

Deep Divers and Satellite Tagging Project in the Virginia Capes OPAREA–Cape Hatteras, NC: 2015 Annual Progress Report

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Satellite-tagged sperm whale (*Physeter macrocephalus*) off Cape Hatteras, North Carolina. Photographed by Heather Foley, Duke University, taken under National Oceanic and Atmospheric Administration Scientific Permit No. 14450 (Bonnie Ponwith) and National Oceanic and Atmospheric Administration General Authorization Letter of Confirmation 16185 held by Duke University.

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Acronyms and Abbreviations

DTag	digital acoustic tag
hr	hour(s)
m	meter(s)
NOAA	National Oceanic and Atmospheric Administration
R/V	Research Vessel
U.S.	United States

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1. Introduction

This report forms part of a multi-institutional monitoring project intended to provide information on the species composition, population identity, density and baseline behavior of marine mammals and sea turtles present in United States (U.S.) Navy range complexes along the U.S. Atlantic coast. The program began in 2007, with baseline aerial and vessel surveys and a passive acoustic monitoring program in Onslow Bay, North Carolina, and has since expanded to include study areas off Jacksonville, Florida, and Cape Hatteras, North Carolina. Off Cape Hatteras, six years of surveys have provided information on the complex patterns of distribution and diversity of the marine mammals and sea turtles in this highly productive area. The current report builds on this past body of work and describes activities conducted during both the Deep Divers and Satellite Tagging projects conducted off Cape Hatteras between January and December 2015. This constitutes the third year of the Deep Divers project, which focuses on the distribution and ecology of several deep-diving odontocete species, including: beaked whales (Cuvier's beaked whale, *Ziphius cavirostris*, and *Mesoplodon* spp.); short-finned pilot whale (*Globicephala macrorhynchus*); and sperm whale (*Physeter macrocephalus*). To achieve a more robust picture of the medium-term movement patterns of these and other odontocete cetaceans in the Cape Hatteras survey area, we began a satellite-tagging project in 2014. Satellite-tagging field effort and associated sightings are presented here; preliminary analyses of movement data are available in a separate report generated by Cascadia Research Collective (see [Baird et al. 2016](#)). Additional photo-identification and biopsy survey effort was also conducted in the Cape Hatteras study site this year and is reported separately in [Foley et al. \(2016\)](#).

2. Methods

2.1 Field Effort

Observers concentrated fieldwork along the shelf break off Cape Hatteras, North Carolina, where previous vessel and aerial surveys consistently demonstrated high densities of deep-diving odontocetes. When conditions permitted, surveys extended into deeper, pelagic waters beyond the shelf break. Field effort focused on deploying digital acoustic tags (DTags) and satellite tags on several deep-diving odontocete species.

Observers conducted fieldwork from the Research Vessel (R/V) *Richard T. Barber* from May through October 2015 (**Figure 1**).

During these surveys, researchers made observations with naked eye and 7 × 50 binoculars. Two observers (one port and one starboard) scanned constantly from straight ahead to 90 degrees abeam either side of the track. Observers recorded the location, size and behavior of each group. Sea turtles were recorded in passing mode, noting the location and species identity of each sighting. Weather conditions, sea state, depth and sea-surface temperature at each sighting were recorded at regular intervals and whenever sighting conditions changed. All data were recorded on an Apple iPad tablet linked to a geographic positioning system unit.



1

2 **Figure 1. The R/V *R.T. Barber*.**

3 Whenever possible, observers obtained photographs of odontocete cetaceans for individual
4 photo-identification; observers also used these photographs to confirm species identification at
5 each sighting. Photographs were obtained with Canon or Nikon digital single-lens reflex
6 cameras (equipped with 100 to 400-millimeter zoom lenses) in 24-bit color at a resolution of
7 3072 x 2048 pixels saved in .jpg format. Remote biopsy-sampling methods were used to collect
8 small skin and blubber samples using a variety of 27- to 68-kilogram pull crossbows, depending
9 on the species and sampling distance. Biopsy samples were collected with specialized 2.5-
10 centimeter stainless-steel biopsy tips attached to a modified bolt, typically fired from the bow of
11 the survey vessel.

12 Observers made every attempt to select well-marked animals in discrete groups of whales as
13 focal animals for tagging; no whales were tagged from groups that included neonates. Prior to
14 tagging the focal animal, observers obtained photographs of all individuals in the group. Each
15 focal whale was equipped with a Version 2 digital acoustic tag (DTag) (Johnson and Tyack
16 2003), programmed to remain on the whale for approximately four hours (hr). The DTag is a
17 small, lightweight archival tag attached to whales with four silicone-rubber suction cups using a
18 carbon-fiber pole. The DTag was equipped with a pressure sensor, three-axis magnetometer
19 and accelerometers that measure depth, heading, pitch, and roll. The tag contained two
20 hydrophones that record stereo sound continuously at a sampling rate of 192 kilohertz. The tag
21 was also equipped with a very high frequency transmitter that allowed observers to track tagged
22 animals at the surface and facilitates re-location of the tag when it released from the whale. All
23 data were recorded on the tag and later downloaded through an infrared port for calibration and

1 analysis. The length of tag deployments was controlled by programming the release mechanism
2 prior to attachment.

3 Please refer to Cascadia Research Collective’s report ([Baird et al. 2016](#)) for details of satellite
4 tagging methods.

5 **2.2 Data Analysis**

6 All vessel survey effort and sighting data were compiled using *ArcGIS* 10.3.2 (ESRI, Redlands,
7 California). All sighting data from January through December 2015 will be contributed to Ocean
8 Biogeographic Information System Spatial Ecological Analysis of Megavertebrate Populations
9 (<http://seamap.env.duke.edu/>).

10 **2.3 Data Storage**

11 All acoustic, visual survey and photographic data were archived on digital media and backed up
12 on a Duke University network server.

13 **3. Results**

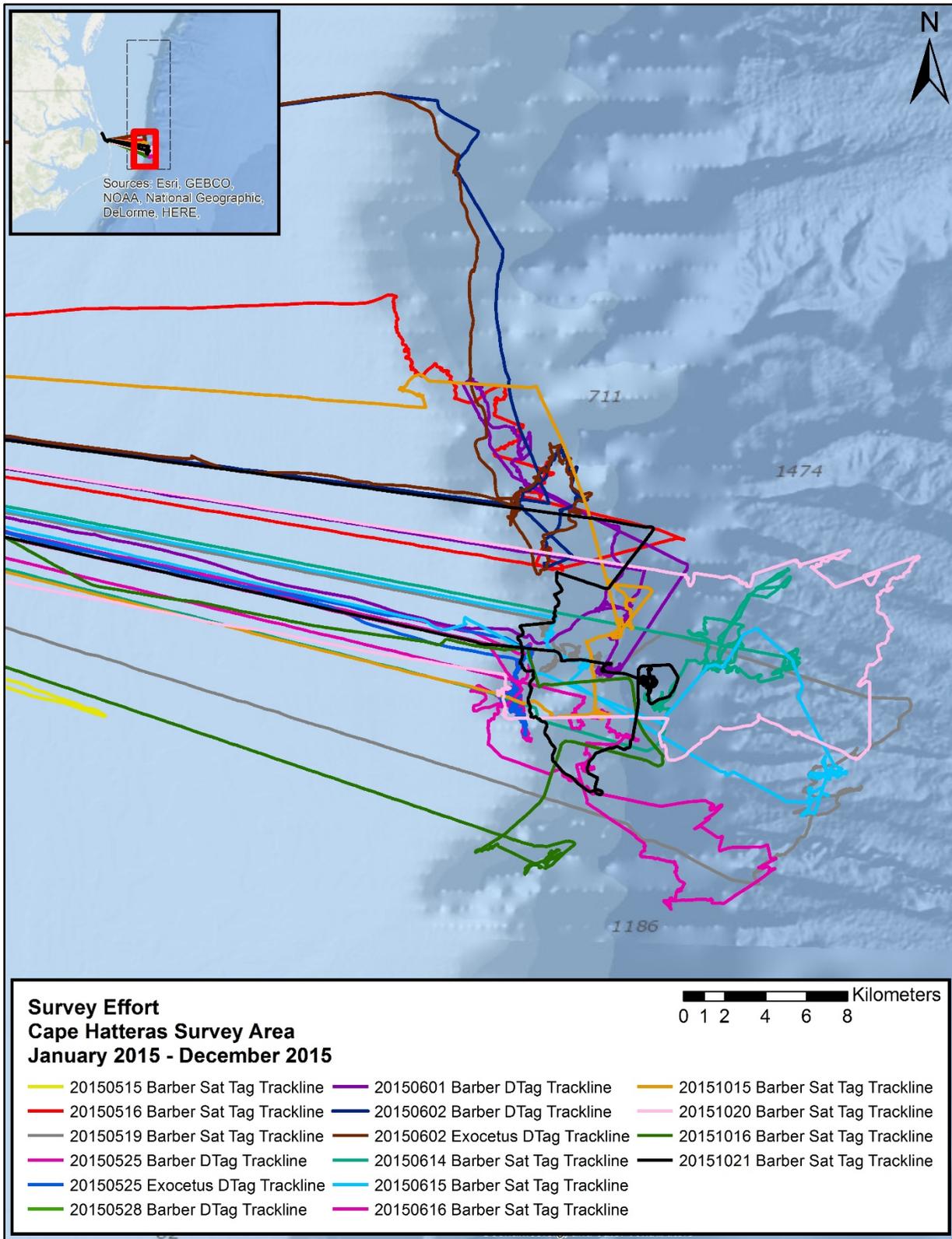
14 **3.1 Field Effort**

15 Fieldwork was conducted on 14 days between May and October 2015. Ten days were
16 dedicated to the Satellite Tagging project and four days to the Deep Diver project (**Table 1**). On
17 two occasions, 25 May and 02 June 2015, observers used two survey vessels- the R/V *R. T.*
18 *Barber* and a smaller rigid-hulled inflatable boat the R/V *Exocetus*.

19 In total, this fieldwork yielded 707.6 kilometers and 105.2 hr of effort (**Table 1, Figure 2**). Eight
20 species of cetaceans were encountered, including 59 sightings of deep-diving odontocetes:
21 short-finned pilot whale ($n=43$), Cuvier’s beaked whale ($n=12$), unidentified beaked whale ($n=1$),
22 and three sperm whales. Other sightings included: bottlenose dolphin (*Tursiops truncatus*,
23 $n=37$); Risso’s dolphin (*Grampus griseus*, $n=1$); common dolphin (*Delphinus delphis*, $n=2$);
24 Atlantic spotted dolphin (*Stenella frontalis*, $n=2$); dwarf or pygmy sperm whale (*Kogia* sp., $n=1$);
25 unidentified delphinid ($n=1$); and unidentified small whale ($n=1$) (**Tables 2 and 3, Figures 3**
26 **through 14**). Five sea turtles were also encountered during 2015: four leatherback turtles
27 (*Dermochelys coriacea*) and one loggerhead turtle (*Caretta caretta*) (**Tables 4 and 5, Figure**
28 **15**).

1 **Table 1. Effort details for fieldwork in the Cape Hatteras survey area, January –December 2015.**

Date	Sea State	km Surveyed	Survey Time (hr:min)	At-Sea Time (hr:min)	Project	Platform
15-May-15	N/A	N/A	N/A	04:21	Sat Tagging	R/V <i>R.T. Barber</i>
16-May-15	2-3	42.7	06:35	10:44	Sat Tagging	R/V <i>R.T. Barber</i>
19-May-15	2-5	67.1	08:59	13:09	Sat Tagging	R/V <i>R.T. Barber</i>
25-May-15	2-3	30.4	08:58	13:48	Deep Divers	R/V <i>R.T. Barber</i>
25-May-15	2-3	27.8	09:00	13:48	Deep Divers	R/V <i>Exocetus</i>
28-May-15	N/A	N/A	N/A	03:03	Deep Divers	R/V <i>R.T. Barber</i>
01-Jun-15	1-2	61.8	07:24	12:14	Deep Divers	R/V <i>R.T. Barber</i>
02-Jun-15	3	48.6	07:07	12:20	Deep Divers	R/V <i>R.T. Barber</i>
02-Jun-15	3	50	07:08	12:19	Deep Divers	R/V <i>Exocetus</i>
14-Jun-15	1-2	65.4	09:00	12:52	Sat Tagging	R/V <i>R.T. Barber</i>
15-Jun-15	2-3	62.4	07:30	11:26	Sat Tagging	R/V <i>R.T. Barber</i>
16-Jun-15	3	63.4	09:03	13:24	Sat Tagging	R/V <i>R.T. Barber</i>
15-Oct-15	3-4	44.2	06:07	10:29	Sat Tagging	R/V <i>R.T. Barber</i>
16-Oct-15	4-5	37.7	04:22	09:51	Sat Tagging	R/V <i>R.T. Barber</i>
20-Oct-15	1-3	57.3	07:12	11:14	Sat Tagging	R/V <i>R.T. Barber</i>
21-Oct-15	1-3	48.8	06:45	10:15	Sat Tagging	R/V <i>R.T. Barber</i>



