DEEP DIVERS: ECOLOGY OF DEEP-DIVING ODONTOCETES IN THE VIRGINIA CAPES OPAREA OFF HATTERAS, NC JANUARY 2013 - DECEMBER 2013

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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 Navy range complexes along the Atlantic coast. This 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. In Onslow Bay, six years of monitoring have yielded a comprehensive picture of the density, distribution and abundance of marine mammals and sea turtles and provided new insights into residency patterns among pelagic delphinid cetaceans in this region. More than four years of monitoring in Jacksonville have provided similar information on the density and distribution of marine mammals and sea turtles in this area. In Cape Hatteras, almost three years of surveys have provided preliminary 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 monitoring activities that formed part of the Deep Divers project conducted off Cape Hatteras between January and December 2013. This constitutes the first year of this project, which focuses on the distribution and ecology of several deep-diving odontocete species, including: beaked (*Ziphius cavirostris* and *Mesoplodon* spp.); short-finned pilot (*Globicephala macrorhynchus*); and sperm whales (*Physeter macrocephalus*).

Methods

We concentrated our field work along the shelf break off Cape Hatteras, NC where our previous vessel and aerial surveys have demonstrated consistently high densities of deep-diving odontocete species. When conditions permitted, we extended our surveys into deeper, pelagic waters beyond the break. We focused our work in this first year of the project on the feasibility of locating and approaching deep-diving animals, specifically sperm and beaked whales, as a prelude to tagging these species in the summers of 2014 and 2015. We have previously demonstrated our ability to approach and tag pilot whales in this area, with support from the Navy and other funding agencies.

Figure 1. The F/V *Samanna.*

We conducted surveys from the F/V *Samanna* from May through October 2013 (Figures 1 and 2). We conducted one additional survey in the Cape Hatteras study area as part of the AFTT baseline monitoring project; this survey is described in the Cape Hatteras 2013 Annual Report on Vessel Monitoring.

To locate sperm whales off Cape Hatteras we used a custom-made directional hydrophone to detect echolocation clicks and creaks produced during foraging dives and codas used in social interactions. We deployed the directional hydrophone by hand to listen for vocalizing sperm whales and stopped frequently to listen for clicks from our survey vessel. Each time we stopped we determined the bearing of the clicks and thus gradually homed in on the position of whale. Visual location of the whale was facilitated by the tendency of sperm whales to stop vocalizing as they approach the surface.

During these surveys we made observations from the vessel's flying bridge with naked eye and 7x50 binoculars. Two observers (one port and one starboard) scanned constantly from straight ahead to 90° abeam either side of the track. We closed on every sighting of cetaceans and recorded the location, species and behavior of each group. We recorded sea turtles in passing mode, but recorded the location and species identity of each turtle sighting. We recorded environmental conditions (weather, sea state, depth and sea surface temperature) at each sighting and whenever survey conditions changed. All data were recorded on an iPad tablet with a linked GPS unit.

We used photo-identification and biopsy techniques to examine patterns of residency and population structure of odontocetes in the Cape Hatteras survey area. Thus, whenever possible, we obtained photographs of cetaceans for individual photo-identification; these photographs were also used to confirm species identification at each sighting and to compare identification features with those used by the aerial survey team. We obtained photographs with Canon or Nikon digital SLR cameras (equipped with 100-400 mm zoom lenses) in 24-bit color at a resolution of 3072 X 2048 pixels saved in .jpg format. We employed remote biopsy sampling methods to collect small skin and blubber samples using a variety of 27 kg – 68 kg pull crossbows, depending on the species and sampling distance. Biopsy samples were obtained with a specialized 2.5 cm stainless biopsy tip attached to a modified bolt, typically fired from the bow of the survey vessel.

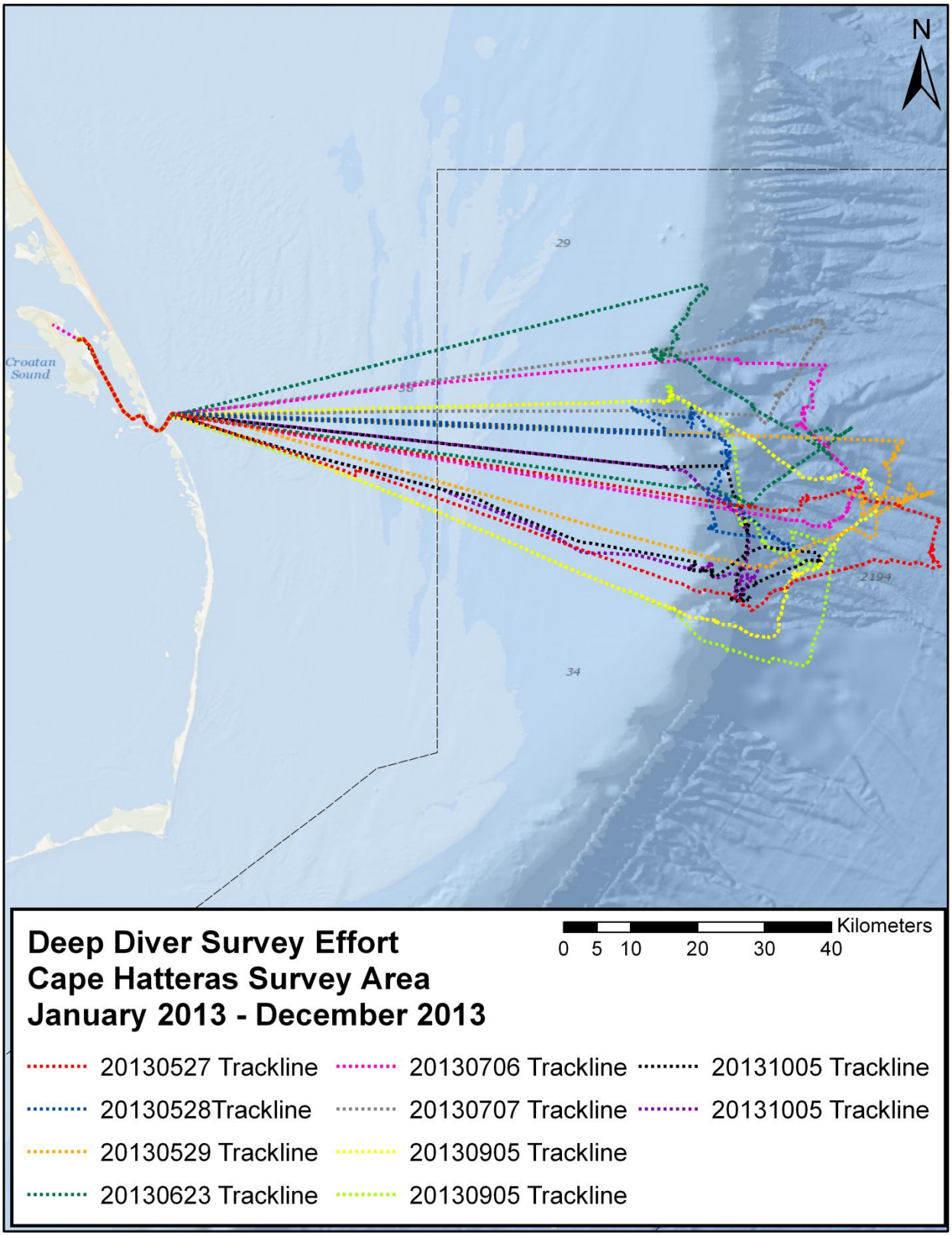

Figure 2. Deep Diver vessel survey effort in the Cape Hatteras survey area, January 2013 – December 2013.

Data Analysis

We compiled and mapped all vessel survey effort and sighting data using *ArcGIS* 10.1. All sighting data from January 2013 through December 2013 have been contributed to OBIS-SEAMAP (http://seamap.env.duke.edu/).

Data Storage

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

Results

Survey Effort

Between May and October 2013, we conducted surveys on eight days. On two of these days we used two survey vessels – the F/V *Samanna* and our RHIB, the R/V *Exocetus*. In total, these surveys yielded a total of 815.3 kilometers and 59.5 hours of effort (Table 1). We detected sperm whale clicks on three survey days, all in May 2013, resulting in three sightings of six sperm whales. We were able to locate individual whales on two of these days, resulting in several close approaches, one biopsy sample and approximately 200 photo-identification images. In addition to sperm whales, we encountered seven species of cetaceans in the Cape Hatteras study area including 39 sightings of deep diving odontocetes: short-finned pilot whale (*n*=32), Cuvier's beaked whale (*Ziphius cavirostris*, *n*=2), unidentified beaked whales (*n*=4), and a single unidentified *Mesoplodon* spp. Other sightings included: bottlenose dolphin (*Tursiops truncatus*, *n*=30); Risso's dolphin (*Grampus griseus*, *n*=3); common dolphin (*Delphinus delphis*, *n*=3); Atlantic spotted dolphin (*Stenella frontalis*, *n*=3); fin whale (*Balaenoptera physalus*, *n*=1); and

an unidentified delphinid (*n*=1) (Tables 2 and 3, Figures 3-14). We also observed seven loggerhead sea turtles (*Caretta caretta)* and one green sea turtle (*Chelonia mydas)* (Tables 4 and 5, Figure 15)**.**

Table 1. Effort details for Deep Diver vessel surveys in the Cape Hatteras survey area, January 2013 - December 2013.

Date	Sea State	Km surveyed	Survey Time (hrs:min)	At Sea Time (hrs:min)	Platform
27-May-13	1-4	114.0	6:48	10:34	F/V *Samanna*
28-May-13	3-4	87.7	6:40	10:54	F/V *Samanna*
29-May-13	2-3	84.0	6:23	11:26	F/V *Samanna*
23-Jun-13	2-3	92.1	5:41	10:18	F/V *Samanna*
6-Jul-13	2-3	59.0	6:11	10:54	F/V *Samanna*
7-Jul-13	3-4	51.1	4:06	8:57	F/V *Samanna*
5-Sep-13	0-3	83.7	5:44	10:29	R/V *Exocetus*
5-Sep-13	0-3	102.0	5:55	10:30	F/V *Samanna*
5-Oct-13	1-2	68.1	6:15	10:22	R/V *Exocetus*
5-Oct-13	2	73.6	5:47	10:17	F/V *Samanna*

T*able 2.* Cetacean sightings observed during Deep Diver vessel surveys in the Cape Hatteras survey area, January 2013 - December 2013.

