

Deep Divers and Satellite Tagging in the Virginia Capes OPAREA - Cape Hatteras, NC: 2016 Annual Progress Report

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Cover Photo Credit:

Satellite-tagged Risso's dolphin (*Grampus griseus*) off Cape Hatteras, North Carolina. Photographed by Andrew Read, Duke University, taken under National Oceanic and Atmospheric Administration Scientific Permit No. 14809 (Doug Nowacek) and National Oceanic and Atmospheric Administration General Authorization Letter of Confirmation 19903 held by Duke University.

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Acronyms and Abbreviations

DTag	digital acoustic tag
GPS	Global Positioning System
hr	hour(s)
min	minute(s)
NOAA	National Oceanic and Atmospheric Administration
Photo-ID	Photo-identification
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, over seven 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 2016. This constitutes the fourth 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. 2017](#)). Additional photo-identification effort was also conducted on images collected in the Cape Hatteras study site this year and is reported separately in [Foley et al. \(2017\)](#).

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 August 2016 (**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 of cetaceans. Sea turtles were also recorded, noting the location and species identity of each sighting. Weather conditions, sea state, depth and sea-surface temperature were recorded at each sighting and whenever sighting conditions changed. All data were recorded on an Apple iPad tablet linked to a Geographic Positioning System (GPS) unit.



1

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

3 Whenever possible, observers took photographs of odontocete cetaceans for individual photo-
4 identification; observers also used these photographs to confirm species identification at each
5 sighting. Photographs were taken with Canon or Nikon digital single-lens reflex cameras
6 (equipped with 100 to 400-millimeter zoom lenses) in 24-bit color at a resolution of 6016 x 4016
7 pixels saved in .jpg format. Remote biopsy-sampling methods were used to collect small skin
8 and blubber samples using a variety of 27- to 68-kilogram pull crossbows, depending on the
9 species and sampling distance. Biopsy samples were collected with specialized 2.5-centimeter
10 stainless-steel biopsy tips attached to a modified bolt, typically fired from the bow of the survey
11 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 in groups that included neonates. Prior to
14 tagging the focal animal, observers took photographs of all individuals in the group. Each focal
15 whale was equipped with a Version 2 DTag (Johnson and Tyack 2003), programmed to remain
16 on the whale for approximately four hours (hr). The DTag is a small, lightweight archival tag
17 attached to whales with four silicone-rubber suction cups using a carbon-fiber pole. The DTag
18 was equipped with a pressure sensor to measure depth, as well as three-axis magnetometer
19 and accelerometers that measure heading, pitch, and roll. The tag contained two hydrophones
20 that record stereo sound continuously at a sampling rate of 192 kilohertz. The tag was also
21 equipped with a very high-frequency transmitter that allowed observers to track tagged animals
22 at the surface and facilitated re-location of the tag when it released from the whale. All data
23 were recorded on the tag and later downloaded through an infrared port for calibration and
24 analysis. The length of tag deployments was controlled by programming the release mechanism
25 prior to attachment.

1 Please refer to Cascadia Research Collective’s report ([Baird et al. 2017](#)) for details of satellite-
2 tagging methods.

3 2.2 Data Analysis

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

7 2.3 Data Storage

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

10 3. Results

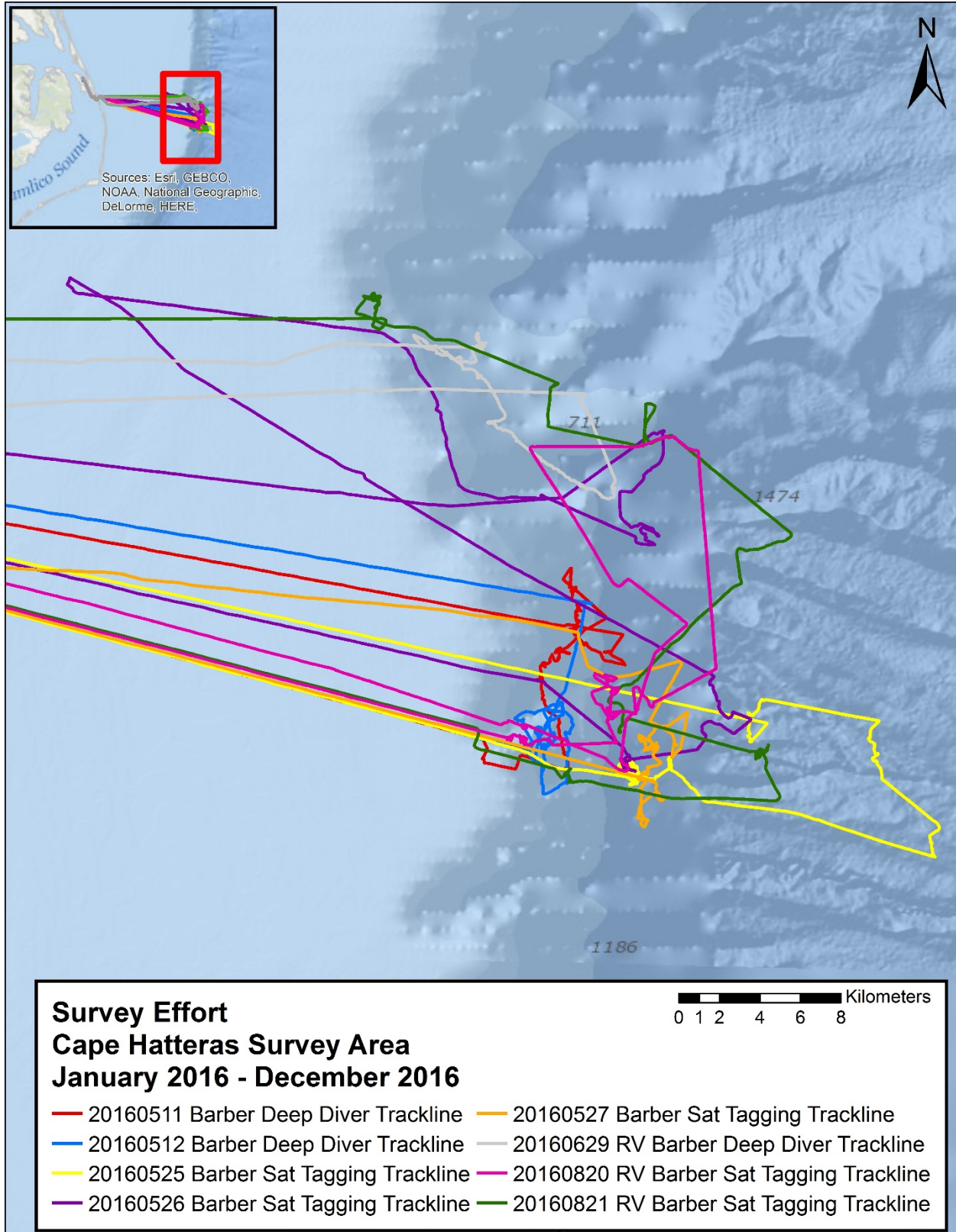
11 3.1 Field Effort

12 Fieldwork was conducted on eight days between May and August, 2016. Five days were
13 dedicated to the Satellite Tagging project and three days to the Deep Divers project (**Table 1**).

14 In total, this fieldwork yielded 456.7 kilometers and 57.3 hr of effort (**Table 1, Figure 2**). Seven
15 species of cetaceans were encountered, including 23 sightings of deep-diving odontocetes:
16 short-finned pilot whale ($n=16$), Cuvier’s beaked whale ($n=6$), and unidentified *Mesoplodon* sp.
17 ($n=1$). Other sightings included: bottlenose dolphin (*Tursiops truncatus*, $n=27$); Risso’s dolphin
18 (*Grampus griseus*, $n=2$); common dolphin (*Delphinus delphis*, $n=3$); and Clymene dolphin
19 (*Stenella clymene*, $n=1$) (**Tables 2 and 3, Figures 3 through 10**). No sea turtles were
20 encountered during 2016.