1

2 Figure 2. Field effort in the Cape Hatteras survey area, January 2015–December 2015.

1 Table 2. Cetacean sightings observed during fieldwork in the Cape Hatteras survey area, January 2015–December 2015.

Date	Time (EDT)	Latitude (N)	Longitude (W)	Species	Common Name	Group Size	Biopsy Samples	Photo-ID images	Tag IDs
16-May-15	8:10	35.79295	74.86173	<i>G. macrorhynchus</i>	Short-finned pilot whale	23	1	312	GmTag122
16-May-15	9:49	35.76130	74.84429	<i>T. truncatus</i>	Bottlenose dolphin	6	0	0	
16-May-15	9:54	35.76166	74.84189	<i>G. macrorhynchus</i>	Short-finned pilot whale	55	0	190	
16-May-15	10:47	35.75313	74.81363	<i>G. macrorhynchus</i>	Short-finned pilot whale	22	0	160	
16-May-15	11:30	35.73598	74.80389	<i>G. macrorhynchus</i>	Short-finned pilot whale	14	1	311	GmTag123
16-May-15	12:37	35.71844	74.80125	<i>G. macrorhynchus</i>	Short-finned pilot whale	na	0	0	
16-May-15	12:43	35.71403	74.79385	<i>G. griseus</i>	Risso's dolphin	1	0	21	
16-May-15	12:52	35.71925	74.79357	<i>G. macrorhynchus</i>	Short-finned pilot whale	10	1	76	GmTag124
16-May-15	14:10	35.67298	74.79300	<i>G. macrorhynchus</i>	Short-finned pilot whale	12	0	18	
19-May-15	8:29	35.55354	74.75070	N/A	Unid. delphinid	1	0	0	
19-May-15	8:50	35.53599	74.70155	<i>T. truncatus</i>	Bottlenose dolphin	6	1	81	TtTag024
19-May-15	8:52	35.53599	74.70155	<i>G. macrorhynchus</i>	Short-finned pilot whale	8	0	18	
19-May-15	9:56	35.56456	74.68098	<i>G. macrorhynchus</i>	Short-finned pilot whale	2	0	17	
19-May-15	10:15	35.56796	-74.66654	<i>G. macrorhynchus</i>	Short-finned pilot whale	8	0	23	
19-May-15	10:47	35.57486	74.68080	<i>G. macrorhynchus</i>	Short-finned pilot whale	7	0	19	
19-May-15	11:03	35.58138	74.67811	<i>Z. cavirostris</i>	Cuvier's beaked whale	5	0	8	
19-May-15	12:46	35.62489	74.67919	<i>T. truncatus</i>	Bottlenose dolphin	2	0	0	
19-May-15	13:15	35.62348	74.76933	<i>G. macrorhynchus</i>	Short-finned pilot whale	6	0	0	
19-May-15	14:18	35.63858	74.77950	<i>G. macrorhynchus</i>	Short-finned pilot whale	8	0	13	
19-May-15	14:29	35.63473	74.78374	<i>G. macrorhynchus</i>	Short-finned pilot whale	7	0	6	
19-May-15	15:11	35.63278	74.79019	<i>G. macrorhynchus</i>	Short-finned pilot whale	6	0	48	GmTag125
19-May-15	15:58	35.64398	74.79382	<i>G. macrorhynchus</i>	Short-finned pilot whale	150	0	271	GmTags126-127
19-May-15	15:59	35.64411	74.79394	<i>D. delphis</i>	Short-beaked common dolphin	na	0	0	
19-May-15	16:09	35.64480	74.79463	<i>T. truncatus</i>	Bottlenose dolphin	5	0	0	
25-May-15	8:43	35.63838	74.80333	<i>G. macrorhynchus</i>	Short-finned pilot whale	500	4	873	Gm_15_145a & b
25-May-15	10:12	35.62233	74.80703	<i>D. delphis</i>	Short-beaked common dolphin	150	0	0	
25-May-15	10:15	35.62102	74.80732	<i>S. frontalis</i>	Atlantic spotted dolphin	10	0	0	
25-May-15	12:19	35.61481	74.81346	<i>T. truncatus</i>	Bottlenose dolphin	4	0	0	
1-Jun-15	8:31	35.64130	74.79160	<i>T. truncatus</i>	Bottlenose dolphin	25	0	0	
1-Jun-15	8:48	35.65786	74.76828	N/A	Unid. beaked whale	2	0	0	

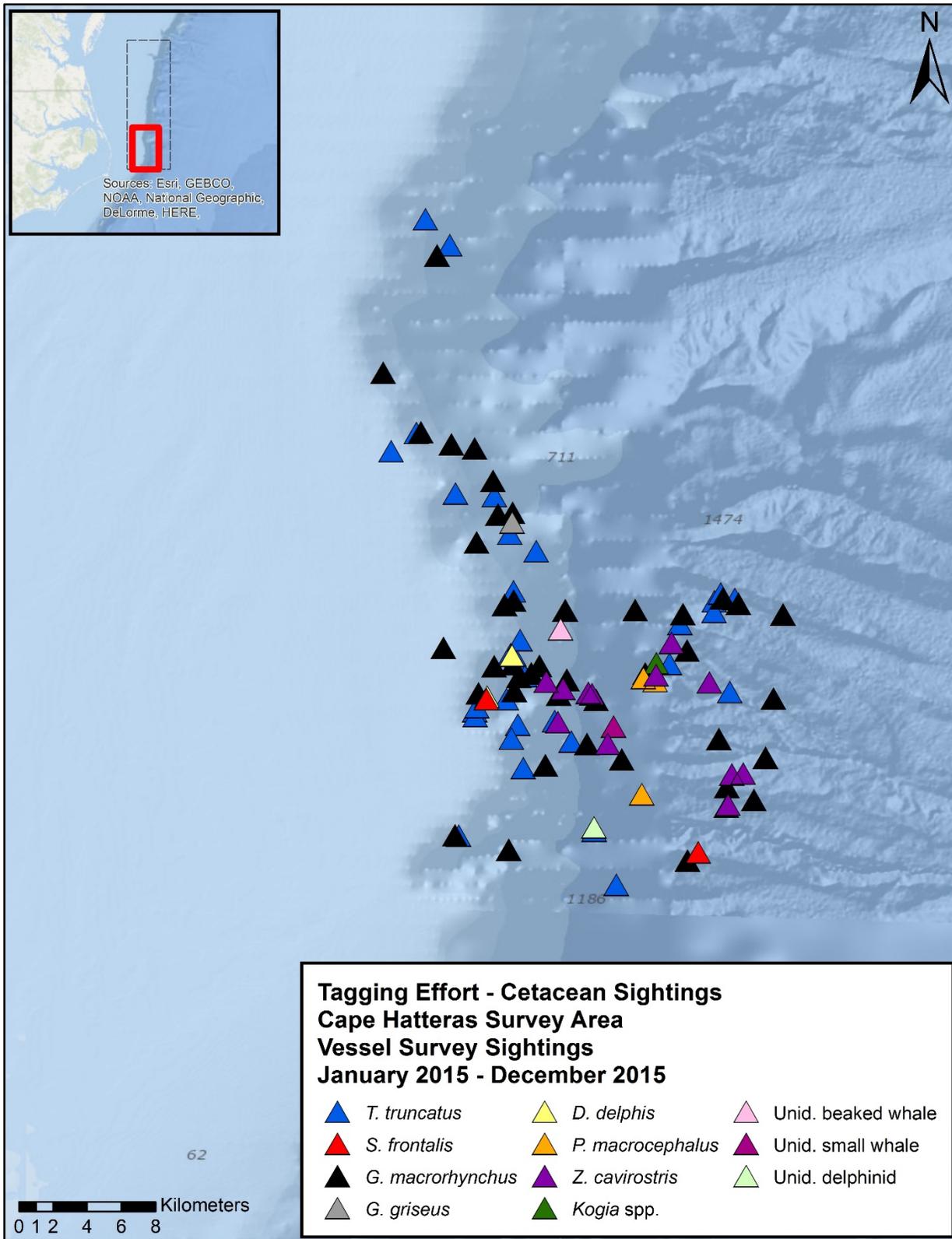
Date	Time (EDT)	Latitude (N)	Longitude (W)	Species	Common Name	Group Size	Biopsy Samples	Photo-ID images	Tag IDs
1-Jun-15	10:54	35.75527	74.82574	<i>G. macrorhynchus</i>	Short-finned pilot whale	50	0	276	Gm_15_152a
1-Jun-15	12:21	35.72815	74.80311	<i>T. truncatus</i>	Bottlenose dolphin	35	0	6	
1-Jun-15	13:11	35.69894	74.78115	<i>T. truncatus</i>	Bottlenose dolphin	5	0	0	
1-Jun-15	14:03	35.62642	74.76702	<i>Z. cavirostris</i>	Cuvier's beaked whale	8	1	182	
2-Jun-15	8:54	35.87385	74.83942	<i>T. truncatus</i>	Bottlenose dolphin	8	0	0	
2-Jun-15	9:02	35.85476	74.83340	<i>G. macrorhynchus</i>	Short-finned pilot whale	12	0	17	
2-Jun-15	9:05	35.86012	74.82661	<i>T. truncatus</i>	Bottlenose dolphin	20	0	0	
2-Jun-15	10:09	35.72945	74.82369	<i>T. truncatus</i>	Bottlenose dolphin	2	0	0	
2-Jun-15	10:13	35.70818	74.79501	<i>T. truncatus</i>	Bottlenose dolphin	15	0	0	
2-Jun-15	10:20	35.70370	74.81247	<i>G. macrorhynchus</i>	Short-finned pilot whale	8	0	9	
2-Jun-15	10:45	35.67070	74.79778	<i>G. macrorhynchus</i>	Short-finned pilot whale	60	1	371	Gm_15_153a
2-Jun-15	11:05	35.67797	74.79314	<i>T. truncatus</i>	Bottlenose dolphin	10	0	8	
14-Jun-15	8:50	35.59762	74.74354	<i>Z. cavirostris</i>	Cuvier's beaked whale	6	1	34	ZcTag038-039
14-Jun-15	10:40	35.63217	74.72476	<i>P. macrocephalus</i>	Sperm whale	2	0	42	
14-Jun-15	11:14	35.63957	74.71098	<i>T. truncatus</i>	Bottlenose dolphin	1	0	0	
14-Jun-15	12:00	35.63462	74.72376	<i>G. macrorhynchus</i>	Short-finned pilot whale	15	0	49	
14-Jun-15	12:50	35.63992	74.71790	<i>Kogia</i> sp.	Dwarf or pygmy sperm whale	1	0	77	
14-Jun-15	12:57	35.65074	74.70986	<i>Z. cavirostris</i>	Cuvier's beaked whale	3	0	0	
14-Jun-15	13:25	35.67259	74.68733	<i>T. truncatus</i>	Bottlenose dolphin	6	0	0	
14-Jun-15	13:41	35.66707	74.68748	<i>T. truncatus</i>	Bottlenose dolphin	13	0	0	
14-Jun-15	13:50	35.66067	74.70548	<i>T. truncatus</i>	Bottlenose dolphin	25	0	0	
14-Jun-15	14:02	35.63369	74.71797	<i>Z. cavirostris</i>	Cuvier's beaked whale	1	0	0	
14-Jun-15	14:04	35.63057	74.71848	<i>P. macrocephalus</i>	Sperm whale	8	0	277	PmTag026
14-Jun-15	15:22	35.62987	74.68997	<i>Z. cavirostris</i>	Cuvier's beaked whale	7	0	202	ZcTag040
15-Jun-15	8:30	35.64804	74.82995	<i>G. macrorhynchus</i>	Short-finned pilot whale	13	0	35	
15-Jun-15	8:51	35.62550	74.79265	<i>T. truncatus</i>	Bottlenose dolphin	6	0	0	
15-Jun-15	8:52	35.62550	74.79265	<i>G. macrorhynchus</i>	Short-finned pilot whale	60	0	0	
15-Jun-15	9:35	35.64661	74.70176	<i>G. macrorhynchus</i>	Short-finned pilot whale	3	0	0	
15-Jun-15	10:29	35.58187	74.67213	<i>Z. cavirostris</i>	Cuvier's beaked whale	7	0	18	
15-Jun-15	12:37	35.56550	74.68020	<i>Z. cavirostris</i>	Cuvier's beaked whale	4	0	20	
15-Jun-15	14:32	35.63025	74.77590	<i>Z. cavirostris</i>	Cuvier's beaked whale	3	0	22	
15-Jun-15	15:12	35.63950	74.79335	<i>G. macrorhynchus</i>	Short-finned pilot whale	120	0	159	