Date	Time	Latitude	Longitude	Species	CommonName	Group Size	Biopsy Samples	Images
27-May-13	8:46	35.53836	-74.75049	Unidentified beaked whale	Unidentified beaked whale	2	0	3
27-May-13	8:46	35.53836	-74.75049	*T. truncatus*	Bottlenose dolphin	9	0	1
27-May-13	9:26	35.56533	-74.68775	*T. truncatus*	Bottlenose dolphin	8	0	0
27-May-13	11:24	35.60483	-74.49842	*P. macrocephalus*	Sperm whale	2	0	34
27-May-13	12:41	35.67833	-74.58385	*P. macrocephalus*	Sperm whale	1	1	81
27-May-13	13:45	35.66484	-74.70034	*G. macrorhynchus*	Short-finned pilot whale	6	0	3
27-May-13	14:07	35.66893	-74.73162	*G. macrorhynchus*	Short-finned pilot whale	6	0	0
27-May-13	14:34	35.67495	-74.77730	*G. macrorhynchus*	Short-finned pilot whale	15	0	0
28-May-13	8:27	35.79004	-74.83185	*T. truncatus*	Bottlenose dolphin	15	0	0
28-May-13	8:39	35.79265	-74.82190	Mesoplodon spp.	Mesoplodon spp.	2	0	12
28-May-13	9:33	35.79311	-74.82047	*T. truncatus*	Bottlenose dolphin	6	0	0
28-May-13	10:17	35.77066	-74.78609	*G. macrorhynchus*	Short-finned pilot whale	6	0	0
28-May-13	10:27	35.74230	-74.77912	*T. truncatus*	Bottlenose dolphin	25	3	100
28-May-13	11:25	35.67188	-74.76550	*D. delphis*	Common dolphin	15	0	14
28-May-13	12:22	35.62684	-74.70360	Unidentified delphinid	Unidentified delphinid	3	0	0
28-May-13	12:42	35.63715	-74.78524	*G. macrorhynchus*	Short-finned pilot whale	200	2	53
28-May-13	12:48	35.64071	-74.79113	*D. delphis*	Common dolphin	100	2	34
29-May-13	8:12	35.59954	-74.78414	*T. truncatus*	Bottlenose dolphin	4	0	0
29-May-13	9:49	35.66816	-74.55654	*G. macrorhynchus*	Short-finned pilot whale	15	1	43
29-May-13	10:18	35.67120	-74.54252	*G. griseus*	Risso's dolphin	8	0	28
29-May-13	10:37	35.68508	-74.50691	*G. macrorhynchus*	Short-finned pilot whale	16	1	29
29-May-13	11:10	35.69662	-74.52450	*G. macrorhynchus*	Short-finned pilot whale	2	0	0
29-May-13	11:23	35.67981	-74.53172	*T. truncatus*	Bottlenose dolphin	20	1	21
29-May-13	11:54	35.68203	-74.55137	*T. truncatus*	Bottlenose dolphin	6	0	0
29-May-13	12:19	35.67991	-74.58892	*T. truncatus*	Bottlenose dolphin	30	0	0
29-May-13	12:29	35.66921	-74.58977	*P. macrocephalus*	Sperm whale	3	0	81
23-Jun-13	8:26	35.69771	-74.81903	*D. delphis*	Common dolphin	45	0	0
23-Jun-13	8:33	35.69575	-74.80949	*G. macrorhynchus*	Short-finned pilot whale	10	0	0
23-Jun-13	9:29	35.76432	-74.62254	*T. truncatus*	Bottlenose dolphin	12	0	3
23-Jun-13	11:01	35.86616	-74.83240	*G. macrorhynchus*	Short-finned pilot whale	10	0	0
23-Jun-13	11:09	35.87244	-74.85801	*G. macrorhynchus*	Short-finned pilot whale	12	0	11
23-Jun-13	11:17	35.86880	-74.86473	*T. truncatus*	Bottlenose dolphin	40	2	41
23-Jun-13	11:49	35.87533	-74.86059	*G. macrorhynchus*	Short-finned pilot whale	35	4	102
23-Jun-13	12:02	35.87310	-74.85954	*G. griseus*	Risso's dolphin	1	0	5
23-Jun-13	12:30	35.86781	-74.86306	*T. truncatus*	Bottlenose dolphin	15	0	0
23-Jun-13	13:15	35.90582	-74.84436	*T. truncatus*	Bottlenose dolphin	25	0	0
6-Jul-13	8:32	35.87084	-74.75936	*S. frontalis*	Atlantic spotted dolphin	50	2	21
6-Jul-13	10:08	35.83796	-74.65890	*G. macrorhynchus*	Short-finned pilot whale	25	0	0
6-Jul-13	10:32	35.80294	-74.65686	Unidentified beaked whale	Unidentified beaked whale	1	0	0
6-Jul-13	11:32	35.78014	-74.67668	*T. truncatus*	Bottlenose dolphin	40	0	29
6-Jul-13	12:05	35.75605	-74.63630	*G. macrorhynchus*	Short-finned pilot whale	15	0	12
6-Jul-13	13:30	35.65984	-74.61466	*T. truncatus*	Bottlenose dolphin	30	1	41
7-Jul-13	8:46	35.82237	-74.69969	*S. frontalis*	Atlantic spotted dolphin	60	0	90
7-Jul-13	9:45	35.86377	-74.66816	*S. frontalis*	Atlantic spotted dolphin	35	0	15
7-Jul-13	10:56	35.91207	-74.68082	*T. truncatus*	Bottlenose dolphin	14	0	24
7-Jul-13	11:43	35.87215	-74.85066	*G. macrorhynchus*	Short-finned pilot whale	75	0	121

Table 2 continued. Cetacean sightings observed during Deep Diver vessel surveys in the Cape Hatteras survey area, January 2013 - December 2013.

Date	Time	Latitude	Longitude	Species	CommonName	Group Size	Biopsy Samples	Images
5-Sep-13	9:08	35.52943	-74.83603	*T. truncatus*	Bottlenose dolphin	25	0	0
5-Sep-13	9:20	35.51593	-74.78703	*T. truncatus*	Bottlenose dolphin	35	1	30
5-Sep-13	9:20	35.47928	-74.77240	Unidentified beaked whale	Unidentified beaked whale	1	0	0
5-Sep-13	9:50	35.45999	-74.66591	*T. truncatus*	Bottlenose dolphin	2	0	0
5-Sep-13	10:48	35.58224	-74.68150	Unidentified beaked whale	Unidentified beaked whale	5	0	0
5-Sep-13	10:50	35.60384	-74.68203	*G. macrorhynchus*	Short-finned pilot whale	15	0	8
5-Sep-13	10:54	35.58155	-74.67610	*T. truncatus*	Bottlenose dolphin	7	1	6
5-Sep-13	12:00	35.62337	-74.72156	*G. macrorhynchus*	Short-finned pilot whale	18	0	84
5-Sep-13	12:01	35.64900	-74.59633	*T. truncatus*	Bottlenose dolphin	25	0	11
5-Sep-13	12:20	35.65051	-74.74865	*G. macrorhynchus*	Short-finned pilot whale	12	0	33
5-Sep-13	12:30	35.65108	-74.75465	*G. macrorhynchus*	Short-finned pilot whale	6	0	0
5-Sep-13	12:32	35.70895	-74.58852	*T. truncatus*	Bottlenose dolphin	12	1	18
5-Sep-13	12:37	35.67943	-74.75368	*G. macrorhynchus*	Short-finned pilot whale	40	0	0
5-Sep-13	12:51	35.72153	-74.75912	*G. macrorhynchus*	Short-finned pilot whale	30	0	0
5-Sep-13	12:58	35.74703	-74.76161	*G. macrorhynchus*	Short-finned pilot whale	15	0	9
5-Sep-13	13:10	35.78987	-74.78711	*G. macrorhynchus*	Short-finned pilot whale	12	0	4
5-Sep-13	13:32	35.70949	-74.63117	*T. truncatus*	Bottlenose dolphin	30	0	49
5-Sep-13	13:35	35.83131	-74.85155	*B. physalus*	Fin whale	3	2	42
5-Sep-13	13:35	35.83131	-74.85155	*T. truncatus*	Bottlenose dolphin	8	0	4
5-Oct-13	8:43	35.59216	-74.81889	*T. truncatus*	Bottlenose dolphin	15	0	9
5-Oct-13	9:03	35.58364	-74.80559	*G. macrorhynchus*	Short-finned pilot whale	200	2	168
5-Oct-13	9:26	35.58556	-74.79254	*T. truncatus*	Bottlenose dolphin	30	0	3
5-Oct-13	10:26	35.57933	-74.74333	*Z. cavirostris*	Cuvier's beaked whale	3	2	140
5-Oct-13	10:34	35.59828	-74.64619	*T. truncatus*	Bottlenose dolphin	10	0	6
5-Oct-13	11:01	35.56520	-74.75510	*G. macrorhynchus*	Short-finned pilot whale	30	0	0
5-Oct-13	11:08	35.57938	-74.70568	*G. macrorhynchus*	Short-finned pilot whale	6	0	0
5-Oct-13	11:13	35.56857	-74.73326	*G. macrorhynchus*	Short-finned pilot whale	6	0	7
5-Oct-13	11:30	35.55461	-74.76085	*T. truncatus*	Bottlenose dolphin	5	0	8
5-Oct-13	11:31	35.54402	-74.74950	*T. truncatus*	Bottlenose dolphin	20	0	3
5-Oct-13	11:38	35.54564	-74.74152	*G. macrorhynchus*	Short-finned pilot whale	10	0	8
5-Oct-13	11:59	35.54554	-74.75481	*T. truncatus*	Bottlenose dolphin	6	0	0
5-Oct-13	12:25	35.54604	-74.76526	*G. macrorhynchus*	Short-finned pilot whale	8	0	13
5-Oct-13	12:34	35.56874	-74.75860	*G. macrorhynchus*	Short-finned pilot whale	3	0	8
5-Oct-13	12:43	35.58496	-74.75501	*Z. cavirostris*	Cuvier's beaked whale	4	0	82
5-Oct-13	13:42	35.64158	-74.74800	*G. griseus*	Risso's dolphin	8	2	51
5-Oct-13	13:42	35.64370	-74.74396	*G. macrorhynchus*	Short-finned pilot whale	4	0	9
5-Oct-13	14:07	35.68345	-74.76091	*G. macrorhynchus*	Short-finned pilot whale	4	0	8

Table 3. Number of cetacean sightings and mean group size for each species observed during Deep Diver vessel surveys in the Cape Hatteras survey area, January 2013 – December 2013.