21 **Table 1. Effort details for fieldwork in the Cape Hatteras survey area, May through August, 2016.**

Date	Sea State	km Surveyed	Survey Time (hr:min)	At-Sea Time (hr:min)	Project	Platform
11-May-16	2–3	34.6	07:50	12:25	Deep Divers	R/V <i>R.T. Barber</i>
12-May-16	2–4	34.8	06:27	11:34	Deep Divers	R/V <i>R.T. Barber</i>
25-May-16	3	61.1	07:54	12:11	Satellite Tagging	R/V <i>R.T. Barber</i>
26-May-16	3	107.6	07:04	11:32	Satellite Tagging	R/V <i>R.T. Barber</i>
27-May-16	2–4	35.2	05:53	10:13	Satellite Tagging	R/V <i>R.T. Barber</i>
29-Jun-16	2–4	37.3	05:30	10:23	Deep Divers	R/V <i>R.T. Barber</i>
20-Aug-16	2–4	72.6	08:15	12:24	Satellite Tagging	R/V <i>R.T. Barber</i>
21-Aug-16	0–4	73.5	08:27	12:27	Satellite Tagging	R/V <i>R.T. Barber</i>



1

2 Figure 2. Field effort in the Cape Hatteras survey area, May through August, 2016.

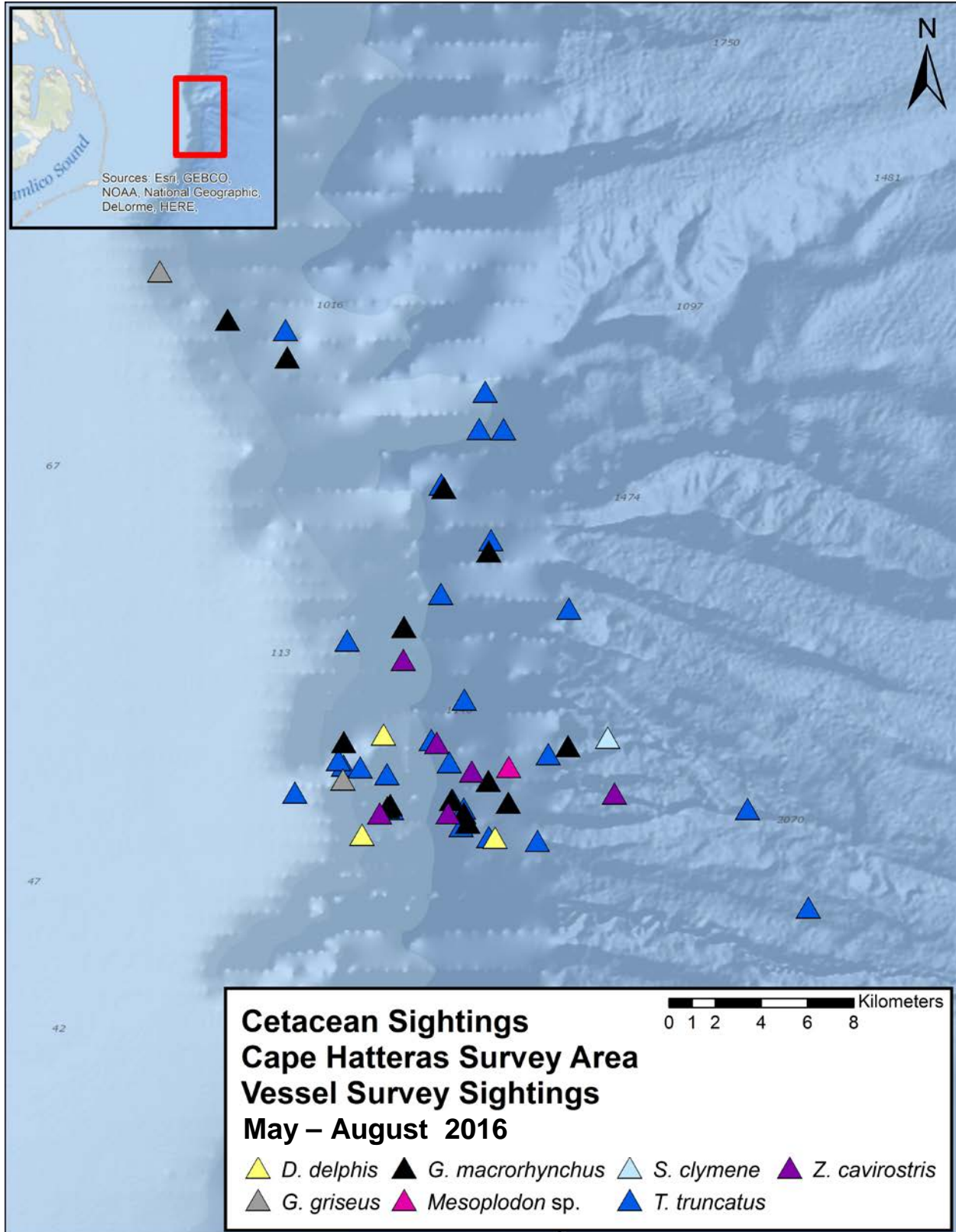
1 Table 2. Cetacean sightings during fieldwork in the Cape Hatteras survey area, May through August, 2016.

Date	Time (EDT)	Latitude (°N)	Longitude (°W)	Species	Common Name	Group Size	Biopsy Samples	Photo-ID images	Tag IDs
11-May-16	9:10	35.60057	74.81258	<i>T. truncatus</i>	Bottlenose dolphin	6	0	5	
11-May-16	9:34	35.89756	75.64252	<i>T. truncatus</i>	Bottlenose dolphin	9	0	0	
11-May-16	9:37	35.59488	74.77657	<i>G. macrorhynchus</i>	Short-finned pilot whale	23	0	73	
11-May-16	10:19	35.59583	74.77541	<i>G. macrorhynchus</i>	Short-finned pilot whale	12	0	199	
11-May-16	12:28	35.64748	74.77795	<i>G. macrorhynchus</i>	Short-finned pilot whale	6	0	0	
11-May-16	13:28	35.68269	74.77506	<i>G. macrorhynchus</i>	Short-finned pilot whale	9	0	85	
11-May-16	14:17	35.66515	74.77003	<i>G. macrorhynchus</i>	Short-finned pilot whale	11	0	260	Gm16_132a
11-May-16	15:43	35.65229	74.77028	<i>Z. cavirostris</i>	Cuvier's beaked whale	2	0	0	
12-May-16	11:16	35.61112	74.79361	<i>T. truncatus</i>	Bottlenose dolphin	7	0	62	
12-May-16	11:33	35.62027	74.79348	<i>G. macrorhynchus</i>	Short-finned pilot whale	25	1	313	Gm16_133a
12-May-16	12:07	35.62317	74.77805	<i>D. delphis</i>	Short-beaked common dolphin	25	0	0	
12-May-16	13:13	35.61044	74.78714	<i>T. truncatus</i>	Bottlenose dolphin	18	0	26	
12-May-16	16:04	35.58414	74.78639	<i>D. delphis</i>	Short-beaked common dolphin	200	0	0	
25-May-16	9:00	35.58756	74.74779	<i>T. truncatus</i>	Bottlenose dolphin	7	0	57	
25-May-16	9:22	35.59255	74.75281	<i>Z. cavirostris</i>	Cuvier's beaked whale	5	0	51	ZcTag046-047
25-May-16	11:17	35.58888	74.74513	<i>G. macrorhynchus</i>	Short-finned pilot whale	15	0	0	
25-May-16	12:08	35.59263	74.74673	<i>G. macrorhynchus</i>	Short-finned pilot whale	6	0	31	GmTag157
25-May-16	12:08	35.59443	74.74677	<i>T. truncatus</i>	Bottlenose dolphin	80	0	46	
25-May-16	12:42	35.59663	74.72940	<i>G. macrorhynchus</i>	Short-finned pilot whale	3	0	15	
25-May-16	13:50	35.55586	74.61245	<i>T. truncatus</i>	Bottlenose dolphin	3	0	9	
25-May-16	14:24	35.59425	74.63616	<i>T. truncatus</i>	Bottlenose dolphin	14	0	94	TtTag029
25-May-16	15:29	35.62197	74.69068	<i>S. clymene</i>	Clymene dolphin	250	0	148	ScTag001
26-May-16	8:45	35.59769	74.75112	<i>T. truncatus</i>	Bottlenose dolphin	8	0	37	
26-May-16	8:46	35.59771	74.75152	<i>G. macrorhynchus</i>	Short-finned pilot whale	18	0	115	GmTag158
26-May-16	9:53	35.61554	74.71386	<i>T. truncatus</i>	Bottlenose dolphin	4	0	0	
26-May-16	10:13	35.61869	74.70610	<i>G. macrorhynchus</i>	Short-finned pilot whale	15	0	97	GmTag159
26-May-16	13:25	35.69453	74.73696	<i>G. macrorhynchus</i>	Short-finned pilot whale	10	1	74	GmTag160
26-May-16	13:48	35.69892	74.73616	<i>T. truncatus</i>	Bottlenose dolphin	20	0	7	