Date	Time (EDT)	Latitude (N)	Longitude (W)	Species	Common Name	Group Size	Biopsy Samples	Photo-ID images	Tag IDs
15-Jun-15	15:34	35.64412	74.79282	<i>T. truncatus</i>	Bottlenose dolphin	4	0	0	
16-Jun-15	8:25	35.61218	74.81320	<i>T. truncatus</i>	Bottlenose dolphin	12	0	53	
16-Jun-15	9:05	35.58471	74.78793	<i>T. truncatus</i>	Bottlenose dolphin	12	0	56	
16-Jun-15	9:53	35.57096	74.72561	<i>P. macrocephalus</i>	Sperm whale	1	0	26	
16-Jun-15	11:04	35.54044	74.69586	<i>S. frontalis</i>	Atlantic spotted dolphin	75	1	9	
16-Jun-15	11:44	35.52331	74.73900	<i>T. truncatus</i>	Bottlenose dolphin	8	0	45	
16-Jun-15	12:25	35.55178	74.75058	<i>T. truncatus</i>	Bottlenose dolphin	8	0	5	
16-Jun-15	12:58	35.58636	74.77635	<i>G. macrorhynchus</i>	Short-finned pilot whale	20	0	247	GmTag128
16-Jun-15	14:34	35.59746	74.75438	<i>G. macrorhynchus</i>	Short-finned pilot whale	60	0	161	GmTags129-131
16-Jun-15	14:49	35.59875	74.76268	<i>T. truncatus</i>	Bottlenose dolphin	12	0	44	
15-Oct-15	9:27	35.60758	74.79089	<i>T. truncatus</i>	Bottlenose dolphin	1	0	0	
15-Oct-15	9:47	35.60896	74.76981	<i>Z. cavirostris</i>	Cuvier's beaked whale	2	0	61	ZcTag041
15-Oct-15	11:13	35.60958	74.77141	<i>T. truncatus</i>	Bottlenose dolphin	11	0	181	
15-Oct-15	12:26	35.66785	74.76592	<i>G. macrorhynchus</i>	Short-finned pilot whale	20	0	206	GmTags134–135
15-Oct-15	12:26	35.66783	74.76580	<i>T. truncatus</i>	Bottlenose dolphin	8	0	9	TtTag026
15-Oct-15	15:12	35.75163	74.85757	<i>T. truncatus</i>	Bottlenose dolphin	9	0	17	
16-Oct-15	9:11	35.62099	74.79684	<i>T. truncatus</i>	Bottlenose dolphin	1	0	0	
16-Oct-15	10:57	35.54939	74.82383	<i>G. macrorhynchus</i>	Short-finned pilot whale	12	0	19	
16-Oct-15	11:00	35.54916	74.82195	<i>T. truncatus</i>	Bottlenose dolphin	2	0	0	
16-Oct-15	11:32	35.54177	74.79561	<i>G. macrorhynchus</i>	Short-finned pilot whale	16	0	80	GmTag136
20-Oct-15	9:15	35.62412	74.81155	<i>G. macrorhynchus</i>	Short-finned pilot whale	50	0	392	GmTags137–138
20-Oct-15	9:52	35.61689	74.81233	<i>T. truncatus</i>	Bottlenose dolphin	1	0	0	
20-Oct-15	10:44	35.60668	74.74044	N/A	Unid. small whale	1	0	0	
20-Oct-15	11:07	35.58929	74.73613	<i>G. macrorhynchus</i>	Short-finned pilot whale	7	0	69	
20-Oct-15	11:43	35.60010	74.68501	<i>G. macrorhynchus</i>	Short-finned pilot whale	5	0	9	
20-Oct-15	11:58	35.59025	74.66042	<i>G. macrorhynchus</i>	Short-finned pilot whale	2	0	0	
20-Oct-15	12:34	35.62144	74.65622	<i>G. macrorhynchus</i>	Short-finned pilot whale	60	0	570	GmTag139
20-Oct-15	14:18	35.66573	74.65122	<i>G. macrorhynchus</i>	Short-finned pilot whale	8	0	12	
20-Oct-15	14:37	35.67136	74.67471	<i>G. macrorhynchus</i>	Short-finned pilot whale	6	0	0	
20-Oct-15	14:42	35.67382	74.67659	<i>T. truncatus</i>	Bottlenose dolphin	20	0	187	TtTag027
20-Oct-15	15:17	35.67421	74.68276	<i>G. macrorhynchus</i>	Short-finned pilot whale	12	0	19	
20-Oct-15	15:28	35.67668	74.68404	<i>T. truncatus</i>	Bottlenose dolphin	9	0	0	
20-Oct-15	15:36	35.66581	74.70386	<i>G. macrorhynchus</i>	Short-finned pilot whale	20	0	202	GmTag140

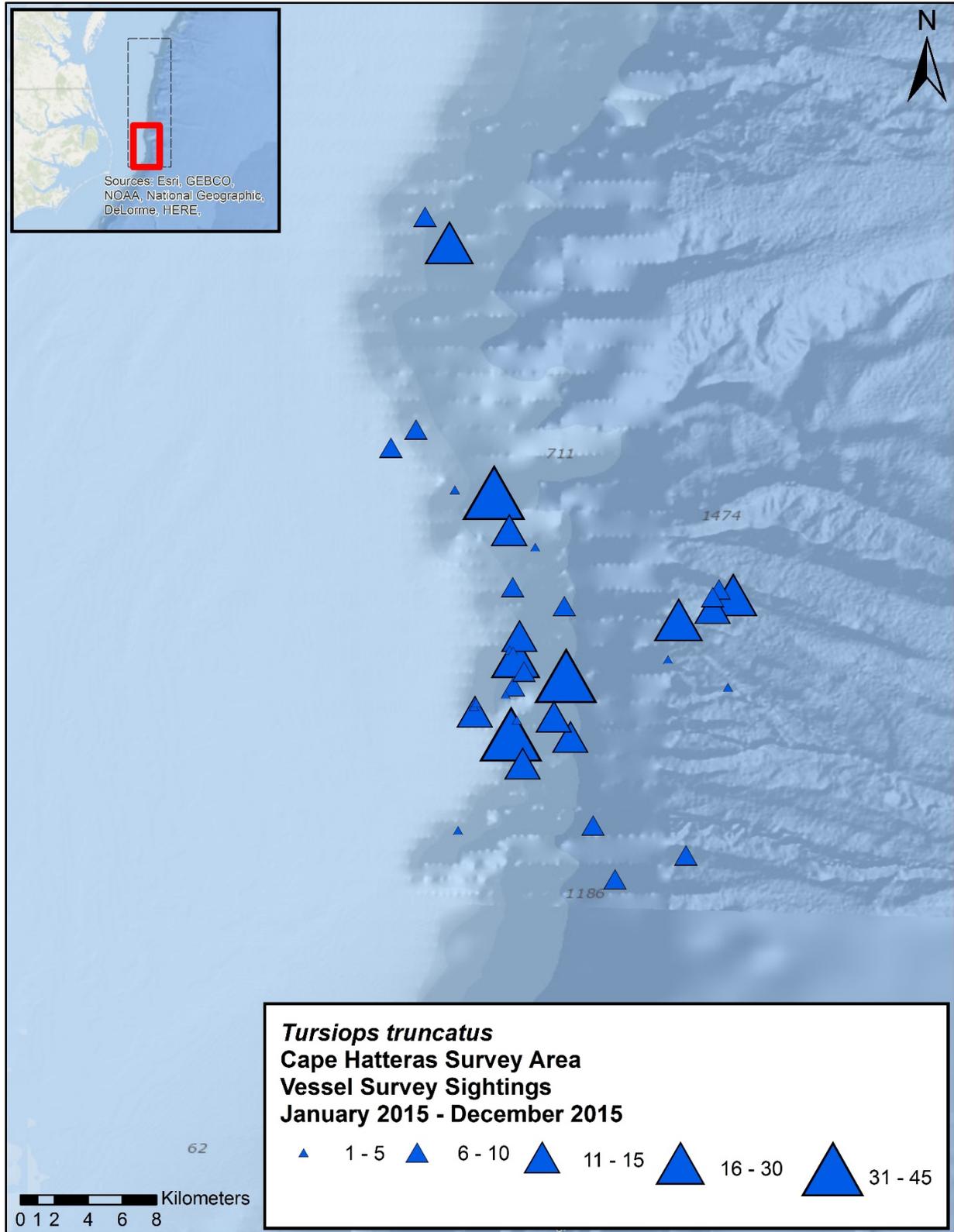
Date	Time (EDT)	Latitude (N)	Longitude (W)	Species	Common Name	Group Size	Biopsy Samples	Photo-ID images	Tag IDs
20-Oct-15	16:07	35.66794	74.72904	<i>G. macrorhynchus</i>	Short-finned pilot whale	18	0	330	GmTag141
21-Oct-15	9:04	35.63329	74.78714	<i>T. truncatus</i>	Bottlenose dolphin	6	0	0	
21-Oct-15	9:15	35.63119	74.76509	<i>T. truncatus</i>	Bottlenose dolphin	35	0	0	
21-Oct-15	9:16	35.63122	74.76502	<i>G. macrorhynchus</i>	Short-finned pilot whale	10	0	98	GmTag142
21-Oct-15	9:52	35.62368	74.75185	<i>Z. cavirostris</i>	Cuvier's beaked whale	4	0	239	ZcTags042–043
21-Oct-15	10:06	35.62444	74.75371	<i>Z. cavirostris</i>	Cuvier's beaked whale	2	0	0	
21-Oct-15	11:54	35.62066	74.74959	<i>G. macrorhynchus</i>	Short-finned pilot whale	50	0	0	
21-Oct-15	13:41	35.60037	74.79425	<i>T. truncatus</i>	Bottlenose dolphin	40	0	116	
21-Oct-15	14:43	35.65215	74.78967	<i>T. truncatus</i>	Bottlenose dolphin	15	0	43	TtTag028

1 Table 3. Number of cetacean sightings for each species observed during fieldwork in the Cape Hatteras survey area, January–December
2 2015.

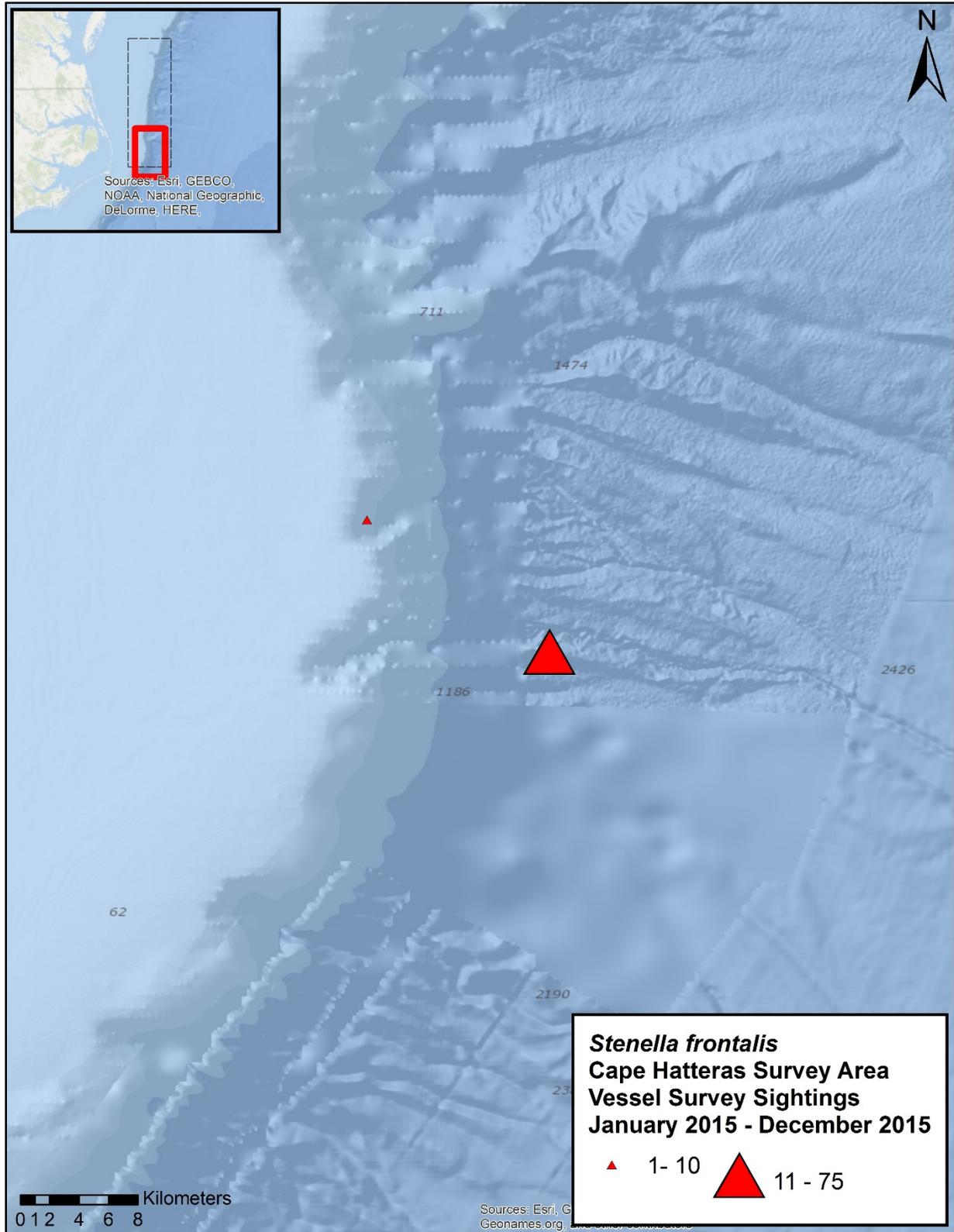
Species	Sightings 2015
<i>Delphinus delphis</i>	2
<i>Globicephala macrorhynchus</i>	43
<i>Grampus griseus</i>	1
<i>Kogia</i> sp.	1
<i>Physeter macrocephalus</i>	3
<i>Stenella frontalis</i>	2
<i>Tursiops truncatus</i>	37
<i>Ziphius cavirostris</i>	12
Unidentified beaked whale	1
Unidentified delphinid	1
Unidentified small whale	1
Total:	104



