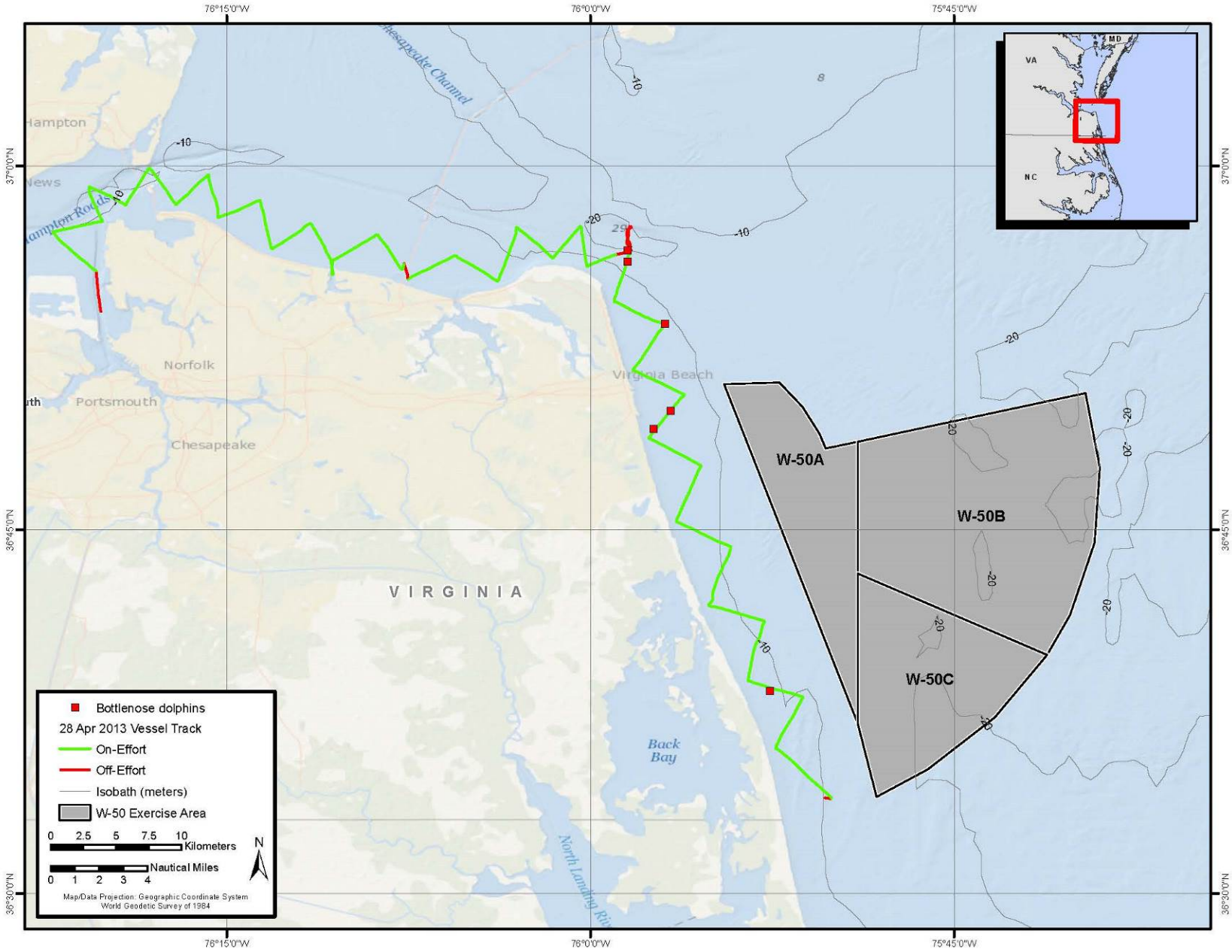
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Bottlenose dolphins
28 Apr 2013 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
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0 1 2 3 4 Nautical Miles
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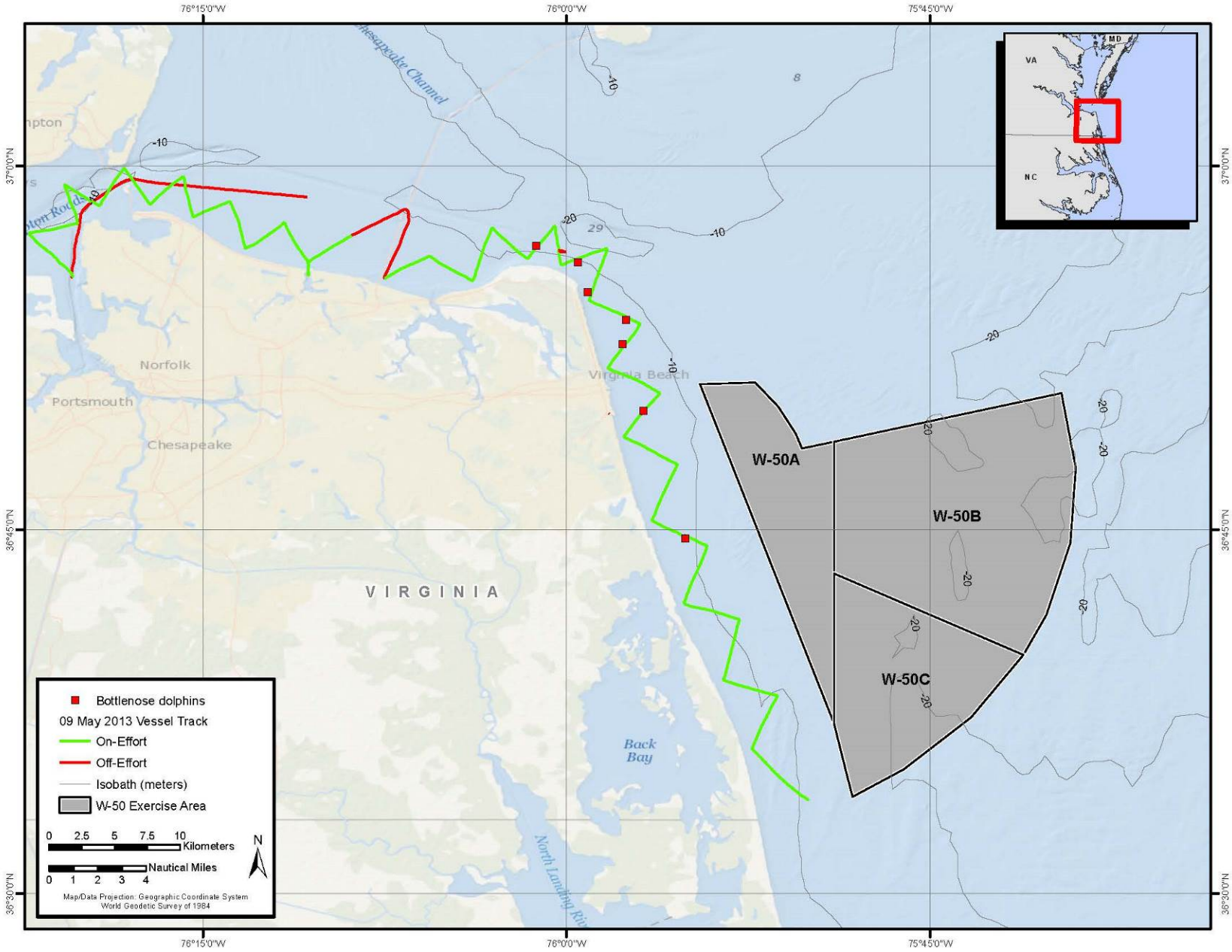
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NC
Bottlenose dolphins
09 May 2013 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
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0 1 2 3 4 Nautical Miles
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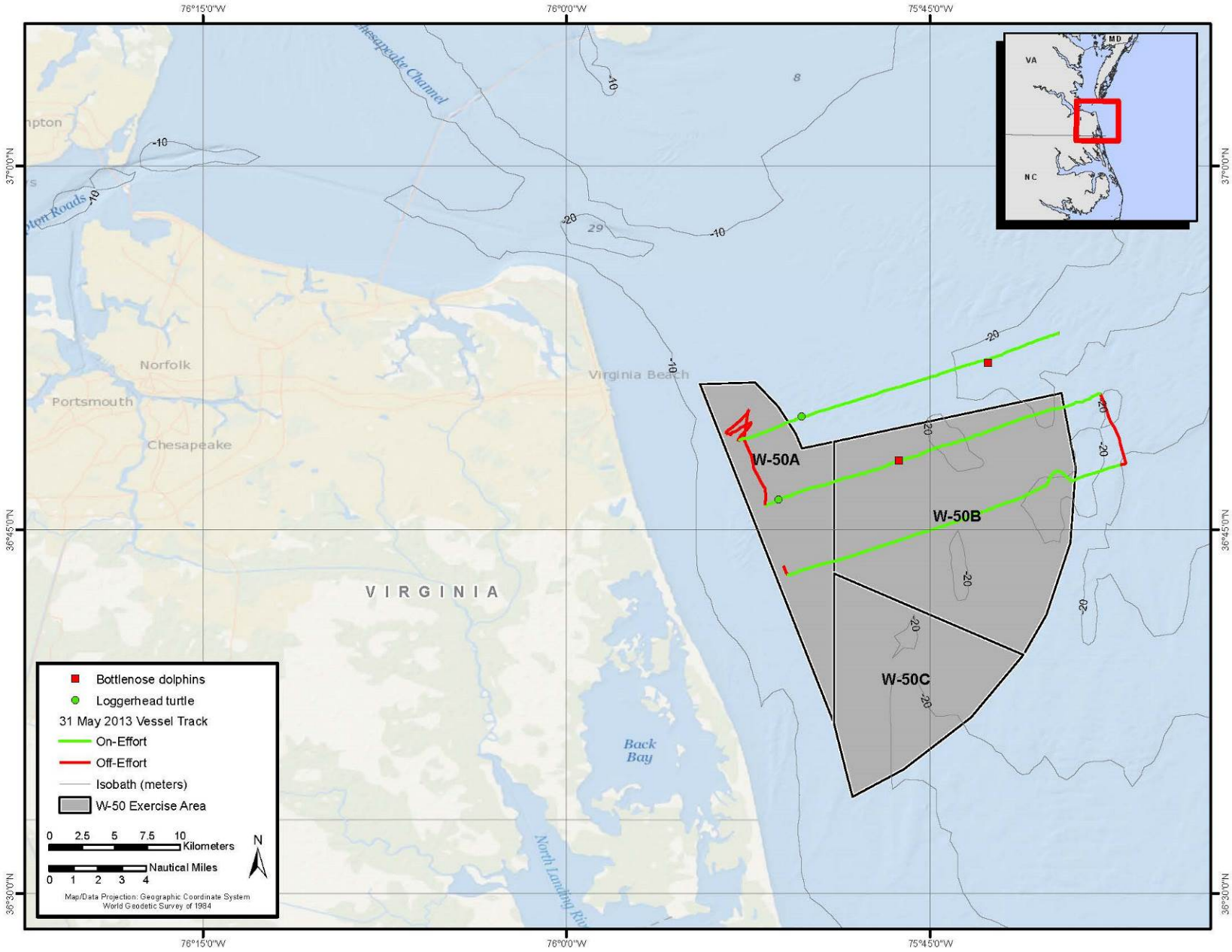
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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Virginia Beach
VIRGINIA
Back Bay
W-50A
W-50B
W-50C
VA
MD
NC
Bottlenose dolphins
Loggerhead turtle
31 May 2013 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
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0 1 2 3 4 Nautical Miles
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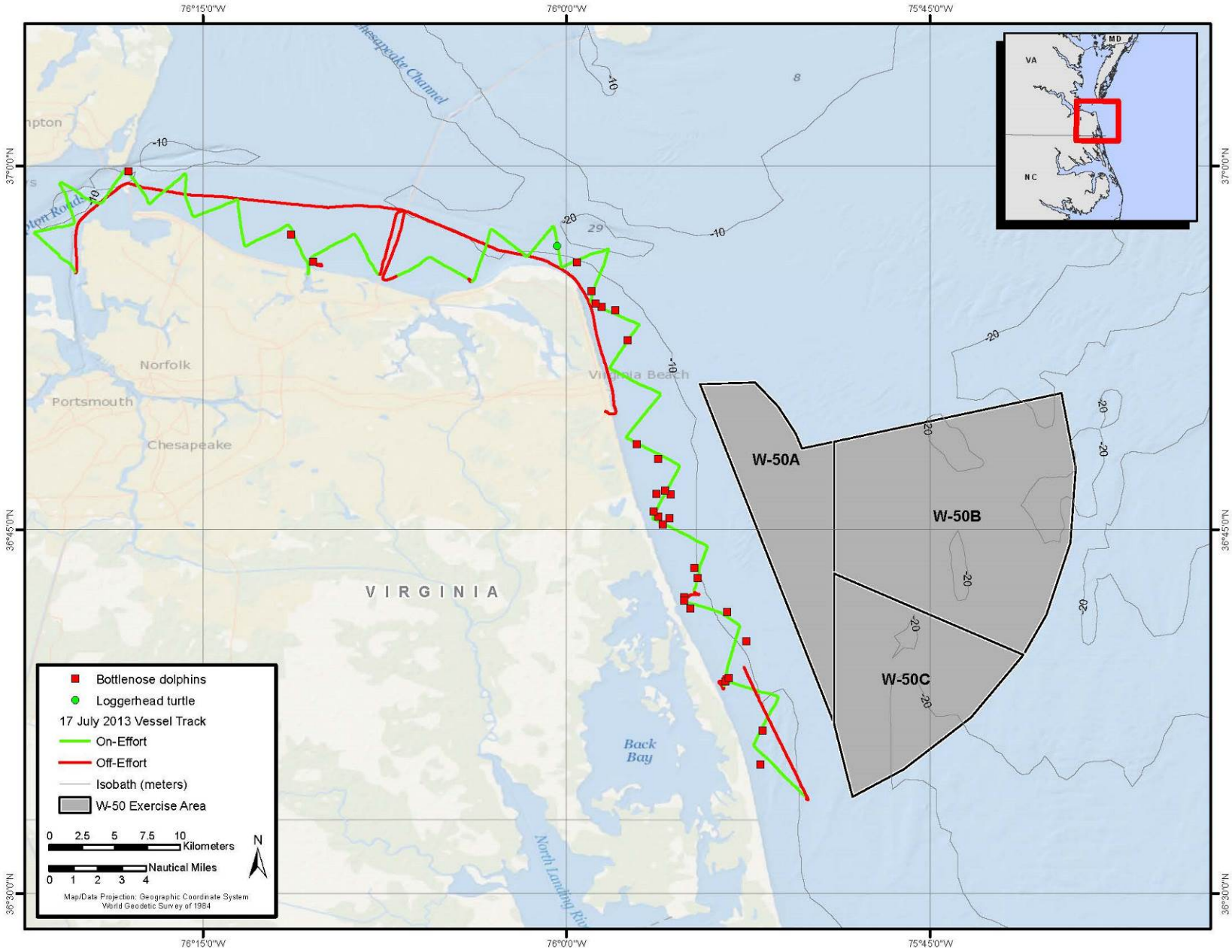
World Geodetic Survey of 1984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Chesapeake
Virginia Beach
VIRGINIA
Back Bay
W-50A
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W-50C
VA
MD
NC
Bottlenose dolphins
Loggerhead turtle
17 July 2013 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
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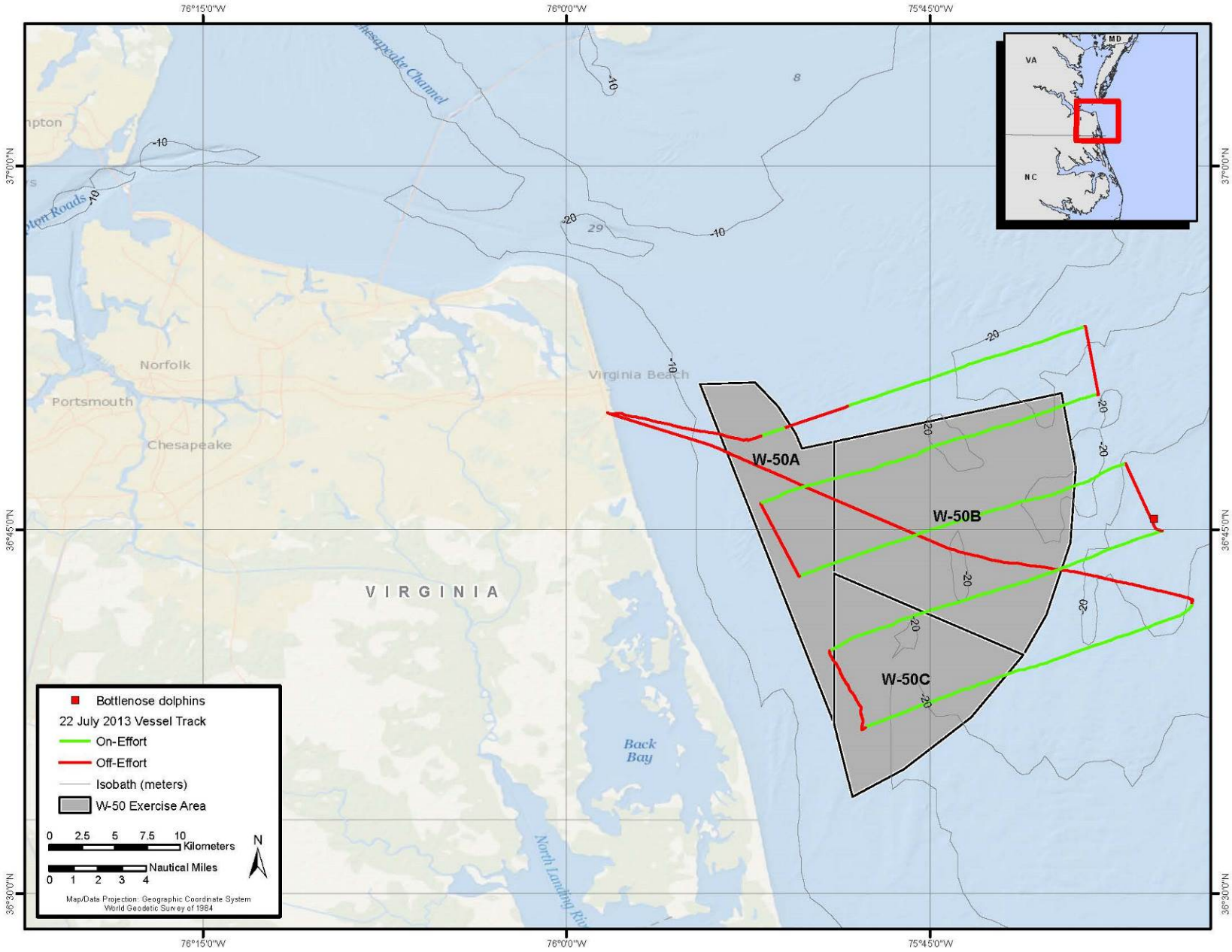
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
MD
VA
NC
Bottlenose dolphins
22 July 2013 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
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0 1 2 3 4 Nautical Miles
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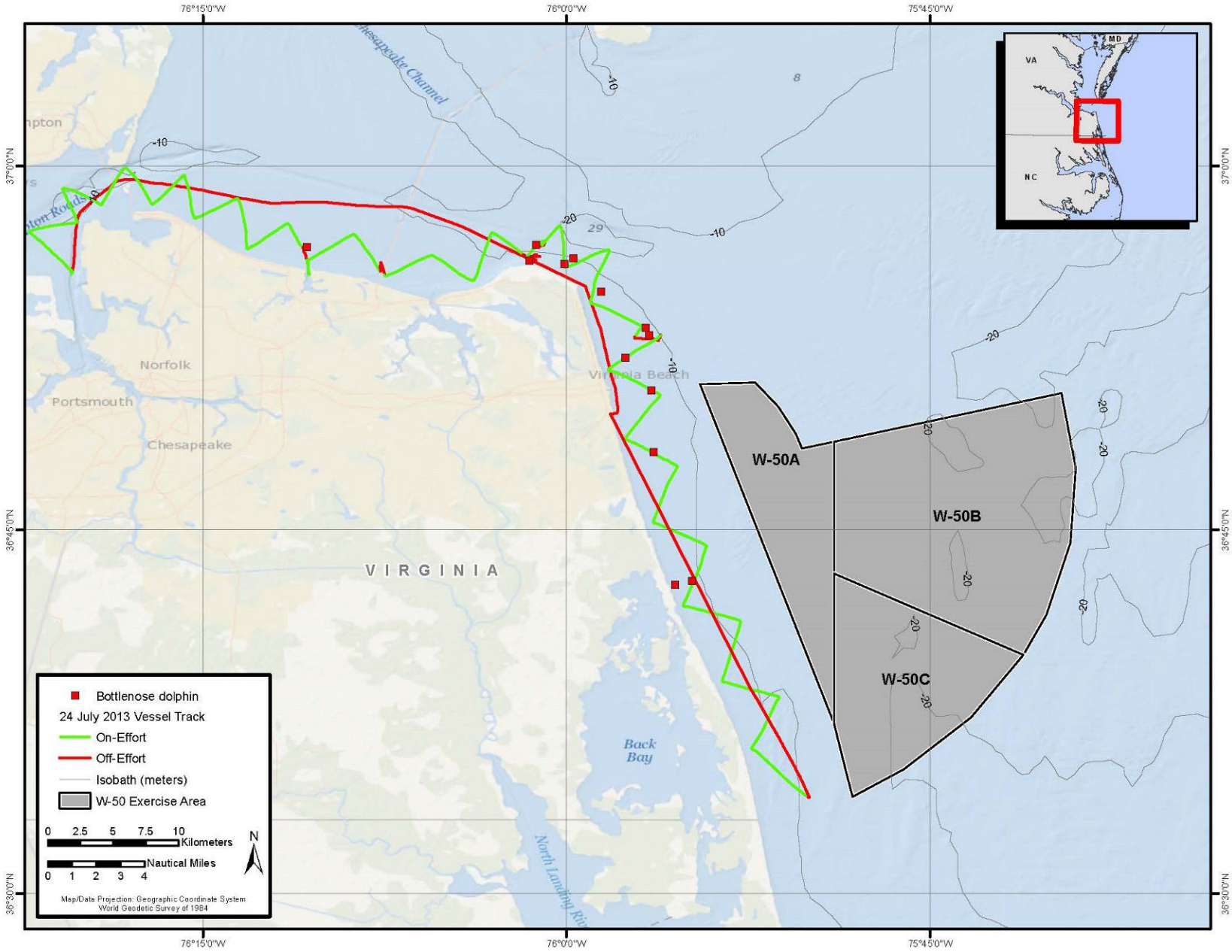
World Geodetic Survey of 1984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Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
W-50A
W-50B
W-50C
MD
VA
NC
Bottlenose dolphin
24 July 2013 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
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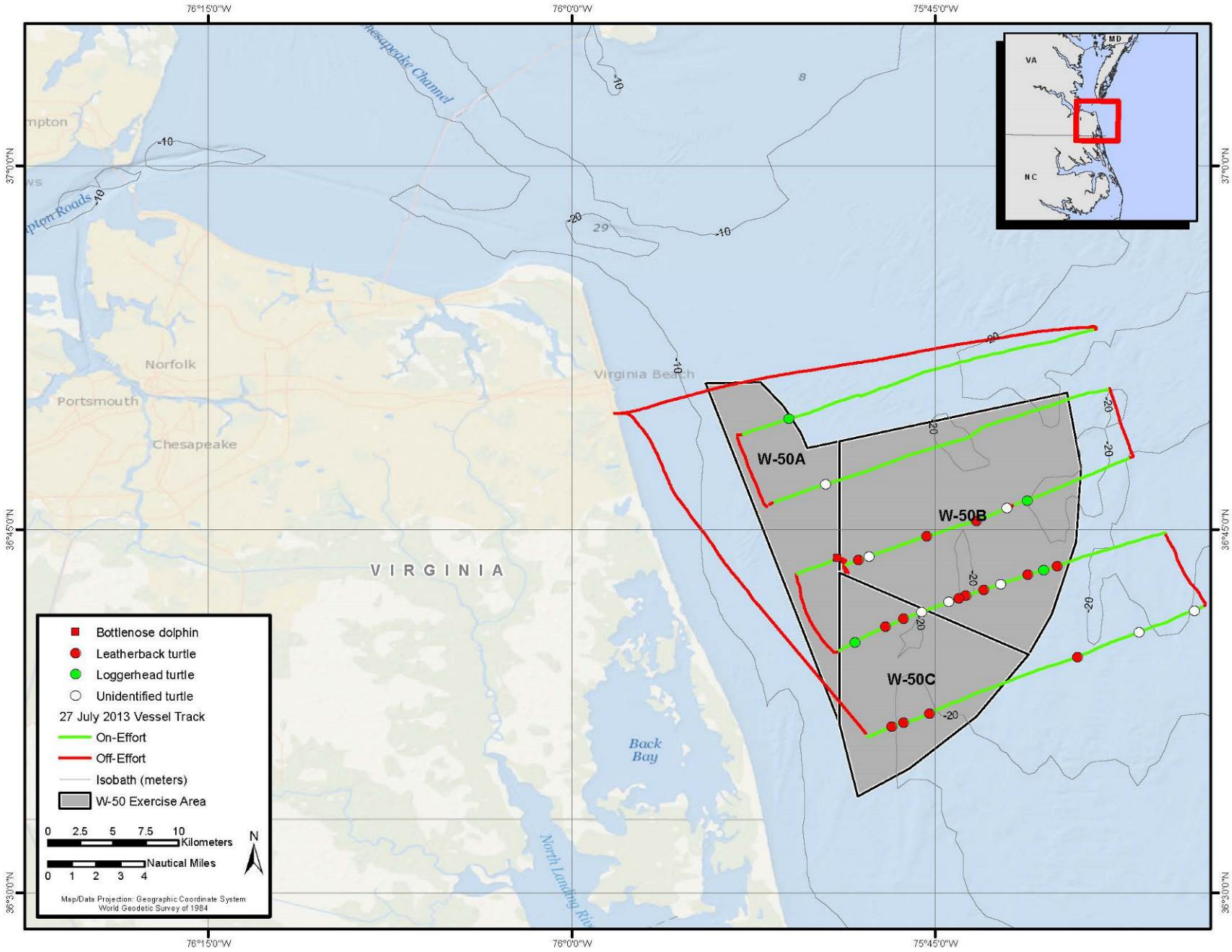
World Geodetic Survey of 1984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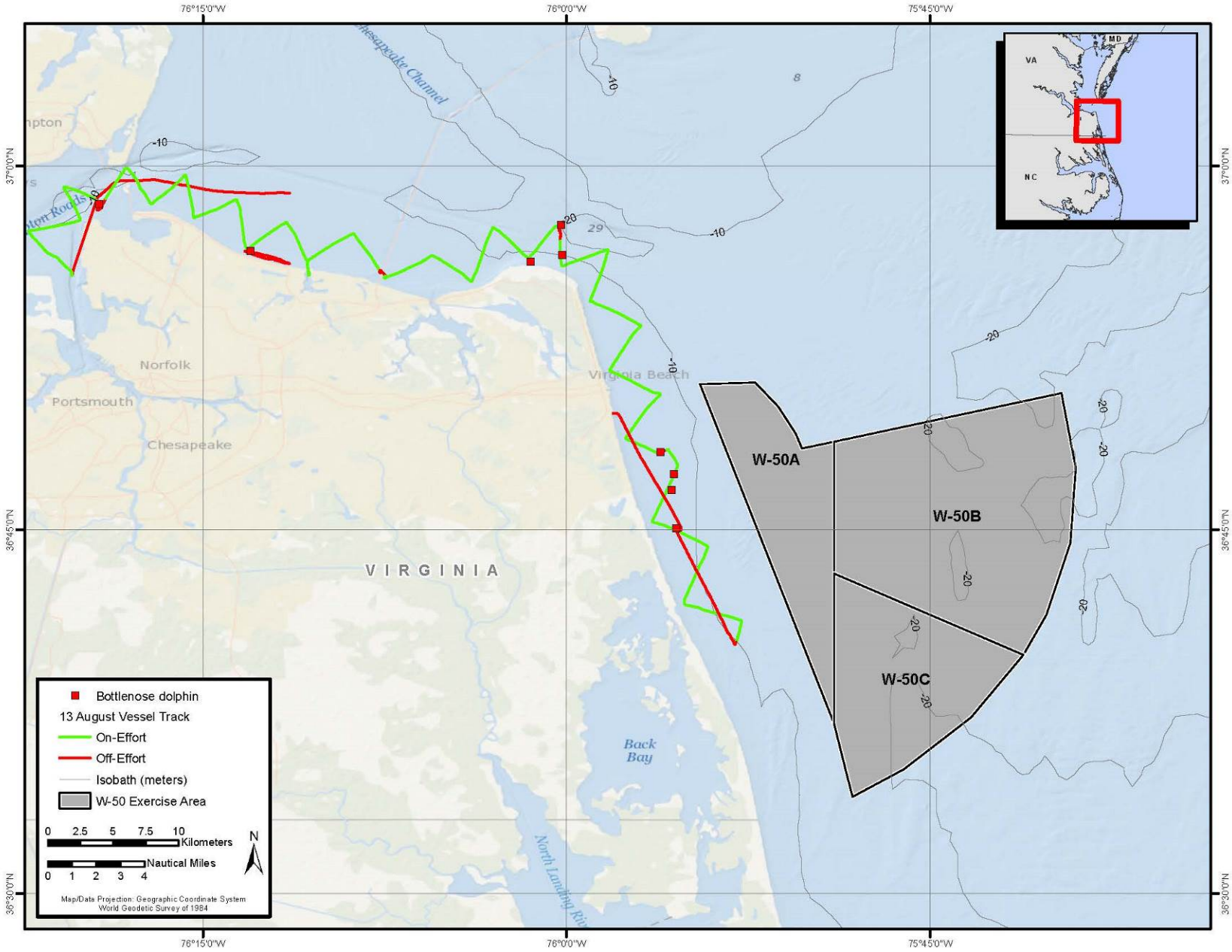
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
MD
VA
NC
Bottlenose dolphin
Leatherback turtle
Loggerhead turtle
Unidentified turtle
27 July 2013 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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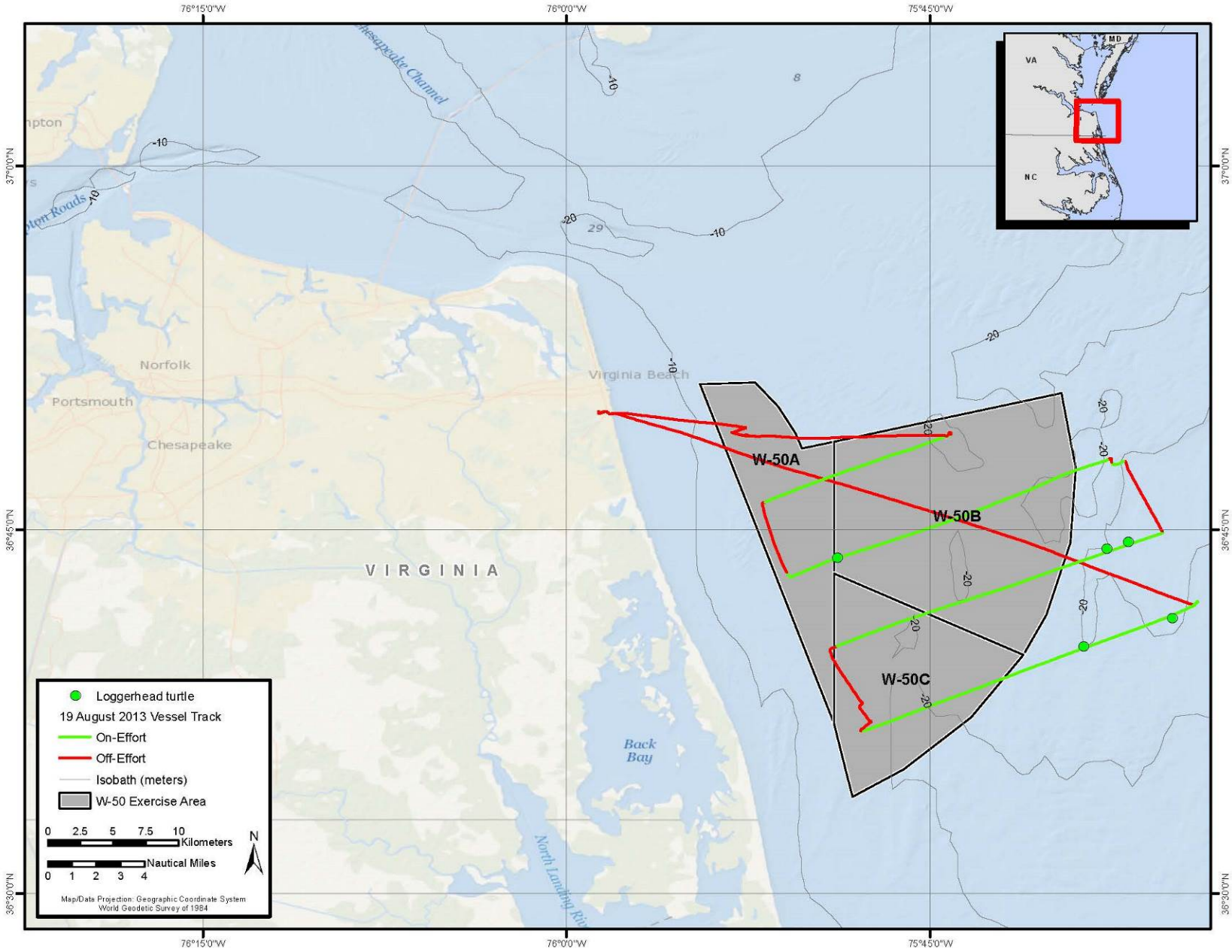
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
W-50A
W-50B
W-50C
VA
MD
NC
Bottlenose dolphin
13 August Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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Hampton Roads
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
MD
VA
NC
Loggerhead turtle
19 August 2013 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
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0 1 2 3 4 Nautical Miles
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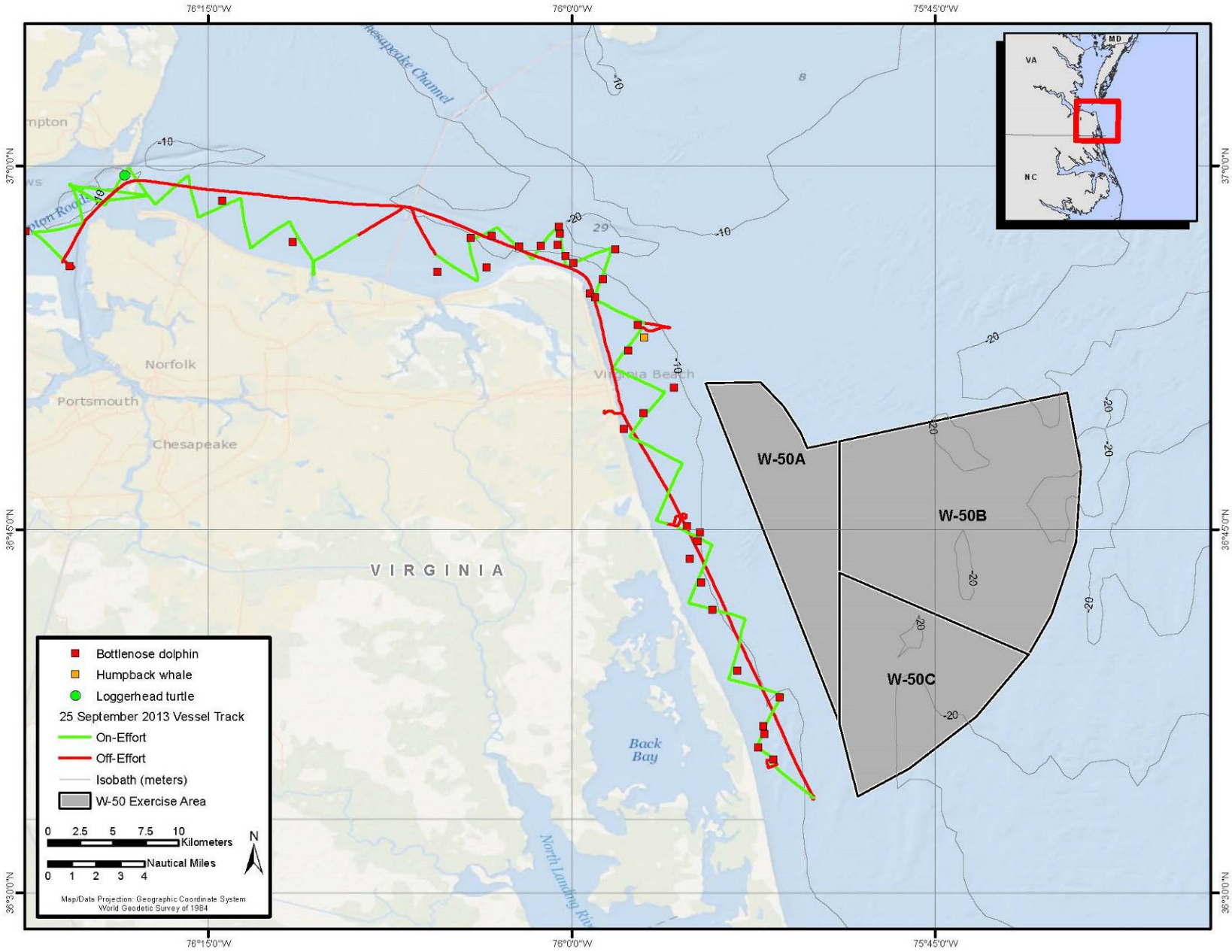
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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Virginia Beach
VIRGINIA
W-50A
W-50B
W-50C
Back Bay
North Landing River
MD
VA
NC
Bottlenose dolphin
Humpback whale
Loggerhead turtle
25 September 2013 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