	Sightings				
Species	**2009**	**2011**	**2012**	**2013**	**Mean Group Size**
Balaenoptera physalus	0	0	1	1	2.3±1.2
Delphinus delphis	0	6	11	3	164.0±201.2
Globicephala macrorhynchus	9	33	52	32	36.5±75.9
Grampus griseus	1	2	2	3	8.9±10.6
Mesoplodon spp.	0	0	0	1	2.0±0.0
Physeter macrocephalus	0	1	4	3	1.8±0.9
Stenella frontalis	0	8	2	3	62.5±76.9
Stenella/Delphinus mix	0	1	0	0	85.0±0.0
Tursiops truncatus	23	27	54	30	17.7±25.1
Tursiops/Stenella mix	0	1	0	0	100.0±0.0
Ziphius cavirostris	0	3	1	2	2.5±1.1
Unid. beaked whale	0	0	0	4	2.3±1.9
Unid. delphinid	1	0	3	1	4.3±2.6
Total:	**34**	**82**	**130**	**83**	

Table 4. Sea turtle sightings observed during Deep Diver vessel surveys in the Cape Hatteras survey area, January 2013 - December 2013.

Date	Time	Latitude	Longitude	Species	Common Name	Group Size
27-May-13	14:45	35.68773	-74.85690	*C. mydas*	Green sea turtle	1
27-May-13	14:49	35.69301	-74.89001	*C. caretta*	Loggerhead sea turtle	1
27-May-13	14:54	35.69996	-74.93256	*C. caretta*	Loggerhead sea turtle	1
27-May-13	15:00	35.70713	-74.97656	*C. caretta*	Loggerhead sea turtle	1
27-May-13	15:03	35.71073	-74.99170	*C. caretta*	Loggerhead sea turtle	1
27-May-13	15:15	35.72561	-75.09114	*C. caretta*	Loggerhead sea turtle	1
23-Jun-13	10:59	35.86616	-74.83240	*C. caretta*	Loggerhead sea turtle	1
5-Sep-13	15:28	35.80622	-75.07549	*C. caretta*	Loggerhead sea turtle	1

Table 5. Number of sea turtle sightings and mean group size for each species observed during Deep Diver vessel surveys in the Cape Hatteras survey area, January 2013 – December 2013.

	Sightings				
Species	**2009**	**2011**	**2012**	**2013**	**Mean Group Size**
Caretta caretta	2	0	2	7	1.0±0.0
Chelonia mydas	0	0	0	1	1.0±0.0
Unid. sea turtle	0	0	1	0	1.0±0.0
Total:	**2**	**0**	**3**	**8**	

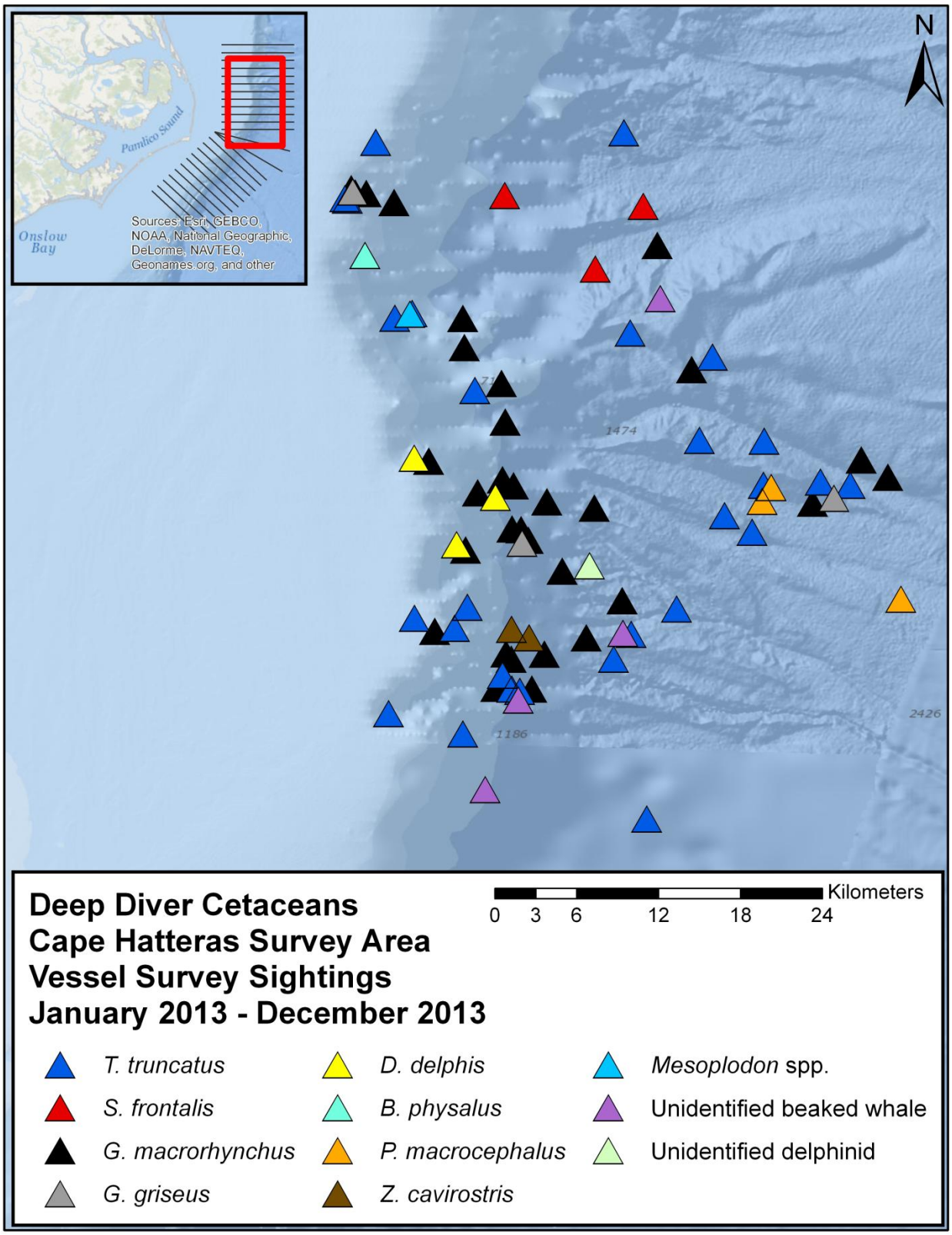

Figure 3. Distribution of all cetacean sightings observed during Deep Diver vessel surveys in the Cape Hatteras survey area, January 2013 - December 2013.

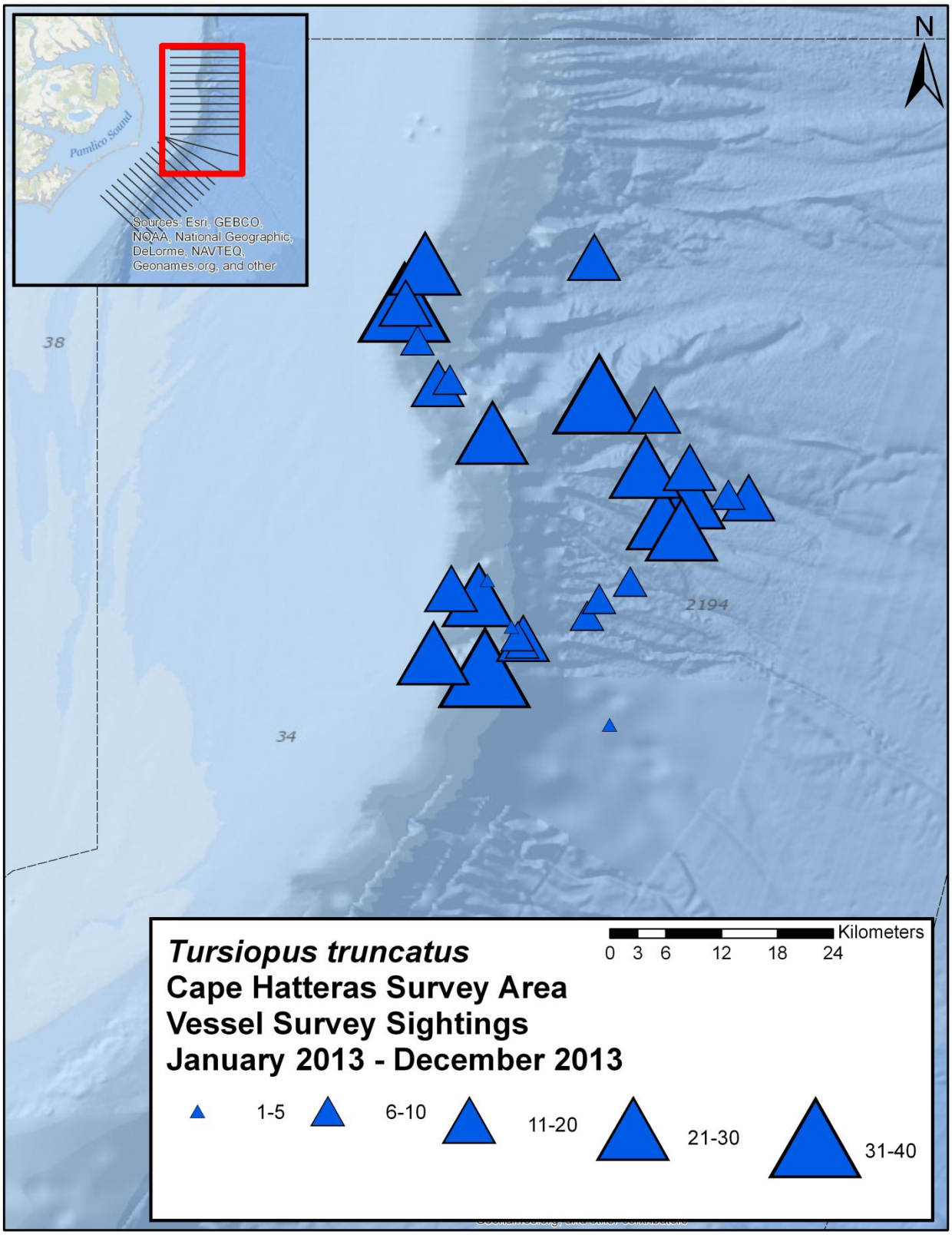

Figure 4. Distribution of bottlenose dolphin sightings indicating group size observed during Deep Diver vessel surveys in the Cape Hatteras survey area, January 2013 - December 2013.