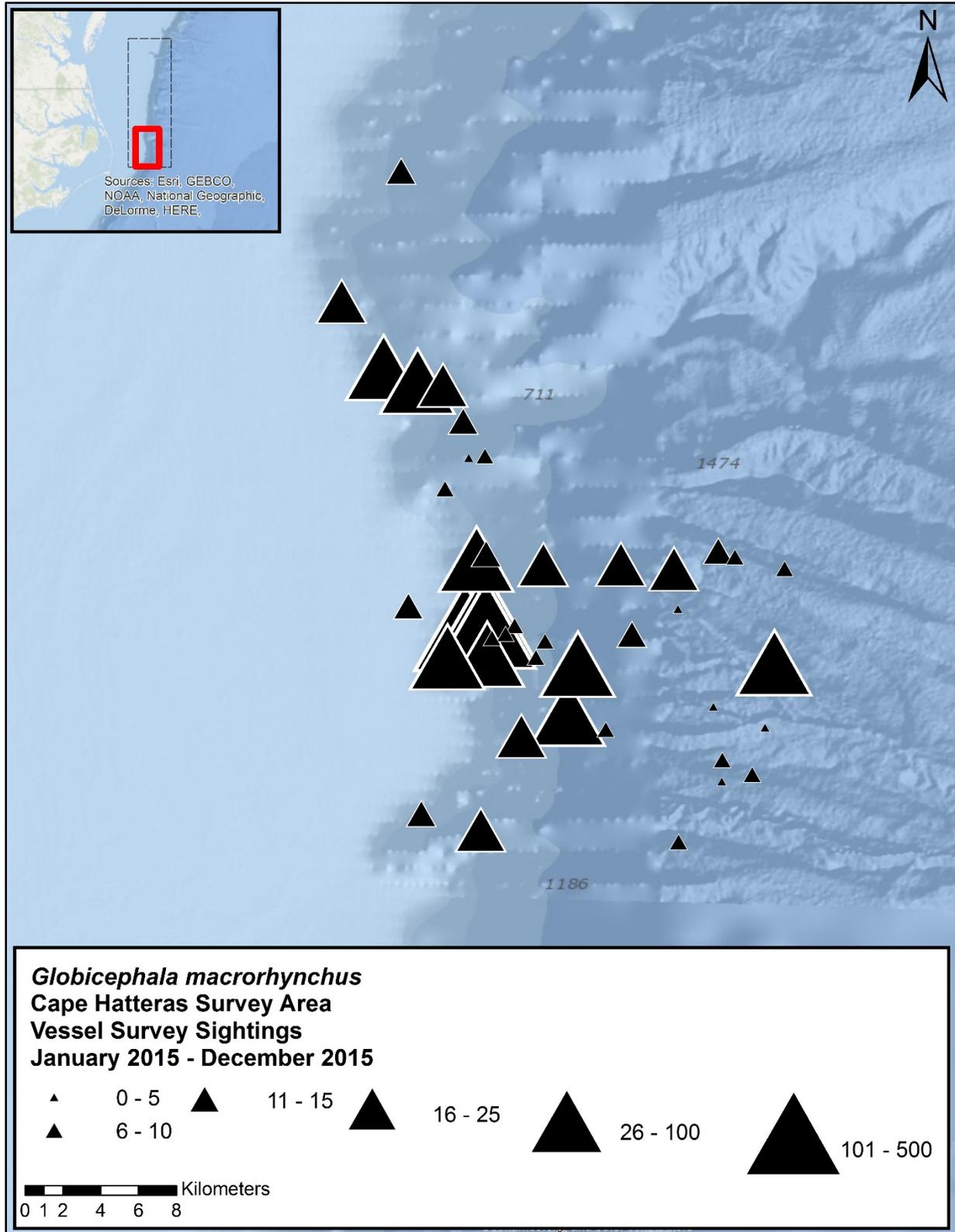
1
2 Figure 3. Distribution of all cetacean sightings observed during fieldwork in the Cape Hatteras
3 survey area, January–December 2015.



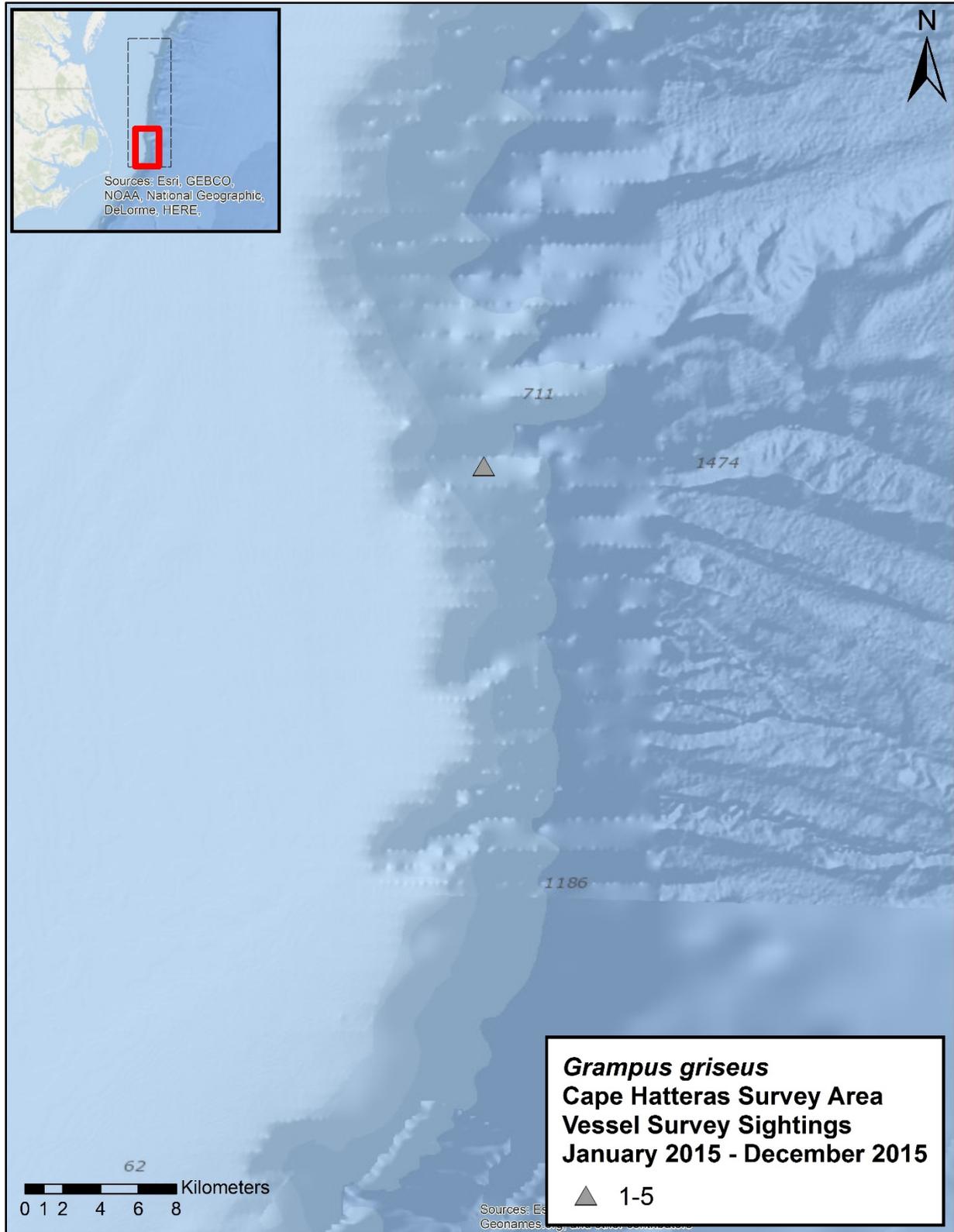
1
2 Figure 4. Distribution of bottlenose dolphin sightings observed during fieldwork in the Cape
3 Hatteras survey area, January –December 2015. Symbol size indicates group size.



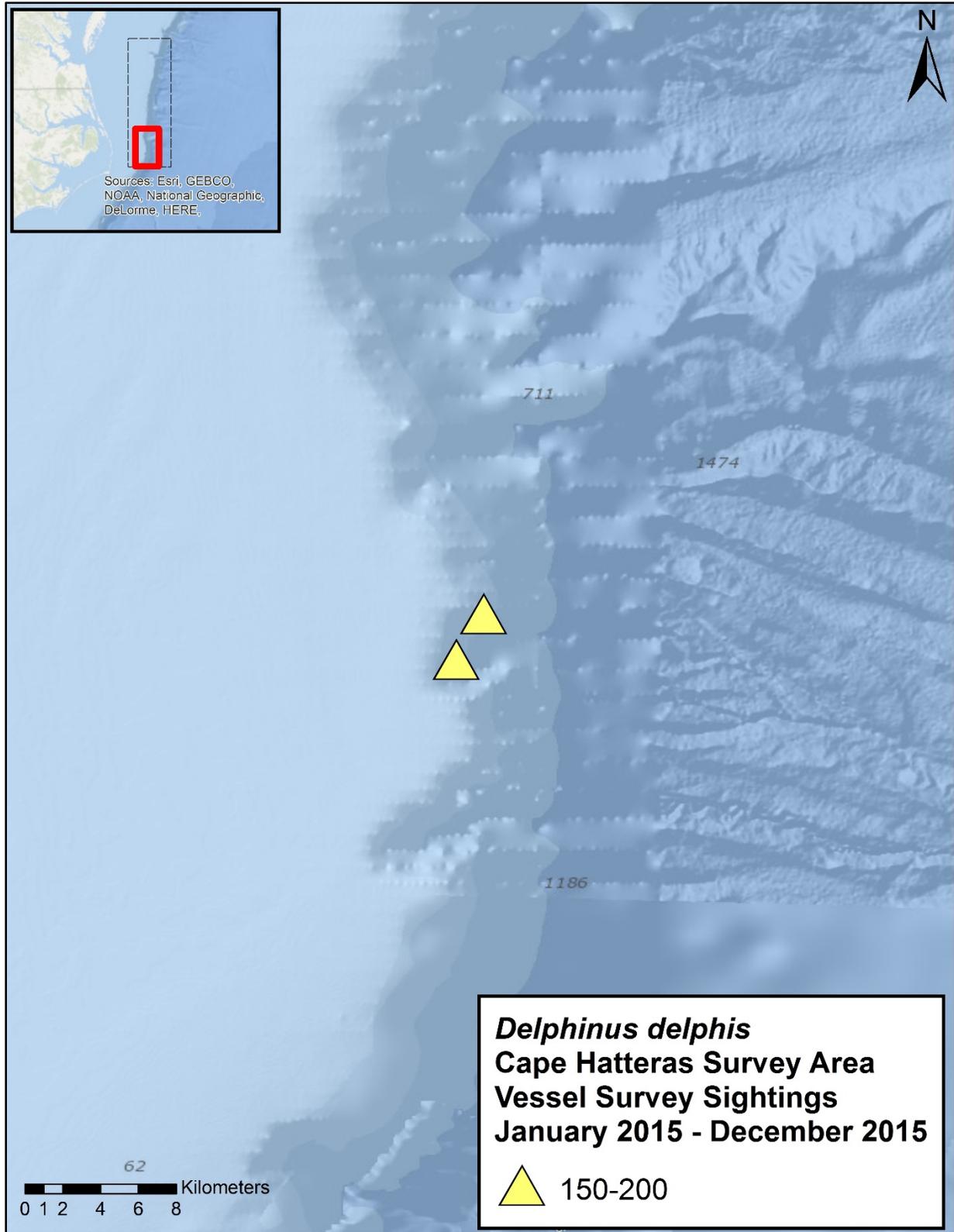
1
2 Figure 5. Distribution of Atlantic spotted dolphin sightings observed during fieldwork in the Cape
3 Hatteras survey area, January –December 2015. Symbol size indicates group size.