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0 1 2 3 4 Nautical Miles
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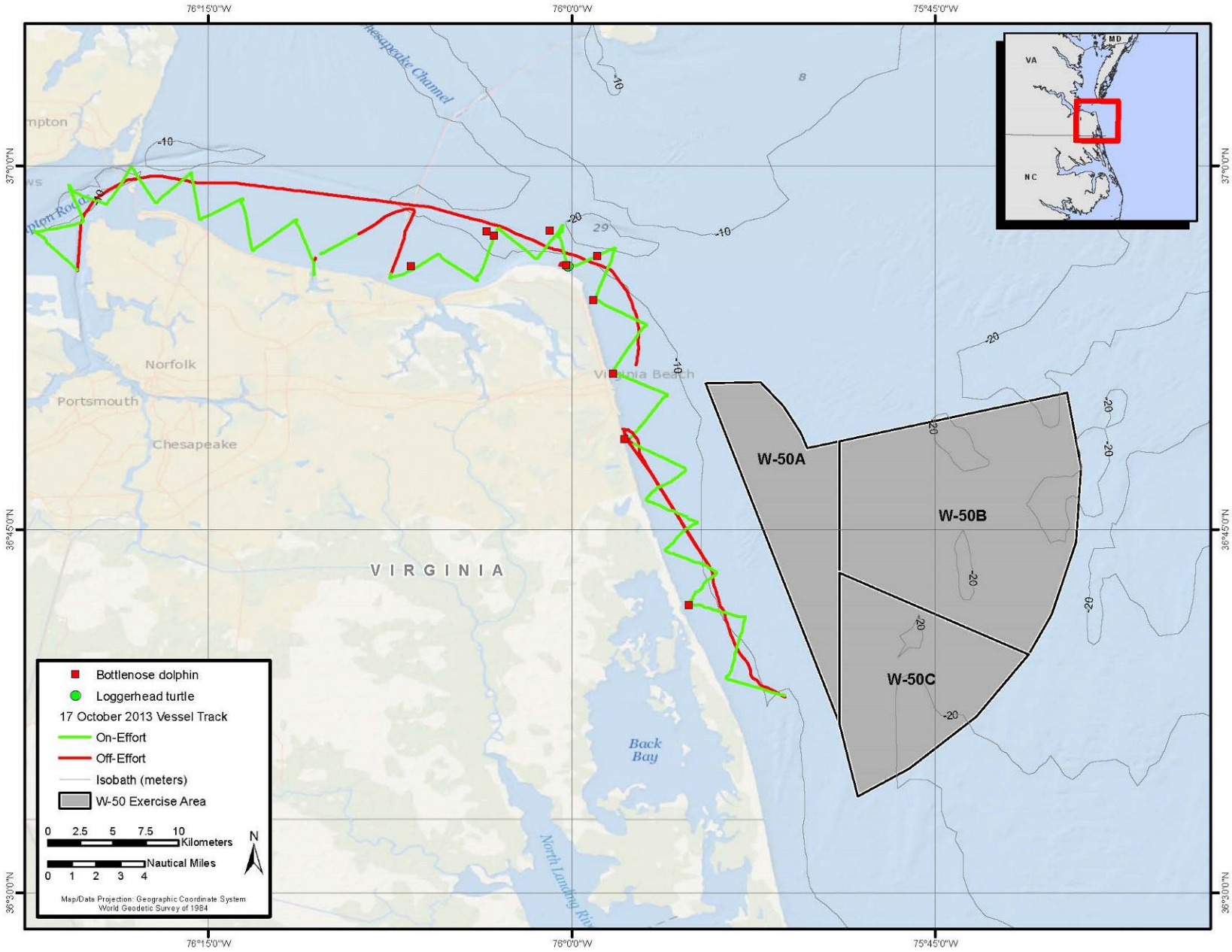
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
W-50A
W-50B
W-50C
VA
MD
NC
Bottlenose dolphin
Loggerhead turtle
17 October 2013 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
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0 1 2 3 4 Nautical Miles
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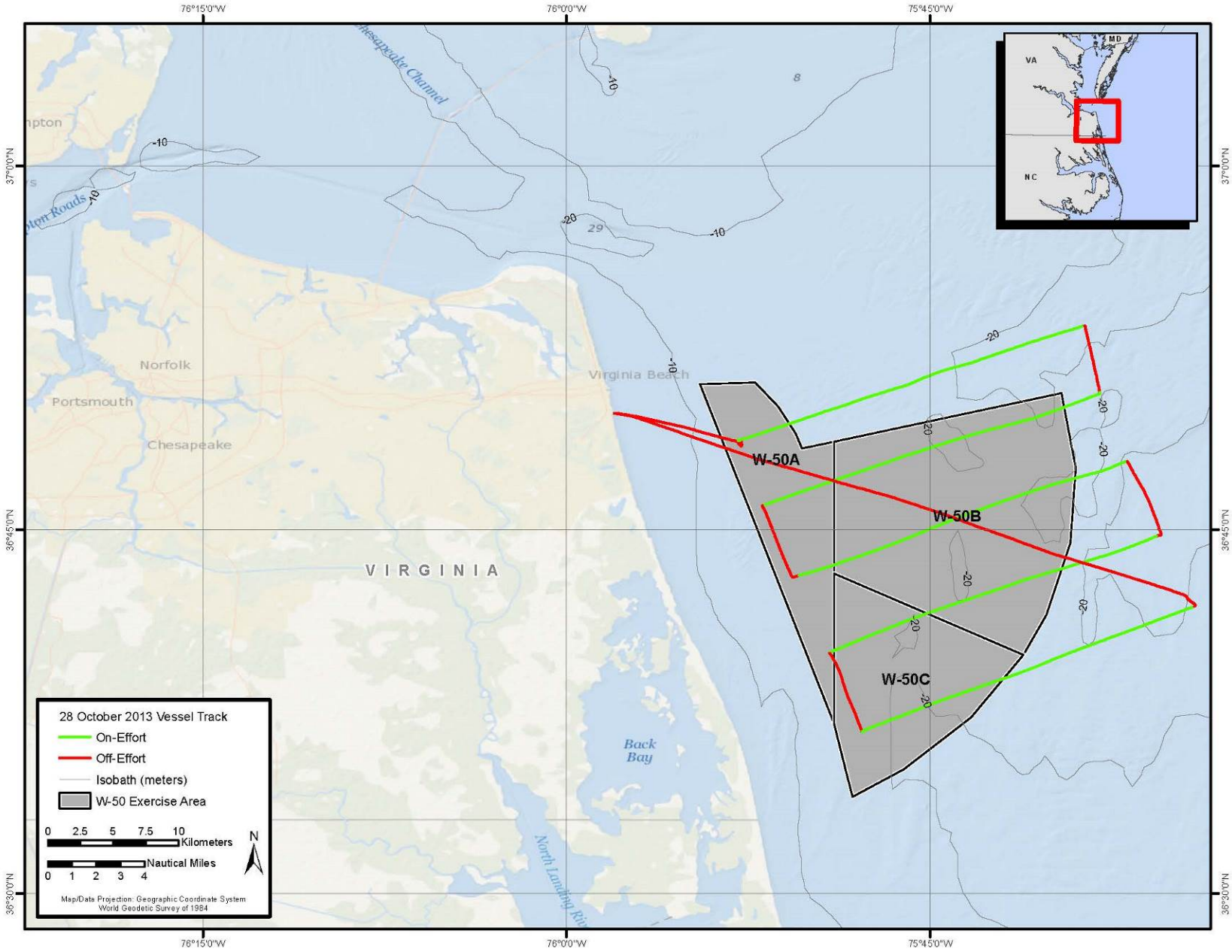
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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Hampton Roads
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
MD
VA
NC
28 October 2013 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
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0 1 2 3 4 Nautical Miles
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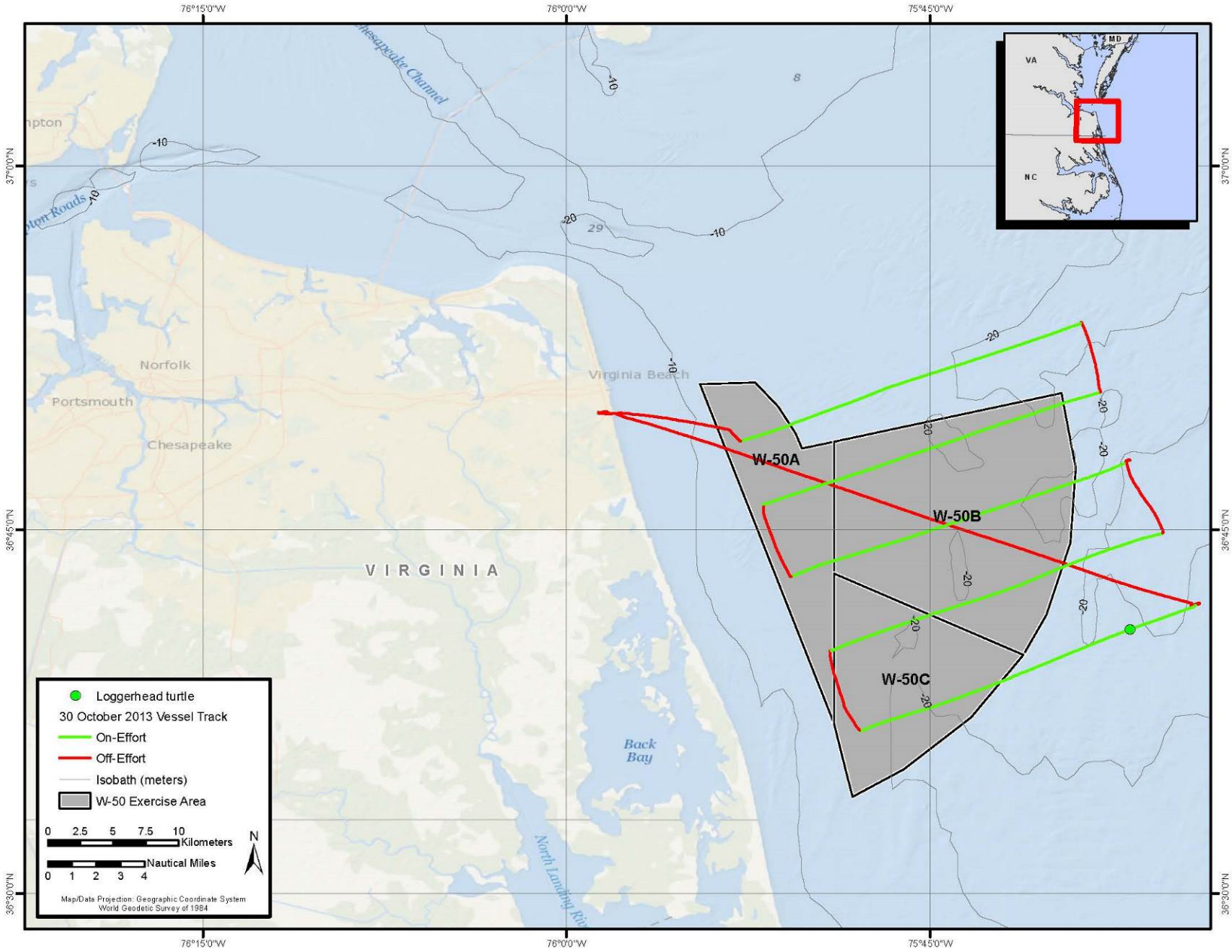
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
VA
MD
NC
Loggerhead turtle
30 October 2013 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
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0 1 2 3 4 Nautical Miles
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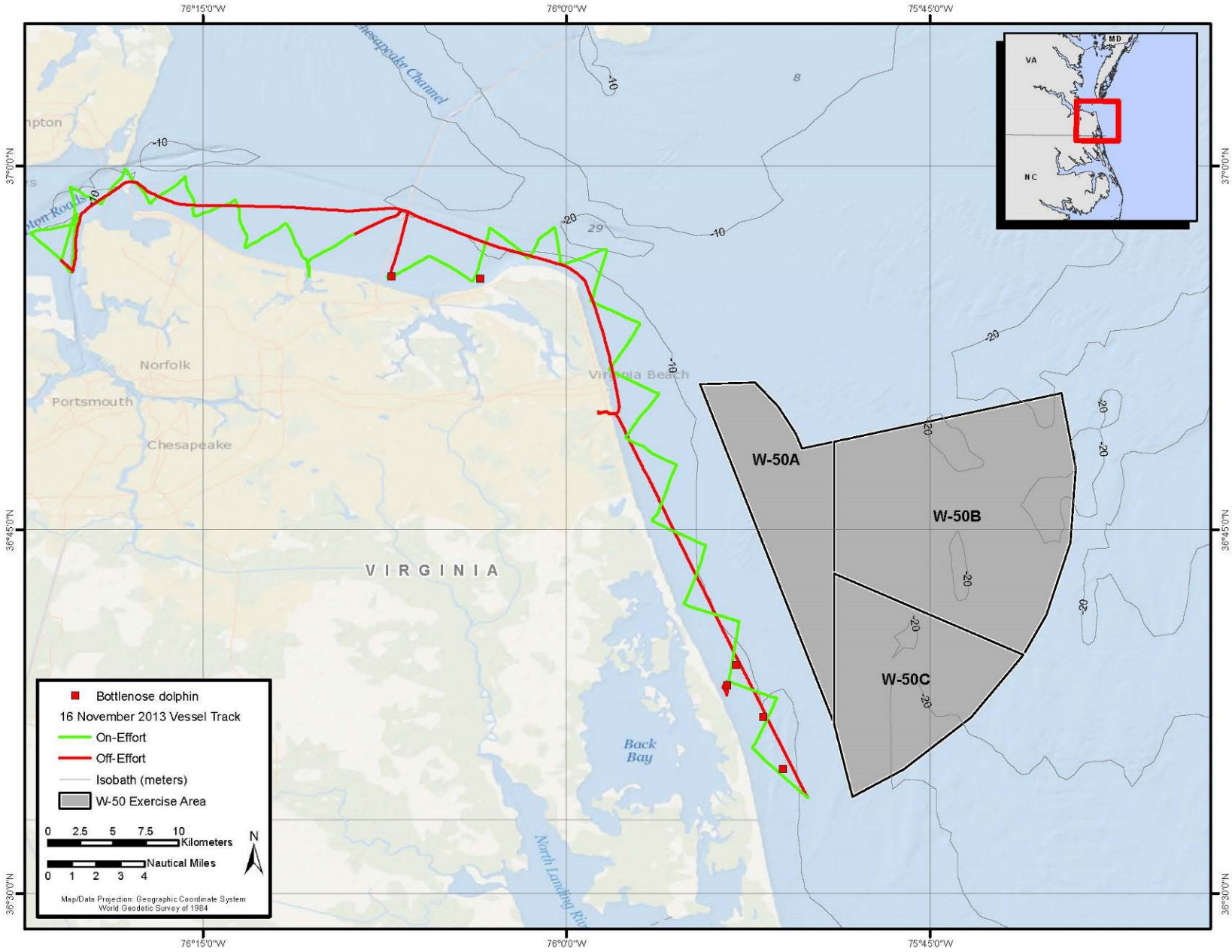
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
W-50A
W-50B
W-50C
VA
MD
NC
Bottlenose dolphin
16 November 2013 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
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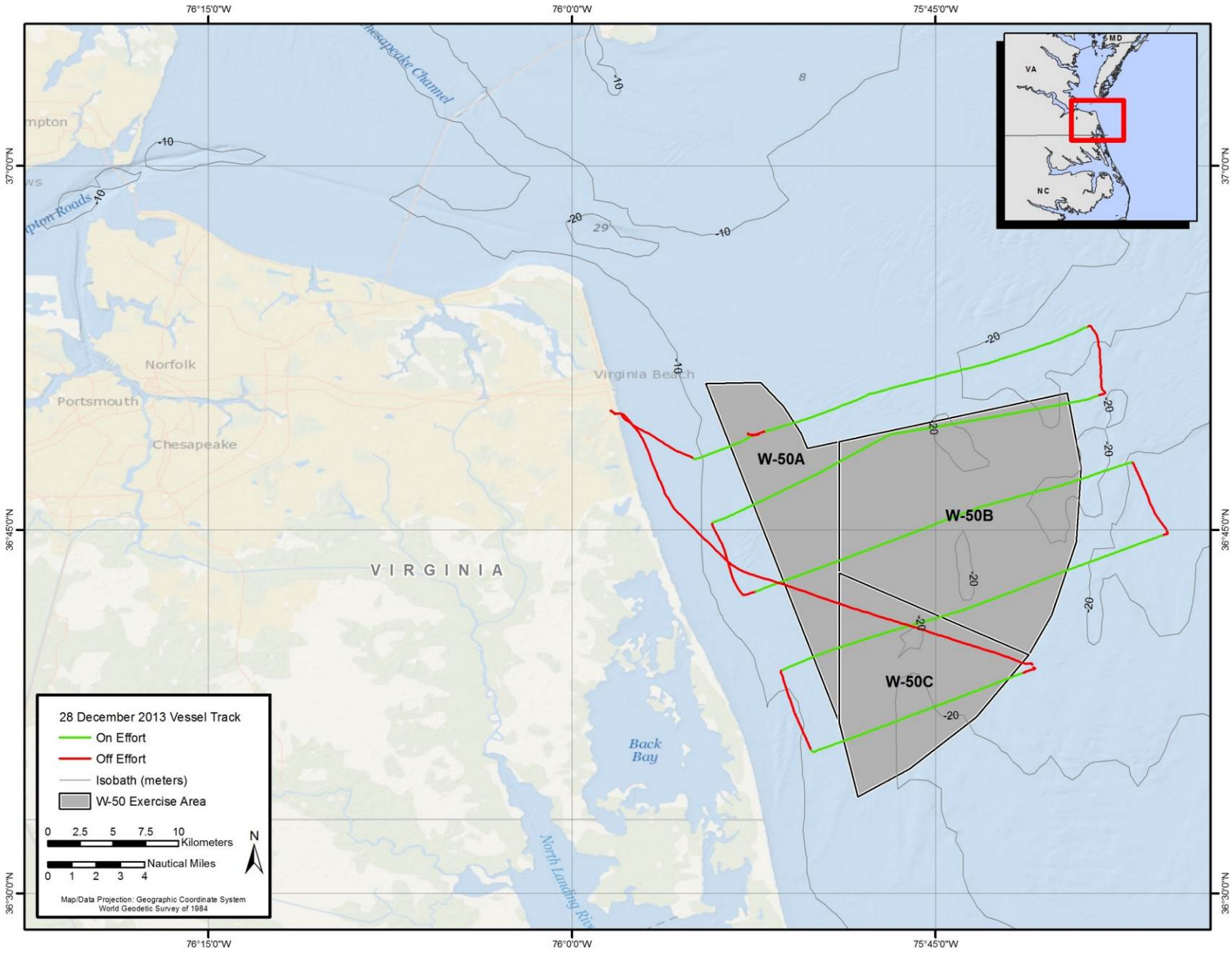
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
MD
VA
NC
28 December 2013 Vessel Track
On Effort
Off Effort
Isobath (meters)
W-50 Exercise Area
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0 1 2 3 4 Nautical Miles
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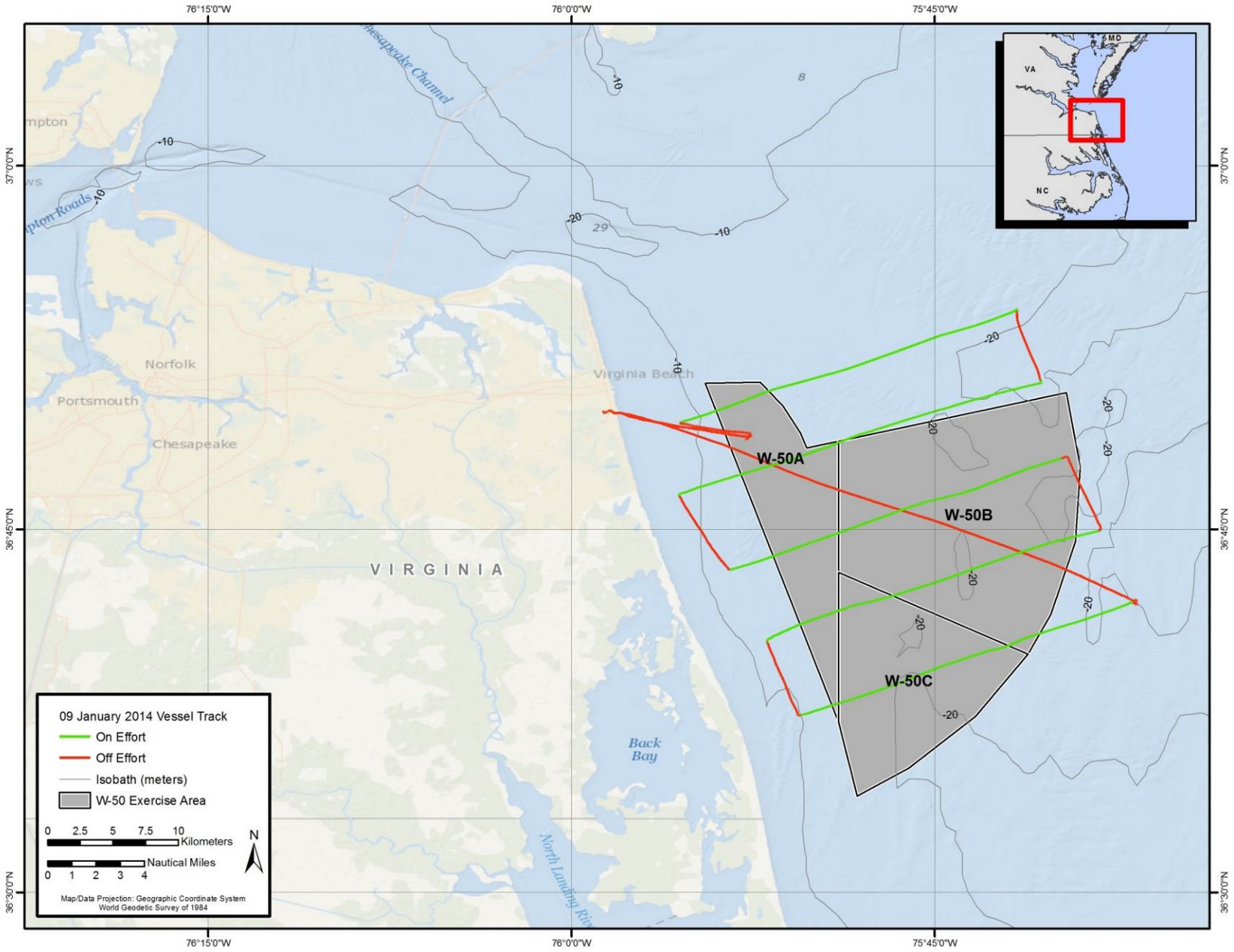
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
MD
VA
NC
09 January 2014 Vessel Track
On Effort
Off Effort
Isobath (meters)
W-50 Exercise Area
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0 1 2 3 4 Nautical Miles
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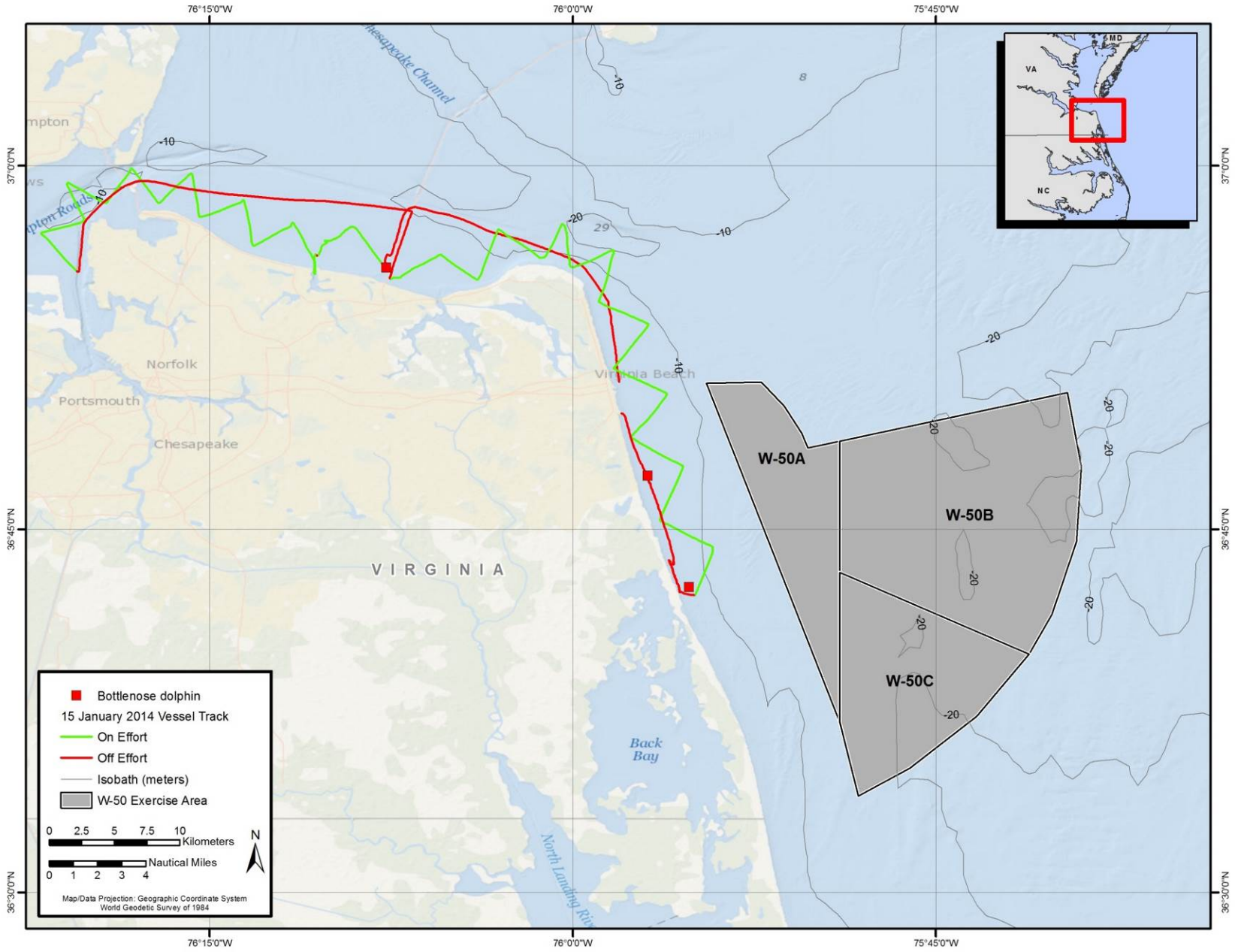
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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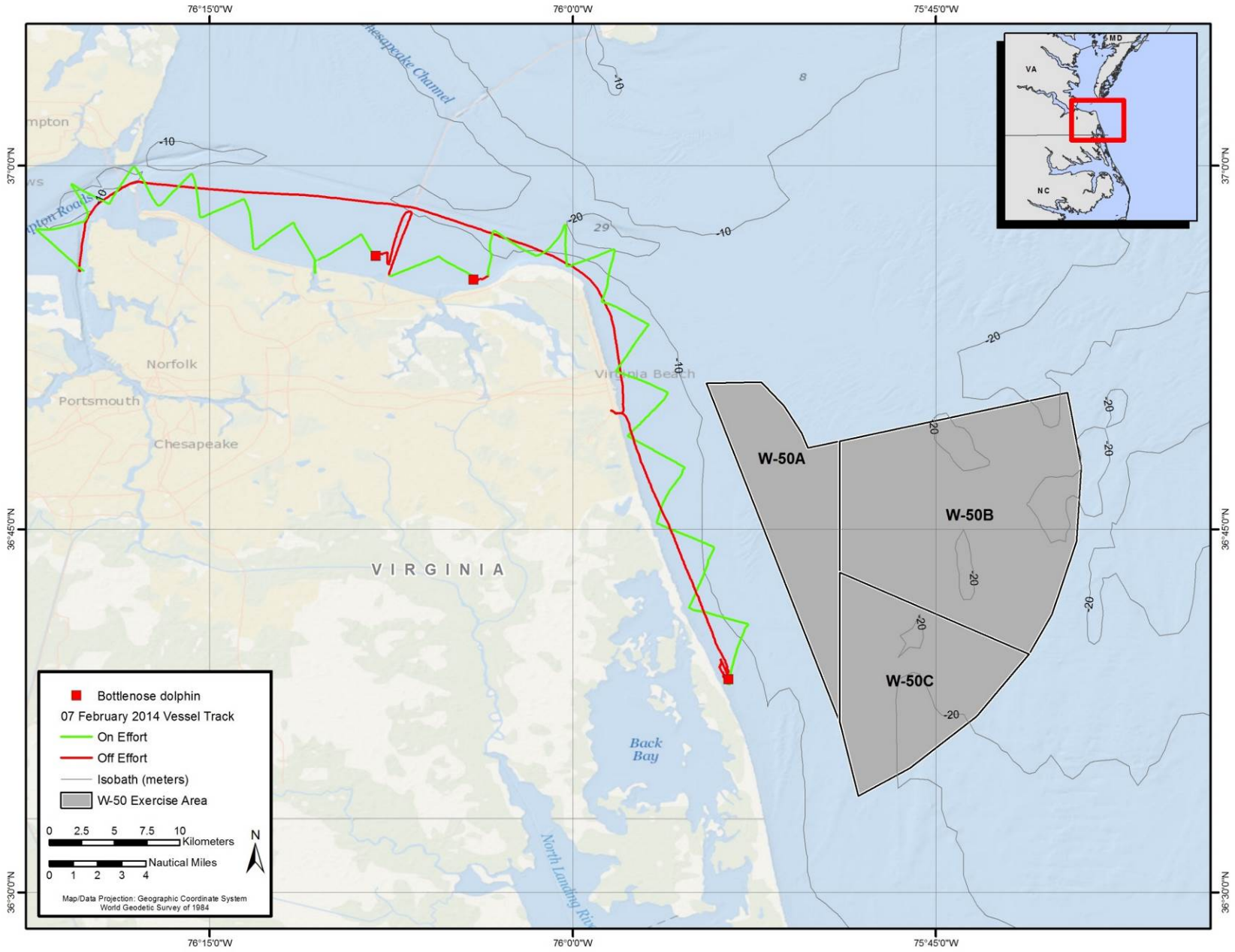
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
MD
VA
NC
Bottlenose dolphin
15 January 2014 Vessel Track
On Effort
Off Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10
Kilometers
0 1 2 3 4
Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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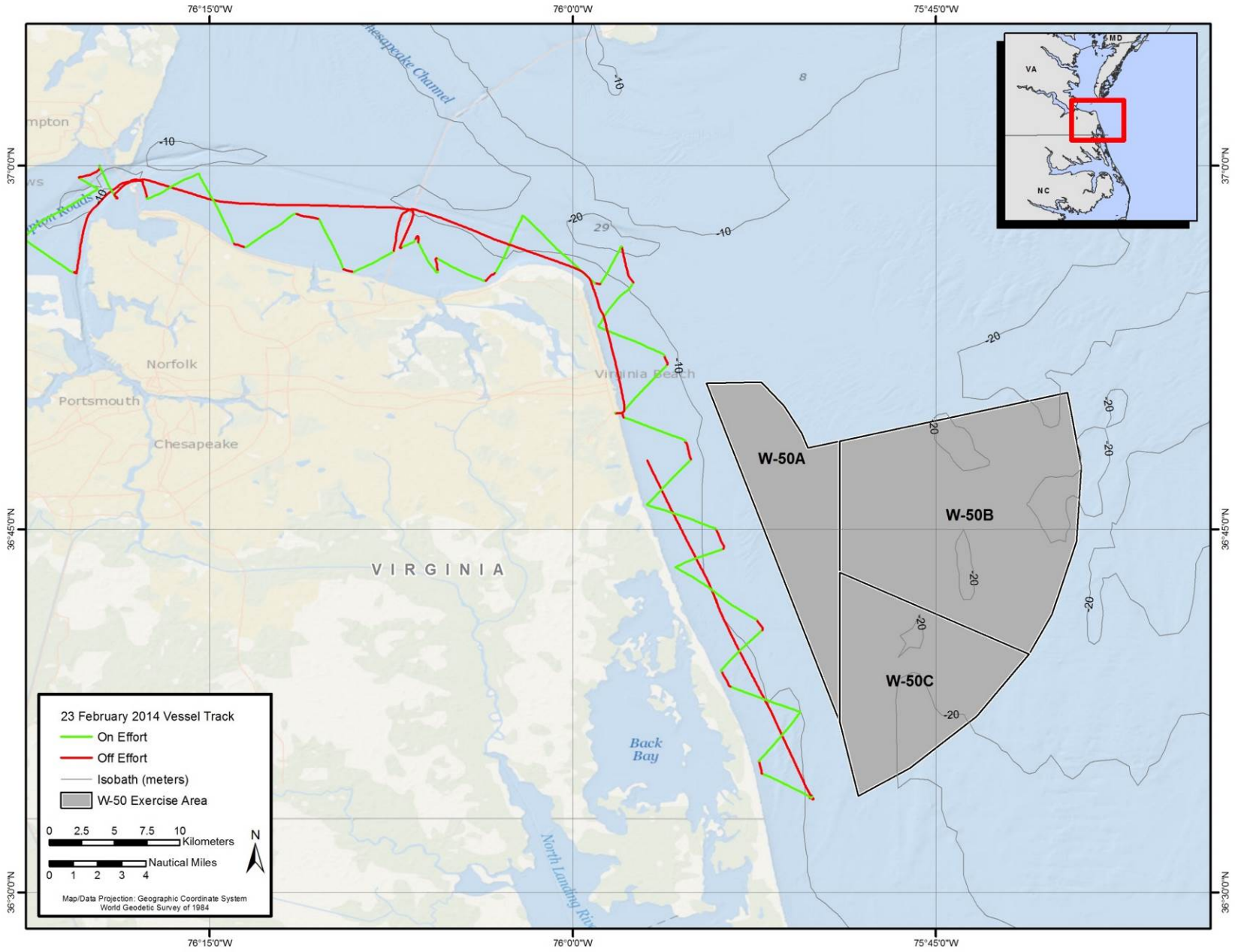
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
MD
VA
NC
Bottlenose dolphin
07 February 2014 Vessel Track
On Effort
Off Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10
Kilometers
0 1 2 3 4
Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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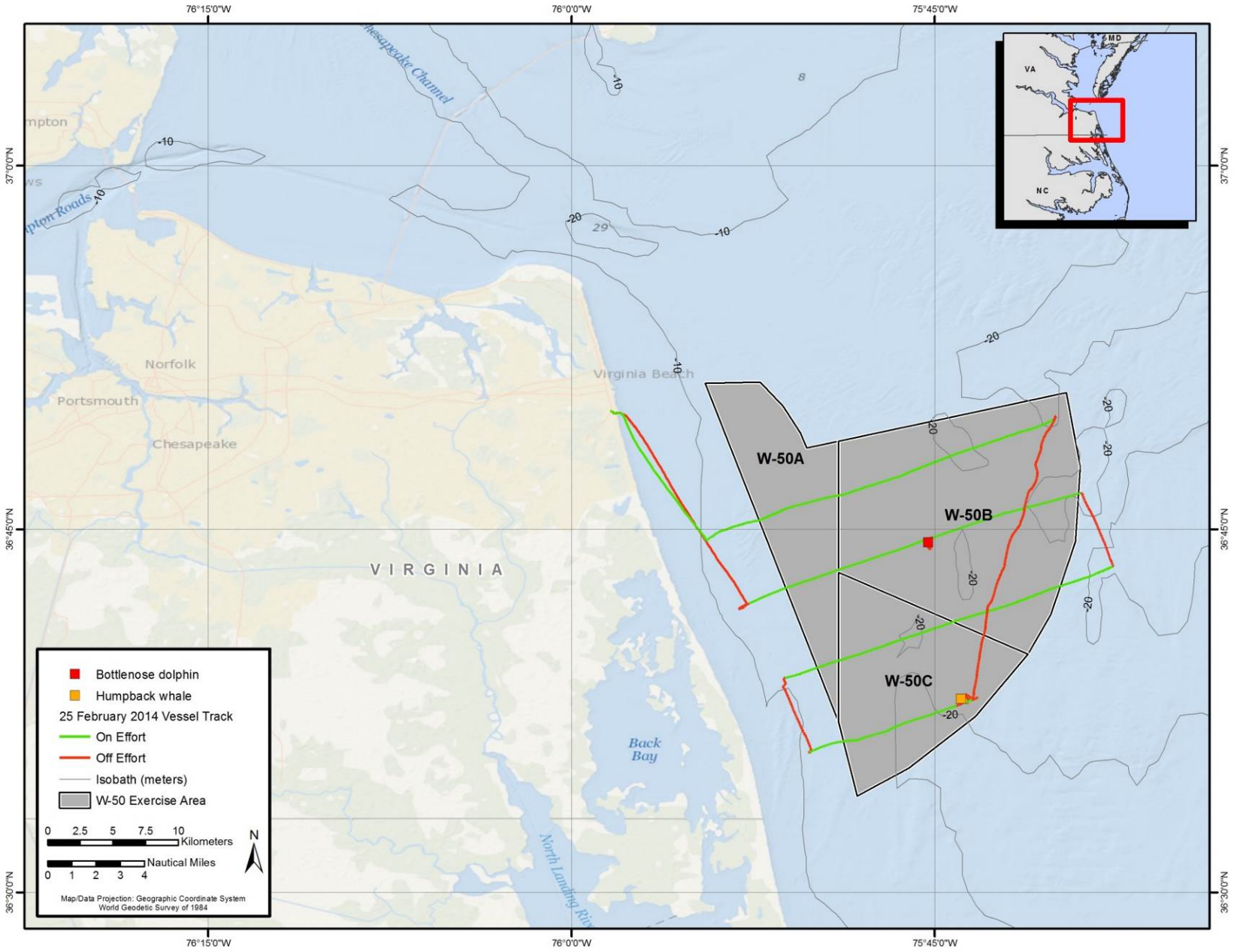
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
MD
VA
NC
23 February 2014 Vessel Track
On Effort
Off Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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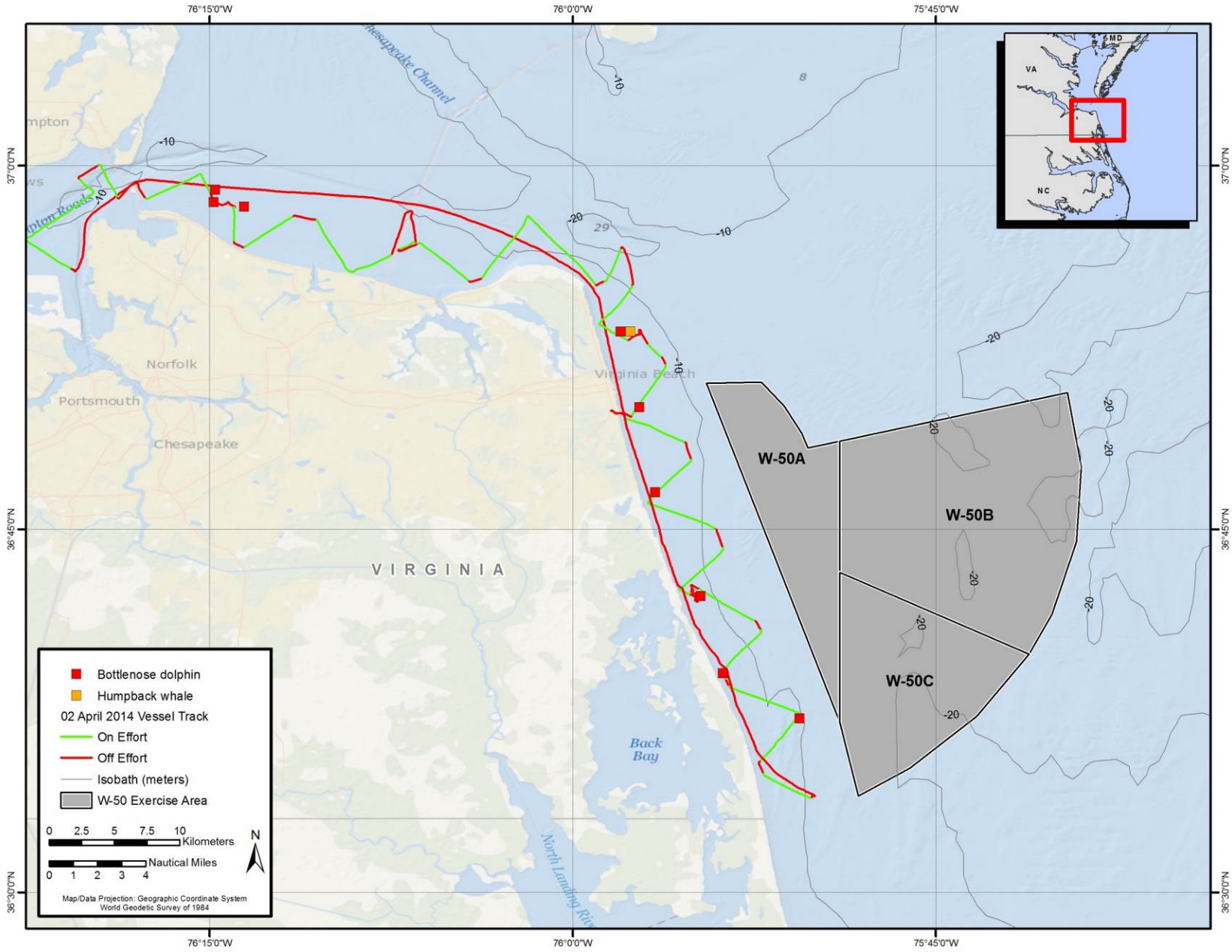
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
MD
VA
NC
Bottlenose dolphin
Humpback whale
25 February 2014 Vessel Track
On Effort
Off Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10
Kilometers
