Small Vessel Surveys for Protected Species in Navy OPAREAs off the U.S. Atlantic Coast: 2016 Annual Progress Report

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Prepared by

Heather J. Foley[1], Robin W. Baird[2], Danielle M, Waples[1], Zach T. Swaim[1], Daniel L. Webster[2], and Andrew J. Read[1]

[1]Duke University Marine Laboratory
135 Duke Marine Lab Road,
Beaufort, NC 28516

[2]Cascadia Research Collective
218 ½ W. 4th Avenue
Olympia, WA 98501

Submitted by:

Virginia Beach, VA

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Cover Photo Credit:

Rough-toothed dolphins (*Steno bredanensis*). Photographed by Joe Fader, Duke University, taken under General Authorization Letter of Confirmation 16185 held by Duke University.

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Acronyms and Abbreviations

AFTT	Atlantic Fleet Testing and Training
BSS	Beaufort sea state
DTag	digital acoustic tag
JAX	Jacksonville
km	kilometer(s)
km^2	square kilometer(s)
NOAA	National Oceanic and Atmospheric Administration
OPAREA	Operating Area
Photo-ID	Photo-identification
R/V	Research Vessel
U.S.	United States
USWTR	Undersea Warfare Training Range

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1. Introduction

This report describes results of vessel surveys from 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. This program began in 2007, with baseline aerial and vessel surveys, as well as a passive acoustic monitoring component 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 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 delphinids in this region (Read et al. 2014). Dedicated survey effort in the Onslow Bay site concluded in 2013; however, two opportunistic surveys were conducted in the area in 2016. More than seven years of monitoring in the Jacksonville (JAX) Operating Area (OPAREA) have provided similar information on the density and distribution of marine mammals and sea turtles. 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 present report describes monitoring activities, including photo-identification and biopsy-sampling vessel surveys, at the Onslow Bay and Jacksonville survey areas between January and December 2016. Fieldwork at Cape Hatteras in 2016 was dedicated to the Deep Divers and Satellite-Tagging Projects, and is reported separately (Foley et al. 2017), but here we report on photographic identification work and amalgamated summary tables for both tagging projects and Atlantic Fleet Testing and Training (AFTT) protected species monitoring for Cape Hatteras, as well as information on satellite tagging in JAX in 2016. A detailed analysis of the satellite-tagging data from Hatteras is available in a report from Cascadia Research Collective (Baird et al. 2017).

2. Onslow Bay Vessel Surveys

2.1 Methods

2.1.1 Study Area

The Onslow Bay study area is approximately 5,560 km^2. The study area straddles the continental shelf break, including a portion of the Blake Plateau, and includes both shelf and pelagic waters (**Figure 1**).