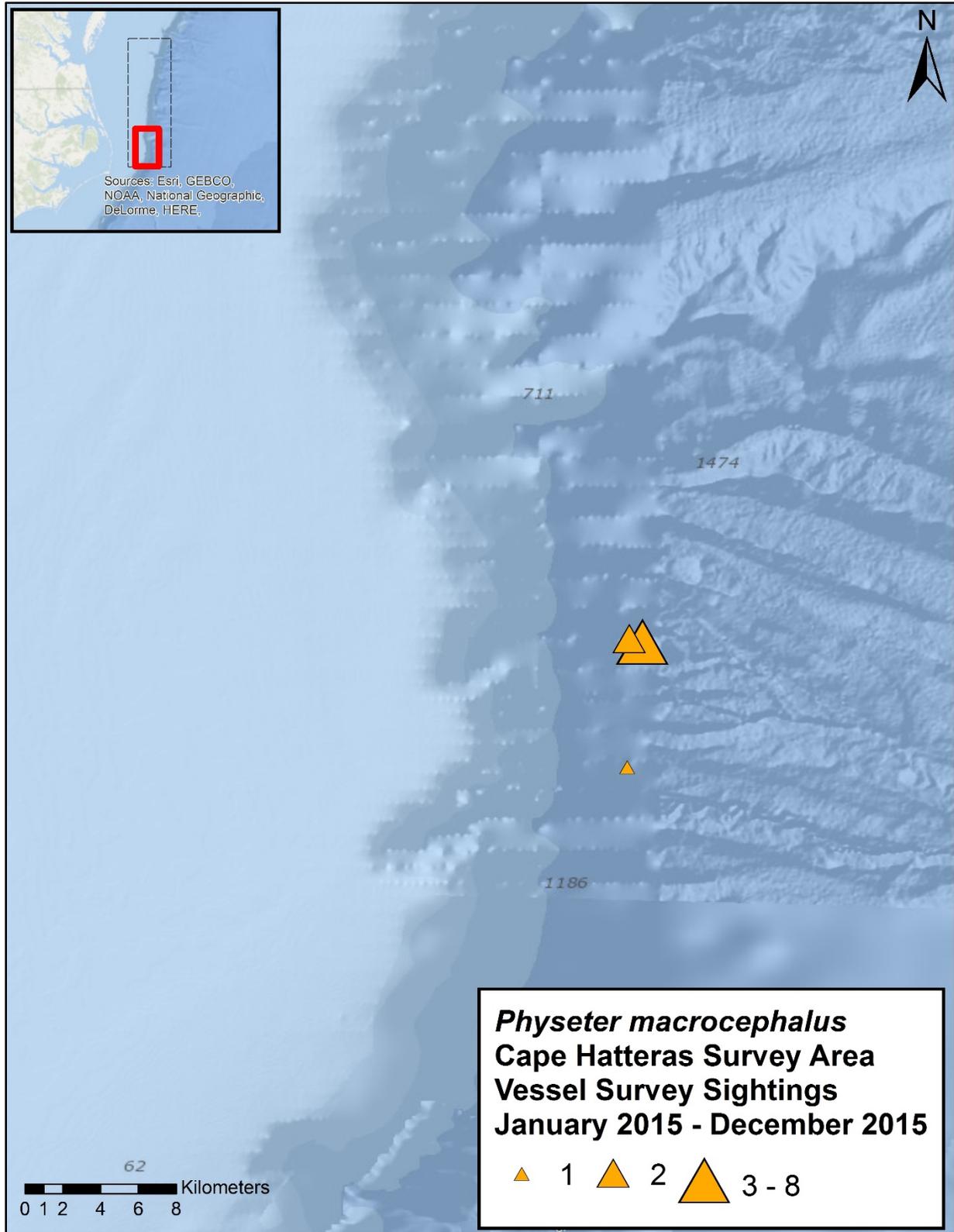
1
2 Figure 6. Distribution of short-finned pilot whale sightings observed during fieldwork in the Cape
3 Hatteras survey area, January –December 2015. Symbol size indicates group size.



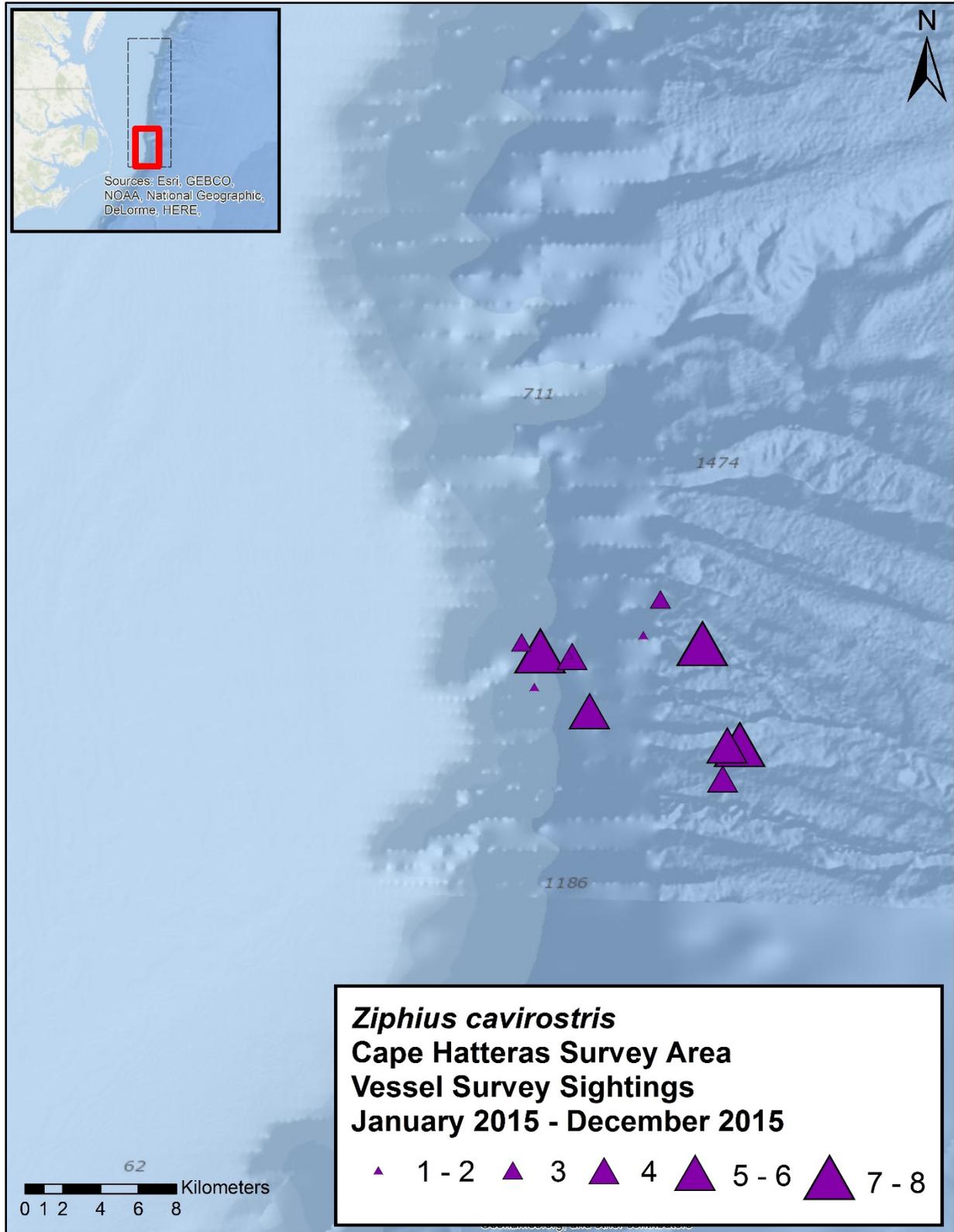
1
2 Figure 7. Distribution of Risso's dolphin sightings observed during fieldwork in the Cape Hatteras
3 survey area, January –December 2015. Symbol size indicates group size.



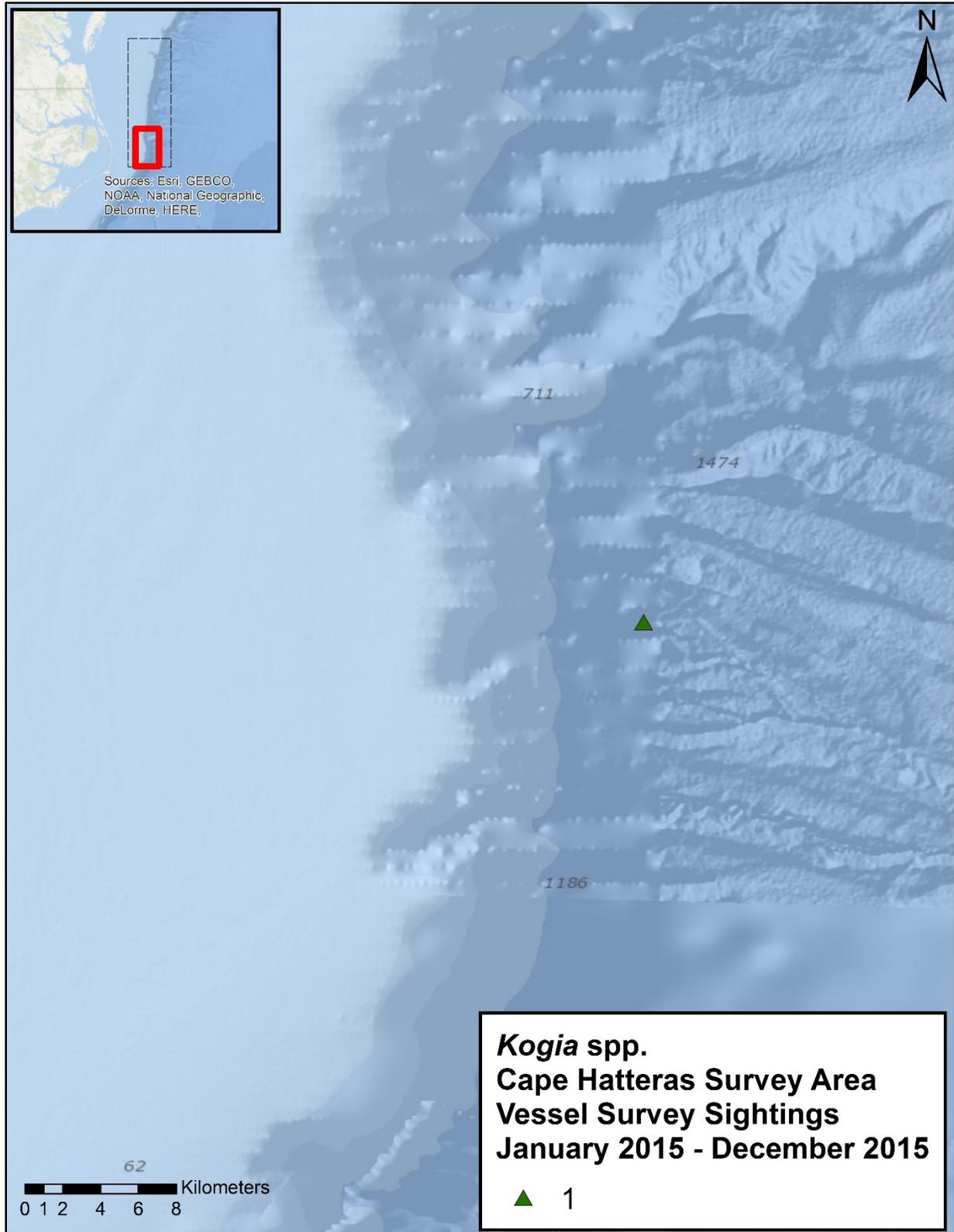
1
2 Figure 8. Distribution of short-beaked common dolphin sightings observed during fieldwork in the
3 Cape Hatteras survey area, January –December 2015. Symbol size indicates group size.



1
2 Figure 9. Distribution of sperm whale sightings observed during fieldwork in the Cape Hatteras
3 survey area, January –December 2015. Symbol size indicates group size.

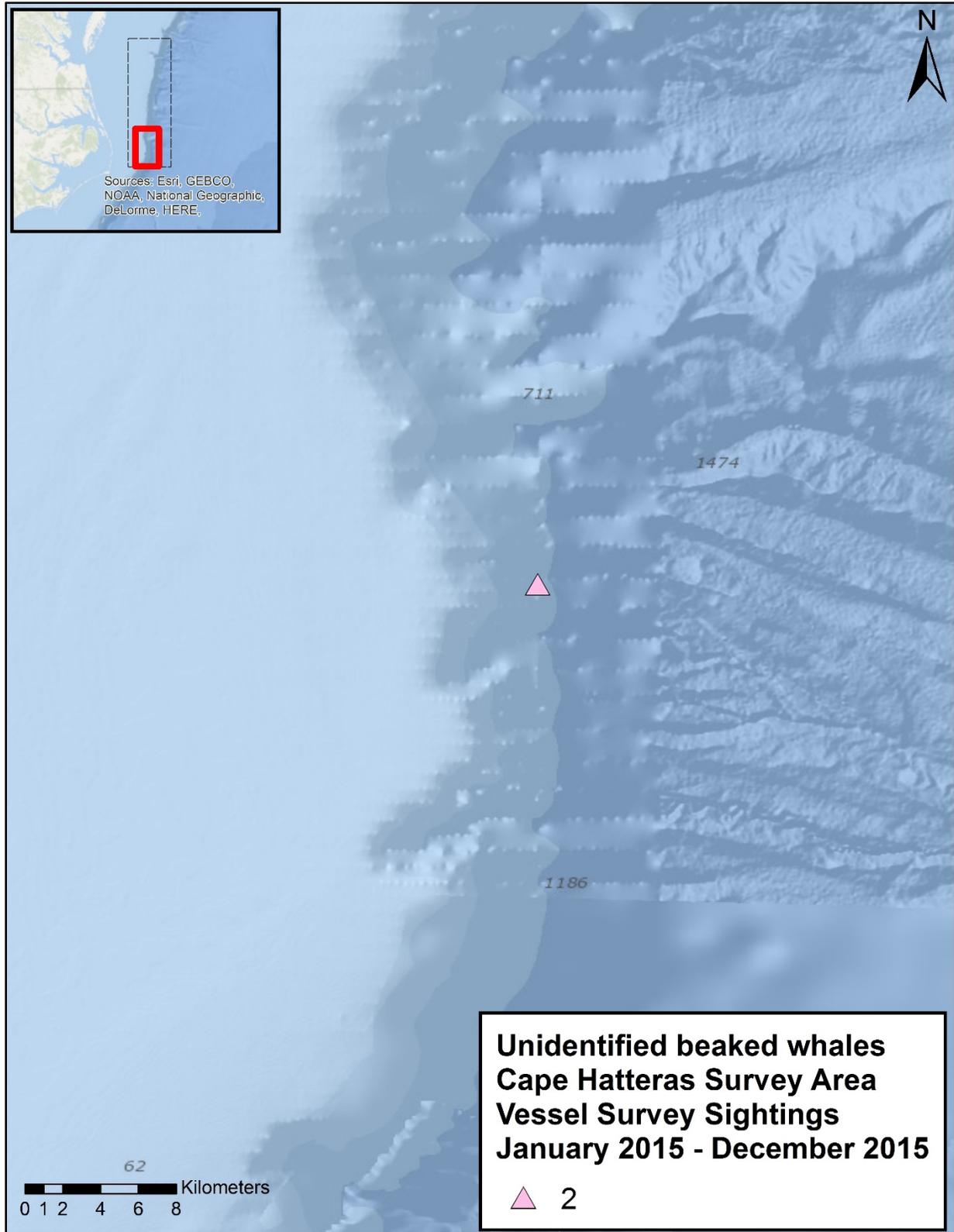


1
2 Figure 10. Distribution of Cuvier's beaked whale sightings observed during fieldwork in the Cape
3 Hatteras survey area, January –December 2015. Symbol size indicates group size.