0 1 2 3 4
Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
MD
VA
NC
Bottlenose dolphin
Humpback whale
02 April 2014 Vessel Track
On Effort
Off Effort
Isobath (meters)
W-50 Exercise Area
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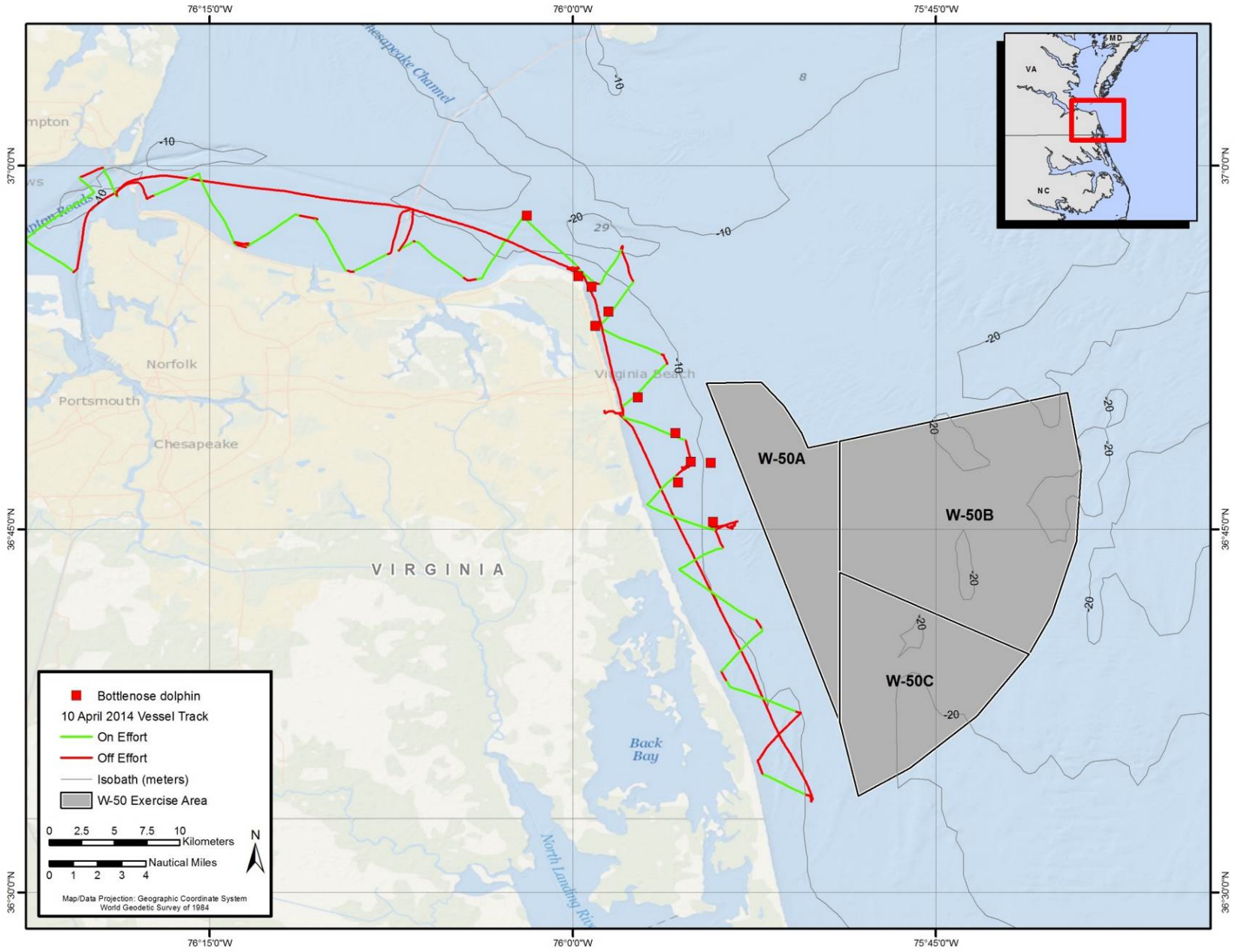
Kilometers
0 1 2 3 4
Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
MD
VA
NC
Bottlenose dolphin
10 April 2014 Vessel Track
On Effort
Off Effort
Isobath (meters)
W-50 Exercise Area
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Kilometers
0 1 2 3 4
Nautical Miles
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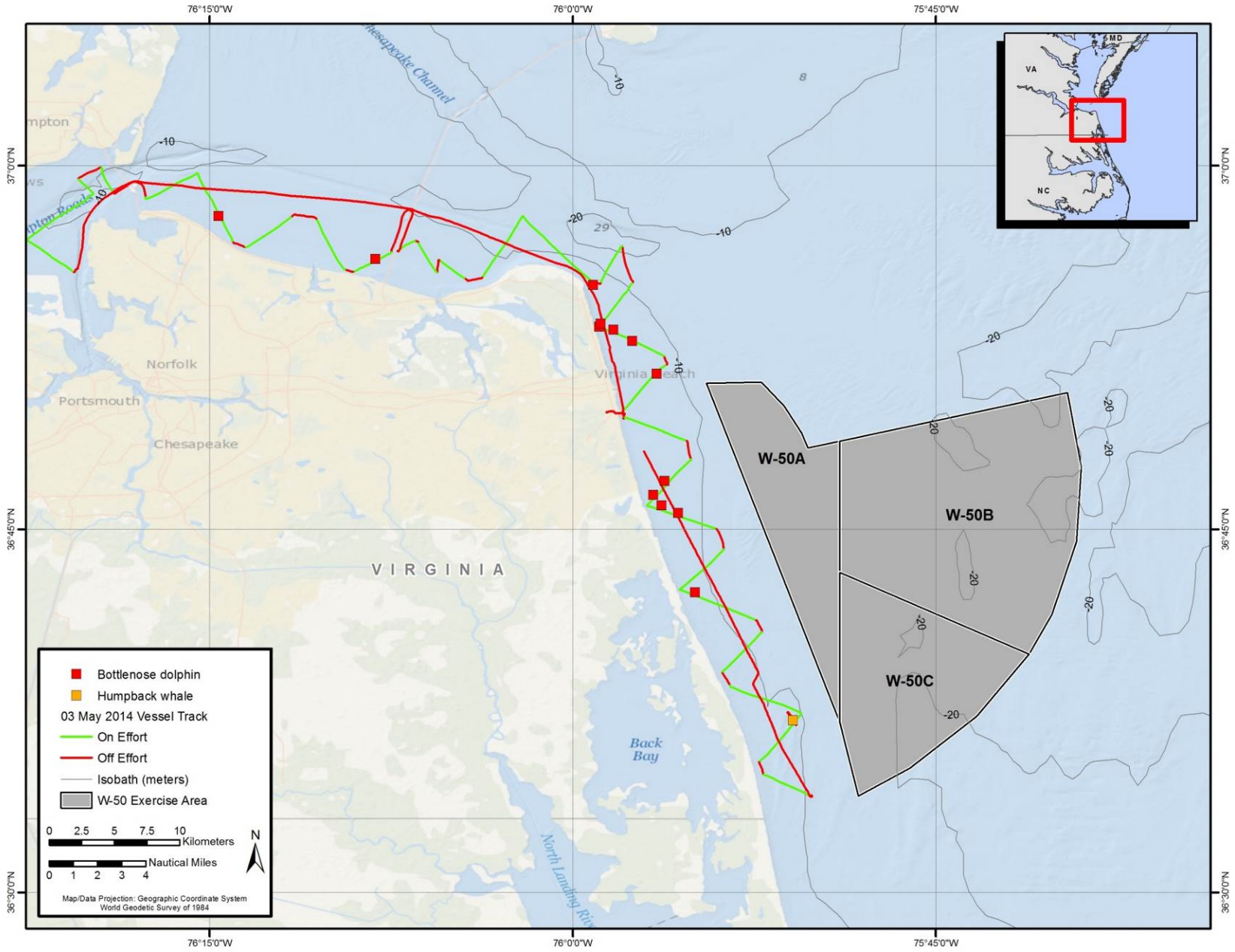
World Geodetic Survey of 1984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Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
MD
VA
NC
Bottlenose dolphin
Humpback whale
03 May 2014 Vessel Track
On Effort
Off Effort
Isobath (meters)
W-50 Exercise Area
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Kilometers
0 1 2 3 4
Nautical Miles
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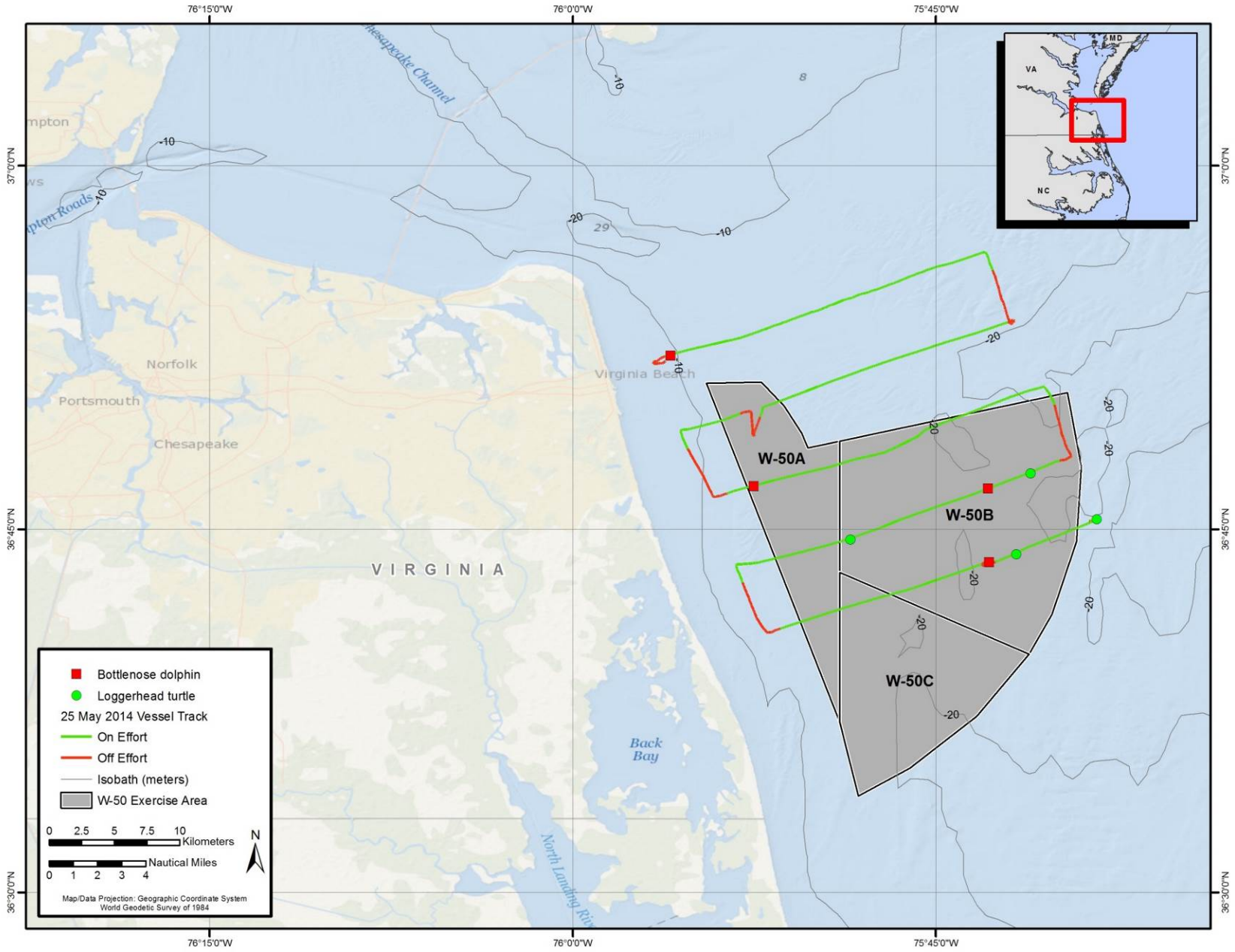
World Geodetic Survey of 1984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Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
MD
VA
NC
Bottlenose dolphin
Loggerhead turtle
25 May 2014 Vessel Track
On Effort
Off Effort
Isobath (meters)
W-50 Exercise Area
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Kilometers
0 1 2 3 4
Nautical Miles
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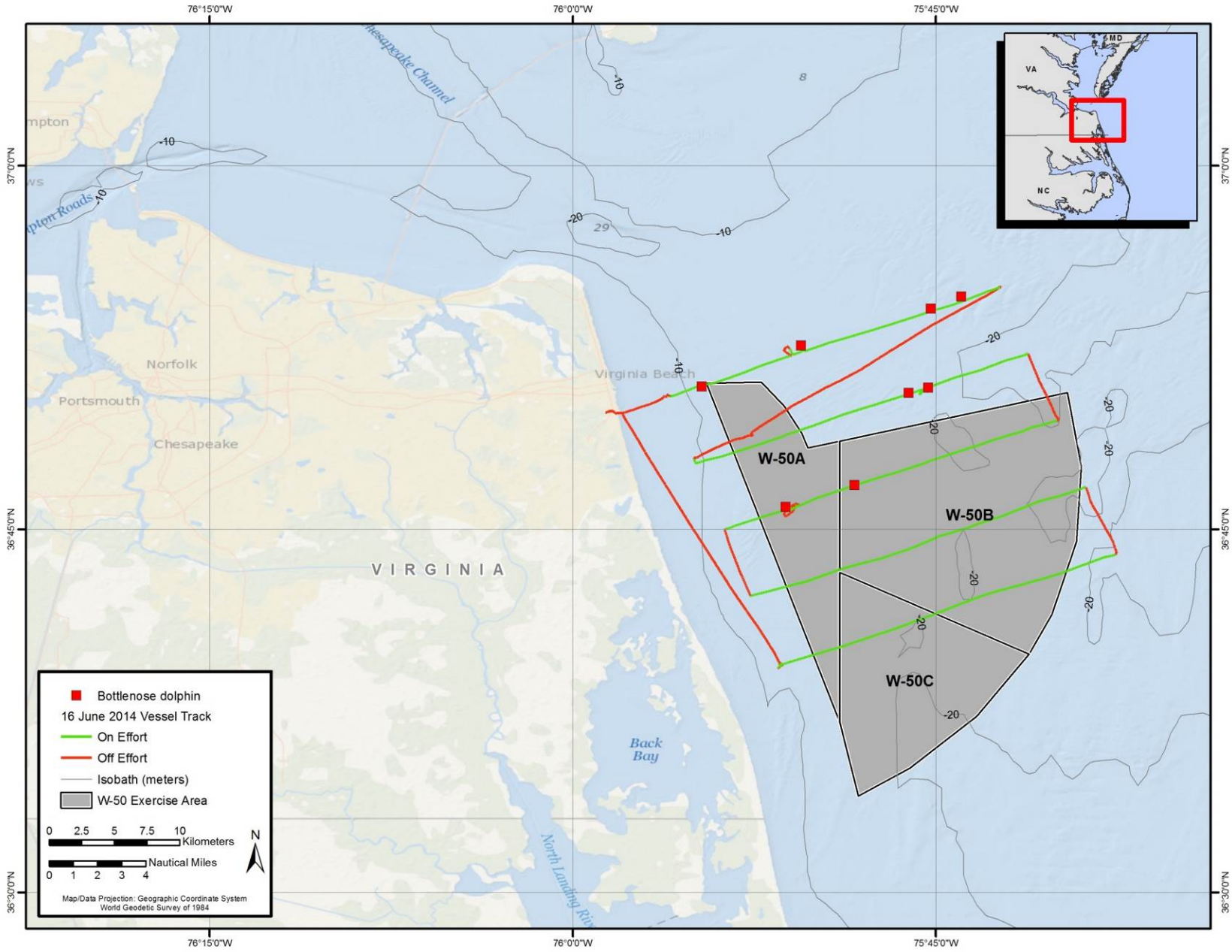
World Geodetic Survey of 1984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Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
MD
VA
NC
Bottlenose dolphin
16 June 2014 Vessel Track
On Effort
Off Effort
Isobath (meters)
W-50 Exercise Area
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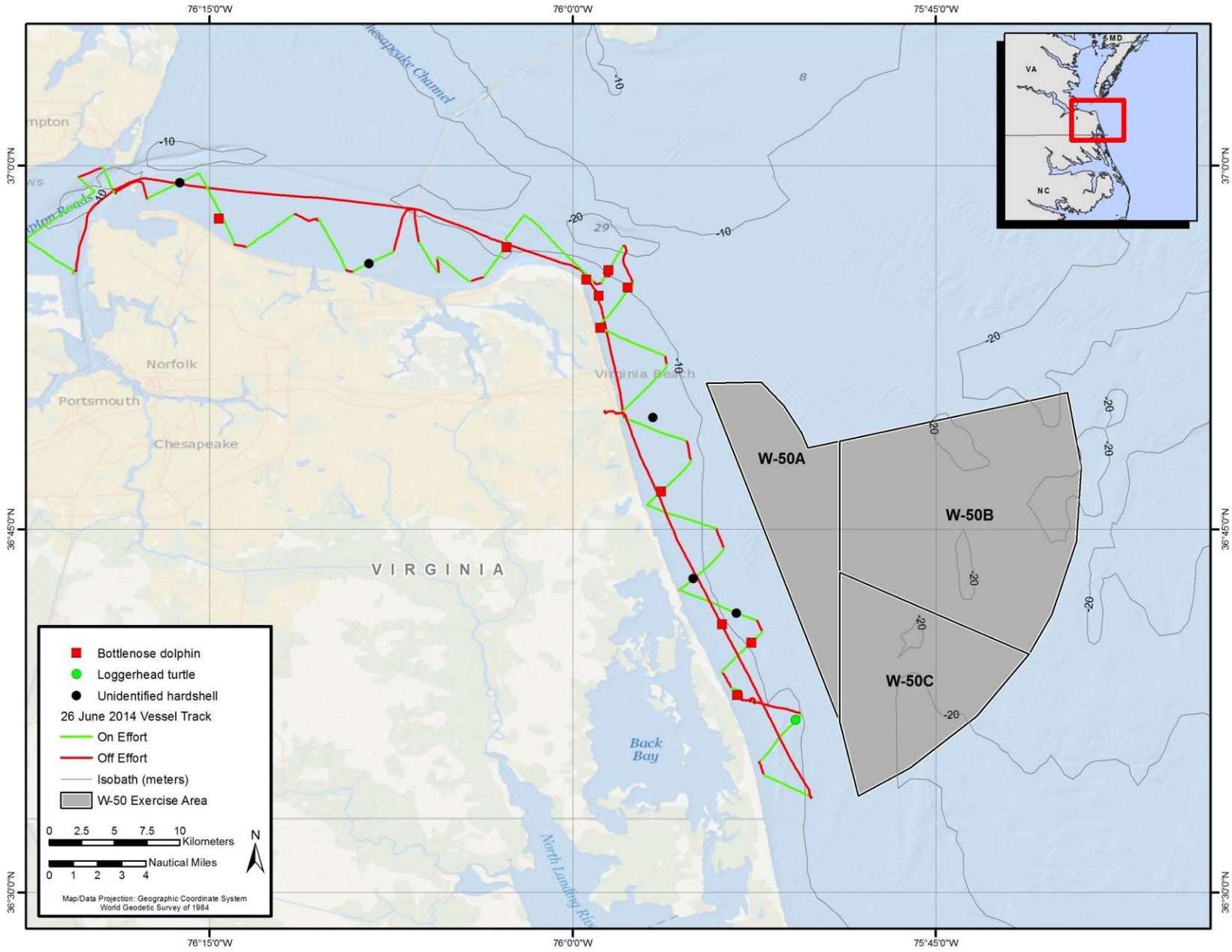
Kilometers
0 1 2 3 4
Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
MD
VA
NC
Bottlenose dolphin
Loggerhead turtle
Unidentified hardshell
26 June 2014 Vessel Track
On Effort
Off Effort
Isobath (meters)
W-50 Exercise Area
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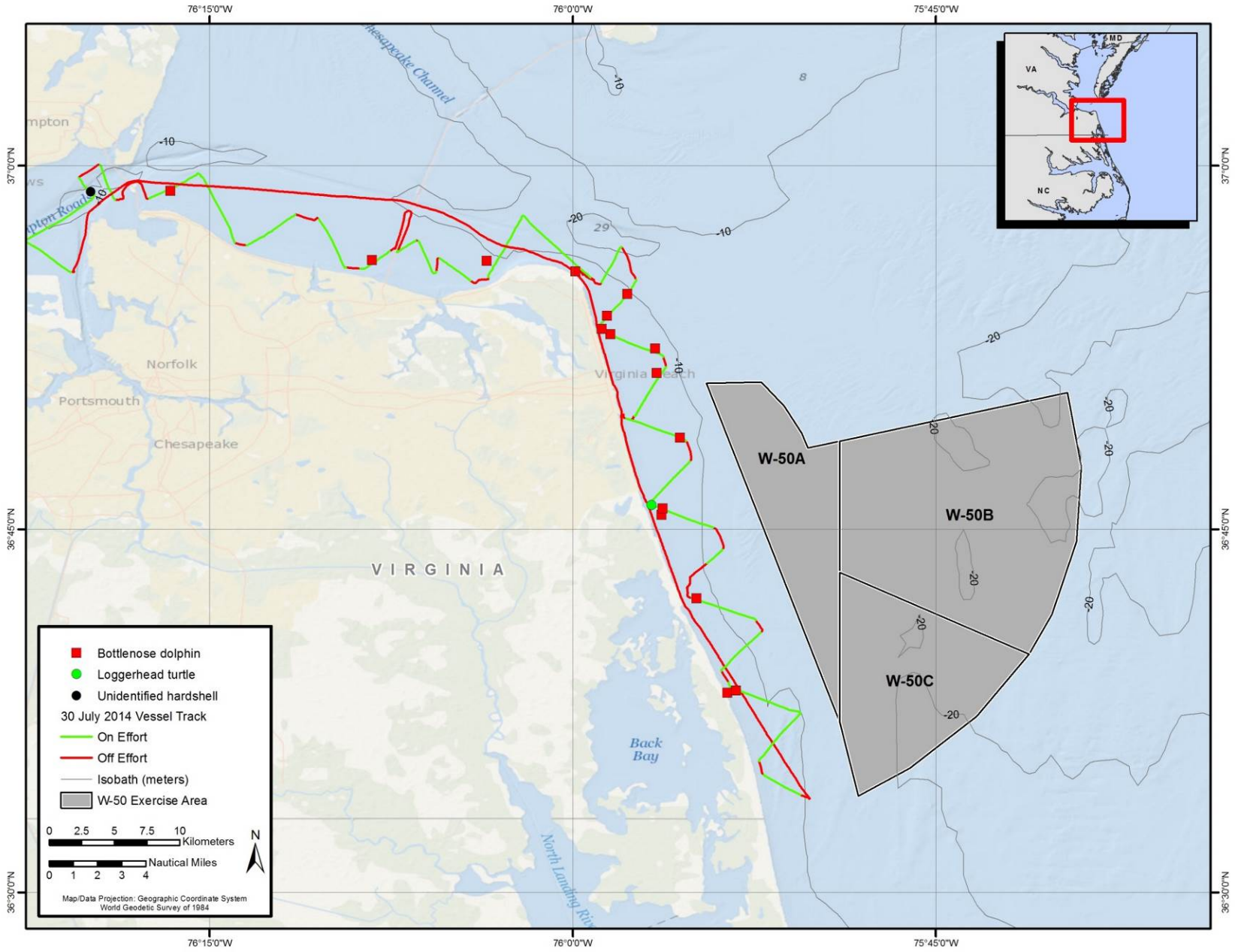
Kilometers
0 1 2 3 4
Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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Back Bay
North Landing River
W-50A
W-50B
W-50C
MD
VA
NC
Bottlenose dolphin
Loggerhead turtle
Unidentified hardshell
30 July 2014 Vessel Track
On Effort
Off Effort
Isobath (meters)
W-50 Exercise Area
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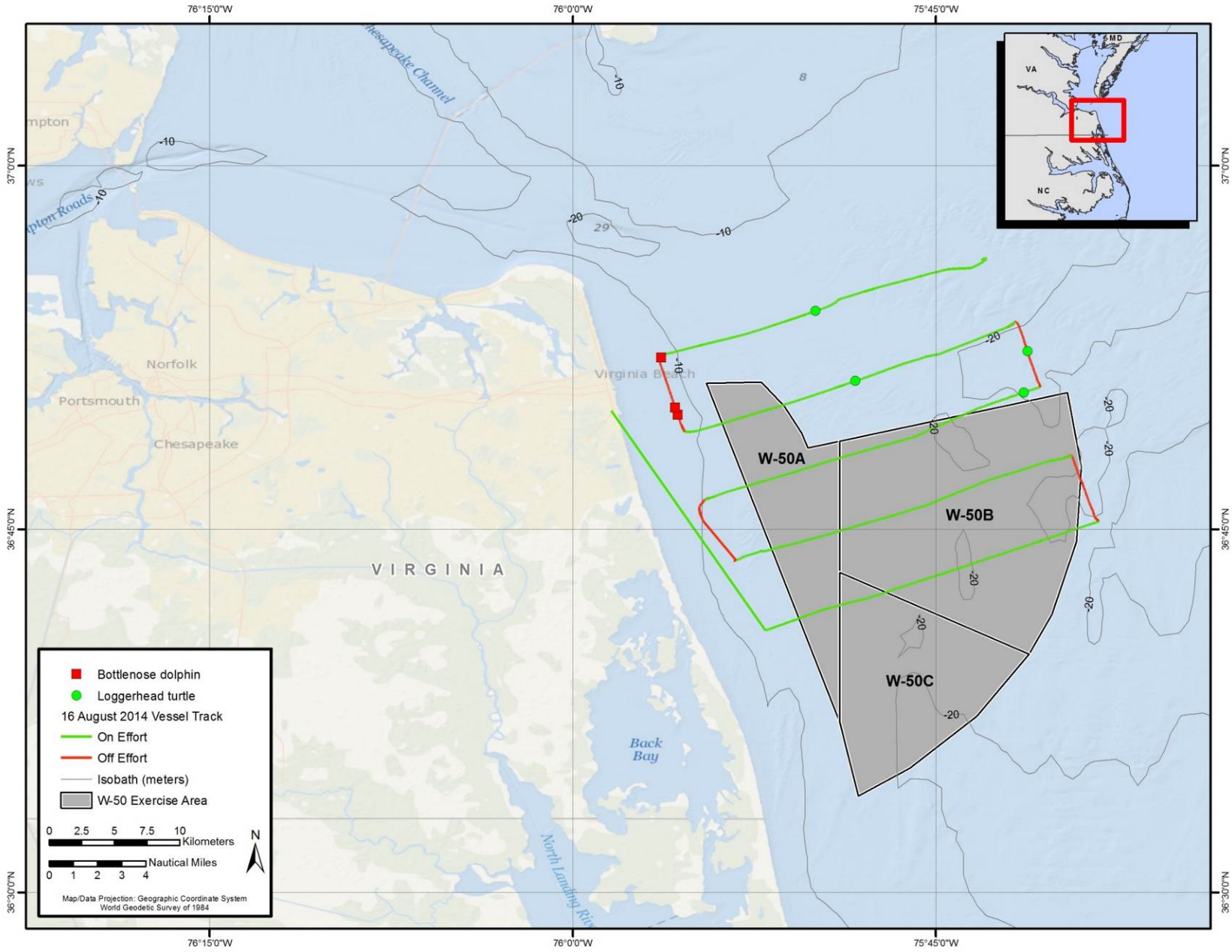
Kilometers
0 1 2 3 4
Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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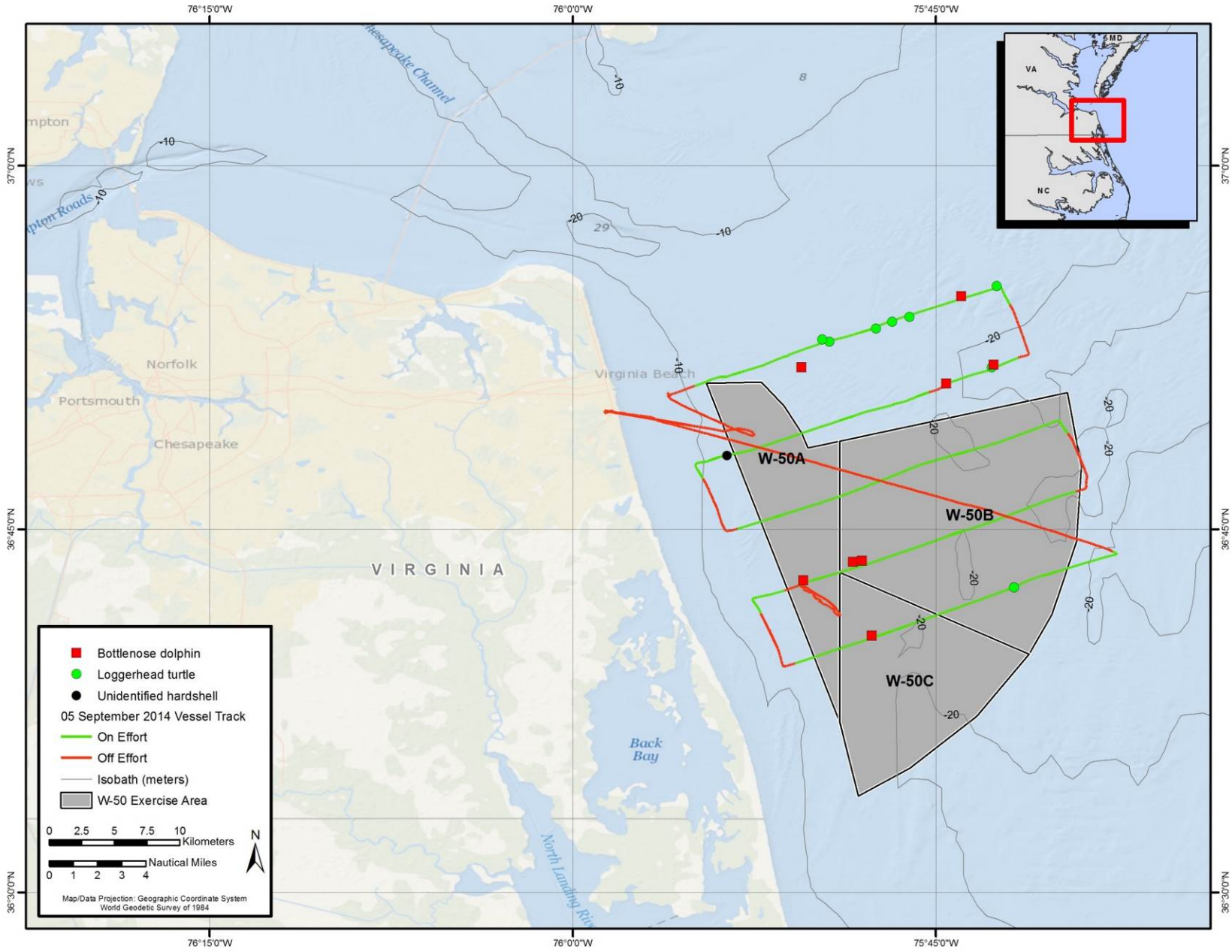
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
MD
VA
NC
Bottlenose dolphin
Loggerhead turtle
16 August 2014 Vessel Track
On Effort
Off Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10
Kilometers
0 1 2 3 4
Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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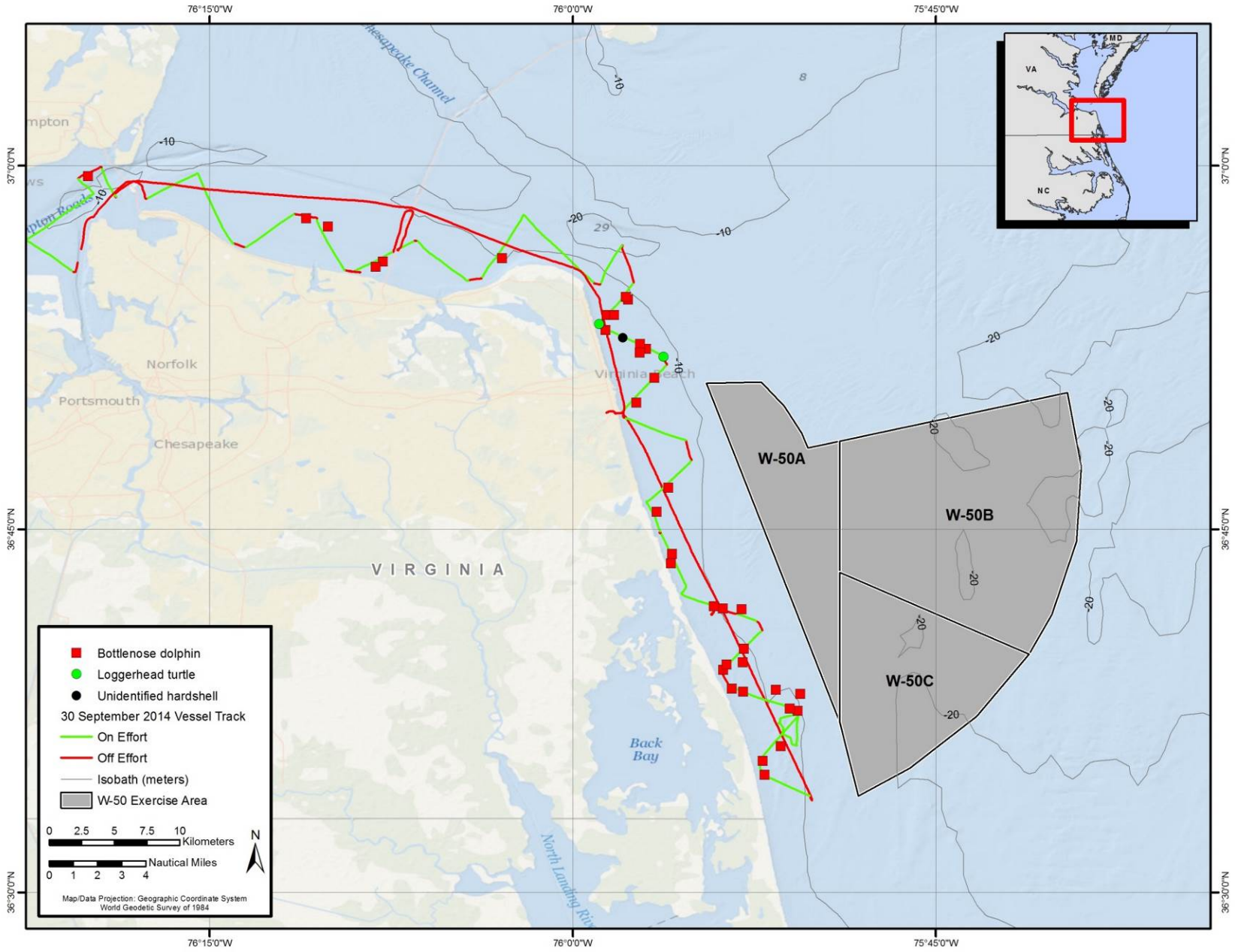
VIRGINIA
Back Bay
North Landing River
MD
VA
NC
W-50A
W-50B
W-50C
Bottlenose dolphin
Loggerhead turtle
Unidentified hardshell
05 September 2014 Vessel Track
On Effort
Off Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10
Kilometers
0 1 2 3 4
Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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Back Bay