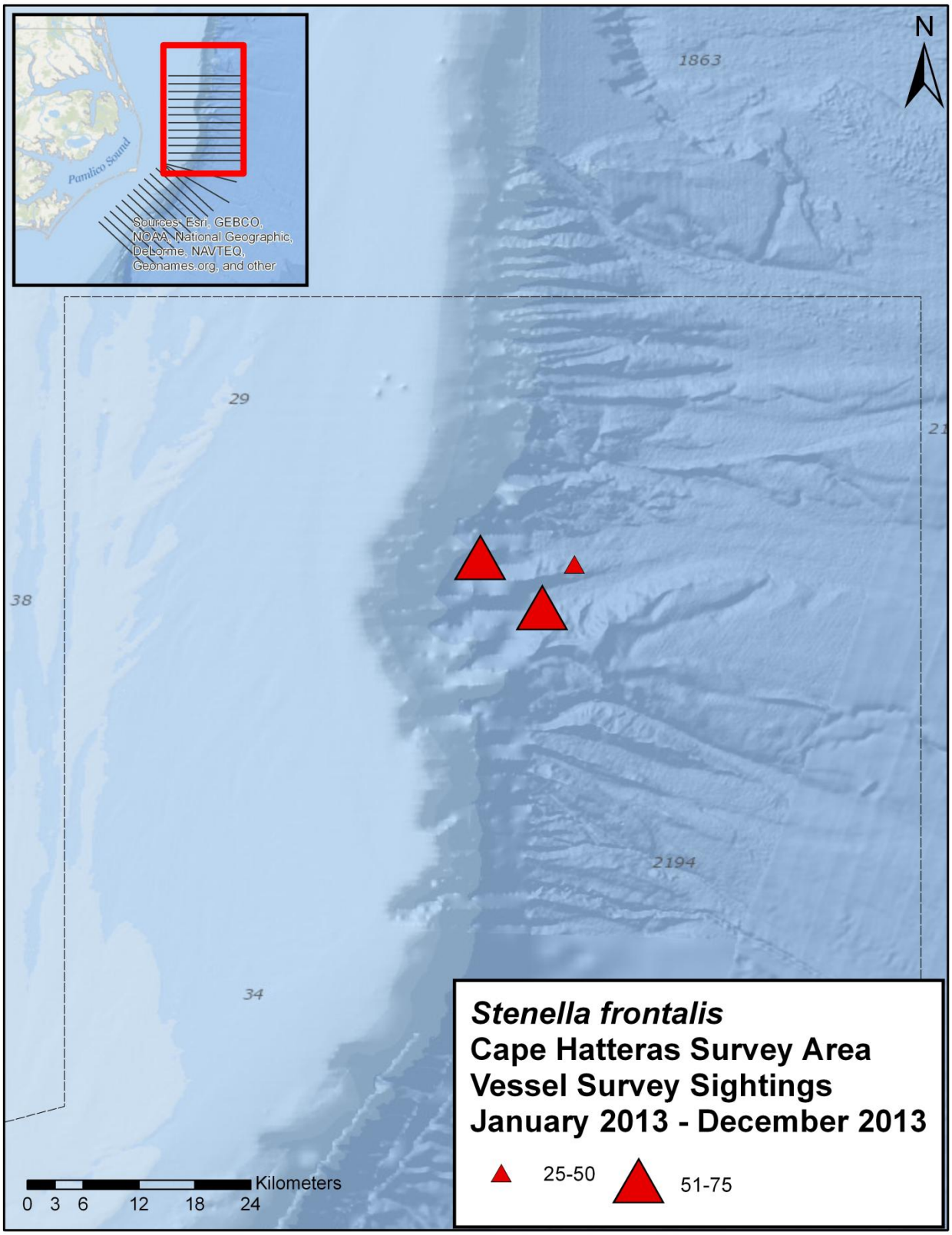

Figure 5. Distribution of Atlantic spotted dolphin sightings indicating group size observed during Deep Diver vessel surveys in the Cape Hatteras survey area, January 2013 - December 2013.

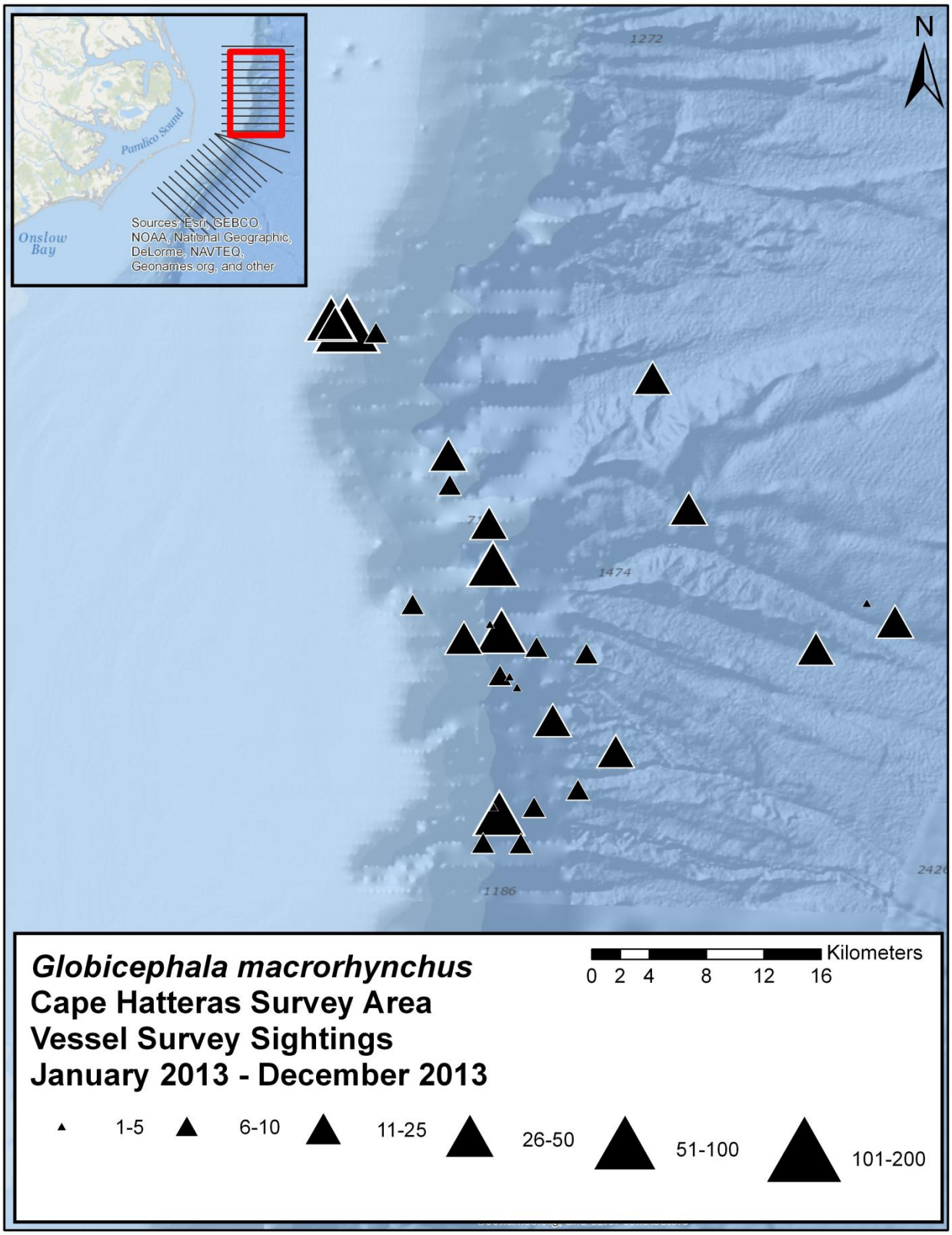

Figure 6. Distribution of short-finned pilot whale sightings indicating group size observed during Deep Diver vessel surveys in the Cape Hatteras survey area, January 2013 - December 2013.

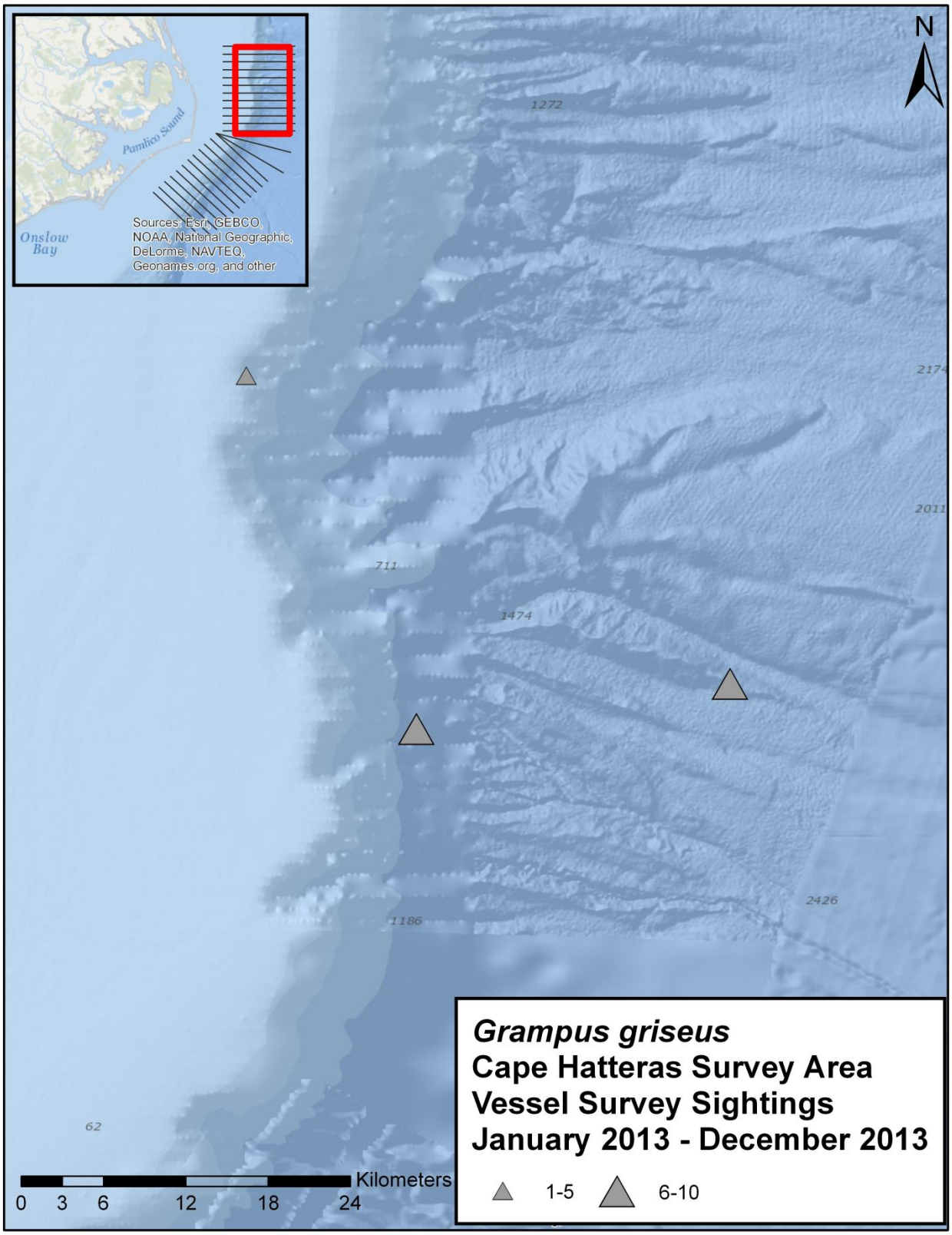

Figure 7. Distribution of Risso's dolphin sightings indicating group size observed during Deep Diver vessel surveys in the Cape Hatteras survey area, January 2013 - December 2013.