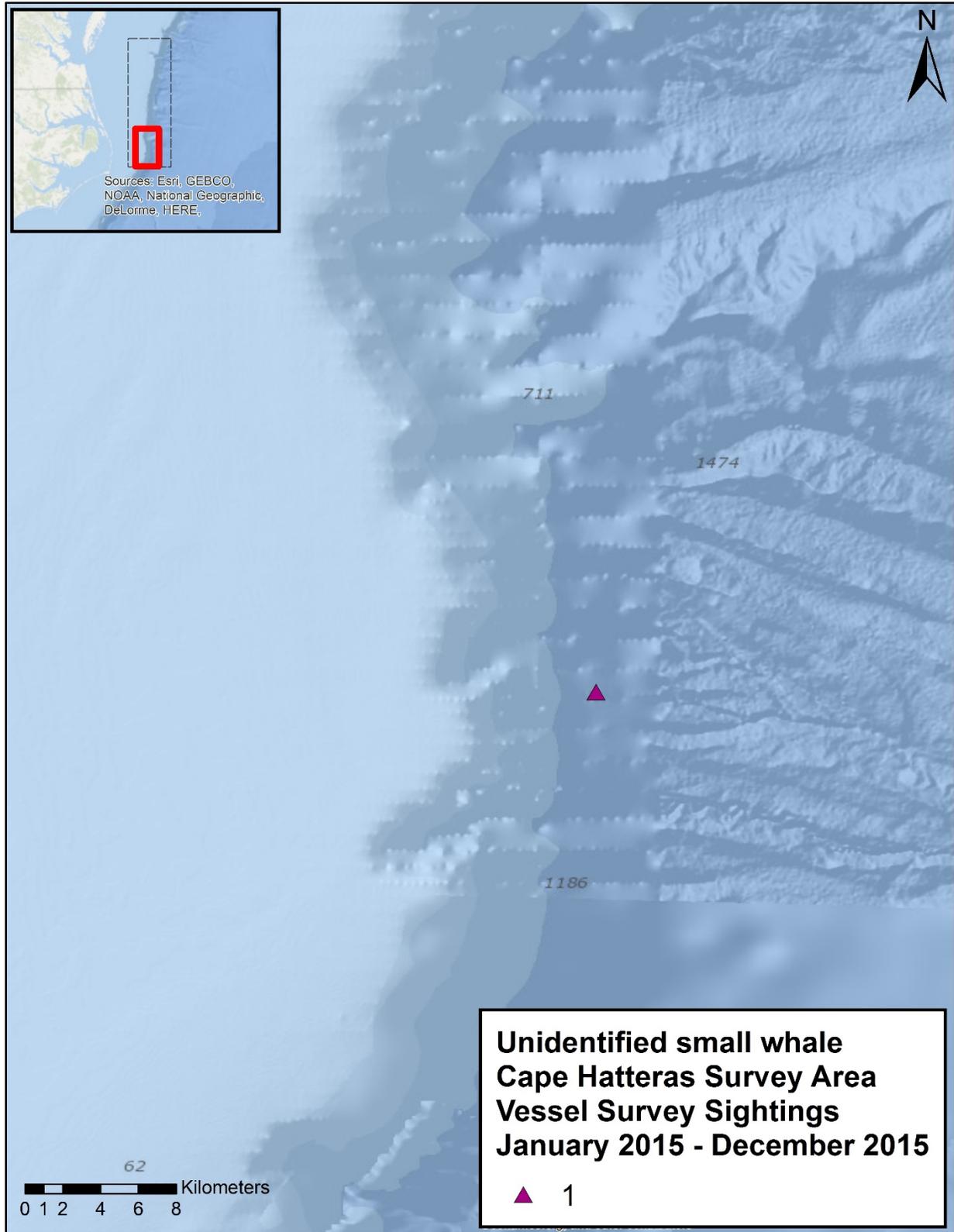
1

2 Figure 11. Distribution of *Kogia* sp. sightings observed during fieldwork in the Cape Hatteras
3 survey area, January –December 2015. Symbol size indicates group size.

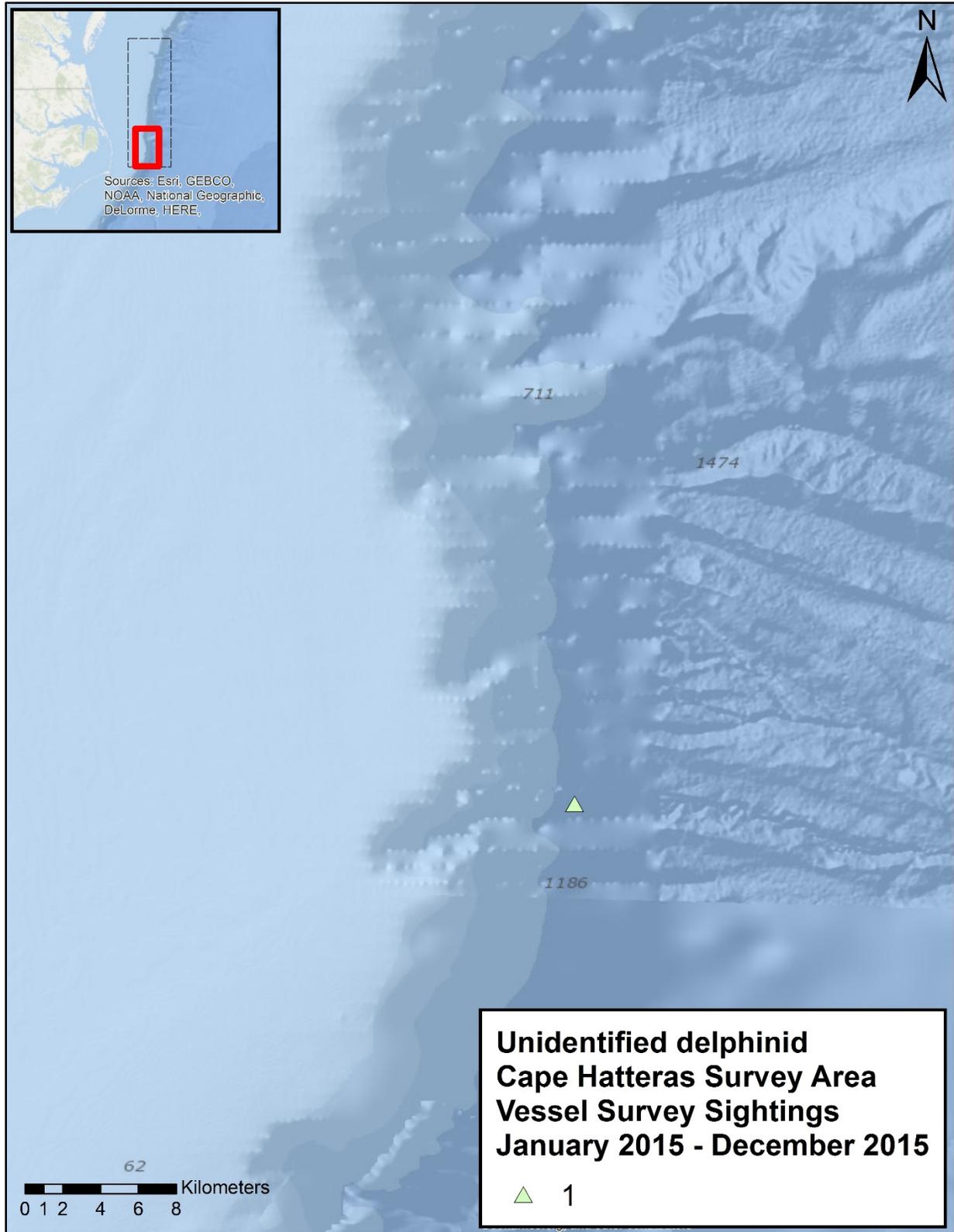


1

2 Figure 12. Distribution of unidentified beaked whale sightings observed during fieldwork in the
3 Cape Hatteras survey area, January –December 2015. Symbol size indicates group size.



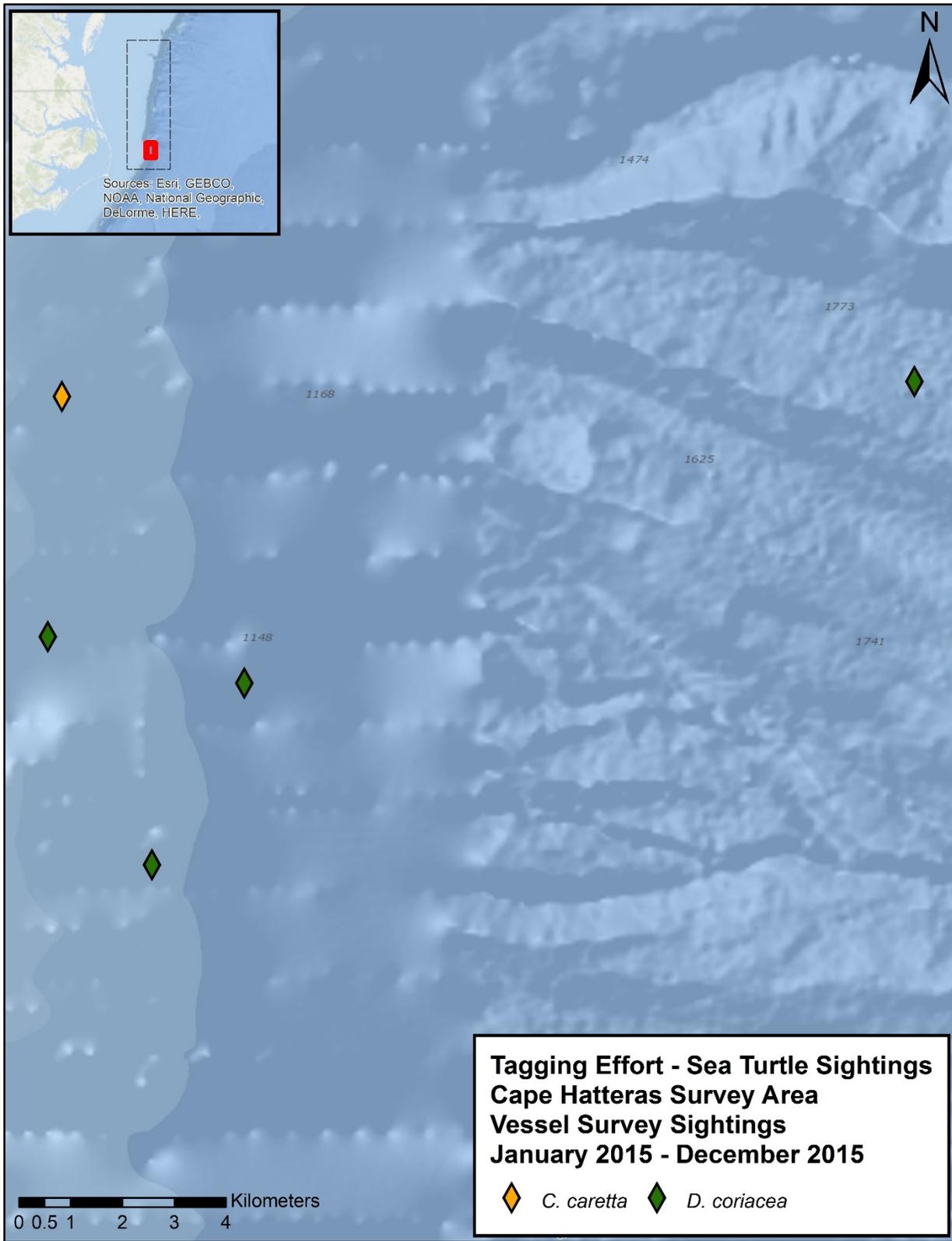
1
2 Figure 13. Distribution of unidentified small whale sightings observed during fieldwork in the
3 Cape Hatteras survey area, January–December 2015.



1
2 **Figure 14. Distribution of unidentified delphinid sightings observed during fieldwork in the Cape**
3 **Hatteras survey area, January–December 2015. Symbol size indicates group size.**

1 **Table 4. Sea turtle sightings observed during fieldwork in the Cape Hatteras survey area, January–**
 2 **December 2015.**

Date	Time	Latitude (N)	Longitude (W)	Species	Common Name	Group Size
16-May-15	14:05	35.67436	74.78243	<i>C. caretta</i>	Loggerhead turtle	1
16-Oct-15	10:12	35.59307	74.76678	<i>D. coriacea</i>	Leatherback turtle	1
20-Oct-15	14:05	35.67697	74.63439	<i>D. coriacea</i>	Leatherback turtle	1
21-Oct-15	09:07	35.63266	74.78489	<i>D. coriacea</i>	Leatherback turtle	1
21-Oct-15	09:57	35.62460	74.75076	<i>D. coriacea</i>	Leatherback turtle	1



1

2 Figure 15. Distribution of sea turtle sightings observed during fieldwork in the Cape Hatteras
3 survey area, January–December 2015.

