Final

Occurrence, Distribution, and Density of Marine Mammals Near Naval Station Norfolk and Virginia Beach, VA: 2014 Annual Progress Report

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Cover Photo:

Bottlenose dolphins (*Tursiops truncatus*) observed on 27 July 2013, off the Virginia coast in the MINEX W-50 exercise area. Photographed by A. Engelhaupt. Photo taken under National Marine Fisheries Service permit no. 14451.

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Abstract

A combination of visual line-transect survey, photo-identification (photo-ID), and automated acoustic monitoring methods is being used to gather important baseline information on the occurrence, distribution, and density of marine mammals near Naval Station Norfolk and adjacent areas. The study area was chosen to cover areas where United States (U.S.) Navy activity is substantial, including Chesapeake Bay waters near Naval Station Norfolk and Joint Expeditionary Base Little Creek-Fort Story, as well as a Mine Exercise (MINEX) Area (W-50) in the Atlantic off the coast of Virginia Beach, Virginia. Forty-seven line-transect surveys were completed in two zones (INSHORE and MINEX) between August 2012 and December 2014, with 5,106 kilometers (km) and 276.5 hours completed on-effort. The majority of sightings were of bottlenose dolphins (*Tursiops truncatus*), although humpback whales (*Megaptera novaeangliae*) and short-beaked common dolphins (*Delphinus delphis*) were also sighted in the study area on occasion. In addition, loggerhead sea turtles (*Caretta caretta*) and leatherback sea turtles (*Dermochelys coriacea*) were sighted during the study period. Conventional line-transect analysis of bottlenose dolphin sightings showed both spatial and seasonal variation in density and abundance, with greatest abundance in the INSHORE zone during fall months. Densities in the INSHORE zone were calculated as 4.12 individuals per square kilometer (km^2) (abundance[n]=1,279) in fall, 0.45 individuals per km^2 (n=138) in winter, 1.02 individuals per km^2 (n=316) in spring, and 2.86 individuals per km^2 (n=887) in summer. Densities in the MINEX zone were calculated as 2.23 individuals per km^2 (n=1,333) in fall, 0.06 individuals per km^2 (n=35) in winter, 0.24 individuals per km^2 (n=145) in spring, and 1.19 individuals per km^2 (n=709) in summer. Nineteen 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 September 2013; it contains 462 identified individuals to date. Forty-one individuals were re-sighted; however, most re-sightings were less than 3 months and 21 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 U.S. Navy activity. Bottlenose dolphins were detected in each deployment location during all deployments from August 2012 to January 2015. Though deployments did not provide consistent coverage in all seasons for each site due to loss of gear, results from one deployment site showed a greater level of occurrence during summer and fall months, and a diel pattern of occurrence with increased detections during nighttime hours for three deployment sites. Additional study is required to improve accuracy in seasonal density estimates and allow further stratification of those estimates, and to better describe the movement patterns and site fidelity of the bottlenose dolphins in these waters. Visual surveys and additional C-POD deployments are currently planned through August 2015.

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Acronyms and Abbreviations

°	degree(s)
BSS	Beaufort Sea State
COR	Contracting Officer Representative
CV	coefficient of variation
DPM	detection positive minutes
EAR	Ecological Acoustic Recorder
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
NMFS	National Marine Fisheries Service
NSN	Naval Station Norfolk
OPAREA	operating area
PAM	passive acoustic monitoring
Photo-ID	photo-identification
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 has investigated metrics to estimate bottlenose dolphin abundance in this region (e.g., Blaylock 1988, Barco et al. 1999, Baker 2000), the 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 base (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 is 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. While the project is expected to continue through at least July 2015, this annual summary report describes the data, progress, and results from August 2012 through December 2014.

1.1 Project Objectives

The HDR Marine Species Monitoring (MSM) Team was tasked to initiate 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. Emphasis was given to working with local researchers and employing proven marine mammal monitoring and research techniques to accomplish the following:

1. Conduct 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. Conduct monthly photo-identification (photo-ID) surveys during summer months to determine the site fidelity and distributional patterns of marine mammals utilizing the areas listed above.
3. Supplement visual surveys by deploying and retrieving four C-POD 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) of 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 (COR).

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 bases 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 COR.

Task 4 – Data Analysis and Reporting. Line-transect survey data were analyzed for bottlenose dolphin density using the software program Distance 6.0 Release 2 (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 the 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 activities are 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). Transect lines were systematically placed with a random start point to adhere to Distance sampling survey design. 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 NM). Beginning and end times for the survey days were dependent on weather conditions and daylight available.

The HDR MSM Team conducted line-transect surveys 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,

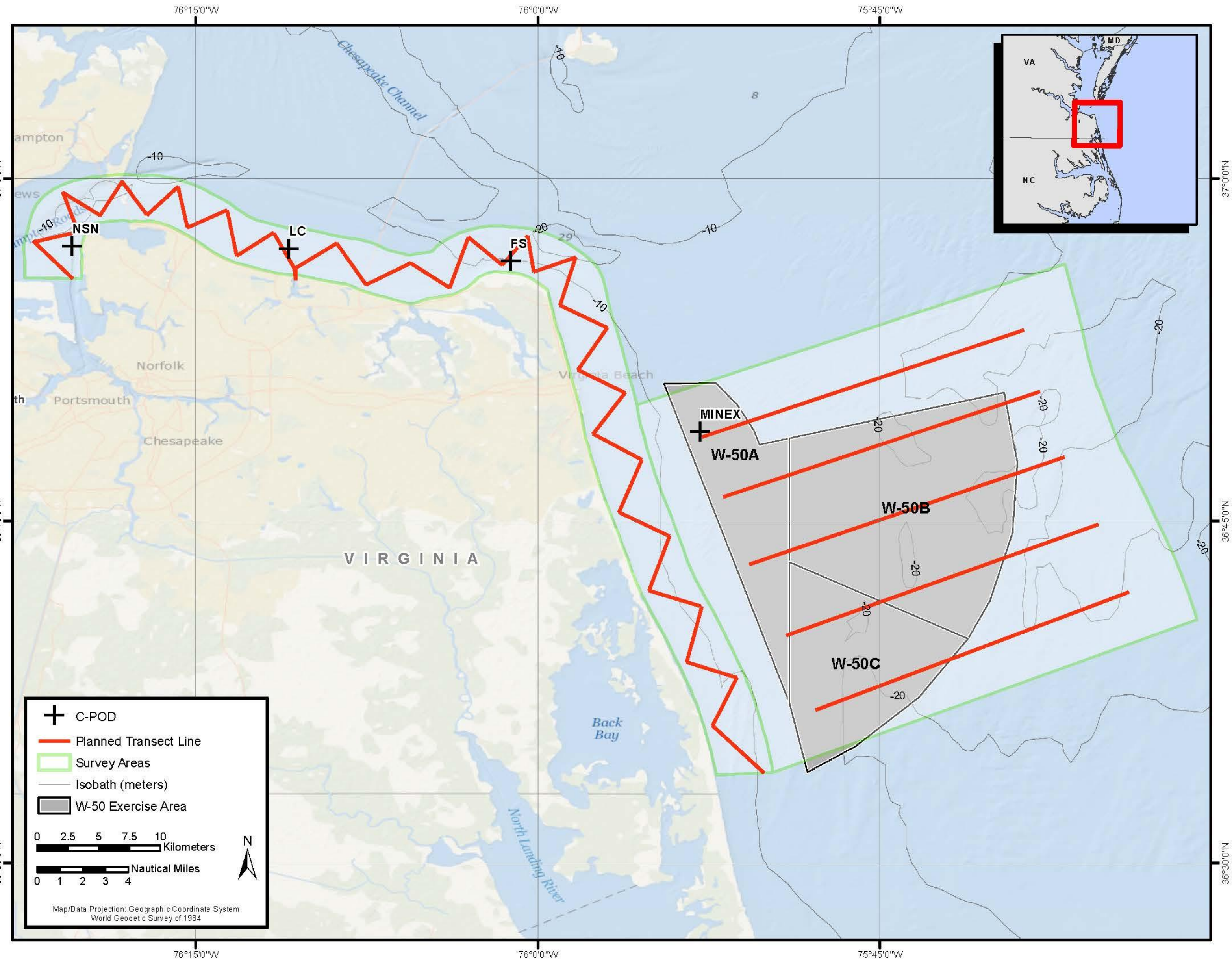

Figure 1. Study area delineated into COASTAL/INSHORE and OFFSHORE/MINEX zones for year one of study.

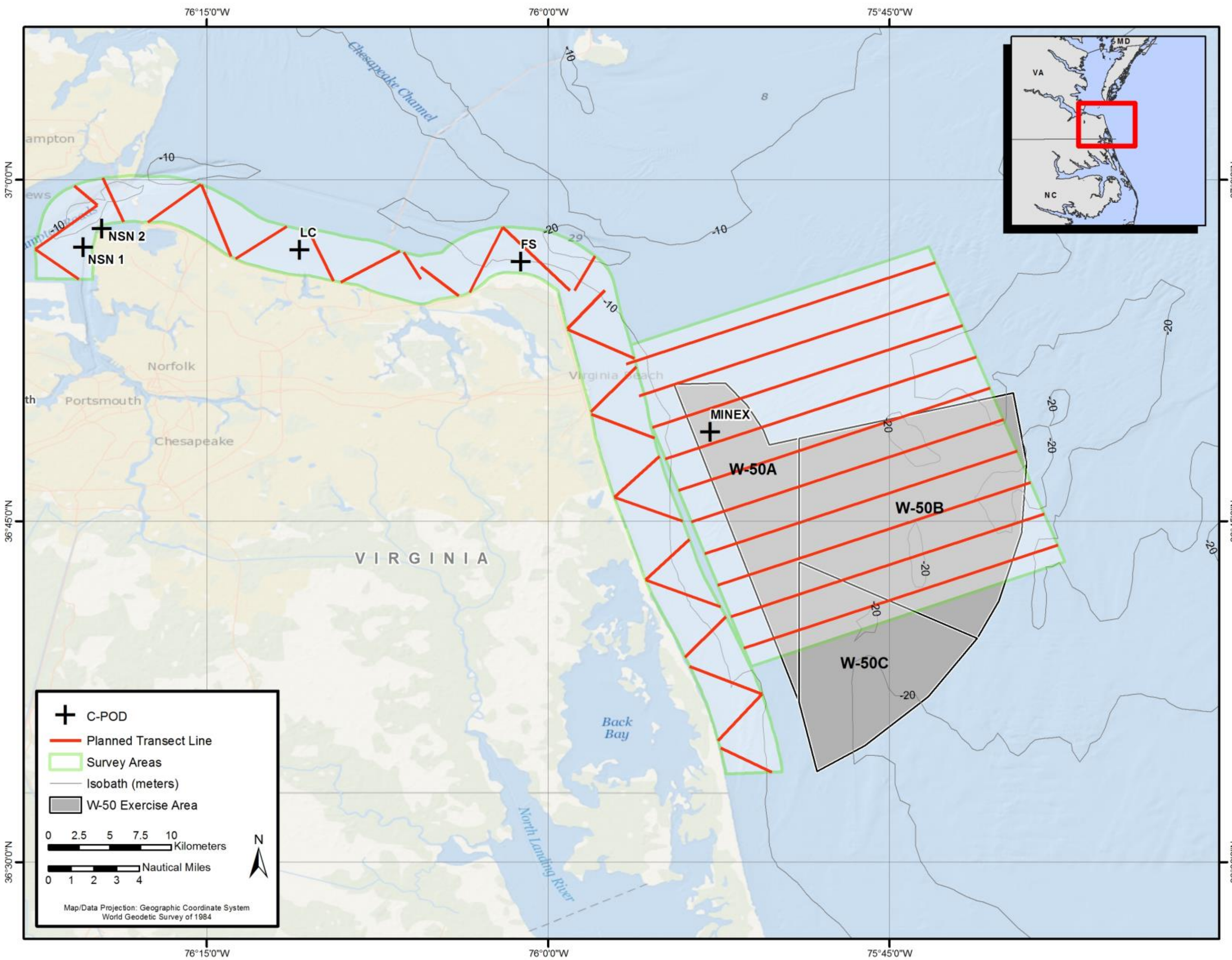

Figure 2. Revised transect lines for COASTAL/INSHORE and OFFSHORE/MINEX zones for years two and beyond of study.

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.*

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 photographs were sent to the Virginia Aquarium & Marine Science Center to contribute to the existing Atlantic catalogs through April 2014, and as of December 2014 are now being incorporated into HDR's Virginia humpback catalog, 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.

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:

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

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

$$C\hat{V} = \sqrt{\frac{\hat{\mathrm{var}}(n)}{n^2} + \frac{\hat{\mathrm{var}}[\hat{f}(0)]}{[\hat{f}(0)]^2} + \frac{\hat{\mathrm{var}}[\hat{E}(s)]}{[\hat{E}(s)]^2} + \frac{\hat{\mathrm{var}}[\hat{g}(0)]}{[\hat{g}(0)]^2}}$$

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.

Detection function and encounter rates were calculated for bottlenose dolphins using the software DISTANCE 6.0 using all on-effort data collected in BSS conditions of 0-3, which was considered good sighting conditions. Estimates were not stratified by BSS or other environmental parameters due to limited sample sizes, and plans to conduct density surface modeling on the data once the project is complete. Stratified estimates of density and abundance (in terms of sighting rate and group size) were generated for the two main survey zones and four seasons. In other words, the monitoring team calculated sighting rate and average group size separately for each stratum, and only pooled across strata for estimating the detection function. Due to sample size limitations, data were pooled from all strata to produce a single 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. However, this estimate was only used if it was lower than the arithmetic mean group size. Group size 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).

Truncation of the perpendicular sighting distance data excluded the most-distant 5 percent of the sightings. The data were modeled with half-normal (using hermite polynomial and cosine series expansions) and hazard rate (using cosine and simple polynomial adjustments) models; the model with the lowest value for Akaike's Information Criterion was selected.

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 (<30 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

A total of seven surveys (one survey day each month) was planned for the initial year of study (summer/fall 2012 included August, September, and October and spring/summer 2013 included May, June, July, and August). Following the initial year, monthly photo-identification 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 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. After three surveys, it was determined that the seasonal fluctuation of dolphins in 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 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 3-7) 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 NVB (Norfolk-Virginia Beach) 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 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 Chelonia Limited or 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.

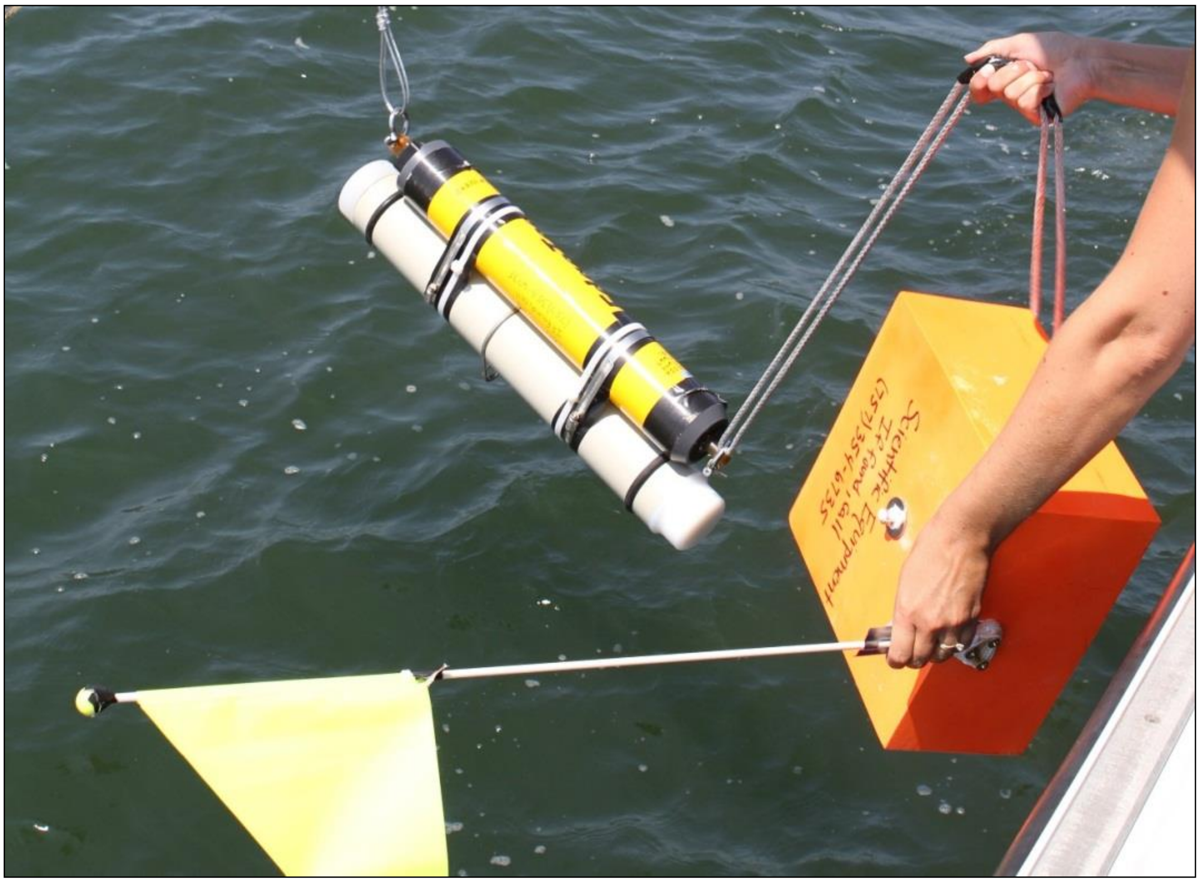

Figure 7. A C-POD unit prepped and in the process of deployment.

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) 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.

As with all automated acoustic techniques, some 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

Twenty-six INSHORE line-transect surveys and 21 MINEX line-transect surveys were completed between August 2012 and December 2014. Surveys covered a total of 5,106 km and 16,587 min on-effort. The total on-effort distance and time spent in the INSHORE zone was 2,928 km and 9,482 min, respectively (**Table 1**), while 2,178 km and 7,105 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–December 2014.

Date	Start Time (local)	Stop Time (local)	Total Survey (min)	Total On-Effort (min)	Trackline On-Effort Distance (km)
07 Sep 2012	8:08	15:15	428	313	86.3
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	124.6
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	123.9
16 Nov 2013	6:46	16:40	593	389	123.0
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	108.4
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
Total			**14,826 (247.1 hr)**	**9,482 (158.0 hr)**	**2,928 km**

Table 2. Summary of MINEX line-transect surveys, August 2012 – December 2014.

Date	Start Time (local)	Stop Time (local)	Total Survey (min)	Total On-Effort (min)	Trackline On-Effort Distance (km)
8 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
3 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	108.6
16 Jun 2014	6:05	15:29	564	363	109.5
16 Aug 2014	6:40	17:53	673	391	107.8
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	111.4
21 Dec 2014	7:21	16:32	552	345	109.2
Total			**10,926 (182.1 hr)**	**7,105 (118.4 hr)**	**2,178 km**

3.2 Sightings

A total of 433 sightings of marine mammals and 75 sightings of sea turtles was recorded during transect surveys from August 2012 through December 2014 (**Figures 8 and 9, Table 3, Appendices C and D**). Sighting locations used are those 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 (95.6 percent; *n*=414 of 433) of marine mammal sightings were of bottlenose dolphins; the other species sighted included 16 sightings of humpback whales (*Megaptera novaeangliae*), one group of short-beaked common dolphins (*Delphinus delphis*), and one group of unidentified dolphins. The unidentified dolphins had a similar shape to the short-beaked common dolphins, but the observer team was

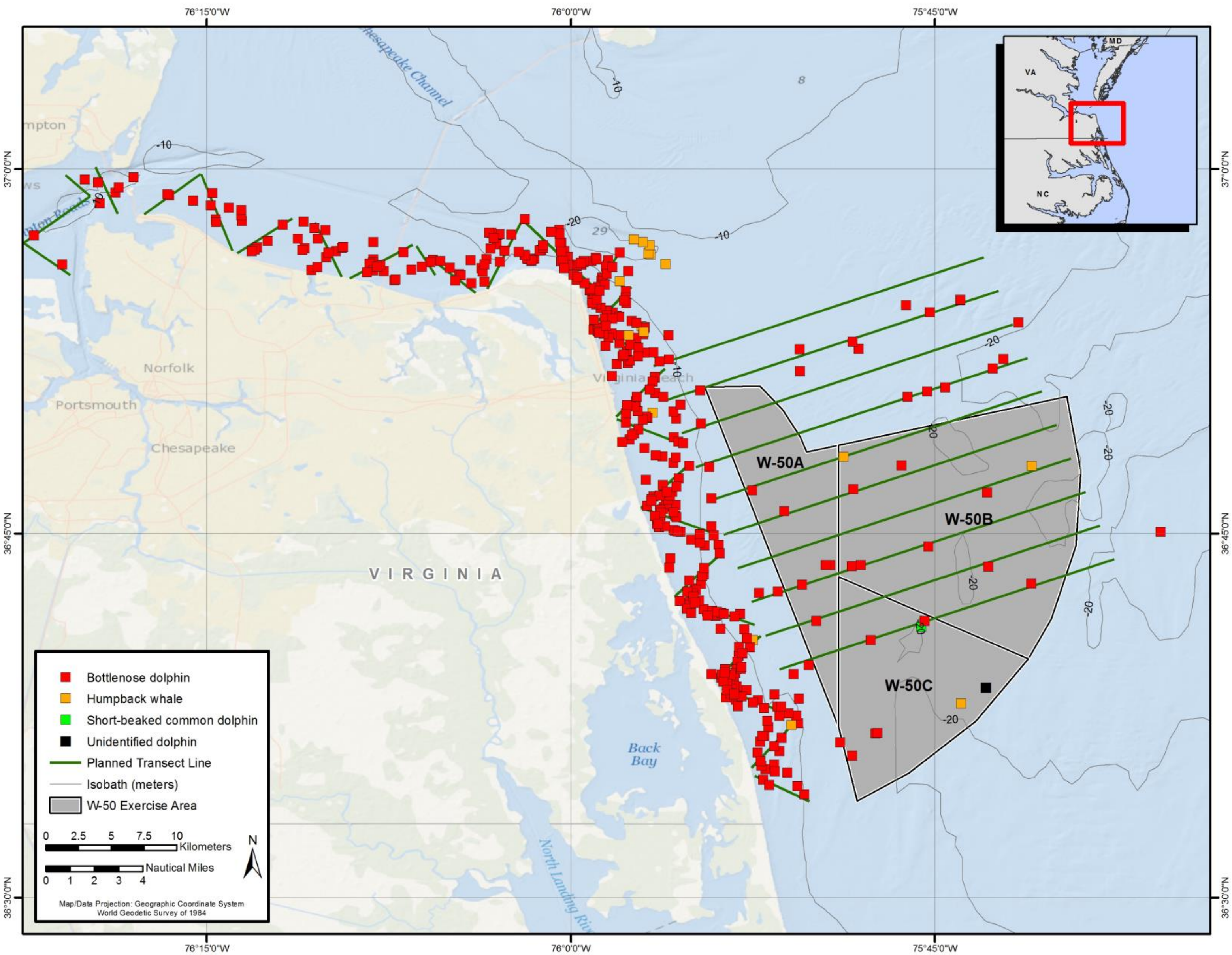

Figure 8. Marine mammal sightings during all line-transect surveys between August 2012 and December 2014.

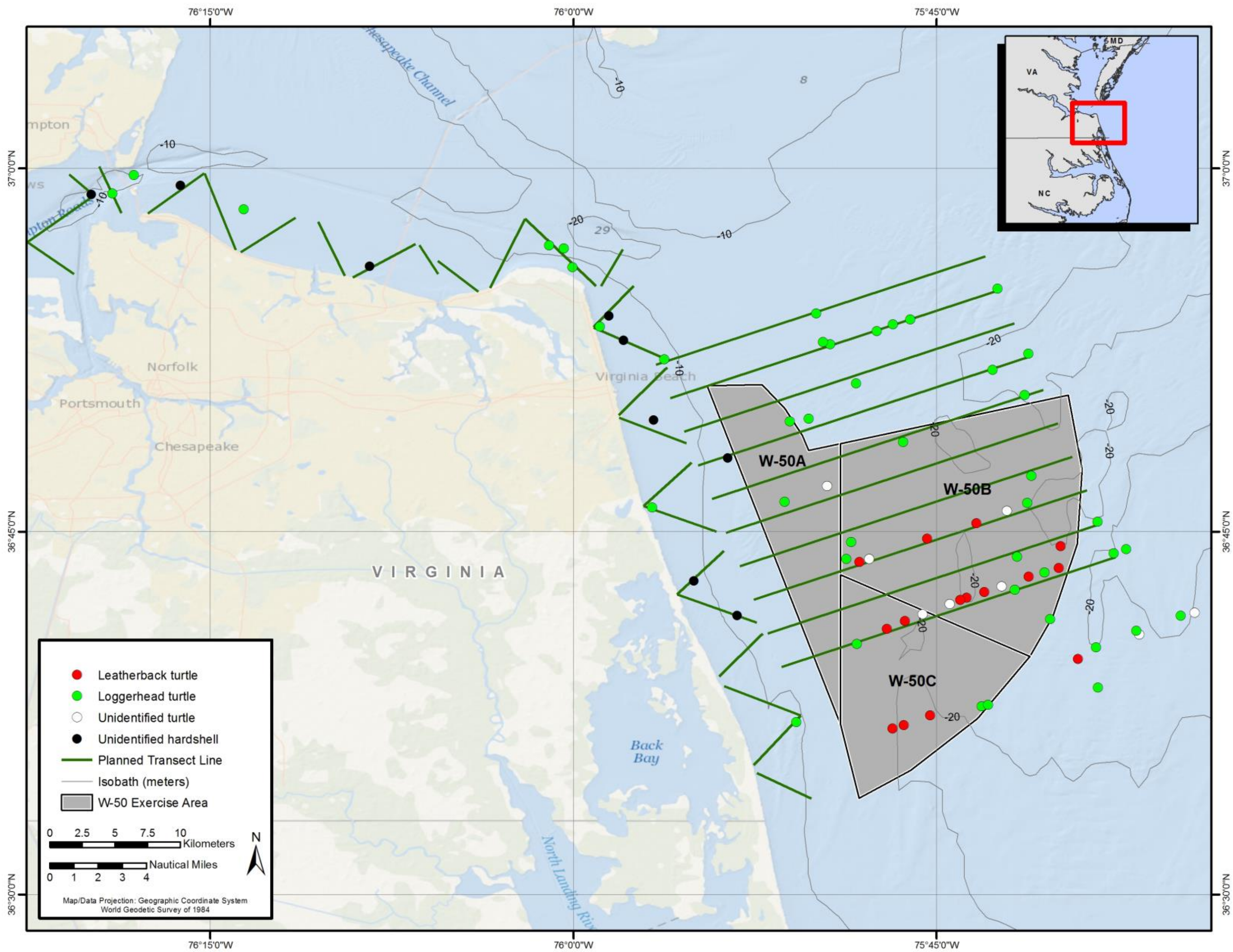

Figure 9. Sea turtle sightings during all line-transect surveys between August 2012 and December 2014.

Table 3. Marine mammal and sea turtle sighting summary- August 2012 through December 2014.

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	1005.7	227	2550	9	9
INSHORE	Winter	6	651.9	24	279	0	0
INSHORE	Spring	6	695.2	51	621	0	0
INSHORE	Summer	5	575.3	78	1354	9	9
MINEX	Fall	7	755.1	26	493	14	14
MINEX	Winter	5	510.6	5	15	0	0
MINEX	Spring	3	284.6	9	41	6	6
MINEX	Summer	6	627.2	13	178	37	37

Note:
*Total individuals are sum of Best group size estimate

unable to re-sight the group to confirm species identification. Fifty-three marine mammal groups were sighted in the MINEX zone, while 380 were sighted in the INSHORE zone. Forty-three of the sea turtle sightings were loggerheads (*Caretta caretta*), 15 were leatherbacks *(Dermochelys coriacea*), 8 were unidentified sea turtles (possible leatherbacks), and 9 were unidentified hardshell turtles. Fifty-seven sightings were made in the MINEX zone and eighteen in the INSHORE zone.

Appendix C and D list all sightings and associated data, including whether identification 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 328 sightings and 2,855 km of line-transect survey effort in the INSHORE zone, and 35 sightings and 1,748 km of effort in the MINEX zone. The detection function was modeled using the hazard rate key function, with a simple polynomial adjustment. The calculated value of f(0) was 4.9805 (CV=13.1 percent), and the effective strip width (1/f(0)) was 201 m. The histogram of perpendicular sighting distances and fitted model are shown in **Figure 10**. Line-transect parameters and resulting estimates are provided in **Table 4**.

Sightings of humpback whales (*n*=16; across fall, winter, and spring months) and short-beaked common dolphins (*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.

While the numbers of sightings for the INSHORE zone appear adequate to produce reliable estimates of density and abundance, there are still too few sightings from the MINEX zone for reliable estimates (CVs are all > 50 percent, some > 100 percent). As a result, the MINEX estimates should be considered highly preliminary, and the observer team will attempt to refine them with further survey effort in 2015. The team will also attempt to further stratify the INSHORE zone if additional data allow densities to be calculated for smaller sections of the area.

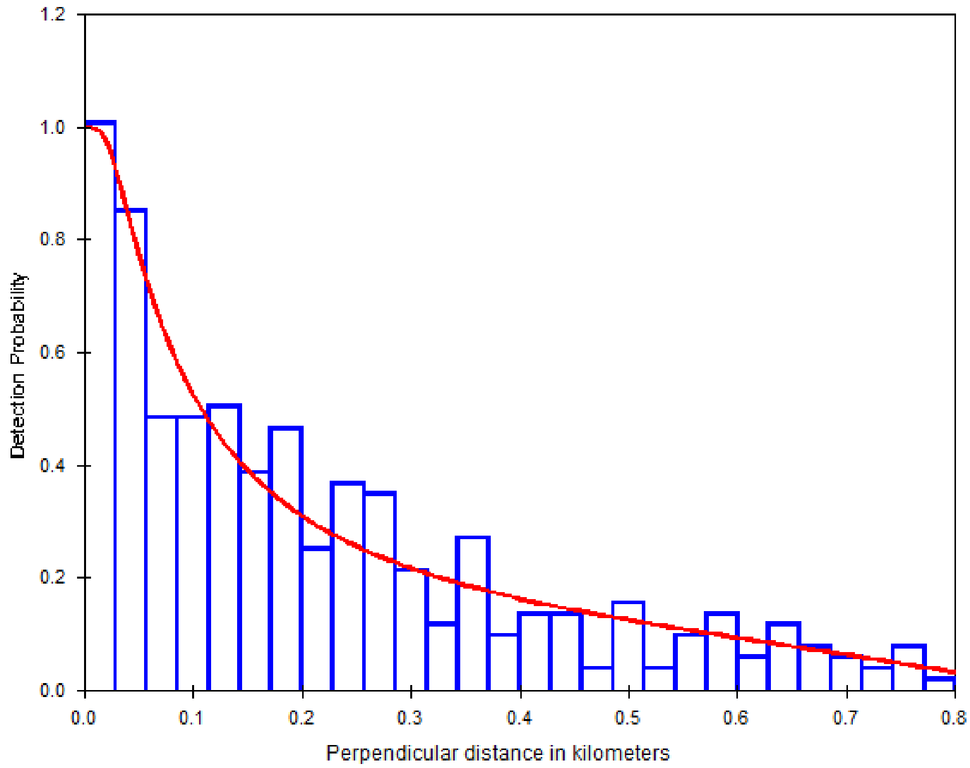

Figure 10. Perpendicular distance histogram and fitted detection function for bottlenose dolphins.

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	199	989	8.2	0.20	4.12	1,279	26
INSHORE	Winter	14	649	8.3	0.02	0.45	138	55
INSHORE	Spring	42	677	6.6	0.06	1.02	316	33
INSHORE	Summer	73	540	8.5	0.14	2.86	887	31
MINEX	Fall	19	658	13.8	0.03	2.23	1,333	60
MINEX	Winter	1	381	9.0	0.00	0.06	35	126
MINEX	Spring	6	198	3.2	0.03	0.24	145	50
MINEX	Summer	9	511	13.6	0.02	1.19	709	86

Note:
* Before truncation
§ Measured as individuals per linear km
# Measured as individuals per km^2
† Coefficient of Variation

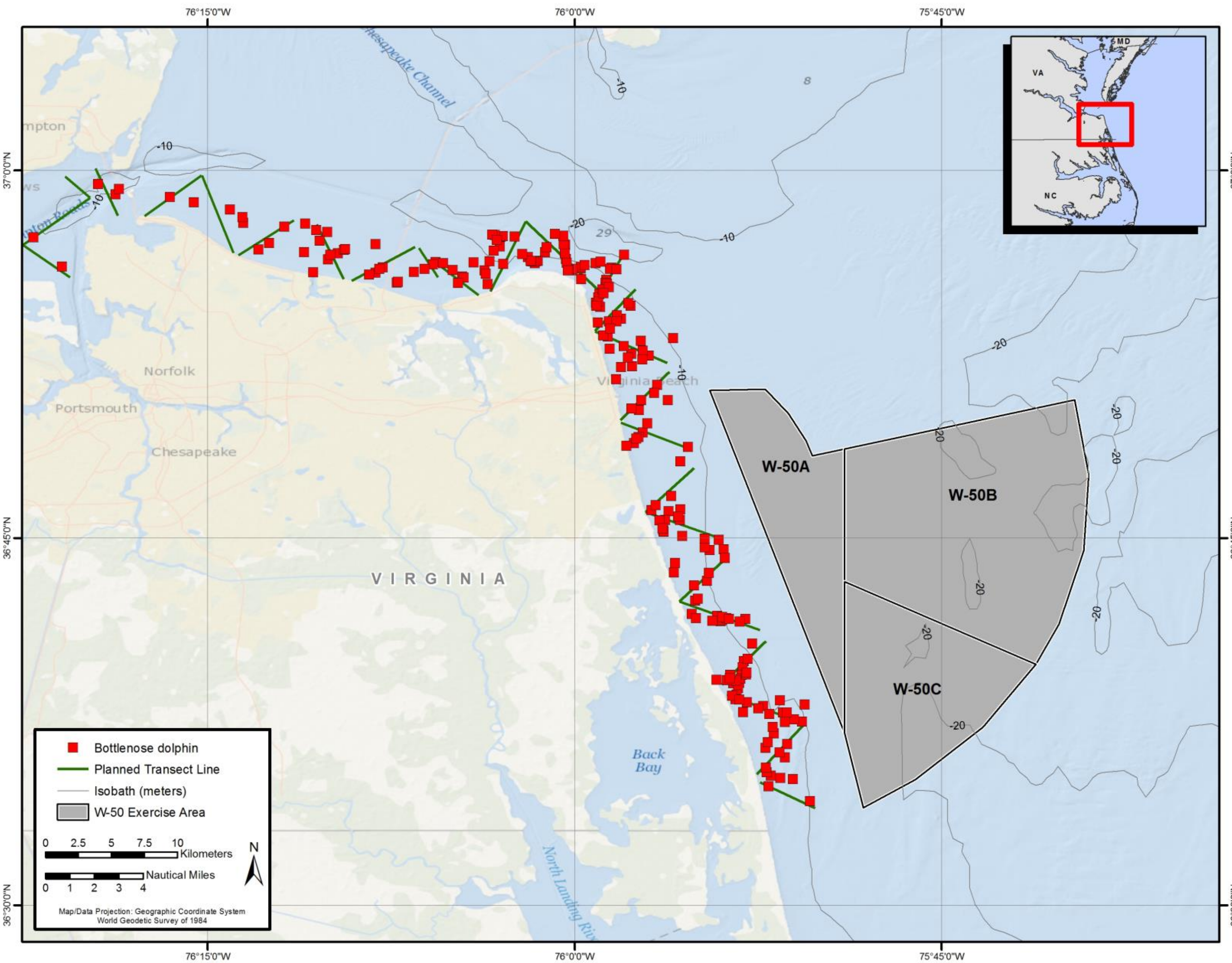

Figure 11. Bottlenose dolphin groups sighted on-effort during fall INSHORE line-transect surveys between August 2012 and December 2014.

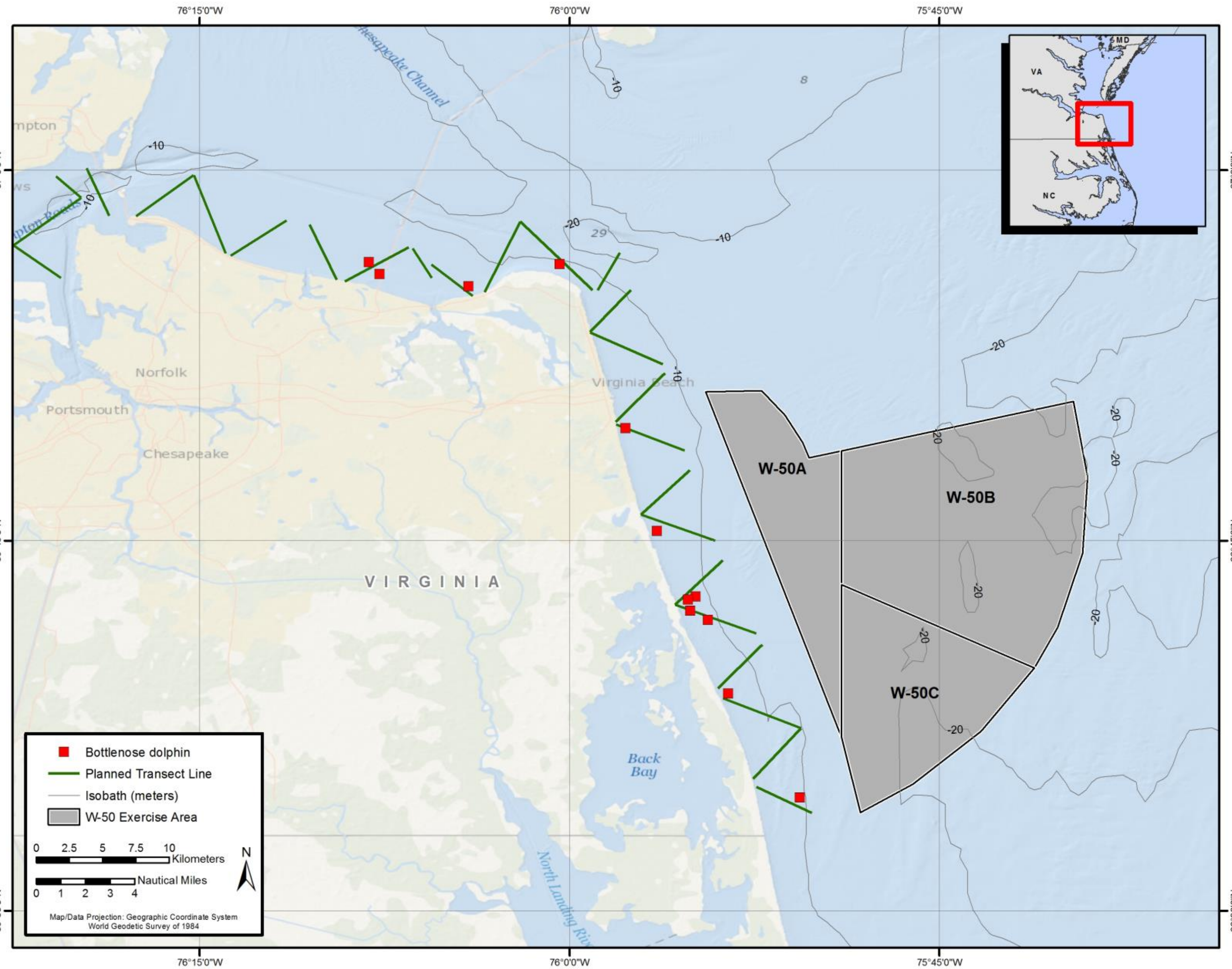

Figure 12. Bottlenose dolphin groups sighted on-effort during winter INSHORE line-transect surveys between August 2012 and December 2014.

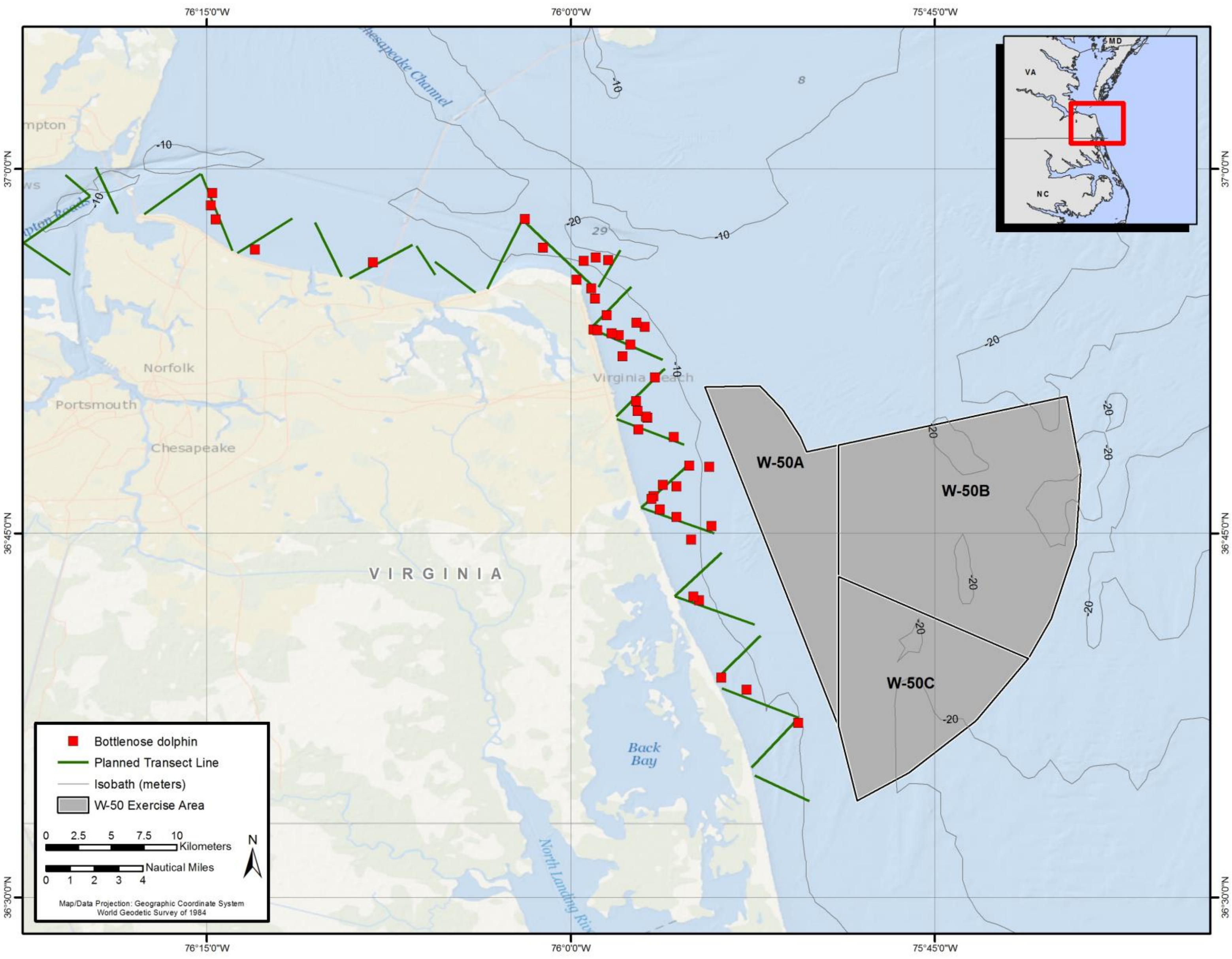

Figure 13. Bottlenose dolphin groups sighted on-effort during spring INSHORE line-transect surveys between August 2012 and December 2014.