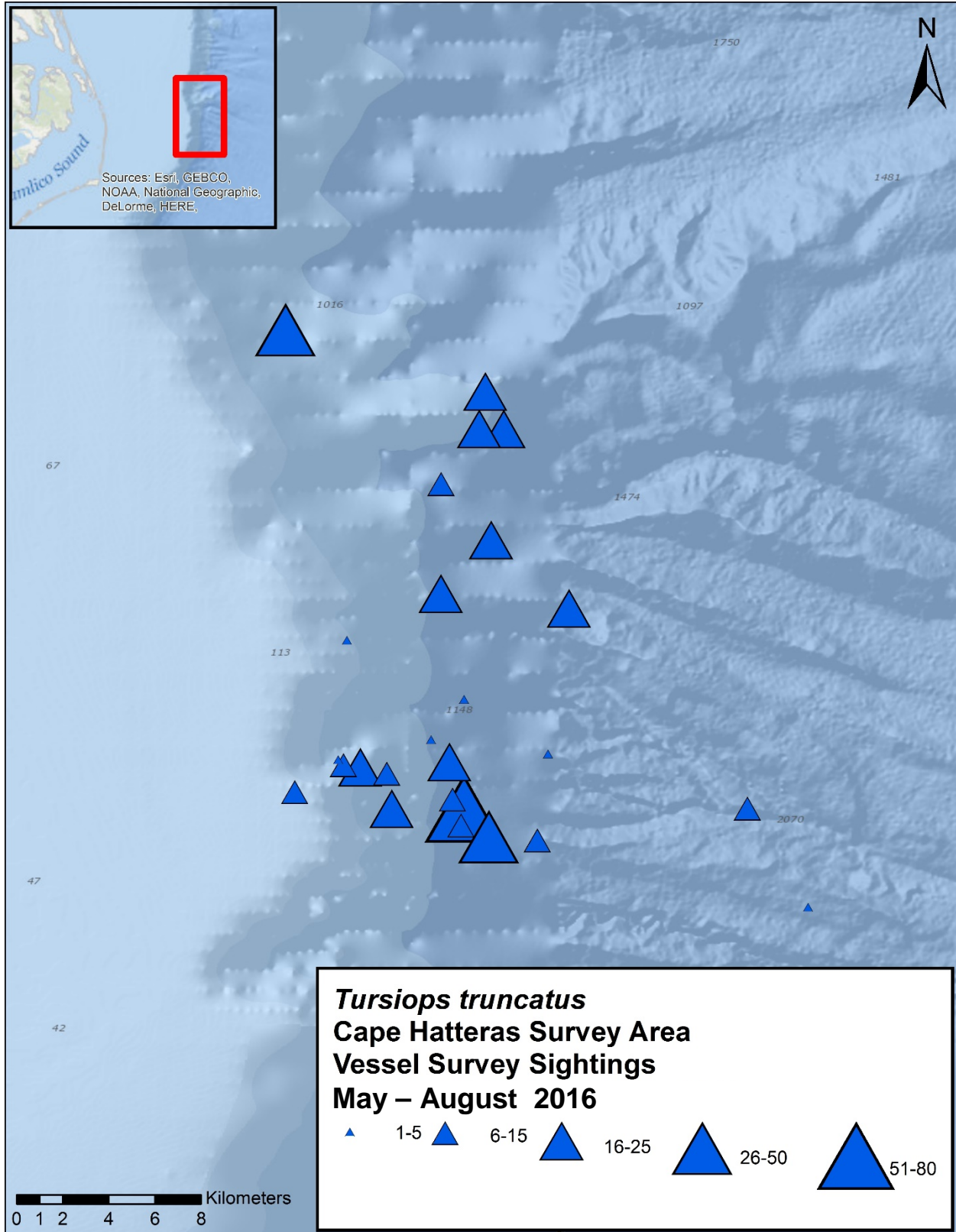
Date	Time (EDT)	Latitude (°N)	Longitude (°W)	Species	Common Name	Group Size	Biopsy Samples	Photo-ID images	Tag IDs
27-May-16	8:32	35.65979	74.79220	<i>T. truncatus</i>	Bottlenose dolphin	2	0	0	
27-May-16	8:57	35.63680	74.74655	<i>T. truncatus</i>	Bottlenose dolphin	4	0	0	
27-May-16	9:21	35.61060	74.72925	<i>Mesoplodon</i> sp.	Unid. Mesoplodon	1	0	0	
27-May-16	10:15	35.60515	74.73717	<i>G. macrorhynchus</i>	Short-finned pilot whale	22	0	94	GmTag161
27-May-16	11:19	35.60883	74.74368	<i>Z. cavirostris</i>	Cuvier's beaked whale	7	0	147	ZcTag048-049
27-May-16	14:04	35.58304	74.73454	<i>D. delphis</i>	Short-beaked common dolphin	500	0	116	DdTag002
29-Jun-16	10:04	35.72057	74.75557	<i>T. truncatus</i>	Bottlenose dolphin	9	0	9	
29-Jun-16	10:10	35.71930	74.75446	<i>G. macrorhynchus</i>	Short-finned pilot whale	5	2	124	Gm16_181a
29-Jun-16	12:16	35.77009	74.81556	<i>G. macrorhynchus</i>	Short-finned pilot whale	13	0	0	
29-Jun-16	12:43	35.78474	74.83883	<i>G. macrorhynchus</i>	Short-finned pilot whale	3	0	18	
20-Aug-16	08:39	35.61328	74.79558	<i>T. truncatus</i>	Bottlenose dolphin	3	0	0	
20-Aug-16	08:51	35.60778	74.77672	<i>T. truncatus</i>	Bottlenose dolphin	12	0	0	
20-Aug-16	09:49	35.67798	74.75572	<i>T. truncatus</i>	Bottlenose dolphin	18	0	0	
20-Aug-16	10:40	35.74208	74.73126	<i>T. truncatus</i>	Bottlenose dolphin	25	0	0	
20-Aug-16	12:33	35.61990	74.75725	<i>Z. cavirostris</i>	Cuvier's beaked whale	6	0	29	ZcTag050
20-Aug-16	14:58	35.62109	74.75943	<i>T. truncatus</i>	Bottlenose dolphin	5	0	0	
20-Aug-16	15:39	35.60570	74.79388	<i>G. griseus</i>	Risso's dolphin	75	0	291	GgTag017
21-Aug-16	08:21	35.59243	74.77950	<i>Z. cavirostris</i>	Cuvier's beaked whale	2	0	29	
21-Aug-16	08:34	35.59420	74.77483	<i>T. truncatus</i>	Bottlenose dolphin	20	0	0	
21-Aug-16	09:39	35.58332	74.73701	<i>T. truncatus</i>	Bottlenose dolphin	50	0	0	
21-Aug-16	09:46	35.58179	74.71802	<i>T. truncatus</i>	Bottlenose dolphin	10	0	0	
21-Aug-16	10:09	35.60029	74.68806	<i>Z. cavirostris</i>	Cuvier's beaked whale	7	0	75	ZcTag051
21-Aug-16	12:23	35.61243	74.75236	<i>T. truncatus</i>	Bottlenose dolphin	25	0	0	
21-Aug-16	13:15	35.67220	74.70582	<i>T. truncatus</i>	Bottlenose dolphin	18	0	22	
21-Aug-16	13:56	35.74221	74.74075	<i>T. truncatus</i>	Bottlenose dolphin	20	0	0	
21-Aug-16	14:01	35.75670	74.73836	<i>T. truncatus</i>	Bottlenose dolphin	25	0	0	
21-Aug-16	14:56	35.78078	74.81627	<i>T. truncatus</i>	Bottlenose dolphin	35	0	0	
21-Aug-16	15:16	35.80360	74.86523	<i>G. griseus</i>	Risso's dolphin	100	0	191	