North Landing River
W-50A
W-50B
W-50C
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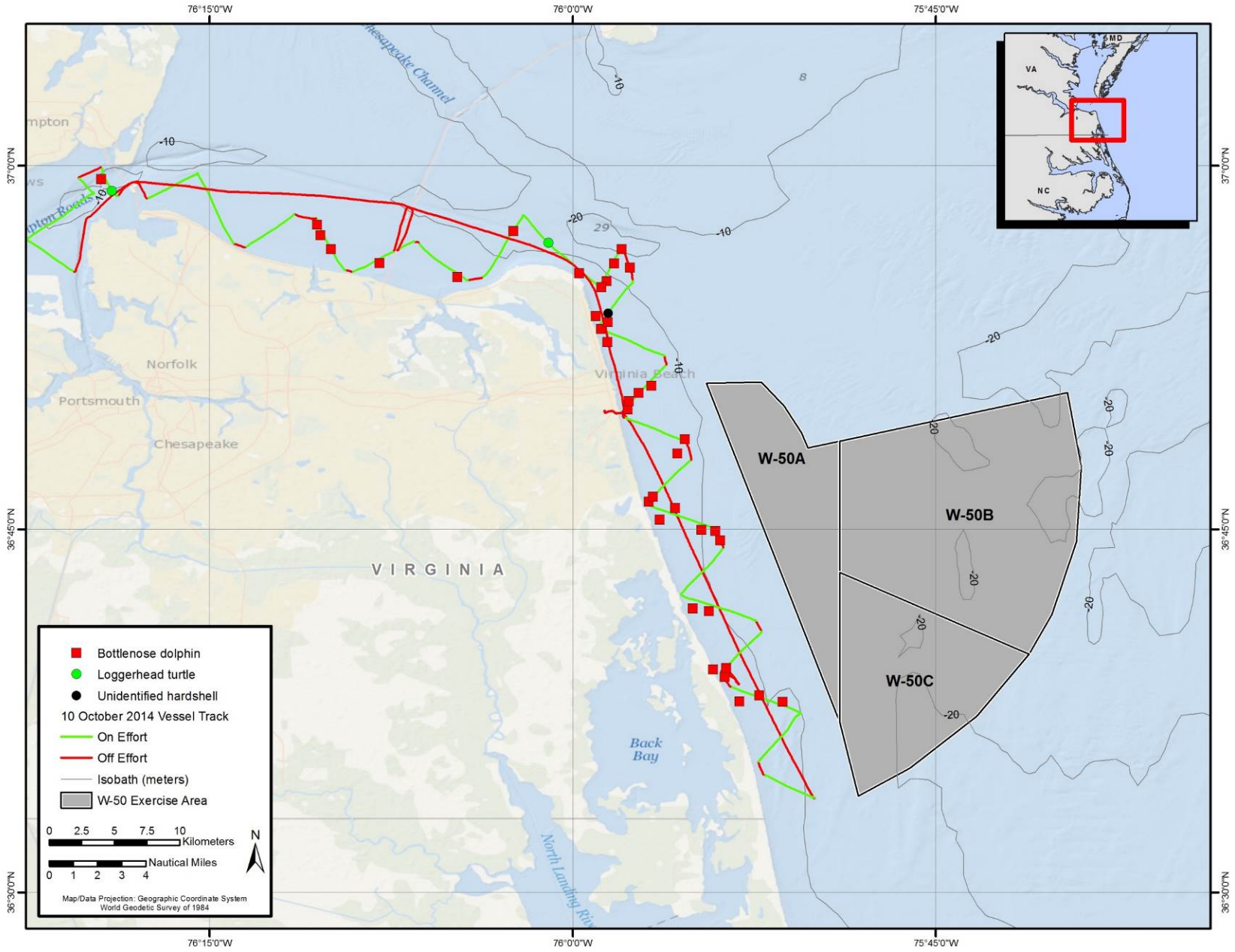
VA
NC
Bottlenose dolphin
Loggerhead turtle
Unidentified hardshell
30 September 2014 Vessel Track
On Effort
Off Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10
Kilometers
0 1 2 3 4
Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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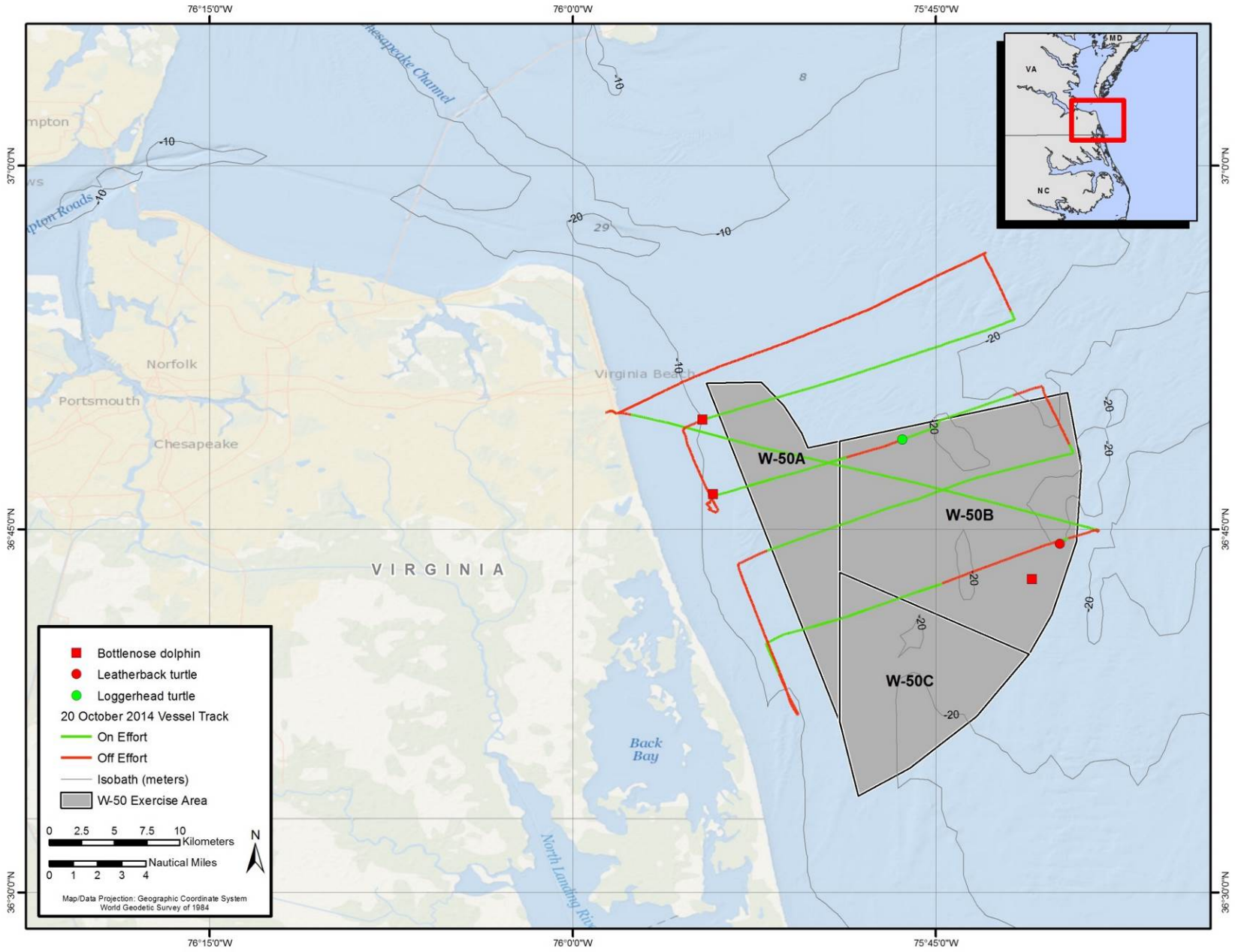
36°45'0"N
36°30'0"N
Chesapeake Channel
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
MD
VA
NC
Bottlenose dolphin
Loggerhead turtle
Unidentified hardshell
10 October 2014 Vessel Track
On Effort
Off Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10
Kilometers
0 1 2 3 4
Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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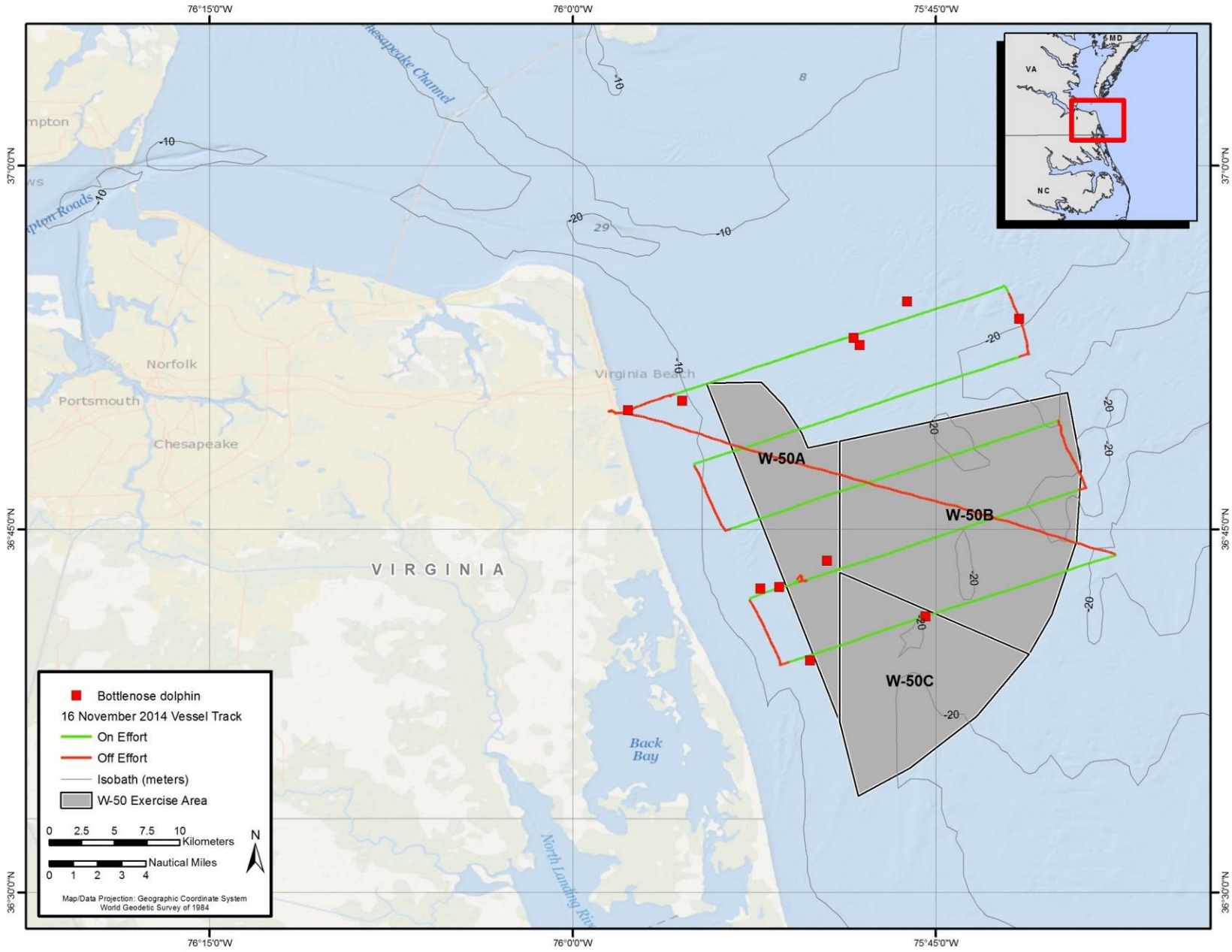
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
MD
VA
NC
Bottlenose dolphin
Leatherback turtle
Loggerhead turtle
20 October 2014 Vessel Track
On Effort
Off Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10
Kilometers
0 1 2 3 4
Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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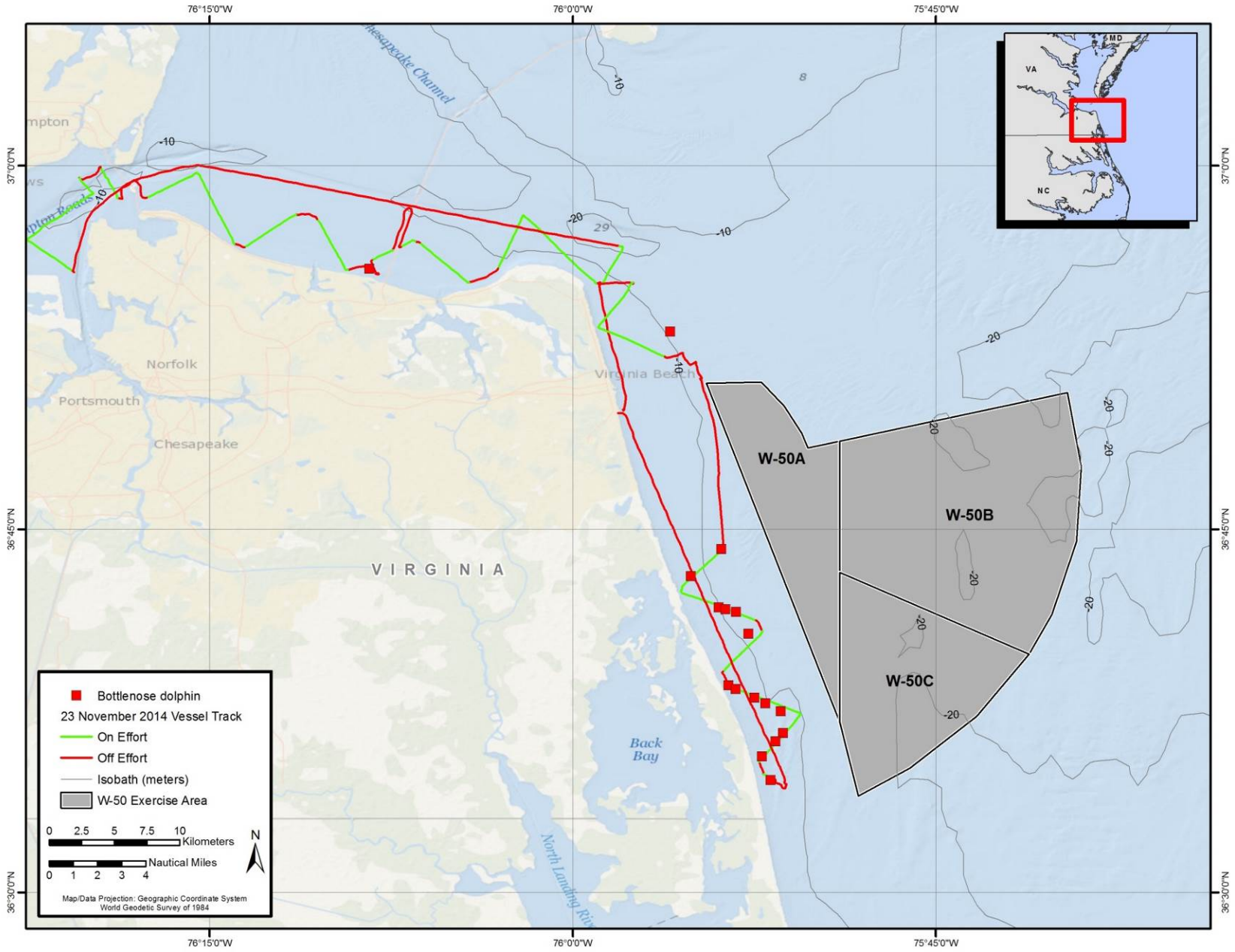
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
MD
VA
NC
Bottlenose dolphin
16 November 2014 Vessel Track
On Effort
Off Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10
Kilometers
0 1 2 3 4
Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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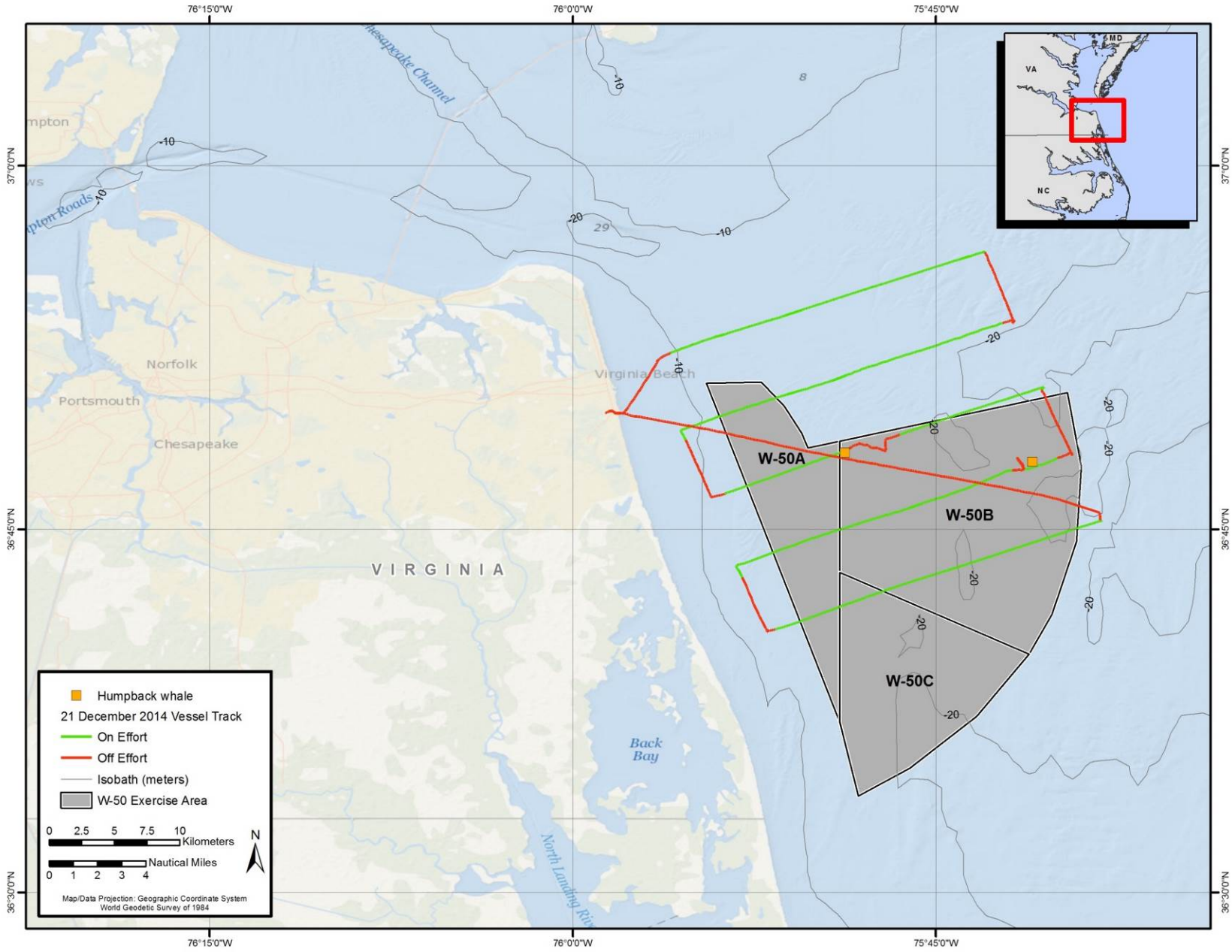
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
MD
VA
NC
Bottlenose dolphin
23 November 2014 Vessel Track
On Effort
Off Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10
Kilometers
0 1 2 3 4
Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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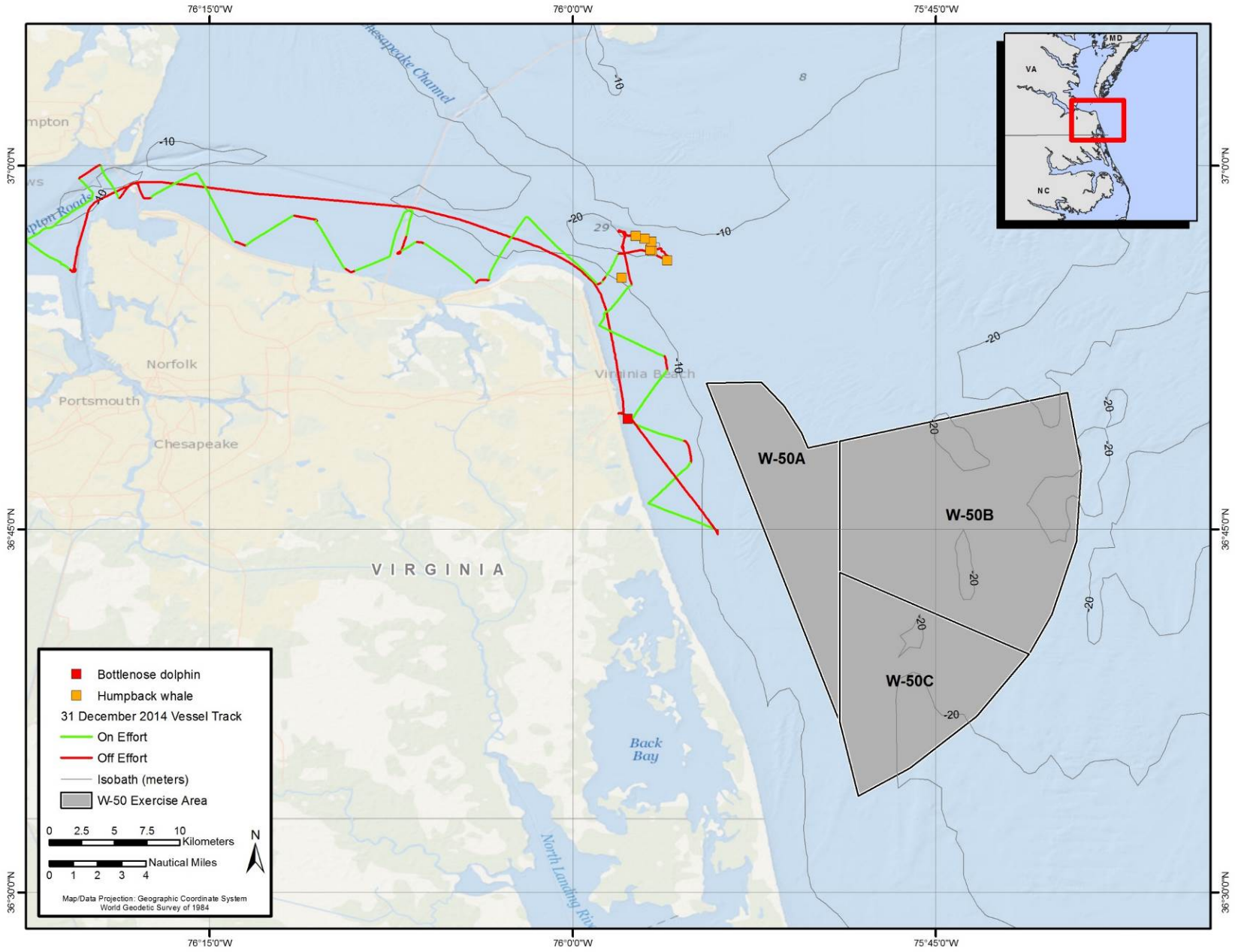
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
MD
VA
NC
Humpback whale
21 December 2014 Vessel Track
On Effort
Off Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10
Kilometers
0 1 2 3 4
Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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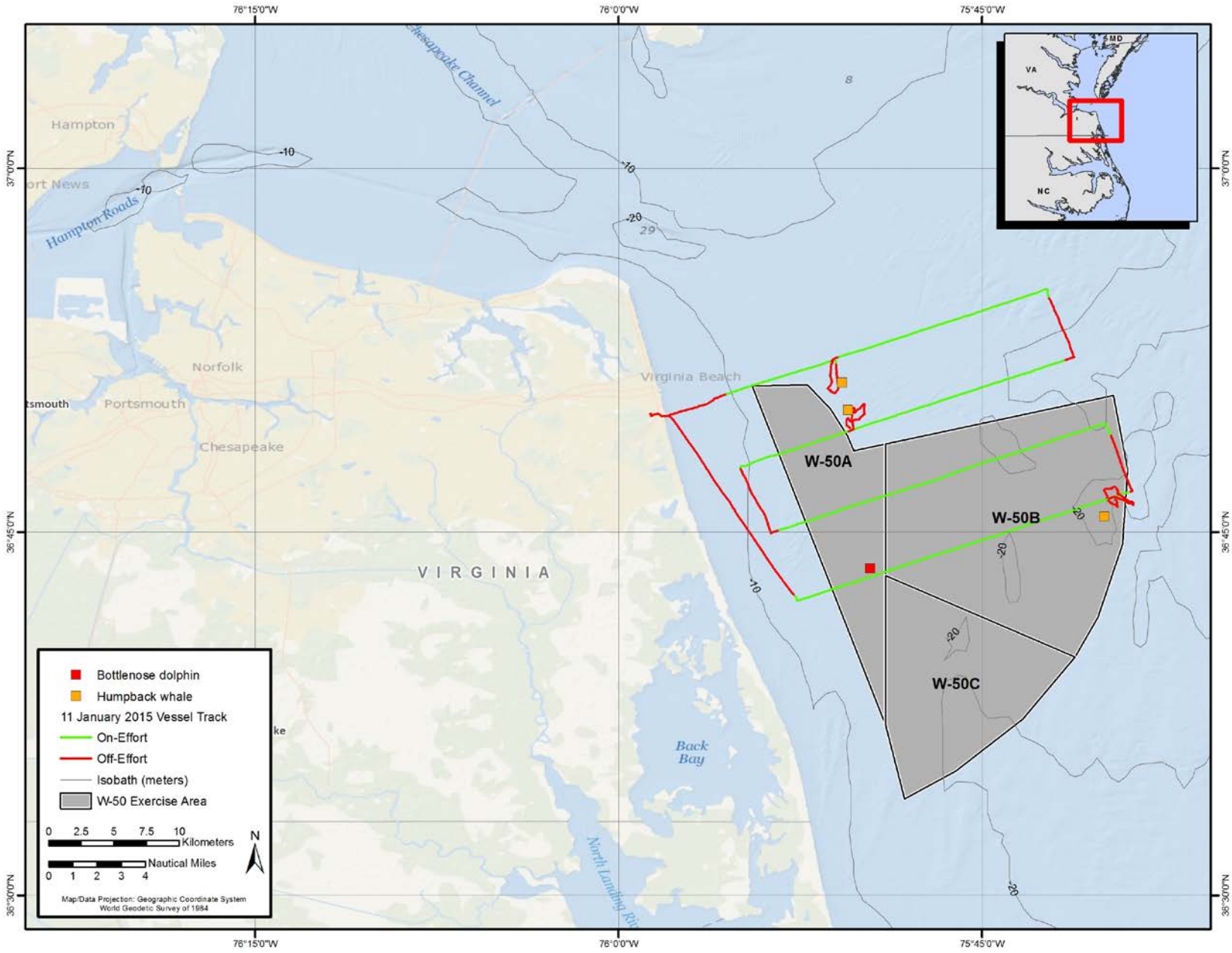
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
MD
VA
NC
Bottlenose dolphin
Humpback whale
31 December 2014 Vessel Track
On Effort
Off Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10
Kilometers
0 1 2 3 4
Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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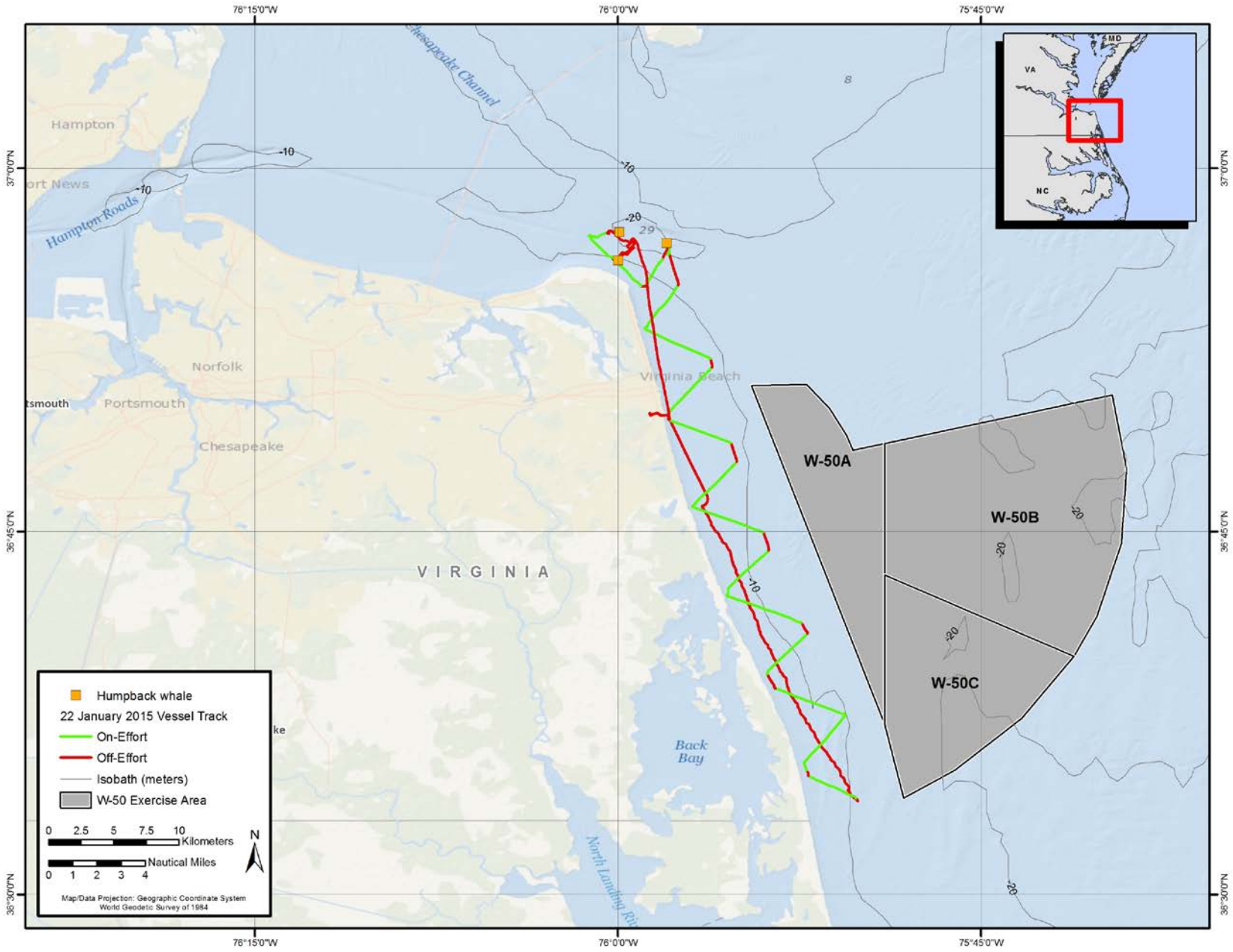
Chesapeake Channel
Hampton
Hampton Roads
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
MD
VA
NC
Bottlenose dolphin
Humpback whale
11 January 2015 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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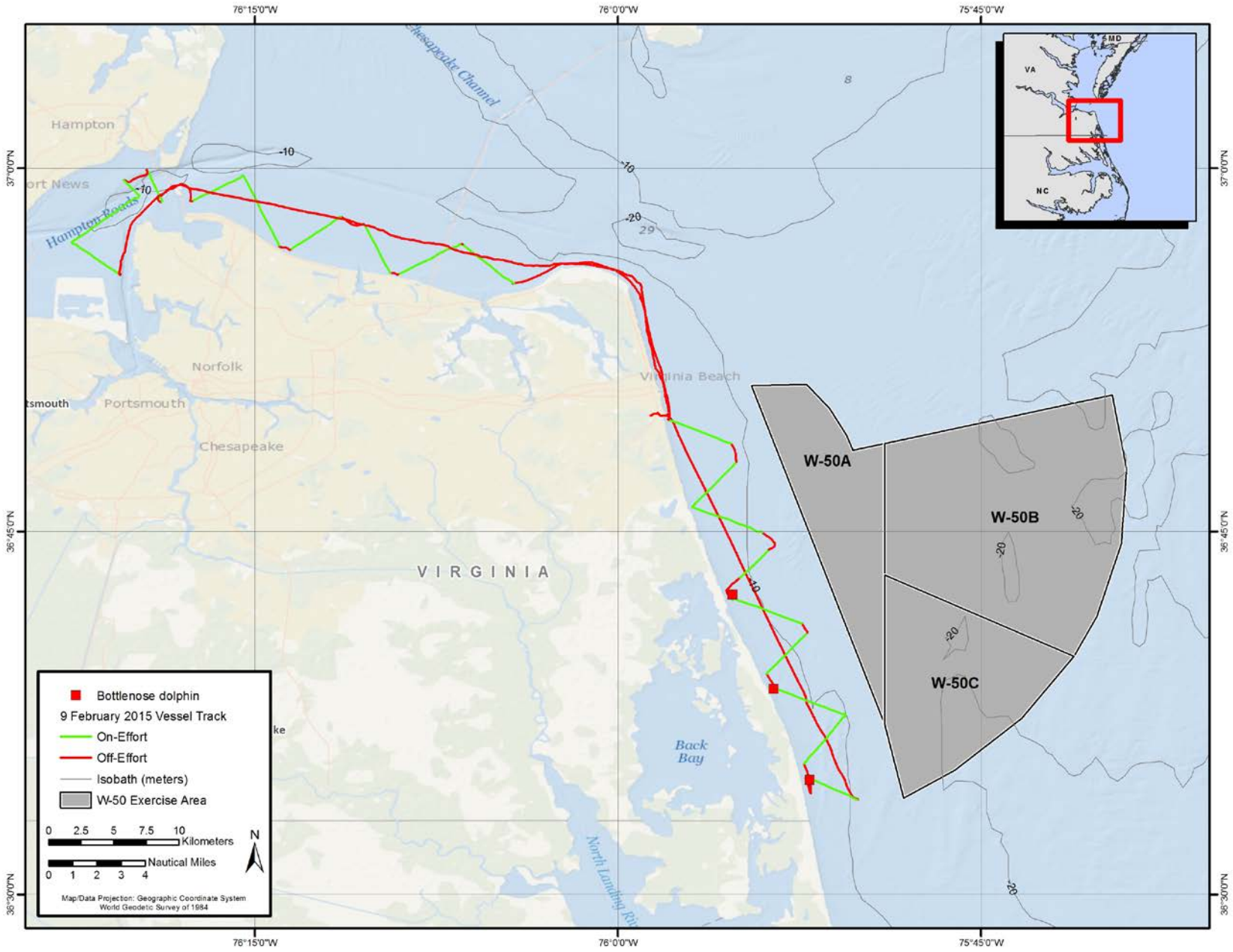
76°0'0"W
75°45'0"W
37°0'0"N
36°45'0"N
36°30'0"N
Chesapeake Channel
Hampton
Hampton Roads
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
MD
VA
NC
Humpback whale
22 January 2015 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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36°30'0"N
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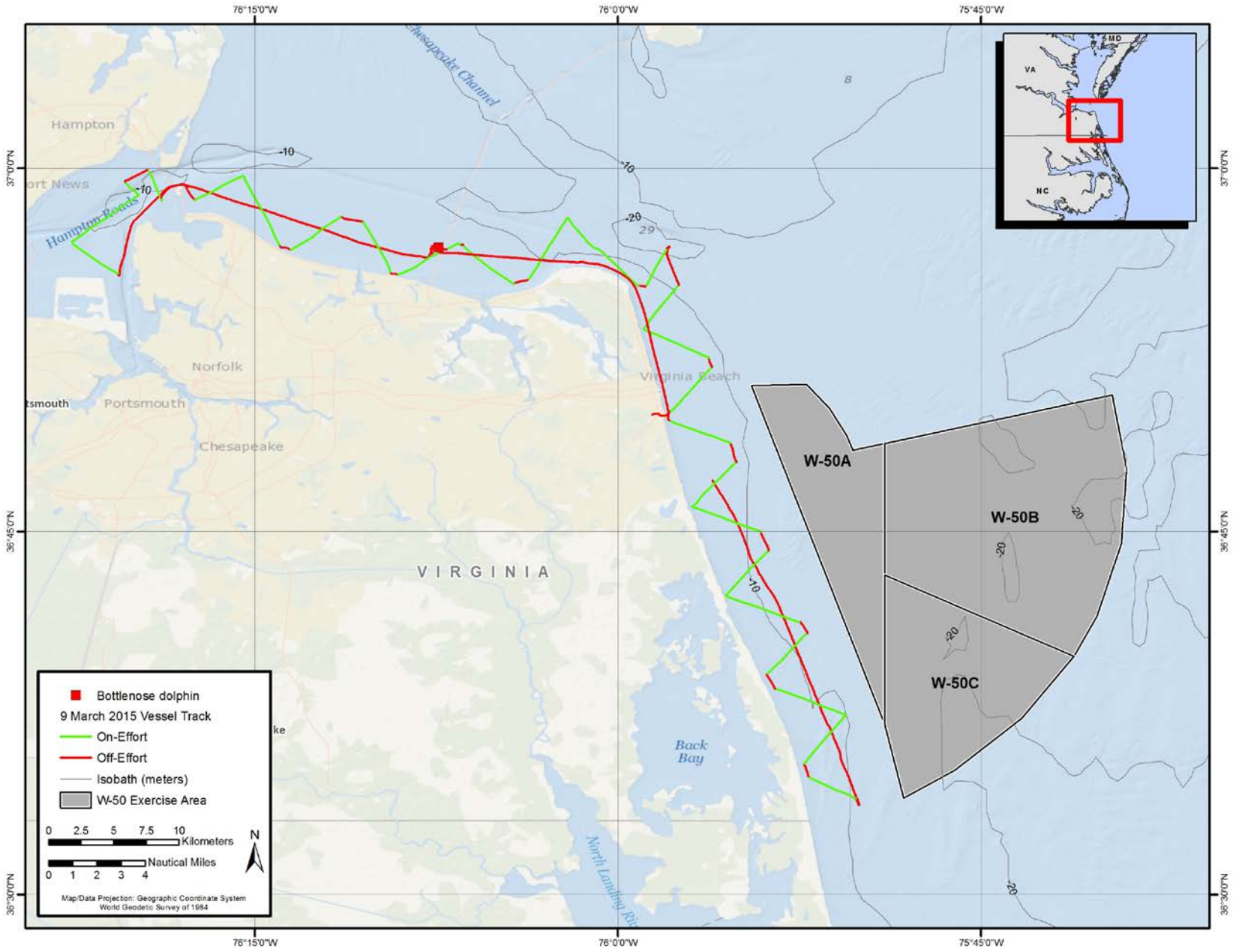
Hampton
Hampton Roads