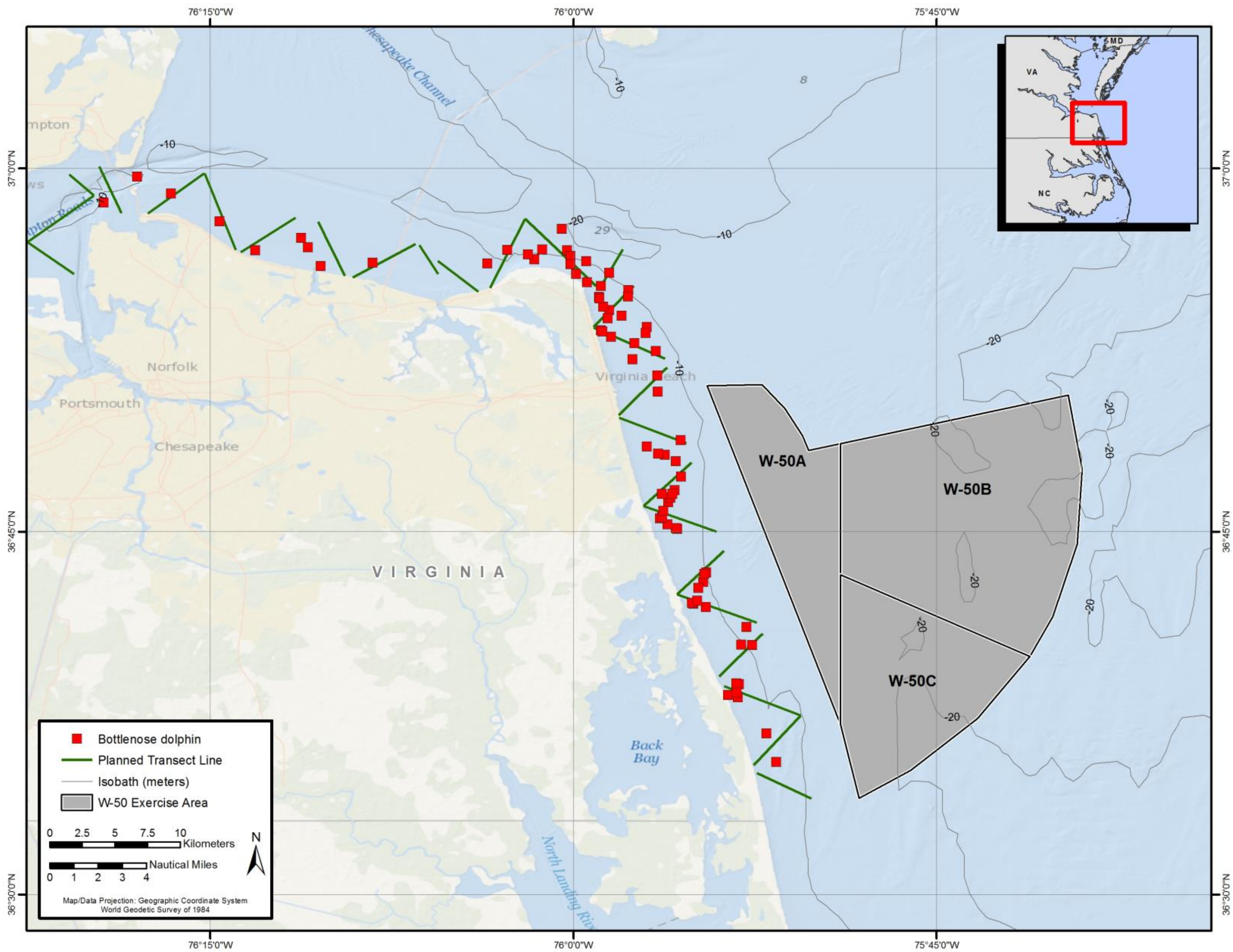

Figure 14. Bottlenose dolphin groups sighted on-effort during summer INSHORE line-transect surveys between August 2012 and December 2014.

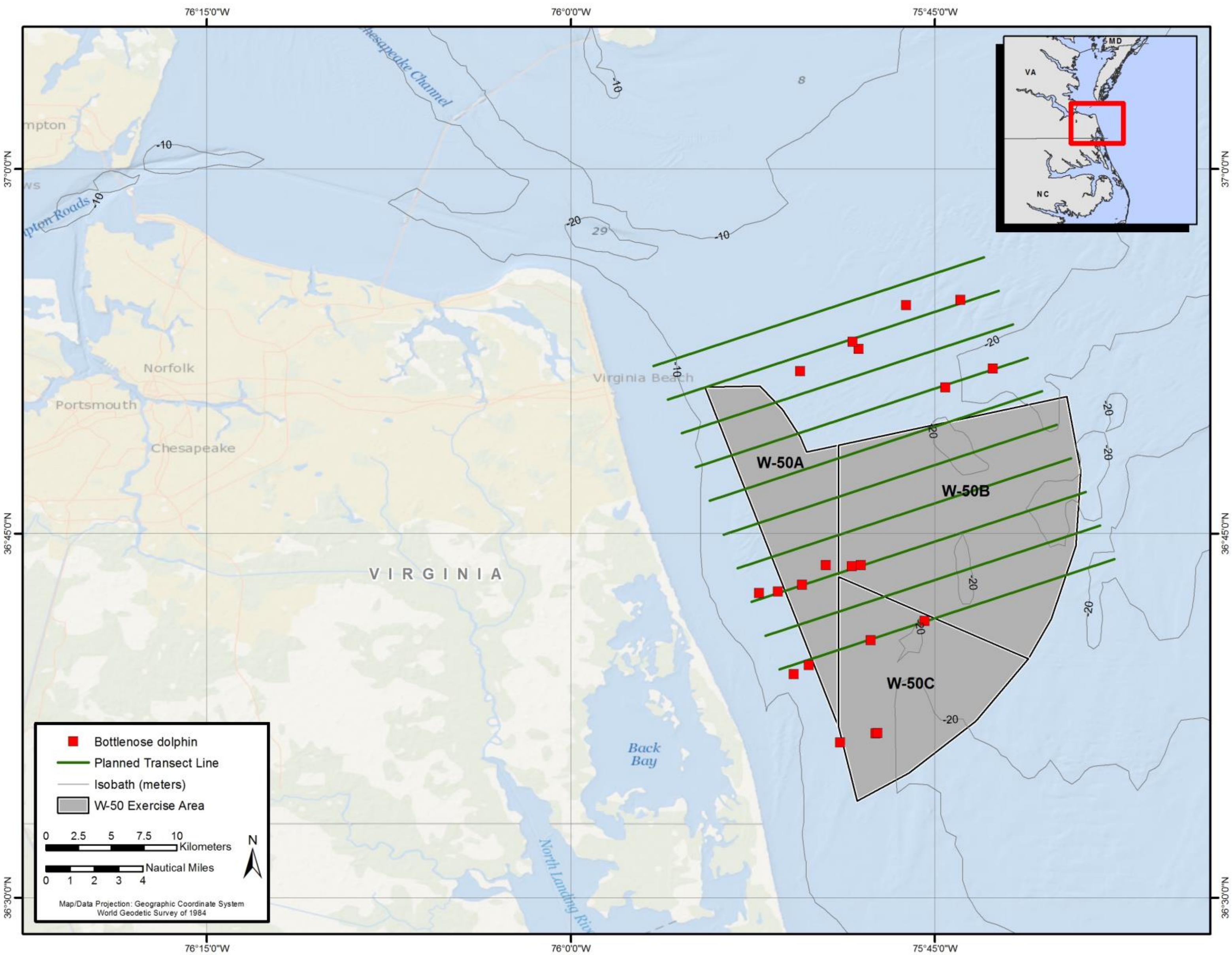

Figure 15. Bottlenose dolphin groups sighted on-effort during fall MINEX line-transect surveys between August 2012 and December 2014.

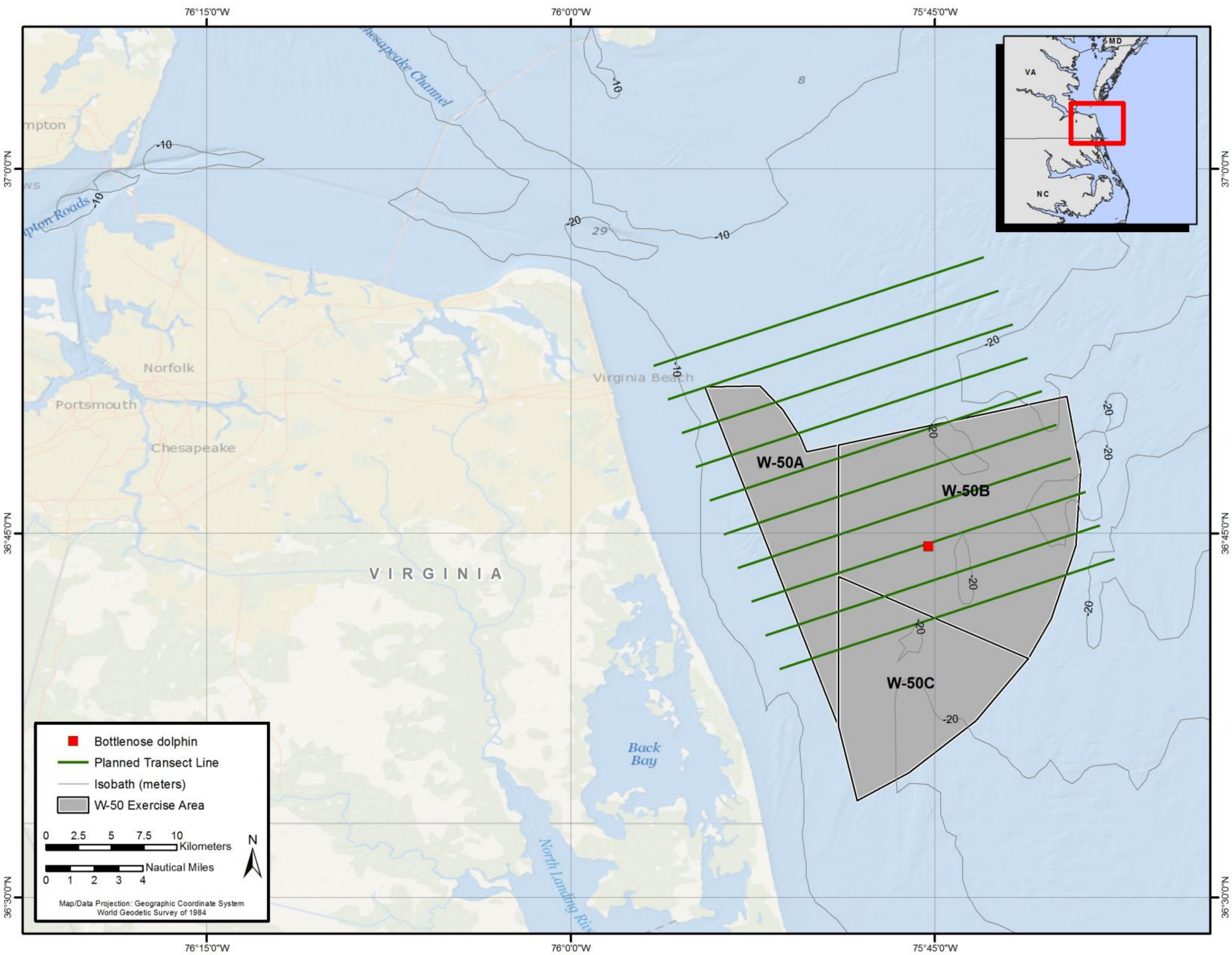

Figure 16. Bottlenose dolphin groups sighted on-effort during winter MINEX line-transect surveys between August 2012 and December 2014.

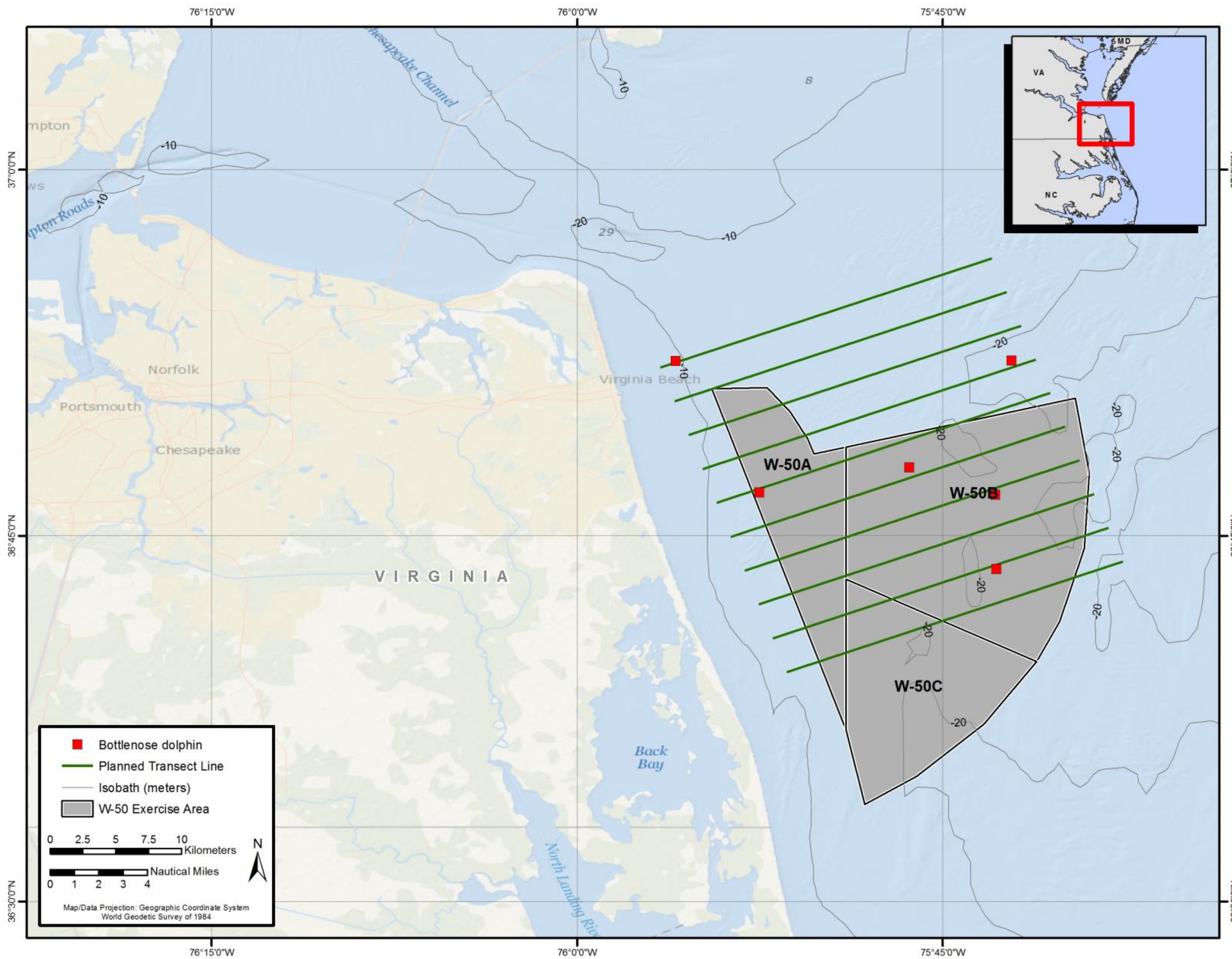

Figure 17. Bottlenose dolphin groups sighted on-effort during spring MINEX line-transect surveys between August 2012 and December 2014.

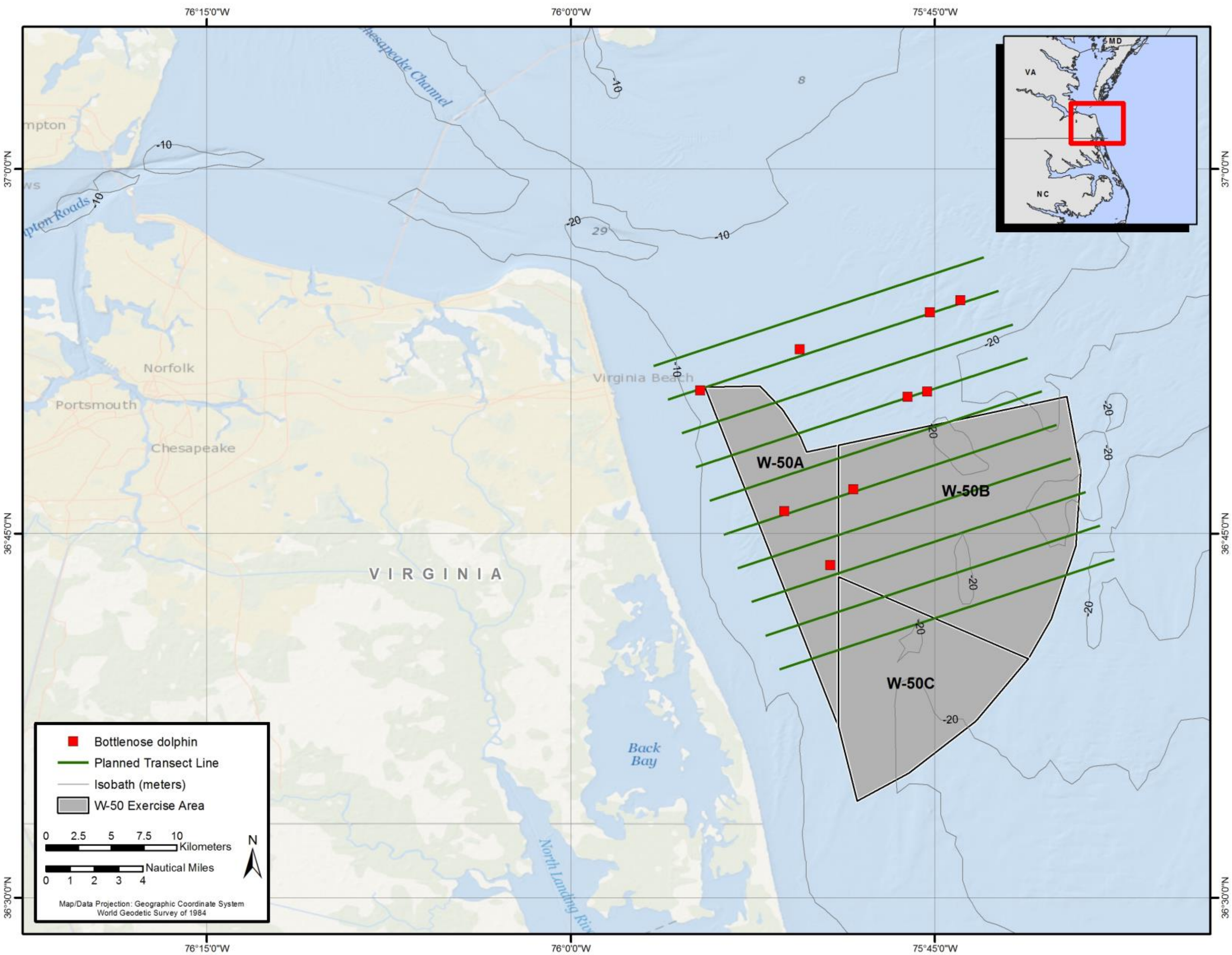

Figure 18. Bottlenose dolphin groups sighted on-effort during summer MINEX line-transect surveys between August 2012 and December 2014.

4. Photo-identification Survey Results

Nineteen photo-ID surveys were completed between August 2012 and December 2014 (**Table 5**). 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 is currently underway, and to-date includes photo-ID and transect photographs taken through 16 September 2013. **Figure 19** shows the locations of all sightings used in the catalog. To date, the catalog contains 462 identifiable individuals. The discovery curve (**Figure 20**) shows the addition of new individuals with each month's surveys. There is no sign of a plateau of the number of identified dolphins in the study area.

Table 5. Summary of completed photo-ID surveys August 2012 to December 2014.

Date	Start Time	Stop Time	Total Survey Minutes	Number of Bottlenose Dolphin Groups Sighted	Total Number 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

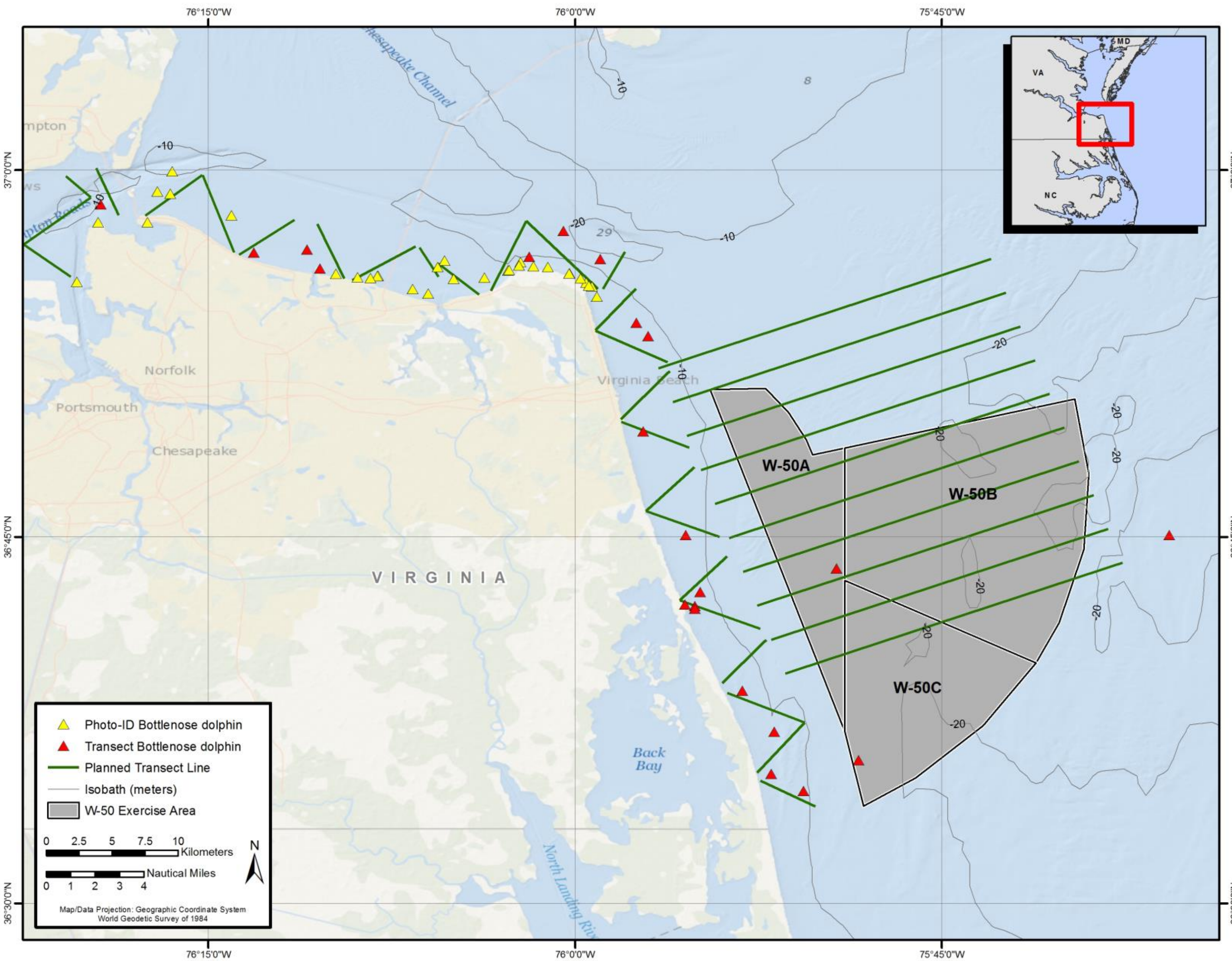

Figure 19. Bottlenose dolphin group sighting locations used in photo-ID catalog. All photo-ID survey locations are shown. For transect surveys, only locations in which identification photos were collected are included.

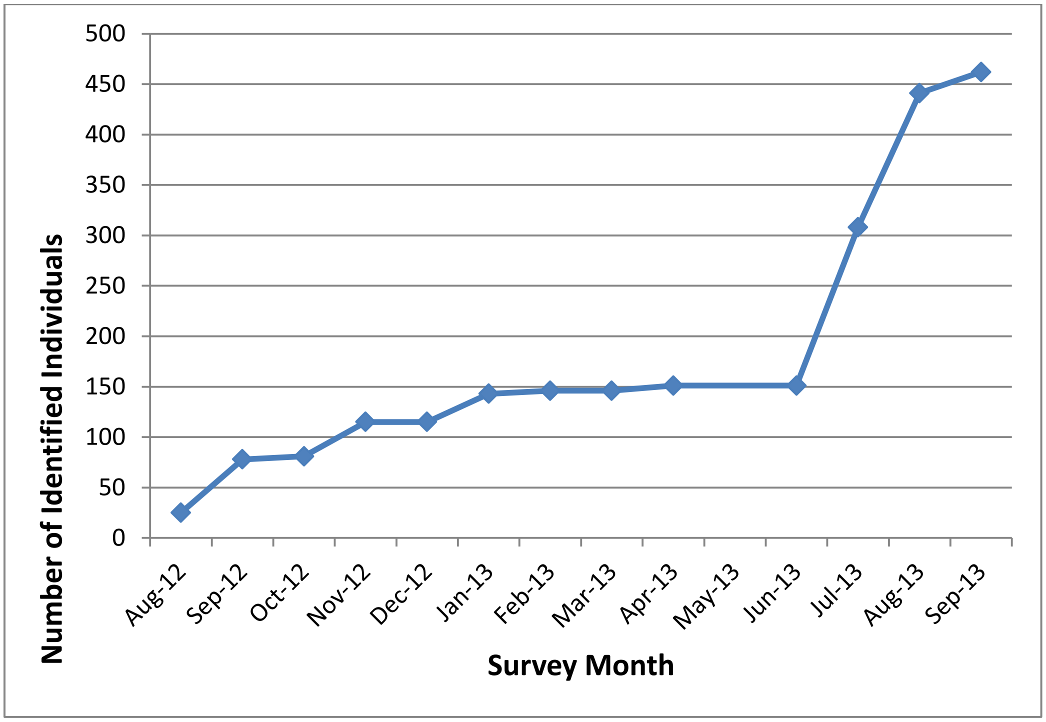

Figure 20. Discovery curve showing the cumulative number of identified dolphins as it increased with each survey month.

Re-sighting rates across surveys are low. Following creation of the catalog and excluding same-day re-sightings, there have been 47 matches of cataloged individuals, which includes a second re-sighting of six individuals (**Table 6**, **Appendix E).** All re-sightings in the study area were recorded less than 21 km from the initial sighting. Dolphins sighted in the Chesapeake Bay and along the Cape Henry area were not re-sighted along the Atlantic side of Virginia Beach in the southern portion of the study area. Most re-sightings occurred within the same year; of the seven re-sightings that were in different years, only two were approximately 1 year apart (September 2012 to July 2013 and September 2012 to September 2013), and five were only 3 months apart (November 2012 to January 2013). More survey and photo-ID effort is required to discern any clear patterns of site fidelity or sub-stock differentiation.

Photos collected through August 2013 have been submitted to the existing Mid-Atlantic Bottlenose Dolphin Catalog established by NMFS and curated by Kim Urian of Duke University Marine Laboratory (Urian et al. 1999), and we are awaiting results at the time of this report. Matches to other adjacent study areas found by comparison to the Mid-Atlantic Bottlenose Dolphin Catalog will be used to piece together information on movement patterns on a larger scale. One match has been made from an individual in the Norfolk-Virginia Beach catalog (NVB0385) to a freeze-branded individual (known as FB405, Kim Urian, Duke University Marine Laboratory, personal communication, 9 December 2013). After the initial sighting in the field, the HDR MSM Survey Team communicated with relevant parties to determine where the animal was branded. It was confirmed that prior to sightings at Cape Henry, Virginia, on 31 August and 16 September 2013, this individual had been photographed in Roanoke Sound, North Carolina, and caught for tagging and freeze-branding at Cape Lookout, North Carolina, on 9 November 1999.

Table 6. Sighting details of re-sighted individuals.

Catalog ID No.	Initial Sighting Date/Sighting No./Grp Size			Re-sighting Date/Sighting No./Grp Size			Distance Between Sightings (km)	Days Between: Sightings / First and Last Sightings
NVB0003	9 Aug 2012	1	15	25 Sep 2012	9	15	4.0	47
NVB0014	9 Aug 2012	5	18	25 Sep 2012	1	6	6.6	47
NVB0020	9 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
NVB0050	25 Sep 2012	3	24	16 Sep 2013	2	75	4.4	356
NVB0083	27 Nov 2012	1	40	9 Jan 2013	2	35	6.4	43
NVB0084	27 Nov 2012	1	40	9 Jan 2013	2	35	6.4	43
NVB0086	27 Nov 2012	1	40	9 Jan 2013	2	35	6.4	43
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
NVB0133	9 Jan 2013	2	35	22 Feb 2013	5	15	1.2	44
NVB0152	9 Jul 2013	1	22	16 Jul 2013	3	33	13.8	7/53
NVB0152	9 Jul 2013	1	22	31 Aug 2013	6	13	15.5	46/53
NVB0153	9 Jul 2013	1	22	13 Aug 2013	2	40	5.3	35/69
NVB0153	9 Jul 2013	1	22	16 Sep 2013	2	75	8.8	34/69
NVB0155	9 Jul 2013	1	22	16 Jul 2013	3	33	13.8	7/69
NVB0155	9 Jul 2013	1	22	16 Sep 2013	2	75	8.8	62/69
NVB0156	9 Jul 2013	1	22	16 Sep 2013	2	33	13.8	69
NVB0164	9 Jul 2013	3	25	9 Jul 2013	4	115	2.0	7
NVB0165	9 Jul 2013	3	25	16 Jul 2013	4	30	6.4	7
NVB0170	9 Jul 2013	4	115	31 Aug 2013	6	13	1.2	53
NVB0172	9 Jul 2013	4	115	24 Jul 2013	2	125	11.8	15
NVB0175	9 Jul 2013	4	115	16 Jul 2013	1	26	6.6	7
NVB0179	9 Jul 2013	4	115	16 Jul 2013	4	30	8.2	7
NVB0183	9 Jul 2013	4	115	16 Jul 2013	3	33	13.8	69
NVB0188	9 Jul 2013	4	115	16 Jul 2013	3	33	13.8	7
NVB0189	9 Jul 2013	4	115	16 Jul 2013	4	30	8.2	7
NVB0192	9 Jul 2013	4	115	13 Aug 2013	2	40	20.2	35/69
NVB0193	9 Jul 2013	4	115	16 Jul 2013	3	33	13.8	34/69
NVB0195	9 Jul 2013	4	115	16 Jul 2013	1	26	6.5	7/69
NVB0195	9 Jul 2013	4	115	16 Sep 2013	2	75	6.2	62/69
NVB0199	9 Jul 2013	4	115	16 Jul 2013	6	65	0.4	7
NVB0211	9 Jul 2013	4	115	16 Jul 2013	1	26	6.5	7
NVB0212	9 Jul 2013	4	115	16 Jul 2013	1	26	6.6	7
NVB0214	9 Jul 2013	4	115	16 Jul 2013	4	30	8.2	7
NVB0229	16 Jul 2013	3	33	13 Aug 2013	2	40	19.1	28/62
NVB0229	16 Jul 2013	3	33	16 Sep 2013	2	75	5.2	34/62

Catalog ID No.	Initial Sighting Date/Sighting No./Grp Size			Re-sighting Date/Sighting No./Grp Size			Distance Between Sightings (km)	Days Between: Sightings / First and Last Sightings
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
NVB0242	16 Jul 2013	4	30	31 Aug 2013	4	40	2.7	46
NVB0252	16 Jul 2013	6	65	31 Aug 2013	4	40	2.1	46
NVB0274	24 Jul 2013	2	125	13 Aug 2013	2	40	17.1	20/38
NVB0274	24 Jul 2013	2	125	31 Aug 2013	6	13	4.2	18/38
NVB0292	24 Jul 2013	8	100	13 Aug 2013	4	90	10.0	20
NVB0332	13 Aug 2013	2	40	31 Aug 2013	3	60	17.0	18
NVB0385	31 Aug 2013	3	60	16 Sep 2013	2	75	1.9	16
NVB0386	31 Aug 2013	3	60	16 Sep 2013	2	75	1.9	16

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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 7, Figure 1**). The MINEX and JEB-LC C-PODs were recovered in October 2012; however, initial mooring systems were inadequate. The instrument deployed at JEB-LC was recovered badly damaged on a nearby beach approximately 6 km from the deployment location. The C-POD deployed at JEB-FS also broke free and was found ashore at Duck, North Carolina (approximately 90 km from its original deployment location). Despite instruments drifting from their moorings and some being significantly damaged, all recovered C-PODs contained usable data. While the JEB-FS unit contained detections, meaningful data comparisons with the other sites cannot be made because it is unknown when the device broke free and if it continued to make detections while it traveled.

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 (132 days) and a subsequent deployment was made at JEB-LC for another 152 days, followed by another 142 day deployment. The NSN unit was also deployed in April 2013 but not recovered. It is suspected that dredging or fishing activity 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 four successful deployments at JEB-LC, two deployments at NSN, and one at the MINEX site, and also one moderately successful deployment at JEB-FS (**Table 7, Figure 21**).

Each of the recovered units contained data that were processed using custom software provided by Chelonia Limited (www.chelonia.co.uk). 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 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.

Table 7. Deployment details of C-POD Automated Acoustic Recorders.

Deployment Date	Location	Coordinates	Total Days Deployed
6 Aug 2012	MINEX	36º 49.905'N, 75º 52.860'W	69
16 Aug 2012	JEB-FS	36º 56.411'N, 76º 01.165'W	53
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	59
7 Dec 2012	NSN	36º 57.056'N, 76º 20.498'W	132
7 Dec 2012	JEB-LC	36º 56.940'N, 76º 10.872'W	132
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	152
20 Sep 2013	JEB-LC	36º 56.927'N 76º 10.951'W	142
9 Feb 2014	JEB-LC	36º 56.952'N 76º 10.957'W	Not recovered
15 Aug 2014	JEB-LC	36⁰ 56.956'N 76⁰ 10.767'W	Unknown*
29 Sep 2014	NSN	36⁰ 57.900'N 76⁰ 19.700'W	114

* Unit was unresponsive during recovery attempt, but was later recovered on beach. Data is under-going evaluation by Chelonia, Ltd. and range of useable data is currently unknown.

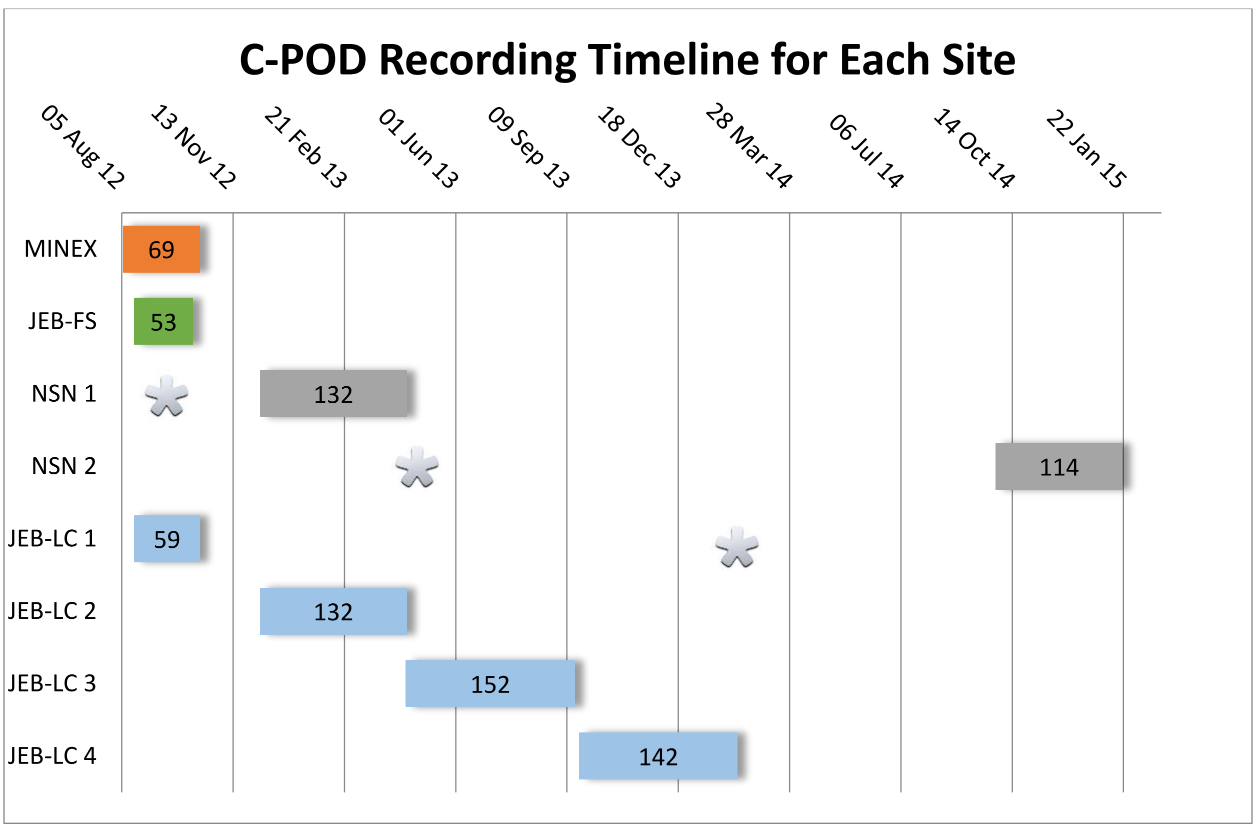

Figure 21. Timeline of C-POD deployments to date. Asterisks indicate C-POD deployments that were unrecoverable and represent temporal data gaps for NSN and JEB-LC sites.

Naval Station Norfolk C-POD

Two successful deployments were completed near NSN although incomplete coverage throughout the year prevented seasonal comparisons, and the location was changed due to risk of losing equipment at the initial site (site 1 vs. site 2, **Figure 2**) precluding additional 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 8**). Relative DPM per week for both NSN deployments is shown in **Figures 22 and 23**. A diel pattern of occurrence for bottlenose dolphins, greater in the nighttime hours, is evident at the NSN site for both deployments (**Figure 24 and 25**).

Table 8. 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	254	351,362	2,474	0.70%
JEB-LC	492	684,001	13,788	2.02%
JEB-FS	66	82,082	11,963	14.57%
MINEX	68	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, aside from 13 October to 7 December 2012, when a unit was not in the water. There was a total of 13,788 DPM for bottlenose dolphins throughout the four deployments. In general, there appears to be a trend indicating an increase in detections in the summer and a decrease in detections in the winter (**Figure 26**). A diel pattern is also evident for bottlenose dolphins at JEB-LC with the majority of DPM occurring during the nighttime hours (**Figure 27**).

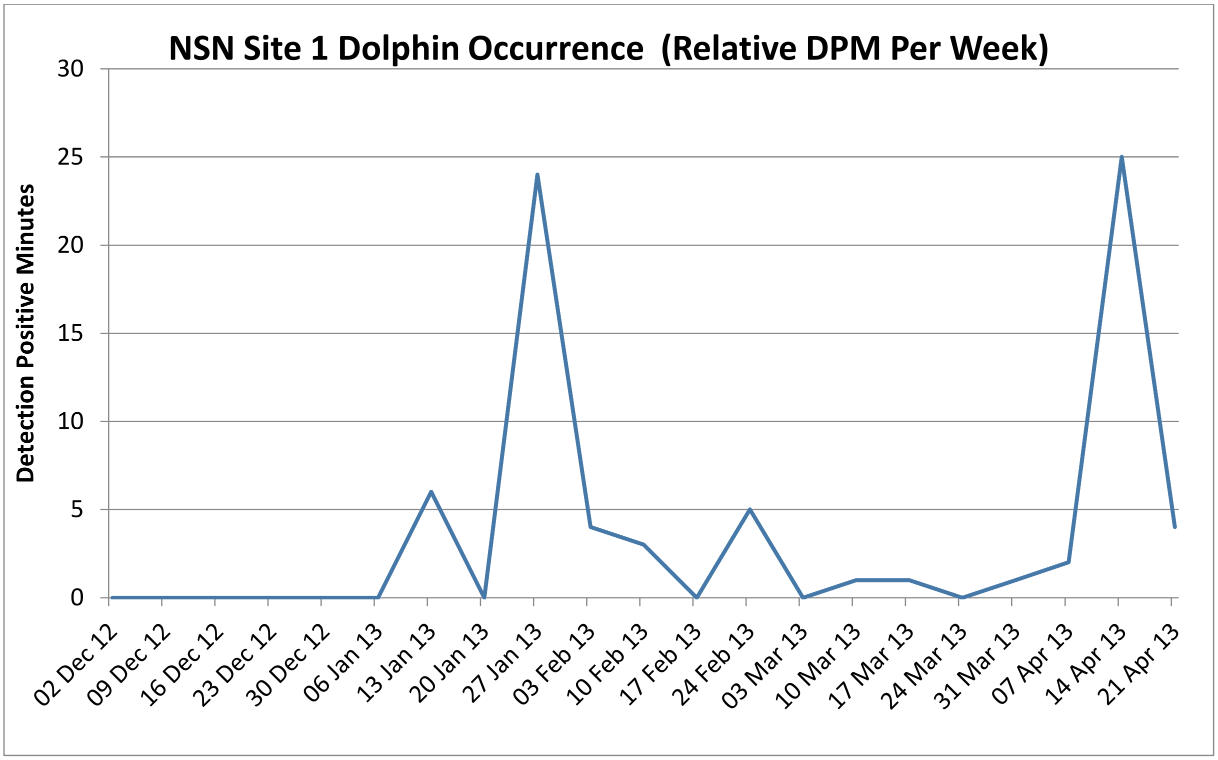

Figure 22. Relative DPM for bottlenose dolphins at the NSN site 1*.
* Weeks at the beginning and end of each deployment may not be a full 7 days.

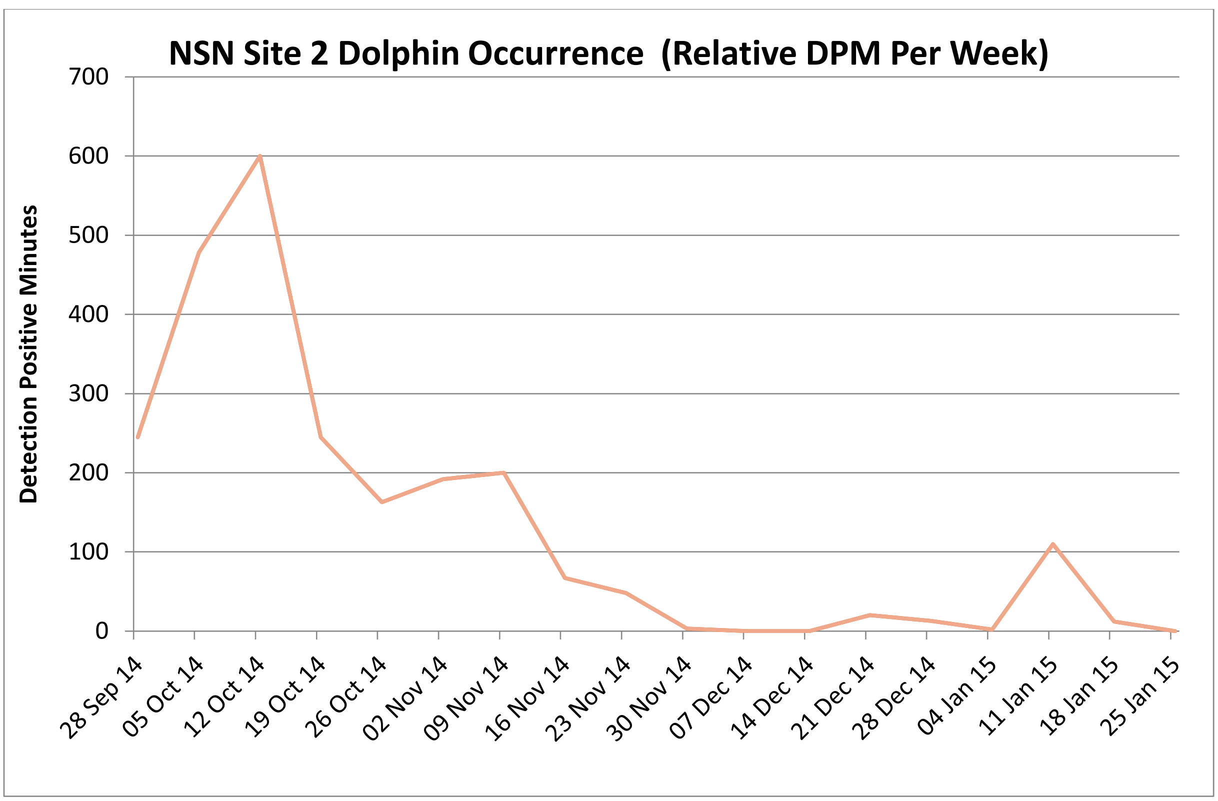

Figure 23. Relative DPM for bottlenose dolphins at the NSN site 2*.
* Weeks at the beginning and end of each deployment may not be a full 7 days.