1 **Table 3. Number of cetacean sightings for each species observed during fieldwork in the Cape**
2 **Hatteras survey area, May through August, 2016.**

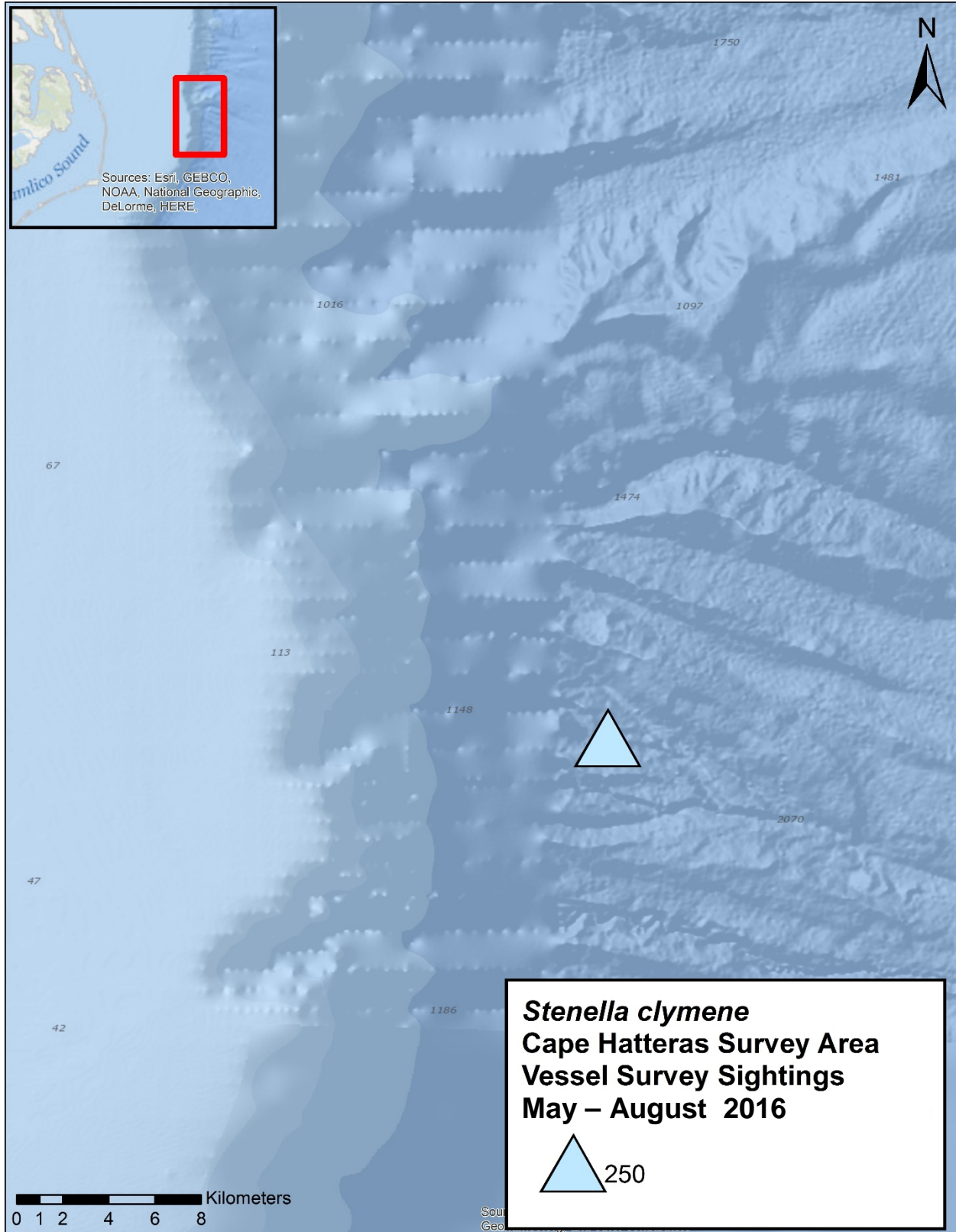
Species	Sightings 2016
<i>Delphinus delphis</i>	3
<i>Globicephala macrorhynchus</i>	16
<i>Grampus griseus</i>	2
<i>Mesoplodon</i> sp.	1
<i>Stenella clymene</i>	1
<i>Tursiops truncatus</i>	27
<i>Ziphius cavirostris</i>	6
Total:	56



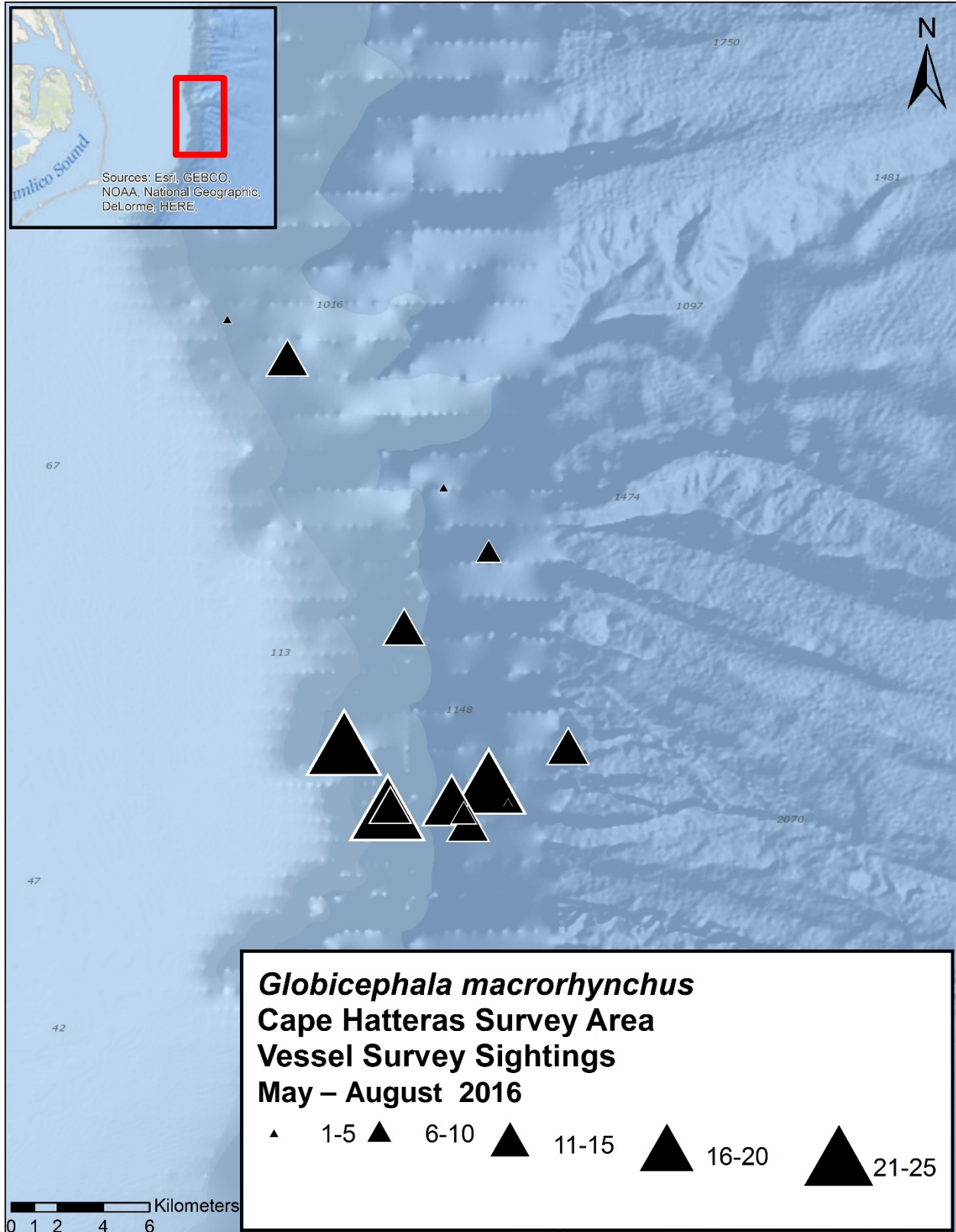
1
2 Figure 3. Distribution of all cetacean sightings in the Cape Hatteras survey area, May through
3 August, 2016.