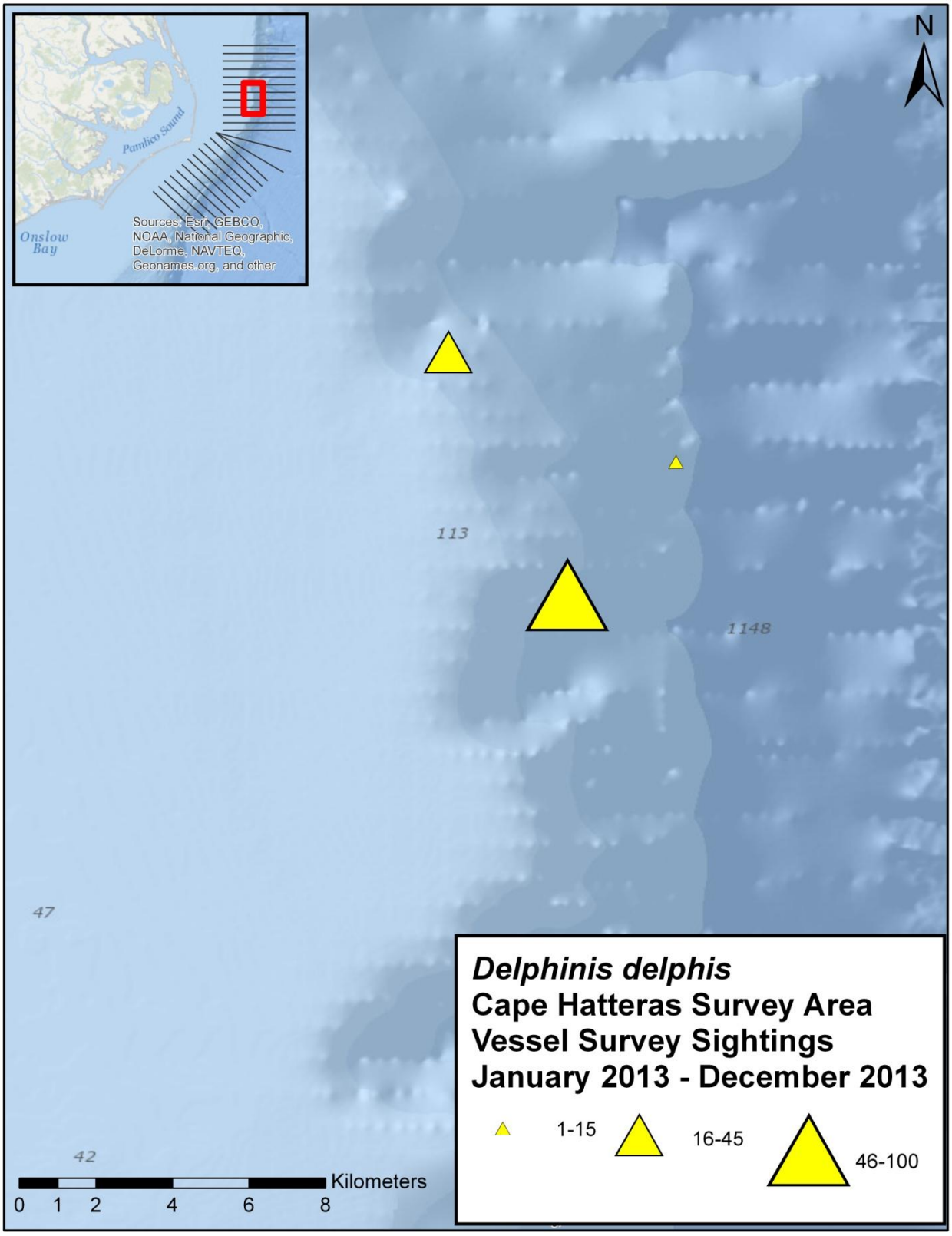

Figure 8. Distribution of common dolphin sightings indicating group size observed during Deep Diver vessel surveys in the Cape Hatteras survey area, January 2013 - December 2013.

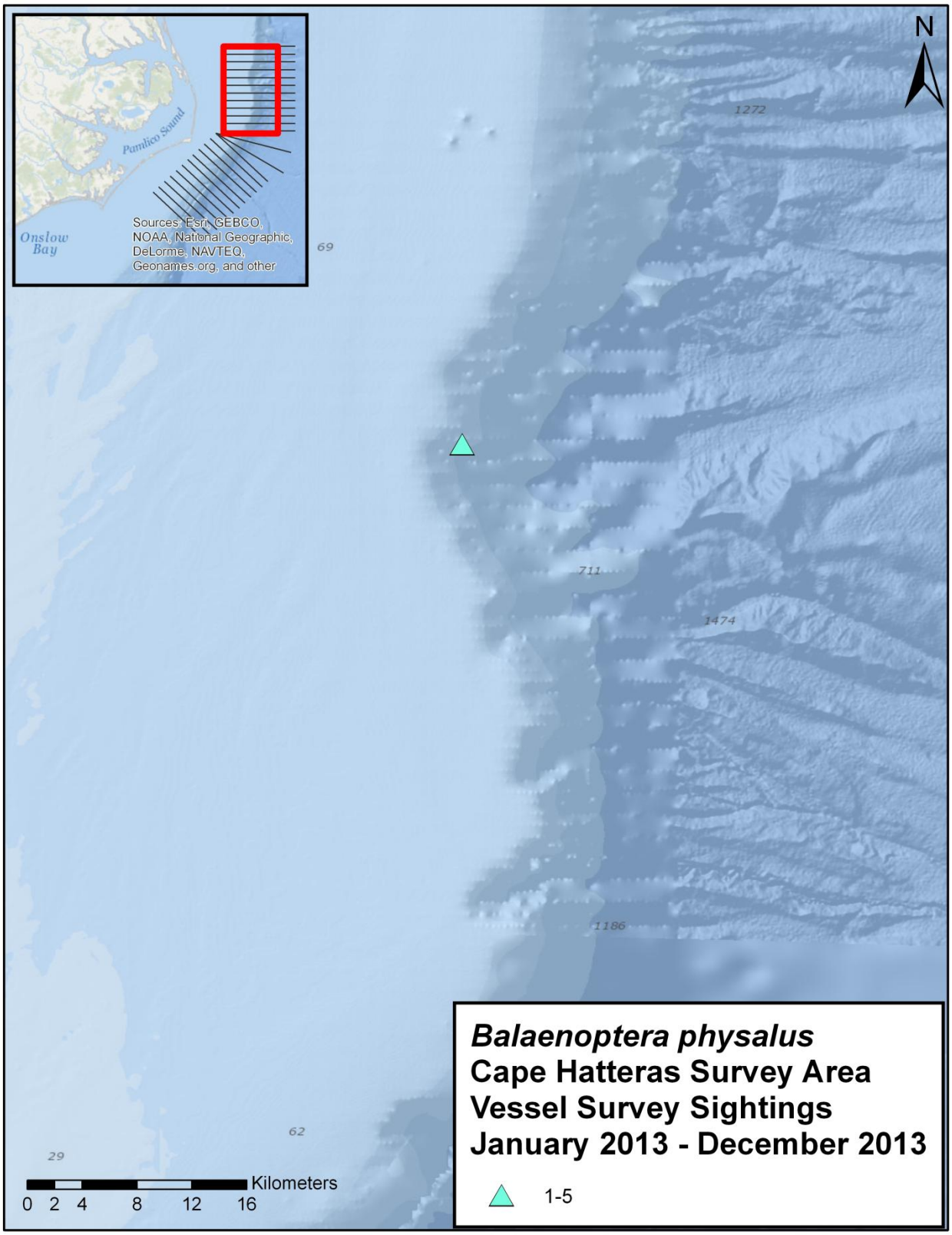

Figure 9. Distribution of fin whale sightings indicating group size observed during Deep Diver vessel surveys in the Cape Hatteras survey area, January 2013 - December 2013.