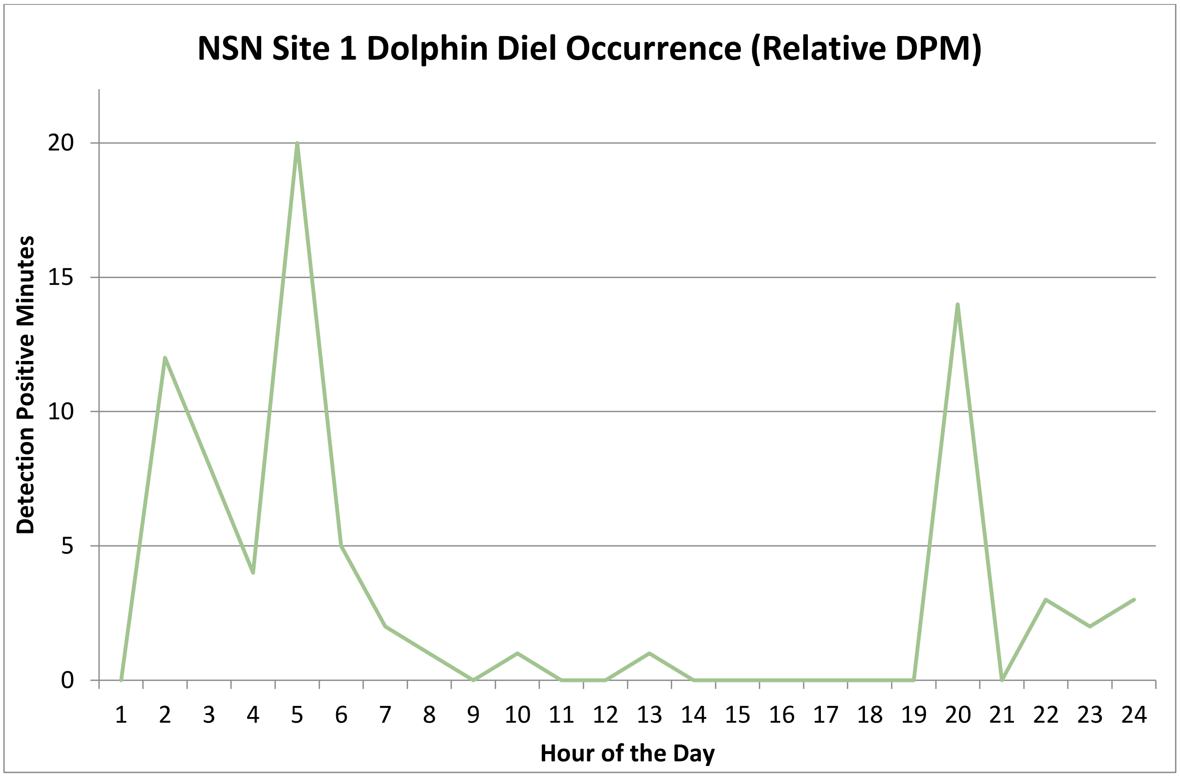

Figure 24. DPM of bottlenose dolphins, binned by hour, to determine diel acoustic activity patterns the NSN site 1.

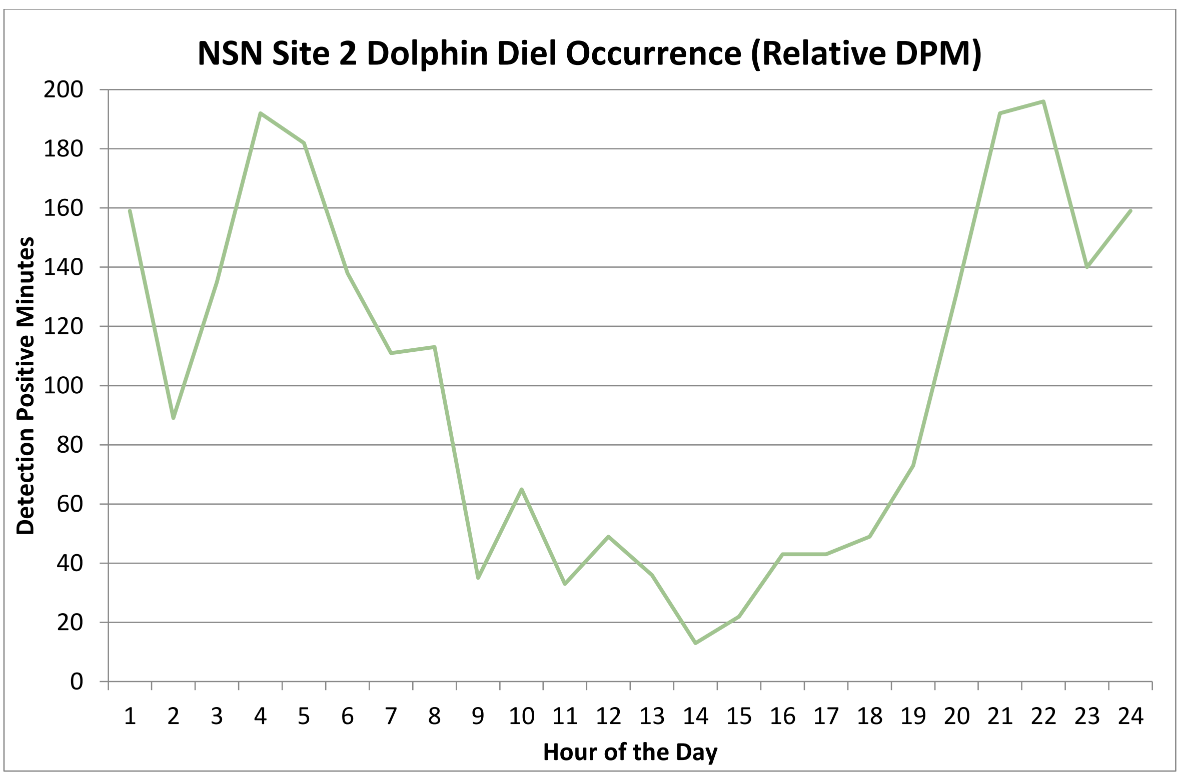

Figure 25. DPM of bottlenose dolphins, binned by hour, to determine diel acoustic activity patterns at NSN site 2.

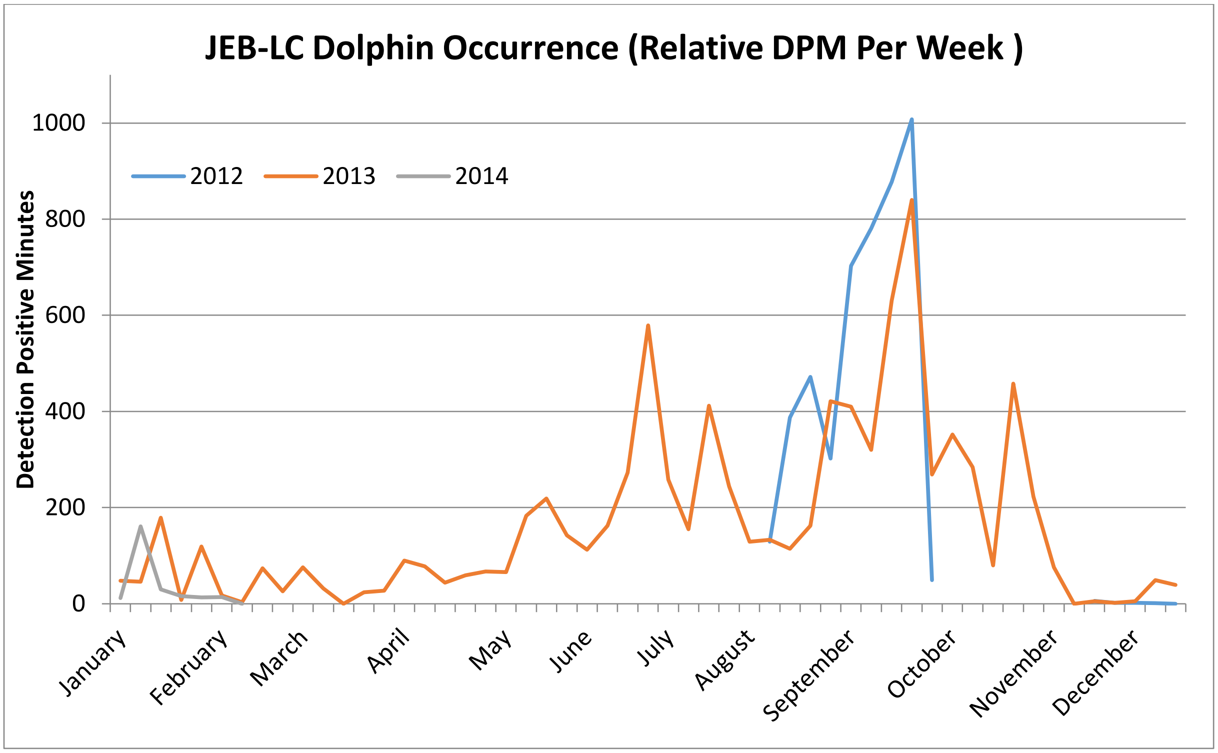

Figure 26. Relative DPM for bottlenose dolphins at the JEB-LC for all deployments*.
* Weeks at the beginning and end of each deployment may not be a full 7 days.

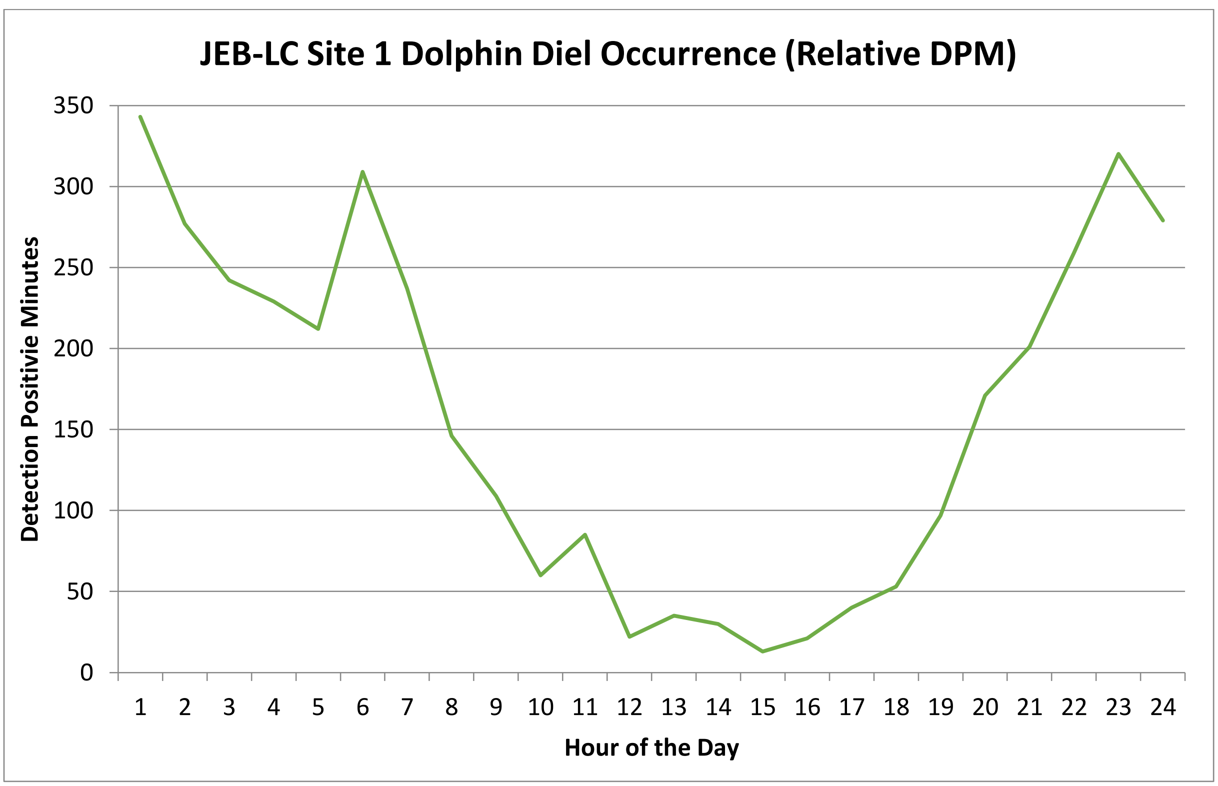

Figure 27. DPM of bottlenose dolphins, binned by hour, to determine diel acoustic activity patterns at the JEB-LC site.

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 28**). While dolphin DPM calculated as a percentage of total minutes logged at JEB-FS was highest when compared to all other sites (**Table 8**), significance cannot be deduced as the unit was not at a fixed location; thus, dolphin presence was not in relation to location.

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 29**). This particular C-POD had one of the shortest deployment durations (53 days) and contained the greatest number of dolphin detections, at nearly 15 percent of the time logging.

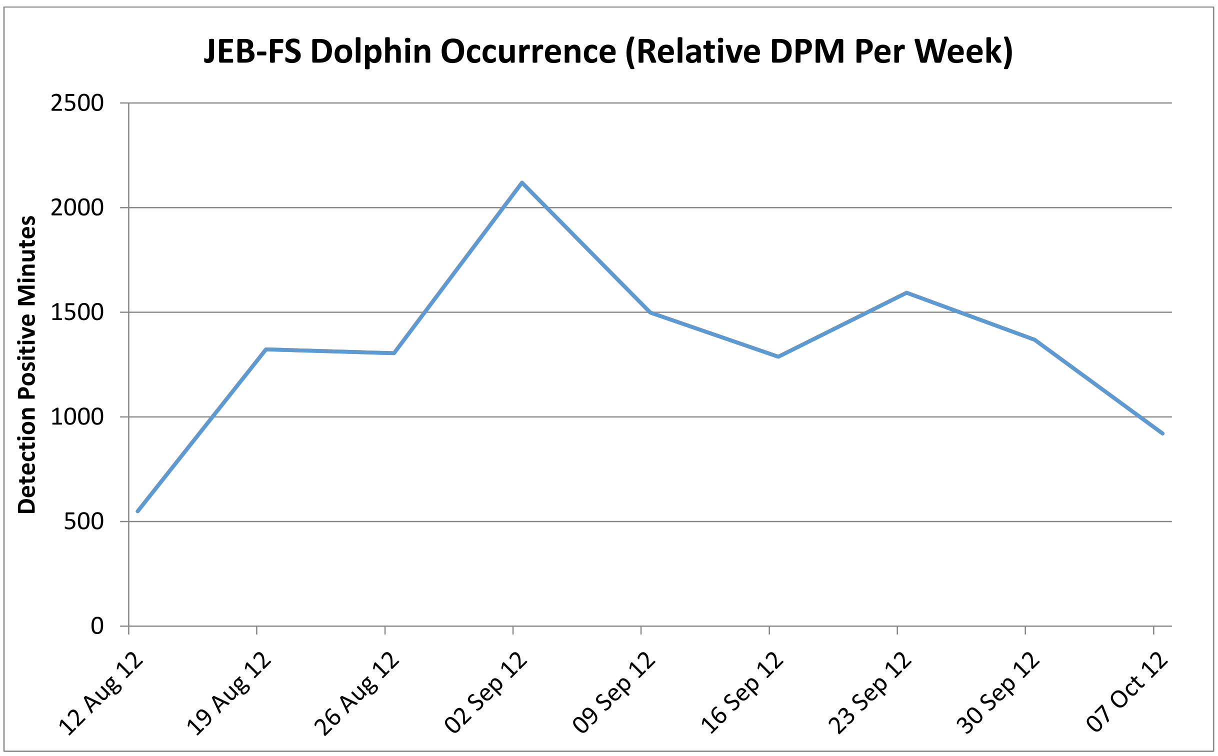

Figure 28. Relative DPM for bottlenose dolphins at the JEB-FS site*°.

* 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.

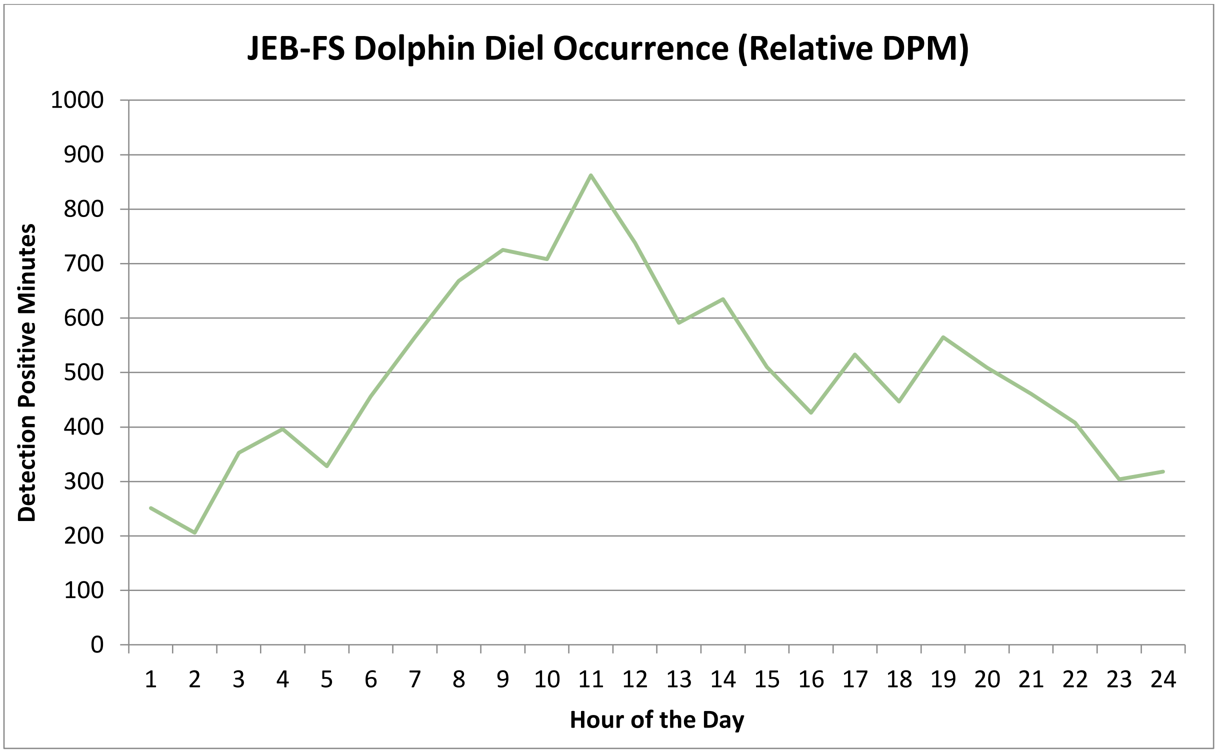

Figure 29. DPM of bottlenose dolphins, binned by hour, to determine diel acoustic activity patterns at the JEB-FS site.

MINEX C-POD

The single deployment at the MINEX site yielded 69 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 30**). There was also a diel trend with the majority of detections occurring in the nighttime hours (**Figure 31**).

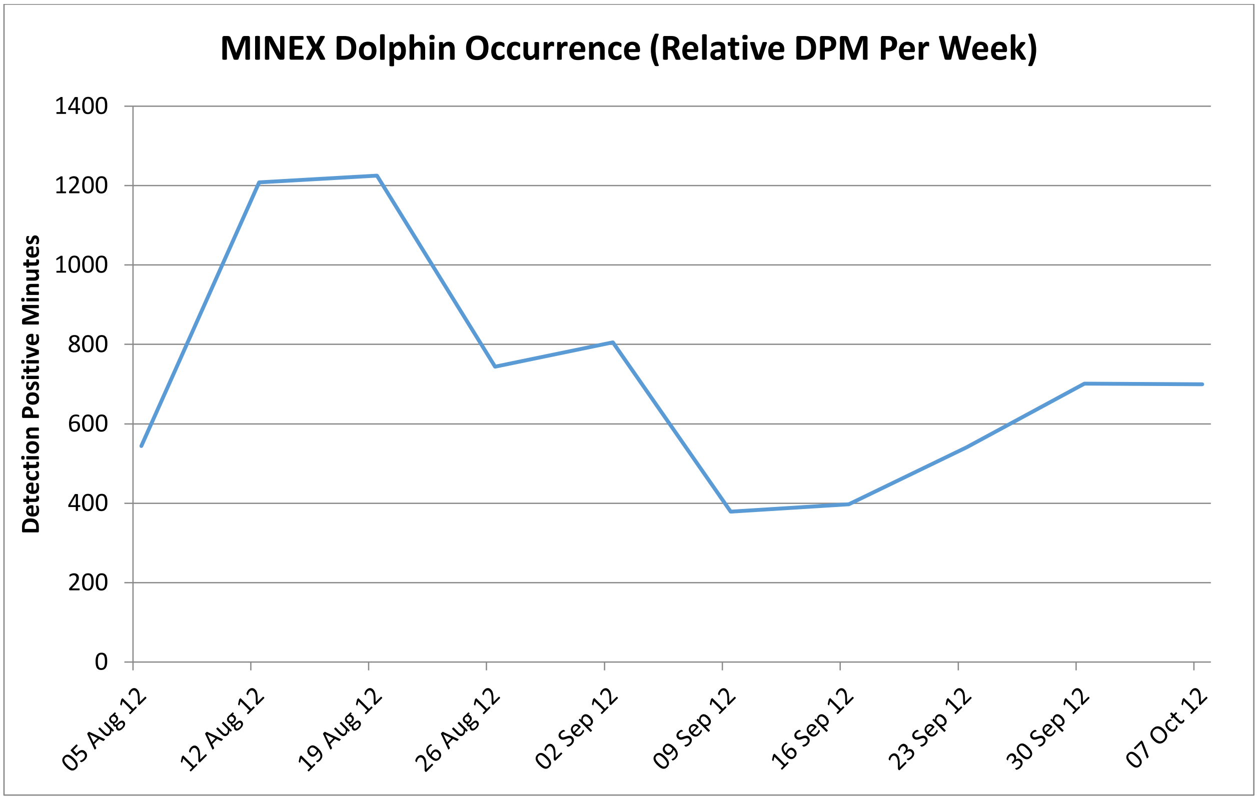

Figure 30. Relative DPM for bottlenose dolphins at the MINEX site*.
* Weeks at the beginning and end of each deployment may not be a full 7 days.

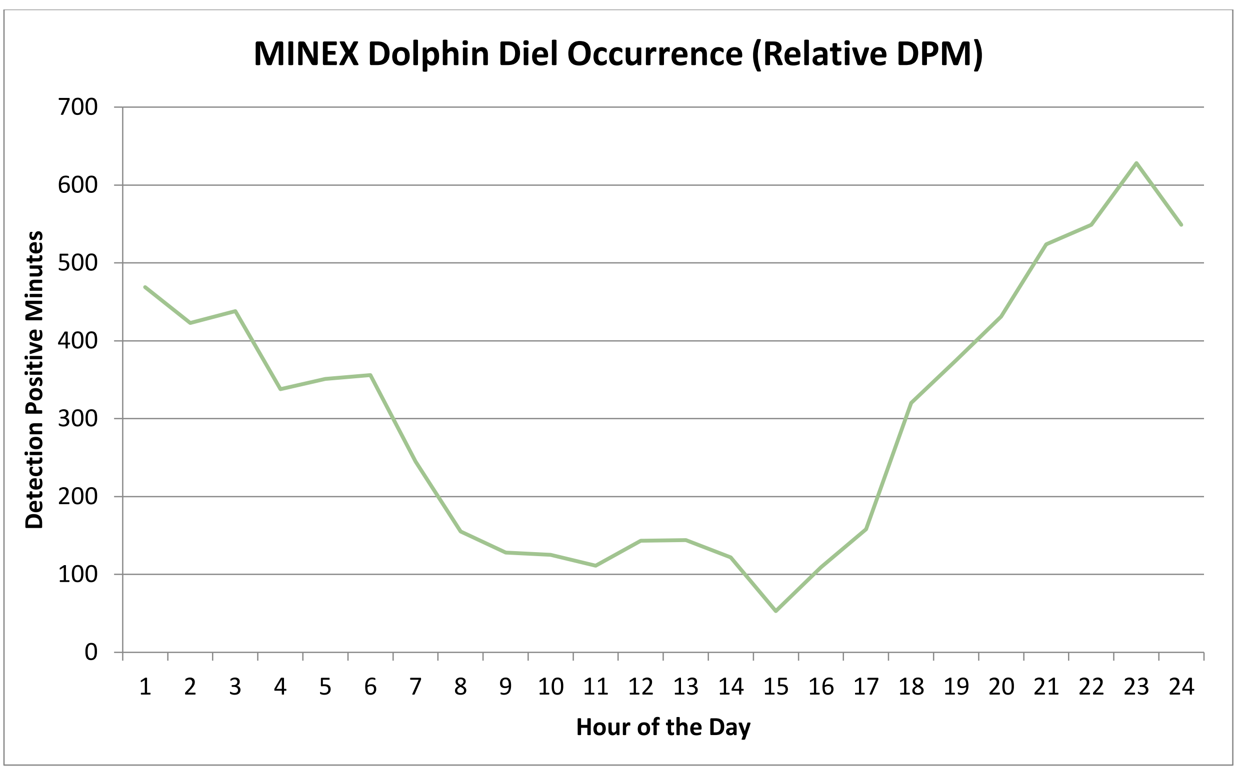

Figure 31. DPM of bottlenose dolphins, binned by hour, to determine diel acoustic activity patterns at the MINEX site.

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6. Conclusions

6.1 Vessel Line-transect Surveys

Results confirmed preliminary 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 1,279 individuals present during the fall (density = 4.12 individuals per km^2), and 887 individuals in summer (density = 2.86 individuals per km^2). However, bottlenose dolphins do not completely move out of these waters in other seasons, with more than 100 individuals still present in winter and spring months. These results agree with previous studies that indicate an increased presence in summer and fall (Blaylock 1988, Barco 1995), but this study furthers the science by measuring the abundance throughout the year and providing updated information. Densities in offshore waters of the MINEX zone are generally lower than in the coastal strip, although more data are needed to estimate reliable numbers for all four seasons. Preliminary indications suggest density in the MINEX area in fall is reasonably high (D = 2.23 individuals per km^2), and that over 2,600 bottlenose dolphins likely inhabit the entire study area in fall months. Continuing the monthly transect surveys will improve the precision of the estimates and reduce the CVs. A more robust dataset will also allow for further analyses, including potential stratification of the survey area to provide density estimates for sub-areas within the INSHORE zone. This stratification will be useful to narrow down bottlenose dolphin densities in specific areas of U.S. Navy activity within the study area, and allow management to potentially reduce potential impacts.

Transects for both survey areas have been modified to better align with U.S. 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 for surveys after May 2014. The INSHORE boundary did not change; however, the initial zig-zag pattern (**Figure 1**) of the INSHORE transects introduces 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 led to uneven coverage (Thomas et al. 2007). Adjustments have been made with assistance from experts at the Centre for Research into Ecological and Environmental Modeling, using tools in the program DISTANCE 6.0 to reduce potential bias, while using as much existing data as possible in later analyses (**Figure 2**). Surveys have been completed using the new INSHORE transects beginning in February 2014.

When comparing the new estimates presented here with the estimates from last year's progress report (Engelhaupt et al. 2014), all of the new estimates are more precise (and several of the INSHORE estimates are now quite precise, with CVs in the 20-30 percent 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. Some estimates are quite different from the previous ones (for instance, the MINEX summer and fall estimates are much higher). This may result partly from reduced bias, but it must be remembered that the previous estimates were highly preliminary and in many cases based on extremely small sample sizes. It is encouraging to see that many of the estimates of density and abundance have not changed much from the older ones (e.g., MINEX winter and spring estimates, and all INSHORE estimates are at least broadly similar), and this is suggestive that the somewhat-inferior survey design that was used in the early stages did not produce large biases in the estimates.

6.2 Photo-ID Surveys

Though continued photo-ID effort and 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. Dolphins that were re-sighted were in close proximity (within 21 km) to their original sighting locations, and in most cases these re-sights occurred within a couple months of each other. Only two re-sightings were longer than 3 months apart (NVB0033, first sighted in September of 2012, and re-sighted in July of 2013; and NVB 0050, first sighted in September of 2012, and re-sighted in September of 2013). As the analysis continues and the catalog grows, observers 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, Gubbins et al. 2003, Waring et al. 2014). Further support of this migration pattern is our sighting and re-sighting of NVB0385, which was also matched to freeze-branded dolphin (FB-405), initially tagged and sighted multiple times in North Carolina. Additional matches found during the on-going comparison of this catalog to the existing Mid-Atlantic Bottlenose Dolphin Catalog will likely provide 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 the 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. Problems with the initial mooring design and deployment in areas of high traffic and fishing activity resulted in loss of gear and prevented the planned coverage, and required adjustments throughout the project. Risk of gear loss through entanglement is still prevalent, and coverage has been reduced due to lost equipment. 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 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 simply 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 has not been a part of the work plan for this project to date.

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, but the instrument was deployed during winter months when dolphin presence is expected to be low, which partly explains the reduced number of detections. Further deployments at the new NSN site throughout the year will allow a valid comparison to other sites. NSN houses a large portion of the U.S. Navy's fleet, and potential pier construction in the area means this is one of the sites of greatest interest.

C-PODs deployed at JEB-LC were the only deployments spanning a full year, with data collected during all seasons. In general, bottlenose dolphin presence, assessed as DPM, was higher in the summer and fall months. Detections were still made sporadically during the winter, 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 this 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 percent) supports the updated visual survey results, in which the abundance estimates for the MINEX transect coverage area has increased to 709 for summer and 1,333 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.

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 are improving 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 is 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 are 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.

7. Recommendations

While this study provides an essential foundation towards determining the occurrence and density of bottlenose dolphins in these areas, logistical challenges inhibited the team from achieving even seasonal coverage. With the majority of the U.S. Navy Marine Species Monitoring Program's east coast efforts focusing on sonar training activity, this project's aim to monitor marine mammal presence/absence, movements, site fidelity, and distribution patterns associated with underwater detonation events within and adjacent to MINEX W-50 is of particular interest, given the number of exercises, as well as construction, and sheer volume of military, commercial, and recreational traffic within the general area.

As discussed in the conclusions, the following are a list of recommendations to further advance the project as a whole:

1. Continue monthly photo-ID surveys and expand area coverage. The overlap of stocks of bottlenose dolphins in the study area is unique and by increasing the photo-ID effort, and thus the photo-ID catalog, observers will gain valuable insight into the movement patterns (both small- and large-scale) and site fidelity of dolphins frequenting U.S. Navy high traffic and training waters. Currently, the discovery curve of the existing photo-ID catalog shows no sign of a plateau, a result that is highly suggestive of a need for more thorough coverage to fully understand the dynamics of individual movement patterns within the region. Coverage to date has been focused on the areas of increased U.S. Navy activity, but investigating dolphins sighted in adjacent areas could lead to more re-sightings and a better understanding of the site fidelity and home range of animals already in the NVB catalog.
2. Employ satellite-monitored and DTAG tagging techniques to clarify medium time-scale movement and residency patterns of bottlenose dolphins. Tagging efforts will provide longer-term movement patterns to identify overlap with the VACAPES training ranges and shipping lanes. Spreading the deployment of tags over a 12-month period will considerably advance our understanding on how bottlenose dolphins utilize these waters.
3. Continue acoustic monitoring with C-PODs at the NSN and JEB-LC sites. The C-PODs provide a low-cost means to detect presence/absence of dolphins and have proven to be a significant complement to the visual surveys. However, the lack of year-round coverage in the primary areas of interest can be addressed with continued deployments.
4. Continue the planned EAR package in Site B of the MINEX W-50 area to a.) detail the daily occurrence of marine mammals near the primary location of MINEX activities, b.) detect underwater explosions associated with training events, and c.) quantify the acoustic activity of dolphins in response to underwater explosions.

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8. Acknowledgements

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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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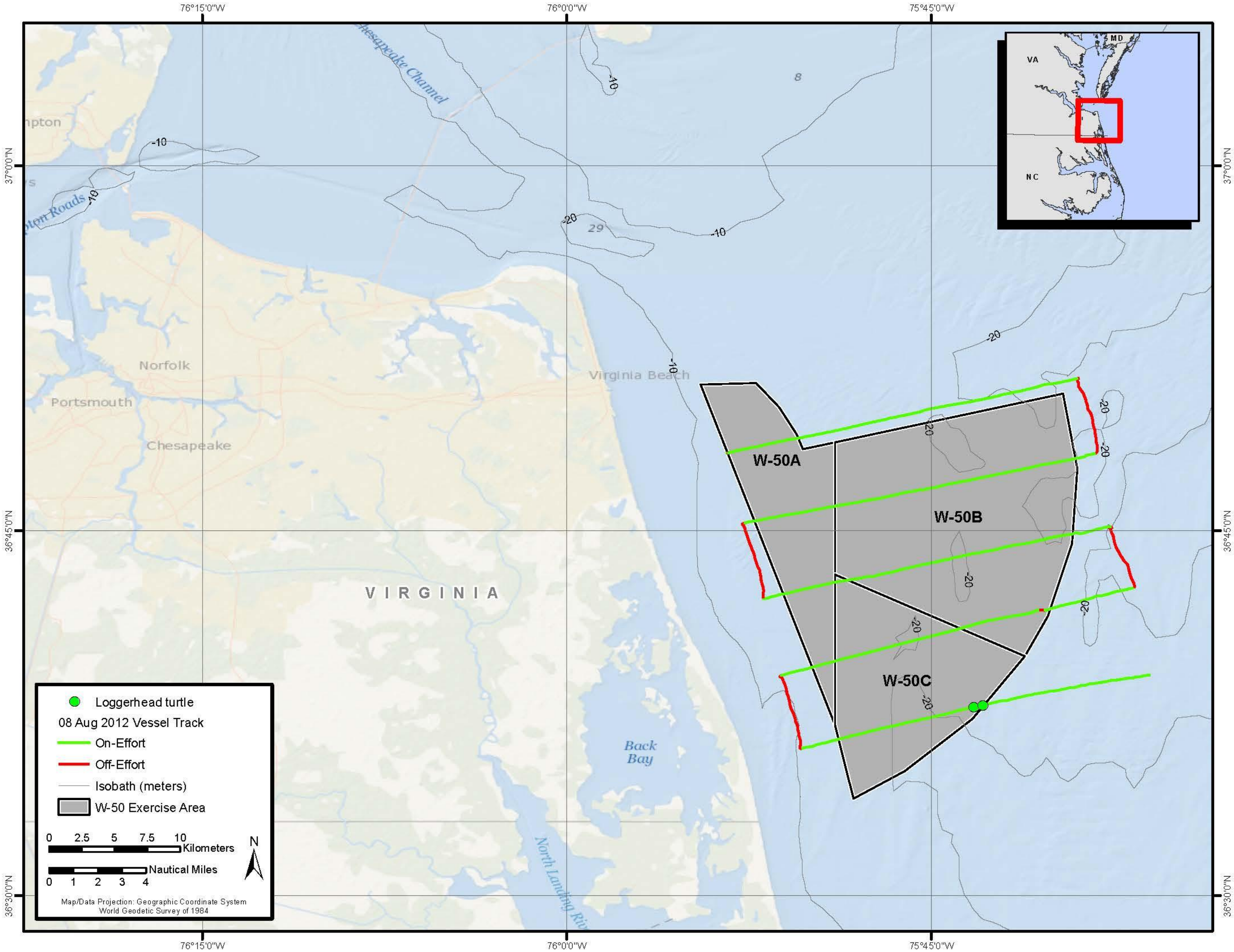