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
-10
-20
-70
W-50A
W-50B
W-50C
MD
VA
NC
Bottlenose dolphin
9 February 2015 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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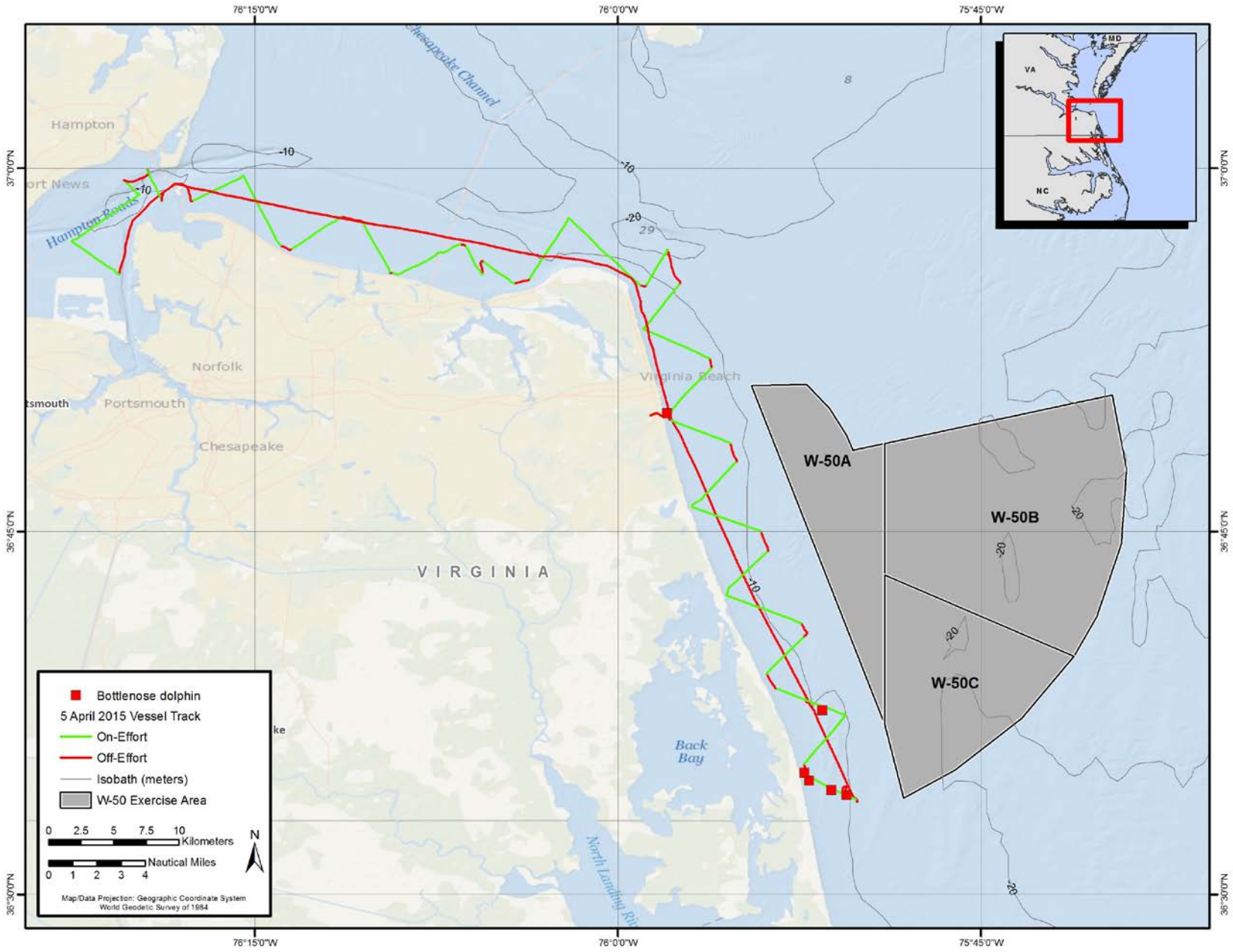
36°30'0"N
Chesapeake Channel
Hampton
Hampton Roads
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
MD
VA
NC
Bottlenose dolphin
9 March 2015 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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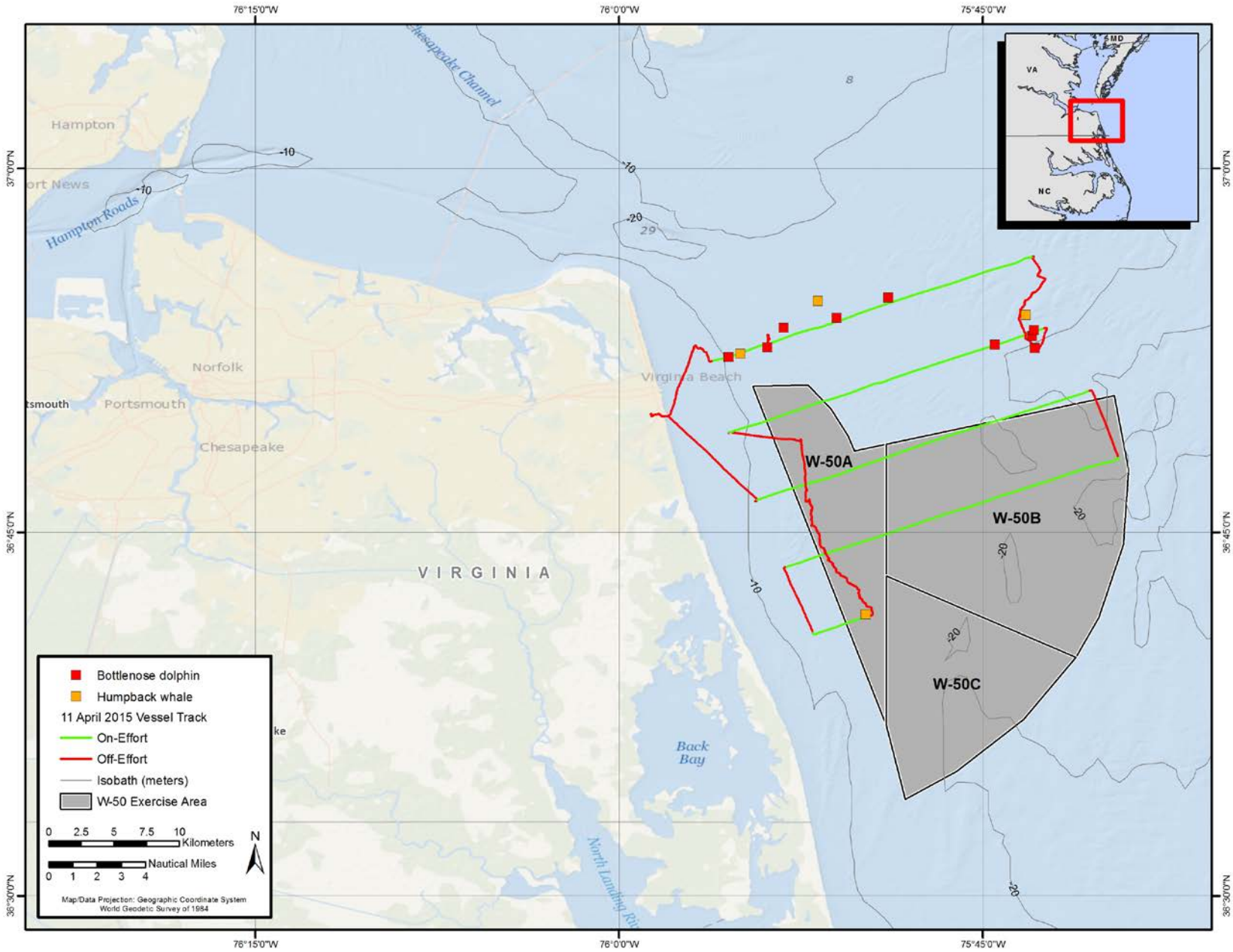
36°30'0"N
Chesapeake Channel
Hampton
Hampton Roads
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
MD
VA
NC
Bottlenose dolphin
5 April 2015 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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Chesapeake Channel
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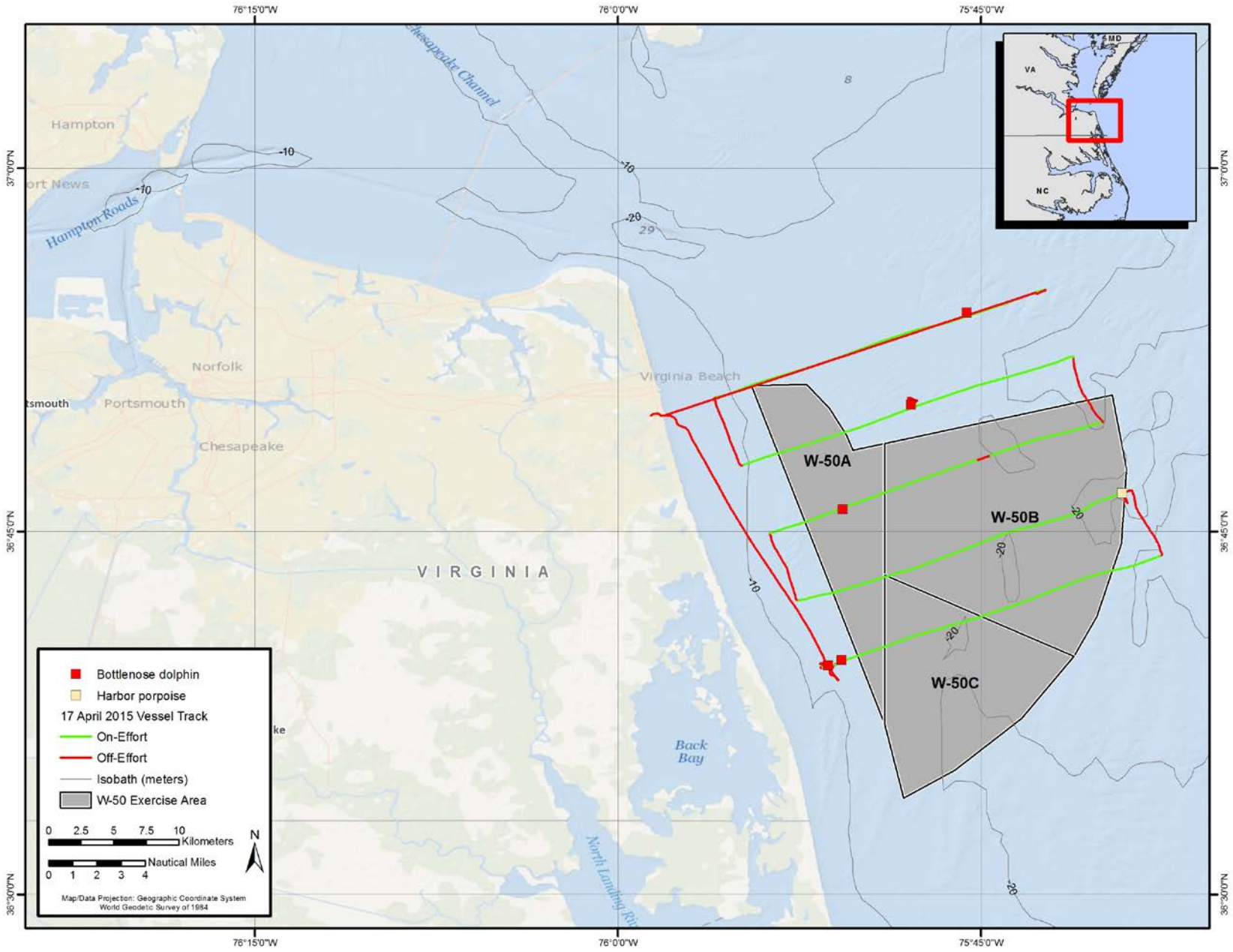
Hampton Roads
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
W-50A
W-50B
W-50C
MD
VA
NC
Bottlenose dolphin
Humpback whale
11 April 2015 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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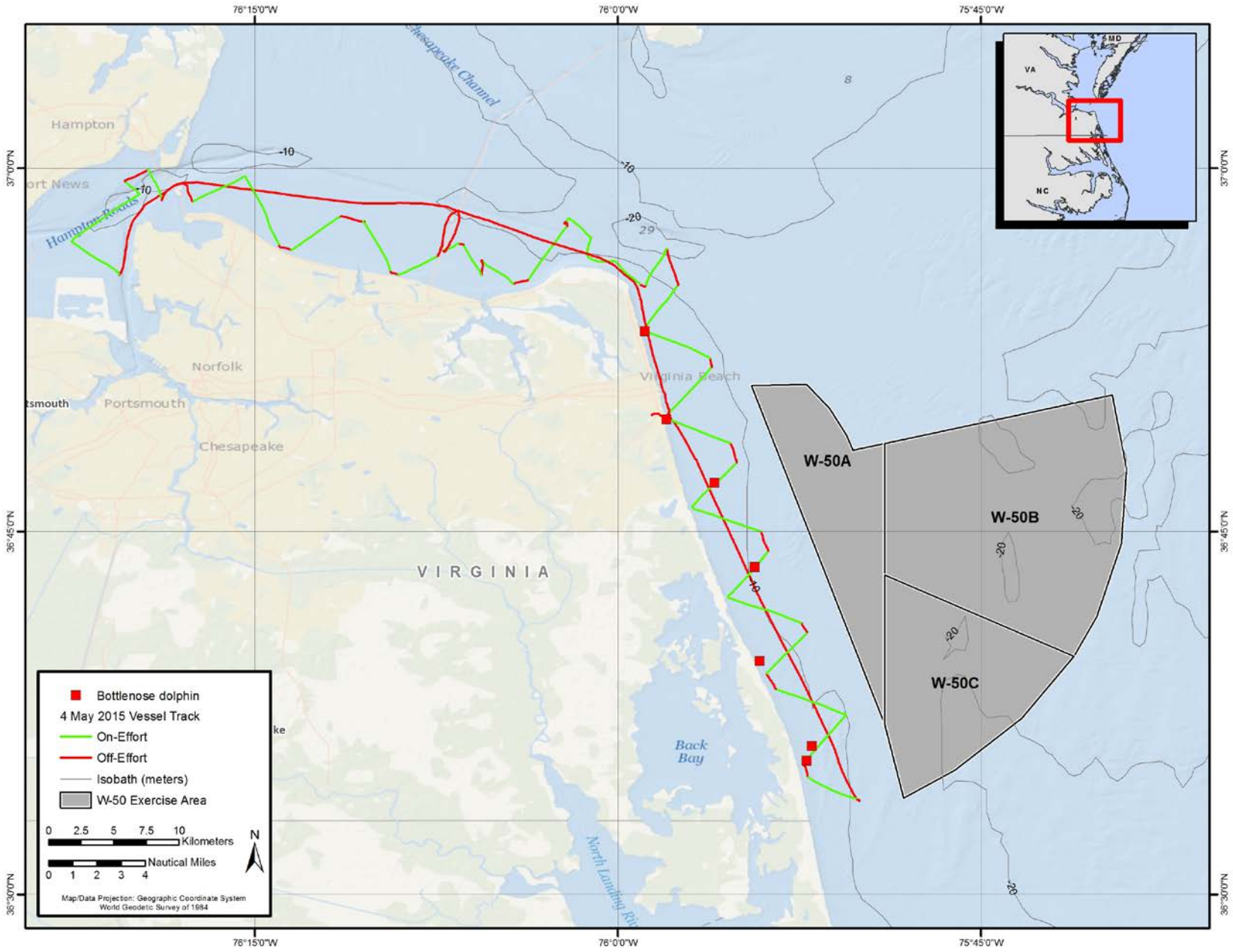
Chesapeake Channel
Hampton
Hampton Roads
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
MD
VA
NC
Bottlenose dolphin
Harbor porpoise
17 April 2015 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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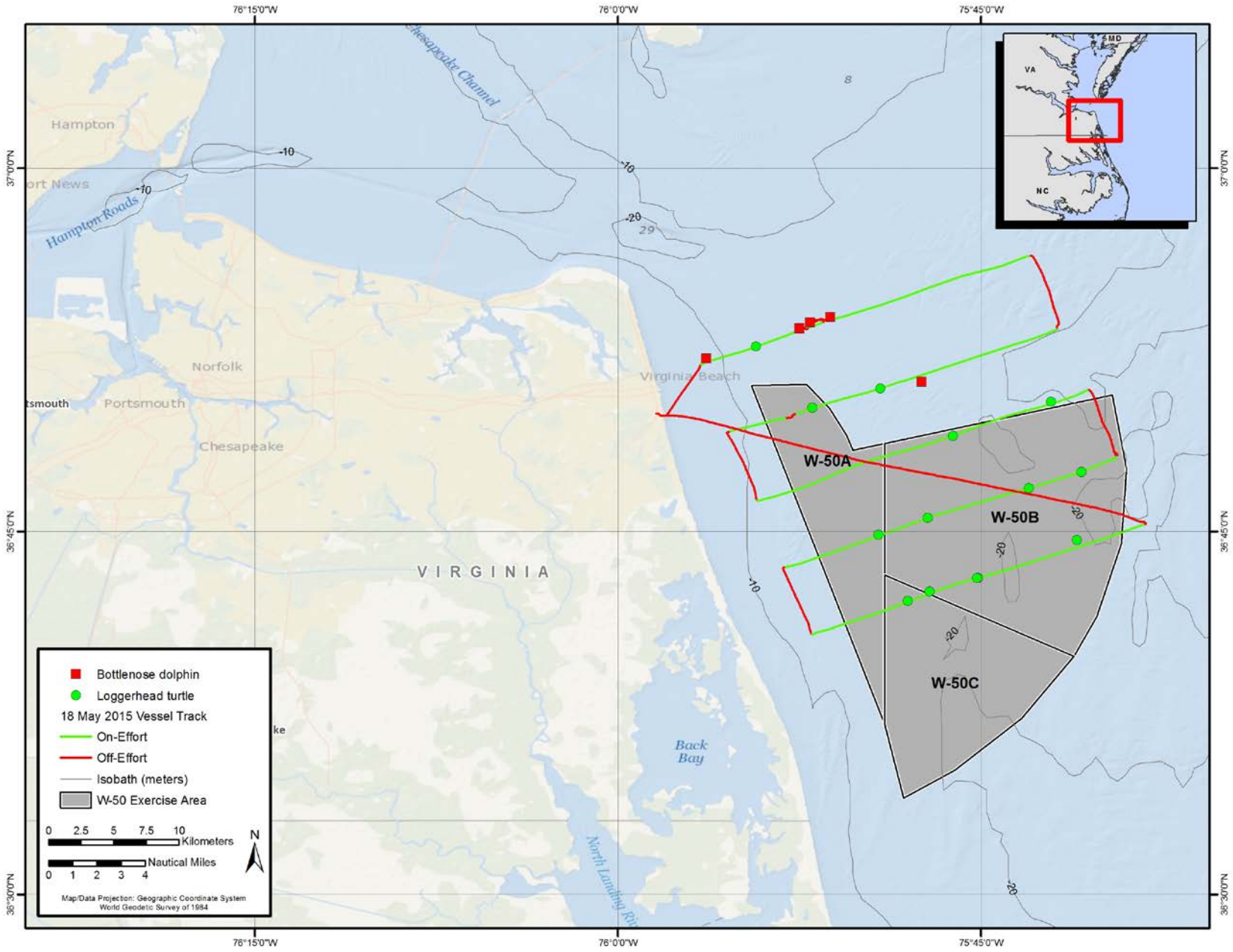
Chesapeake Channel
Hampton
Hampton Roads
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
MD
VA
NC
Bottlenose dolphin
4 May 2015 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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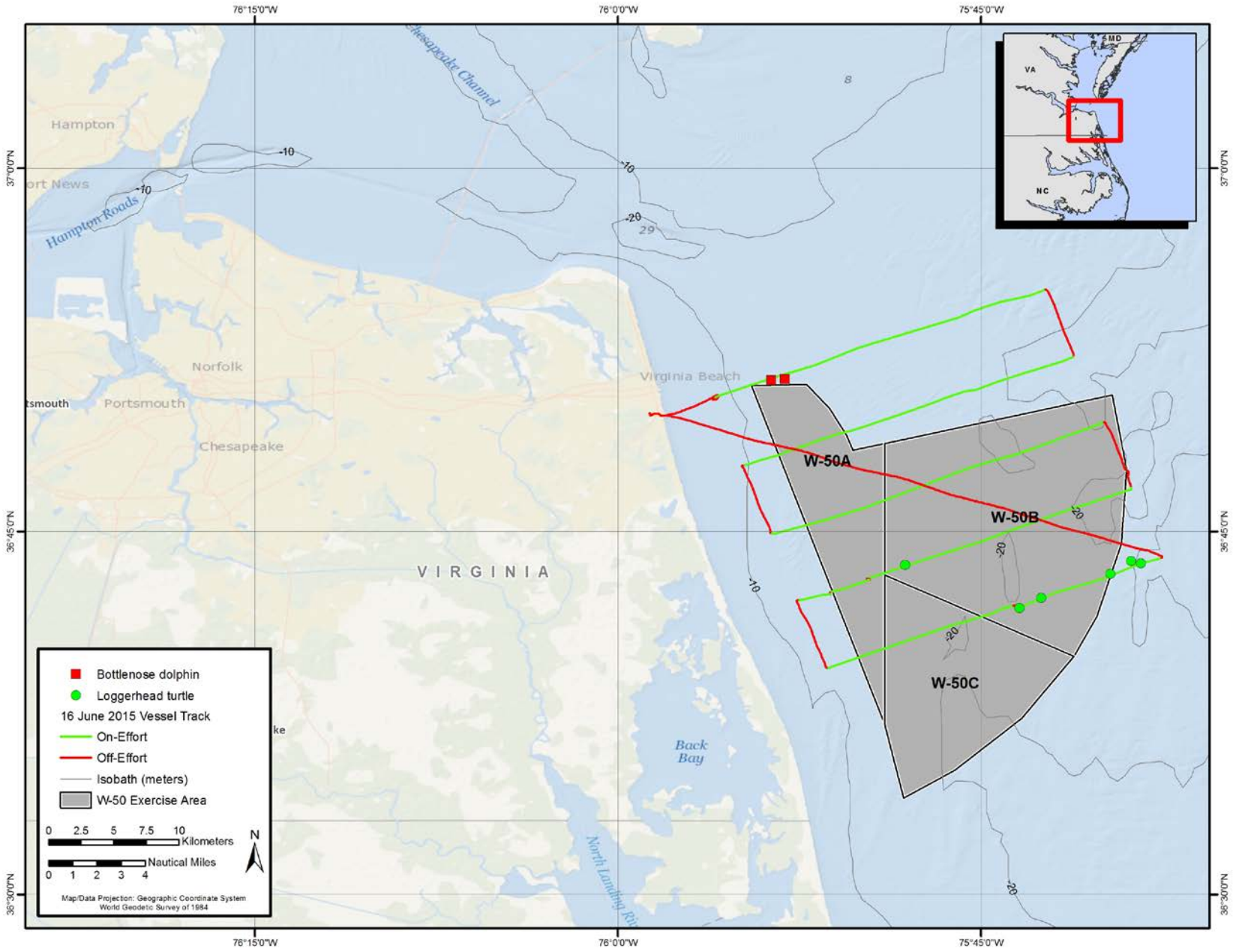
Chesapeake Channel
Hampton
Hampton Roads
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
MD
VA
NC
Bottlenose dolphin
Loggerhead turtle
18 May 2015 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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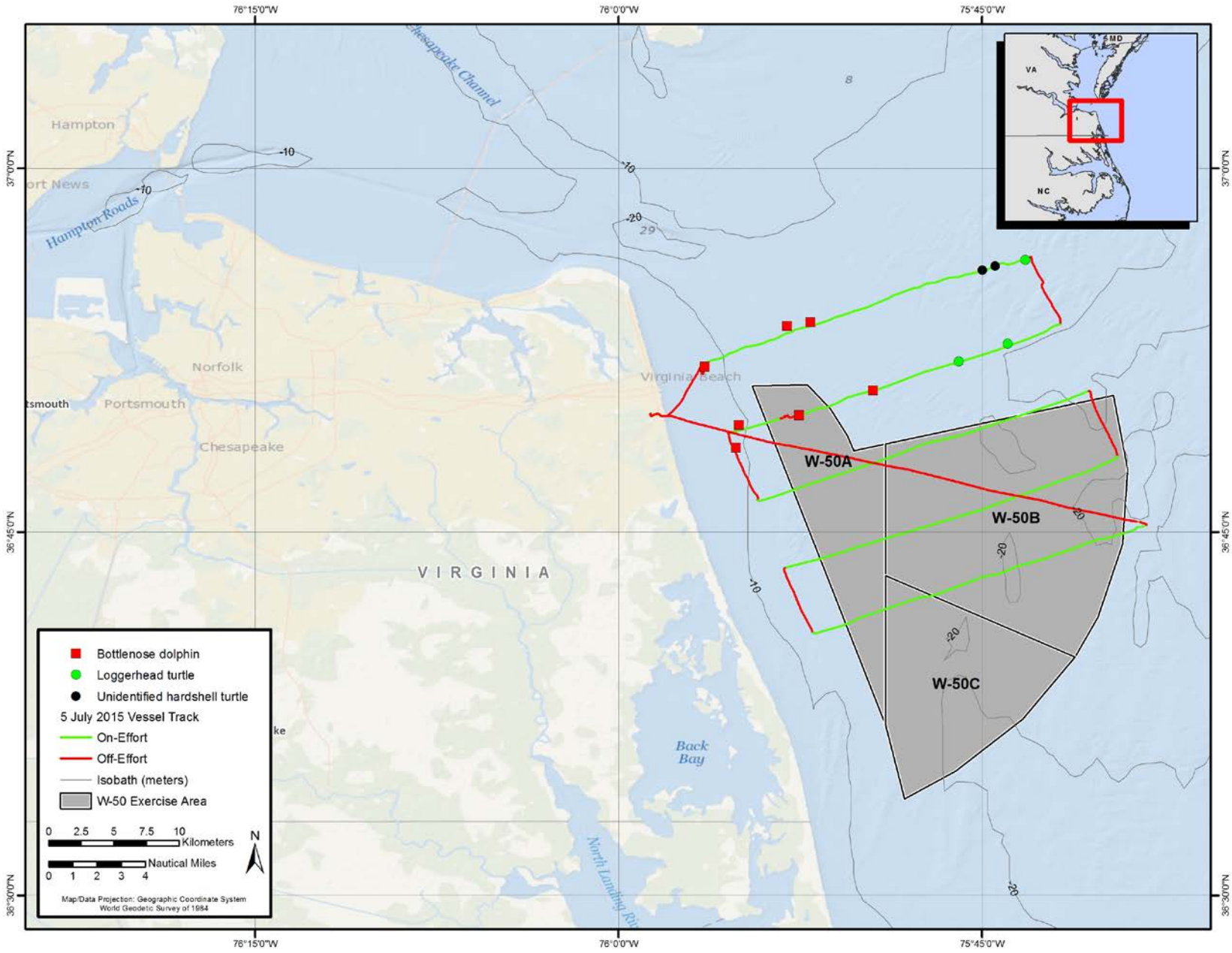
Hampton Roads
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
MD
VA
NC
Bottlenose dolphin
Loggerhead turtle
16 June 2015 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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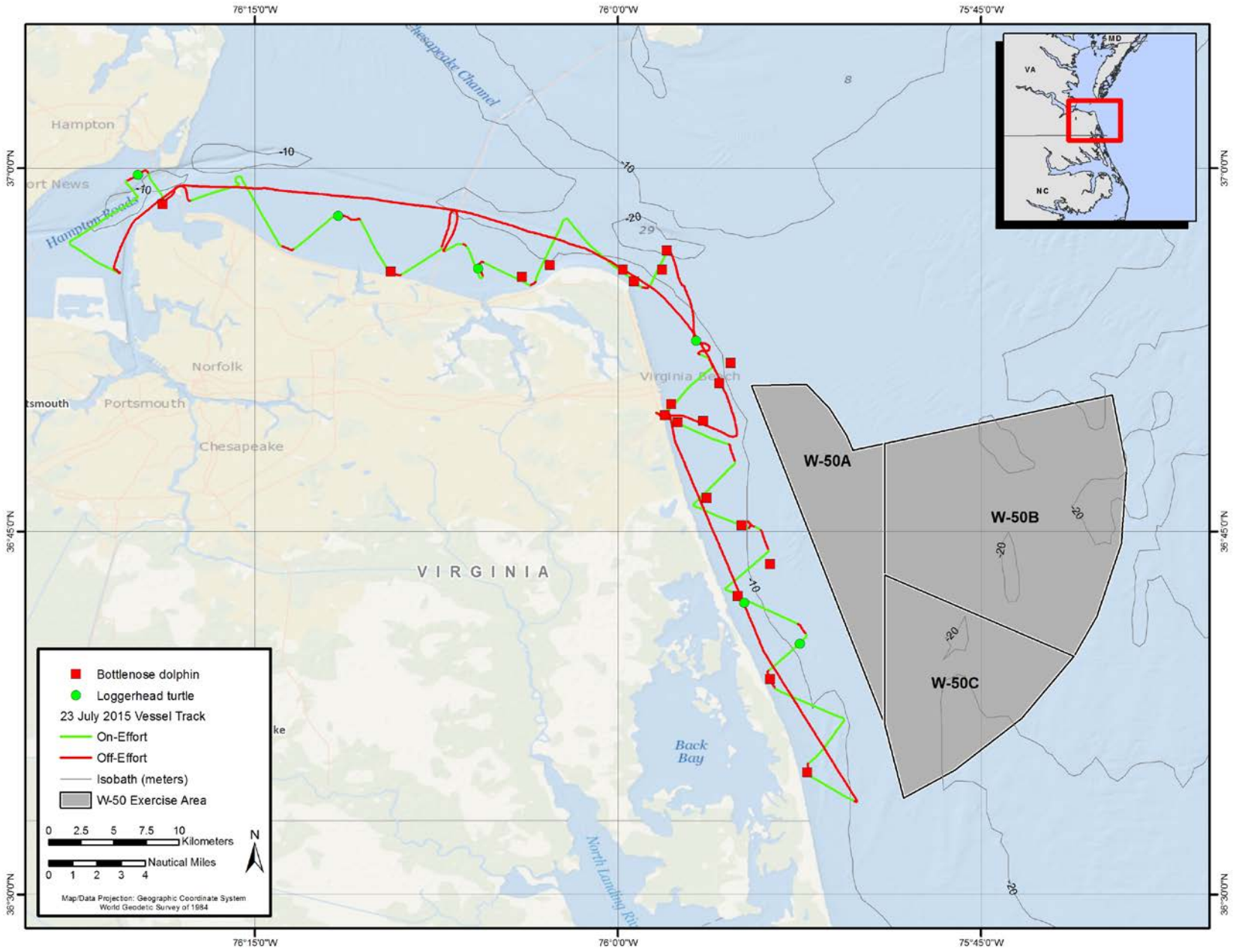
Chesapeake Channel
Hampton
Hampton Roads
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
MD
VA
NC
Bottlenose dolphin
Loggerhead turtle
Unidentified hardshell turtle
5 July 2015 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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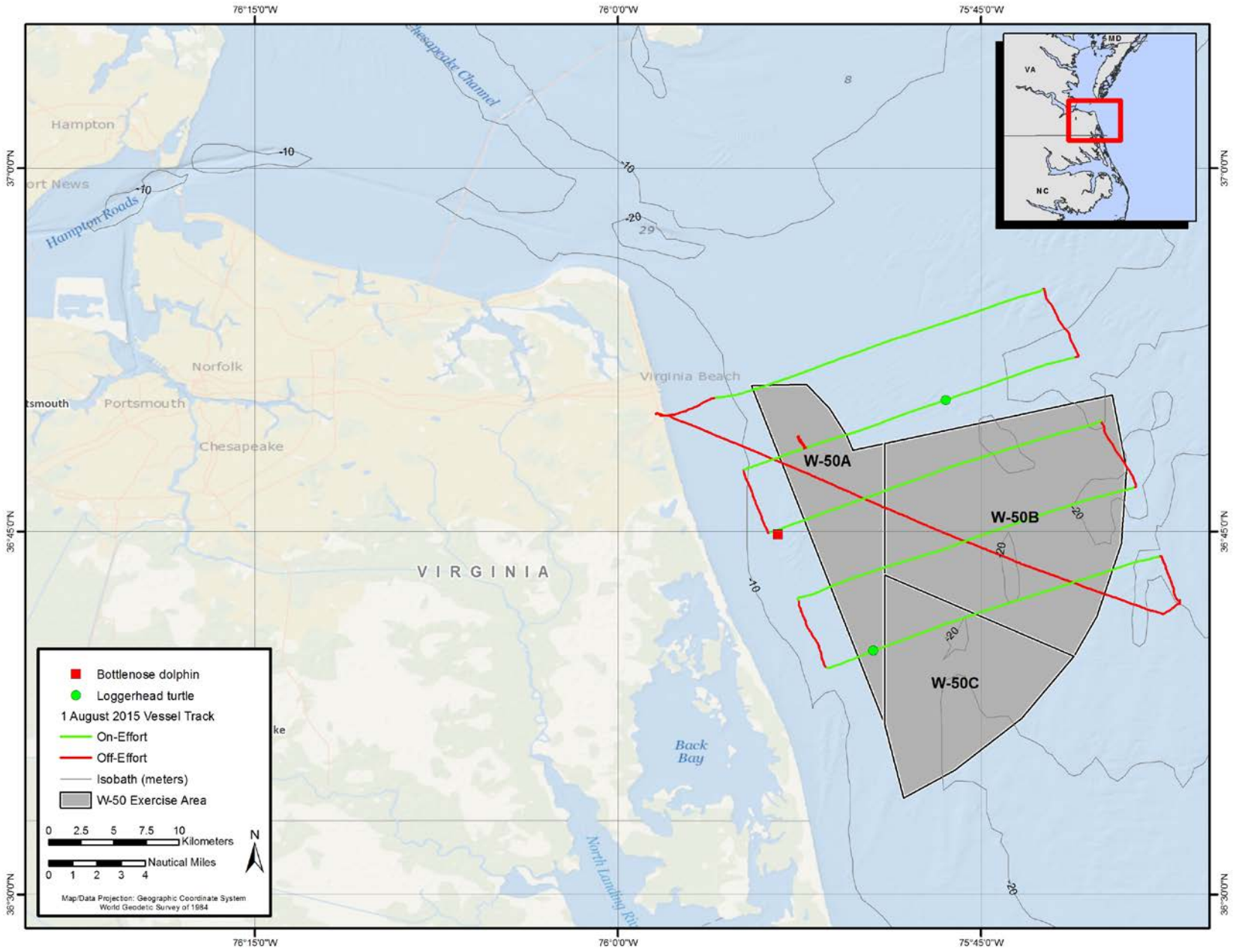
Hampton Roads
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
W-50A
W-50B
W-50C
MD
VA
NC
Bottlenose dolphin
Loggerhead turtle
23 July 2015 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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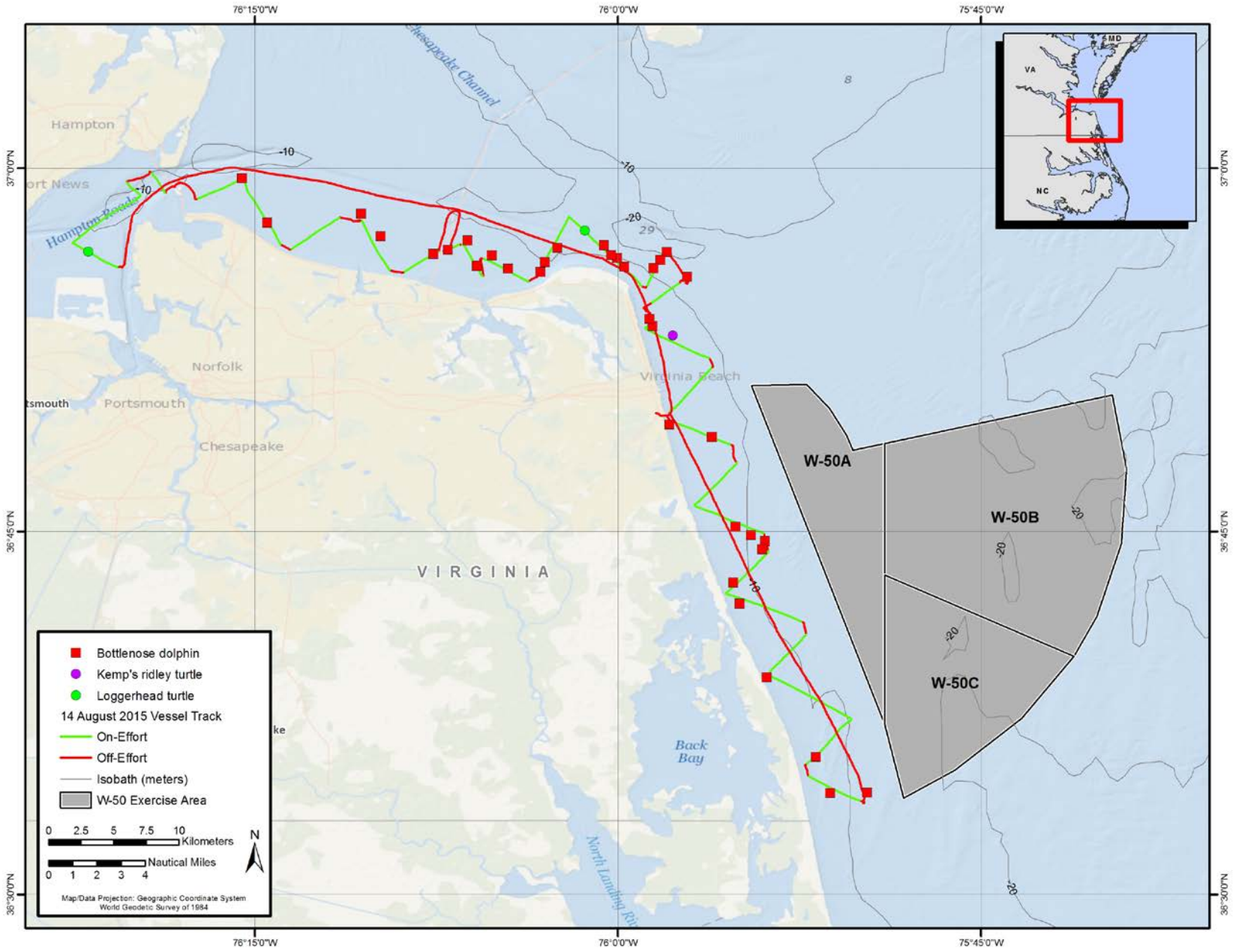
Hampton
Hampton Roads
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
MD
VA
NC
Bottlenose dolphin
Loggerhead turtle
1 August 2015 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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Hampton
Hampton Roads
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
-10
-20
W-50A
W-50B
W-50C
MD
VA
NC
Bottlenose dolphin
Kemp's ridley turtle
Loggerhead turtle
14 August 2015 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984