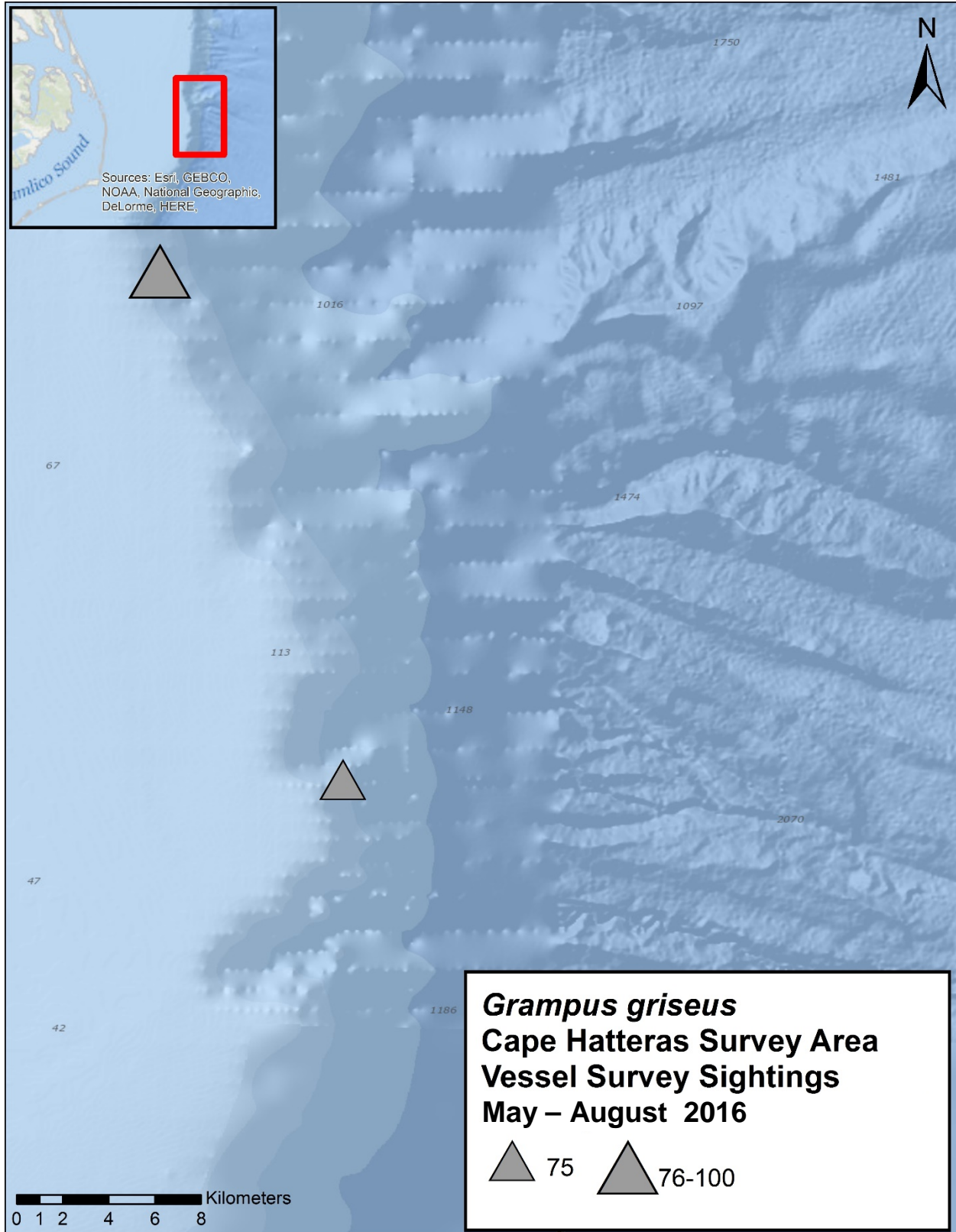
1
2 Figure 4. Distribution of bottlenose dolphin sightings in the Cape Hatteras survey area, May
3 through August, 2016 ($n=27$). Symbol size indicates group size.



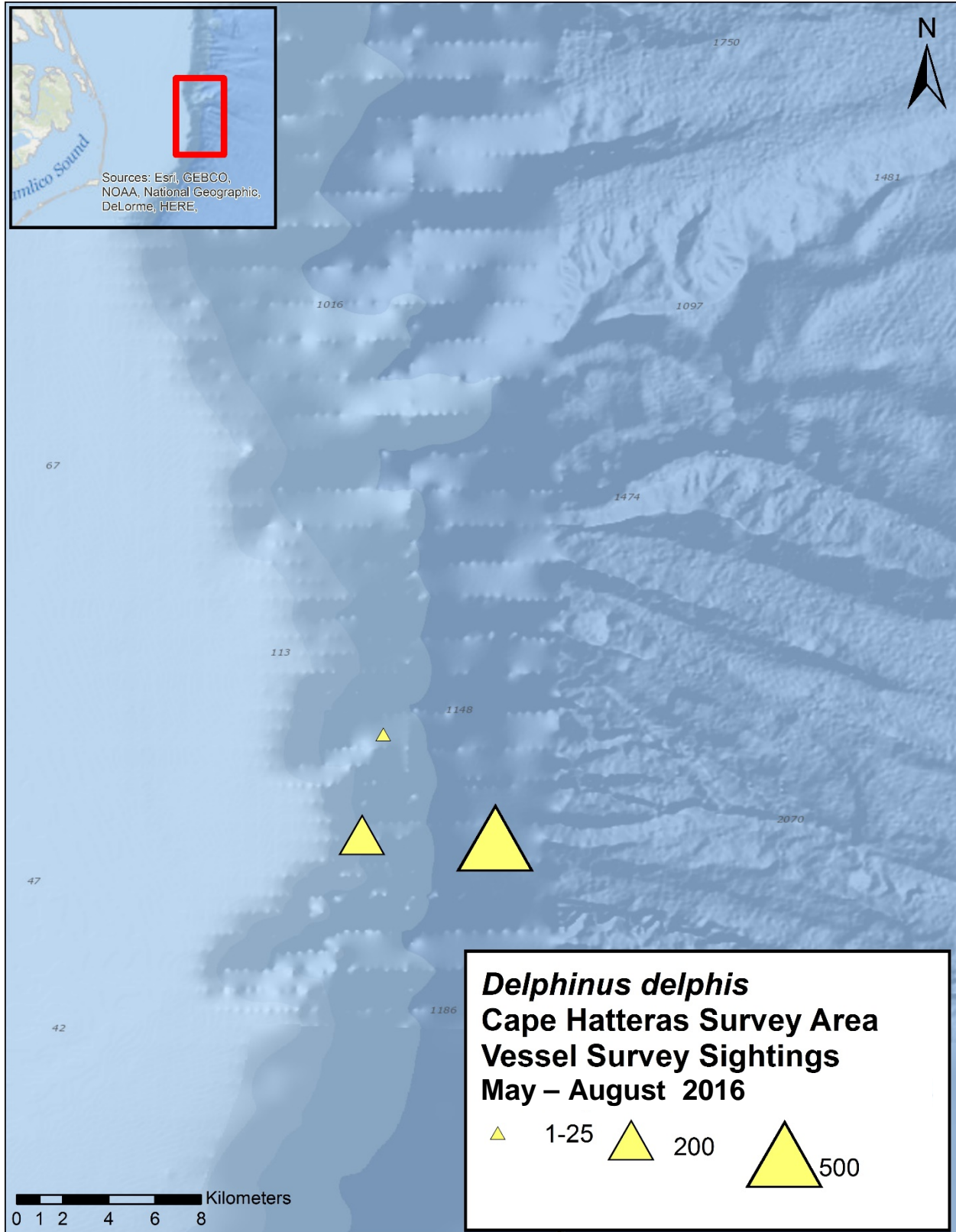
1
2 Figure 5. Distribution of a Clymene dolphin sightings in the Cape Hatteras survey area, May
3 through August, 2016. Symbol size indicates group size.