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36°45'0"N
36°30'0"N
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MD
NC
Chesapeake Channel
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
Loggerhead turtle
08 Aug 2012 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
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0 1 2 3 4 Nautical Miles
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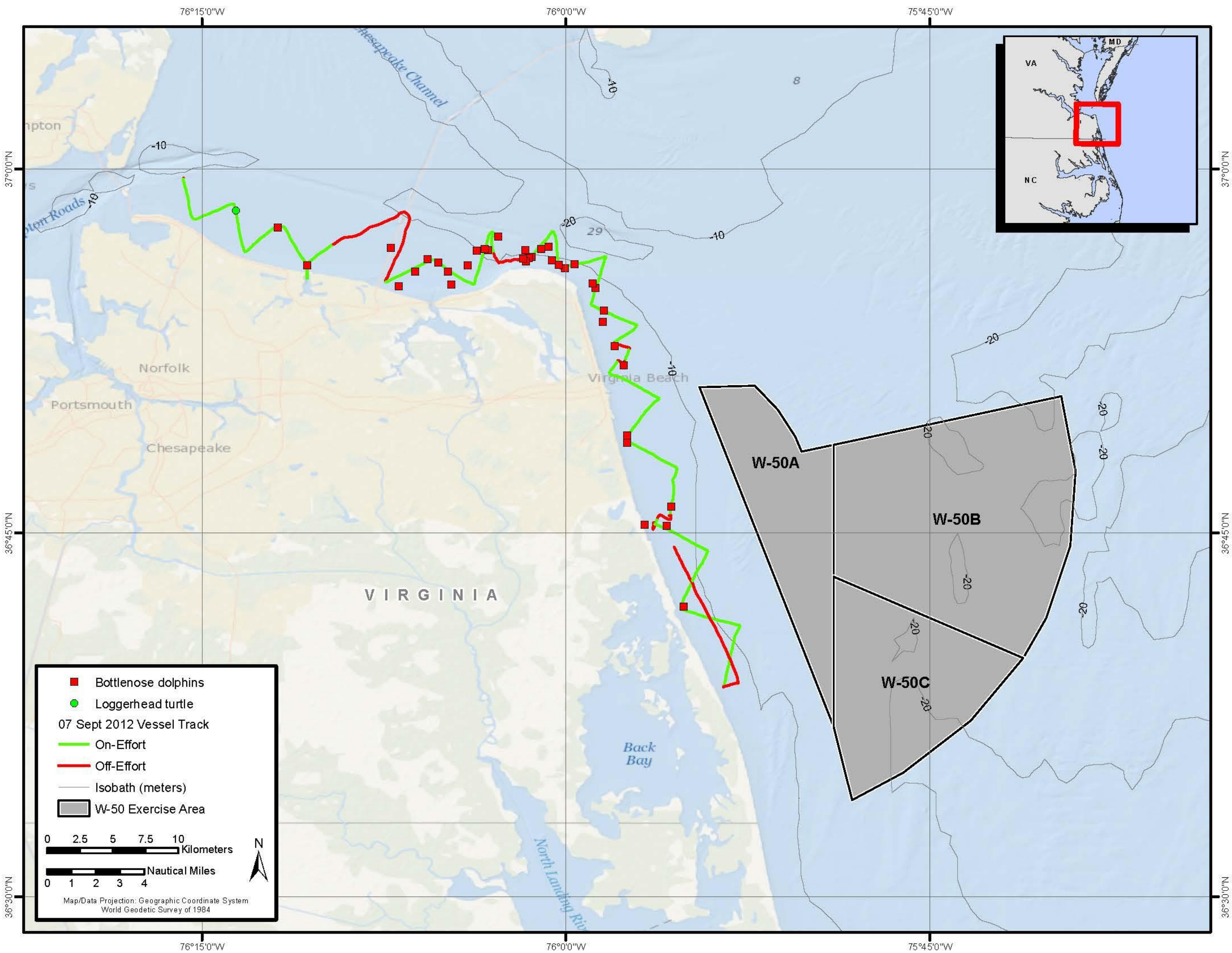
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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Chesapeake Channel
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
VA
MD
NC
Bottlenose dolphins
Loggerhead turtle
07 Sept 2012 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
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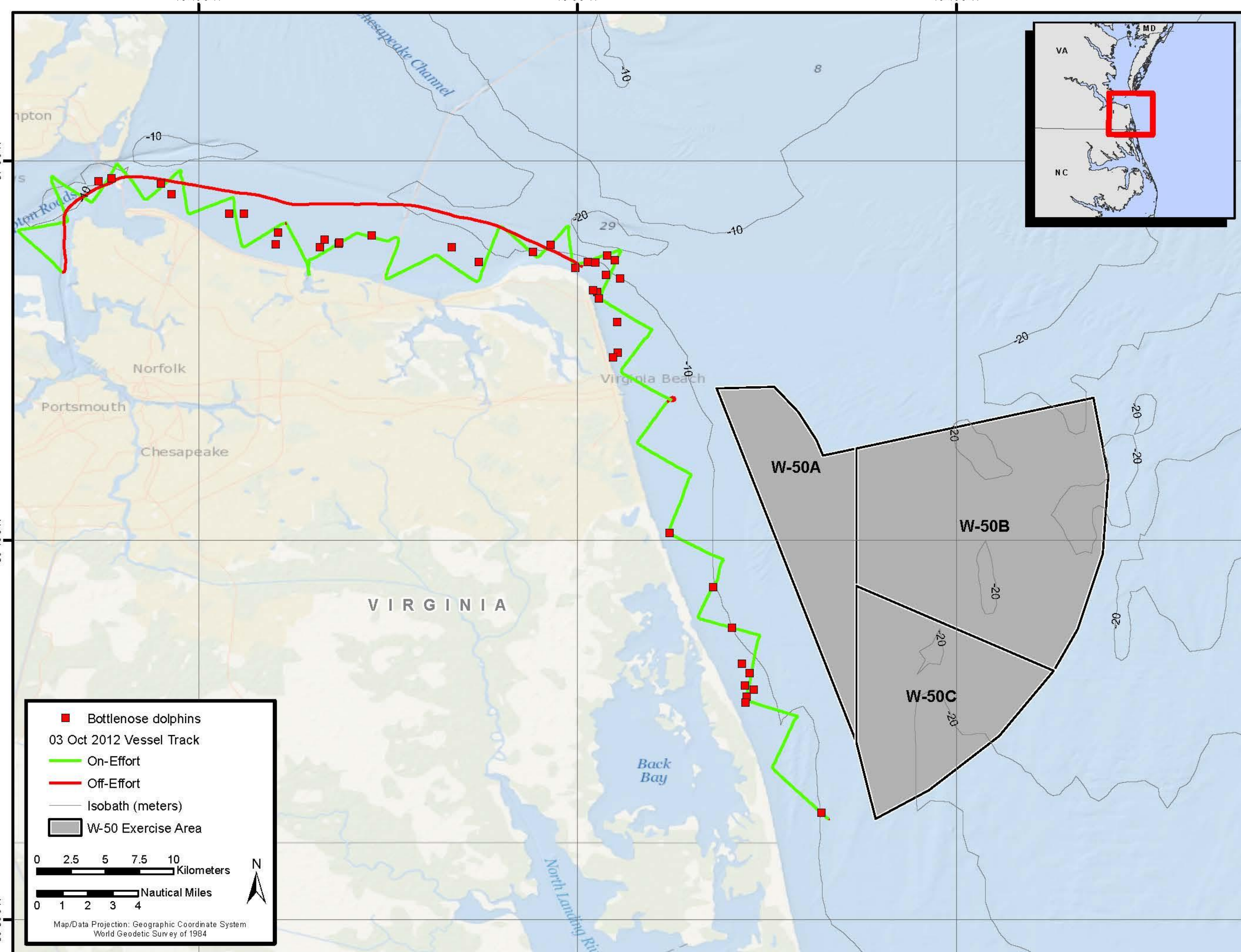
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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Chesapeake Channel
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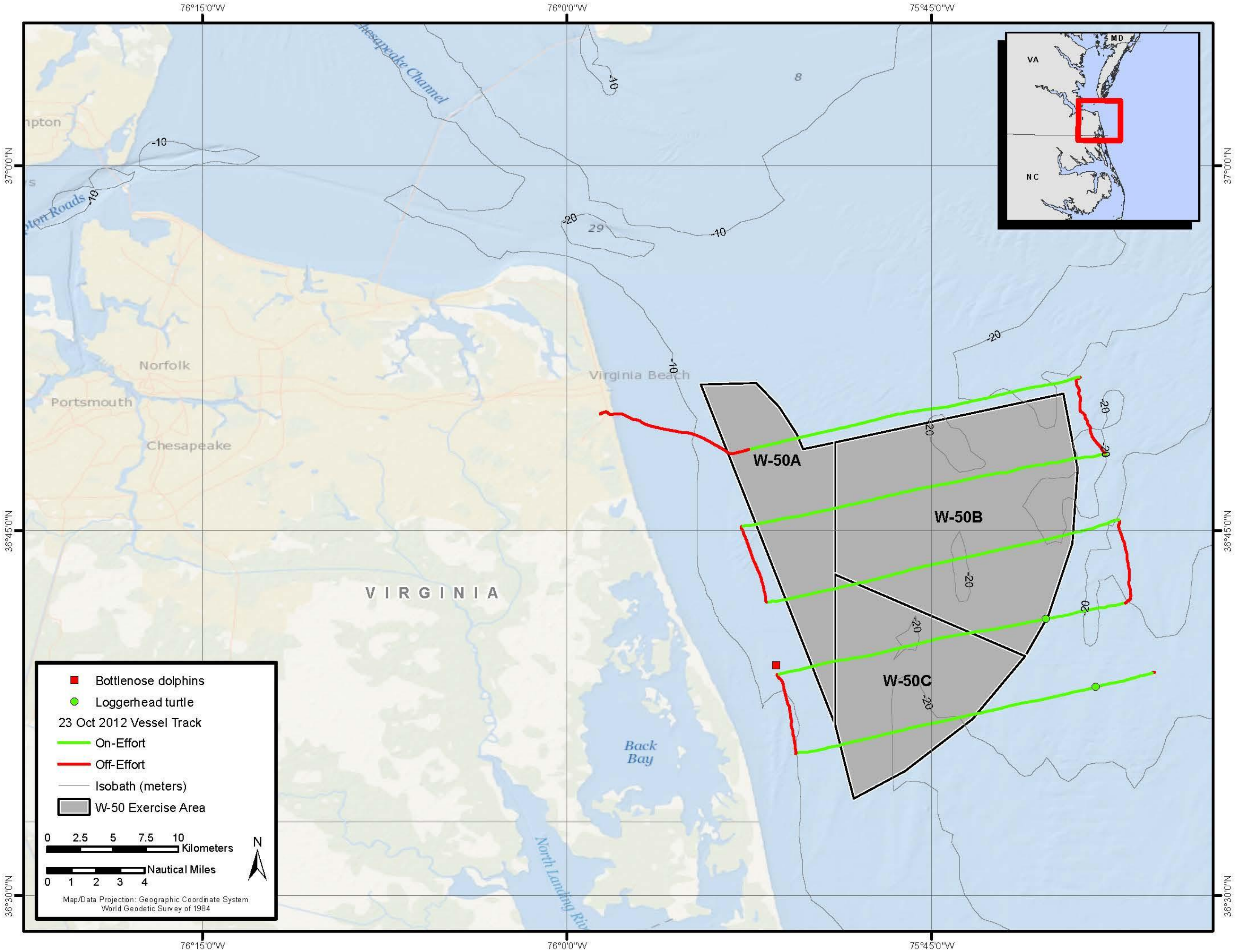
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
VA
MD
NC
Bottlenose dolphins
03 Oct 2012 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
Kilometers
Nautical Miles
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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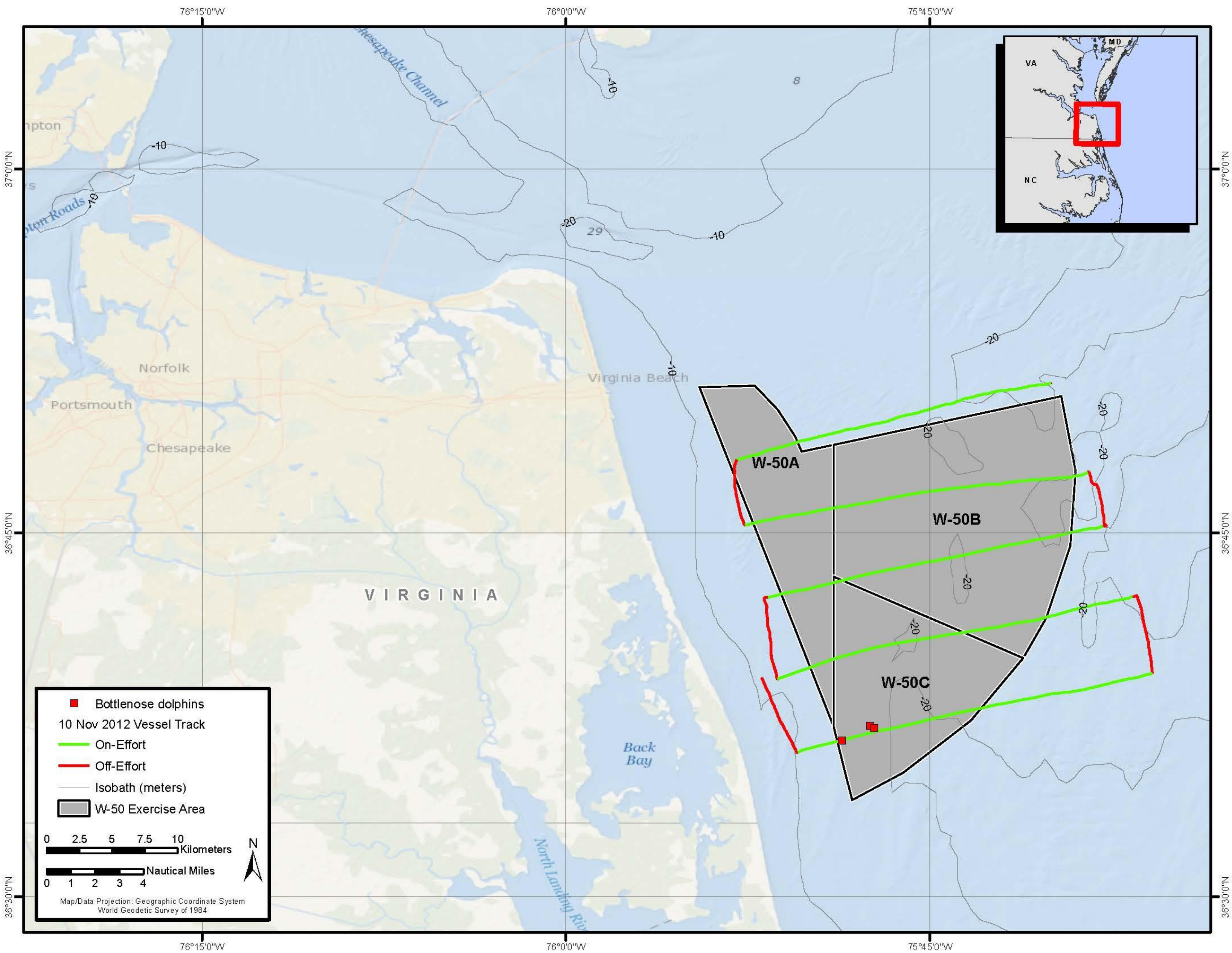
76°0'0"W
75°45'0"W
37°0'0"N
36°45'0"N
36°30'0"N
Chesapeake Channel
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
VA
MD
NC
Bottlenose dolphins
Loggerhead turtle
23 Oct 2012 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 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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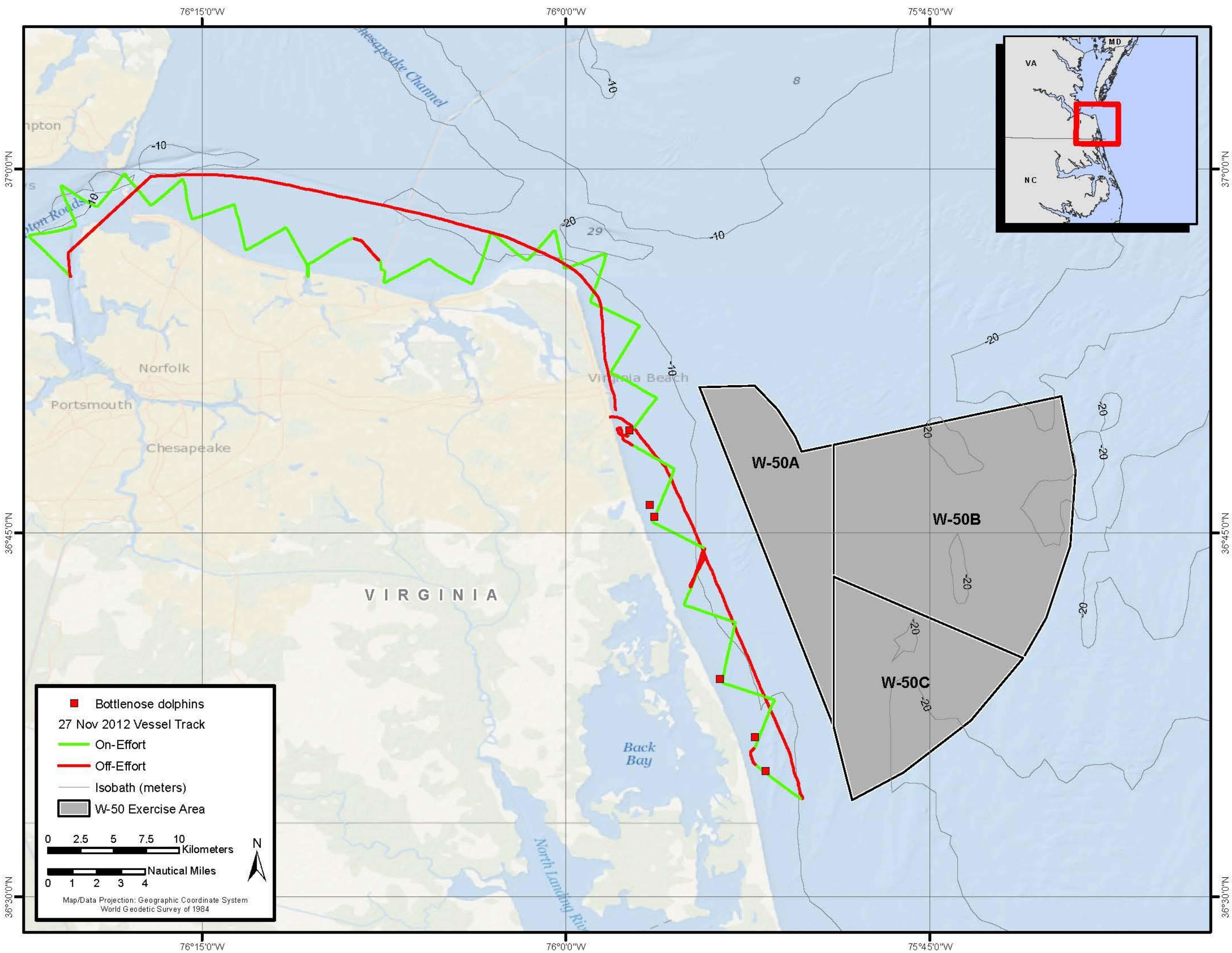
VA
MD
NC
Chesapeake Channel
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
Bottlenose dolphins
10 Nov 2012 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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Chesapeake Channel
Norfolk
Portsmouth
Chesapeake
Virginia Beach
V I R G I N I A
Back Bay
North Landing River
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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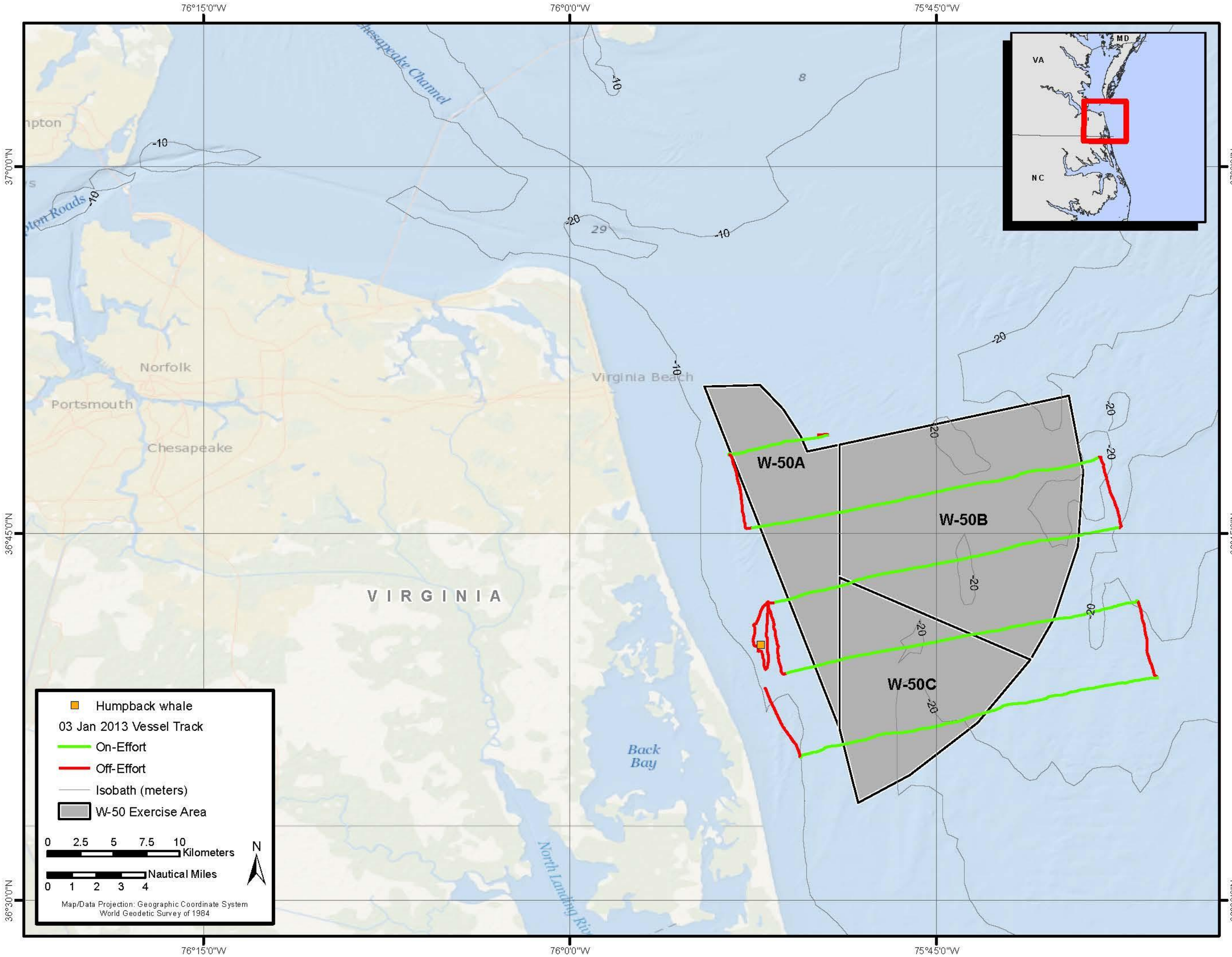
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984



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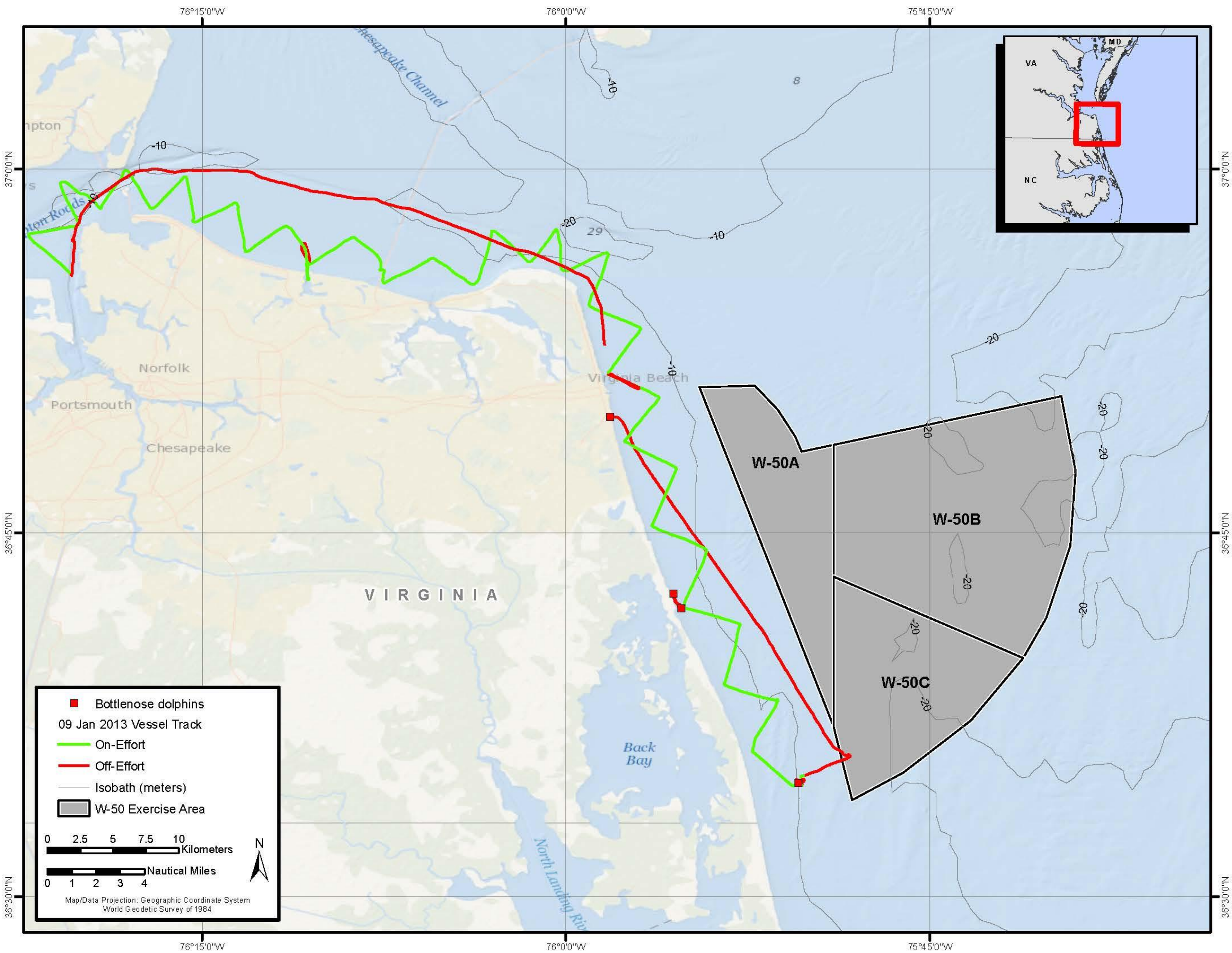
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
VA
MD
NC
Humpback whale
03 Jan 2013 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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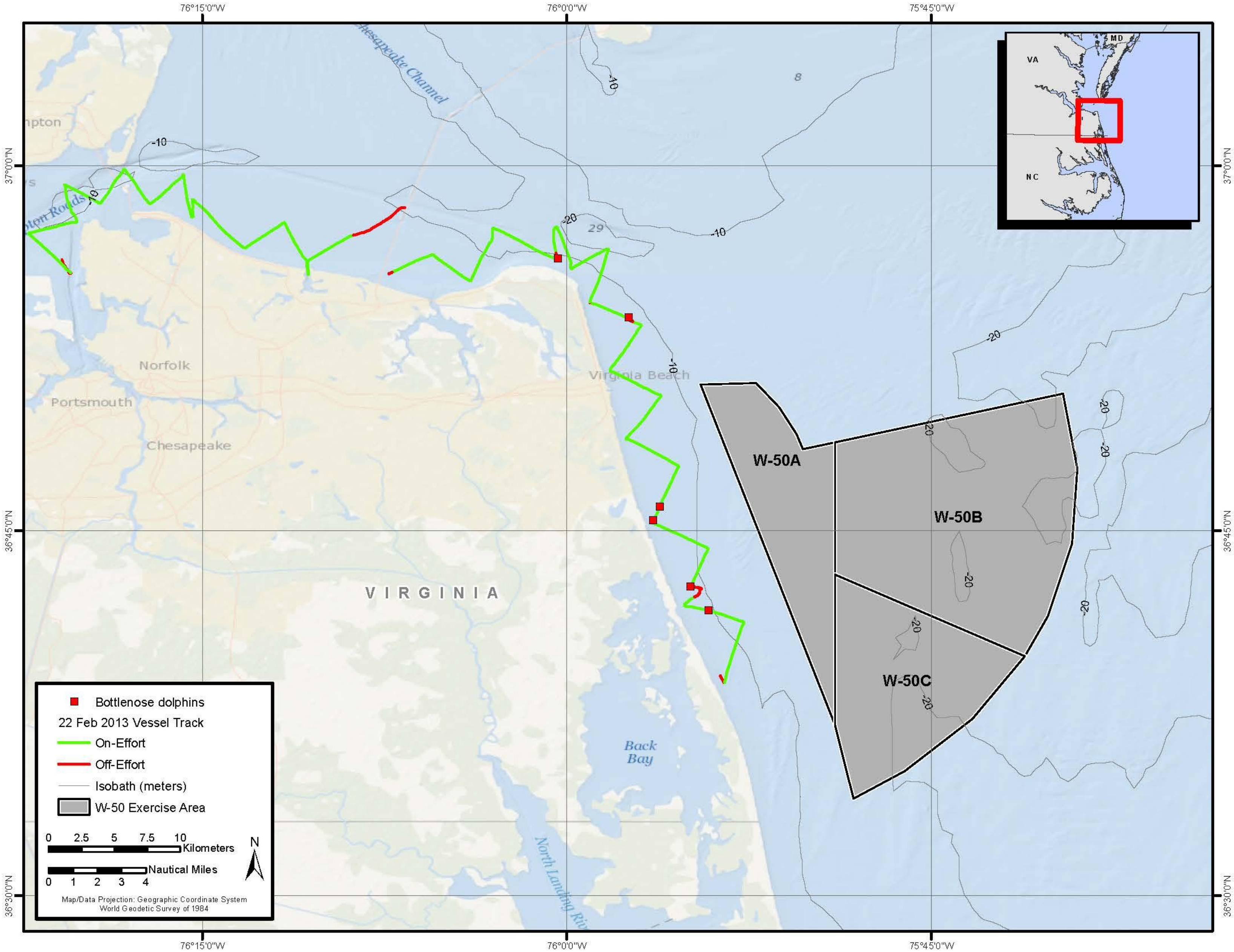
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
W-50A
W-50B
W-50C
VA
MD
NC
Bottlenose dolphins
09 Jan 2013 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
Nautical Miles
0 1 2 3 4
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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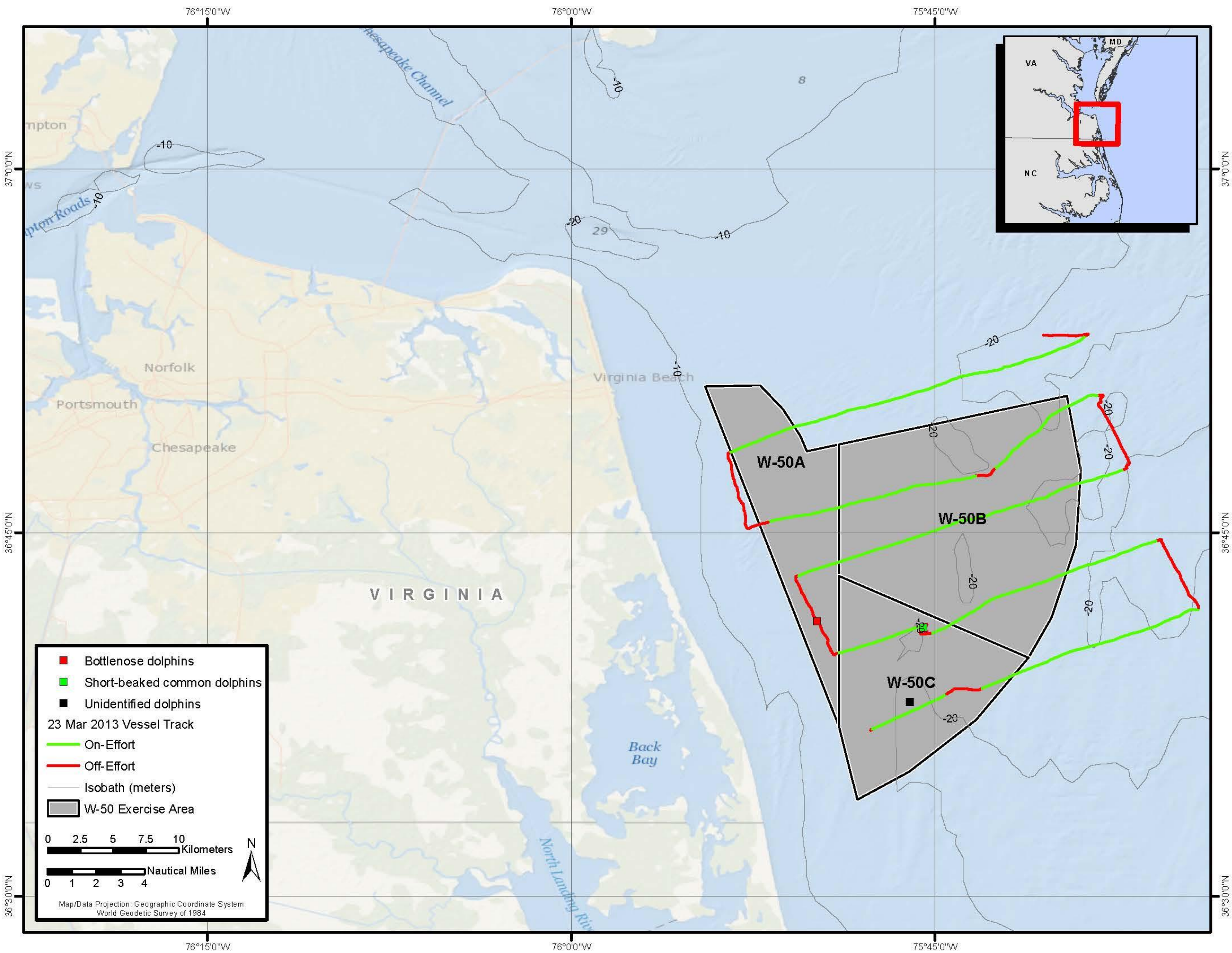
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing Riv
W-50A
W-50B
W-50C
VA
MD
NC
Bottlenose dolphins
22 Feb 2013 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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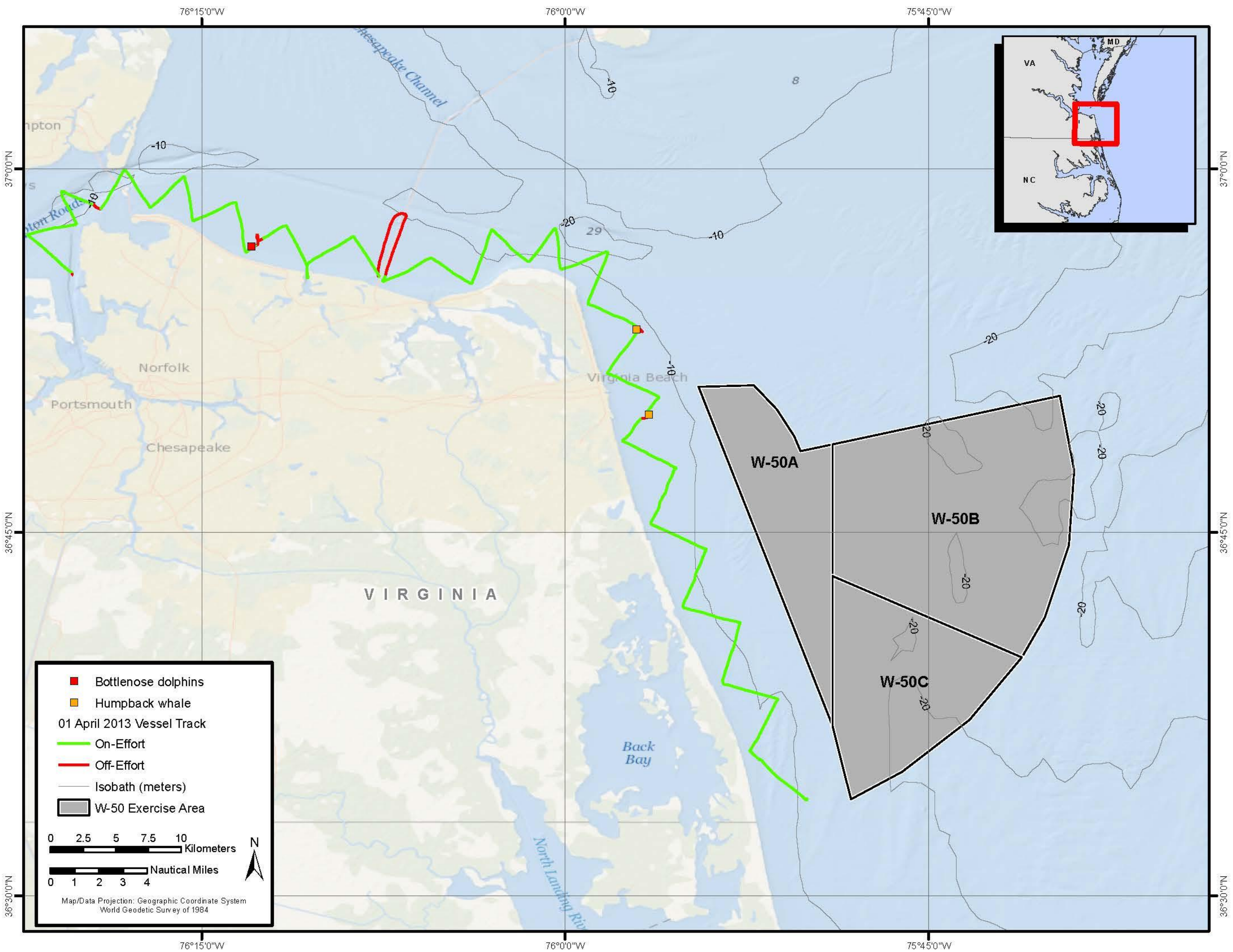
MD
NC
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
W-50A
W-50B
W-50C
Bottlenose dolphins
Short-beaked common dolphins
Unidentified dolphins
23 Mar 2013 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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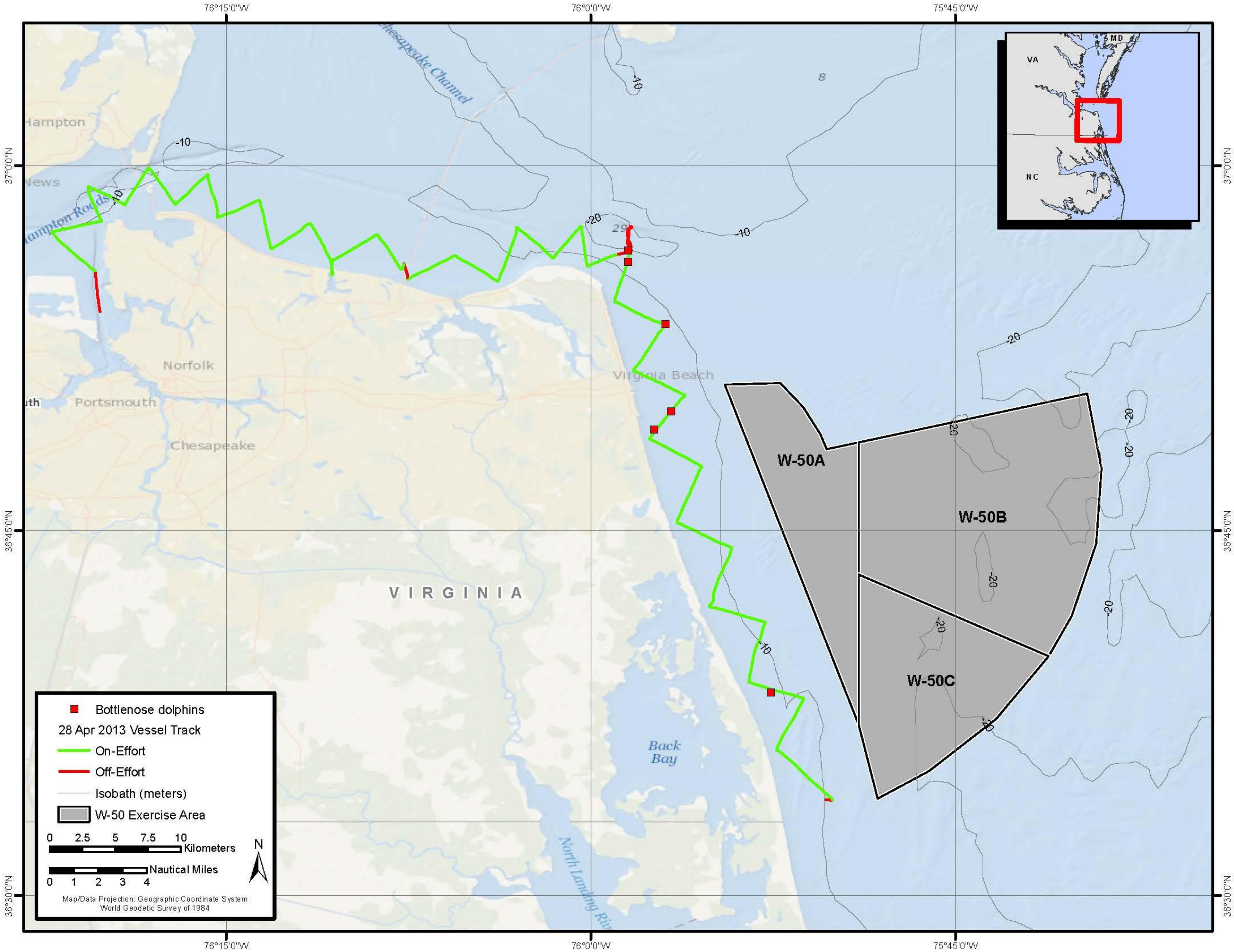
Norfolk
Portsmouth
Chesapeake
Virginia Beach
V I R G I N I A
Back Bay
North Landing River
W-50A
W-50B
W-50C
VA
MD
NC
Bottlenose dolphins
Humpback whale
01 April 2013 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984



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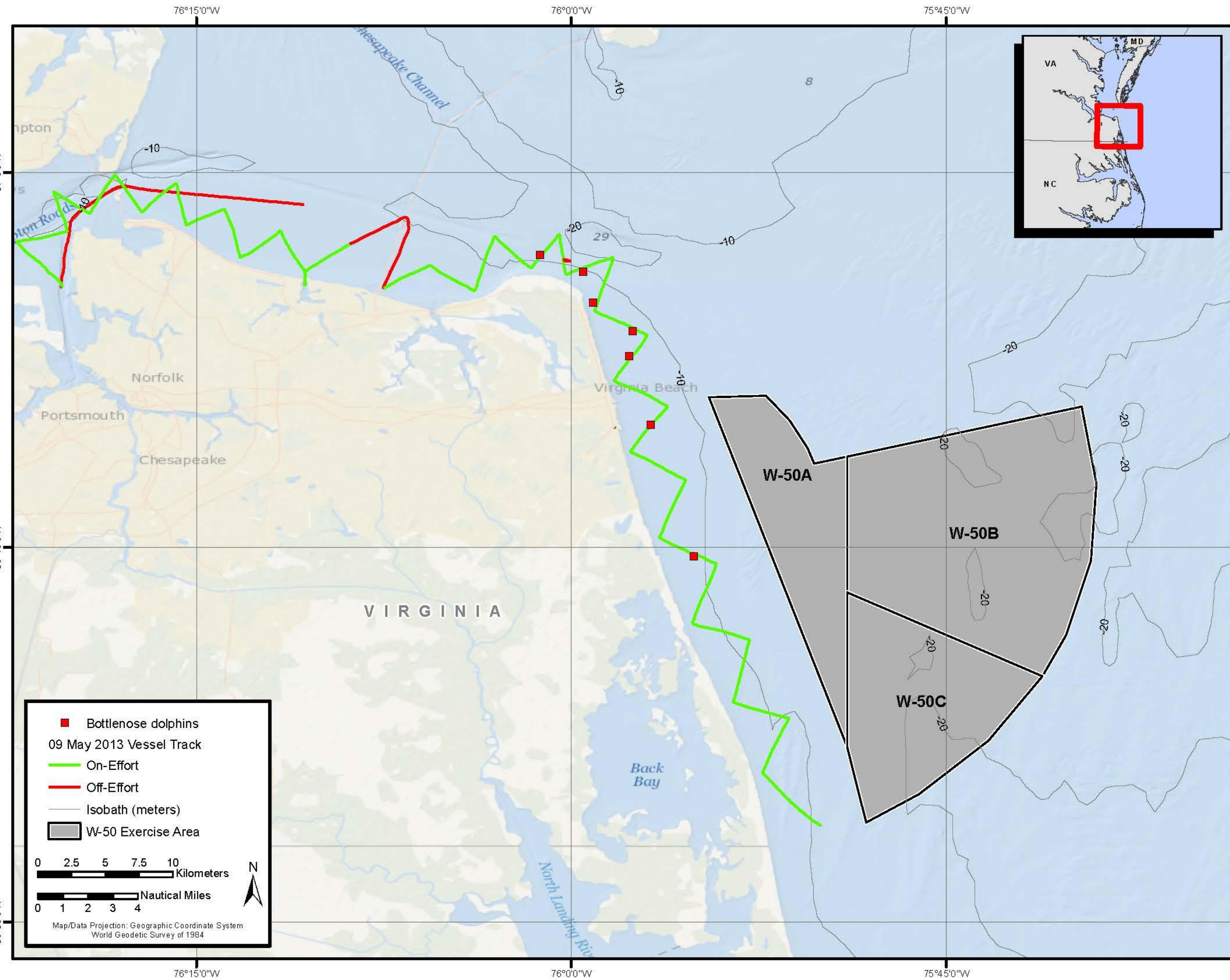
Hampton
News
Hampton Roads
Chesapeake Channel
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
VA
MD
NC
Bottlenose dolphins
28 Apr 2013 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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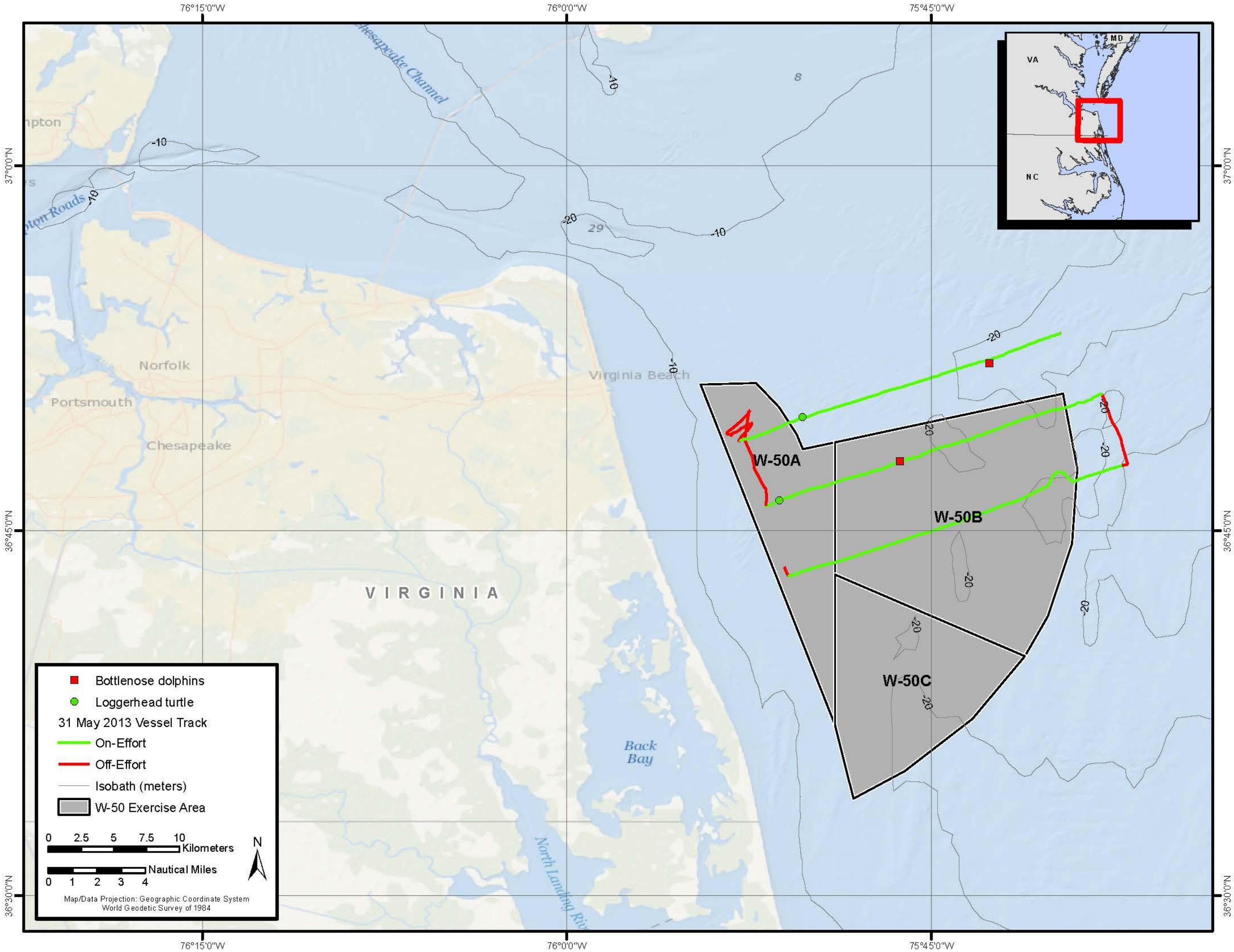
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
VA
MD
NC
Bottlenose dolphins
09 May 2013 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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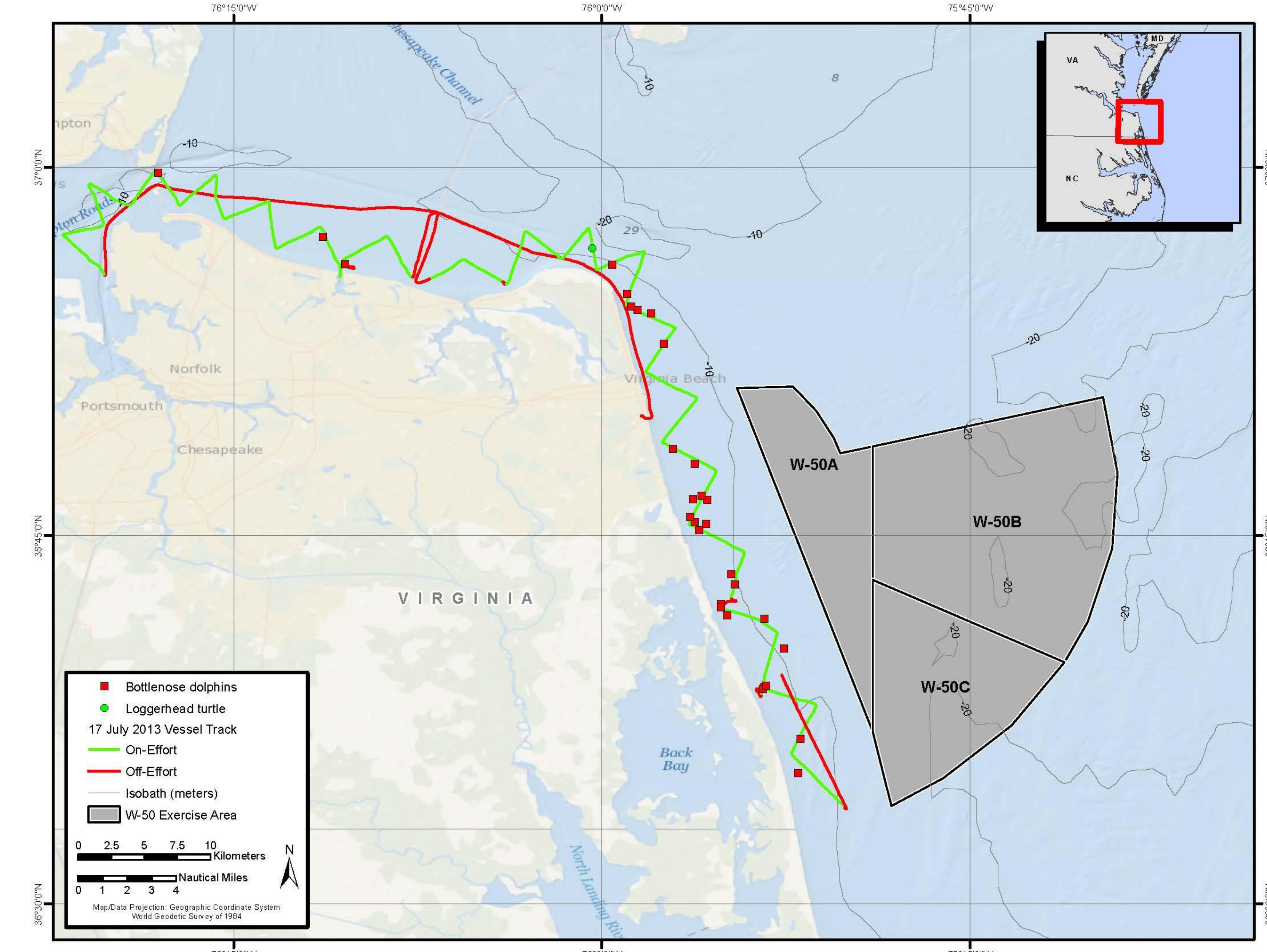
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing Riv
W-50A
W-50B
W-50C
VA
MD
NC
Bottlenose dolphins
Loggerhead turtle
31 May 2013 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
Nautical Miles 0 1 2 3 4
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984