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C

INSHORE Transect Survey Marine Mammal and Sea Turtle Sightings

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Sighting No.	Date	Time	Species	Group Size Best/High/Low			Calves	Sighting Latitude	Sighting Longitude	Effort	Bearing Angle	PSD† (m)	BSS*	Bottom Depth (m)	SST§ (ºF)	Photos Taken
07 September 2012 INSHORE transect																
1	07 Sep 2012	8:46	Tt	2	2	2	0	36.699	-75.919	On	15	31	3	7	80	No
2	07 Sep 2012	9:19	Tt	2	2	2	0	36.756	-75.946	On	304	580	3	8	80	No
3	07 Sep 2012	9:29	Tt	4	5	4	0	36.755	-75.931	On	70	364	3	10	80	No
4	07 Sep 2012	9:36	Tt	3	3	3	0	36.768	-75.928	On	354	31	3	9	80	No
5	07 Sep 2012	10:00	Tt	4	4	4	0	36.812	-75.958	On	315	177	3	9	80	No
6	07 Sep 2012	10:04	Tt	1	1	1	0	36.817	-75.958	On	330	50	3	9	80	No
7	07 Sep 2012	10:36	Tt	5	5	3	0	36.865	-75.960	On	90	267	3	9	80	No
8	07 Sep 2012	10:46	Tt	5	6	3	0	36.878	-75.966	On	292	927	3	8	80	No
9	07 Sep 2012	11:00	Tt	4	4	4	0	36.895	-75.975	On	296	809	3	7	80	No
10	07 Sep 2012	11:03	Tt	10	10	7	0	36.903	-75.974	Off	12	6	3	7	80	No
11	07 Sep 2012	11:13	Tt	4	4	4	0	36.918	-75.980	On	0	0	3	8	80	No
12	07 Sep 2012	11:14	Tt	8	9	4	0	36.922	-75.982	On	274	299	3	7	80	No
13	07 Sep 2012	11:29	Tt	3	3	3	0	36.935	-75.994	On	0	0	3	13	80	No
14	07 Sep 2012	11:30	Tt	25	30	10	0	36.932	-76.001	On	336	325	3	11	80	No
15	07 Sep 2012	11:35	Tt	5	5	3	0	36.934	-76.005	On	35	143	3	10	80	No
16	07 Sep 2012	11:38	Tt	5	5	3	0	36.937	-76.010	On	280	201	3	16	80	No
17	07 Sep 2012	11:41	Tt	6	6	4	0	36.947	-76.012	On	270	500	3	21	80	No
18	07 Sep 2012	11:51	Tt	3	3	3	0	36.945	-76.017	On	335	211	3	19	80	No
19	07 Sep 2012	11:53	Tt	1	1	1	0	36.940	-76.024	On	355	17	3	16	80	No
20	07 Sep 2012	11:55	Tt	2	2	2	0	36.939	-76.026	On	21	72	3	15	80	No
21	07 Sep 2012	11:57	Tt	25	30	5	1	36.937	-76.028	On	325	123	3	15	80	No
22	07 Sep 2012	12:02	Tt	7	7	4	0	36.938	-76.030	Off	35	57	3	16	80	No
23	07 Sep 2012	12:03	Tt	8	8	4	1	36.944	-76.028	Off	90	387	3	16	80	No
24	07 Sep 2012	12:42	Tt	3	3	3	0	36.944	-76.061	On	280	98	2	14	80	No
25	07 Sep 2012	12:44	Tt	8	8	4	0	36.954	-76.047	On	35	222	2	14	80	No
26	07 Sep 2012	12:50	Tt	3	3	3	1	36.944	-76.053	On	344	152	2	13	80	No
27	07 Sep 2012	12:53	Tt	12	14	5	1	36.945	-76.056	On	90	100	2	11	80	No
28	07 Sep 2012	12:56	Tt	2	2	2	0	36.934	-76.068	On	90	387	2	11	80	No
29	07 Sep 2012	13:04	Tt	7	7	7	0	36.921	-76.079	On	272	750	2	10	80	No
30	07 Sep 2012	13:06	Tt	13	15	6	0	36.929	-76.081	On	337	117	2	10	80	No
31	07 Sep 2012	13:09	Tt	8	8	3	0	36.936	-76.088	On	346	48	2	9	80	No
32	07 Sep 2012	13:11	Tt	10	12	8	0	36.938	-76.095	On	45	84	2	9	80	No
33	07 Sep 2012	13:13	Tt	2	2	2	0	36.930	-76.104	On	332	282	2	9	80	No

Sighting No.	Date	Time	Species	Group Size Best/High/Low			Calves	Sighting Latitude	Sighting Longitude	Effort	Bearing Angle	PSD† (m)	BSS*	Bottom Depth (m)	SST§ (ºF)	Photos Taken
07 September 2012 INSHORE transect (continued)																
34	07 Sep 2012	13:20	Tt	3	3	3	0	36.920	-76.115	On	90	650	2	5	80	No
35	07 Sep 2012	13:28	Tt	35	43	28	-	36.946	-76.121	Off	316	347	2	8	80	No
36	07 Sep 2012	14:03	Tt	6	4	4	0	36.934	-76.178	On	0	0	2	9	80	No
37	07 Sep 2012	14:32	Tt	32	35	10	2	36.960	-76.198	On	45	32	3	8	80	No
38	07 Sep 2012	14:54	Cc	1	1	1	-	36.971	-76.227	On	300	-	3	-	80	No
03 October 2012 INSHORE transect																
1	03 Oct 2012	8:54	Tt	1	1	1	0	36.987	-76.316	On	298	441	1	4	72	No
2	03 Oct 2012	8:56	Tt	5	5	4	0	36.989	-76.308	On	18	83	1	7	72	No
3	03 Oct 2012	9:15	Tt	4	4	4	0	36.985	-76.275	On	328	212	1	5	72	No
4	03 Oct 2012	9:27	Tt	3	3	3	0	36.978	-76.268	On	90	800	1	7	72	No
5	03 Oct 2012	9:39	Tt	6	6	3	0	36.965	-76.230	On	85	996	1	8	72	No
6	03 Oct 2012	9:46	Tt	2	2	2	0	36.965	-76.220	On	285	258	2	7	72	No
7	03 Oct 2012	9:55	Tt	3	3	3	0	36.953	-76.198	On	8	167	2	9	72	No
8	03 Oct 2012	9:58	Tt	7	8	4	1	36.945	-76.199	On	76	970	2	7	72	No
9	03 Oct 2012	10:34	Tt	3	3	3	0	36.943	-76.170	On	288	451	2	3	73	No
10	03 Oct 2012	10:36	Tt	6	8	6	0	36.948	-76.167	On	270	387	2	3	73	No
11	03 Oct 2012	10:38	Tt	1	1	1	0	36.946	-76.158	On	0	0	2	3	73	No
12	03 Oct 2012	10:38	Tt	1	1	1	0	36.946	-76.157	On	270	50	2	3	73	No
13	03 Oct 2012	10:46	Tt	3	3	3	0	36.951	-76.136	On	286	115	2	8	73	No
14	03 Oct 2012	11:13	Tt	12	15	10	0	36.943	-76.083	On	0	0	2	11	72	No
15	03 Oct 2012	11:29	Tt	10	11	8	0	36.934	-76.065	On	288	194	2	10	72	No
16	03 Oct 2012	11:47	Tt	5	5	4	0	36.940	-76.030	On	350	35	2	7	72	No
17	03 Oct 2012	11:49	Tt	7	8	4	0	36.945	-76.018	On	280	693	2	5	72	No
18	03 Oct 2012	12:08	Tt	8	8	6	0	36.930	-76.001	On	90	300	1	3	72	No
19	03 Oct 2012	12:10	Tt	10	10	5	0	36.933	-75.988	On	20	132	1	3	72	No
20	03 Oct 2012	12:11	Tt	12	15	8	0	36.933	-75.994	Off	125	43	1	5	72	No
21	03 Oct 2012	12:13	Tt	6	6	4	0	36.938	-75.981	On	5	23	1	6	72	No
22	03 Oct 2012	12:20	Tt	18	21	10	2	36.935	-75.976	On	73	96	1	6	72	No
23	03 Oct 2012	12:24	Tt	7	7	6	2	36.922	-75.972	On	292	359	1	7	72	No
24	03 Oct 2012	12:24	Tt	9	14	9	0	36.925	-75.981	On	83	248	1	3	72	No
25	03 Oct 2012	12:28	Tt	2	2	2	0	36.914	-75.987	On	32	265	1	3	72	No
26	03 Oct 2012	12:29	Tt	6	6	5	0	36.915	-75.990	On	82	545	1	3	72	No
27	03 Oct 2012	12:30	Tt	3	3	3	0	36.909	-75.986	On	12	31	1	2	72	No

Sighting No.	Date	Time	Species	Group Size Best/High/Low			Calves	Sighting Latitude	Sighting Longitude	Effort	Bearing Angle	PSD† (m)	BSS*	Bottom Depth (m)	SST§ (ºF)	Photos Taken
03 October 2012 INSHORE transect (continued)																
28	03 Oct 2012	12:37	Tt	1	1	1	0	36.894	-75.974	On	90	750	1	2	72	No
29	03 Oct 2012	12:49	Tt	3	4	3	0	36.874	-75.974	On	42	803	1	3	72	No
30	03 Oct 2012	12:53	Tt	8	10	6	0	36.871	-75.977	On	84	895	1	5	72	No
31	03 Oct 2012	14:03	Tt	1	1	1	0	36.755	-75.939	On	2	3	2	3	73	No
32	03 Oct 2012	14:21	Tt	7	12	7	0	36.719	-75.910	On	358	10	2	4	73	No
33	03 Oct 2012	14:36	Tt	11	13	10	0	36.692	-75.898	On	0	0	2	4	73	No
34	03 Oct 2012	14:50	Tt	18	20	15	2	36.668	-75.892	On	90	650	2	3	73	No
35	03 Oct 2012	14:52	Tt	5	5	5	0	36.663	-75.886	On	85	99	2	3	73	No
36	03 Oct 2012	14:53	Tt	5	5	4	0	36.647	-75.889	On	2	42	2	3	73	No
37	03 Oct 2012	14:54	Tt	5	5	5	0	36.654	-75.890	On	72	238	2	3	73	No
38	03 Oct 2012	14:55	Tt	3	3	3	0	36.651	-75.884	On	72	238	2	3	73	No
39	03 Oct 2012	14:57	Tt	4	4	4	0	36.643	-75.889	On	270	165	2	3	73	No
40	03 Oct 2012	15:35	Tt	6	6	3	0	36.570	-75.839	On	355	52	3	4	73	No
27 November 2012 INSHORE transect																
1	27 Nov 2012	12:35	Tt	40	50	40	6	36.820	-75.957	On	032	159	3	5-15	49	Yes
2	27 Nov 2012	13:18	Tt	18	25	15	0	36.769	-75.942	On	085	598	2	5-15	50	No
3	27 Nov 2012	13:20	Tt	7	8	5	0	36.761	-75.939	On	025	42	2	5-15	50	No
4	27 Nov 2012	14:31	Tt	3	3	3	0	36.650	-75.894	On	048	186	1	5-15	50	No
5	27 Nov 2012	14:50	Tt	8	10	7	1	36.609	-75.870	On	012	208	2	5-15	50	Yes
6	27 Nov 2012	15:07	Tt	8	9	7	0	36.586	-75.863	On	340	70	1	5-15	51	Yes
09 January 2013 INSHORE transect																
1	09 Jan 2013	13:52	Tt	30	40	30	6	36.699	-75.923	On	023	277	2	5-15	47	Yes
2	09 Jan 2013	14:07	Tt	35	35	35	12	36.708	-75.924	Off	000	268	2	5-15	47	Yes
3	09 Jan 2013	15:20	Tt	4	5	3	0	36.578	-75.840	On	328	200	2	5-15	47	Yes
4	09 Jan 2013	15:48	Tt	23	25	20	0	36.597	-75.807	Off	000	-	2	5-15	47	Yes
22 February 2013 INSHORE transect																
1	22 Feb 2013	12:50	Tt	4	4	4	1	36.937	-76.006	On	346	23	2	5-15	43	No
2	22 Feb 2013	13:49	Tt	3	3	3	0	36.896	-75.958	On	279	55	2	5-15	43	Yes
3	22 Feb 2013	15:03	Tt	3	3	3	0	36.767	-75.936	On	303	19	2	5-15	43	No
4	22 Feb 2013	15:08	Tt	5	5	5	1	36.757	-75.941	On	000	0	2	5-15	43	No
5	22 Feb 2013	15:33	Tt	15	15	12	1	36.712	-75.915	On	054	42	2	5-15	43	Yes
6	22 Feb 2013	16:04	Tt	2	2	2	0	36.695	-75.903	On	002	0	3	5-15	43	No

Sighting No.	Date	Time	Species	Group Size Best/High/Low			Calves	Sighting Latitude	Sighting Longitude	Effort	Bearing Angle	PSD† (m)	BSS*	Bottom Depth (m)	SST§ (ºF)	Photos Taken
01 April 2013 INSHORE transect																
1	01 Apr 2013	10:17	Tt	1	1	1	0	36.95	-76.22	On	324	110	2	5-15	47	No
2	01 Apr 2013	13:12	Mn	1	1	1	0	36.89	-75.95	On	032	140	2	9	49	Yes
3	01 Apr 2013	14:08	Mn	1	1	1	0	36.83	-75.94	On	321	139	2	9	50	No
28 April 2013 INSHORE transect																
1	28 Apr 2013	12:02	Tt	68	75	60	4	36.942	-75.975	On	316	80	3	15	57	Yes
2	28 Apr 2013	12:33	Tt	7	8	6	0	36.934	-75.975	On	331	80	3	5-15	57	No
3	28 Apr 2013	12:56	Tt	4	4	4	0	36.892	-75.949	Off	180	5	3	5-15	59	No
4	28 Apr 2013	13:27	Tt	4	4	3	0	36.832	-75.945	On	339	8	3	5-15	59	No
5	28 Apr 2013	13:31	Tt	3	4	2	0	36.820	-75.956	On	042	110	3	5-15	59	No
6	28 Apr 2013	14:59	Tt	9	10	8	0	36.639	-75.877	On	042	250	4	5-15	59	No
09 May 2013 INSHORE transect																
1	09 May 2013	10:48	Tt	1	1	1	0	36.744	-75.919	On	271	200	2	11	62	No
2	09 May 2013	11:34	Tt	5	7	3	0	36.832	-75.947	On	002	10	2	11	63	No
3	09 May 2013	11:56	Tt	26	30	25	2	36.877	-75.962	On	346	160	2	8	61	No
4	09 May 2013	12:09	Tt	3	3	3	0	36.894	-75.959	On	316	243	2	10	62	No
5	09 May 2013	12:20	Tt	8	9	7	0	36.913	-75.986	On	296	269	2	7	63	No
6	09 May 2013	12:37	Tt	8	10	7	0	36.934	-75.992	On	305	287	2	14	64	No
7	09 May 2013	13:06	Tt	7	7	5	0	36.945	-76.021	On	030	80	2	14	64	No
17 July 2013 INSHORE transect																
1	17 Jul 2013	7:15	Tt	8	10	6	0	36.588	-75.867	On	277	645	2	9	79	No
2	17 Jul 2013	7:22	Tt	3	3	3	0	36.612	-75.865	On	042	105	2	9	79	No
3	17 Jul 2013	7:40	Tt	5	5	5	0	36.646	-75.891	On	352	59	2	5-15	79	Yes
4	17 Jul 2013	7:41	Tt	14	18	7	0	36.648	-75.889	On	056	211	2	5-15	79	Yes
5	17 Jul 2013	8:11	Tt	3	3	3	0	36.673	-75.877	On	063	600	2	5-15	79	No
6	17 Jul 2013	8:19	Tt	2	2	2	0	36.693	-75.890	On	065	645	2	5-15	79	No
7	17 Jul 2013	8:24	Tt	7	10	5	0	36.696	-75.915	On	275	105	2	5-15	79	No
8	17 Jul 2013	8:27	Tt	35	40	30	0	36.704	-75.919	On	061	59	2	5-15	84	No
9	17 Jul 2013	8:27	Tt	50	60	45	0	36.701	-75.919	On	285	211	2	7	84	Yes
10	17 Jul 2013	8:44	Tt	2	2	2	0	36.717	-75.910	On	033	600	2	7	84	No
11	17 Jul 2013	8:46	Tt	12	15	10	1	36.724	-75.912	On	309	181	2	5-15	80	No
12	17 Jul 2013	9:00	Tt	2	2	2	0	36.758	-75.929	On	063	418	2	5-15	80	No
13	17 Jul 2013	9:00	Tt	2	2	2	0	36.754	-75.934	On	000	350	2	5-15	80	No
14	17 Jul 2013	9:02	Tt	4	5	2	0	36.759	-75.937	On	054	97	2	5-15	80	No

Sighting No.	Date	Time	Species	Group Size Best/High/Low			Calves	Sighting Latitude	Sighting Longitude	Effort	Bearing Angle	PSD† (m)	BSS*	Bottom Depth (m)	SST§ (ºF)	Photos Taken
17 July 2013 INSHORE transect (continued)																
15	17 Jul 2013	9:04	Tt	32	35	30	1	36.762	-75.940	On	347	54	2	5-15	80	No
16	17 Jul 2013	9:08	Tt	14	20	10	0	36.775	-75.938	On	306	272	2	5-15	80	No
17	17 Jul 2013	9:09	Tt	2	2	2	0	36.774	-75.928	On	090	623	2	5-15	80	No
18	17 Jul 2013	9:10	Tt	2	2	2	0	36.777	-75.933	On	271	0	2	5-15	80	No
19	17 Jul 2013	9:19	Tt	7	9	5	0	36.799	-75.937	On	338	323	3	5-15	82	No
20	17 Jul 2013	9:25	Tt	8	10	6	1	36.809	-75.952	On	329	72	3	5-15	81	No
21	17 Jul 2013	9:58	Tt	1	1	1	0	36.881	-75.958	On	322	70	3	5-15	81	No
22	17 Jul 2013	10:08	Tt	3	3	3	0	36.905	-75.966	On	076	65	3	5-15	81	No
23	17 Jul 2013	10:10	Tt	4	4	4	0	36.905	-75.976	On	000	193	3	5-15	75	No
24	17 Jul 2013	10:12	Tt	5	5	5	0	36.906	-75.980	On	056	41	3	5-15	75	No
25	17 Jul 2013	10:15	Tt	24	25	22	2	36.914	-75.983	On	335	74	3	5-15	75	No
26	17 Jul 2013	10:32	Tt	9	10	6	0	36.934	-75.993	On	318	134	3	5-15	81	No
27	17 Jul 2013	11:41	Cc	1	1	1	-	36.945	-76.007	On	063	-	2	5-15	81	No
28	17 Jul 2013	12:22	Tt	5	6	4	0	36.934	-76.175	On	314	108	2	5-15	81	Yes
29	17 Jul 2013	12:45	Tt	11	12	10	0	36.953	-76.189	On	283	146	2	5-15	81	No
30	17 Jul 2013	13:42	Tt	1	1	1	0	36.997	-76.302	On	032	106	2	5-15	81	No
24 July 2013 INSHORE transect																
1	24 Jul 2013	9:36	Tt	5	7	5	1	36.944	-76.179	On	119	191	2	9	78	Yes
2	24 Jul 2013	11:14	Tt	125	140	110	6	36.935	-76.026	On	153	109	2	4	77	Yes
3	24 Jul 2013	11:45	Tt	11	15	8	0	36.946	-76.021	On	017	33	2	18	77	No
4	24 Jul 2013	12:19	Tt	6	6	6	0	36.936	-75.995	On	131	200	1	12	80	No
5	24 Jul 2013	12:21	Tt	22	25	16	1	36.933	-76.002	On	178	36	1	9	80	No
6	24 Jul 2013	12:41	Tt	18	18	18	0	36.914	-75.976	On	153	179	1	5	78	No
7	24 Jul 2013	12:57	Tt	3	3	3	0	36.889	-75.946	On	135	13	2	9	73	No
8	24 Jul 2013	12:58	Tt	100	110	90	3	36.884	-75.943	On	127	241	2	9	73	Yes
9	24 Jul 2013	13:28	Tt	3	3	3	0	36.868	-75.960	On	250	7	2	8	73	No
10	24 Jul 2013	13:42	Tt	6	6	6	0	36.846	-75.942	On	223	75	2	9	78	No
11	24 Jul 2013	14:04	Tt	2	2	2	0	36.803	-75.940	On	103	50	2	9	73	No
12	24 Jul 2013	14:43	Tt	10	12	6	1	36.715	-75.914	On	218	97	2	10	77	No
13	24 Jul 2013	14:46	Tt	8	8	8	0	36.712	-75.925	On	288	978	2	9	77	No
13 August 2013 INSHORE transect																
1	13 Aug 2013	8:12	Tt	4	4	3	0	36.974	-76.322	On	166	117	3	2	81	Yes
2	13 Aug 2013	9:28	Tt	40	45	35	2	36.942	-76.218	On	160	249	2	3	81	Yes