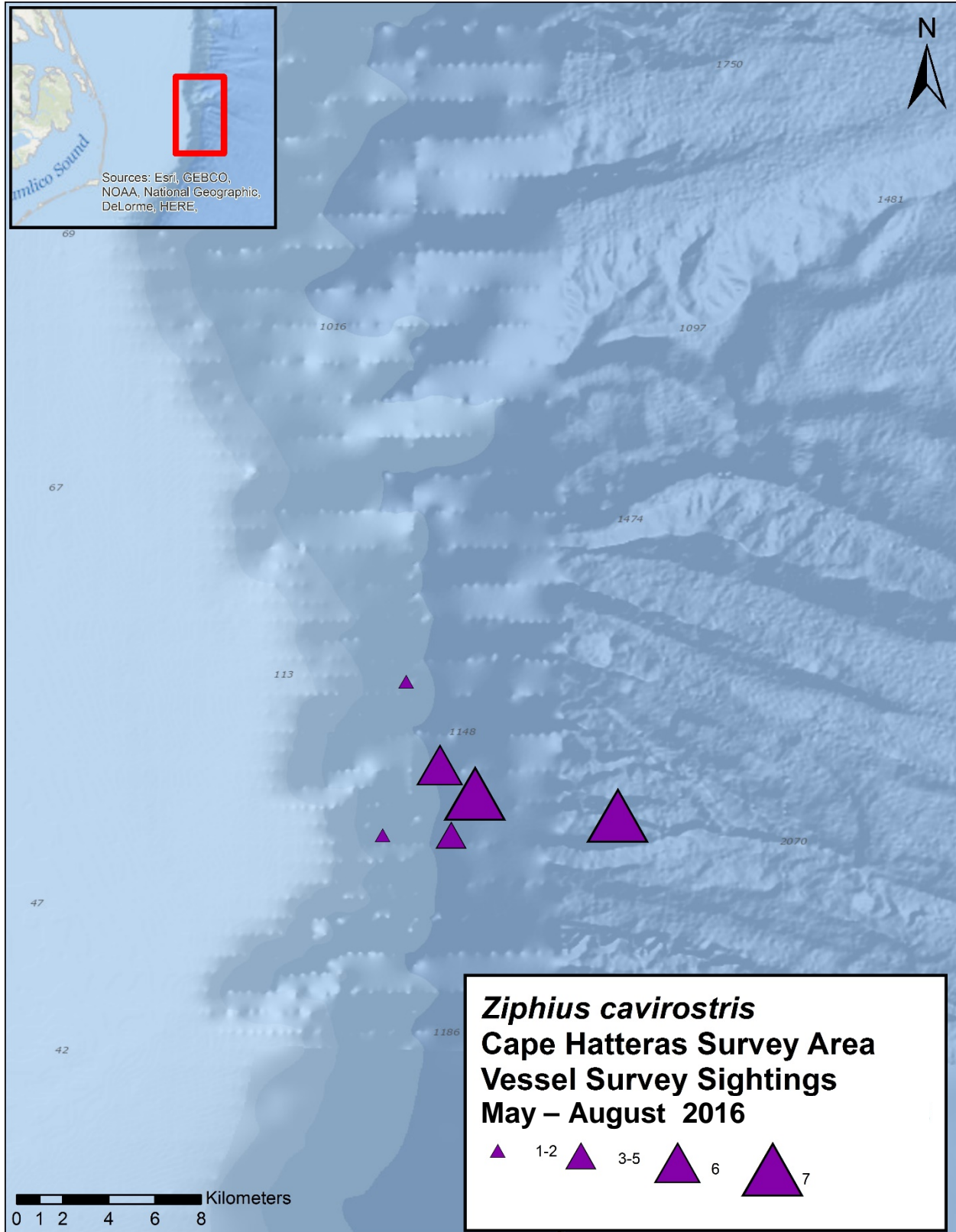
1
2 Figure 6. Distribution of short-finned pilot whale sightings in the Cape Hatteras survey area, May
3 through August, 2016 ($n=16$). Symbol size indicates group size.



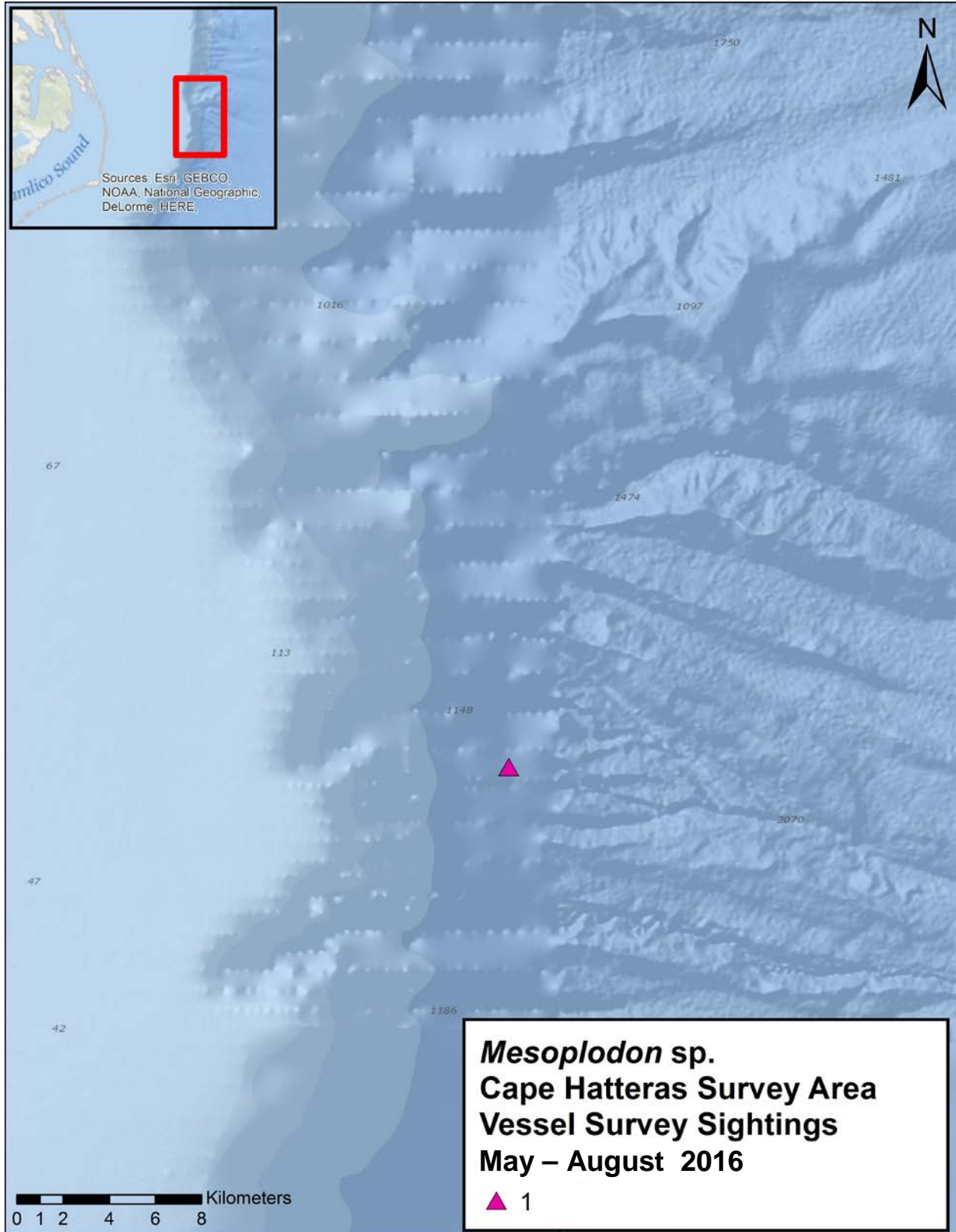
1
2 Figure 7. Distribution of Risso's dolphin sightings in the Cape Hatteras survey area, May through
3 August, 2016 ($n=2$). Symbol size indicates group size.



1
2 Figure 8. Distribution of short-beaked common dolphin sightings in the Cape Hatteras survey
3 area, May through August, 2016 ($n=3$). Symbol size indicates group size.



1
2 Figure 9. Distribution of Cuvier’s beaked whale sightings in the Cape Hatteras survey area, May
3 through August, 2016 (n=6). Symbol size indicates group size.



1
2 Figure 10. Distribution of an unidentified *Mesoplodon* sighting in the Cape Hatteras survey area,
3 May through August, 2016.