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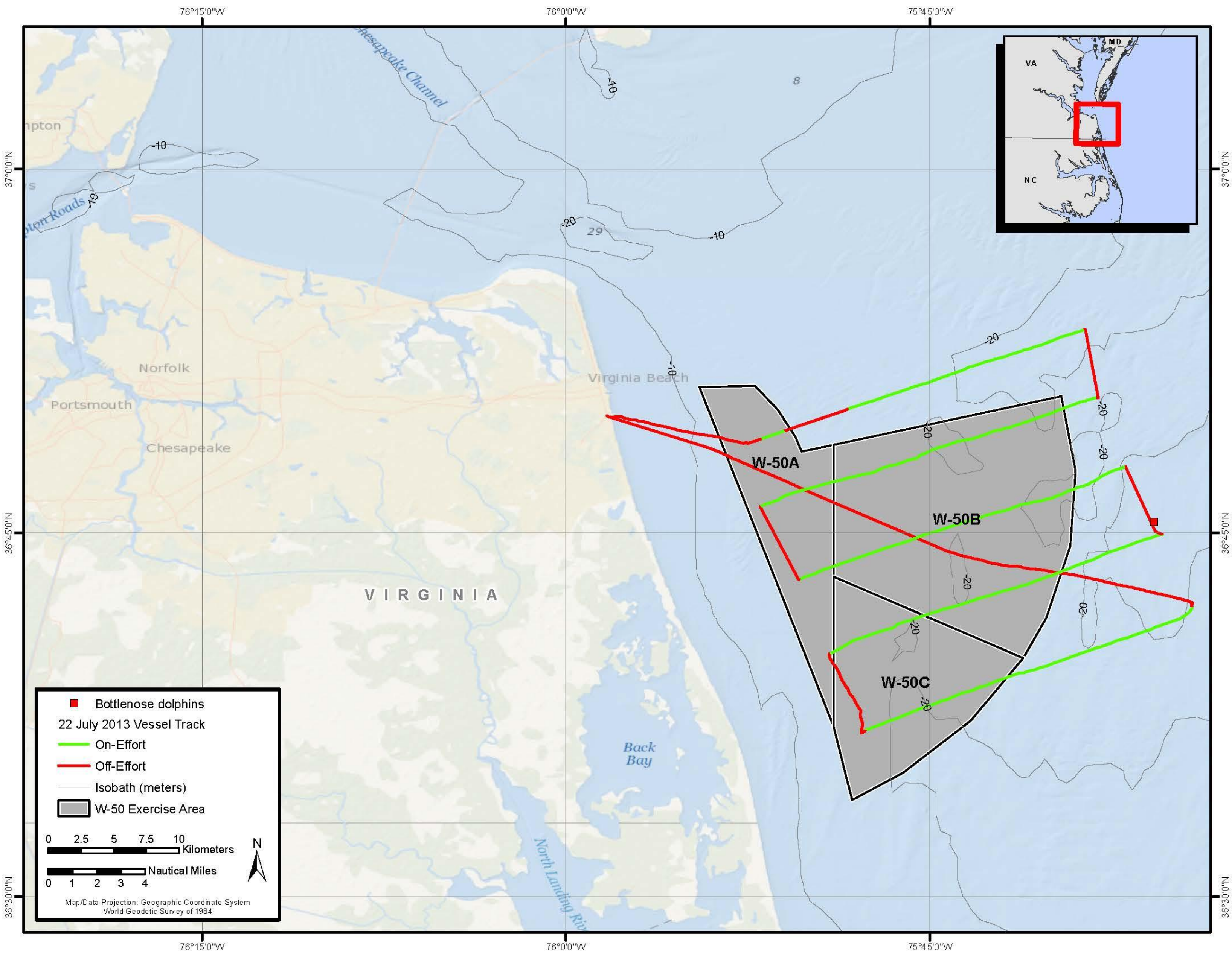
Chesapeake Channel
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
VA
MD
NC
Bottlenose dolphins
Loggerhead turtle
17 July 2013 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984



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MD
NC
Chesapeake Channel
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing Riv
W-50A
W-50B
W-50C
Bottlenose dolphins
22 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
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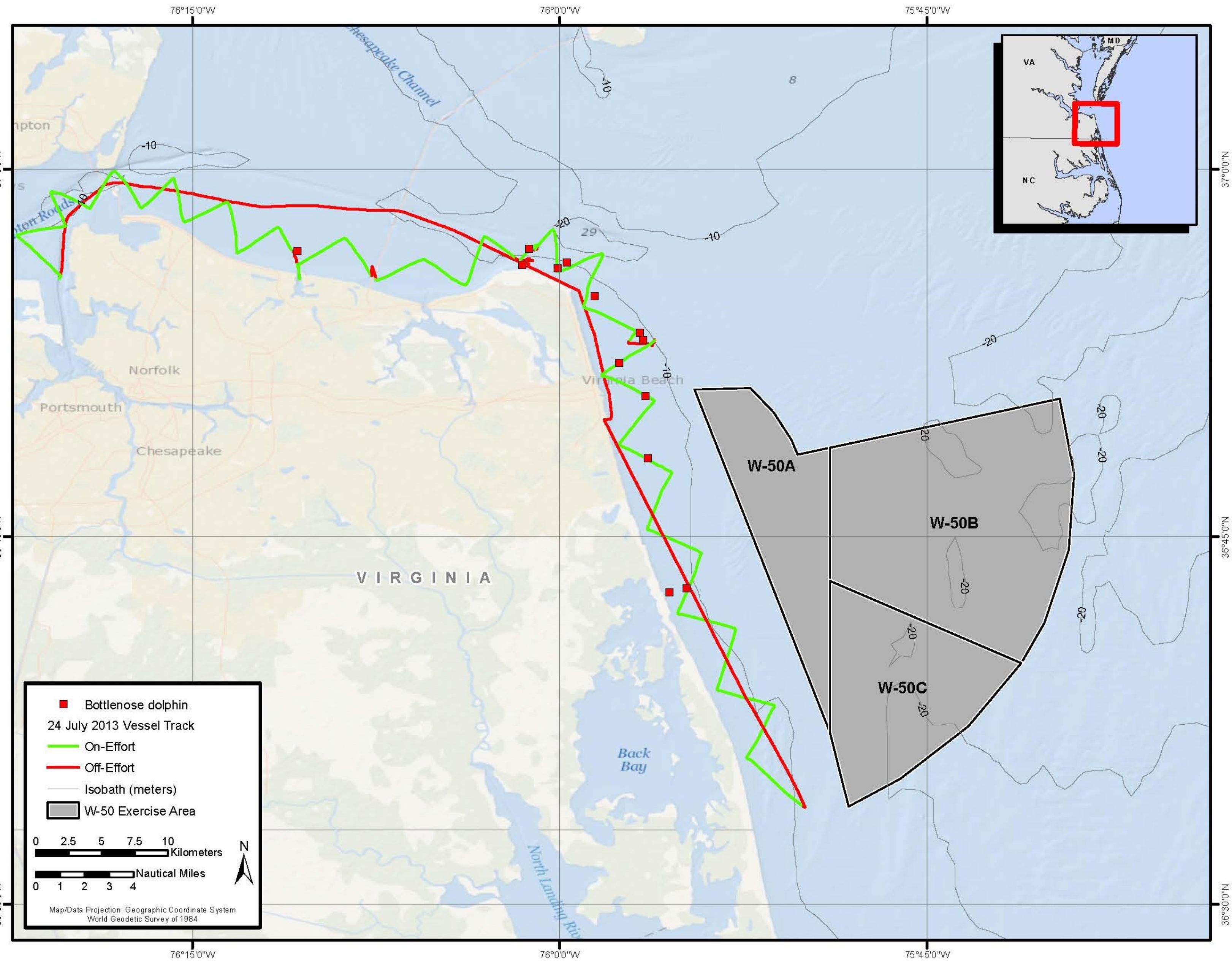
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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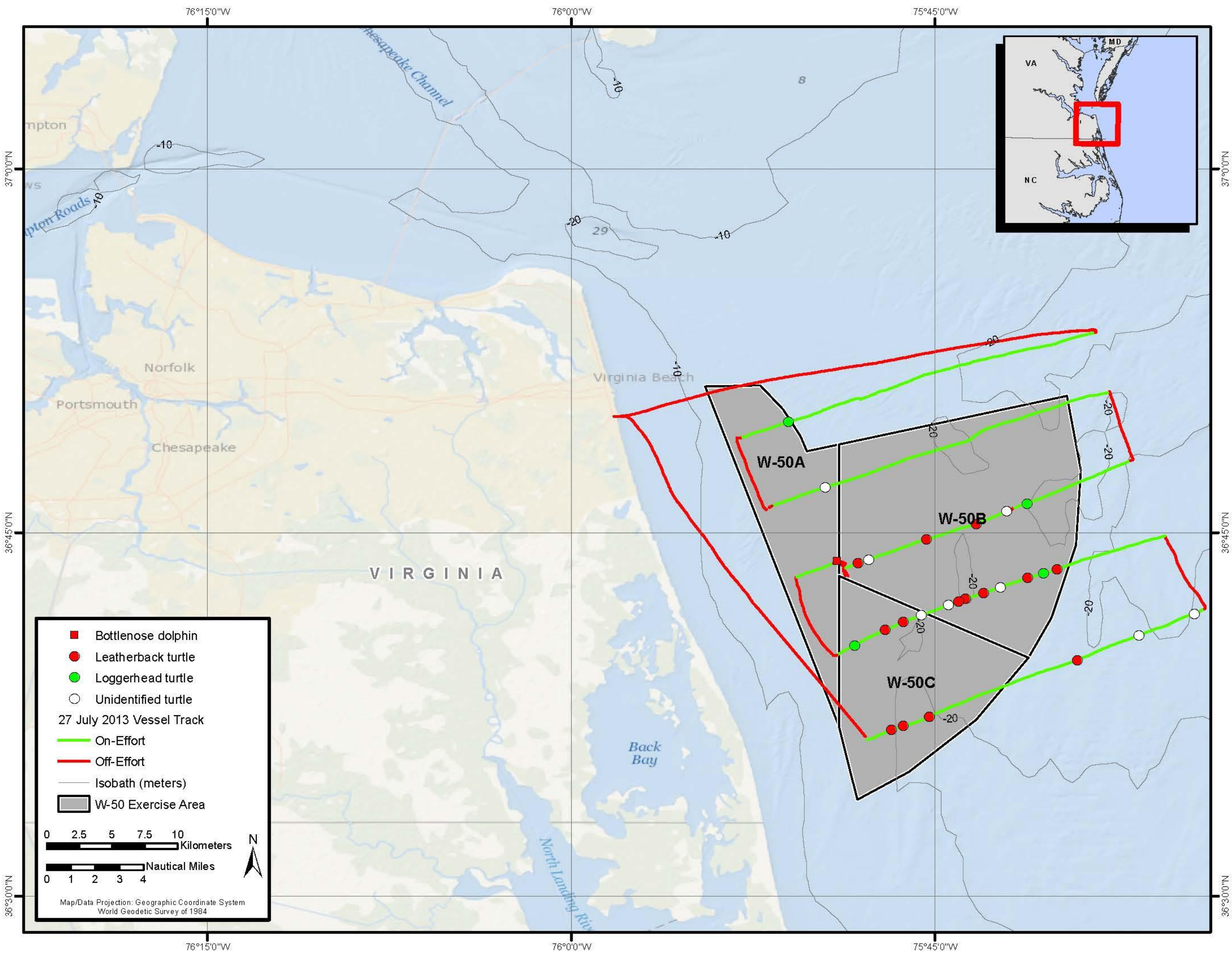
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing Riv
W-50A
W-50B
W-50C
VA
MD
NC
Bottlenose dolphin
24 July 2013 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
Nautical Miles
0 1 2 3 4
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984



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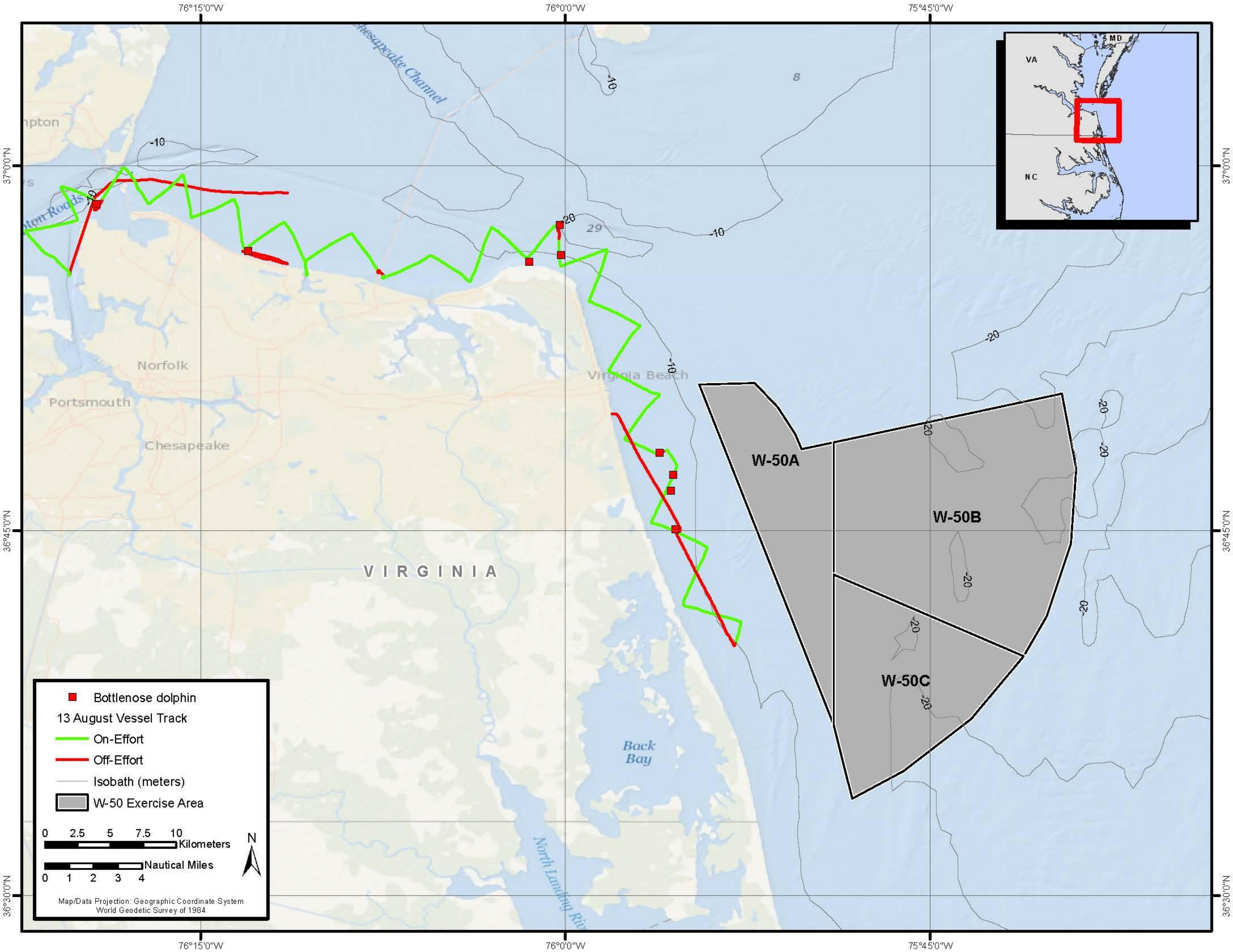
MD
NC
Chesapeake Channel
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing Riv
W-50A
W-50B
W-50C
-10
-20
29
8
Bottlenose dolphin
Leatherback turtle
Loggerhead turtle
Unidentified turtle
27 July 2013 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 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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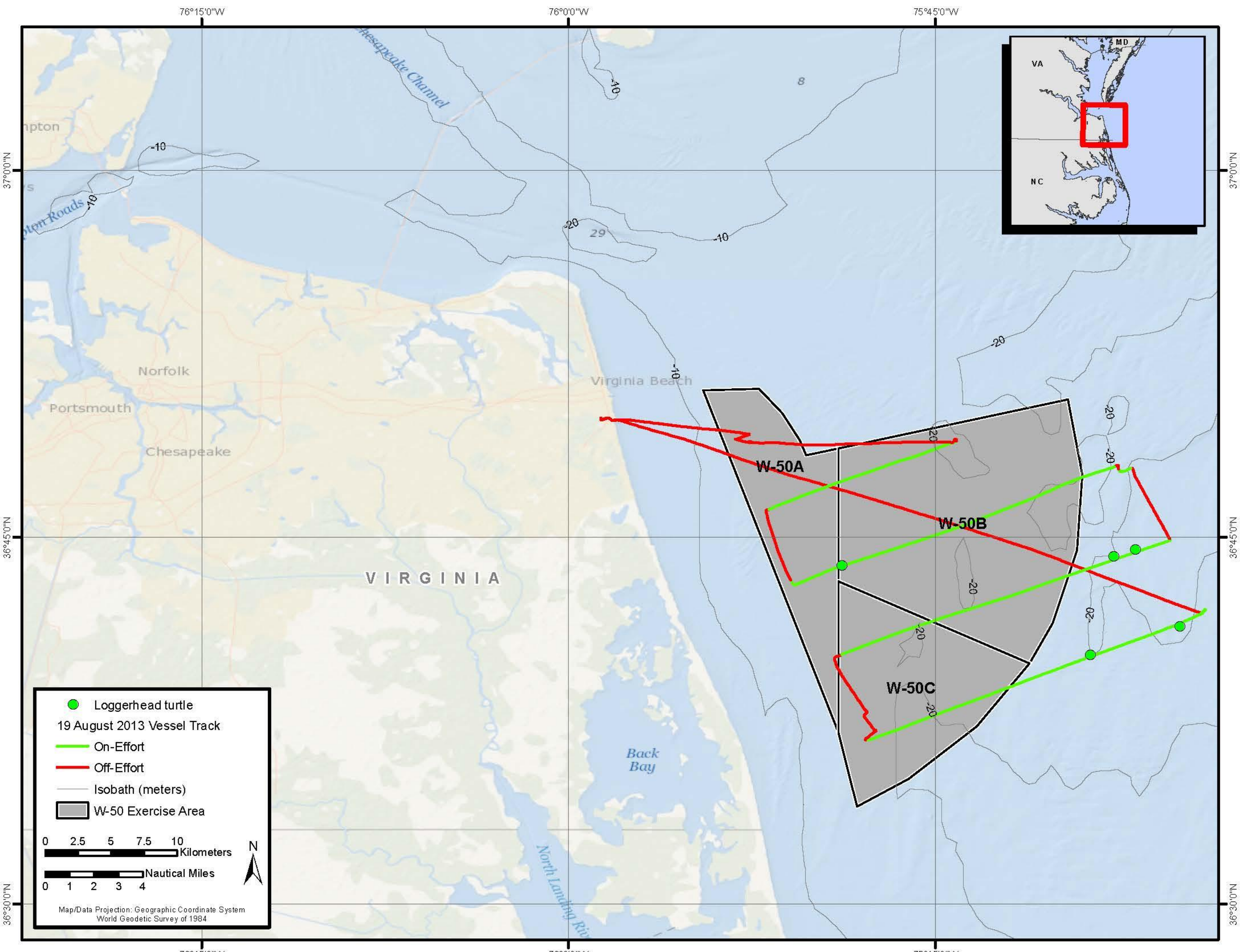
Chesapeake Channel
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
VA
MD
NC
Bottlenose dolphin
13 August Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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NC
Chesapeake Channel
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing Ri
W-50A
W-50B
W-50C
Loggerhead turtle
19 August 2013 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
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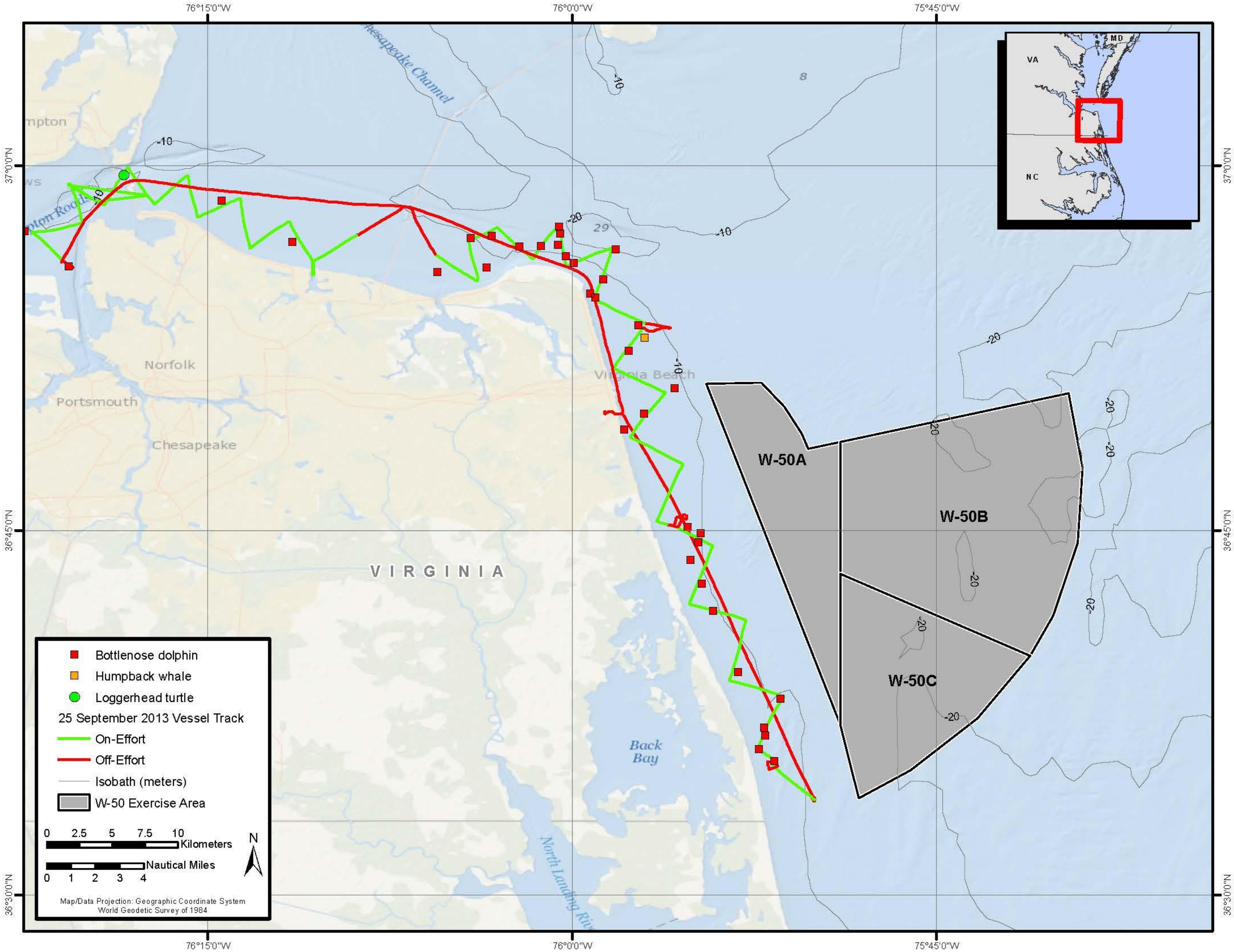
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984



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Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing Riv
Chesapeake Channel
W-50A
W-50B
W-50C
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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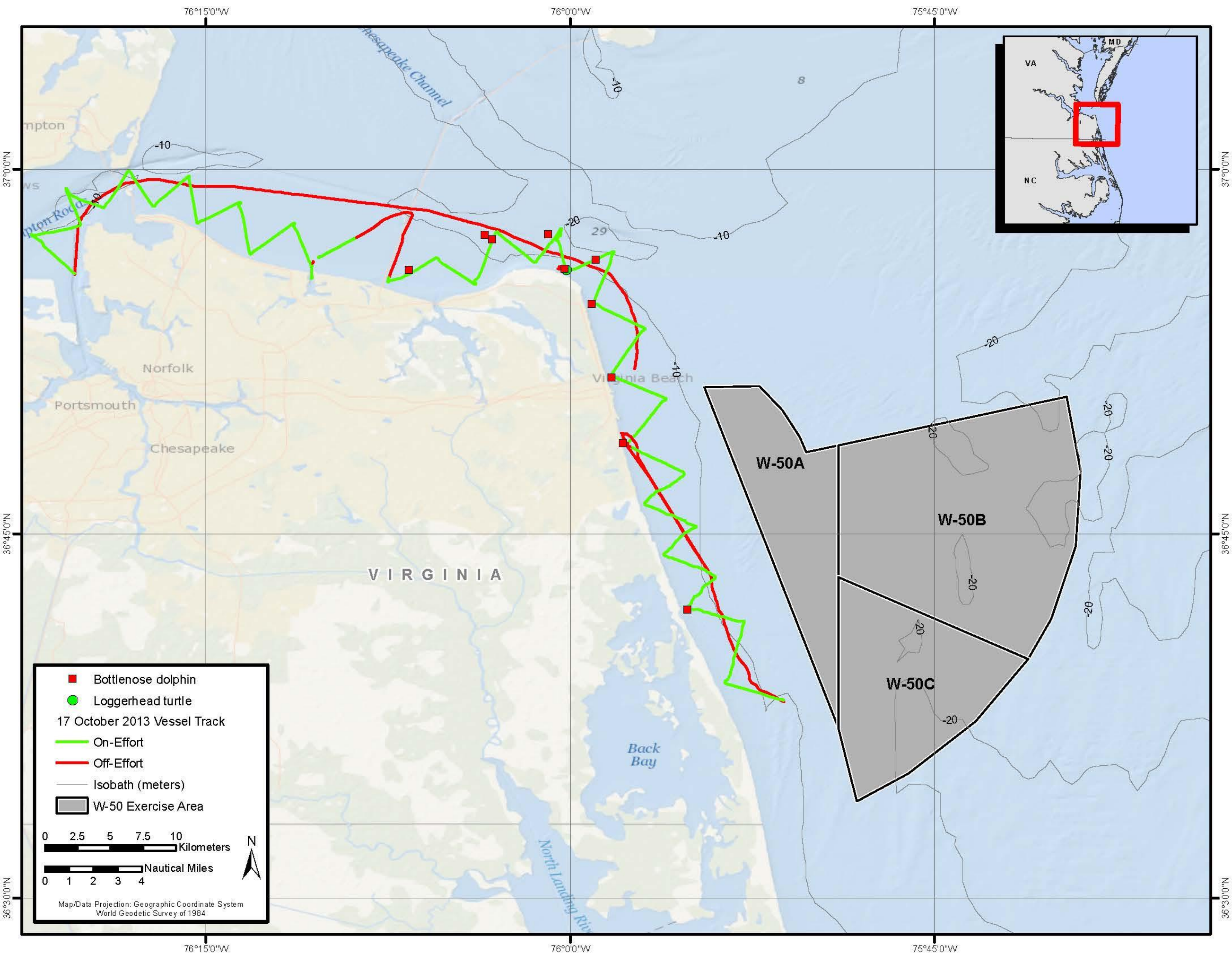
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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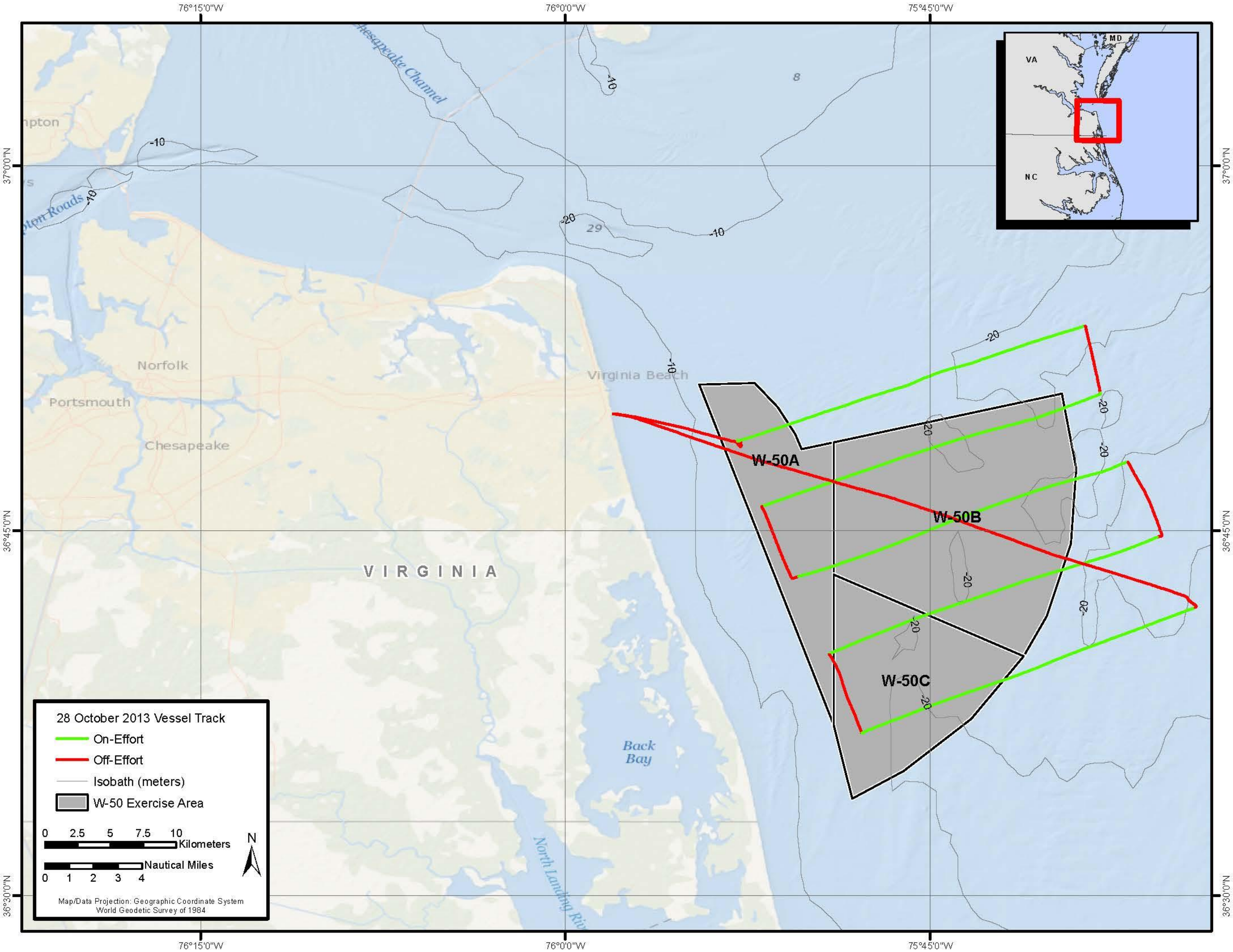
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing Riv
W-50A
W-50B
W-50C
VA
MD
NC
Bottlenose dolphin
Loggerhead turtle
17 October 2013 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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MD
NC
Chesapeake Channel
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
28 October 2013 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
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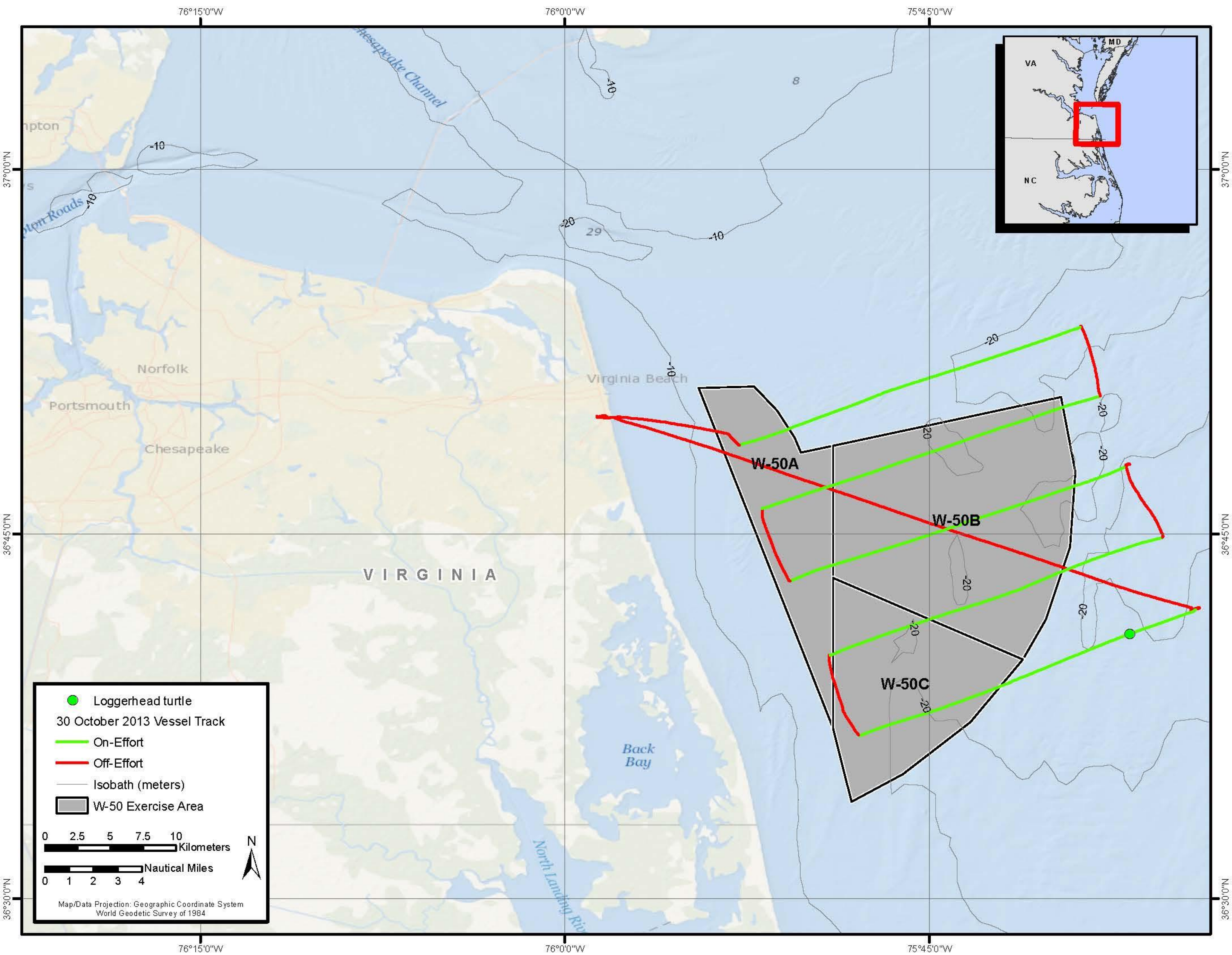
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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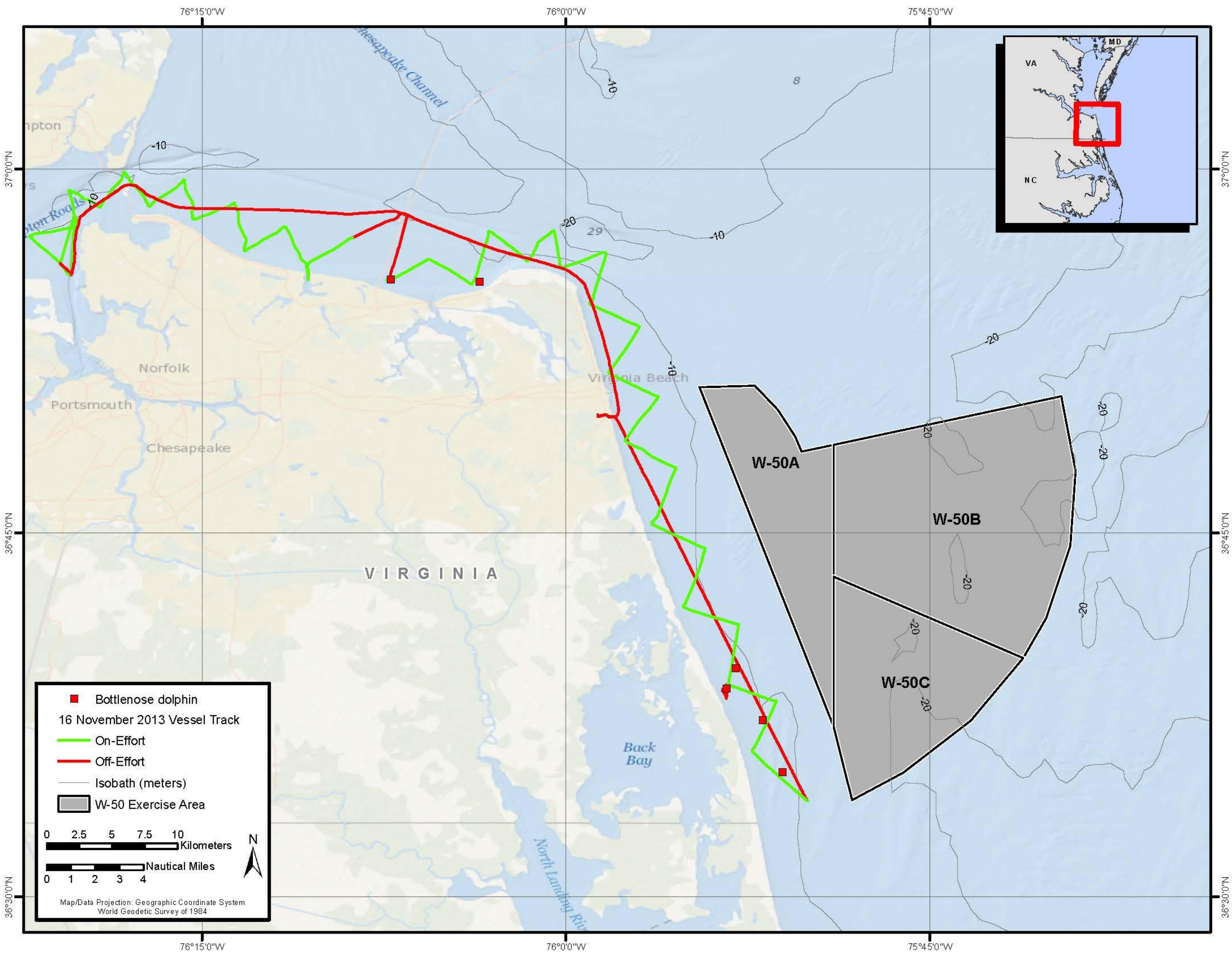
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
W-50A
W-50B
W-50C
VA
MD
NC
Loggerhead turtle
30 October 2013 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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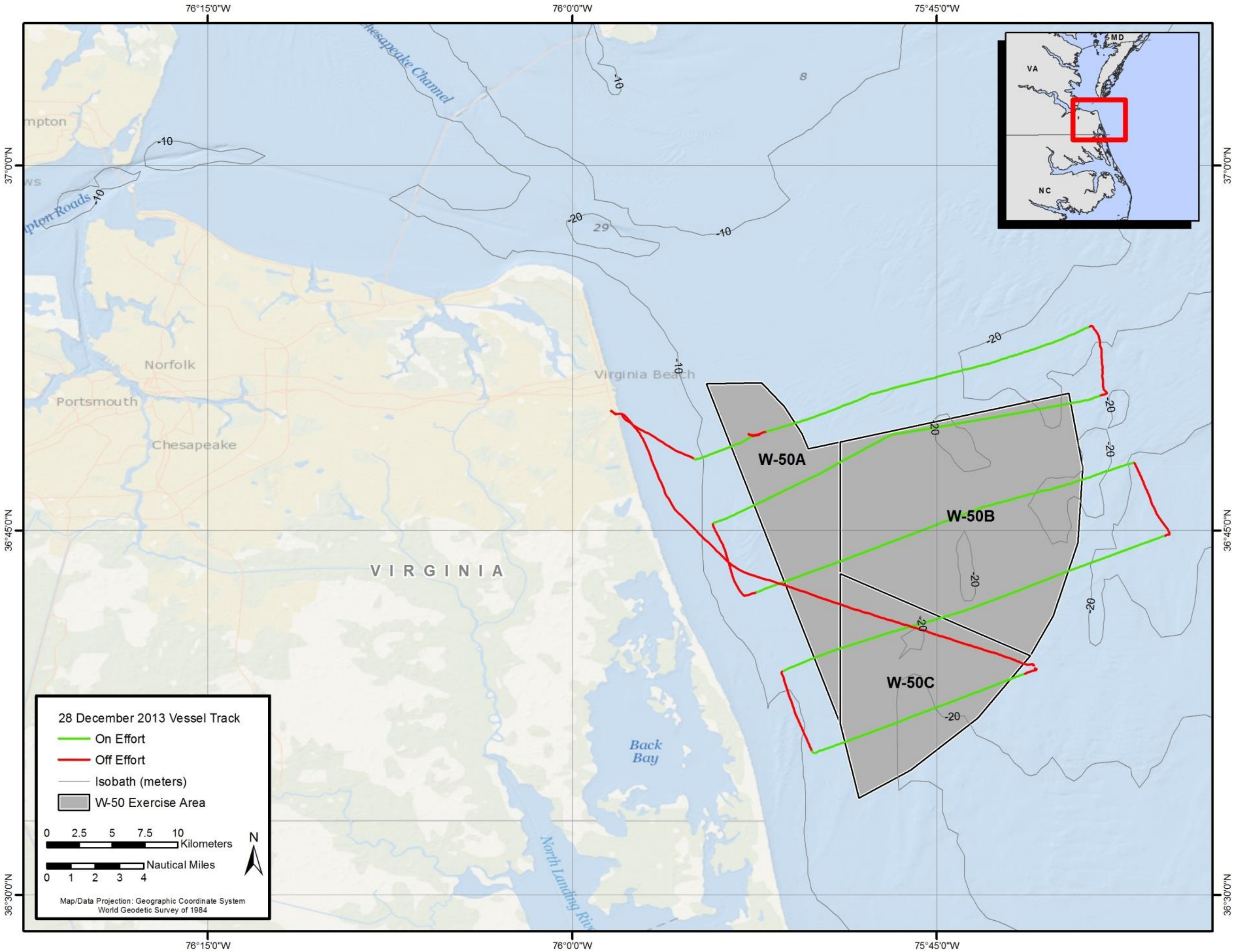
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
VA
MD
NC
Bottlenose dolphin
16 November 2013 Vessel Track
On-Effort
Off-Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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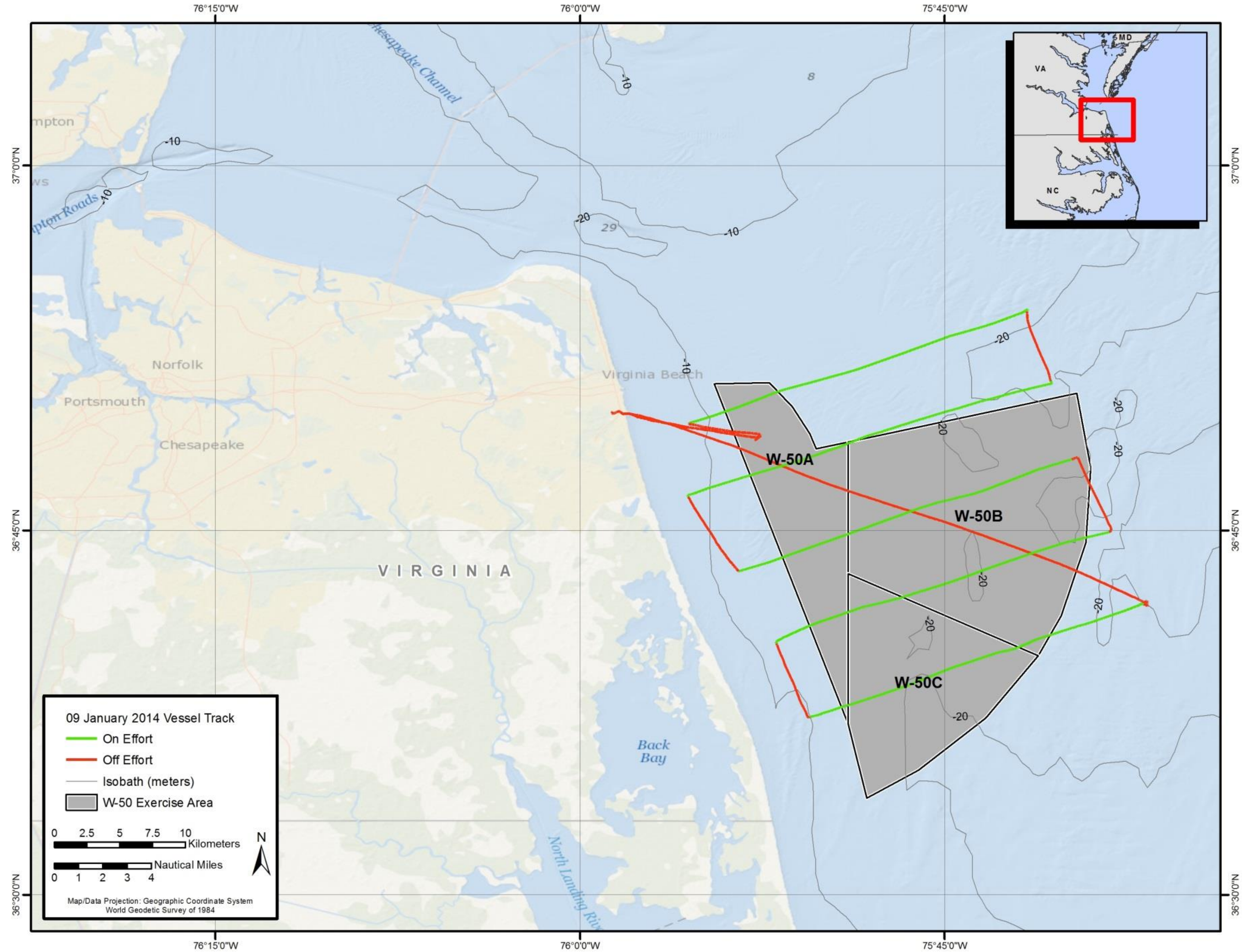
Hampton Roads
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
-10
-20
VA
MD
NC
28 December 2013 Vessel Track
On Effort
Off Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984