Sighting No.	Date	Time	Species	Group Size Best/High/Low			Calves	Sighting Latitude	Sighting Longitude	Effort	Bearing Angle	PSD† (m)	BSS*	Bottom Depth (m)	SST§ (ºF)	Photos Taken
13 August 2013 INSHORE transect (continued)																
3	13 Aug 2013	12:03	Tt	10	12	7	0	36.934	-76.025	On	169	137	3	16	80	No
4	13 Aug 2013	12:12	Tt	90	100	80	4	36.960	-76.004	On	082	199	3	24	80	Yes
5	13 Aug 2013	12:26	Tt	9	13	3	0	36.939	-76.003	On	180	87	3	24	80	No
6	13 Aug 2013	13:48	Tt	2	2	2	0	36.803	-75.935	On	077	76	3	9	77	No
7	13 Aug 2013	14:02	Tt	3	3	3	0	36.788	-75.926	On	000	35	3	12	77	No
8	13 Aug 2013	14:05	Tt	68	75	65	0	36.778	-75.928	On	124	252	3	12	77	No
9	13 Aug 2013	15:21	Tt	150	100	175	3	36.751	-75.924	Off	-	320	2	12	77	Yes
25 September 2013 INSHORE transect																
1	25 Sep 2013	9:10	Tt	175	180	150	0	36.592	-75.861	On	358	241	2	10	72	Yes
2	25 Sep 2013	9:37	Tt	6	6	6	0	36.600	-75.872	Off	000	0	2	10	72	No
3	25 Sep 2013	9:40	Tt	9	15	12	0	36.609	-75.868	On	049	103	2	10	72	No
4	25 Sep 2013	9:42	Tt	5	7	5	0	36.614	-75.869	On	006	137	2	11	71	No
5	25 Sep 2013	9:49	Tt	30	35	20	0	36.635	-75.857	On	017	137	2	11	71	No
6	25 Sep 2013	10:05	Tt	1	1	1	0	36.653	-75.886	On	105	362	2	11	71	No
7	25 Sep 2013	10:24	Tt	3	3	3	0	36.694	-75.903	On	289	56	2	10	72	No
8	25 Sep 2013	10:33	Tt	7	7	5	0	36.714	-75.911	On	047	239	1	10	72	No
9	25 Sep 2013	10:40	Tt	3	3	3	0	36.729	-75.919	On	301	975	1	12	72	No
10	25 Sep 2013	10:46	Tt	3	3	3	0	36.742	-75.914	On	279	266	1	10	72	No
11	25 Sep 2013	10:47	Tt	4	5	4	0	36.748	-75.912	On	003	362	1	10	72	No
12	25 Sep 2013	10:53	Tt	145	160	120	6	36.752	-75.921	On	348	411	1	10	72	Yes
13	25 Sep 2013	11:47	Tt	6	7	5	0	36.819	-75.964	On	306	600	1	9	73	No
14	25 Sep 2013	11:52	Tt	3	4	3	0	36.830	-75.951	On	000	139	1	9	73	No
15	25 Sep 2013	11:59	Tt	55	60	45	0	36.847	-75.930	On	067	447	1	9	73	No
16	25 Sep 2013	12:15	Tt	7	10	7	0	36.873	-75.961	On	098	160	1	8	73	No
17	25 Sep 2013	12:20	Tt	30	35	25	0	36.890	-75.955	On	009	354	2	12	73	No
18	25 Sep 2013	12:22	Mn	1	1	1	0	36.882	-75.950	On	196	496	2	12	73	Yes
19	25 Sep 2013	12:49	Tt	3	3	3	0	36.909	-75.984	On	341	176	2	11	71	No
20	25 Sep 2013	12:50	Tt	15	20	12	0	36.912	-75.988	On	303	383	2	11	71	No
21	25 Sep 2013	12:53	Tt	5	5	5	0	36.922	-75.979	On	044	95	2	11	71	No
22	25 Sep 2013	12:59	Tt	18	25	15	0	36.942	-75.970	On	305	199	2	11	72	No
23	25 Sep 2013	13:12	Tt	13	15	8	0	36.933	-75.999	On	252	12	2	11	72	No
24	25 Sep 2013	13:17	Tt	8	10	8	0	36.938	-76.004	On	060	114	2	11	72	No
25	25 Sep 2013	13:19	Tt	4	4	4	0	36.946	-76.010	On	312	280	2	11	72	No

Sighting No.	Date	Time	Species	Group Size Best/High/Low			Calves	Sighting Latitude	Sighting Longitude	Effort	Bearing Angle	PSD† (m)	BSS*	Bottom Depth (m)	SST§ (ºF)	Photos Taken
25 September 2013 INSHORE transect (continued)																
26	25 Sep 2013	13:22	Tt	8	10	7	0	36.953	-76.008	On	358	51	2	11	72	No
27	25 Sep 2013	13:24	Tt	5	5	5	0	36.958	-76.009	On	345	107	2	11	72	No
28	25 Sep 2013	13:30	Tt	21	25	21	0	36.945	-76.022	On	226	42	2	10	72	No
29	25 Sep 2013	13:38	Tt	1	1	1	0	36.944	-76.036	On	351	57	2	10	72	No
30	25 Sep 2013	13:44	Tt	6	6	5	0	36.952	-76.055	On	242	680	2	10	72	No
31	25 Sep 2013	13:46	Tt	42	35	50	0	36.950	-76.070	On	256	260	2	10	72	No
32	25 Sep 2013	13:55	Tt	9	10	8	0	36.930	-76.059	On	143	671	2	10	73	No
33	25 Sep 2013	14:05	Tt	2	2	2	0	36.927	-76.093	On	279	964	2	10	73	No
34	25 Sep 2013	14:45	Tt	6	8	5	0	36.948	-76.192	On	307	436	2	6	74	No
35	25 Sep 2013	15:11	Tt	2	2	2	0	36.976	-76.241	On	313	1149	2	7	74	No
36	25 Sep 2013	15:53	Cc	1	1	1	0	36.993	-76.308	On	252	500	2	21	74	No
37	25 Sep 2013	16:34	Tt	28	30	25	2	36.955	-76.376	On	282	104	2	7	74	No
38	25 Sep 2013	16:49	Tt	40	45	35	4	36.931	-76.346	On	153	70	2	7	74	Yes
17 October 2013 INSHORE transect																
1	17 Oct 2013	11:59	Tt	3	4	3	0	36.931	-76.111	On	340	275	2	7	70	No
2	17 Oct 2013	12:26	Tt	8	10	4	0	36.955	-76.059	On	321	570	1	12	70	No
3	17 Oct 2013	12:28	Tt	2	2	2	0	36.952	-76.054	On	299	250	1	12	70	No
4	17 Oct 2013	12:46	Tt	5	8	4	0	36.955	-76.015	On	306	525	3	21	70	No
17 October 2013 INSHORE transect (continued)																
5	17 Oct 2013	12:59	Tt	54	60	45	2	36.932	-76.004	On	215	26	3	4	70	Yes
6	17 Oct 2013	13:23	Cc	1	1	1	-	-	-	Off	-	-	-	7	70	No
7	17 Oct 2013	13:28	Tt	1	1	1	0	36.938	-75.983	On	032	11	3	17	69	No
8	17 Oct 2013	13:45	Tt	12	15	8	0	36.907	-75.985	On	280	94	3	4	69	No
9	17 Oct 2013	14:13	Tt	20	24	16	0	36.857	-75.972	On	264	122	3	7	69	No
10	17 Oct 2013	14:39	Tt	36	41	29	4	36.812	-75.964	On	236	61	3	5	70	Yes
11	17 Oct 2013	16:17	Tt	5	8	4	0	36.698	-75.920	On	237	20	3	6	69	No
16 November 2013 INSHORE transect																
1	16 Nov 2013	8:03	Tt	5	7	3	0	36.586	-75.851	On	061	366	2	11	58	No
2	16 Nov 2013	8:19	Tt	4	5	3	0	36.621	-75.865	On	302	299	2	11	57	No
3	16 Nov 2013	8:35	Tt	22	25	16	0	36.643	-75.890	On	213.8	300	2	4	56	Yes
4	16 Nov 2013	8:54	Tt	3	4	2	0	36.657	-75.883	On	65.0	259	2	5	54	No
5	16 Nov 2013	12:14	Tt	9	12	6	0	36.923	-76.059	On	139.5	334	2	5	54	No
6	16 Nov 2013	12:34	Tt	4	4	3	1	36.924	-76.120	On	259.0	23	2	3	53	Yes

Sighting No.	Date	Time	Species	Group Size Best/High/Low			Calves	Sighting Latitude	Sighting Longitude	Effort	Bearing Angle	PSD† (m)	BSS*	Bottom Depth (m)	SST§ (ºF)	Photos Taken
15 January 2014 INSHORE transect																
1	15 Jan 2014	8:43	Tt	6	8	4	1	36.930	-76.128	On	062	203	1	8	46	Yes
2	15 Jan 2014	15:39	Tt	68	79	60	5	36.710	-75.920	On	055	512	1	5	47	Yes
3	15 Jan 2014	16:57	Tt	7	9	5	0	36.787	-75.948	Off	180	54	1	8	47	Yes
07 February 2014 INSHORE transect																
1	07 Feb 2014	11:48	Tt	8	10	8	0	36.938	-76.136	On	350	48	2	8	40	Yes
2	07 Feb 2014	12:41	Tt	12	15	10	1	36.922	-76.068	On	040	129	2	5	40	Yes
3	07 Feb 2014	16:07	Tt	46	50	43	3	36.647	-75.893	On	000	29	2	7	40	Yes
23 February 2014 INSHORE transect																
No Sightings																
02 April 2014 INSHORE transect																
1	02 Apr 2014	7:53	Tt	5	5	3	0	36.775	-75.943	On	023	59	2	8	44	No
2	02 Apr 2014	8:33	Tt	38	40	30	2	36.704	-75.912	On	014	163	2	9	44	Yes
3	02 Apr 2014	9:25	Tt	3	3	3	0	36.651	-75.897	On	336	31	2	4	44	No
4	02 Apr 2014	9:46	Tt	4	5	3	0	36.620	-75.844	On	270	170	2	9	45	No
5	02 Apr 2014	14:02	Tt	43	48	40	3	36.975	-76.247	On	004	87	2	7	48	Yes
6	02 Apr 2014	14:03	Tt	75	80	70	4	36.984	-76.246	On	277	367	2	7	48	Yes
7	02 Apr 2014	14:31	Tt	35	40	30	0	36.972	-76.226	Off	250	633	2	7	48	No
8	02 Apr 2014	17:14	Tt	5	6	4	0	36.886	-75.967	On	304	306	2	7	44	No
9	02 Apr 2014	17:18	Mn	1	1	1	0	36.886	-75.960	On	318	319	2	7	44	Yes
10	02 Apr 2014	17:49	Tt	8	9	4	0	36.834	-75.954	On	282	147	2	8	46	No
10 April 2014 INSHORE transect																
1	10 Apr 2014	8:43	Tt	58	63	50	0	36.755	-75.903	On	089	499	2	12	51	Yes
2	10 Apr 2014	9:31	Tt	62	66	23	0	36.782	-75.927	On	002	42	2	10	53	Yes
3	10 Apr 2014	9:33	Tt	22	25	20	0	36.796	-75.919	On	045	189	2	10	53	No
4	10 Apr 2014	9:58	Tt	3	3	3	0	36.796	-75.905	On	045	851	1	10	52	No
5	10 Apr 2014	10:06	Tt	2	2	2	0	36.816	-75.929	On	090	267	1	9	52	No
6	10 Apr 2014	10:23	Tt	2	2	2	0	36.841	-75.955	On	043	182	1	8	52	No
7	10 Apr 2014	10:51	Tt	2	2	2	0	36.890	-75.984	On	028	117	1	4	52	No
8	10 Apr 2014	10:54	Tt	5	7	2	0	36.900	-75.975	On	317	484	1	4	52	No
9	10 Apr 2014	11:27	Tt	8	10	7	0	36.917	-75.987	On	312	253	1	6	55	No
10	10 Apr 2014	11:31	Tt	23	25	20	1	36.924	-75.996	On	312	297	1	7	54	Yes
11	10 Apr 2014	12:01	Tt	60	66	56	0	36.966	-76.032	On	085	458	1	14	54	No

Sighting No.	Date	Time	Species	Group Size Best/High/Low			Calves	Sighting Latitude	Sighting Longitude	Effort	Bearing Angle	PSD† (m)	BSS*	Bottom Depth (m)	SST§ (ºF)	Photos Taken
03 May 2014 INSHORE transect																
1	03 May 2014	6:37	Tt	1	1	1	0	36.783	-75.937	On	315	189	1	8	57	No
2	03 May 2014	6:41	Tt	2	2	1	0	36.773	-75.945	On	010	35	1	8	57	No
3	03 May 2014	6:47	Tt	1	1	1	0	36.766	-75.939	On	330	194	1	8	57	No
4	03 May 2014	6:50	Tt	3	3	3	0	36.761	-75.928	On	000	0	1	8	57	No
5	03 May 2014	7:18	Tt	2	2	1	0	36.706	-75.916	On	010	35	1	8	57	No
6	03 May 2014	8:07	Mn	1	1	1	0	36.618	-75.849	Off	310	153	1	9	57	Yes
7	03 May 2014	10:13	Tt	1	1	1	0	36.857	-75.942	On	350	17	1	9	57	No
8	03 May 2014	10:24	Tt	4	4	1	0	36.879	-75.959	On	020	34	1	8	58	No
9	03 May 2014	10:29	Tt	3	3	2	0	36.887	-75.972	On	090	250	1	8	58	No
10	03 May 2014	10:32	Tt	2	2	2	0	36.889	-75.982	On	045	71	1	8	58	No
11	03 May 2014	10:35	Tt	6	7	4	0	36.891	-75.981	Off	030	50	1	8	58	No
12	03 May 2014	11:09	Tt	1	1	1	0	36.918	-75.986	On	330	85	1	7	58	No
13	03 May 2014	12:28	Tt	1	1	1	0	36.936	-76.136	On	350	26	2	9	62	No
14	03 May 2014	13:25	Tt	2	2	2	0	36.965	-76.244	On	328	53	2	8	62	No
26 June 2014 INSHORE transect																
1	26 Jun 2014	9:43	UnidHT	1	1	1	0	36.988	-76.271	On	267	38	3	8	80	No
2	26 Jun 2014	10:00	Tt	5	4	4	0	36.964	-76.244	On	298	279	3	8	80	No
3	26 Jun 2014	10:55	UnidHT	1	1	1	0	36.933	-76.140	On	348	4	3	10	80	No
4	26 Jun 2014	11:46	Tt	2	3	2	0	36.928	-75.975	On	087	120	2	13	76	No
5	26 Jun 2014	12:15	Tt	6	8	4	0	36.922	-75.991	On	086	273	2	11	79	No
6	26 Jun 2014	12:19	Tt	27	32	23	0	36.910	-75.982	On	005	44	2	11	79	Yes
7	26 Jun 2014	12:49	Tt	12	15	10	0	36.916	-75.962	On	031	84	2	8	80	No
8	26 Jun 2014	12:51	Tt	2	2	2	0	36.776	-75.939	On	018	23	2	8	80	No
9	26 Jun 2014	12:58	Tt	1	1	1	0	36.636	-75.887	On	014	5	2	6	80	No
10	26 Jun 2014	13:11	UnidHT	1	1	1	0	36.684	-75.897	On	052	48	3	6	80	No
11	26 Jun 2014	13:58	Tt	2	2	2	0	36.827	-75.945	On	036	3	3	9	78	No
12	26 Jun 2014	14:31	UnidHT	1	1	1	0	36.672	-75.877	On	088	35	3	11	78	No
13	26 Jun 2014	14:48	UnidHT	1	1	1	0	36.619	-75.847	On	345	1	4	11	78	No
14	26 Jun 2014	14:57	Tt	4	5	3	0	36.716	-75.917	On	340	21	3	11	79	No
15	26 Jun 2014	15:07	Tt	1	1	1	0	36.944	-76.045	On	045	3	3	4	78	No
16	26 Jun 2014	15:10	Tt	45	50	42	0	36.692	-75.887	On	038	433	3	9	77	Yes
17	26 Jun 2014	15:41	Cc	1	1	1	0	36.888	-75.981	On	090	10	3	9	77	No

Sighting No.	Date	Time	Species	Group Size Best/High/Low			Calves	Sighting Latitude	Sighting Longitude	Effort	Bearing Angle	PSD† (m)	BSS*	Bottom Depth (m)	SST§ (ºF)	Photos Taken
30 July 2014 INSHORE transect																
1	30 Jul 2014	7:07	Tt	8	9	7	0	36.857	-75.942	On	052	210	2	9	76	No
2	30 Jul 2014	7:13	Tt	2	2	2	0	36.874	-75.943	On	063	345	2	9	76	No
3	30 Jul 2014	7:24	Tt	4	5	2	0	36.884	-75.974	On	337	108	2	9	75	No
4	30 Jul 2014	7:25	Tt	1	1	1	0	36.888	-75.980	On	037	45	2	9	75	No
5	30 Jul 2014	7:30	Tt	42	45	2	0	36.897	-75.976	On	004	10	2	6	73	No
6	30 Jul 2014	7:37	Tt	2	2	2	0	36.912	-75.962	On	332	77	2	6	73	No
7	30 Jul 2014	8:06	Tt	125	150	100	5	36.927	-75.998	On	331	129	2	6	76	Yes
8	30 Jul 2014	9:04	Tt	14	18	14	0	36.935	-76.059	On	350	113	3	9	77	No
9	30 Jul 2014	10:00	Tt	3	3	3	0	36.935	-76.138	On	041	141	2	4	78	No
10	30 Jul 2014	11:12	Tt	6	6	4	0	36.983	-76.277	On	312	520	2	5	79	No
11	30 Jul 2014	11:51	UnidHT	1	1	1	0	36.982	-76.332	On	292	32	1	5	78	No
12	30 Jul 2014	15:12	Tt	5	5	5	0	36.637	-75.894	On	000	0	2	5	78	No
13	30 Jul 2014	15:13	Tt	7	8	4	0	36.639	-75.888	On	286	87	2	5	78	No
14	30 Jul 2014	15:43	Tt	45	55	35	2	36.702	-75.915	On	031	412	2	2	78	Yes
15	30 Jul 2014	16:28	Tt	3	3	3	0	36.760	-75.939	On	001	14	2	7	78	No
16	30 Jul 2014	16:30	Tt	5	5	5	0	36.764	-75.938	On	042	84	2	7	78	No
17	30 Jul 2014	16:33	Cc	1	1	1	0	36.767	-75.946	On	276	10	2	7	78	No
18	30 Jul 2014	16:52	Tt	3	3	3	0	36.813	-75.926	On	298	66	2	8	77	No
30 September 2014 INSHORE transect																
1	30 Sep 2014	7:33	Tt	1	1	1	0	36.581	-75.868	On	014	5	3	3	72	No
2	30 Sep 2014	7:37	Tt	4	5	3	0	36.590	-75.869	On	054	158	3	3	72	No
3	30 Sep 2014	7:43	Tt	5	6	4	0	36.600	-75.857	On	068	561	3	9	72	No
4	30 Sep 2014	7:49	Tt	82	98	65	0	36.625	-75.845	On	284	703	3	10	72	Yes
5	30 Sep 2014	8:27	Tt	15	18	12	0	36.637	-75.843	On	303	1053	3	9	72	No
6	30 Sep 2014	8:29	Tt	8	10	6	0	36.626	-75.851	On	044	247	3	9	72	No
7	30 Sep 2014	8:32	Tt	5	6	4	0	36.639	-75.860	On	308	743	3	10	72	No
8	30 Sep 2014	8:38	Tt	4	4	4	0	36.638	-75.883	On	056	40	3	7	72	No
9	30 Sep 2014	8:41	Tt	4	6	4	0	36.640	-75.890	On	088	156	3	7	72	No
10	30 Sep 2014	8:44	Tt	3	3	3	0	36.653	-75.896	On	334	19	3	7	73	No
11	30 Sep 2014	8:45	Tt	10	12	8	0	36.657	-75.894	On	270	195	3	7	73	No
12	30 Sep 2014	8:47	Tt	5	7	3	0	36.668	-75.882	On	299	1053	3	9	72	No
13	30 Sep 2014	8:48	Tt	7	8	6	0	36.658	-75.883	On	038	401	3	9	72	No
14	30 Sep 2014	9:02	Tt	10	14	6	0	36.695	-75.884	On	301	360	3	12	72	No

Sighting No.	Date	Time	Species	Group Size Best/High/Low			Calves	Sighting Latitude	Sighting Longitude	Effort	Bearing Angle	PSD† (m)	BSS*	Bottom Depth (m)	SST§ (ºF)	Photos Taken
30 September 2014 INSHORE transect (continued)																
15	30 Sep 2014	9:07	Tt	45	55	36	1	36.695	-75.897	On	348	30	3	11	72	Yes
16	30 Sep 2014	9:19	Tt	10	15	8	0	36.697	-75.903	On	038	363	3	11	72	No
17	30 Sep 2014	9:34	Tt	5	5	4	0	36.726	-75.932	On	090	499	3	8	72	No
18	30 Sep 2014	9:36	Tt	15	16	12	0	36.733	-75.932	On	050	296	3	7	72	No
19	30 Sep 2014	9:48	Tt	8	11	7	0	36.762	-75.942	On	007	40	3	6	72	No
20	30 Sep 2014	9:57	Tt	4	5	3	0	36.778	-75.934	On	043	182	3	9	72	No
21	30 Sep 2014	10:25	Tt	7	9	6	0	36.837	-75.956	On	025	139	3	9	73	No
22	30 Sep 2014	10:31	Tt	3	4	3	0	36.854	-75.944	On	302	328	3	9	72	No
23	30 Sep 2014	10:39	Cc	1	1	1	0	36.869	-75.938	On	061	174	3	8	72	No
24	30 Sep 2014	10:43	Tt	2	2	1	0	36.874	-75.950	On	066	223	3	8	72	No
25	30 Sep 2014	10:45	Tt	4	5	4	0	36.877	-75.954	On	028	150	3	8	73	No
26	30 Sep 2014	10:47	Tt	6	7	5	0	36.871	-75.954	On	062	1063	3	8	73	No
27	30 Sep 2014	10:48	UnidHT	1	1	1	0	36.882	-75.965	On	088	99	3	8	73	No
28	30 Sep 2014	10:52	Tt	7	8	5	0	36.887	-75.978	On	064	139	3	8	73	No
29	30 Sep 2014	10:54	Cc	1	1	1	0	36.891	-75.982	On	000	0	3	8	73	No
30	30 Sep 2014	10:55	Tt	7	8	5	0	36.897	-75.977	On	292	329	3	8	73	No
31	30 Sep 2014	10:59	Tt	5	6	4	0	36.897	-75.972	On	085	603	3	7	73	No
32	30 Sep 2014	11:02	Tt	2	2	2	0	36.908	-75.962	On	000	0	3	11	73	No
33	30 Sep 2014	11:04	Tt	5	6	3	0	36.910	-75.963	On	087	424	3	11	73	No
34	30 Sep 2014	12:00	Tt	4	5	4	0	36.936	-76.049	On	052	299	3	11	72	No
35	30 Sep 2014	12:41	Tt	4	5	4	0	36.934	-76.131	On	025	298	2	8	73	No
36	30 Sep 2014	12:43	Tt	92	100	75	2	36.931	-76.136	On	028	428	2	8	73	Yes
37	30 Sep 2014	13:10	Tt	4	5	4	0	36.958	-76.168	On	328	264	2	7	73	No
38	30 Sep 2014	13:24	Tt	9	12	8	0	36.964	-76.183	On	029	630	2	7	74	No
39	30 Sep 2014	14:26	Tt	10	13	10	0	36.993	-76.334	Off	052	234	2	3	73	No
10 October 2014 INSHORE transect																
1	10 Oct 2014	7:36	Tt	2	3	1	0	36.631	-75.856	On	090	251	3	11	70	No
2	10 Oct 2014	7:40	Tt	3	4	3	0	36.636	-75.872	On	042	133	3	9	70	No
3	10 Oct 2014	7:44	Tt	2	2	2	0	36.631	-75.885	On	286	769	3	7	70	No
4	10 Oct 2014	7:48	Tt	2	2	2	0	36.648	-75.895	Off	045	49	3	5	70	No
5	10 Oct 2014	7:50	Tt	40	45	36	2	36.654	-75.894	On	071	148	3	5	70	Yes
6	10 Oct 2014	8:11	Tt	6	8	4	0	36.653	-75.903	On	303	1180	2	10	70	No
7	10 Oct 2014	8:29	Tt	28	33	22	0	36.693	-75.906	On	068	754	3	12	70	No

Sighting No.	Date	Time	Species	Group Size Best/High/Low			Calves	Sighting Latitude	Sighting Longitude	Effort	Bearing Angle	PSD† (m)	BSS*	Bottom Depth (m)	SST§ (ºF)	Photos Taken
10 October 2014 INSHORE transect (continued)																
8	10 Oct 2014	8:35	Tt	20	30	19	0	36.695	-75.917	On	022	249	3	4	70	No
9	10 Oct 2014	8:53	Tt	2	2	2	0	36.742	-75.898	Off	310	38	3	13	70	No
10	10 Oct 2014	8:54	Tt	5	6	4	0	36.749	-75.902	Off	066	110	3	13	70	No
11	10 Oct 2014	8:58	Tt	3	5	2	0	36.749	-75.911	On	006	49	4	11	70	No
12	10 Oct 2014	9:01	Tt	5	6	3	0	36.764	-75.929	On	038	741	3	10	70	No
13	10 Oct 2014	9:05	Tt	20	30	15	0	36.757	-75.940	On	312	600	3	10	70	No
14	10 Oct 2014	9:10	Tt	5	6	4	0	36.769	-75.948	On	000	0	3	8	70	No
15	10 Oct 2014	9:11	Tt	2	3	2	0	36.772	-75.945	On	002	4	3	8	70	No
16	10 Oct 2014	9:25	Tt	10	12	8	0	36.802	-75.928	Off	270	799	3	10	70	No
17	10 Oct 2014	9:27	Tt	2	2	2	0	36.812	-75.923	On	090	83	3	10	70	No
18	10 Oct 2014	9:41	Tt	2	3	2	0	36.832	-75.962	Off	089	355	3	8	70	No
19	10 Oct 2014	9:43	Tt	5	5	5	0	36.838	-75.961	On	353	32	2	9	70	No
20	10 Oct 2014	9:46	Tt	2	2	2	0	36.844	-75.955	On	004	10	2	9	70	No
21	10 Oct 2014	9:47	Tt	7	10	5	0	36.848	-75.946	On	040	494	2	9	70	No
22	10 Oct 2014	10:08	Tt	2	2	2	0	36.879	-75.976	On	305	582	1	8	70	No
23	10 Oct 2014	10:10	Tt	18	20	15	0	36.888	-75.980	On	000	0	1	5	70	No
24	10 Oct 2014	10:14	Tt	7	8	5	0	36.892	-75.976	On	078	334	1	7	70	No
25	10 Oct 2014	10:16	Tt	7	8	5	0	36.897	-75.984	On	270	560	1	7	70	No
26	10 Oct 2014	10:17	UnidHT	1	1	1	0	36.899	-75.976	On	100	9	1	7	70	No
27	10 Oct 2014	10:29	Tt	6	10	4	0	36.930	-75.961	Off	024	74	1	20	70	Yes
28	10 Oct 2014	10:33	Tt	1	1	1	0	36.943	-75.966	On	028	42	1	22	70	No
29	10 Oct 2014	10:38	Tt	3	4	3	0	36.933	-75.972	On	270	425	1	14	70	No
30	10 Oct 2014	10:41	Tt	7	8	6	0	36.921	-75.977	On	020	99	1	9	70	No
31	10 Oct 2014	10:43	Tt	26	32	20	0	36.916	-75.980	On	000	0	1	7	70	No
32	10 Oct 2014	10:48	Tt	2	2	2	0	36.926	-75.995	On	329	80	1	8	70	No
33	10 Oct 2014	10:57	Cc	1	1	1	0	36.947	-76.017	On	063	5	1	8	70	No
34	10 Oct 2014	11:09	Tt	9	11	7	0	36.955	-76.041	On	068	233	2	18	70	No
35	10 Oct 2014	11:26	Tt	7	8	6	0	36.923	-76.079	On	001	6	2	9	70	No
36	10 Oct 2014	11:58	Tt	3	4	3	0	36.933	-76.133	On	330	139	2	9	70	No
37	10 Oct 2014	12:11	Tt	5	7	4	0	36.943	-76.166	On	044	108	2	8	70	No
38	10 Oct 2014	12:14	Tt	18	25	14	1	36.952	-76.174	On	000	0	2	7	70	No
39	10 Oct 2014	12:17	Tt	4	5	4	0	36.959	-76.176	On	300	116	2	7	70	No
40	10 Oct 2014	13:13	Cc	1	1	1	0	36.983	-76.317	On	043	28	3	107	70	No

Sighting No.	Date	Time	Species	Group Size Best/High/Low			Calves	Sighting Latitude	Sighting Longitude	Effort	Bearing Angle	PSD† (m)	BSS*	Bottom Depth (m)	SST§ (ºF)	Photos Taken
10 October 2014 INSHORE transect (continued)																
41	10 Oct 2014	13:16	Tt	6	8	4	0	36.991	-76.325	On	010	42	3	11	70	Yes
23 November 2014 INSHORE transect																
1	23 Nov 2014	8:28	Tt	22	24	18	2	36.929	-76.140	On	297	740	1	7	46	Yes
2	23 Nov 2014	12:56	Tt	110	125	65	1	36.886	-75.933	On	274	1890	2	12	48	Yes
3	23 Nov 2014	13:50	Tt	3	4	2	0	36.736	-75.898	On	342	49	1	11	50	No
4	23 Nov 2014	13:57	Tt	11	12	9	0	36.718	-75.919	On	302	645	1	10	51	No
5	23 Nov 2014	14:10	Tt	4	4	4	0	36.696	-75.899	On	308	555	1	10	50	No
6	23 Nov 2014	14:13	Tt	7	8	5	0	36.695	-75.895	On	355	9	1	11	49	No
7	23 Nov 2014	14:15	Tt	5	6	4	0	36.693	-75.888	On	288	254	1	11	49	No
8	23 Nov 2014	14:25	Tt	2	2	2	0	36.678	-75.879	On	002	23	1	12	49	No
9	23 Nov 2014	14:39	Tt	12	15	10	0	36.642	-75.893	On	090	125	2	6	51	No
10	23 Nov 2014	14:41	Tt	2	2	2	0	36.640	-75.888	On	043	18	2	6	51	No
11	23 Nov 2014	14:43	Tt	11	13	8	0	36.634	-75.875	On	315	353	2	10	51	No
12	23 Nov 2014	14:47	Tt	3	3	3	0	36.630	-75.867	On	352	45	2	10	51	No
13	23 Nov 2014	14:51	Tt	1	1	1	0	36.625	-75.857	On	304	216	2	9	51	No
14	23 Nov 2014	15:00	Tt	5	5	5	0	36.610	-75.855	On	337	46	2	8	51	No
15	23 Nov 2014	15:02	Tt	5	6	4	0	36.604	-75.860	On	312	198	2	17	51	No
16	23 Nov 2014	15:08	Tt	3	3	2	0	36.594	-75.870	On	088	180	2	2	51	No
17	23 Nov 2014	15:15	Tt	90	95	85	3	36.577	-75.864	Off	000	0	2	9	50	Yes
31 December 2014 INSHORE transect																
1	31 Dec 2014	12:45	Mn	1	1	1	0	36.923	-75.966	On	070	1131	2	18	45	Yes
2	31 Dec 2014	12:58	Mn	1	1	1	0	36.941	-75.945	On	000	-	2	18	45	Yes
3	31 Dec 2014	13:03	Mn	1	1	1	0	36.935	-75.935	On	000	-	2	18	45	Yes
4	31 Dec 2014	13:21	Mn	2	2	2	0	36.942	-75.947	On	000	-	2	18	45	Yes
5	31 Dec 2014	13:33	Mn	1	1	1	0	36.948	-75.946	On	000	-	2	18	45	Yes
6	31 Dec 2014	13:35	Mn	1	1	1	0	36.950	-75.950	On	000	-	2	18	45	Yes
7	31 Dec 2014	13:38	Mn	2	2	2	0	36.952	-75.957	On	000	-	2	18	45	Yes
8	31 Dec 2014	15:04	Tt	2	2	2	0	36.826	-75.962	On	088	7	3	9	45	No
22 January 2015 INSHORE transect																
1	22 Jan 2015	14:21	Mn	1	1	1	0	36.945	-75.965	On	090	400	3	77	43	Yes
2	22 Jan 2015	15:06	Mn	3	4	3	0	36.934	-75.999	On	020	103	2	47	43	Yes
3	22 Jan 2015	15:49	Mn	3	3	3	0	36.955	-76.003	On	010	69	2	64	43	Yes