1 3.2 Tagging

2 Observers deployed four DTags on short-finned pilot whales in the reporting period (**Table 5,**
3 **Figure 16**).

4 DTags were deployed on two short-finned pilot whales on 25 May 2015. The first animal,
5 Gm_15_145a, was tagged shortly after going on effort, but the tag was jettisoned after
6 approximately one hr. The second DTag was attached to pilot whale Gm_15_145b for
7 approximately 6.5 hr, during which a behavioral focal follow was conducted and a biopsy
8 sample was obtained. This individual exhibited 11 foraging dives, all containing terminal
9 echolocation buzzes indicative of foraging attempts. All of these dives were shallower than 400
10 meters (**Figure 17**). The dives occurred in bouts interspaced by periods of surface time.

11 On 01 June 2015, a DTag was deployed on a short-finned pilot whale, Gm_15_152a, but the
12 duration of this deployment was only seven minutes. The following day both the R/Vs *R.T.*
13 *Barber* and *Exocetus* were used to deploy a DTag on pilot whale Gm_15_153a for
14 approximately 3.75 hr. A behavioral focal follow was conducted for the duration of the tagging,
15 and a biopsy sample was obtained from the individual. The individual exhibited eight foraging
16 dives, all containing terminal echolocation buzzes indicative of foraging attempts. All eight dives
17 were deeper than 600 meters and lasted approximately 20 minutes, followed by a short surface
18 duration (**Figure 18**).

19 Researchers from Cascadia Research Collective deployed 30 satellite tags on four species of
20 odontocete cetaceans in the Cape Hatteras survey area in 2015. Tags were deployed on 19
21 short-finned pilot whales, four bottlenose dolphins, six Cuvier's beaked whales, and one sperm
22 whale (**Table 5, Figure 16**). Nine tags transmitted dive data (Wildlife Computers, Mk10 tags):
23 four on Cuvier's beaked whales, four on short-finned pilot whales, and one on a sperm whale.
24 All other satellite tags were location-only (Wildlife Computers, Smart Position and Temperature
25 tags). Several tags were still transmitting in 2016, and a summary of these deployments is
26 provided in **Table 6**, but please refer to Cascadia Research Collective's report for a full analysis
27 of the data obtained from the satellite-tagged individuals ([Baird et al. 2016](#)).

28 3.3 Biopsy Sampling

29 Observers obtained 12 biopsy samples from four species of cetaceans, including two deep-
30 diving odontocete species: short-finned pilot whales ($n=8$) and Cuvier's beaked whales ($n=2$).
31 Samples also were obtained from single bottlenose and Atlantic spotted dolphins (**Table 7,**
32 **Figure 19**). Genetic analysis of extracted deoxyribonucleic acid from bottlenose dolphin biopsy
33 samples collected in the Cape Hatteras study area between May 2011 and July 2013 confirmed
34 that all of the sampled dolphins were of the offshore ecotype, suggesting there is limited overlap
35 between coastal and offshore populations in the study area. Voucher specimens from all these
36 samples have or will be archived with the Southeast Fisheries Science Center in Lafayette,
37 Louisiana.

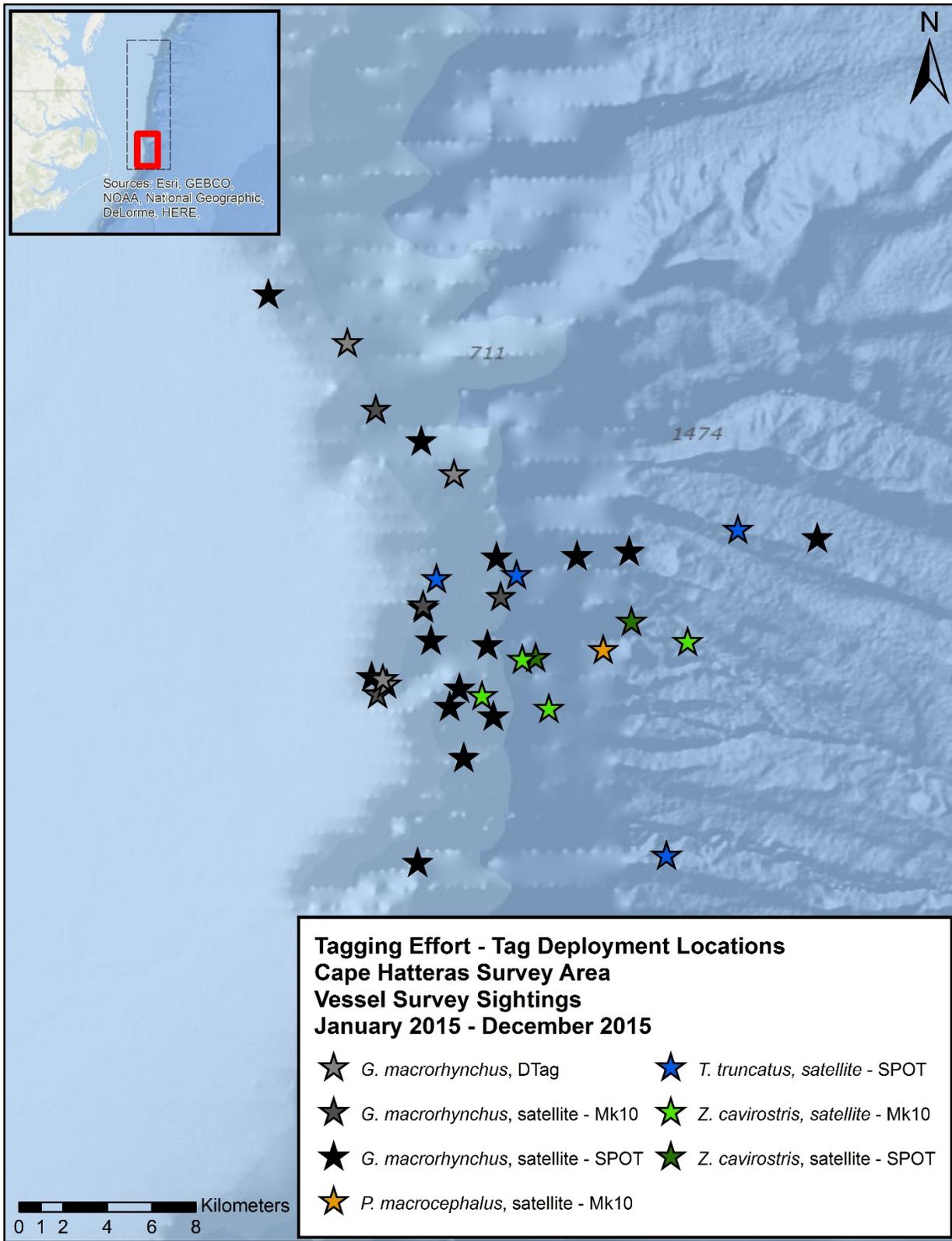
1 Table 5. Tag deployments on odontocete cetaceans in the Cape Hatteras survey area, January–December 2015.

Date	Time	Latitude (N)	Longitude (W)	Species	Common Name	Sighting #	Tag Type ¹	Tag # ²
16-May-15	9:04	35.77279	74.85675	<i>G. macrorhynchus</i>	Short-finned pilot whale	1	satellite - SPOT	GmTag122
16-May-15	12:08	35.72600	74.81323	<i>G. macrorhynchus</i>	Short-finned pilot whale	5	satellite - Mk10	GmTag123
16-May-15	13:04	35.71312	74.79474	<i>G. macrorhynchus</i>	Short-finned pilot whale	8	satellite - SPOT	GmTag124
19-May-15	9:14	35.54482	74.69516	<i>T. truncatus</i>	Bottlenose dolphin	2	satellite - SPOT	TtTag024
19-May-15	15:10	35.63226	74.79073	<i>G. macrorhynchus</i>	Short-finned pilot whale	12	satellite - SPOT	GmTag125
19-May-15	16:20	35.64534	74.79386	<i>G. macrorhynchus</i>	Short-finned pilot whale	13	satellite - SPOT	GmTag126
19-May-15	16:53	35.64647	74.79402	<i>G. macrorhynchus</i>	Short-finned pilot whale	13	satellite - Mk10	GmTag127
25-May-15	10:25	35.61452	74.80873	<i>G. macrorhynchus</i>	Short-finned pilot whale	1	DTag	Gm_15_145a
25-May-15	11:07	35.61650	74.81035	<i>G. macrorhynchus</i>	Short-finned pilot whale	1	DTag	Gm_15_145b
1-Jun-15	11:12	35.75302	74.82471	<i>G. macrorhynchus</i>	Short-finned pilot whale	3	DTag	Gm_15_152a
2-Jun-15	11:50	35.69973	74.78144	<i>G. macrorhynchus</i>	Short-finned pilot whale	7	DTag	Gm_15_153a
14-Jun-15	9:07	35.60452	74.74287	<i>Z. cavirostris</i>	Cuvier's beaked whale	1	satellite - Mk10	ZcTag038
14-Jun-15	11:26	35.63990	74.70941	<i>Z. cavirostris</i>	Cuvier's beaked whale	1	satellite - SPOT	ZcTag039
14-Jun-15	14:12	35.62844	74.72081	<i>P. macrocephalus</i>	Sperm whale	11	satellite - Mk10	PmTag026
14-Jun-15	15:59	35.63165	74.68653	<i>Z. cavirostris</i>	Cuvier's beaked whale	12	satellite - Mk10	ZcTag040
16-Jun-15	13:17	35.58458	74.77744	<i>G. macrorhynchus</i>	Short-finned pilot whale	7	satellite - SPOT	GmTag128
16-Jun-15	15:03	35.60147	74.76542	<i>G. macrorhynchus</i>	Short-finned pilot whale	8	satellite - SPOT	GmTag129
16-Jun-15	16:24	35.60539	74.78318	<i>G. macrorhynchus</i>	Short-finned pilot whale	8	satellite - SPOT	GmTag130
16-Jun-15	16:59	35.61270	74.77916	<i>G. macrorhynchus</i>	Short-finned pilot whale	8	satellite - SPOT	GmTag131
15-Oct-15	9:48	35.60974	74.77007	<i>Z. cavirostris</i>	Cuvier's beaked whale	2	satellite - Mk10	ZcTag041
15-Oct-15	12:30	35.66607	74.76415	<i>G. macrorhynchus</i>	Short-finned pilot whale	4	satellite - SPOT	GmTag134
15-Oct-15	12:42	35.65881	74.75601	<i>T. truncatus</i>	Bottlenose dolphin	5	satellite - SPOT	TtTag026
15-Oct-15	13:15	35.64992	74.76252	<i>G. macrorhynchus</i>	Short-finned pilot whale	4	satellite - Mk10	GmTag135
16-Oct-15	11:38	35.54200	74.79621	<i>G. macrorhynchus</i>	Short-finned pilot whale	5	satellite - SPOT	GmTag136

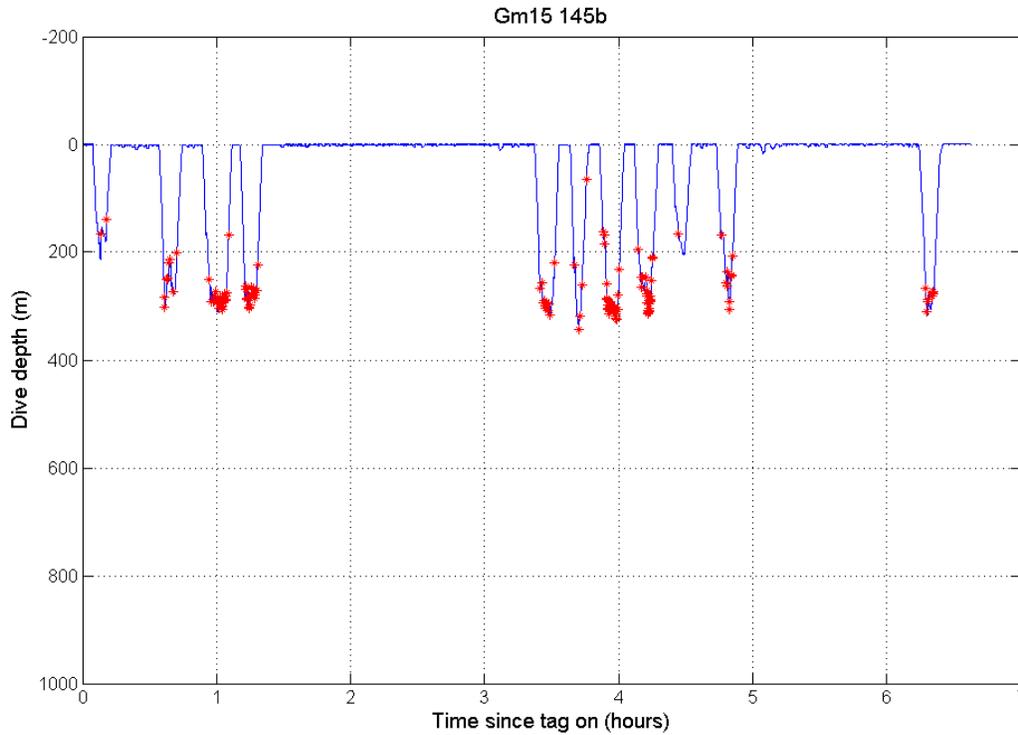
Date	Time	Latitude (N)	Longitude (W)	Species	Common Name	Sighting #	Tag Type ¹	Tag # ²
20-Oct-15	9:42	35.61745	74.81490	<i>G. macrorhynchus</i>	Short-finned pilot whale	1	satellite - SPOT	GmTag137
20-Oct-15	10:07	35.61040	74.81247	<i>G. macrorhynchus</i>	Short-finned pilot whale	1	satellite - Mk10	GmTag138
20-Oct-15	13:54	35.67383	74.63390	<i>G. macrorhynchus</i>	Short-finned pilot whale	7	satellite - SPOT	GmTag139
20-Oct-15	14:58	35.67718	74.66619	<i>T. truncatus</i>	Bottlenose dolphin	11	satellite - SPOT	Tt Tag 027
20-Oct-15	15:50	35.66832	74.71029	<i>G. macrorhynchus</i>	Short-finned pilot whale	14	satellite - SPOT	GmTag140
20-Oct-15	16:17	35.66649	74.73143	<i>G. macrorhynchus</i>	Short-finned pilot whale	15	satellite - SPOT	GmTag141
21-Oct-15	9:33	35.63042	74.76779	<i>G. macrorhynchus</i>	Short-finned pilot whale	4	satellite - SPOT	GmTag142
21-Oct-15	10:04	35.62444	74.75371	<i>Z. cavirostris</i>	Cuvier's beaked whale	5	satellite - Mk10	ZcTag042
21-Oct-15	10:59	35.62518	74.74822	<i>Z. cavirostris</i>	Cuvier's beaked whale	5	satellite - SPOT	ZcTag043
21-Oct-15	14:49	35.65726	74.78853	<i>T. truncatus</i>	Bottlenose dolphin	10	satellite - SPOT	TtTag028