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76°0'0"W
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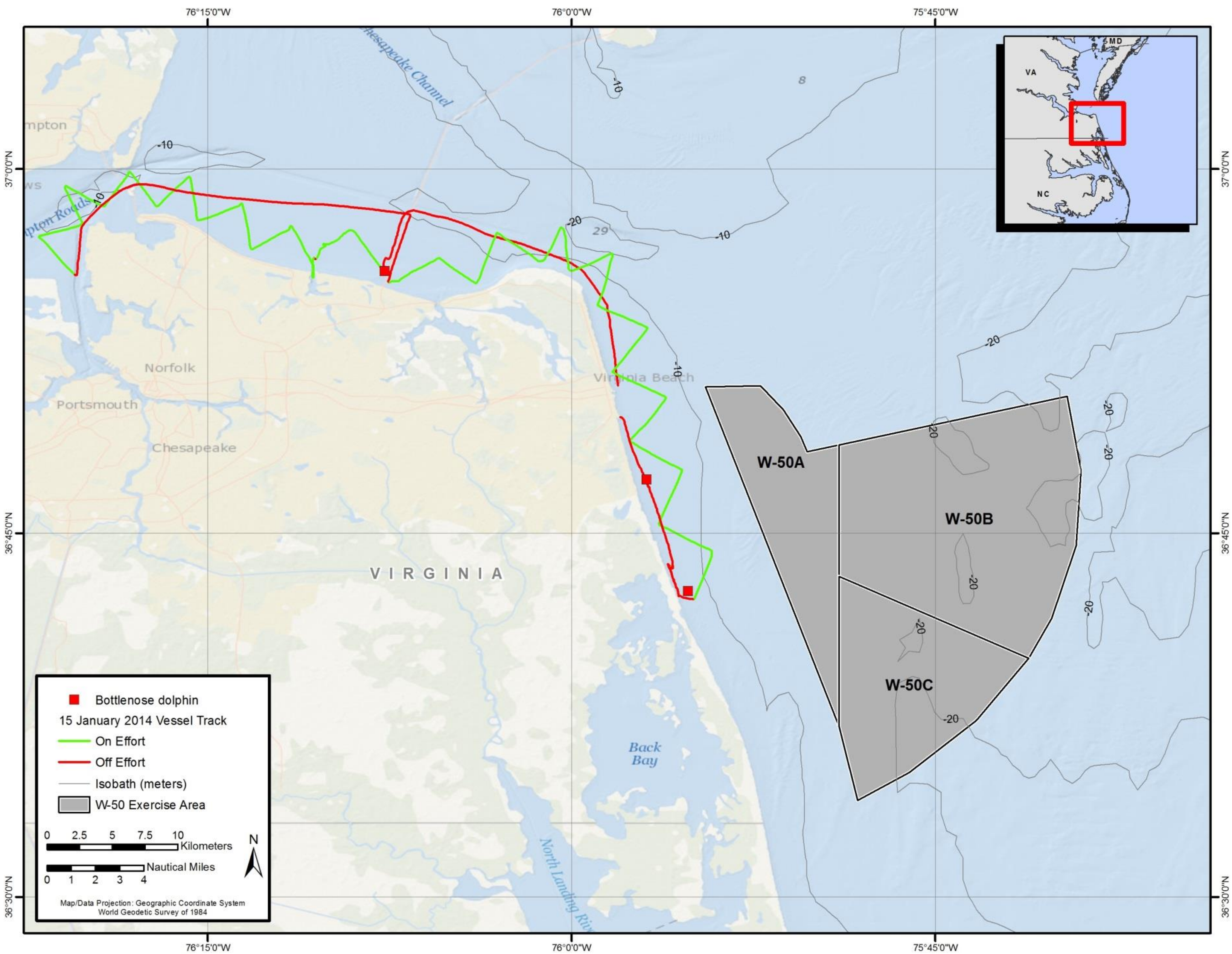
VA
MD
NC
Chesapeake Channel
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
-10
-20
09 January 2014 Vessel Track
On Effort
Off Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984



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VA
MD
NC
Chesapeake Channel
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
Bottlenose dolphin
15 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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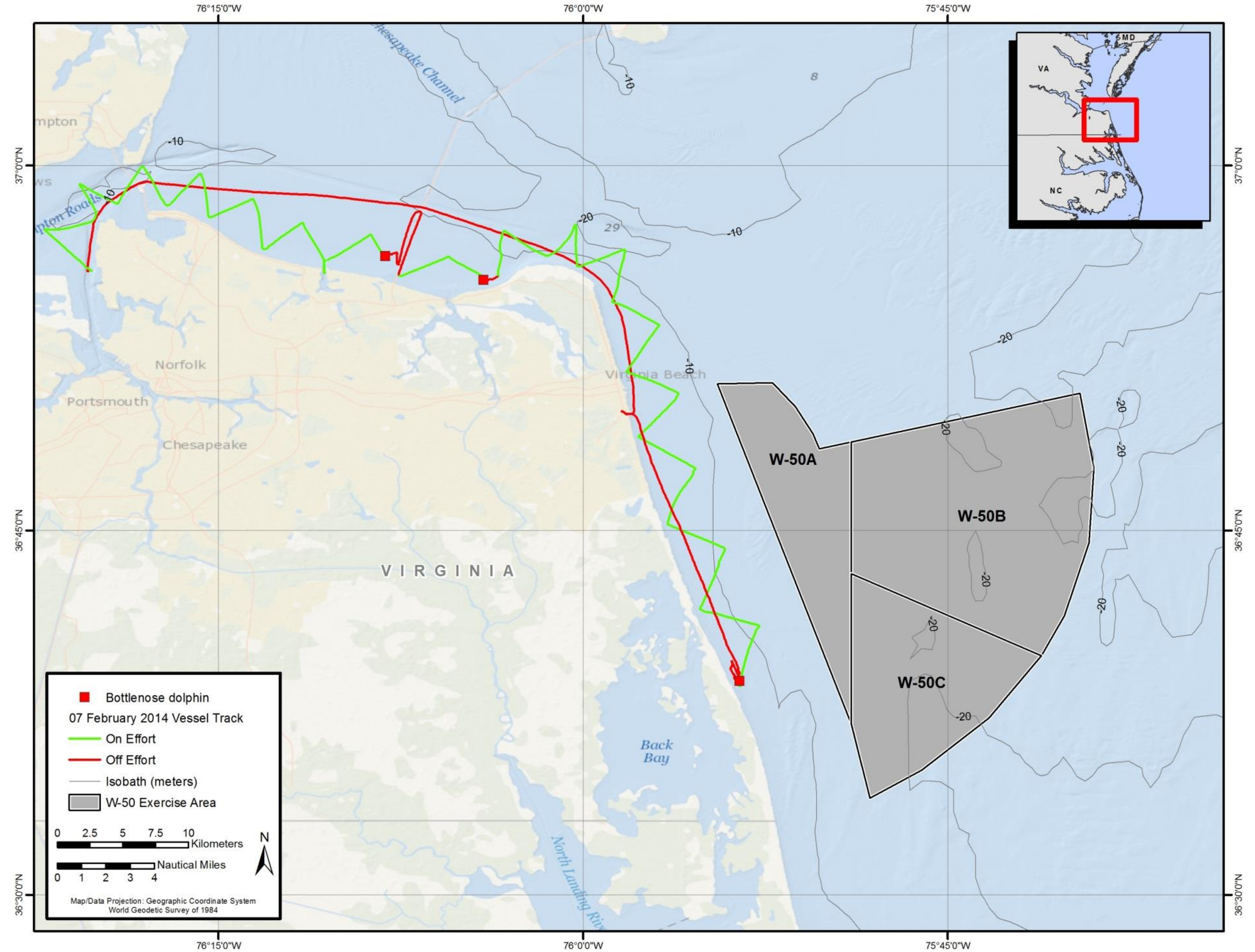
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984



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37°0'0"N
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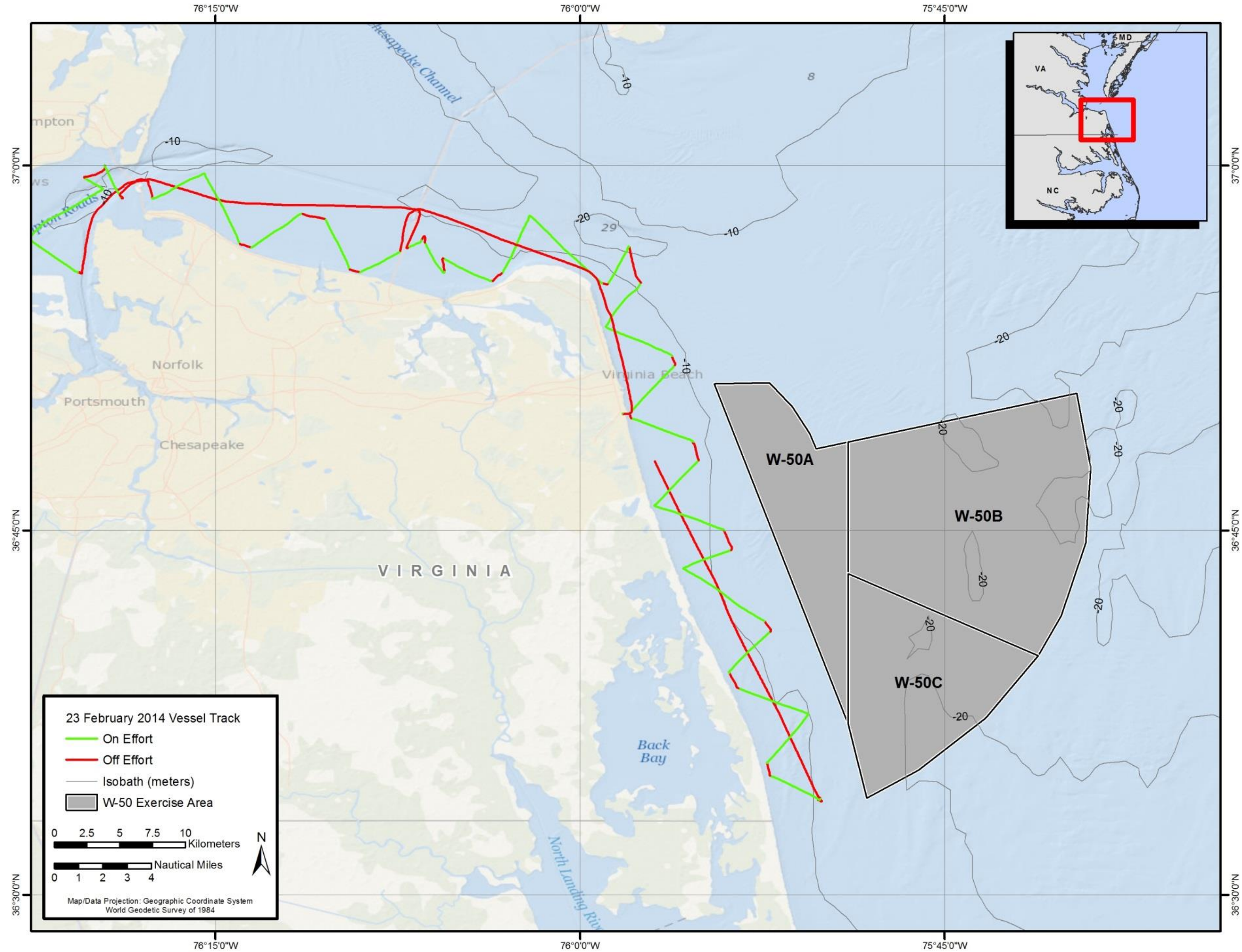
Chesapeake Channel
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
-10
-20
VA
MD
NC
Bottlenose dolphin
07 February 2014 Vessel Track
On Effort
Off Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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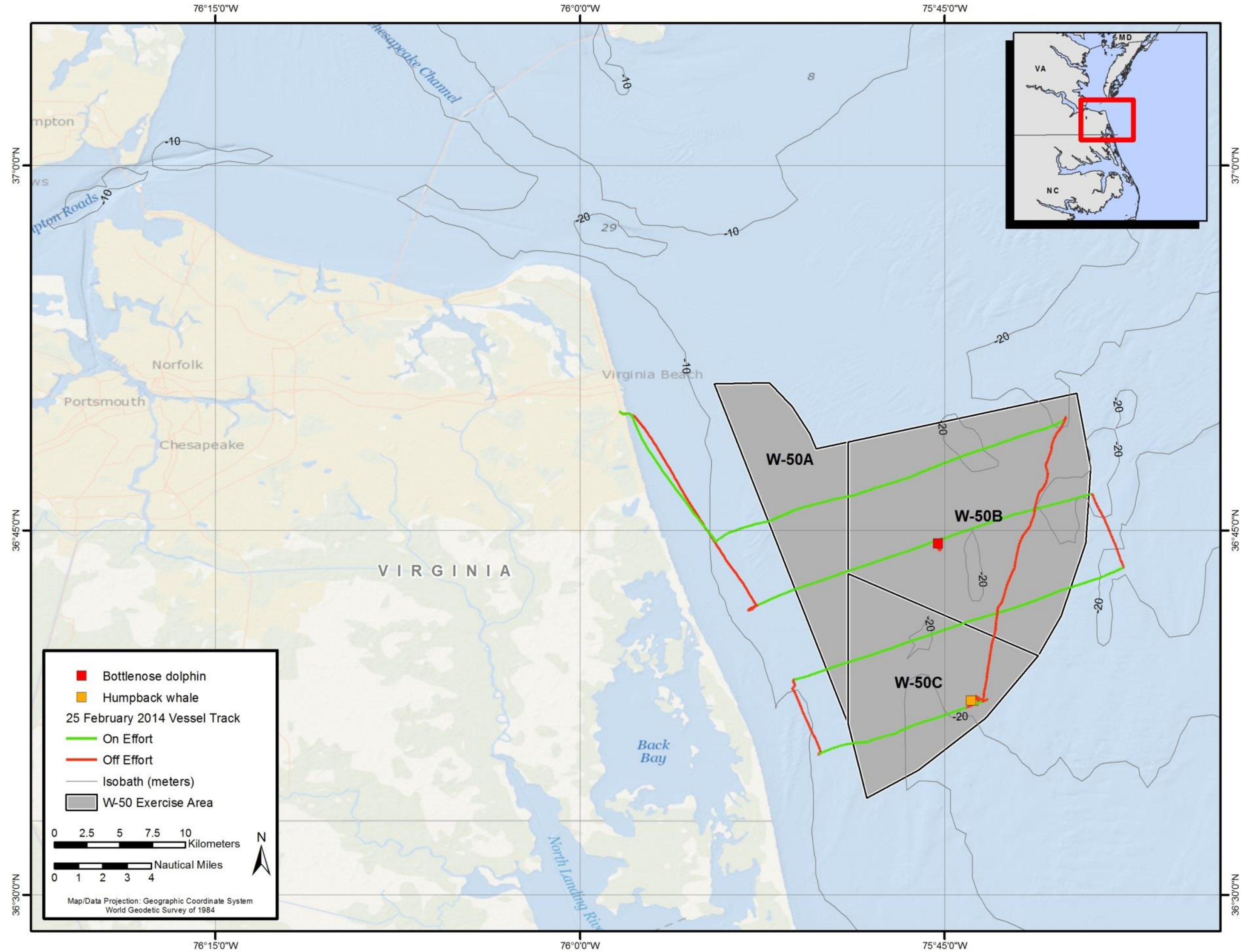
75°45'0"W
37°0'0"N
36°45'0"N
36°30'0"N
VA
MD
NC
Chesapeake Channel
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
-10
-20
23 February 2014 Vessel Track
On Effort
Off Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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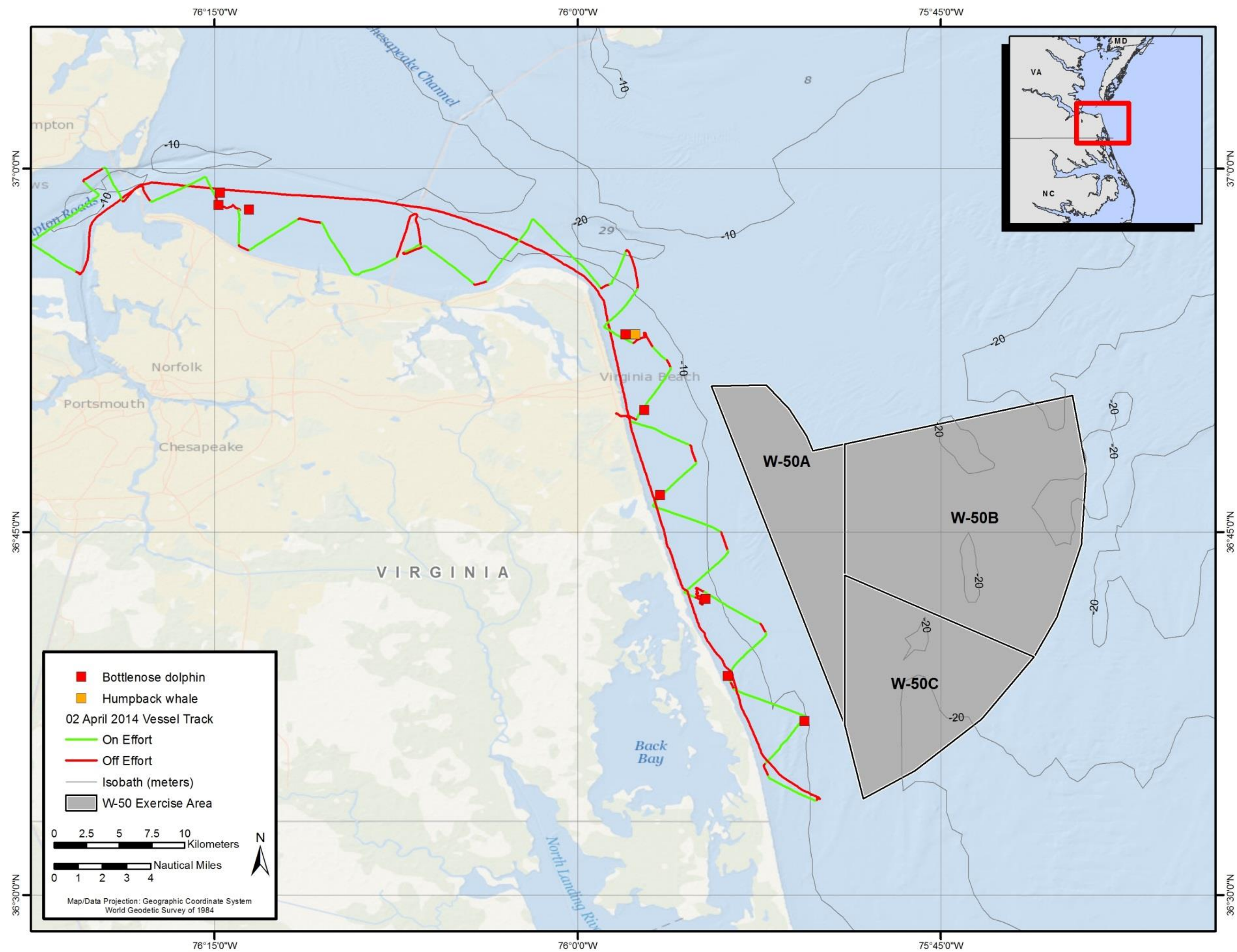
Chesapeake Channel
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
VA
MD
NC
Bottlenose dolphin
Humpback whale
25 February 2014 Vessel Track
On Effort
Off Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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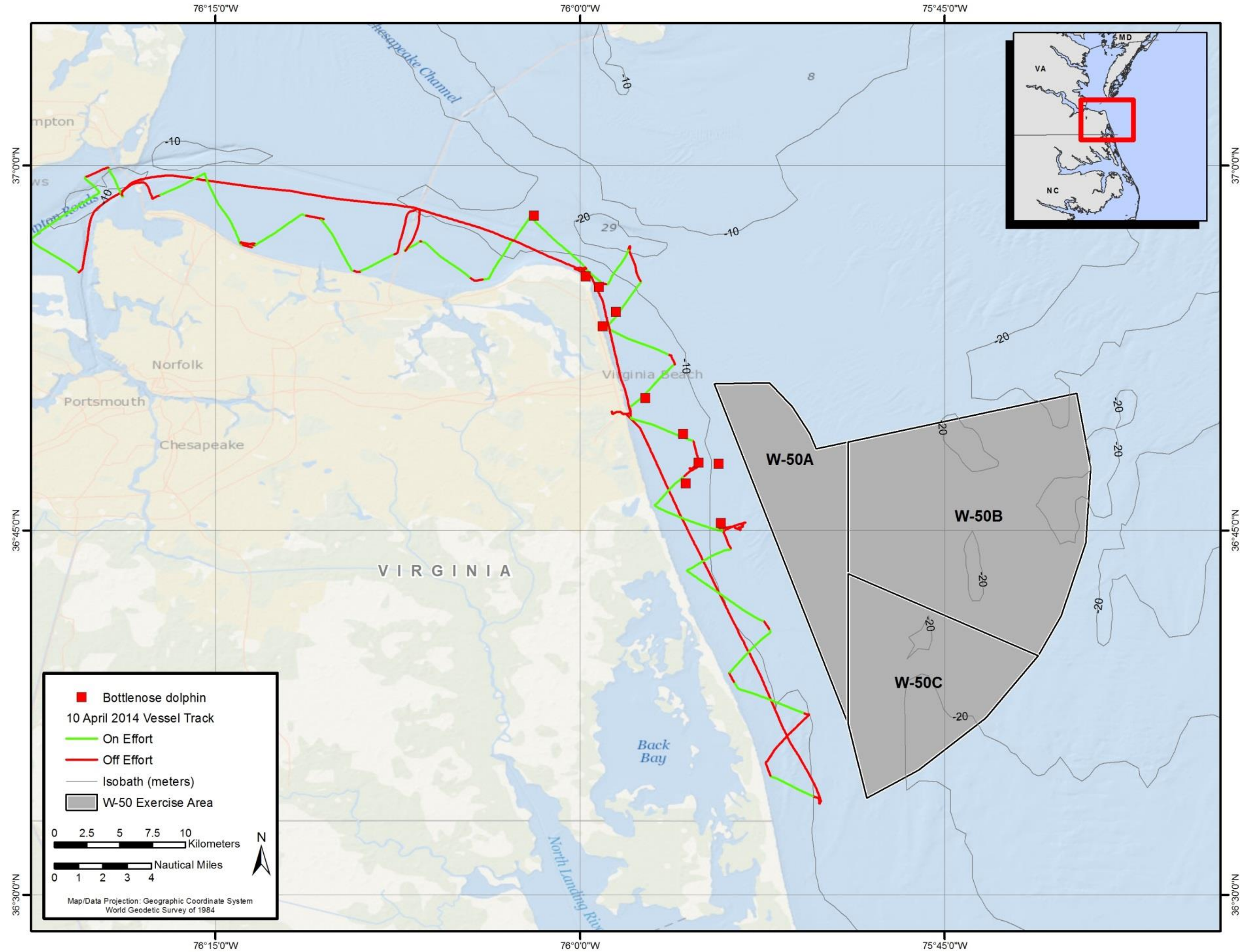
Chesapeake Channel
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing Riv
W-50A
W-50B
W-50C
VA
MD
NC
Bottlenose dolphin
Humpback whale
02 April 2014 Vessel Track
On Effort
Off Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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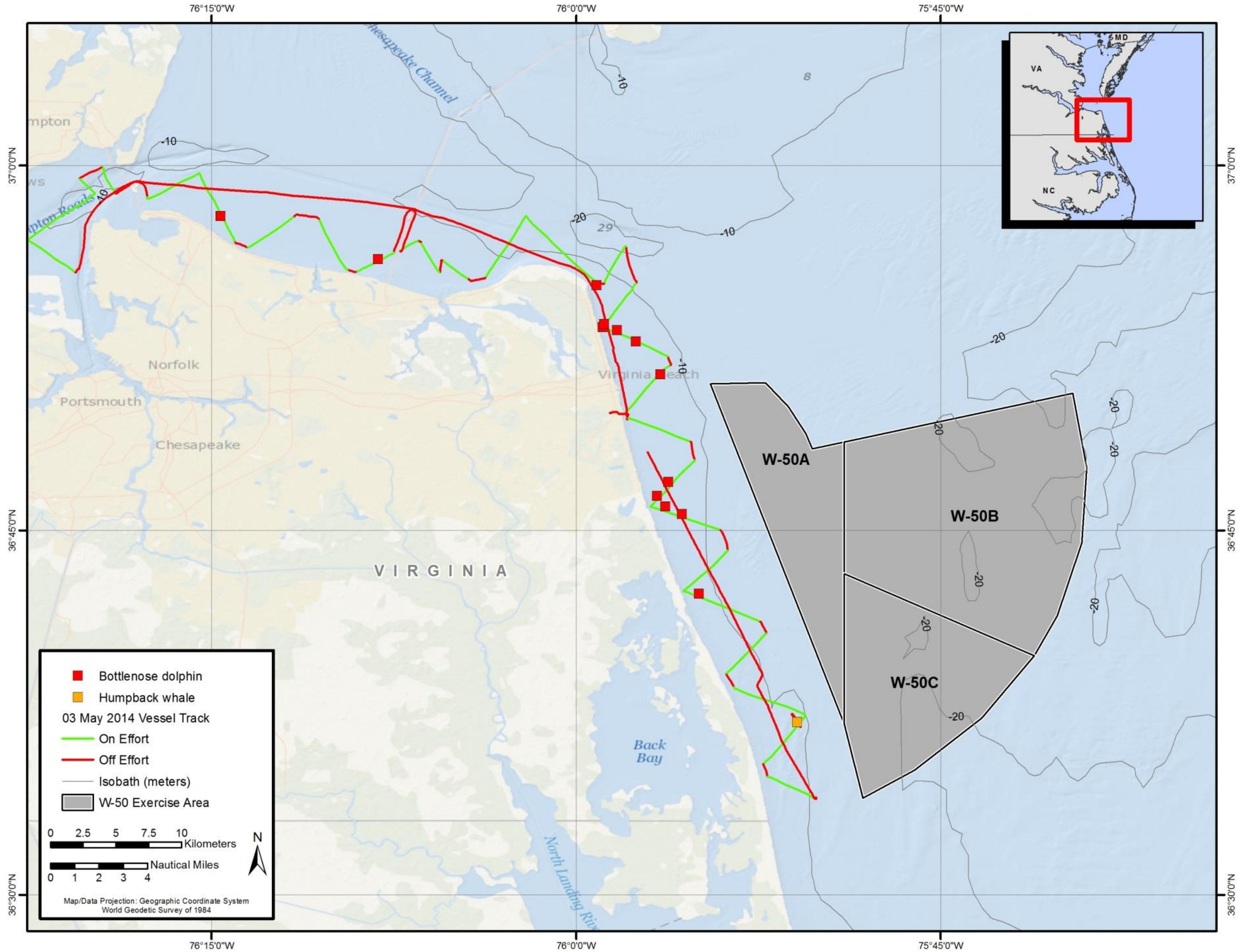
Chesapeake Channel
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
VA
MD
NC
Bottlenose dolphin
10 April 2014 Vessel Track
On Effort
Off Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984



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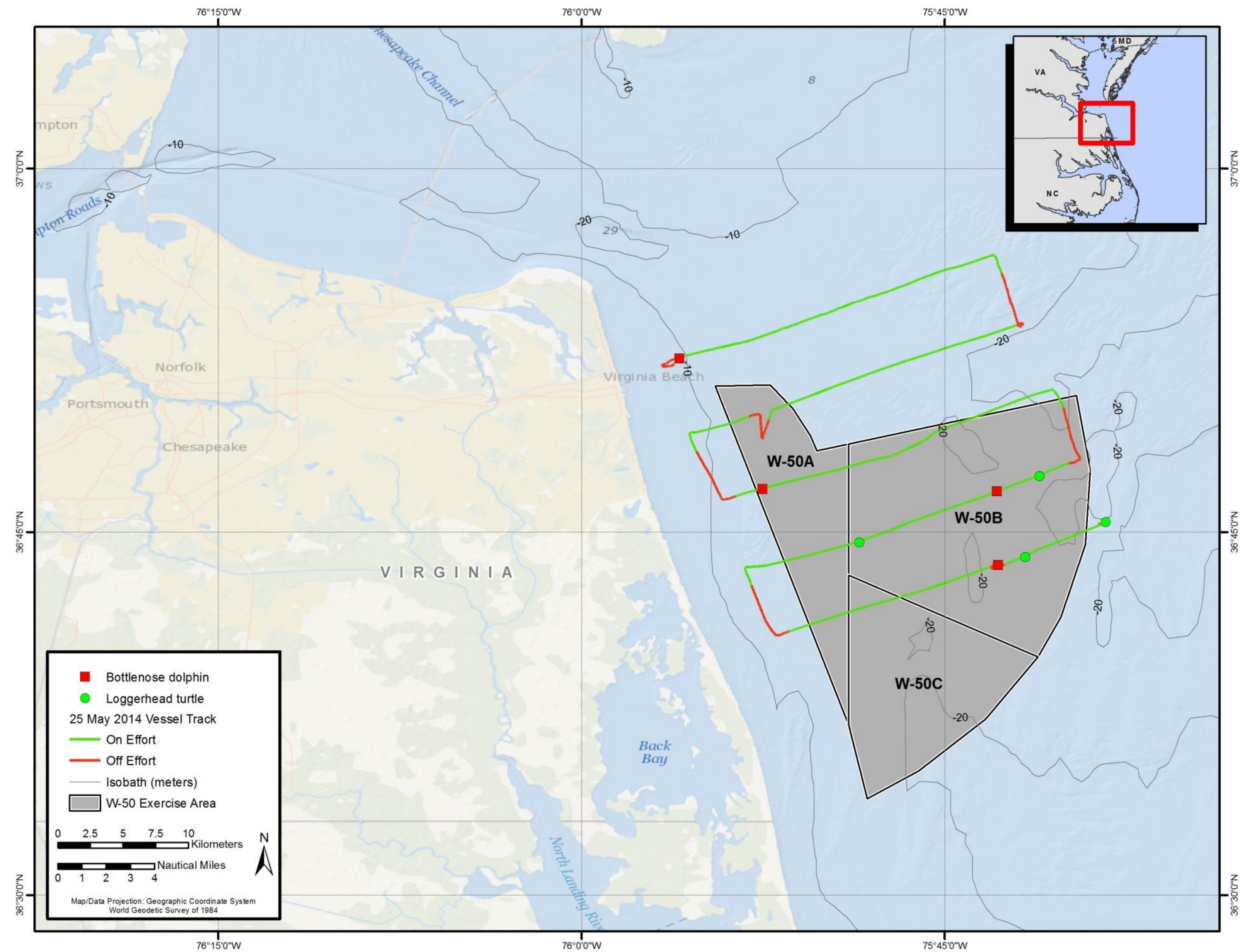
75°45'0"W
37°0'0"N
36°45'0"N
36°30'0"N
VA
MD
NC
Chesapeake Channel
Hampton Roads
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
-10
-20
8
29
Bottlenose dolphin
Humpback whale
03 May 2014 Vessel Track
On Effort
Off Effort
Isobath (meters)
W-50 Exercise 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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76°0'0"W
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36°45'0"N
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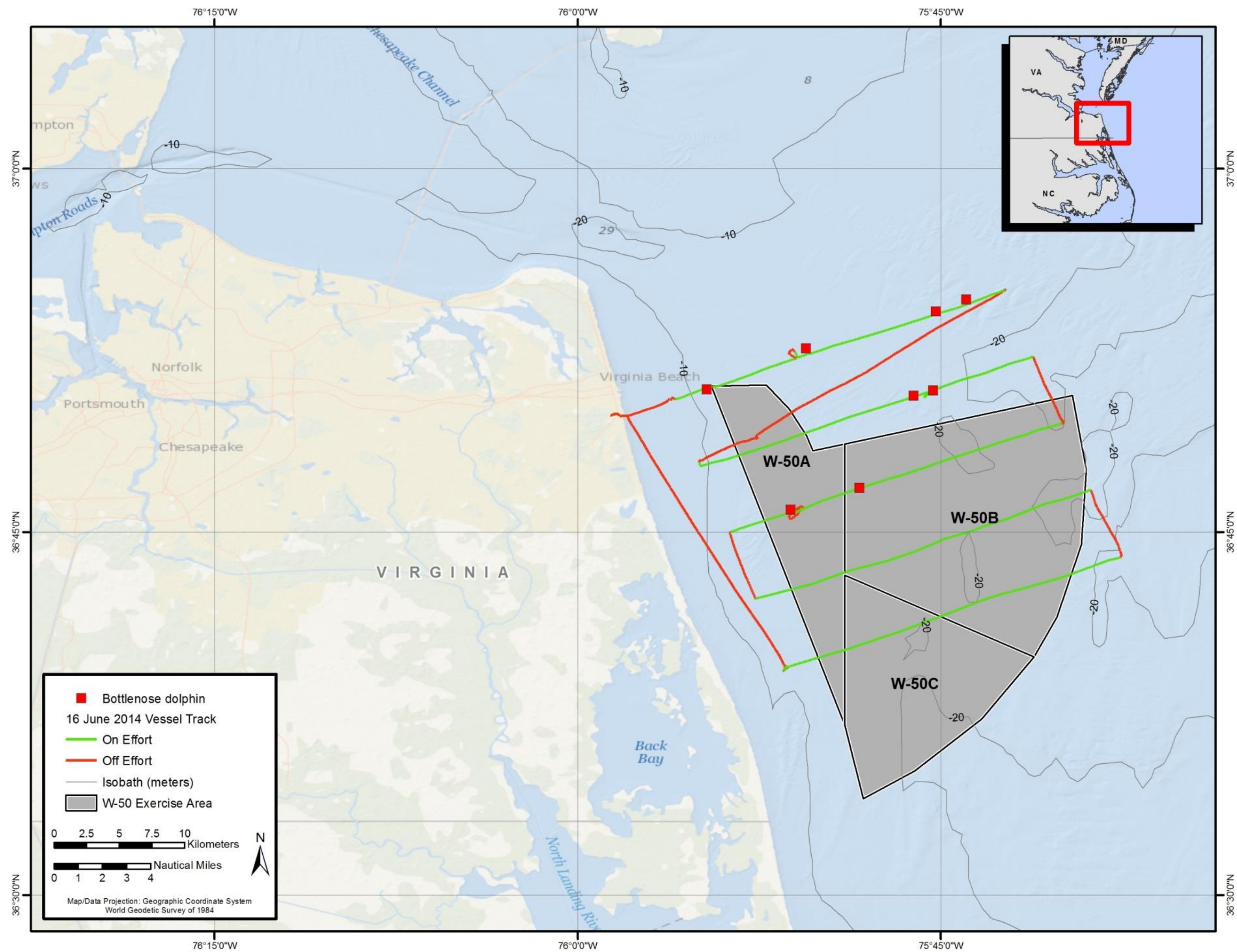
VA
MD
NC
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
Chesapeake Channel
W-50A
W-50B
W-50C
Bottlenose dolphin
Loggerhead turtle
25 May 2014 Vessel Track
On Effort
Off Effort
Isobath (meters)
W-50 Exercise Area
Kilometers
Nautical Miles
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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75°45'0"W
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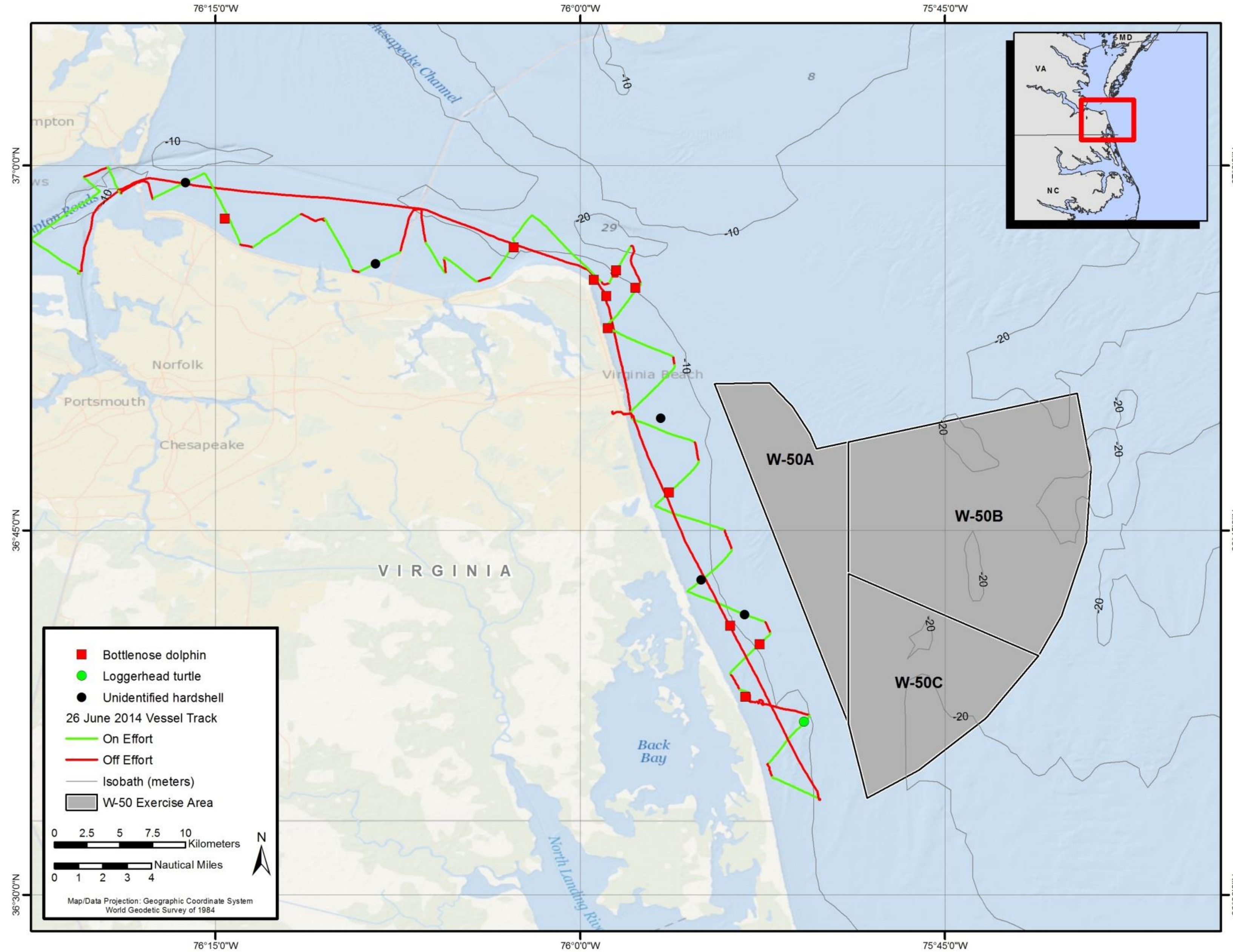
Chesapeake Channel
Hampton Roads
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
-10
-20
VA
MD
NC
Bottlenose dolphin
16 June 2014 Vessel Track
On Effort
Off Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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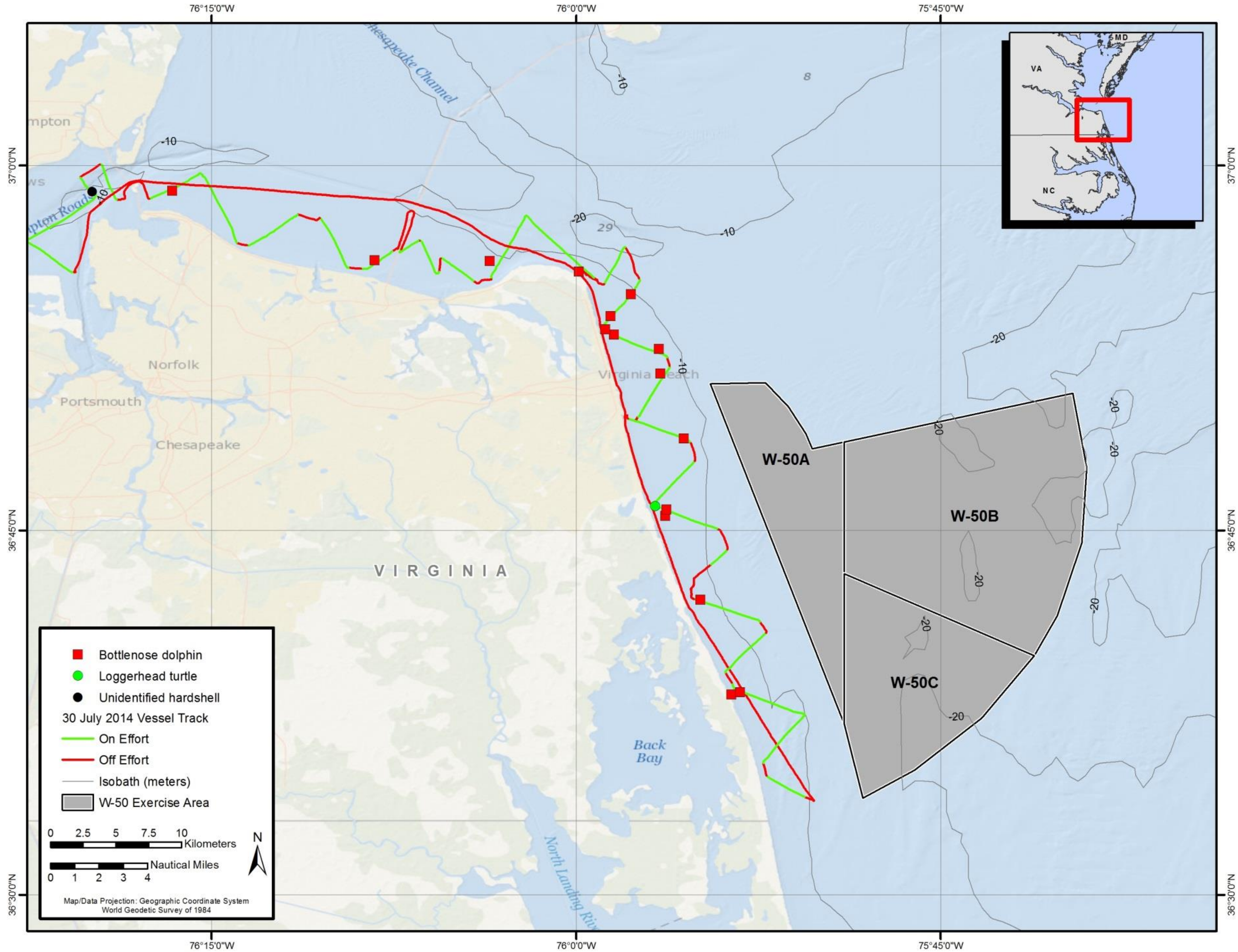
Chesapeake Channel
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing Riv
W-50A
W-50B
W-50C
VA
MD
NC
Bottlenose dolphin
Loggerhead turtle
Unidentified hardshell
26 June 2014 Vessel Track
On Effort
Off Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984