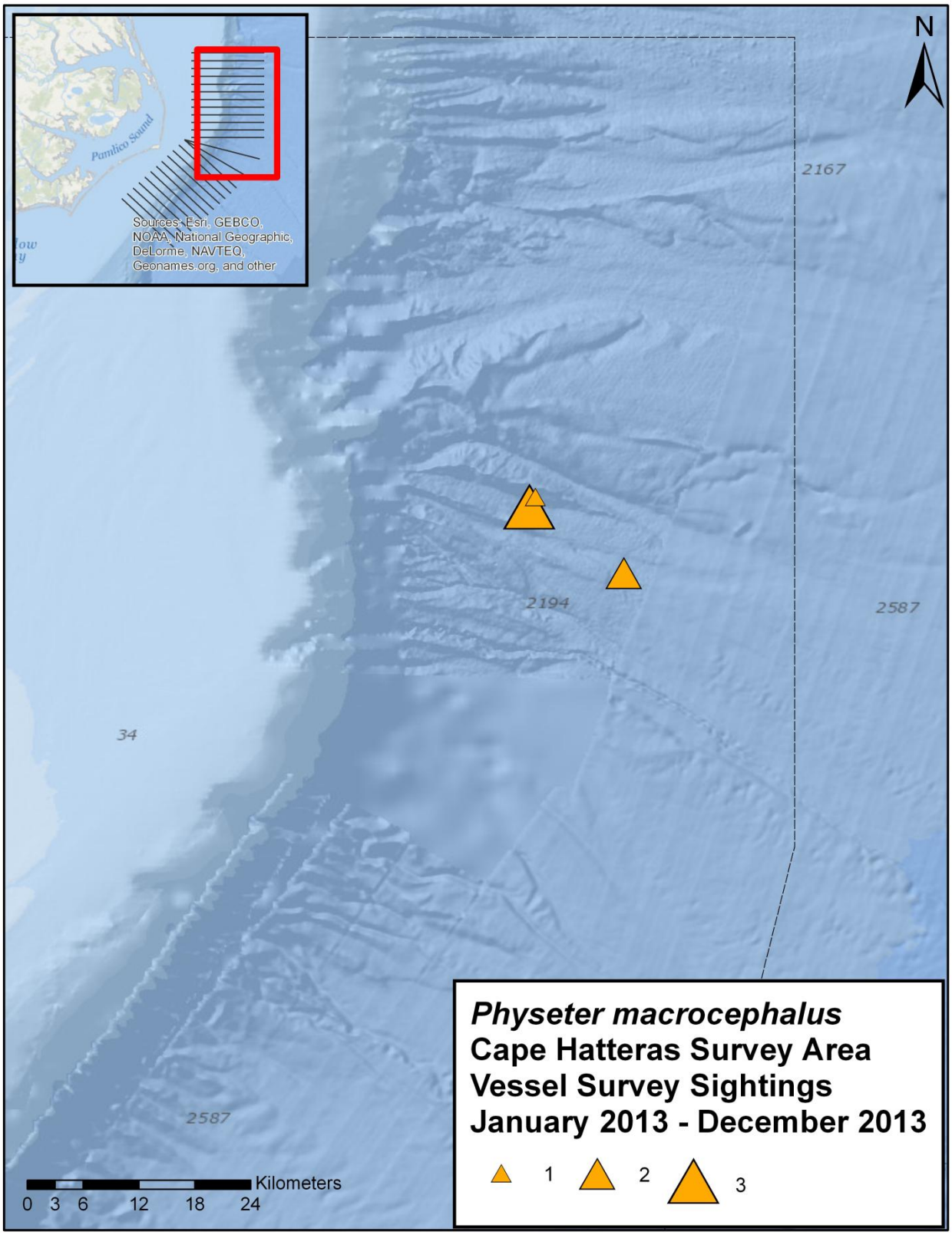

Figure 10. Distribution of sperm whale sightings indicating group size observed during Deep Diver vessel surveys in the Cape Hatteras survey area, January 2013 - December 2013.

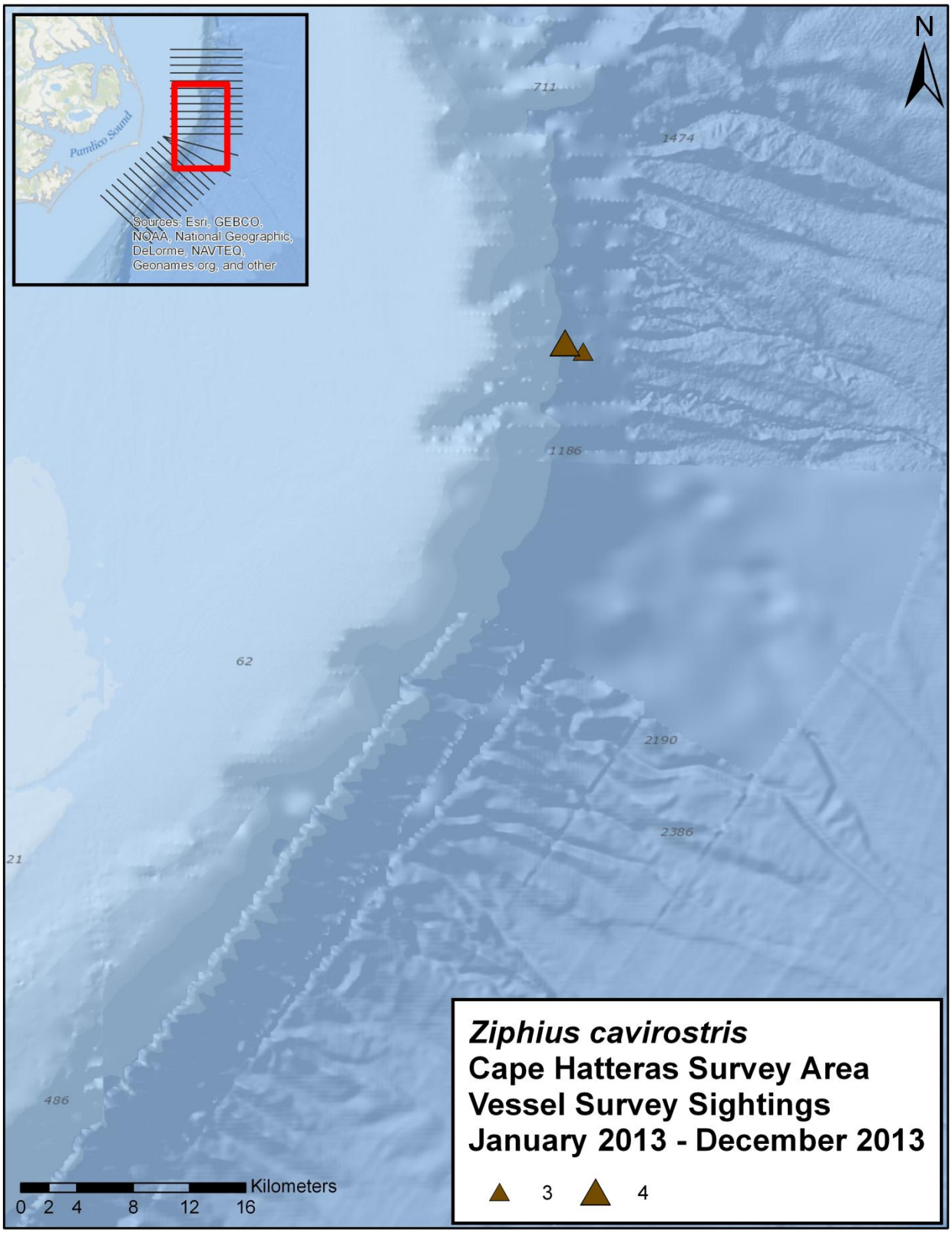

Figure 11. Distribution of Cuvier's beaked whale sightings indicating group size observed during Deep Diver vessel surveys in the Cape Hatteras survey area, January 2013 - December 2013.

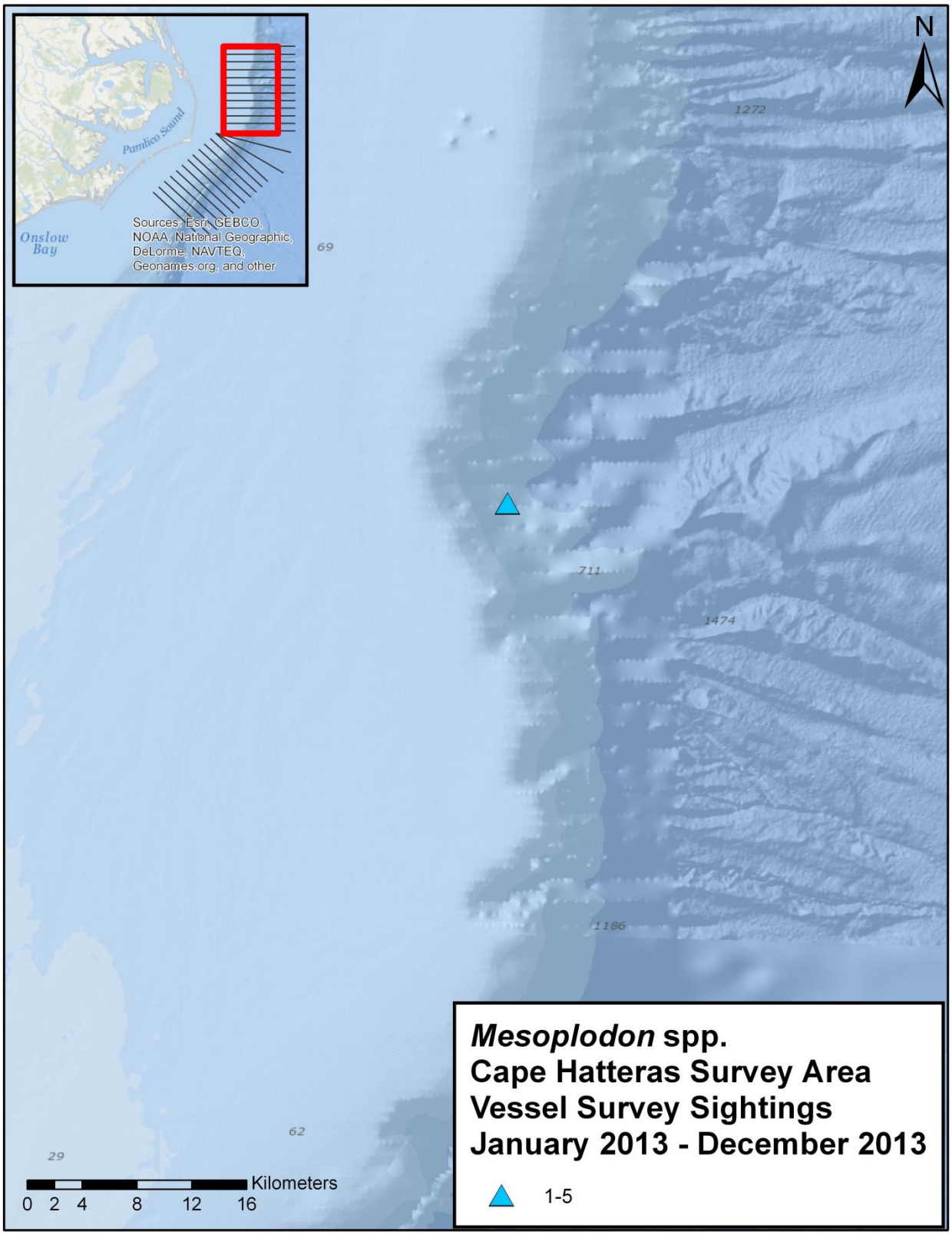

Figure 12. Distribution of unidentified Mesoplodons indicating group size observed during Deep Diver vessel surveys in the Cape Hatteras survey area, January 2013 - December 2013.