Sighting No.	Date	Time	Species	Group Size Best/High/Low			Calves	Sighting Latitude	Sighting Longitude	Effort	Bearing Angle	PSD† (m)	BSS*	Bottom Depth (m)	SST§ (ºF)	Photos Taken
09 February 2015 INSHORE transect																
1	09 Feb 2015	12:33	Tt	33	36	29	2	36.579	-75.868	On	325	229	3	18	42	Yes
2	09 Feb 2015	13:32	Tt	2	2	2	0	36.641	-75.893	On	315	71	2	18	42	Yes
3	09 Feb 2015	14:12	Tt	11	1	1	0	36.706	-75.921	On	075	290	2	22	42	Yes
09 March 2015 INSHORE transect																
1	09 Mar 2015	12:56	Tt	3	3	3	1	36.945	-76.124	Off	000	0	1	31	39	Yes
05 April 2015 INSHORE transect																
1	15 Apr 2015	7:22	Tt	7	9	5	0	36.569	-75.843	On	090	300	0	35	47	No
2	15 Apr 2015	7:35	Tt	4	4	4	0	36.572	-75.853	On	000	0	0	24	47	No
3	15 Apr 2015	7:39	Tt	4	5	3	0	36.578	-75.578	On	000	0	0	28	47	No
4	15 Apr 2015	7:40	Tt	35	40	32	1	36.284	-75.584	On	045	353	0	28	47	Yes
5	15 Apr 2015	8:21	Tt	3	4	3	0	36.627	-75.627	On	315	248	1	37	47	No
6	15 Apr 2015	10:16	Tt	2	2	2	0	36.831	-75.966	Off	350	17	0	28	48	No
04 May 2015 INSHORE transect																
1	04 May 2015	7:35	Tt	8	9	7	0	36.831	-75.975	Off	272	170	3	19	58	No
2	04 May 2015	7:57	Tt	3	5	3	0	36.602	-75.867	On	283	312	2	32	59	No
3	04 May 2015	8:26	Tt	5	6	4	0	36.661	-75.902	On	292	844	2	28	58	No
4	04 May 2015	9:03	Tt	5	8	5	0	36.725	-75.906	On	350	32	2	38	58	No
5	04 May 2015	9:33	Tt	3	3	2	1	36.783	-75.934	On	000	0	3	31	58	No
6	04 May 2015	9:57	Tt	4	5	3	0	36.827	-75.967	On	010	55	3	14	57	No
7	04 May 2015	10:28	Tt	3	3	2	0	36.888	-75.982	On	000	0	3	19	57	No
23 July 2015 INSHORE transect																
1	23 Jul 2015	7:19	Tt	13	15	11	1	36.83007	-75.96778	On	000	0	1	15	82	No
2	23 Jul 2015	7:23	Tt	11	13	10	0	36.82509	-75.9588	On	317	117	1	25	82	No
3	23 Jul 2015	7:26	Tt	5	7	3	0	36.82615	-75.94126	On	033	510	1	25	82	No
4	23 Jul 2015	7:47	Tt	3	4	2	0	36.77307	-75.93891	On	085	385	1	26	82	No
5	23 Jul 2015	8:02	Tt	37	41	33	3	36.75418	-75.91496	On	357	0	1	34	81	Yes
6	23 Jul 2015	8:22	Tt	10	15	8	0	36.72737	-75.89513	On	058	636	2	36	81	No
7	23 Jul 2015	8:38	Tt	3	4	2	0	36.70547	-75.91737	On	270	305	2	30	82	No
8	23 Jul 2015	8:56	Cc	1	1	1	0	36.67258	-75.87476	On	087	41	2	38	82	No
9	23 Jul 2015	9:08	Tt	5	5	4	0	36.64824	-75.89515	On	090	170	2	12	82	No
10	23 Jul 2015	9:43	Tt	7	8	6	0	36.58391	-75.86957	On	270	0	2	16	82	No
11	23 Jul 2015	10:25	Cc	1	1	1	0	36.70065	-75.91305	Off	010	8	2	-	-	No
12	23 Jul 2015	10:51	Tt	12	15	10	0	36.83775	-75.96319	Off	318	200	2	26	82	No
13	23 Jul 2015	11:04	Tt	8	10	6	0	36.8521	-75.93019	On	83.0	821	2	30	82	No

Sighting No.	Date	Time	Species	Group Size Best/High/Low			Calves	Sighting Latitude	Sighting Longitude	Effort	Bearing Angle	PSD† (m)	BSS*	Bottom Depth (m)	SST§ (ºF)	Photos Taken
23 July 2015 INSHORE transect (continued)																
14	23 Jul 2015	11:07	Tt	290	350	220	14	36.86599	-75.92229	On	084	1399	2	26	82	No
15	23 Jul 2015	11:26	Cc	1	1	1	0	36.88128	-75.9462	On	010	21	2	26	82	Yes
16	23 Jul 2015	11:58	Tt	2	2	2	0	36.94332	-75.96644	Off	285	9	2	64	83	No
17	23 Jul 2015	12:02	Tt	15	18	15	0	36.93008	-75.96941	On	000	0	2	42	83	No
18	23 Jul 2015	12:10	Tt	45	52	38	3	36.92203	-75.98892	On	272	159	2	20	84	Yes
19	23 Jul 2015	12:13	Tt	14	16	12	0	36.93028	-75.99667	On	340	75	2	26	83	No
20	23 Jul 2015	12:41	Tt	2	2	1	0	36.93341	-76.04688	On	355	40	2	38	83	No
21	23 Jul 2015	12:50	Tt	16	18	14	0	36.92515	-76.06605	On	038	194	2	25	84	No
22	23 Jul 2015	13:03	Cc	1	1	1	0	36.93092	-76.09643	On	015	35	2	30	84	No
23	23 Jul 2015	13:36	Tt	2	2	2	0	36.92893	-76.15643	On	350	9	2	15	84	No
24	23 Jul 2015	13:55	Cc	1	1	1	0	36.96713	-76.19279	On	010	5	2	22	85	No
25	23 Jul 2015	14:51	Tt	9	9	8	0	36.97531	-76.31369	On	086	129	2	5	83	Yes
26	23 Jul 2015	15:07	Cc	1	1	1	0	36.99547	-76.33069	Off	350	4	2	14	84	No
14 August 2015 INSHORE transect																
1	14 Aug 2015	6:36	Tt	4	5	3	0	36.82344	-75.96448	On	090	407	2	27	79	No
2	14 Aug 2015	6:43	Tt	4	5	4	0	36.81506	-75.93519	On	312	172	2	30	79	No
3	14 Aug 2015	7:12	Tt	3	4	2	0	36.75298	-75.91891	On	009	66	2	33	79	No
4	14 Aug 2015	7:15	Tt	8	9	7	0	36.74725	-75.90841	On	006	68	2	33	79	No
5	14 Aug 2015	7:18	Tt	6	7	4	0	36.74321	-75.89866	On	006	74	2	33	79	No
6	14 Aug 2015	7:22	Tt	2	2	2	0	36.73755	-75.90049	On	272	499	2	36	80	No
7	14 Aug 2015	7:32	Tt	4	4	3	0	36.71466	-75.92051	On	307	367	2	21	80	No
8	14 Aug 2015	7:36	Tt	3	3	3	0	36.7002	-75.91624	On	018	142	2	33	79	No
9	14 Aug 2015	8:04	Tt	1	1	1	0	36.64952	-75.89755	On	073	268	2	24	79	No
10	14 Aug 2015	8:32	Tt	3	4	3	0	36.59467	-75.86366	On	012	0	2	30	79	No
11	14 Aug 2015	8:43	Tt	6	7	3	0	36.56958	-75.85372	On	059	332	2	30	80	No
12	14 Aug 2015	8:48	Tt	5	7	4	0	36.56989	-75.82822	On	285	815	2	42	80	No
13	14 Aug 2015	10:09	Lk	1	1	1	0	36.88498	-75.96214	On	002	348	2	24	80	No
14	14 Aug 2015	10:12	Tt	26	28	24	0	36.89123	-75.97624	On	332	182	2	24	80	No
15	14 Aug 2015	10:15	Tt	18	20	16	1	36.8963	-75.97826	On	288	160	2	18	80	Yes
16	14 Aug 2015	10:35	Tt	54	60	48	6	36.92535	-75.95229	On	000	0	2	48	80	Yes
17	14 Aug 2015	10:57	Tt	6	7	6	0	36.94246	-75.96629	On	288	194	2	66	80	No
18	14 Aug 2015	10:59	Tt	7	7	7	0	36.93695	-75.97067	On	352	29	1	66	80	No
19	14 Aug 2015	11:01	Tt	50	54	48	4	36.93134	-75.97545	On	030	180	1	48	80	No
20	14 Aug 2015	11:13	Tt	9	10	8	0	36.93227	-75.99562	On	282	362	1	30	80	No

Sighting No.	Date	Time	Species	Group Size Best/High/Low			Calves	Sighting Latitude	Sighting Longitude	Effort	Bearing Angle	PSD† (m)	BSS*	Bottom Depth (m)	SST§ (ºF)	Photos Taken
14 August 2015 INSHORE transect (continued)																
21	14 Aug 2015	11:15	Tt	6	7	5	0	36.93813	-76.00053	On	297	364	1	30	80	No
22	14 Aug 2015	11:17	Tt	14	16	12	0	36.94025	-76.00481	On	284	178	1	48	80	No
23	14 Aug 2015	11:19	Tt	10	11	9	0	36.94701	-76.00958	On	300	342	1	48	80	No
24	14 Aug 2015	11:25	Cc	1	1	1	0	36.95721	-76.02279	On	000	0	1	54	80	No
25	14 Aug 2015	11:36	Tt	18	19	17	0	36.94527	-76.04181	On	281	291	1	36	81	No
26	14 Aug 2015	11:39	Tt	1	1	1	0	36.93529	-76.05039	On	000	0	1	36	81	No
27	14 Aug 2015	11:41	Tt	13	14	12	1	36.92864	-76.05329	On	003	18	1	36	81	No
28	14 Aug 2015	11:49	Tt	2	2	2	0	36.93092	-76.07563	On	281	86	1	30	82	No
29	14 Aug 2015	11:53	Tt	8	9	7	0	36.93994	-76.08691	On	301	441	2	30	82	No
30	14 Aug 2015	12:00	Tt	4	4	4	0	36.93288	-76.0972	On	298	87	2	30	81	No
31	14 Aug 2015	12:06	Tt	4	4	3	0	36.95038	-76.10369	On	338	159	2	24	81	No
32	14 Aug 2015	12:09	Tt	7	8	6	0	36.9438	-76.11698	On	078	309	2	24	81	No
33	14 Aug 2015	12:22	Tt	10	12	8	0	36.94108	-76.12727	On	090	210	2	24	81	No
34	14 Aug 2015	12:41	Tt	6	6	6	0	36.9533	-76.16355	On	008	91	2	18	82	No
35	14 Aug 2015	12:46	Tt	6	7	5	0	36.96885	-76.17689	On	305	577	2	21	81	Yes
36	14 Aug 2015	13:16	Tt	6	7	5	0	36.96255	-76.24169	On	270	350	2	24	82	No
37	14 Aug 2015	13:30	Tt	1	1	1	0	36.99316	-76.25906	On	342	20	3	5	81	No
38	14 Aug 2015	14:30	Cc	1	1	1	0	36.94267	-76.36501	On	330	10	3	24	83	No

Notes:
* BSS = Beaufort Sea State
† PSD = Perpendicular Sighting Distance
§ SST = Sea Surface Temperature

Key:
Cc = Loggerhead turtle (*Caretta caretta*)
Ll = Kemp's Ridley turtle (*Lepidochelys kempii*)
Mn = Humpback whale (*Megaptera novaeangliae*)
Tt = Bottlenose dolphin (*Tursiops truncatus*)
UnidHT = unidentified hardshell sea turtle

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MINEX Transect Survey Marine Mammal and Sea Turtle Sightings

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Sighting No.	Date	Time	Species	Group Size Best/High/Low			Calves	Sighting Latitude	Sighting Longitude	Effort	Bearing Angle	PSD† (m)	BSS*	Bottom Depth (m)	SST§ (ºF)	Photos Taken
08 August 2012 MINEX transect																
1	08 Aug 2012	15:09	Cc	1	1	1	-	36.629	-75.721	On	280	157	180	12	78	No
2	08 Aug 2012	15:10	Cc	1	1	1	-	36.630	-75.715	On	090	194	140	12	78	No
23 October 2012 MINEX transect																
1	23 Oct 2012	12:02	Cc	1	1	1	-	36.754	-75.658	On	000	0	2	10-20	65	No
2	23 Oct 2012	13:03	Tt	5	6	4	0	36.658	-75.857	On	043	682	2	10-20	66	No
3	23 Oct 2012	14:23	Cc	1	1	1	-	36.643	-75.636	On	355	267	1	10-20	66	No
10 November 2012 MINEX transect																
1	10 Nov 2012	7:33	Tt	5	5	3	0	36.607	-75.810	On	010	60	2	14	55	No
2	10 Nov 2012	7:39	Tt	3	3	3	0	36.617	-75.791	On	278	500	2	14	56	No
3	10 Nov 2012	7:40	Tt	2	2	2	0	36.616	-75.788	On	000	250	2	14	56	No
03 January 2013 MINEX transect																
1	03 Jan 2013	11:35	Mn	1	1	1	0	36.674	-75.870	Off	308	394	3	15	45	Yes
23 March 2013 MINEX transect																
1	23 Mar 2013	13:13	Tt	5	5	5	0	36.689	-75.831	Off	025	55	2	10-20	41	No
2	23 Mar 2013	13:38	Dd	5	8	5	1	36.685	-75.758	On	085	298	2	10-20	41	No
3	23 Mar 2013	15:37	Unid	7	12	5	0	36.633	-75.767	On	041	751	2	10-20	41	No
31 May 2013 MINEX transect																
1	31 May 2013	11:31	Tt	4	5	3	0	36.865	-75.710	On	344	221	3	21	68	No
2	31 May 2013	12:11	Cc	1	1	1	-	36.828	-75.838	On	089	20	3	10-20	68	No
3	31 May 2013	13:35	Cc	1	1	1	-	36.771	-75.854	On	326	17	4	10-20	68	No
4	31 May 2013	14:00	Tt	3	3	3	0	36.797	-75.772	On	337	105	4	18	68	No
22 July 2013 MINEX transect																
1	22 Jul 2013	11:34	Tt	45	50	40	1	36.75762	-75.5959	Off	290	650	2	22	74	Yes
27 July 2013 MINEX transect																
1	27 Jul 2013	7:39	Dc	1	1	1	-	36.615	-75.780	On	000	44	1	22	72	No
2	27 Jul 2013	7:42	Dc	1	1	1	-	36.617	-75.771	On	053	37	1	23	72	No
3	27 Jul 2013	7:47	Dc	1	1	1	-	36.625	-75.754	On	035	83	1	20	72	No
4	27 Jul 2013	8:19	Dc	1	1	1	-	36.662	-75.652	On	101	20	1	21	72	No

Sighting No.	Date	Time	Species	Group Size Best/High/Low			Calves	Sighting Latitude	Sighting Longitude	Effort	Bearing Angle	PSD† (m)	BSS*	Bottom Depth (m)	SST§ (ºF)	Photos Taken
27 July 2013 MINEX transect (continued)																
5	27 Jul 2013	8:32	UnidST	1	1	1	-	36.678	-75.608	On	134	211	1	21	72	No
6	27 Jul 2013	8:44	UnidST	1	1	1	-	36.693	-75.570	On	128	145	1	20	72	No
7	27 Jul 2013	9:28	Dc	1	1	1	-	36.725	-75.667	On	327	86	1	23	74	No
8	27 Jul 2013	9:31	Cc	1	1	1	-	36.721	-75.676	On	198	22	1	19	74	No
9	27 Jul 2013	9:34	Dc	1	1	1	-	36.719	-75.687	On	244	29	1	18	74	No
10	27 Jul 2013	9:40	UnidST	1	1	1	-	36.713	-75.707	On	305	89	1	20	74	No
11	27 Jul 2013	9:44	Dc	1	1	1	-	36.707	-75.718	On	200	97	1	20	74	No
12	27 Jul 2013	9:47	Dc	1	1	1	-	36.704	-75.731	On	250	27	1	23	74	No
13	27 Jul 2013	9:49	Dc	1	1	1	-	36.702	-75.735	On	242	22	1	20	74	No
14	27 Jul 2013	9:51	UnidST	1	1	1	-	36.699	-75.740	On	167	160	1	19	74	No
15	27 Jul 2013	9:56	UnidST	1	1	1	-	36.693	-75.760	On	168	9	1	19	74	No
16	27 Jul 2013	10:00	Dc	1	1	1	-	36.689	-75.773	On	344	120	1	19	74	No
17	27 Jul 2013	10:04	Dc	1	1	1	-	36.685	-75.786	On	338	240	1	19	74	No
18	27 Jul 2013	10:10	Cc	1	1	1	-	36.673	-75.809	On	300	259	1	20	74	No
19	27 Jul 2013	10:41	Tt	36	36	13	3	36.729	-75.820	On	068	4	2	15	74	Yes
20	27 Jul 2013	11:06	Dc	1	1	1	-	36.730	-75.803	On	025	60	2	16	72	No
21	27 Jul 2013	11:08	UnidST	1	1	1	-	36.731	-75.795	On	119	79	2	16	72	No
22	27 Jul 2013	11:20	Dc	1	1	1	-	36.743	-75.755	On	171	320	2	16	72	No
23	27 Jul 2013	11:30	Dc	1	1	1	-	36.756	-75.721	On	098	30	2	18	72	No
24	27 Jul 2013	11:37	UnidST	1	1	1	-	36.765	-75.702	On	340	60	2	20	72	No
25	27 Jul 2013	11:43	Cc	1	1	1	-	36.769	-75.686	On	128	57	2	22	72	No
26	27 Jul 2013	13:20	UnidST	1	1	1	-	36.780	-75.826	On	206	42	2	17	73	No
27	27 Jul 2013	14:02	Cc	1	1	1	-	36.826	-75.851	On	349	70	2	17	73	No
19 August 2013 MINEX transect																
1	19 Aug 2013	7:55	Cc	1	1	1	-	36.689	-75.583	On	210	193	3	25	79	No
2	19 Aug 2013	8:14	Cc	1	1	1	-	36.670	-75.645	On	276	125	3	26	78	No
3	19 Aug 2013	10:24	Cc	1	1	1	-	36.737	-75.629	On	349	252	3	20	73	No
4	19 Aug 2013	10:27	Cc	1	1	1	-	36.742	-75.614	On	057	282	3	20	73	No

Sighting No.	Date	Time	Species	Group Size Best/High/Low			Calves	Sighting Latitude	Sighting Longitude	Effort	Bearing Angle	PSD† (m)	BSS*	Bottom Depth (m)	SST§ (ºF)	Photos Taken
19 August 2013 MINEX transect (continued)																
5	19 Aug 2013	12:00	Cc	1	1	1	-	36.731	-75.814	On	276	51	2	14	72	No
28 October 2013 MINEX transect																
No Sightings																
30 October 2013 MINEX transect																
1	30 Oct 2013	8:57	Cc	1	1	1	-	36.683	-75.614	on	345	193	1	16	63	No
28 December 2013 MINEX transect																
No Sightings																
25 February 2014 MINEX transect																
1	25 Feb 2014	8:46	Tt	9	9	9	0	36.741	-75.754	On	089	255	3	18	41	No
2	25 Feb 2014	12:02	Mn	2	2	2	0	36.633	-75.732	On	324	396	3	17	41	Yes
25 May 2014 MINEX transect																
1	25 May 2014	7:20	Tt	6	6	4	0	36.869	-75.933	On	036	157	3	13	63	No
2	25 May 2014	10:26	Tt	4	4	4	0	36.779	-75.875	On	042	137	3	13	63	No
3	25 May 2014	11:50	Cc	1	1	1	0	36.788	-75.685	On	062	79	3	14	63	No
4	25 May 2014	12:00	Tt	2	2	2	0	36.778	-75.714	On	332	96	3	14	63	No
5	25 May 2014	12:30	Cc	1	1	1	0	36.743	-75.809	On	046	79	2	14	63	No
6	25 May 2014	13:53	Tt	5	7	2	0	36.727	-75.713	On	022	76	3	18	65	No
7	25 May 2014	14:07	Cc	1	1	1	0	36.733	-75.695	On	023	80	3	18	65	No
8	25 May 2014	14:27	Cc	1	1	1	0	36.757	-75.639	On	000	0	3	18	65	No
16 June 2014 MINEX transect																
1	16 Jun 2014	9:55	Tt	12	15	8	0	36.765	-75.853	On	356	27	2	14	74	No
2	16 Jun 2014	10:30	Tt	2	2	2	0	36.780	-75.806	Off	180	0	2	13	74	No
3	16 Jun 2014	11:44	Tt	10	12	9	0	36.847	-75.755	On	314	506	2	19	76	No
4	16 Jun 2014	12:05	Tt	8	9	6	0	36.844	-75.769	On	350	24	2	18	75	No
5	16 Jun 2014	13:48	Tt	5	5	4	0	36.910	-75.733	On	45	264	2	17	76	No
6	16 Jun 2014	13:54	Tt	12	13	10	0	36.902	-75.753	On	342	83	2	17	76	No
7	16 Jun 2014	14:23	Tt	28	32	25	1	36.876	-75.843	On	75	680	2	16	75	Yes
8	16 Jun 2014	14:58	Tt	1	1	1	0	36.848	-75.911	On	270	150	3	16	75	No

Sighting No.	Date	Time	Species	Group Size Best/High/Low			Calves	Sighting Latitude	Sighting Longitude	Effort	Bearing Angle	PSD† (m)	BSS*	Bottom Depth (m)	SST§ (ºF)	Photos Taken
16 August 2014 MINEX transect																
1	16 Aug 2014	12:49	Cc	1	1	1	0	36.844	-75.690	On	008	15	2	9	79	No
2	16 Aug 2014	13:03	Cc	1	1	1	0	36.873	-75.687	Off	351	1	2	9	79	No
3	16 Aug 2014	13:50	Cc	1	1	1	0	36.852	-75.806	On	324	21	2	9	79	No
4	16 Aug 2014	14:33	Tt	3	3	3	0	36.828	-75.928	Off	275	120	2	9	80	No
5	16 Aug 2014	14:35	Tt	6	6	6	0	36.832	-75.930	Off	286	124	2	9	80	No
6	16 Aug 2014	14:48	Tt	10	12	8	0	36.870	-75.940	Off	078	200	2	10	80	No
7	16 Aug 2014	15:26	Cc	1	1	1	0	36.900	-75.833	On	302	36	3	10	79	No
05 September 2014 MINEX transect																
1	05 Sep 2014	7:38	Tt	16	18	14	0	36.861	-75.842	On	300	1043	2	14	80	No
2	05 Sep 2014	7:46	Cc	1	1	1	0	36.879	-75.823	On	315	71	2	14	80	Yes
3	05 Sep 2014	7:50	Cc	1	1	1	0	36.881	-75.828	On	060	87	2	14	80	Yes
4	05 Sep 2014	8:03	Cc	1	1	1	0	36.888	-75.791	On	290	130	2	16	80	No
5	05 Sep 2014	8:06	Cc	1	1	1	0	36.893	-75.780	On	312	152	2	16	80	No
6	05 Sep 2014	8:10	Cc	1	1	1	0	36.896	-75.768	On	328	73	2	16	80	No
7	05 Sep 2014	8:21	Tt	8	10	6	0	36.910	-75.732	On	295	286	2	18	80	No
8	05 Sep 2014	8:29	Cc	1	1	1	0	36.917	-75.708	On	270	231	2	18	80	No
9	05 Sep 2014	8:48	Cc	1	1	1	0	36.861	-75.711	On	350	17	2	18	80	No
10	05 Sep 2014	8:49	Tt	5	6	4	0	36.863	-75.710	On	85	266	2	22	80	No
11	05 Sep 2014	9:00	Tt	13	15	11	2	36.850	-75.743	On	300	177	2	19	80	Yes
12	05 Sep 2014	9:57	UnidHT	1	1	1	0	36.801	-75.894	On	012	1	2	11	81	No
13	05 Sep 2014	12:17	Tt	5	6	4	0	36.728	-75.801	On	310	922	2	15	81	No
14	05 Sep 2014	12:21	Tt	4	5	3	0	36.727	-75.807	On	350	105	2	15	81	No
15	05 Sep 2014	12:32	Tt	90	100	75	3	36.715	-75.841	On	332	148	2	14	82	Yes
17	05 Sep 2014	13:49	Tt	60	90	30	0	36.677	-75.794	On	010	209	3	18	82	No
20 October 2014 MINEX transect																
1	20 Oct 2014	7:30	Dc	1	1	1	0	36.740	-75.665	On	275	230	1	16	69	No
2	20 Oct 2014	7:37	Tt	7	9	5	0	36.716	-75.684	On	273	2147	1	16	69	No
3	20 Oct 2014	11:16	Cc	1	1	1	0	36.812	-75.773	On	088	112	4	19	69	No

Sighting No.	Date	Time	Species	Group Size Best/High/Low			Calves	Sighting Latitude	Sighting Longitude	Effort	Bearing Angle	PSD† (m)	BSS*	Bottom Depth (m)	SST§ (ºF)	Photos Taken
19 August 2013 MINEX transect (continued)																
4	20 Oct 2014	11:55	Tt	190	220	150	14	36.774	-75.903	On	028	115	4	11	67	Yes
5	20 Oct 2014	12:49	Tt	2	0	2	0	36.825	-75.911	On	020	27	4	11	67	No
16 November 2014 MINEX transect																
1	16 Nov 2014	6:35	Tt	8	9	7	0	36.832	-75.962	Off	088	12	2	2	54	
2	16 Nov 2014	6:55	Tt	6	7	5	0	36.838	-75.925	Off	279	695	2	11	55	No
3	16 Nov 2014	7:32	Tt	4	5	3	0	36.877	-75.802	On	325	604	2	15	55	No
4	16 Nov 2014	7:34	Tt	4	5	3	0	36.882	-75.807	On	044	174	2	15	55	No
5	16 Nov 2014	7:45	Tt	5	6	4	0	36.906	-75.770	On	335	509	2	17	56	No
6	16 Nov 2014	8:16	Tt	4	5	3	0	36.895	-75.693	Off	290	94	2	17	56	No
7	16 Nov 2014	12:16	Tt	25	30	21	2	36.728	-75.825	On	022	345	1	16	52	Yes
8	16 Nov 2014	12:42	Tt	12	14	10	1	36.710	-75.858	On	005	8	1	16	52	No
9	16 Nov 2014	12:46	Tt	6	7	5	0	36.709	-75.871	On	030	200	1	13	51	No
10	16 Nov 2014	13:06	Tt	4	6	4	0	36.660	-75.837	On	348	80	1	14	52	No
11	16 Nov 2014	13:32	Tt	1	1	1	0	36.690	-75.757	On	090	200	1	14	54	No
21 December 2014 MINEX transect																
1	21 Dec 2014	12:05	Mn	1	1	1	0	36.803	-75.813	On	020	137	3	19	45	Yes
2	21 Dec 2014	13:31	Mn	2	2	2	0	36.796	-75.683	On	005	187	3	17	46	Yes
11 January 2015 MINEX transect																
1	11 Jan 2015	9:30	Mn	1	1	1	0	36.85274	-75.84614	On	090	1800	2	-	46	Yes
2	11 Jan 2015	11:41	Mn	3	3	3	0	36.83393	-75.84214	On	015	556	2	55	46	Yes
3	11 Jan 2015	14:33	Mn	4	4	4	0	36.76047	-75.66562	On	315	1520	1	72	46	Yes
4	11 Jan 2015	16:35	Tt	2	2	2	0	36.72475	-75.82681	On	045	498	1	54	46	No
11 April 2015 MINEX transect																
1	11 Apr 2015	10:36	Mn	2	2	2	0	36.69337	-75.83046	On	010	92	1	-	54	Yes
2	11 Apr 2015	14:31	Tt	9	12	8	0	36.87885	-75.74149	On	022	76	2	52	54	Yes
3	11 Apr 2015	14:38	Tt	10	15	6	0	36.88474	-75.71608	On	300	231	0	66	56	No
4	11 Apr 2015	14:39	Tt	3	5	3	0	36.88913	-75.71469	On	089	138	0	64	56	No
5	11 Apr 2015	14:40	Mn	2	2	2	0	36.89927	-75.72039	On	91	1407	0	69	56	Yes

Sighting No.	Date	Time	Species	Group Size Best/High/Low			Calves	Sighting Latitude	Sighting Longitude	Effort	Bearing Angle	PSD† (m)	BSS*	Bottom Depth (m)	SST§ (ºF)	Photos Taken
11 April 2015 MINEX transect (continued)																
6	11 Apr 2015	14:45	Tt	5	6	4	0	36.87664	-75.71407	Off	012	46	0	69	56	No
7	11 Apr 2015	16:36	Tt	4	5	3	0	36.91124	-75.81476	On	061	372	1	43	54	No
8	11 Apr 2015	16:47	Tt	10	12	8	0	36.89722	-75.85028	On	315	177	2	37	54	No
9	11 Apr 2015	16:53	Mn	1	1	1	0	36.909	-75.86334	On	350	373	2	37	54	No
10	11 Apr 2015	16:59	Tt	14	16	12	0	36.89047	-75.88695	On	337	293	2	54	54	No
11	11 Apr 2015	17:14	Tt	17	24	14	0	36.87711	-75.89807	On	028	234	2	49	53	No
12	11 Apr 2015	17:20	Mn	1	1	1	0	36.8728	-75.9167	On	038	344	2	32	55	Yes
13	11 Apr 2015	17:23	Tt	30	40	20	0	36.87041	-75.92472	On	038	375	2	32	55	Yes
17 April 2015 MINEX transect																
1	17 Apr 2015	12:09	Tt	145	165	125	7	36.65785	-75.85516	On	270	100	2	45	53	Yes
2	17 Apr 2015	12:30	Tt	6	6	3	-	36.6613	-75.84592	On	323	66	2	55	52	No
3	17 Apr 2015	13:52	Pp	2	2	2	0	36.77629	-75.6528	On	045	64	3	73	48	Yes
4	17 Apr 2015	15:39	Tt	3	4	3	0	36.76531	-75.84528	On	090	90	3	45	54	No
5	17 Apr 2015	17:18	Tt	6	7	6	0	36.83714	-75.79807	On	090	200	3	52	53	No
6	17 Apr 2015	19:07	Tt	4	5	3	0	36.90057	-75.75964	On	290	251	3	60	52	No
18 May 2015 MINEX transect																
1	18 May 2015	9:29	Tt	2	2	2	0	36.86914	-75.93921	On	339	96	0	33	67	No
2	18 May 2015	9:40	Cc	1	1	1	0	36.87745	-75.90488	On	270	15	0	51	68	No
3	18 May 2015	9:48	Tt	3	3	3	0	36.88974	-75.87494	On	037	233	1	50	66	Yes
4	18 May 2015	9:55	Tt	37	42	32	1	36.89391	-75.86775	On	349	71	1	36	66	Yes
5	18 May 2015	10:12	Tt	3	3	2	0	36.89746	-75.85374	On	343	78	0	39	66	No
6	18 May 2015	11:31	Tt	6	8	5	0	36.85299	-75.79079	On	000	0	0	56	66	No
7	18 May 2015	11:41	Cc	1	1	1	0	36.84831	-75.81926	On	338	11	0	61	69	No
8	18 May 2015	11:54	Cc	1	1	1	0	36.83527	-75.86623	On	088	50	0	50	71	No
9	18 May 2015	13:07	Cc	1	1	1	0	36.81581	-75.76927	On	088	30	1	66	70	No
10	18 May 2015	13:28	Cc	1	1	1	0	36.83937	-75.7016	On	303	0	1	50	70	No
11	18 May 2015	13:59	Cc	1	1	1	0	36.79093	-75.68085	On	305	16	1	58	71	No
12	18 May 2015	14:10	Cc	1	1	1	0	36.77961	-75.71711	On	282	49	1	64	69	No

Sighting No.	Date	Time	Species	Group Size Best/High/Low			Calves	Sighting Latitude	Sighting Longitude	Effort	Bearing Angle	PSD† (m)	BSS*	Bottom Depth (m)	SST§ (ºF)	Photos Taken
18 May 2015 MINEX transect (continued)																
13	18 May 2015	14:30	Cc	1	1	1	0	36.75933	-75.78673	On	307	3	1	53	74	No
14	18 May 2015	14:39	Cc	1	1	1	0	36.74769	-75.82045	On	087	80	1	50	72	No
15	18 May 2015	15:30	Cc	1	1	1	0	36.70194	-75.80047	On	006	14	2	50	71	No
16	18 May 2015	15:34	Cc	1	1	1	0	36.70863	-75.78525	On	018	201	2	53	71	No
17	18 May 2015	15:44	Cc	1	1	1	0	36.71795	-75.75189	On	032	205	2	51	70	No
18	18 May 2015	15:45	Cc	1	1	1	0	36.71792	-75.75271	On	280	20	2	51	70	No
19	18 May 2015	16:06	Cc	1	1	1	0	36.74395	-75.68375	On	305	409	2	60	71	No
16 June 2015 MINEX transect																
1	16 Jun 2015	6:36	Tt	1	1	1	0	36.85411	-75.89439	On	028	96	2	46	78	No
2	16 Jun 2015	6:39	Tt	3	4	2	0	36.85483	-75.88514	On	086	386	2	49	77	No
3	16 Jun 2015	11:16	Cc	1	1	1	0	36.72681	-75.8022	On	271	73	1	49	83	No
4	16 Jun 2015	12:38	Cc	1	1	1	0	36.69702	-75.72341	On	040	77	1	60	85	Yes
5	16 Jun 2015	12:44	Cc	1	1	1	0	36.70419	-75.70833	On	322	49	1	53	85	Yes
6	16 Jun 2015	12:58	Cc	1	1	1	0	36.72069	-75.66091	On	270	123	1	65	83	No
7	16 Jun 2015	13:02	Cc	1	1	1	0	36.72945	-75.64665	On	283	589	1	65	83	No
8	16 Jun 2015	13:05	Cc	1	1	1	0	36.72781	-75.63986	On	023	0	1	63	84	Yes
05 July 2015 MINEX transect																
1	05 Jul 2015	6:55	Tt	25	27	21	1	36.86355	-75.94073	On	000	0	0	27	73	Yes
2	05 Jul 2015	7:19	Tt	7	8	6	0	36.89147	-75.88414	On	290	469	0	51	75	No
3	05 Jul 2015	7:23	Tt	5	6	4	0	36.89418	-75.86792	On	285	258	0	34	76	No
4	05 Jul 2015	8:00	UnidHT	1	1	1	0	36.93011	-75.74956	On	325	68	0	56	77	No
5	05 Jul 2015	8:02	UnidHT	1	1	1	0	36.93305	-75.74069	On	005	13	0	56	77	No
6	05 Jul 2015	8:09	Cc	1	1	1	0	36.93713	-75.72016	On	004	15	0	55	78	No
7	05 Jul 2015	8:36	Cc	1	1	1	0	36.87947	-75.73218	On	289	252	0	62	77	No
8	05 Jul 2015	8:46	Cc	1	1	1	0	36.86732	-75.76589	On	315	57	0	64	76	No
9	05 Jul 2015	9:04	Tt	1	1	1	0	36.84738	-75.82505	On	348	5	0	58	76	No
10	05 Jul 2015	9:20	Tt	55	70	45	0	36.83034	-75.87581	On	000	0	0	46	78	Yes
11	05 Jul 2015	9:40	Tt	6	8	5	0	36.82353	-75.9172	On	270	387	0	34	78	No

Sighting No.	Date	Time	Species	Group Size Best/High/Low			Calves	Sighting Latitude	Sighting Longitude	Effort	Bearing Angle	PSD† (m)	BSS*	Bottom Depth (m)	SST§ (ºF)	Photos Taken
05 July 2015 MINEX transect (continued)																
12	05 Jul 2015	9:44	Tt	8	10	6	0	36.80788	-75.91936	Off	272	236	1	-	-	No
01 August 2015 MINEX transect																
1	01 Aug 2015	8:23	Cc	1	1	1	0	36.66796	-75.824266	On	052	30	3	-	-	No
2	01 Aug 2015	10:46	Tt	2	2	2	0	36.7519	-75.888067	On	324	480	3	-	-	No
3	01 Aug 2015	12:03	Cc	1	1	1	0	36.84043	-75.77421	On	089	42	3	-	-	No

Notes:
* BSS = Beaufort Sea State
† PSD = Perpendicular Sighting Distance
§ SST = Sea Surface Temperature

Key:
Cc = Loggerhead turtle (*Caretta caretta*)
Dc = Leatherback turtle (*Dermochelys coriacea*)
Dd = Short-beaked common dolphin (*Delphinus delphis*)
Mn = Humpback whale (*Megaptera novaeangliae*)
Pp = Harbor porpoise (*Phocoena phocoena*)
Tt = Bottlenose dolphin (*Tursiops truncatus*)
UnidHT = unidentified hardshell sea turtle
UnidST = unidentified sea turtle
Unid = unidentified dolphin