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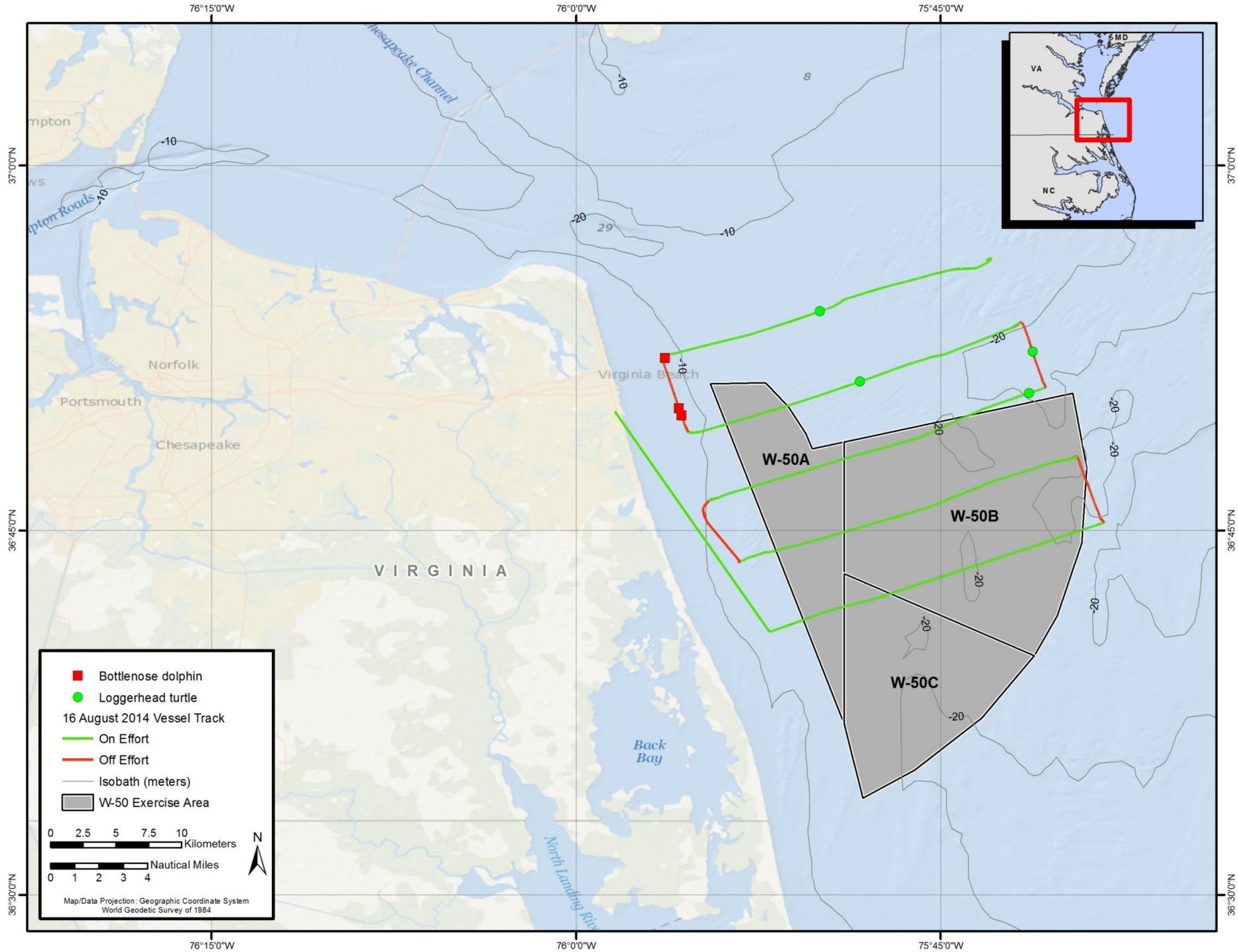
37°0'0"N
36°45'0"N
36°30'0"N
Chesapeake Channel
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
VA
MD
NC
Bottlenose dolphin
Loggerhead turtle
Unidentified hardshell
30 July 2014 Vessel Track
On Effort
Off Effort
Isobath (meters)
W-50 Exercise Area
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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76°0'0"W
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37°0'0"N
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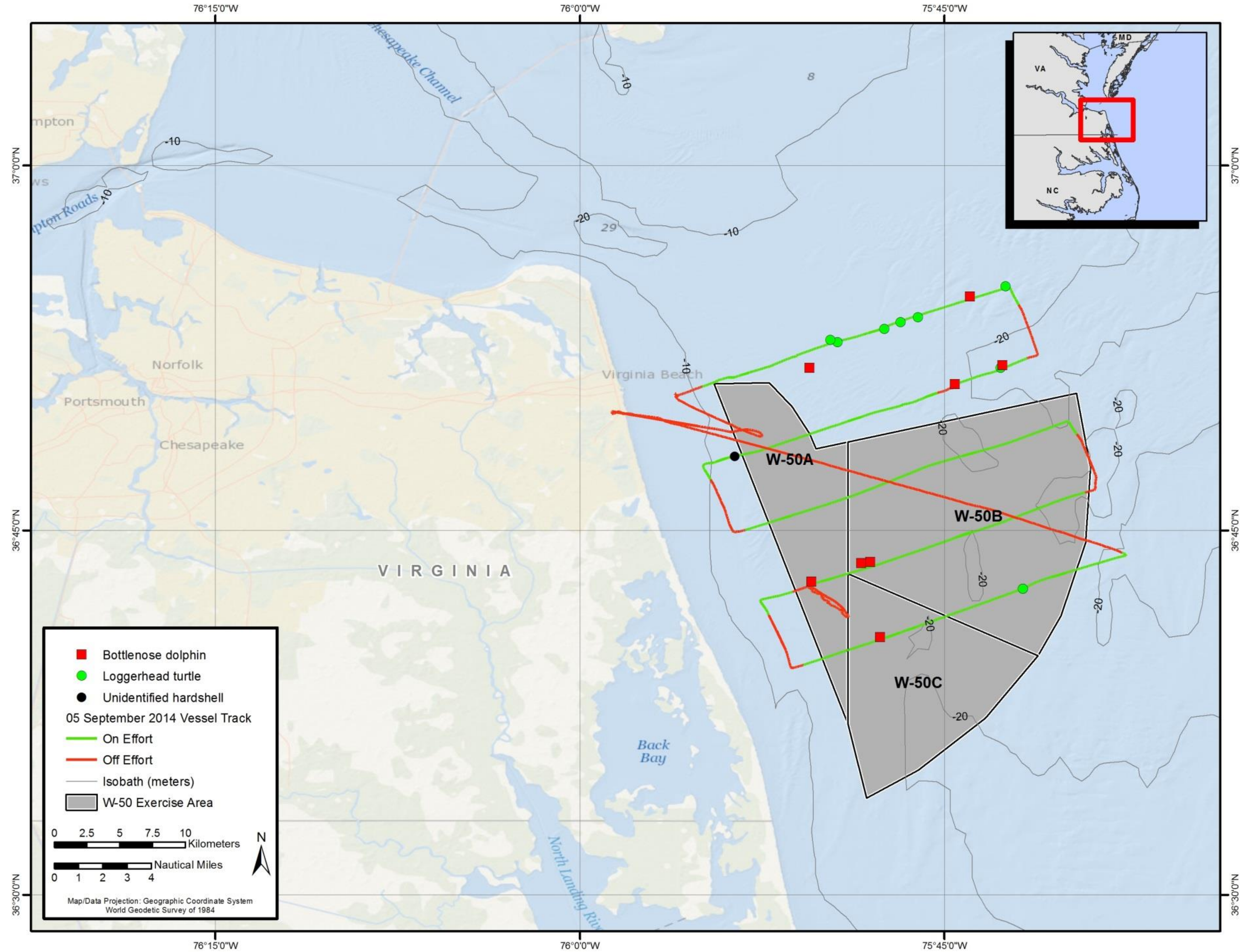
36°30'0"N
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
Chesapeake Channel
W-50A
W-50B
W-50C
VA
MD
NC
Bottlenose dolphin
Loggerhead turtle
16 August 2014 Vessel Track
On Effort
Off Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System World Geodetic Survey of 1984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VA
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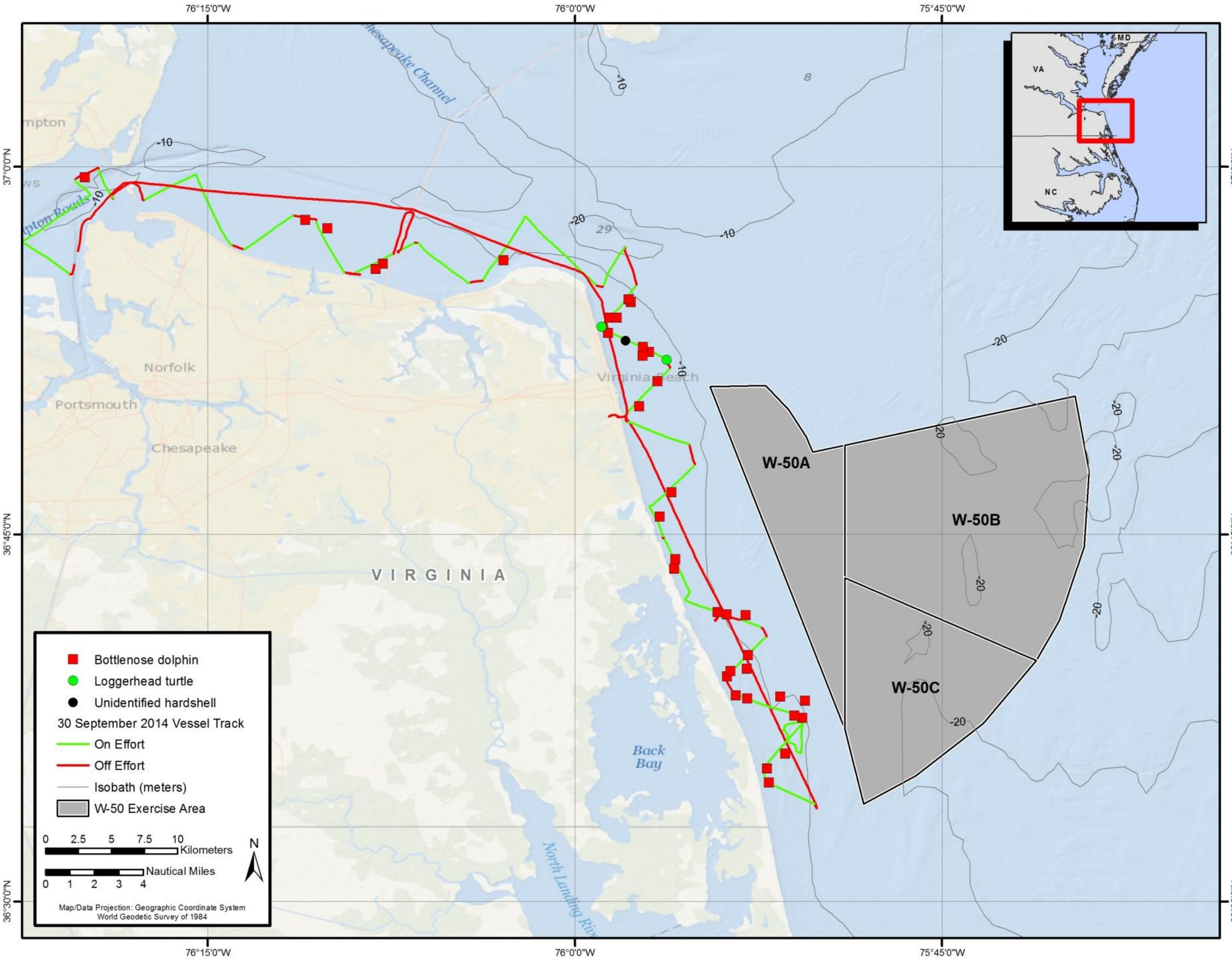
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Chesapeake Channel
Back Bay
North Landing River
W-50A
W-50B
W-50C
Bottlenose dolphin
Loggerhead turtle
Unidentified hardshell
05 September 2014 Vessel Track
On Effort
Off Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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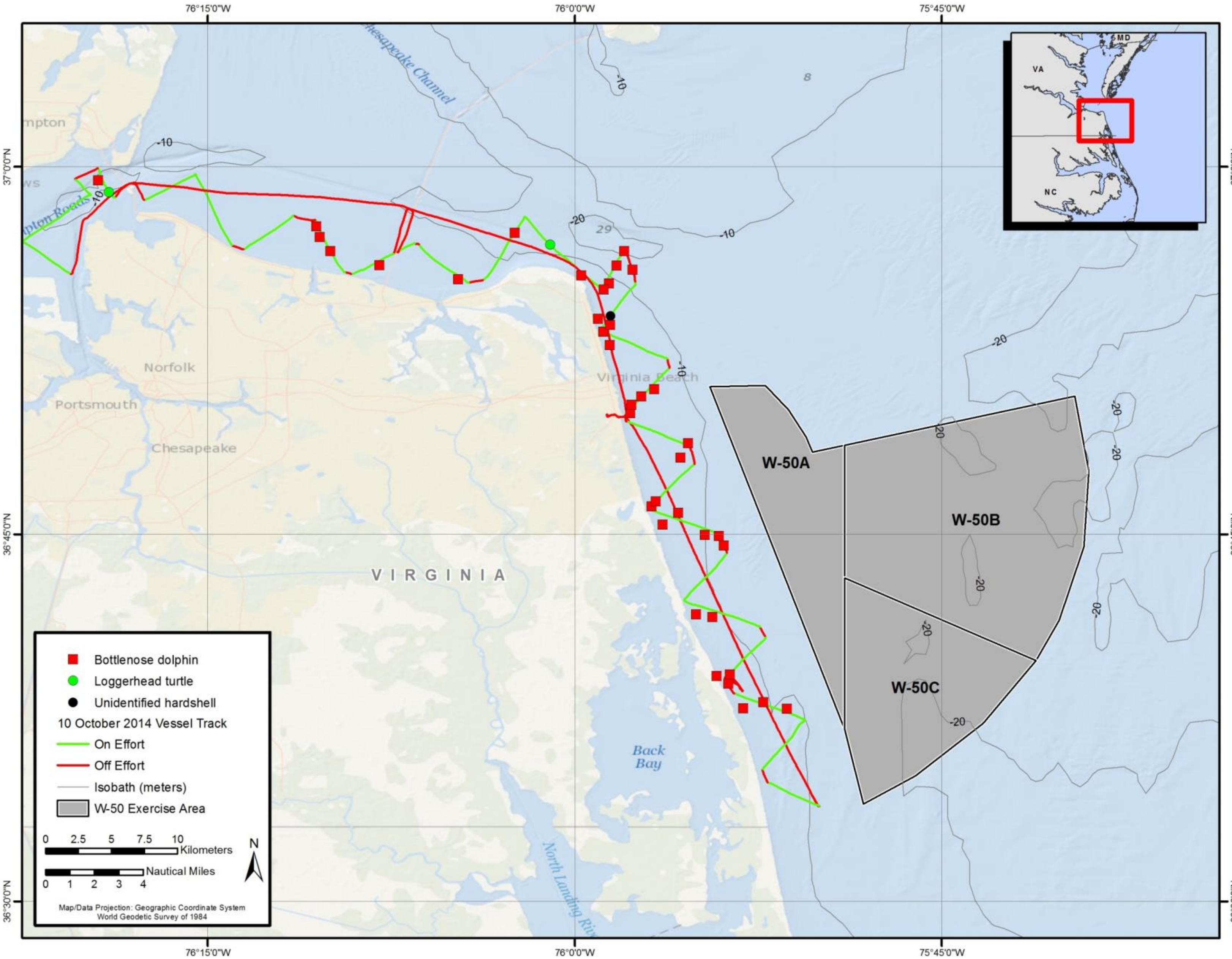
36°45'0"N
36°30'0"N
Chesapeake Channel
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
VA
MD
NC
Bottlenose dolphin
Loggerhead turtle
Unidentified hardshell
30 September 2014 Vessel Track
On Effort
Off Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 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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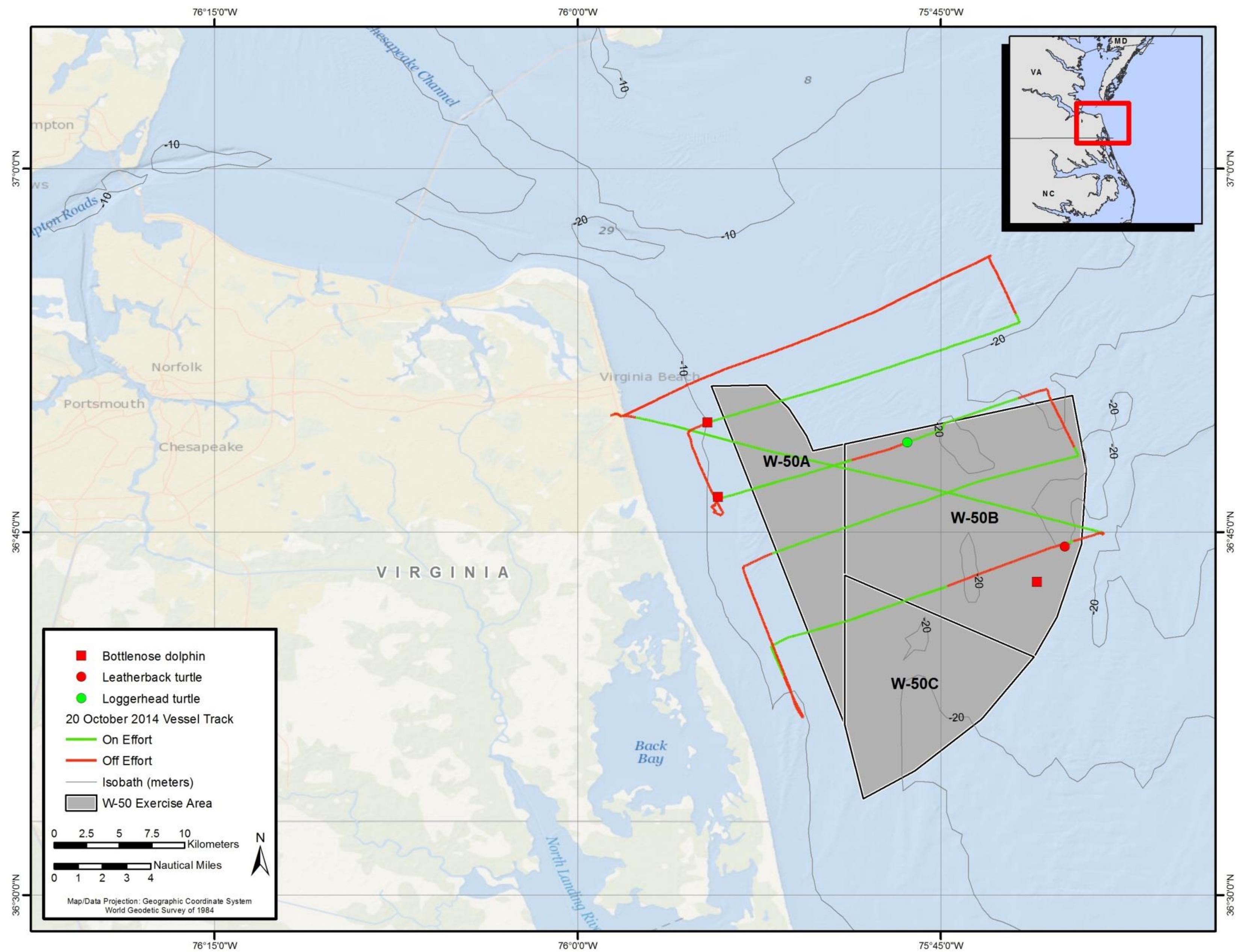
75°45'0"W
37°0'0"N
36°45'0"N
36°30'0"N
Chesapeake Channel
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
VA
MD
NC
Bottlenose dolphin
Loggerhead turtle
Unidentified hardshell
10 October 2014 Vessel Track
On Effort
Off Effort
Isobath (meters)
W-50 Exercise Area
Kilometers
Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984