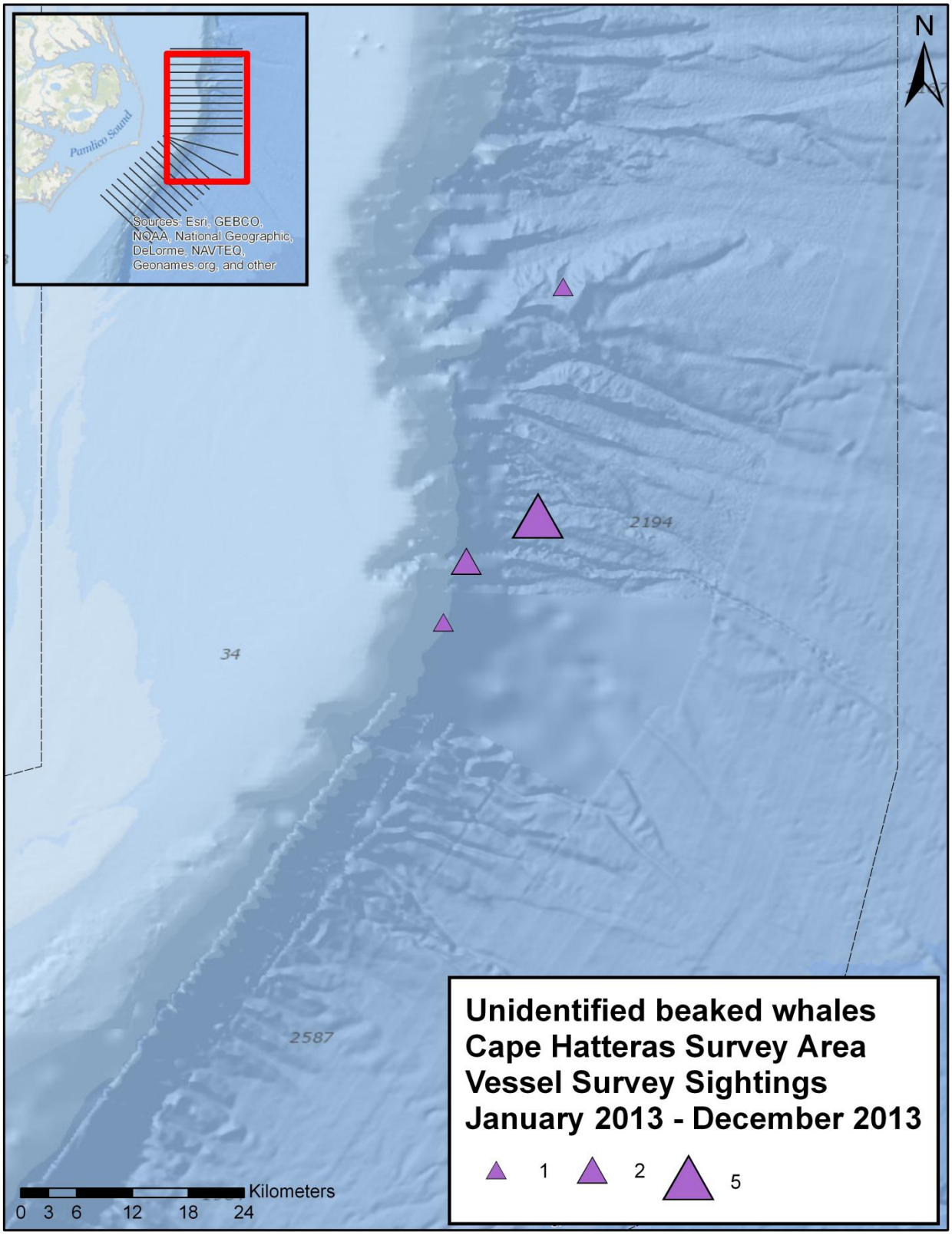

Figure 13. Distribution of unidentified beaked whale sightings indicating group size observed during Deep Diver vessel surveys in the Cape Hatteras survey area, January 2013 - December 2013.

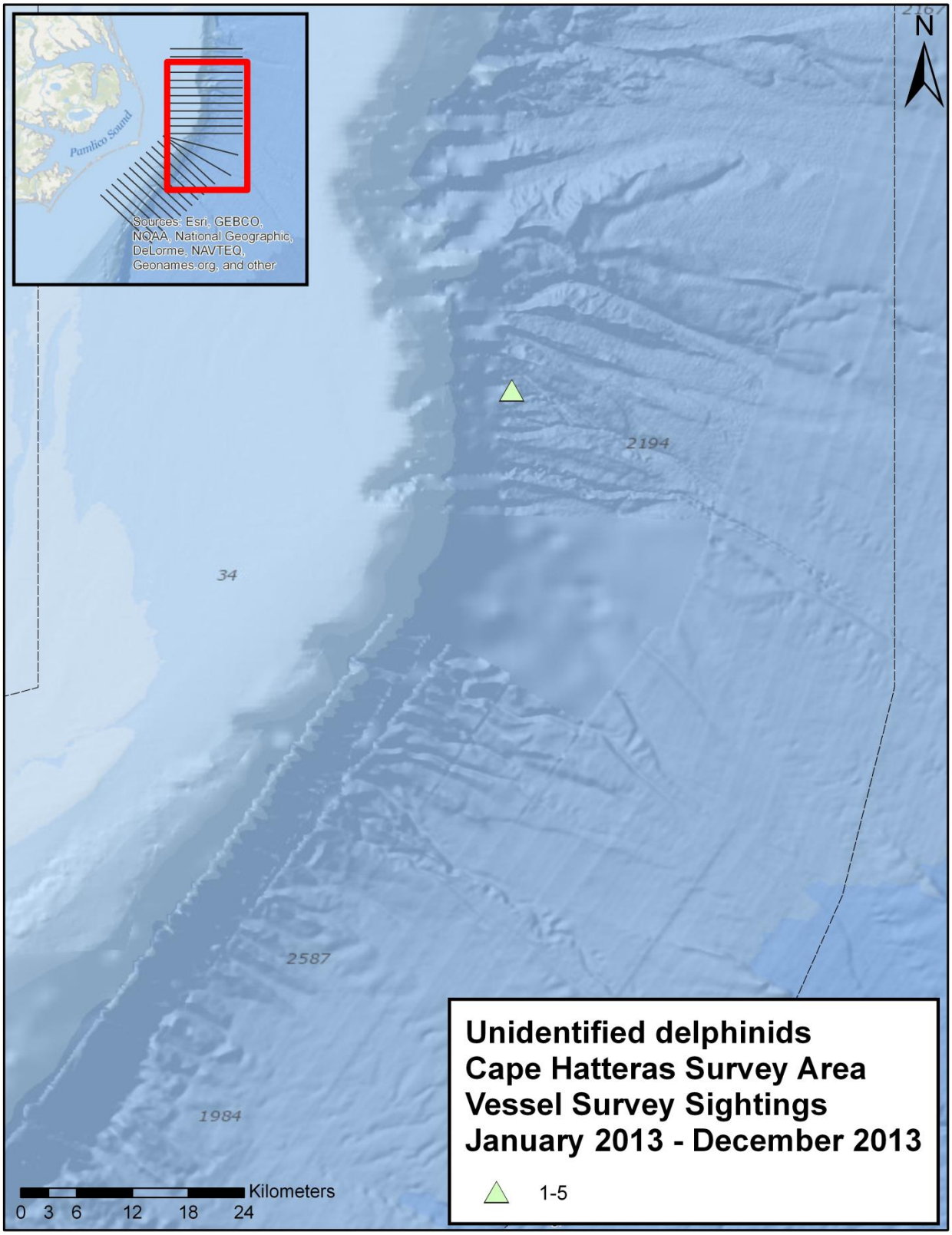

Figure 14. Distribution of unidentified delphinid sightings indicating group size observed during Deep Diver vessel surveys in the Cape Hatteras survey area, January 2013 - December 2013.

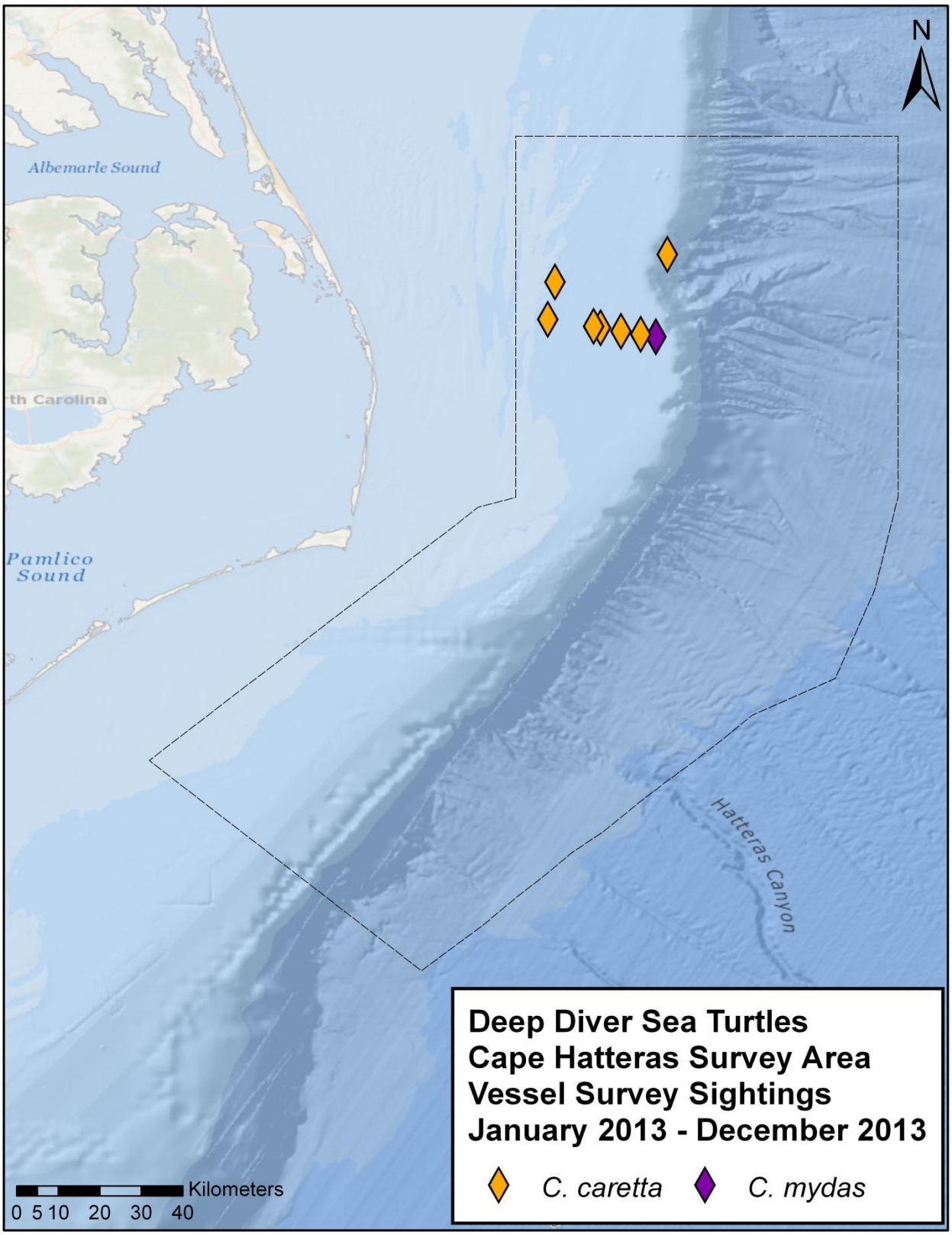

Figure 15. Distribution of sea turtle sightings observed during Deep Diver vessel surveys in the Cape Hatteras survey area, January 2013 - December 2013.