1 3.2 Tagging

2 Observers deployed three DTags on short-finned pilot whales in the reporting period (**Table 4,**
3 **Figure 11**).

4 On 11–12 May 2016, DTags were deployed on two short-finned pilot whales (Gm16_132a;
5 Gm16_133a); focal follows were conducted prior to and during each deployment. The
6 deployments lasted approximately 1.5 hr and 4 hr, respectively. To help us understand vocal
7 production in relation to observed behavior, we deployed a four-element distributed hydrophone
8 array to record pilot whale vocalizations in synchrony with the focal follows. This allows us to
9 accurately localize caller direction and link exact times of vocalizations with exact times of
10 surface observations. We recorded a total of 5.25 hr on the hydrophone array.

11 On 29 June 2016, a DTag was deployed on a short-finned pilot whale (Gm16_181a). The focal
12 individual was tracked during the tag's approximately 4-hr duration.

13 Researchers from Cascadia Research Collective deployed 15 satellite tags on six species of
14 odontocete cetaceans in the Cape Hatteras survey area in 2016. Tags were deployed on six
15 Cuvier's beaked whales, five short-finned pilot whales, one bottlenose dolphin, one Risso's
16 dolphin, one short-beaked common dolphin, and one Clymene dolphin (**Table 4, Figure 11**).
17 Five tags were equipped to transmit dive data (Wildlife Computers, Mk10 tags), all deployed on
18 Cuvier's beaked whales. Nine other satellite tags were location-only (Wildlife Computers, Smart
19 Position and Temperature tags), and one tag with a GPS receiver was deployed on a short-
20 finned pilot whale. No tags were actively transmitting at the end of 2016; a summary of these
21 deployments is provided in **Table 5**, but please refer to Cascadia Research Collective's report
22 for a full analysis of the data obtained from the satellite-tagged individuals ([Baird et al. 2017](#)).

23 3.3 Biopsy Sampling

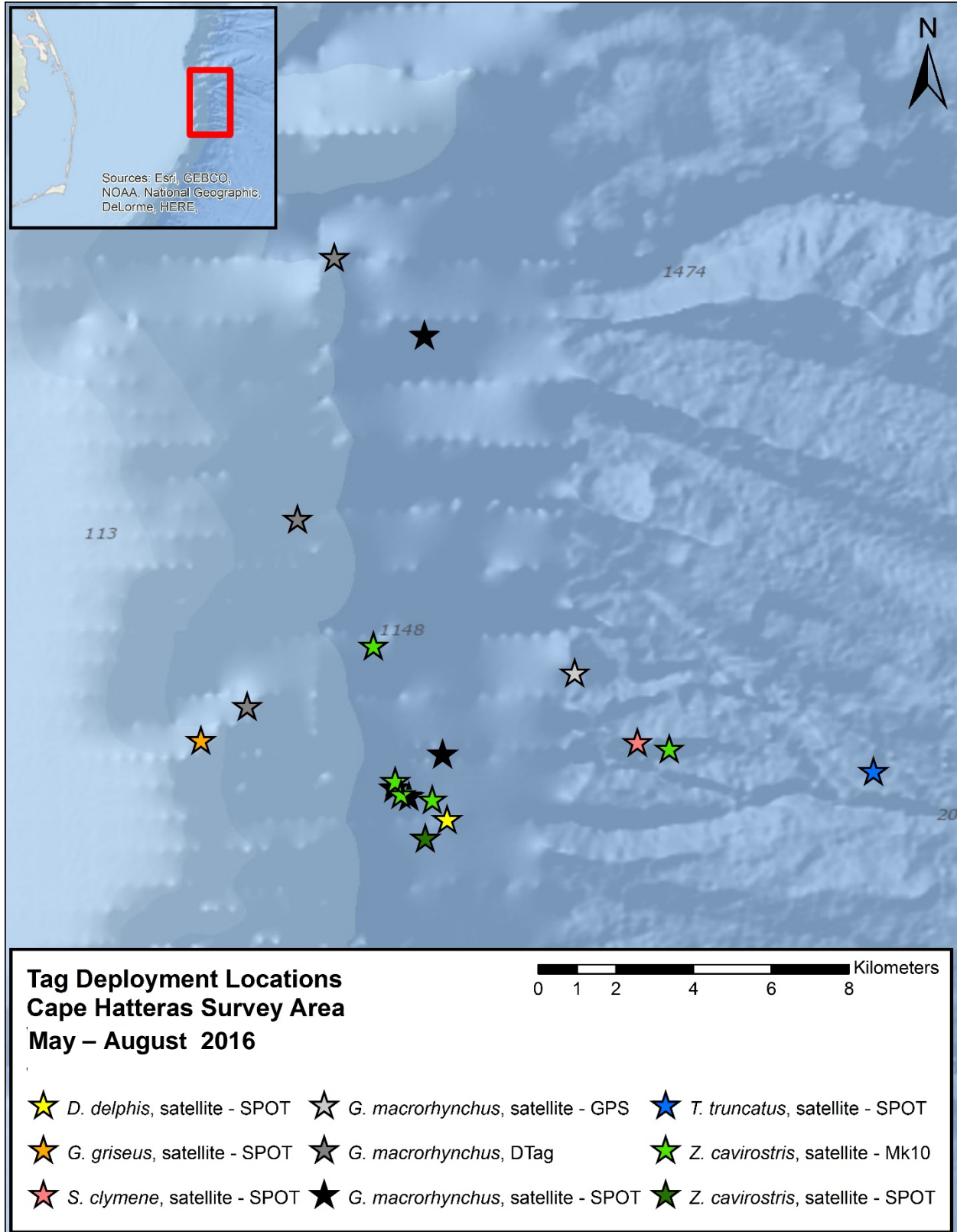
24 Observers obtained four biopsy samples from short-finned pilot whales (**Table 6, Figure 12**).
25 Voucher specimens from all these samples have been or will be archived with the Southeast
26 Fisheries Science Center in Lafayette, Louisiana.

1 Table 4. Tag deployments on odontocete cetaceans in the Cape Hatteras survey area, May through August, 2016.

Date	Time	Latitude (°N)	Longitude (°W)	Species	Common Name	Sighting #	Tag Type ¹	Tag # ²
11-May-16	15:04	35.65854	74.77259	<i>G. macrorhynchus</i>	Short-finned pilot whale	7	DTag	Gm16_132a
12-May-16	12:51	35.61521	74.78423	<i>G. macrorhynchus</i>	Short-finned pilot whale	2	DTag	Gm16_133a
25-May-16	13:49	35.59491	74.74860	<i>Z. cavirostris</i>	Cuvier's beaked whale	2	satellite–Mk10	ZcTag046
25-May-16	14:26	35.59792	74.74997	<i>Z. cavirostris</i>	Cuvier's beaked whale	2	satellite–Mk10	ZcTag047
25-May-16	16:05	35.59443	74.74677	<i>G. macrorhynchus</i>	Short-finned pilot whale	4	satellite–SPOT	GmTag157
25-May-16	18:42	35.60019	74.63929	<i>T. truncatus</i>	Bottlenose dolphin	8	satellite–SPOT	TtTag029
25-May-16	20:08	35.60689	74.69394	<i>S. clymene</i>	Clymene dolphin	9	satellite–SPOT	ScTag001
26-May-16	12:59	35.59639	74.75029	<i>G. macrorhynchus</i>	Short-finned pilot whale	2	satellite–SPOT	GmTag158
26-May-16	14:21	35.62296	74.70840	<i>G. macrorhynchus</i>	Short-finned pilot whale	4	satellite–GPS	GmTag159
26-May-16	17:40	35.70104	74.74320	<i>G. macrorhynchus</i>	Short-finned pilot whale	5	satellite–SPOT	GmTag160
27-May-16	14:46	35.60418	74.73898	<i>G. macrorhynchus</i>	Short-finned pilot whale	4	satellite–SPOT	GmTag161
27-May-16	16:58	35.59365	74.74136	<i>Z. cavirostris</i>	Cuvier's beaked whale	5	satellite–Mk10	ZcTag048
27-May-16	17:11	35.58476	74.74301	<i>Z. cavirostris</i>	Cuvier's beaked whale	5	satellite–SPOT	ZcTag049
27-May-16	18:21	35.58906	74.73796	<i>D. delphis</i>	Short-beaked common dolphin	6	satellite–SPOT	DdTag002
29-Jun-16	10:25	35.71906	74.76407	<i>G. macrorhynchus</i>	Short-finned pilot whale	2	DTag	Gm16_181a
20-Aug-16	13:11	35.62921	74.75501	<i>Z. cavirostris</i>	Cuvier's beaked wale	5	satellite–Mk10	ZcTag050
20-Aug-16	15:55	35.60738	74.79493	<i>G. griseus</i>	Risso's dolphin	7	satellite–SPOT	GgTag017
21-Aug-16	10:30	35.60539	74.68651	<i>Z. cavirostris</i>	Cuvier's beaked wale	5	satellite–Mk10	ZcTag051