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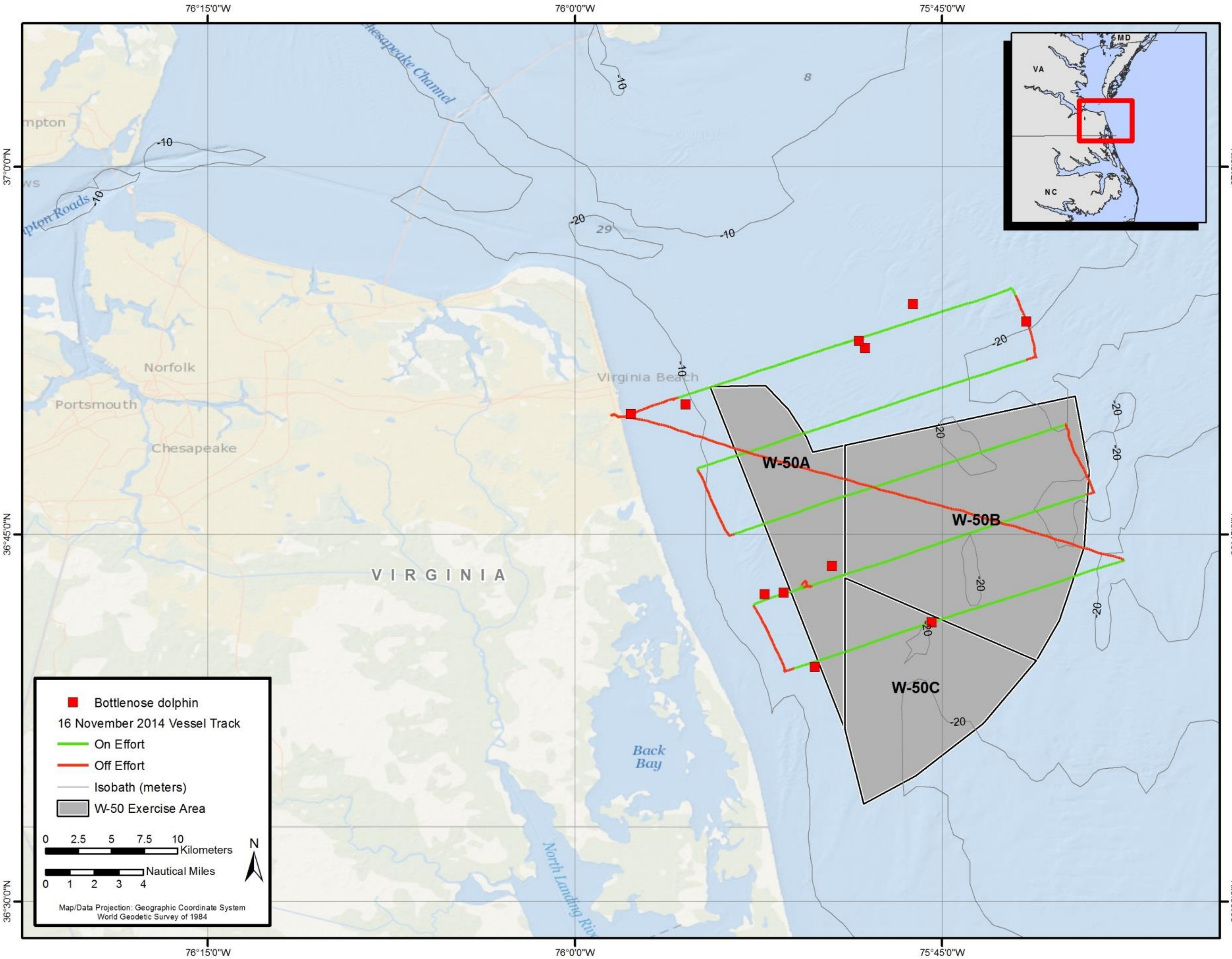
36°45'0"N
36°30'0"N
MD
VA
NC
Chesapeake Channel
Hampton Roads
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
-10
-20
Bottlenose dolphin
Leatherback turtle
Loggerhead turtle
20 October 2014 Vessel Track
On Effort
Off Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10
Kilometers
Nautical Miles
0 1 2 3 4
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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36°30'0"N
VA
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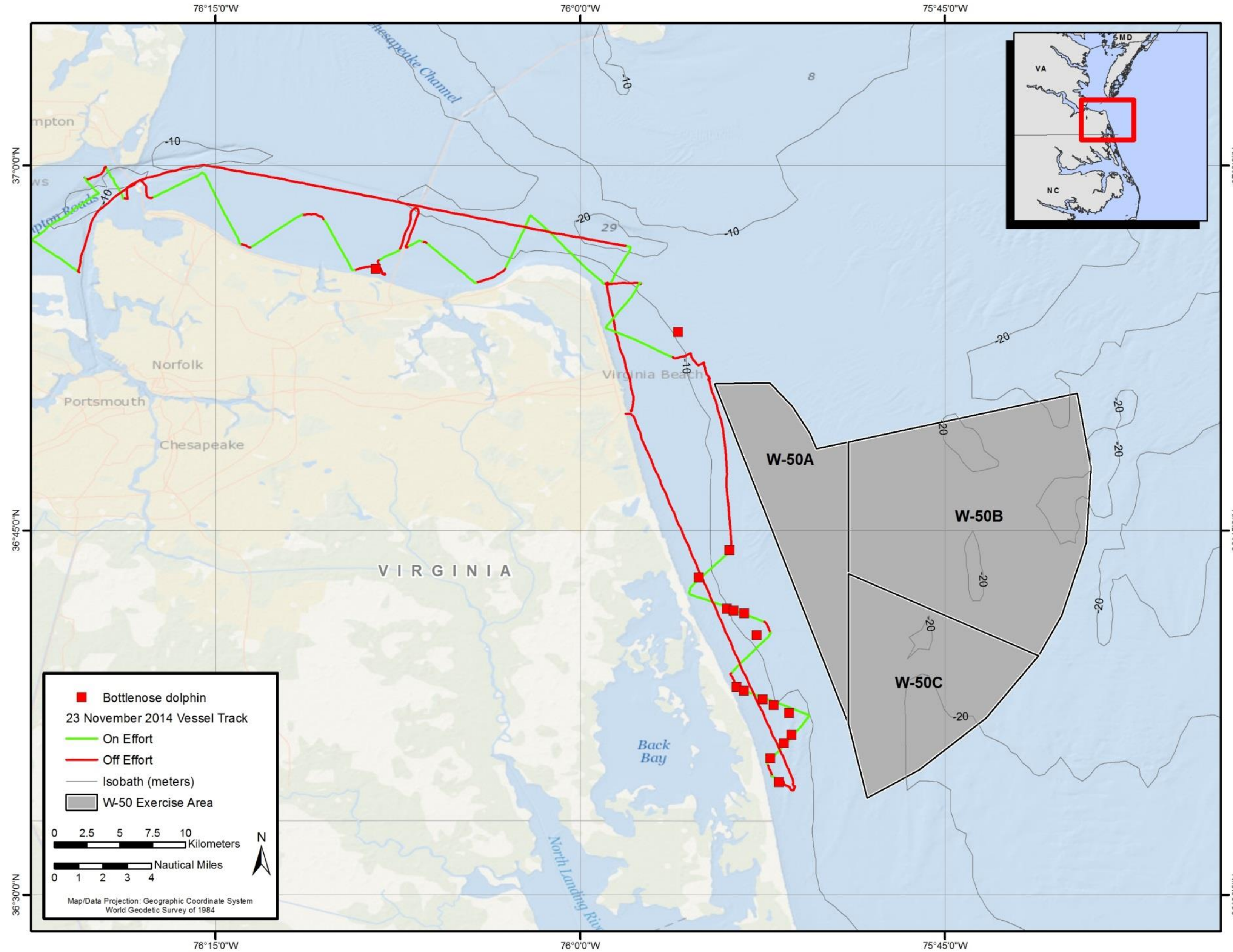
NC
Chesapeake Channel
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
Bottlenose dolphin
16 November 2014 Vessel Track
On Effort
Off Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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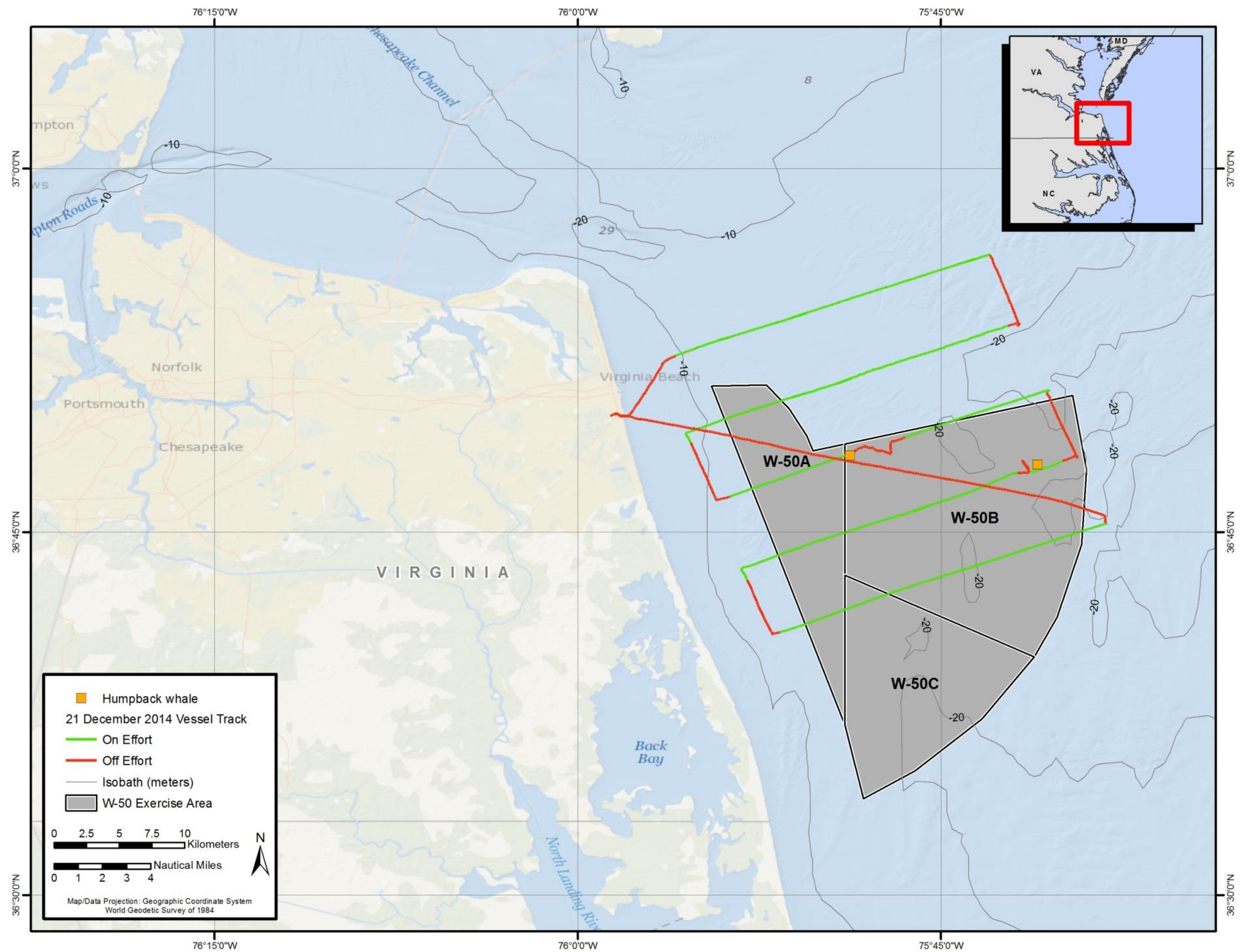
36°30'0"N
VA
MD
NC
Chesapeake Channel
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
Bottlenose dolphin
23 November 2014 Vessel Track
On Effort
Off Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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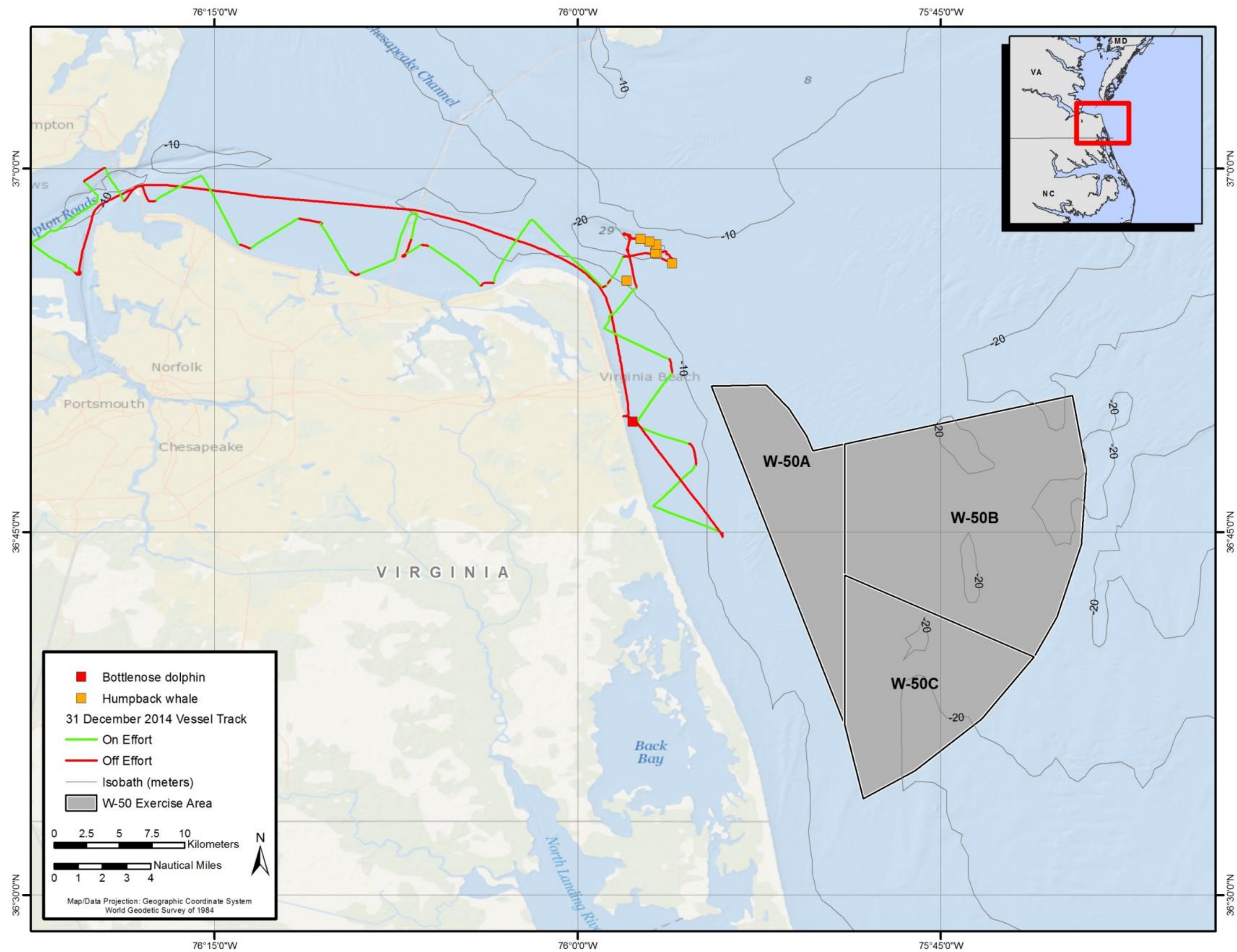
37°0'0"N
36°45'0"N
36°30'0"N
VA
MD
NC
Chesapeake Channel
Hampton Roads
Norfolk
Portsmouth
Chesapeake
Virginia Beach
VIRGINIA
Back Bay
North Landing River
W-50A
W-50B
W-50C
Humpback whale
21 December 2014 Vessel Track
On Effort
Off Effort
Isobath (meters)
W-50 Exercise Area
0 2.5 5 7.5 10 Kilometers
0 1 2 3 4 Nautical Miles
N
Map/Data Projection: Geographic Coordinate System
World Geodetic Survey of 1984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76°0'0"W
75°45'0"W
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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
VA
MD
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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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	7 Sep 2012	8:46	Tt	2	2	2	0	36.699	-75.919	On	15	31	3	7	80	No
2	7 Sep 2012	9:19	Tt	2	2	2	0	36.756	-75.946	On	304	580	3	8	80	No
3	7 Sep 2012	9:29	Tt	4	5	4	0	36.755	-75.931	On	70	364	3	10	80	No
4	7 Sep 2012	9:36	Tt	3	3	3	0	36.768	-75.928	On	354	31	3	9	80	No
5	7 Sep 2012	10:00	Tt	4	4	4	0	36.812	-75.958	On	315	177	3	9	80	No
6	7 Sep 2012	10:04	Tt	1	1	1	0	36.817	-75.958	On	330	50	3	9	80	No
7	7 Sep 2012	10:36	Tt	5	5	3	0	36.865	-75.960	On	90	267	3	9	80	No
8	7 Sep 2012	10:46	Tt	5	6	3	0	36.878	-75.966	On	292	927	3	8	80	No
9	7 Sep 2012	11:00	Tt	4	4	4	0	36.895	-75.975	On	296	809	3	7	80	No
10	7 Sep 2012	11:03	Tt	10	10	7	0	36.903	-75.974	Off	12	6	3	7	80	No
11	7 Sep 2012	11:13	Tt	4	4	4	0	36.918	-75.980	On	0	0	3	8	80	No
12	7 Sep 2012	11:14	Tt	8	9	4	0	36.922	-75.982	On	274	299	3	7	80	No
13	7 Sep 2012	11:29	Tt	3	3	3	0	36.935	-75.994	On	0	0	3	13	80	No
14	7 Sep 2012	11:30	Tt	25	30	10	0	36.932	-76.001	On	336	325	3	11	80	No
15	7 Sep 2012	11:35	Tt	5	5	3	0	36.934	-76.005	On	35	143	3	10	80	No
16	7 Sep 2012	11:38	Tt	5	5	3	0	36.937	-76.010	On	280	201	3	16	80	No
17	7 Sep 2012	11:41	Tt	6	6	4	0	36.947	-76.012	On	270	500	3	21	80	No
18	7 Sep 2012	11:51	Tt	3	3	3	0	36.945	-76.017	On	335	211	3	19	80	No
19	7 Sep 2012	11:53	Tt	1	1	1	0	36.940	-76.024	On	355	17	3	16	80	No
20	7 Sep 2012	11:55	Tt	2	2	2	0	36.939	-76.026	On	21	72	3	15	80	No
21	7 Sep 2012	11:57	Tt	25	30	5	1	36.937	-76.028	On	325	123	3	15	80	No
22	7 Sep 2012	12:02	Tt	7	7	4	0	36.938	-76.030	Off	35	57	3	16	80	No
23	7 Sep 2012	12:03	Tt	8	8	4	1	36.944	-76.028	Off	90	387	3	16	80	No
24	7 Sep 2012	12:42	Tt	3	3	3	0	36.944	-76.061	On	280	98	2	14	80	No
25	7 Sep 2012	12:44	Tt	8	8	4	0	36.954	-76.047	On	35	222	2	14	80	No
26	7 Sep 2012	12:50	Tt	3	3	3	1	36.944	-76.053	On	344	152	2	13	80	No
27	7 Sep 2012	12:53	Tt	12	14	5	1	36.945	-76.056	On	90	100	2	11	80	No
28	7 Sep 2012	12:56	Tt	2	2	2	0	36.934	-76.068	On	90	387	2	11	80	No
29	7 Sep 2012	13:04	Tt	7	7	7	0	36.921	-76.079	On	272	750	2	10	80	No
30	7 Sep 2012	13:06	Tt	13	15	6	0	36.929	-76.081	On	337	117	2	10	80	No
31	7 Sep 2012	13:09	Tt	8	8	3	0	36.936	-76.088	On	346	48	2	9	80	No
32	7 Sep 2012	13:11	Tt	10	12	8	0	36.938	-76.095	On	45	84	2	9	80	No
33	7 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	7 Sep 2012	13:20	Tt	3	3	3	0	36.920	-76.115	On	90	650	2	5	80	No
35	7 Sep 2012	13:28	Tt	35	43	28	-	36.946	-76.121	Off	316	347	2	8	80	No
36	7 Sep 2012	14:03	Tt	6	4	4	0	36.934	-76.178	On	0	0	2	9	80	No
37	7 Sep 2012	14:32	Tt	32	35	10	2	36.960	-76.198	On	45	32	3	8	80	No
38	7 Sep 2012	14:54	Cc	1	1	1	-	36.971	-76.227	On	300	-	3	-	80	No
03 October 2012 INSHORE transect																
1	3 Oct 2012	8:54	Tt	1	1	1	0	36.987	-76.316	On	298	441	1	4	72	No
2	3 Oct 2012	8:56	Tt	5	5	4	0	36.989	-76.308	On	18	83	1	7	72	No
3	3 Oct 2012	9:15	Tt	4	4	4	0	36.985	-76.275	On	328	212	1	5	72	No
4	3 Oct 2012	9:27	Tt	3	3	3	0	36.978	-76.268	On	90	800	1	7	72	No
5	3 Oct 2012	9:39	Tt	6	6	3	0	36.965	-76.230	On	85	996	1	8	72	No
6	3 Oct 2012	9:46	Tt	2	2	2	0	36.965	-76.220	On	285	258	2	7	72	No
7	3 Oct 2012	9:55	Tt	3	3	3	0	36.953	-76.198	On	8	167	2	9	72	No
8	3 Oct 2012	9:58	Tt	7	8	4	1	36.945	-76.199	On	76	970	2	7	72	No
9	3 Oct 2012	10:34	Tt	3	3	3	0	36.943	-76.170	On	288	451	2	3	73	No
10	3 Oct 2012	10:36	Tt	6	8	6	0	36.948	-76.167	On	270	387	2	3	73	No
11	3 Oct 2012	10:38	Tt	1	1	1	0	36.946	-76.158	On	0	0	2	3	73	No
12	3 Oct 2012	10:38	Tt	1	1	1	0	36.946	-76.157	On	270	50	2	3	73	No
13	3 Oct 2012	10:46	Tt	3	3	3	0	36.951	-76.136	On	286	115	2	8	73	No
14	3 Oct 2012	11:13	Tt	12	15	10	0	36.943	-76.083	On	0	0	2	11	72	No
15	3 Oct 2012	11:29	Tt	10	11	8	0	36.934	-76.065	On	288	194	2	10	72	No
16	3 Oct 2012	11:47	Tt	5	5	4	0	36.940	-76.030	On	350	35	2	7	72	No
17	3 Oct 2012	11:49	Tt	7	8	4	0	36.945	-76.018	On	280	693	2	5	72	No
18	3 Oct 2012	12:08	Tt	8	8	6	0	36.930	-76.001	On	90	300	1	3	72	No
19	3 Oct 2012	12:10	Tt	10	10	5	0	36.933	-75.988	On	20	132	1	3	72	No
20	3 Oct 2012	12:11	Tt	12	15	8	0	36.933	-75.994	Off	125	43	1	5	72	No
21	3 Oct 2012	12:13	Tt	6	6	4	0	36.938	-75.981	On	5	23	1	6	72	No
22	3 Oct 2012	12:20	Tt	18	21	10	2	36.935	-75.976	On	73	96	1	6	72	No
23	3 Oct 2012	12:24	Tt	7	7	6	2	36.922	-75.972	On	292	359	1	7	72	No
24	3 Oct 2012	12:24	Tt	9	14	9	0	36.925	-75.981	On	83	248	1	3	72	No
25	3 Oct 2012	12:28	Tt	2	2	2	0	36.914	-75.987	On	32	265	1	3	72	No
26	3 Oct 2012	12:29	Tt	6	6	5	0	36.915	-75.990	On	82	545	1	3	72	No
27	3 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	3 Oct 2012	12:37	Tt	1	1	1	0	36.894	-75.974	On	90	750	1	2	72	No
29	3 Oct 2012	12:49	Tt	3	4	3	0	36.874	-75.974	On	42	803	1	3	72	No
30	3 Oct 2012	12:53	Tt	8	10	6	0	36.871	-75.977	On	84	895	1	5	72	No
31	3 Oct 2012	14:03	Tt	1	1	1	0	36.755	-75.939	On	2	3	2	3	73	No
32	3 Oct 2012	14:21	Tt	7	12	7	0	36.719	-75.910	On	358	10	2	4	73	No
33	3 Oct 2012	14:36	Tt	11	13	10	0	36.692	-75.898	On	0	0	2	4	73	No
34	3 Oct 2012	14:50	Tt	18	20	15	2	36.668	-75.892	On	90	650	2	3	73	No
35	3 Oct 2012	14:52	Tt	5	5	5	0	36.663	-75.886	On	85	99	2	3	73	No
36	3 Oct 2012	14:53	Tt	5	5	4	0	36.647	-75.889	On	2	42	2	3	73	No
37	3 Oct 2012	14:54	Tt	5	5	5	0	36.654	-75.890	On	72	238	2	3	73	No
38	3 Oct 2012	14:55	Tt	3	3	3	0	36.651	-75.884	On	72	238	2	3	73	No
39	3 Oct 2012	14:57	Tt	4	4	4	0	36.643	-75.889	On	270	165	2	3	73	No
40	3 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	9 Jan 2013	13:52	Tt	30	40	30	6	36.699	-75.923	On	023	277	2	5-15	47	Yes
2	9 Jan 2013	14:07	Tt	35	35	35	12	36.708	-75.924	Off	000	268	2	5-15	47	Yes
3	9 Jan 2013	15:20	Tt	4	5	3	0	36.578	-75.840	On	328	200	2	5-15	47	Yes
4	9 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	1 Apr 2013	10:17	Tt	1	1	1	0	36.95	-76.22	On	324	110	2	5-15	47	No
2	1 Apr 2013	13:12	Mn	1	1	1	0	36.89	-75.95	On	032	140	2	9	49	Yes
3	1 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	9 May 2013	10:48	Tt	1	1	1	0	36.744	-75.919	On	271	200	2	11	62	No
2	9 May 2013	11:34	Tt	5	7	3	0	36.832	-75.947	On	002	10	2	11	63	No
3	9 May 2013	11:56	Tt	26	30	25	2	36.877	-75.962	On	346	160	2	8	61	No
4	9 May 2013	12:09	Tt	3	3	3	0	36.894	-75.959	On	316	243	2	10	62	No
5	9 May 2013	12:20	Tt	8	9	7	0	36.913	-75.986	On	296	269	2	7	63	No
6	9 May 2013	12:37	Tt	8	10	7	0	36.934	-75.992	On	305	287	2	14	64	No
7	9 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	118.9	191	2	9	78	Yes
2	24 Jul 2013	11:14	Tt	125	140	110	6	36.935	-76.026	On	152.8	109	2	4	77	Yes
3	24 Jul 2013	11:45	Tt	11	15	8	0	36.946	-76.021	On	17.0	33	2	18	77	No
4	24 Jul 2013	12:19	Tt	6	6	6	0	36.936	-75.995	On	131.3	200	1	12	80	No
5	24 Jul 2013	12:21	Tt	22	25	16	1	36.933	-76.002	On	178.4	36	1	9	80	No
6	24 Jul 2013	12:41	Tt	18	18	18	0	36.914	-75.976	On	152.9	179	1	5	78	No
7	24 Jul 2013	12:57	Tt	3	3	3	0	36.889	-75.946	On	135.4	13	2	9	73	No
8	24 Jul 2013	12:58	Tt	100	110	90	3	36.884	-75.943	On	127.0	241	2	9	73	Yes
9	24 Jul 2013	13:28	Tt	3	3	3	0	36.868	-75.960	On	250.2	7	2	8	73	No
10	24 Jul 2013	13:42	Tt	6	6	6	0	36.846	-75.942	On	223.3	75	2	9	78	No
11	24 Jul 2013	14:04	Tt	2	2	2	0	36.803	-75.940	On	102.5	50	2	9	73	No
12	24 Jul 2013	14:43	Tt	10	12	6	1	36.715	-75.914	On	217.8	97	2	10	77	No
13	24 Jul 2013	14:46	Tt	8	8	8	0	36.712	-75.925	On	287.7	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	165.7	117	3	2	81	Yes
2	13 Aug 2013	9:28	Tt	40	45	35	2	36.942	-76.218	On	159.8	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	169.1	137	3	16	80	No
4	13 Aug 2013	12:12	Tt	90	100	80	4	36.960	-76.004	On	81.7	199	3	24	80	Yes
5	13 Aug 2013	12:26	Tt	9	13	3	0	36.939	-76.003	On	180.0	87	3	24	80	No
6	13 Aug 2013	13:48	Tt	2	2	2	0	36.803	-75.935	On	76.5	76	3	9	77	No
7	13 Aug 2013	14:02	Tt	3	3	3	0	36.788	-75.926	On	0.0	35	3	12	77	No
8	13 Aug 2013	14:05	Tt	68	75	65	0	36.778	-75.928	On	123.9	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	358.1	241	2	10	72	Yes
2	25 Sep 2013	9:37	Tt	6	6	6	0	36.600	-75.872	Off	0.0	0	2	10	72	No
3	25 Sep 2013	9:40	Tt	9	15	12	0	36.609	-75.868	On	48.6	103	2	10	72	No
4	25 Sep 2013	9:42	Tt	5	7	5	0	36.614	-75.869	On	6.2	137	2	11	71	No
5	25 Sep 2013	9:49	Tt	30	35	20	0	36.635	-75.857	On	17.0	137	2	11	71	No
6	25 Sep 2013	10:05	Tt	1	1	1	0	36.653	-75.886	On	104.5	362	2	11	71	No
7	25 Sep 2013	10:24	Tt	3	3	3	0	36.694	-75.903	On	289.1	56	2	10	72	No
8	25 Sep 2013	10:33	Tt	7	7	5	0	36.714	-75.911	On	46.6	239	1	10	72	No
9	25 Sep 2013	10:40	Tt	3	3	3	0	36.729	-75.919	On	300.9	975	1	12	72	No
10	25 Sep 2013	10:46	Tt	3	3	3	0	36.742	-75.914	On	279.4	266	1	10	72	No
11	25 Sep 2013	10:47	Tt	4	5	4	0	36.748	-75.912	On	3.1	362	1	10	72	No
12	25 Sep 2013	10:53	Tt	145	160	120	6	36.752	-75.921	On	348.3	411	1	10	72	Yes
13	25 Sep 2013	11:47	Tt	6	7	5	0	36.819	-75.964	On	306.3	600	1	9	73	No
14	25 Sep 2013	11:52	Tt	3	4	3	0	36.830	-75.951	On	0.0	139	1	9	73	No
15	25 Sep 2013	11:59	Tt	55	60	45	0	36.847	-75.930	On	66.7	447	1	9	73	No
16	25 Sep 2013	12:15	Tt	7	10	7	0	36.873	-75.961	On	97.9	160	1	8	73	No
17	25 Sep 2013	12:20	Tt	30	35	25	0	36.890	-75.955	On	8.8	354	2	12	73	No
18	25 Sep 2013	12:22	Mn	1	1	1	0	36.882	-75.950	On	195.7	496	2	12	73	Yes
19	25 Sep 2013	12:49	Tt	3	3	3	0	36.909	-75.984	On	341.1	176	2	11	71	No
20	25 Sep 2013	12:50	Tt	15	20	12	0	36.912	-75.988	On	302.9	383	2	11	71	No
21	25 Sep 2013	12:53	Tt	5	5	5	0	36.922	-75.979	On	43.6	95	2	11	71	No
22	25 Sep 2013	12:59	Tt	18	25	15	0	36.942	-75.970	On	35.0	199	2	11	72	No
23	25 Sep 2013	13:12	Tt	13	15	8	0	36.933	-75.999	On	252.1	12	2	11	72	No
24	25 Sep 2013	13:17	Tt	8	10	8	0	36.938	-76.004	On	59.5	114	2	11	72	No
25	25 Sep 2013	13:19	Tt	4	4	4	0	36.946	-76.010	On	312.4	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	357.7	51	2	11	72	No
27	25 Sep 2013	13:24	Tt	5	5	5	0	36.958	-76.009	On	345.3	107	2	11	72	No
28	25 Sep 2013	13:30	Tt	21	25	21	0	36.945	-76.022	On	226.1	42	2	10	72	No
29	25 Sep 2013	13:38	Tt	1	1	1	0	36.944	-76.036	On	350.7	57	2	10	72	No
30	25 Sep 2013	13:44	Tt	6	6	5	0	36.952	-76.055	On	242.4	680	2	10	72	No
31	25 Sep 2013	13:46	Tt	42	35	50	0	36.950	-76.070	On	255.9	260	2	10	72	No
32	25 Sep 2013	13:55	Tt	9	10	8	0	36.930	-76.059	On	143.0	671	2	10	73	No
33	25 Sep 2013	14:05	Tt	2	2	2	0	36.927	-76.093	On	278.6	964	2	10	73	No
34	25 Sep 2013	14:45	Tt	6	8	5	0	36.948	-76.192	On	307.2	436	2	6	74	No
35	25 Sep 2013	15:11	Tt	2	2	2	0	36.976	-76.241	On	313.0	1149	2	7	74	No
36	25 Sep 2013	15:53	Cc	1	1	1	0	36.993	-76.308	On	251.6	500	2	21	74	No
37	25 Sep 2013	16:34	Tt	28	30	25	2	36.955	-76.376	On	282.4	104	2	7	74	No
38	25 Sep 2013	16:49	Tt	40	45	35	4	36.931	-76.346	On	152.8	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	340.0	275	2	7	70	No
2	17 Oct 2013	12:26	Tt	8	10	4	0	36.955	-76.059	On	321.0	570	1	12	70	No
3	17 Oct 2013	12:28	Tt	2	2	2	0	36.952	-76.054	On	299.0	250	1	12	70	No
4	17 Oct 2013	12:46	Tt	5	8	4	0	36.955	-76.015	On	306.0	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	215.0	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	32.0	11	3	17	69	No
8	17 Oct 2013	13:45	Tt	12	15	8	0	36.907	-75.985	On	280.0	94	3	4	69	No
9	17 Oct 2013	14:13	Tt	20	24	16	0	36.857	-75.972	On	264.0	122	3	7	69	No
10	17 Oct 2013	14:39	Tt	36	41	29	4	36.812	-75.964	On	236.0	61	3	5	70	Yes
11	17 Oct 2013	16:17	Tt	5	8	4	0	36.698	-75.920	On	237.0	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	60.9	366	2	11	58	No
2	16 Nov 2013	8:19	Tt	4	5	3	0	36.621	-75.865	On	302.4	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	62.0	203	1	8	46	Yes
2	15 Jan 2014	15:39	Tt	68	79	60	5	36.710	-75.920	On	55.0	512	1	5	47	Yes
3	15 Jan 2014	16:57	Tt	7	9	5	0	36.787	-75.948	Off	180.0	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	350.0	48	2	8	40	Yes
2	07 Feb 2014	12:41	Tt	12	15	10	1	36.922	-76.068	On	40.0	129	2	5	40	Yes
3	07 Feb 2014	16:07	Tt	46	50	43	3	36.647	-75.893	On	0.0	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	23.0	59	2	8	44	No
2	02 Apr 2014	8:33	Tt	38	40	30	2	36.704	-75.912	On	14.0	163	2	9	44	Yes
3	02 Apr 2014	9:25	Tt	3	3	3	0	36.651	-75.897	On	336.0	31	2	4	44	No
4	02 Apr 2014	9:46	Tt	4	5	3	0	36.620	-75.844	On	270.0	170	2	9	45	No
5	02 Apr 2014	14:02	Tt	43	48	40	3	36.975	-76.247	On	4.0	87	2	7	48	Yes
6	02 Apr 2014	14:03	Tt	75	80	70	4	36.984	-76.246	On	277.0	367	2	7	48	Yes
7	02 Apr 2014	14:31	Tt	35	40	30	0	36.972	-76.226	Off	250.0	633	2	7	48	No
8	02 Apr 2014	17:14	Tt	5	6	4	0	36.886	-75.967	On	304.0	306	2	7	44	No
9	02 Apr 2014	17:18	Mn	1	1	1	0	36.886	-75.960	On	318.0	319	2	7	44	Yes
10	02 Apr 2014	17:49	Tt	8	9	4	0	36.834	-75.954	On	282.0	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	89.0	499	2	12	51	Yes
2	10 Apr 2014	9:31	Tt	62	66	23	0	36.782	-75.927	On	2.0	42	2	10	53	Yes
3	10 Apr 2014	9:33	Tt	22	25	20	0	36.796	-75.919	On	45.0	189	2	10	53	No
4	10 Apr 2014	9:58	Tt	3	3	3	0	36.796	-75.905	On	45.0	851	1	10	52	No
5	10 Apr 2014	10:06	Tt	2	2	2	0	36.816	-75.929	On	90.0	267	1	9	52	No
6	10 Apr 2014	10:23	Tt	2	2	2	0	36.841	-75.955	On	43.0	182	1	8	52	No
7	10 Apr 2014	10:51	Tt	2	2	2	0	36.890	-75.984	On	28.0	117	1	4	52	No
8	10 Apr 2014	10:54	Tt	5	7	2	0	36.900	-75.975	On	317.0	484	1	4	52	No
9	10 Apr 2014	11:27	Tt	8	10	7	0	36.917	-75.987	On	312.0	253	1	6	55	No
10	10 Apr 2014	11:31	Tt	23	25	20	1	36.924	-75.996	On	312.0	297	1	7	54	Yes
11	10 Apr 2014	12:01	Tt	60	66	56	0	36.966	-76.032	On	85.0	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	315.0	189	1	8	57	No
2	03 May 2014	6:41	Tt	2	2	1	0	36.773	-75.945	On	10.0	35	1	8	57	No
3	03 May 2014	6:47	Tt	1	1	1	0	36.766	-75.939	On	330.0	194	1	8	57	No
4	03 May 2014	6:50	Tt	3	3	3	0	36.761	-75.928	On	0.0	0	1	8	57	No
5	03 May 2014	7:18	Tt	2	2	1	0	36.706	-75.916	On	10.0	35	1	8	57	No
6	03 May 2014	8:07	Mn	1	1	1	0	36.618	-75.849	Off	310.0	153	1	9	57	Yes
7	03 May 2014	10:13	Tt	1	1	1	0	36.857	-75.942	On	350.0	17	1	9	57	No
8	03 May 2014	10:24	Tt	4	4	1	0	36.879	-75.959	On	20.0	34	1	8	58	No
9	03 May 2014	10:29	Tt	3	3	2	0	36.887	-75.972	On	90.0	250	1	8	58	No
10	03 May 2014	10:32	Tt	2	2	2	0	36.889	-75.982	On	45.0	71	1	8	58	No
11	03 May 2014	10:35	Tt	6	7	4	0	36.891	-75.981	Off	30.0	50	1	8	58	No
12	03 May 2014	11:09	Tt	1	1	1	0	36.918	-75.986	On	330.0	85	1	7	58	No
13	03 May 2014	12:28	Tt	1	1	1	0	36.936	-76.136	On	350.0	26	2	9	62	No
14	03 May 2014	13:25	Tt	2	2	2	0	36.965	-76.244	On	328.0	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	267.0	38	3	8	80	No
2	26 Jun 2014	10:00	Tt	5	4	4	0	36.964	-76.244	On	298.0	279	3	8	80	No
3	26 Jun 2014	10:55	UnidHT	1	1	1	0	36.933	-76.140	On	348.0	4	3	10	80	No
4	26 Jun 2014	11:46	Tt	2	3	2	0	36.928	-75.975	On	87.0	120	2	13	76	No
5	26 Jun 2014	12:15	Tt	6	8	4	0	36.922	-75.991	On	86.0	273	2	11	79	No
6	26 Jun 2014	12:19	Tt	27	32	23	0	36.910	-75.982	On	5.0	44	2	11	79	Yes
7	26 Jun 2014	12:49	Tt	12	15	10	0	36.916	-75.962	On	31.0	84	2	8	80	No
8	26 Jun 2014	12:51	Tt	2	2	2	0	36.776	-75.939	On	18.0	23	2	8	80	No
9	26 Jun 2014	12:58	Tt	1	1	1	0	36.636	-75.887	On	14.0	5	2	6	80	No
10	26 Jun 2014	13:11	UnidHT	1	1	1	0	36.684	-75.897	On	52.0	48	3	6	80	No
11	26 Jun 2014	13:58	Tt	2	2	2	0	36.827	-75.945	On	36.0	3	3	9	78	No
12	26 Jun 2014	14:31	UnidHT	1	1	1	0	36.672	-75.877	On	88.0	35	3	11	78	No
13	26 Jun 2014	14:48	UnidHT	1	1	1	0	36.619	-75.847	On	345.0	1	4	11	78	No
14	26 Jun 2014	14:57	Tt	4	5	3	0	36.716	-75.917	On	340.0	21	3	11	79	No
15	26 Jun 2014	15:07	Tt	1	1	1	0	36.944	-76.045	On	45.0	3	3	4	78	No
16	26 Jun 2014	15:10	Tt	45	50	42	0	36.692	-75.887	On	38.0	433	3	9	77	Yes
17	26 Jun 2014	15:41	Cc	1	1	1	0	36.888	-75.981	On	90.0	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	52.0	210	2	9	76	No
2	30 Jul 2014	7:13	Tt	2	2	2	0	36.874	-75.943	On	63.0	345	2	9	76	No
3	30 Jul 2014	7:24	Tt	4	5	2	0	36.884	-75.974	On	337.0	108	2	9	75	No
4	30 Jul 2014	7:25	Tt	1	1	1	0	36.888	-75.980	On	37.0	45	2	9	75	No
5	30 Jul 2014	7:30	Tt	42	45	2	0	36.897	-75.976	On	4.0	10	2	6	73	No
6	30 Jul 2014	7:37	Tt	2	2	2	0	36.912	-75.962	On	332.0	77	2	6	73	No
7	30 Jul 2014	8:06	Tt	125	150	100	5	36.927	-75.998	On	331.0	129	2	6	76	Yes
8	30 Jul 2014	9:04	Tt	14	18	14	0	36.935	-76.059	On	350.0	113	3	9	77	No
9	30 Jul 2014	10:00	Tt	3	3	3	0	36.935	-76.138	On	41.0	141	2	4	78	No
10	30 Jul 2014	11:12	Tt	6	6	4	0	36.983	-76.277	On	312.0	520	2	5	79	No
11	30 Jul 2014	11:51	UnidHT	1	1	1	0	36.982	-76.332	On	292.0	32	1	5	78	No
12	30 Jul 2014	15:12	Tt	5	5	5	0	36.637	-75.894	On	0.0	0	2	5	78	No
13	30 Jul 2014	15:13	Tt	7	8	4	0	36.639	-75.888	On	286.0	87	2	5	78	No
14	30 Jul 2014	15:43	Tt	45	55	35	2	36.702	-75.915	On	31.0	412	2	2	78	Yes
15	30 Jul 2014	16:28	Tt	3	3	3	0	36.760	-75.939	On	1.0	14	2	7	78	No
16	30 Jul 2014	16:30	Tt	5	5	5	0	36.764	-75.938	On	42.0	84	2	7	78	No
17	30 Jul 2014	16:33	Cc	1	1	1	0	36.767	-75.946	On	276.0	10	2	7	78	No
18	30 Jul 2014	16:52	Tt	3	3	3	0	36.813	-75.926	On	298.0	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	14.0	5	3	3	72	No
2	30 Sep 2014	7:37	Tt	4	5	3	0	36.590	-75.869	On	54.0	158	3	3	72	No
3	30 Sep 2014	7:43	Tt	5	6	4	0	36.600	-75.857	On	68.0	561	3	9	72	No
4	30 Sep 2014	7:49	Tt	82	98	65	0	36.625	-75.845	On	284.0	703	3	10	72	Yes
5	30 Sep 2014	8:27	Tt	15	18	12	0	36.637	-75.843	On	303.0	1053	3	9	72	No
6	30 Sep 2014	8:29	Tt	8	10	6	0	36.626	-75.851	On	44.0	247	3	9	72	No
7	30 Sep 2014	8:32	Tt	5	6	4	0	36.639	-75.860	On	308.0	743	3	10	72	No
8	30 Sep 2014	8:38	Tt	4	4	4	0	36.638	-75.883	On	56.0	40	3	7	72	No
9	30 Sep 2014	8:41	Tt	4	6	4	0	36.640	-75.890	On	88.0	156	3	7	72	No
10	30 Sep 2014	8:44	Tt	3	3	3	0	36.653	-75.896	On	334.0	19	3	7	73	No
11	30 Sep 2014	8:45	Tt	10	12	8	0	36.657	-75.894	On	270.0	195	3	7	73	No
12	30 Sep 2014	8:47	Tt	5	7	3	0	36.668	-75.882	On	299.0	1053	3	9	72	No
13	30 Sep 2014	8:48	Tt	7	8	6	0	36.658	-75.883	On	38.0	401	3	9	72	No
14	30 Sep 2014	9:02	Tt	10	14	6	0	36.695	-75.884	On	301.0	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	348.0	30	3	11	72	Yes
16	30 Sep 2014	9:19	Tt	10	15	8	0	36.697	-75.903	On	38.0	363	3	11	72	No
17	30 Sep 2014	9:34	Tt	5	5	4	0	36.726	-75.932	On	90.0	499	3	8	72	No
18	30 Sep 2014	9:36	Tt	15	16	12	0	36.733	-75.932	On	50.0	296	3	7	72	No
19	30 Sep 2014	9:48	Tt	8	11	7	0	36.762	-75.942	On	7.0	40	3	6	72	No
20	30 Sep 2014	9:57	Tt	4	5	3	0	36.778	-75.934	On	43.0	182	3	9	72	No
21	30 Sep 2014	10:25	Tt	7	9	6	0	36.837	-75.956	On	25.0	139	3	9	73	No
22	30 Sep 2014	10:31	Tt	3	4	3	0	36.854	-75.944	On	302.0	328	3	9	72	No
23	30 Sep 2014	10:39	Cc	1	1	1	0	36.869	-75.938	On	61.0	174	3	8	72	No
24	30 Sep 2014	10:43	Tt	2	2	1	0	36.874	-75.950	On	66.0	223	3	8	72	No
25	30 Sep 2014	10:45	Tt	4	5	4	0	36.877	-75.954	On	28.0	150	3	8	73	No
26	30 Sep 2014	10:47	Tt	6	7	5	0	36.871	-75.954	On	62.0	1063	3	8	73	No
27	30 Sep 2014	10:48	UnidHT	1	1	1	0	36.882	-75.965	On	88.0	99	3	8	73	No
28	30 Sep 2014	10:52	Tt	7	8	5	0	36.887	-75.978	On	64.0	139	3	8	73	No
29	30 Sep 2014	10:54	Cc	1	1	1	0	36.891	-75.982	On	0.0	0	3	8	73	No
30	30 Sep 2014	10:55	Tt	7	8	5	0	36.897	-75.977	On	292.0	329	3	8	73	No
31	30 Sep 2014	10:59	Tt	5	6	4	0	36.897	-75.972	On	85.0	603	3	7	73	No
32	30 Sep 2014	11:02	Tt	2	2	2	0	36.908	-75.962	On	0.0	0	3	11	73	No
33	30 Sep 2014	11:04	Tt	5	6	3	0	36.910	-75.963	On	87.0	424	3	11	73	No
34	30 Sep 2014	12:00	Tt	4	5	4	0	36.936	-76.049	On	52.0	299	3	11	72	No
35	30 Sep 2014	12:41	Tt	4	5	4	0	36.934	-76.131	On	25.0	298	2	8	73	No
36	30 Sep 2014	12:43	Tt	92	100	75	2	36.931	-76.136	On	28.0	428	2	8	73	Yes
37	30 Sep 2014	13:10	Tt	4	5	4	0	36.958	-76.168	On	328.0	264	2	7	73	No
38	30 Sep 2014	13:24	Tt	9	12	8	0	36.964	-76.183	On	29.0	630	2	7	74	No
39	30 Sep 2014	14:26	Tt	10	13	10	0	36.993	-76.334	Off	52.0	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	90.0	251	3	11	70	No
2	10 Oct 2014	7:40	Tt	3	4	3	0	36.636	-75.872	On	42.0	133	3	9	70	No
3	10 Oct 2014	7:44	Tt	2	2	2	0	36.631	-75.885	On	286.0	769	3	7	70	No
4	10 Oct 2014	7:48	Tt	2	2	2	0	36.648	-75.895	Off	45.0	49	3	5	70	No
5	10 Oct 2014	7:50	Tt	40	45	36	2	36.654	-75.894	On	71.0	148	3	5	70	Yes
6	10 Oct 2014	8:11	Tt	6	8	4	0	36.653	-75.903	On	303.0	1180	2	10	70	No
7	10 Oct 2014	8:29	Tt	28	33	22	0	36.693	-75.906	On	68.0	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	22.0	249	3	4	70	No
9	10 Oct 2014	8:53	Tt	2	2	2	0	36.742	-75.898	Off	310.0	38	3	13	70	No
10	10 Oct 2014	8:54	Tt	5	6	4	0	36.749	-75.902	Off	66.0	110	3	13	70	No
11	10 Oct 2014	8:58	Tt	3	5	2	0	36.749	-75.911	On	6.0	49	4	11	70	No
12	10 Oct 2014	9:01	Tt	5	6	3	0	36.764	-75.929	On	38.0	741	3	10	70	No
13	10 Oct 2014	9:05	Tt	20	30	15	0	36.757	-75.940	On	312.0	600	3	10	70	No
14	10 Oct 2014	9:10	Tt	5	6	4	0	36.769	-75.948	On	0.0	0	3	8	70	No
15	10 Oct 2014	9:11	Tt	2	3	2	0	36.772	-75.945	On	2.0	4	3	8	70	No
16	10 Oct 2014	9:25	Tt	10	12	8	0	36.802	-75.928	Off	270.0	799	3	10	70	No
17	10 Oct 2014	9:27	Tt	2	2	2	0	36.812	-75.923	On	90.0	83	3	10	70	No
18	10 Oct 2014	9:41	Tt	2	3	2	0	36.832	-75.962	Off	89.0	355	3	8	70	No
19	10 Oct 2014	9:43	Tt	5	5	5	0	36.838	-75.961	On	353.0	32	2	9	70	No
20	10 Oct 2014	9:46	Tt	2	2	2	0	36.844	-75.955	On	4.0	10	2	9	70	No
21	10 Oct 2014	9:47	Tt	7	10	5	0	36.848	-75.946	On	40.0	494	2	9	70	No
22	10 Oct 2014	10:08	Tt	2	2	2	0	36.879	-75.976	On	305.0	582	1	8	70	No
23	10 Oct 2014	10:10	Tt	18	20	15	0	36.888	-75.980	On	0.0	0	1	5	70	No
24	10 Oct 2014	10:14	Tt	7	8	5	0	36.892	-75.976	On	78.0	334	1	7	70	No
25	10 Oct 2014	10:16	Tt	7	8	5	0	36.897	-75.984	On	270.0	560	1	7	70	No
26	10 Oct 2014	10:17	UnidHT	1	1	1	0	36.899	-75.976	On	10.0	9	1	7	70	No
27	10 Oct 2014	10:29	Tt	6	10	4	0	36.930	-75.961	Off	24.0	74	1	20	70	Yes
28	10 Oct 2014	10:33	Tt	1	1	1	0	36.943	-75.966	On	28.0	42	1	22	70	No
29	10 Oct 2014	10:38	Tt	3	4	3	0	36.933	-75.972	On	270.0	425	1	14	70	No
30	10 Oct 2014	10:41	Tt	7	8	6	0	36.921	-75.977	On	20.0	99	1	9	70	No
31	10 Oct 2014	10:43	Tt	26	32	20	0	36.916	-75.980	On	0.0	0	1	7	70	No
32	10 Oct 2014	10:48	Tt	2	2	2	0	36.926	-75.995	On	329.0	80	1	8	70	No
33	10 Oct 2014	10:57	Cc	1	1	1	0	36.947	-76.017	On	63.0	5	1	8	70	No
34	10 Oct 2014	11:09	Tt	9	11	7	0	36.955	-76.041	On	68.0	233	2	18	70	No
35	10 Oct 2014	11:26	Tt	7	8	6	0	36.923	-76.079	On	1.0	6	2	9	70	No
36	10 Oct 2014	11:58	Tt	3	4	3	0	36.933	-76.133	On	330.0	139	2	9	70	No
37	10 Oct 2014	12:11	Tt	5	7	4	0	36.943	-76.166	On	44.0	108	2	8	70	No
38	10 Oct 2014	12:14	Tt	18	25	14	1	36.952	-76.174	On	0.0	0	2	7	70	No
39	10 Oct 2014	12:17	Tt	4	5	4	0	36.959	-76.176	On	300.0	116	2	7	70	No
40	10 Oct 2014	13:13	Cc	1	1	1	0	36.983	-76.317	On	43.0	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	10.0	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	297.0	740	1	7	46	Yes
2	23 Nov 2014	12:56	Tt	110	125	65	1	36.886	-75.933	On	274.0	1890	2	12	48	Yes
3	23 Nov 2014	13:50	Tt	3	4	2	0	36.736	-75.898	On	342.0	49	1	11	50	No
4	23 Nov 2014	13:57	Tt	11	12	9	0	36.718	-75.919	On	302.0	645	1	10	51	No
5	23 Nov 2014	14:10	Tt	4	4	4	0	36.696	-75.899	On	308.0	555	1	10	50	No
6	23 Nov 2014	14:13	Tt	7	8	5	0	36.695	-75.895	On	355.0	9	1	11	49	No
7	23 Nov 2014	14:15	Tt	5	6	4	0	36.693	-75.888	On	288.0	254	1	11	49	No
8	23 Nov 2014	14:25	Tt	2	2	2	0	36.678	-75.879	On	2.0	23	1	12	49	No
9	23 Nov 2014	14:39	Tt	12	15	10	0	36.642	-75.893	On	90.0	125	2	6	51	No
10	23 Nov 2014	14:41	Tt	2	2	2	0	36.640	-75.888	On	43.0	18	2	6	51	No
11	23 Nov 2014	14:43	Tt	11	13	8	0	36.634	-75.875	On	315.0	353	2	10	51	No
12	23 Nov 2014	14:47	Tt	3	3	3	0	36.630	-75.867	On	352.0	45	2	10	51	No
13	23 Nov 2014	14:51	Tt	1	1	1	0	36.625	-75.857	On	34.0	216	2	9	51	No
14	23 Nov 2014	15:00	Tt	5	5	5	0	36.610	-75.855	On	337.0	46	2	8	51	No
15	23 Nov 2014	15:02	Tt	5	6	4	0	36.604	-75.860	On	312.0	198	2	17	51	No
16	23 Nov 2014	15:08	Tt	3	3	2	0	36.594	-75.870	On	88.0	180	2	2	51	No
17	23 Nov 2014	15:15	Tt	90	95	85	3	36.577	-75.864	Off	0.0	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	70.0	1131	2	18	45	Yes
2	31 Dec 2014	12:58	Mn	1	1	1	0	36.941	-75.945	On	0.0	-	2	18	45	Yes
3	31 Dec 2014	13:03	Mn	1	1	1	0	36.935	-75.935	On	0.0	-	2	18	45	Yes
4	31 Dec 2014	13:21	Mn	2	2	2	0	36.942	-75.947	On	0.0	-	2	18	45	Yes
5	31 Dec 2014	13:33	Mn	1	1	1	0	36.948	-75.946	On	0.0	-	2	18	45	Yes
6	31 Dec 2014	13:35	Mn	1	1	1	0	36.950	-75.950	On	0.0	-	2	18	45	Yes
7	31 Dec 2014	13:38	Mn	2	2	2	0	36.952	-75.957	On	0.0	-	2	18	45	Yes
8	31 Dec 2014	15:04	Tt	2	2	2	0	36.826	-75.962	On	88.0	7	3	9	45	No

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

Key:
Cc = Loggerhead turtle (*Caretta caretta*)
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§ (°F)	Photos Taken
08 August 2012 MINEX transect																
1	8 Aug 2012	15:09	Cc	1	1	1	-	36.629	-75.721	On	280	157	180	12	78	No
2	8 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	3 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	0.0	44	1	22	72	No
2	27 Jul 2013	7:42	Dc	1	1	1	-	36.617	-75.771	On	53.1	37	1	23	72	No
3	27 Jul 2013	7:47	Dc	1	1	1	-	36.625	-75.754	On	34.6	83	1	20	72	No
4	27 Jul 2013	8:19	Dc	1	1	1	-	36.662	-75.652	On	100.9	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	134.0	211	1	21	72	No
6	27 Jul 2013	8:44	UnidST	1	1	1	-	36.693	-75.570	On	128.3	145	1	20	72	No
7	27 Jul 2013	9:28	Dc	1	1	1	-	36.725	-75.667	On	326.8	86	1	23	74	No
8	27 Jul 2013	9:31	Cc	1	1	1	-	36.721	-75.676	On	198.1	22	1	19	74	No
9	27 Jul 2013	9:34	Dc	1	1	1	-	36.719	-75.687	On	243.9	29	1	18	74	No
10	27 Jul 2013	9:40	UnidST	1	1	1	-	36.713	-75.707	On	304.5	89	1	20	74	No
11	27 Jul 2013	9:44	Dc	1	1	1	-	36.707	-75.718	On	200.2	97	1	20	74	No
12	27 Jul 2013	9:47	Dc	1	1	1	-	36.704	-75.731	On	249.7	27	1	23	74	No
13	27 Jul 2013	9:49	Dc	1	1	1	-	36.702	-75.735	On	242.2	22	1	20	74	No
14	27 Jul 2013	9:51	UnidST	1	1	1	-	36.699	-75.740	On	166.6	160	1	19	74	No
15	27 Jul 2013	9:56	UnidST	1	1	1	-	36.693	-75.760	On	167.9	9	1	19	74	No
16	27 Jul 2013	10:00	Dc	1	1	1	-	36.689	-75.773	On	344.0	120	1	19	74	No
17	27 Jul 2013	10:04	Dc	1	1	1	-	36.685	-75.786	On	338.0	240	1	19	74	No
18	27 Jul 2013	10:10	Cc	1	1	1	-	36.673	-75.809	On	300.0	259	1	20	74	No
19	27 Jul 2013	10:41	Tt	36	36	13	3	36.729	-75.820	On	68	4	2	15	74	Yes
20	27 Jul 2013	11:06	Dc	1	1	1	-	36.730	-75.803	On	24.6	60	2	16	72	No
21	27 Jul 2013	11:08	UnidST	1	1	1	-	36.731	-75.795	On	119.1	79	2	16	72	No
22	27 Jul 2013	11:20	Dc	1	1	1	-	36.743	-75.755	On	170.8	320	2	16	72	No
23	27 Jul 2013	11:30	Dc	1	1	1	-	36.756	-75.721	On	97.8	30	2	18	72	No
24	27 Jul 2013	11:37	UnidST	1	1	1	-	36.765	-75.702	On	339.7	60	2	20	72	No
25	27 Jul 2013	11:43	Cc	1	1	1	-	36.769	-75.686	On	128.4	57	2	22	72	No
26	27 Jul 2013	13:20	UnidST	1	1	1	-	36.780	-75.826	On	205.5	42	2	17	73	No
27	27 Jul 2013	14:02	Cc	1	1	1	-	36.826	-75.851	On	349.3	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	210.3	193	3	25	79	No
2	19 Aug 2013	8:14	Cc	1	1	1	-	36.670	-75.645	On	275.6	125	3	26	78	No
3	19 Aug 2013	10:24	Cc	1	1	1	-	36.737	-75.629	On	348.8	252	3	20	73	No
4	19 Aug 2013	10:27	Cc	1	1	1	-	36.742	-75.614	On	57.4	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	275.6	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	345.4	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	89	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	36	157	3	13	63	No
2	25 May 2014	10:26	Tt	4	4	4	0	36.779	-75.875	On	42	137	3	13	63	No
3	25 May 2014	11:50	Cc	1	1	1	0	36.788	-75.685	On	62	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	46	79	2	14	63	No
6	25 May 2014	13:53	Tt	5	7	2	0	36.727	-75.713	On	22	76	3	18	65	No
7	25 May 2014	14:07	Cc	1	1	1	0	36.733	-75.695	On	23	80	3	18	65	No
8	25 May 2014	14:27	Cc	1	1	1	0	36.757	-75.639	On	0	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	8	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	78	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	60	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	12	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	10	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	88	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	28	115	4	11	67	Yes
5	20 Oct 2014	12:49	Tt	2	0	2	0	36.825	-75.911	On	20	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	88	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	44	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	22	345	1	16	52	Yes
8	16 Nov 2014	12:42	Tt	12	14	10	1	36.710	-75.858	On	5	8	1	16	52	No
9	16 Nov 2014	12:46	Tt	6	7	5	0	36.709	-75.871	On	30	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	90	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	20	137	3	19	45	Yes
2	21 Dec 2014	13:31	Mn	2	2	2	0	36.796	-75.683	On	5	187	3	17	46	Yes

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)
Tt = Bottlenose dolphin (Tursiops truncatus)
UnidHT = unidentified hardshell sea turtle
UnidST = unidentified sea turtle
Unid = unidentified dolphin

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E

Identification Photos of Re-sighted Individuals

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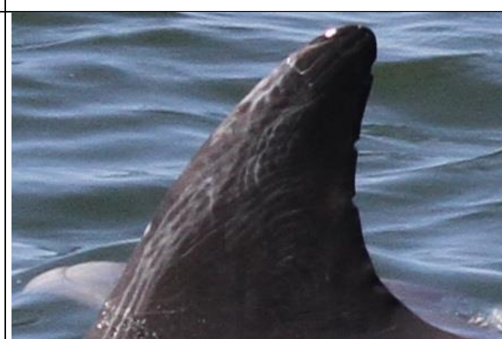
Catalog ID No.	Initial Sighting Photo	First Matched Re-sighting Photo	Second Matched Re-sighting Photo
NVB0003	 09 Aug 2012	 25 Sep 2012	
NVB0014	 09 Aug 2012	 25 Sep 2012	
NVB0020	 09 Aug 2012	 25 Sep 2012	

Catalog ID No.	Initial Sighting Photo	First Matched Re-sighting Photo	Second Matched Re-sighting Photo
NVB0033	 25 Sep 2012	 16 Jul 2013	
NVB050	 25 Sep 2012	 16 Sep 2013	
NVB0083	 27 Nov 2012	 09 Jan 2013	

Catalog ID No.	Initial Sighting Photo	First Matched Re-sighting Photo	Second Matched Re-sighting Photo
NVB0084	 27 Nov 2012	 09 Jan 2013	
NVB0086	 27 Nov 2012	 09 Jan 2013	
NVB0111	 27 Nov 2012	 09 Jan 2013	

Catalog ID No.	Initial Sighting Photo	First Matched Re-sighting Photo	Second Matched Re-sighting Photo
NVB0115	 27 Nov 2012	 09 Jan 2013	
NVB0133	 09 Jan 2013	 22 Feb 2013	
NVB0152	 09 Jul 2013	 16 Jul 2013	 31 Aug 2013

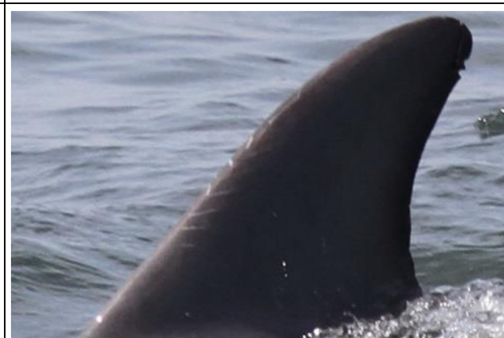
Catalog ID No.	Initial Sighting Photo	First Matched Re-sighting Photo	Second Matched Re-sighting Photo
NVB0153	 09 Jul 2013	 13 Aug 2013	 16 Sep 2013
NVB0155	 09 Jul 2013	 16 Jul 2013	 16 Sep 2013
NVB0156	 09 Jul 2013	 16 Sep 2013	

Catalog ID No.	Initial Sighting Photo	First Matched Re-sighting Photo	Second Matched Re-sighting Photo
NVB0164	 09 Jul 2013	 16 Jul 2013	
NVB0165	 09 Jul 2013	 16 Jul 2013	
NVB0170	 09 Jul 2013	 24 Jul 2013	

Catalog ID No.	Initial Sighting Photo	First Matched Re-sighting Photo	Second Matched Re-sighting Photo
NVB0172	 09 Jul 2013	 24 Jul 2013	
NVB0175	 09 Jul 2013	 16 Jul 2013	
NVB0179	 09 Jul 2013	 16 Jul 2013	

Catalog ID No.	Initial Sighting Photo	First Matched Re-sighting Photo	Second Matched Re-sighting Photo
NVB0183	 09 Jul 2013	 16 Jul 2013	
NVB0188	 09 Jul 2013	 16 Jul 2013	
NVB0189	 09 Jul 2013	 16 Jul 2013	

Catalog ID No.	Initial Sighting Photo	First Matched Re-sighting Photo	Second Matched Re-sighting Photo
NVB0192	 09 Jul 2013	 13 Aug 2013	
NVB0193	 09 Jul 2013	 16 Jul 2013	
NVB0195	 09 Jul 2013	 16 Jul 2013	 16 Sep 2013

Catalog ID No.	Initial Sighting Photo	First Matched Re-sighting Photo	Second Matched Re-sighting Photo
NVB0199	 09 Jul 2013	 16 Jul 2013	
NVB0211	 09 Jul 2013	 16 Jul 2013	
NVB0212	 09 Jul 2013	 16 Jul 2013	

Catalog ID No.	Initial Sighting Photo	First Matched Re-sighting Photo	Second Matched Re-sighting Photo
NVB0214	 09 Jul 2013	 16 Jul 2013	
NVB0229	 16 Jul 2013	 13 Aug 2013	 16 Sep 2013
NVB0234	 16 Jul 2013	 13 Aug 2013	

Catalog ID No.	Initial Sighting Photo	First Matched Re-sighting Photo	Second Matched Re-sighting Photo
NVB0235	 16 Jul 2013	 31 Aug 2013	
NVB0242	 16 Jul 2013	 31 Aug 2013	
NVB0252	 16 Jul 2013	 31 Aug 2013	

Catalog ID No.	Initial Sighting Photo	First Matched Re-sighting Photo	Second Matched Re-sighting Photo
NVB0274	 24 Jul 2013	 13 Aug 2013	 31 Aug 2013
NVB0292	 24 Jul 2013	 13 Aug 2013	
NVB0332	 13 Aug 2013	 31 Aug 2013	

Catalog ID No.	Initial Sighting Photo	First Matched Re-sighting Photo	Second Matched Re-sighting Photo
NVB0385/ FB405	 31 Aug 2013	 16 Sep 2013	
NVB0386	 31 Aug 2013	 16 Sep 2013	