Biopsy Sampling

We collected biopsy samples from eight species of cetaceans, including three deep-diving odontocetes: short-finned pilot whale (*n*=10); Cuvier's beaked whale (*n*=2); and sperm whale (*n*=1). We also collected samples from bottlenose dolphins (*n*=10), Atlantic spotted dolphins (*n*=2), Risso's dolphins (*n*=2), common dolphins (*n*=2) and fin whales (*n*=2) (Table 6, Figure 16). Genetic analysis of extracted DNA from bottlenose dolphin biopsy samples collected in the Cape Hatteras study area between May 2011 and July 2013 confirmed that all of the sampled dolphins were of the offshore ecotype, suggesting that there is limited overlap between coastal and offshore populations in the study area. Skin samples collected after July 2013 will be analyzed for sex and population identity in the coming months. Voucher specimens of these samples have been or will be archived with the Southeast Fisheries Science Center in Lafayette, LA.

Table 6. Biopsy samples collected from animals during Deep Diver vessel surveys in the Cape Hatteras survey area, January 2013 - December 2013.

Date	Time	Latitude	Longitude	Species	Sample #
27-May-13	12:47	35.69539	-74.59319	*P. macrocephalus*	HJF-13-003
28-May-13	10:47	35.74041	-74.77236	*T. truncatus*	ZTS-13-005
28-May-13	11:05	35.71534	-74.78384	*T. truncatus*	ZTS-13-006a
28-May-13	11:05	35.71534	-74.78384	*T. truncatus*	ZTS-13-006b
28-May-13	12:55	35.64266	-74.79273	*G. macrorhynchus*	ZTS-13-007
28-May-13	13:06	35.64304	-74.79345	*G. macrorhynchus*	ZTS-13-008
28-May-13	13:16	35.64296	-74.79047	*D. delphis*	ZTS-13-009
28-May-13	13:25	35.64441	-74.78746	*D. delphis*	ZTS-13-010
29-May-13	10:00	35.67454	-74.54071	*G. macrorhynchus*	ZTS-13-011
29-May-13	10:39	35.68597	-74.50522	*G. macrorhynchus*	ZTS-13-012
29-May-13	11:28	35.68084	-74.52648	*T. truncatus*	ZTS-13-013
23-Jun-13	11:21	35.86878	-74.86130	*T. truncatus*	ZTS-13-014
23-Jun-13	11:33	35.87283	-74.87057	*T. truncatus*	ZTS-13-015
23-Jun-13	12:00	35.87331	-74.85929	*G. macrorhynchus*	ZTS-13-016
23-Jun-13	12:17	35.87200	-74.85945	*G. macrorhynchus*	ZTS-13-017
23-Jun-13	12:22	35.86807	-74.85970	*G. macrorhynchus*	ZTS-13-018
23-Jun-13	12:33	35.86661	-74.86239	*G. macrorhynchus*	ZTS-13-019
6-Jul-13	8:37	35.86685	-74.75659	*S. frontalis*	AJR-13-001
6-Jul-13	8:41	35.86685	-74.75659	*S. frontalis*	AJR-13-002
6-Jul-13	13:40	35.65599	-74.61683	*T. truncatus*	AJR-13-003
5-Sep-13	9:37	35.51531	-74.78606	*T. truncatus*	ZTS-13-025
5-Sep-13	10:54	35.58155	-74.67610	*T. truncatus*	ZTS-13-026
5-Sep-13	12:52	35.71997	-74.58727	*T. truncatus*	DMW13-005
5-Sep-13	14:52	35.80935	-74.85700	*B. physalus*	DMW13-006
5-Sep-13	14:40	35.81391	-74.84311	*B. physalus*	ZTS-13-027
5-Oct-13	9:33	35.59158	-74.79435	*G. macrorhynchus*	DMW-13-007
5-Oct-13	9:48	35.59532	-74.79444	*G. macrorhynchus*	DMW-13-008
5-Oct-13	10:49	35.57044	-74.75569	*Z. cavirostris*	ZTS-13-031
5-Oct-13	11:10	35.56198	-74.76050	*Z. cavirostris*	ZTS-13-032
5-Oct-13	13:41	35.64158	-74.74800	*G. griseus*	ZTS-13-033
5-Oct-13	13:50	35.64439	-74.75005	*G. griseus*	ZTS-13-034

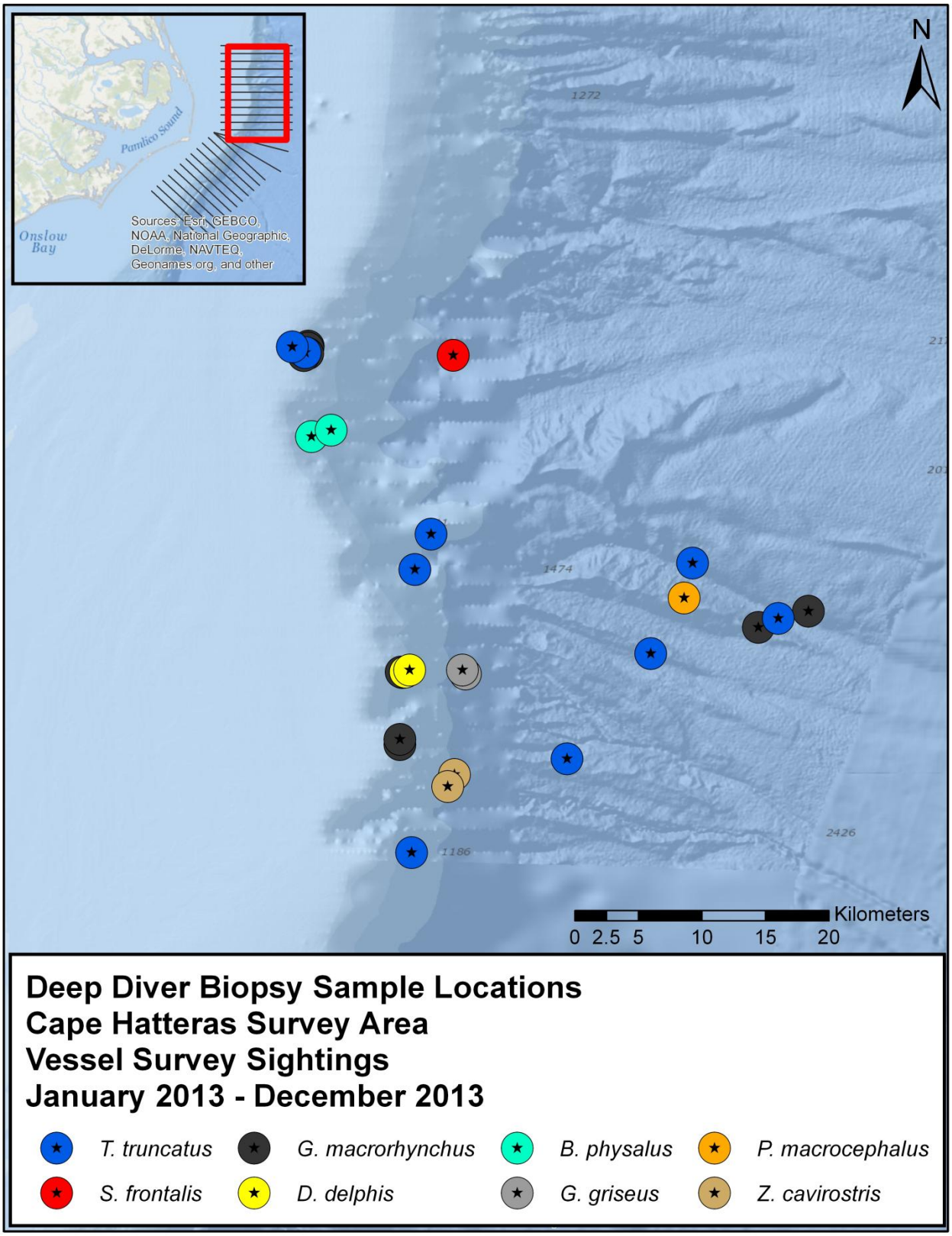

Figure 16. Distribution of biopsy sample locations collected during Deep Diver vessel surveys in the Cape Hatteras survey area, January 2013 - December 2013.

Photographic Effort

We obtained 1610 digital images for species confirmation and individual identification during the 2013 Deep Diver vessel surveys. Images of newly identified animals were added to existing catalogs and to new catalogs that we created for sperm and Cuvier's beaked whales (Table 7). Please refer to the photo-ID and biopsy section within the Cape Hatteras 2013 annual report for further information regarding photo-identification analysis of these and other species observed in the Cape Hatteras survey area.

Table 7. Summary of images collected during Deep Diver vessel surveys in the Cape Hatteras survey area, January 2013 - December 2013, with photo-identification catalog sizes and matches to date, and 2013 biopsy samples collected with the total number of biopsy samples collected to date in paranthesis.

Common Name	Scientific Name	Photos Taken	Catalog Size	Matches	Samples
		2013			2013 (Total)
Common dolphin	*D. delphis*	48	20	1	2 (7)
Short-finned pilot whale	*G. macrorhynchus*	649	229	22	10 (47)
Risso's dolphin	*G. griseus*	84	3	0	2 (2)
Sperm whale	*P. macrocephalus*	196	3	0	1 (1)
Atlantic spotted dolphin	*S. frontalis*	126	13	0	2 (8)
Bottlenose dolphin	*T. truncatus*	444	107	3	10 (37)
Cuvier's beaked whale	*Z. cavirostris*	140	1	0	2 (2)

Summaries of the photographic images and biopsy samples conducted since the commencement of the AFTT monitoring program in the Cape Hatteras survey area in 2009 are reported in the Cape Hatteras 2013 Annual Report.

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