¹ DTag=digital acoustic tag; GPS=Global Positioning System tag (location only); Mk10=location and dive data tag; SPOT=Smart Position and Temperature tag (location only)

² Dd=*Delphinus delphis* (short-beaked common dolphin); Gg=*Grampus griseus* (Risso's dolphin); Gm=*Globicephala macrorhynchus* (short-finned pilot whale); Sc=*Stenella clymene* (Clymene dolphin); Tt=*Tursiops truncatus* (bottlenose dolphin); Zc=*Ziphius cavirostris* (Cuvier's beaked whale);



1

2 Figure 11. Locations of tag deployments in the Cape Hatteras survey area, May through August,
3 2016.

1 **Table 5. Summary of satellite tag deployments in the Cape Hatteras survey area, May through**
2 **August, 2016.**

Deployment	Tag Type ¹	Animal ID ²	ARGOS ID	Last Transmission	Duration
21-Oct-15	SPOT	GmTag142	94805	04-Oct-16	350 days
25-May-16	Mk10	ZcTag046	98362	10-Jun-16	16 days
25-May-16	Mk10	ZcTag047	94798	31-Jul-16	67 days
25-May-16	SPOT	GmTag157	145099	4-Oct-16	132 days
25-May-16	SPOT	TtTag029	23747	7-Jun-16	13 days
25-May-16	SPOT	ScTag001	102475	15-Jun-16	20 days
26-May-16	SPOT	GmTag158	98358	23-Oct-16	151 days
26-May-16	GPS	GmTag159	162271	20-Jun-16	25 days
26-May-16	SPOT	GmTag160	98363	25-Oct-16	157 days
27-May-16	SPOT	GmTag161	145103	21-Jun-16	24 days
27-May-16	Mk10	ZcTag048	53655	3-Jul-16	36 days
27-May-16	SPOT	ZcTag049	102473	23-Aug-16	93 days
27-May-16	SPOT	DdTag002	144026	8-Jun-16	11 days
20-Aug-16	Mk10	ZcTag050	144033	20-Sep-16	30 days
20-Aug-16	SPOT	GgTag017	144037	07-Sep-16	18 days
21-Aug-16	Mk10	ZcTag051	94815	29-Aug-16	11 days

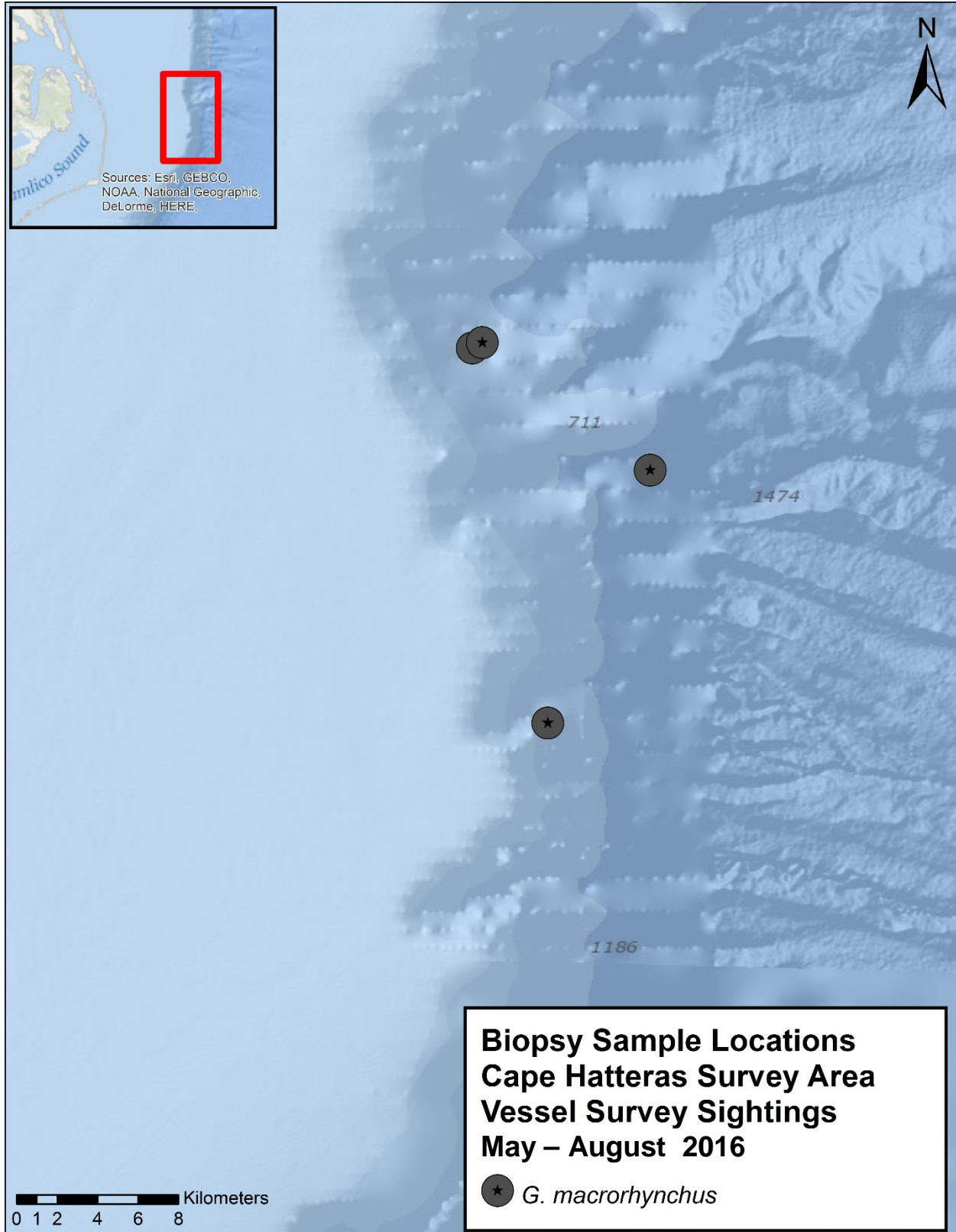
¹ Mk10=location and dive data tag; SPOT=Smart Position and Temperature tag (location only); GPS=Global Positioning System tag (location only)

² Gm=*Globicephala macrorhynchus* (short-finned pilot whale); Tt=*Tursiops truncatus* (bottlenose dolphin); Zc=*Ziphius cavirostris* (Cuvier's beaked whale); Sc=*Stenella clymene* (Clymene dolphin); Dd=*Delphinus delphis* (short-beaked common dolphin); Gg=*Grampus griseus* (Risso's dolphin)

3 **Table 6. Biopsy samples collected from animals during fieldwork in the Cape Hatteras survey**
4 **area, May through August, 2016.**

Date	Time	Latitude (°N)	Longitude (°W)	Species	Common Name	Sample#	WhaleID ¹
12-May-16	12:51	35.61521	74.78423	<i>G. macrorhynchus</i>	Short-finned pilot whale	ZTS_16_005	Gm16_133a
26-May-16	14:14	35.72734	74.73883	<i>G. macrorhynchus</i>	Short-finned pilot whale	ZTS_16_006	GmTag160
29-Jun-16	13:22	35.78149	74.81781	<i>G. macrorhynchus</i>	Short-finned pilot whale	ZTS_16_009	
29-Jun-16	14:17	35.78390	74.81330	<i>G. macrorhynchus</i>	Short-finned pilot whale	ZTS_16_010	Gm16_181a

¹ Gm=*Globicephala macrorhynchus* (short-finned pilot whale)



1
2 **Figure 12. Distribution of biopsy sample locations collected in the Cape Hatteras survey area, May**
3 **through August, 2016.**

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