¹ Mk10=location and dive data tag; SPOT= Smart Position and Temperature (location only)

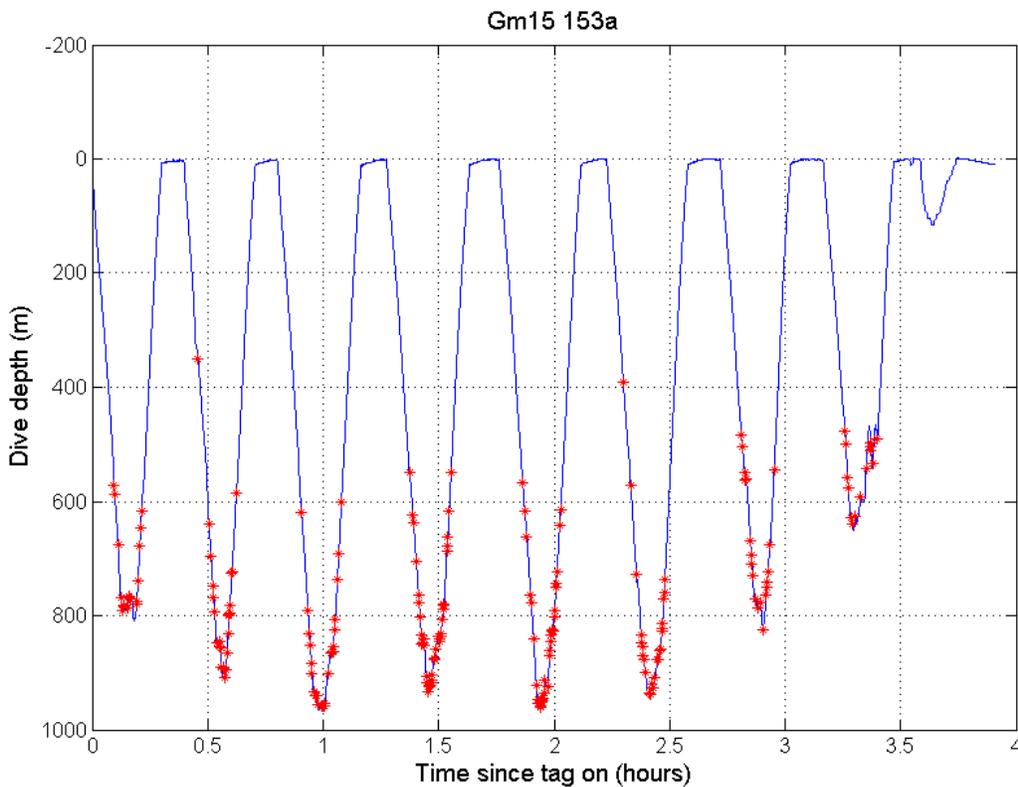
² Gm=*Globicephala macrorhynchus* (short-finned pilot whale); Pm=*Physeter macrocephalus* (sperm whale); Tt=*Tursiops truncatus* (bottlenose dolphin); Zc=*Ziphius cavirostris* (Cuvier's beaked whale)



1
2 Figure 16. Locations of tag deployments in the Cape Hatteras survey area, January–December
3 2015.



1
2 **Figure 17. Dive profile of Gm_15_145b from 25 May 2015 DTag record. Red symbols designate**
3 **foraging buzzes.**



4
5 **Figure 18. Dive profile of Gm_15_153a from 02 June 2015 DTag record. Red symbols designate**
6 **foraging buzzes.**

1 **Table 6. Summary of satellite tag deployments in the Cape Hatteras survey area, January–**
 2 **December 2015.**

Deployment ¹	Tag Type ²	Animal ID	ARGOS ID	Last Transmission
GmTag122	SPOT	23747	42140	13-Jul-15
GmTag123	Mk10	53644	42140	25-May-15
GmTag124	SPOT	145102	42140	16-Jul-15
TtTag024	SPOT	98365	42143	06-Jun-15
GmTag125	SPOT	102475	42143	05-Oct-15
GmTag126	SPOT	94825	42143	03-Jul-15
GmTag127	Mk10	94814	42143	19-Jun-15
ZcTag038	Mk10	102473	42169	09-Aug-15
ZcTag039	SPOT	144024	42169	24-Jul-15
PmTag026	Mk10	94804	42169	26-Jun-15
ZcTag040	Mk10	145106	42169	16-Jun-15
GmTag128	SPOT	98363	42171	25-Jul-15
GmTag129	SPOT	144023	42171	25-Jun-15
GmTag130	SPOT	109833	42171	
GmTag131	SPOT	102463	42171	18-Sep-15
ZcTag041	Mk10	94816	42292	19-Nov-15
GmTag134	SPOT	109827	42292	12-Dec-15
TtTag026	SPOT	102466	42292	04-Nov-15
GmTag135	Mk10	94813	42292	15-Nov-15
GmTag136	SPOT	144030	42293	
GmTag137	SPOT	102465	42297	
GmTag138	Mk10	94796	42297	14-Nov-15
GmTag139	SPOT	145109	42297	23-Dec-15
TtTag027	SPOT	144025	42297	18-Nov-15
GmTag140	SPOT	98367	42297	02-Nov-15
GmTag141	SPOT	145103	42297	24-Nov-15
GmTag142	SPOT	94805	42298	
ZcTag042	Mk10	98360	42298	19-Dec-15
ZcTag043	SPOT	144027	42298	17-Dec-15
TtTag028	SPOT	94798	42298	13-Nov-15

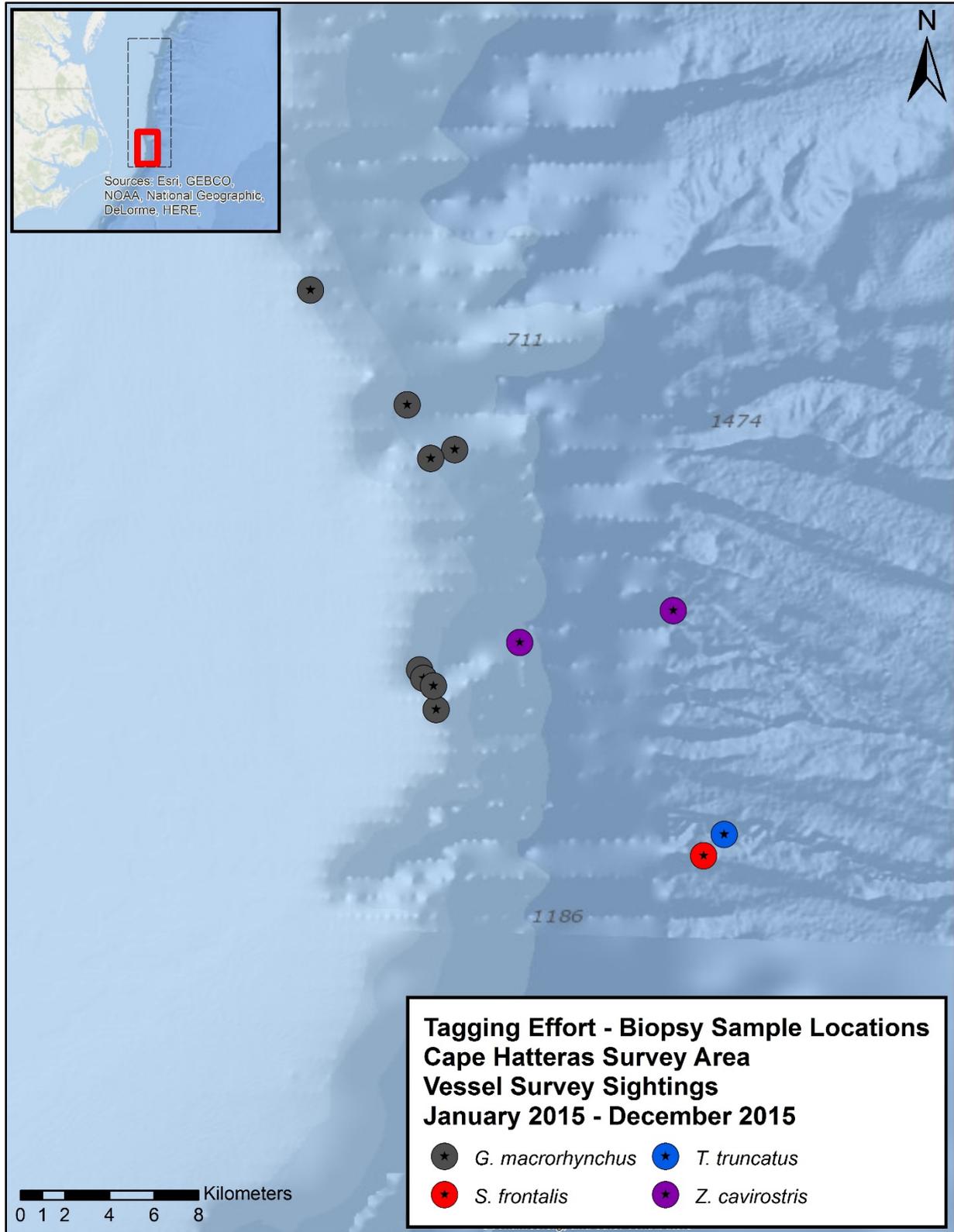
¹ Gm=*Globicephala macrorhynchus* (short-finned pilot whale); Pm=*Physeter macrocephalus* (sperm whale); Tt=*Tursiops truncatus* (bottlenose dolphin); Zc=*Ziphius cavirostris* (Cuvier's beaked whale)

² Mk10=location and dive data tag; SPOT= Smart Position and Temperature (location only)

3

1 Table 7. Biopsy samples collected from animals during fieldwork in the Cape Hatteras survey area, January 2015–December 2015.

Date	Time	Latitude (N)	Longitude (W)	Species	Common Name	Sample#	WhaleID
16-May-15	9:14	35.76860	74.85451	<i>G. macrorhynchus</i>	Short-finned pilot whale	ZTS_15_03	GmTag122
16-May-15	12:23	35.72227	74.81543	<i>G. macrorhynchus</i>	Short-finned pilot whale	ZTS_15_04	GmTag123
16-May-15	13:18	35.70420	74.79627	<i>G. macrorhynchus</i>	Short-finned pilot whale	ZTS_15_05	GmTag124
19-May-15	9:26	35.54889	74.68750	<i>T. truncatus</i>	Bottlenose dolphin	ZTS_15_06	TtTag024
25-May-15	10:37	35.61527	74.81041	<i>G. macrorhynchus</i>	Short-finned pilot whale	ZTS_15_12	GmTag127
25-May-15	12:15	35.61187	74.80881	<i>G. macrorhynchus</i>	Short-finned pilot whale	ZTS_15_13	
25-May-15	14:33	35.59926	74.80375	<i>G. macrorhynchus</i>	Short-finned pilot whale	ZTS_15_14	
25-May-15	14:45	35.60885	74.80488	<i>G. macrorhynchus</i>	Short-finned pilot whale	DMW_15_01	Gm_15_145b
1-Jun-15	14:34	35.62637	74.77001	<i>Z. cavirostris</i>	Cuvier's beaked whale	ZTS_15_15	
2-Jun-15	15:23	35.70066	74.80597	<i>G. macrorhynchus</i>	Short-finned pilot whale	ZTS_15_16	Gm_15_153a
14-Jun-15	11:27	35.63925	74.70812	<i>Z. cavirostris</i>	Cuvier's beaked whale	ZTS_15_17	
16-Jun-15	11:05	35.54026	74.69588	<i>S. frontalis</i>	Atlantic spotted dolphin	AJR_15_01	



1
2 Figure 19. Distribution of biopsy sample locations collected during fieldwork in the Cape Hatteras
3 survey area, January–December 2015.

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