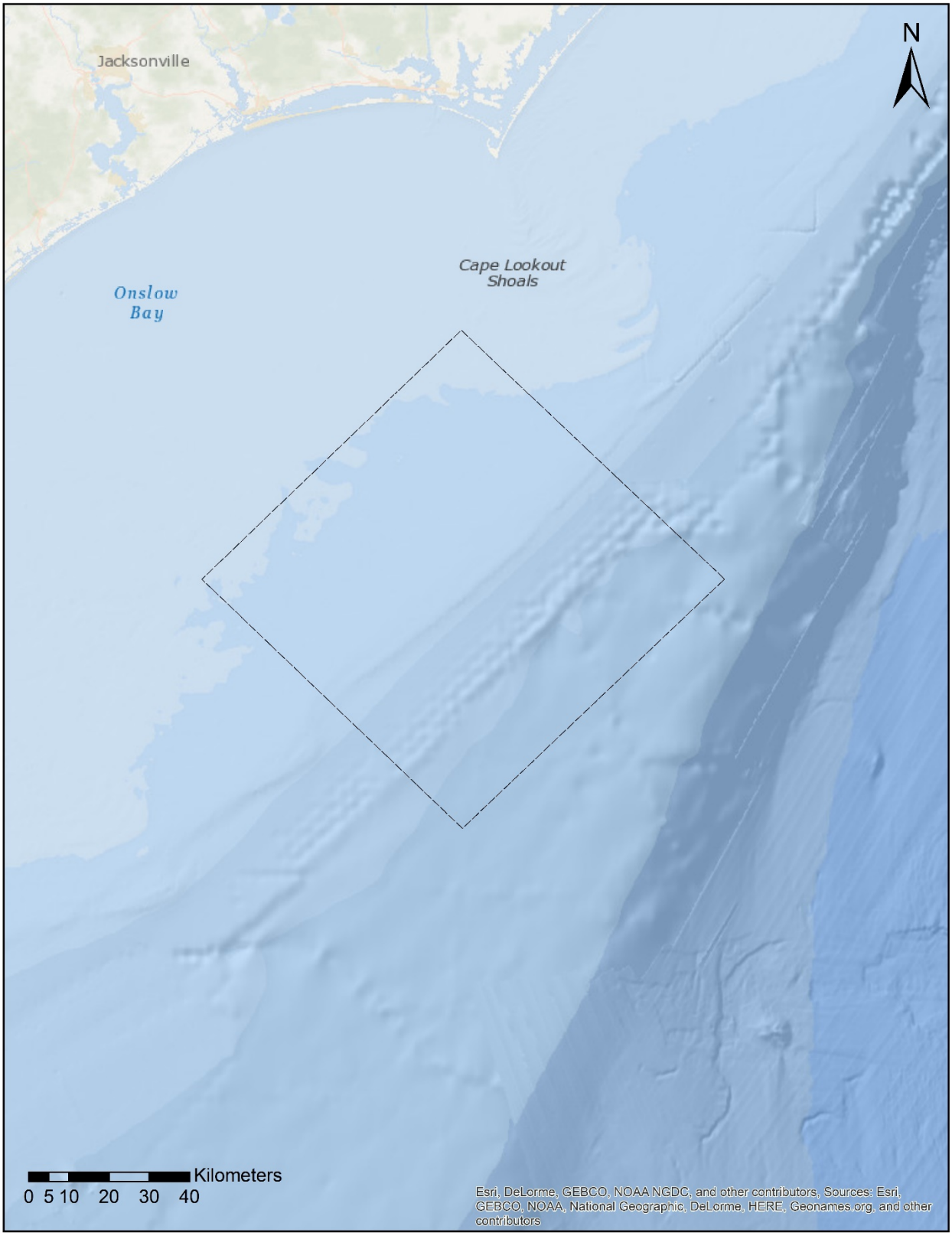

Figure 1. Map of the Onslow Bay study area (dashed outline).

2.1.2 Data Collection

Vessel survey effort in Onslow Bay during 2016 consisted of two opportunistic surveys aboard the Research Vessel (R/V) *Richard T. Barber*, a U.S. Coast Guard-approved offshore research vessel outfitted with a bow pulpit, satellite phone, lifeboat, and wireless communication system (**Figure 2**). Surveys in 2016 were focused on attempting to deploy a digital acoustic tag (DTag) on a small delphinid while simultaneously deploying a four-element distributed hydrophone array from the research vessel. This array enables the localization of vocalizations produced by delphinids. The ability to localize vocalizations to groups of animals, observed at the surface, would allow ascription of vocal events to surface behaviors. In addition, the array would provide species-specific voucher recordings for use in ongoing research in the classification of whistles and clicks. This type of adaptable array, used in conjunction with tagging studies, will help to better analyze and provide context to acoustic recordings obtained from tag data. While delphinids were observed on each survey, no DTags were deployed on either day.

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

Use of the survey area by individual cetaceans was examined using photo-identification. Digital photographs were taken to confirm species identification at each sighting. Photographs were collected with Canon or Nikon digital SLR cameras (equipped with 100 to 400-millimeter zoom lenses) in 24-bit color at a resolution of 6016 x 4016 pixels and saved in .jpg format.

2.1.3 Data Analysis

Vessel survey effort and sighting data were mapped using *ArcGIS* 10.3.2. All vessel sighting data will be posted on the data archive OBIS-SEAMAP (http://seamap.env.duke.edu/).

2.1.4 Data Storage

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

2.2 Results

2.2.1 Vessel Survey Effort

Two vessel surveys were conducted in 2016, totaling 124.5 kilometers (km), or 6.9 hours, of survey effort (**Table 1**). These surveys were conducted in Beaufort sea states (BSS) 2 to 3 and covered coastal waters inshore of the Onslow Bay survey area (**Figure 3**).

Table 1. Dates, distance, and durations surveyed during vessel surveys in the Onslow Bay survey area in 2016.

Date	Sea State	km Surveyed	Survey Time (hr:min)	At-Sea Time	Platform
13-Sep-16	2–3	20.2	00:57	02:08	R/V *R.T. Barber*
14-Sep-16	2–3	104.3	05:59	06:57	R/V *R.T. Barber*

2.2.2 Marine Mammal and Sea Turtle Sightings

Two cetacean sightings of Atlantic spotted dolphins (*Stenella frontalis*) were recorded during vessel surveys in the Onslow Bay survey area (**Tables 2 and 3**). No sea turtles were sighted during these vessel surveys.

Table 2. Cetacean sightings from vessel surveys in the Onslow Bay survey area in 2016.

Date	Time (Local)	Latitude (°N)	Longitude (°W)	Species	Common Name	Group Size	Biopsy Samples	Photo-ID images	Vessel
13-Sep-16	07:38	34.58790	76.80881	*S. frontalis*	Atlantic spotted dolphin	3	0	0	R/V *R.T. Barber*
14-Sep-16	10:16	34.55691	76.86501	*S. frontalis*	Atlantic spotted dolphin	3	0	22	R/V *R.T. Barber*

Table 3. Numbers of cetacean sightings for each species observed in the Onslow Bay survey area, in 2016.

Species	Sightings 2016
Stenella frontalis	2
Total:	**2**

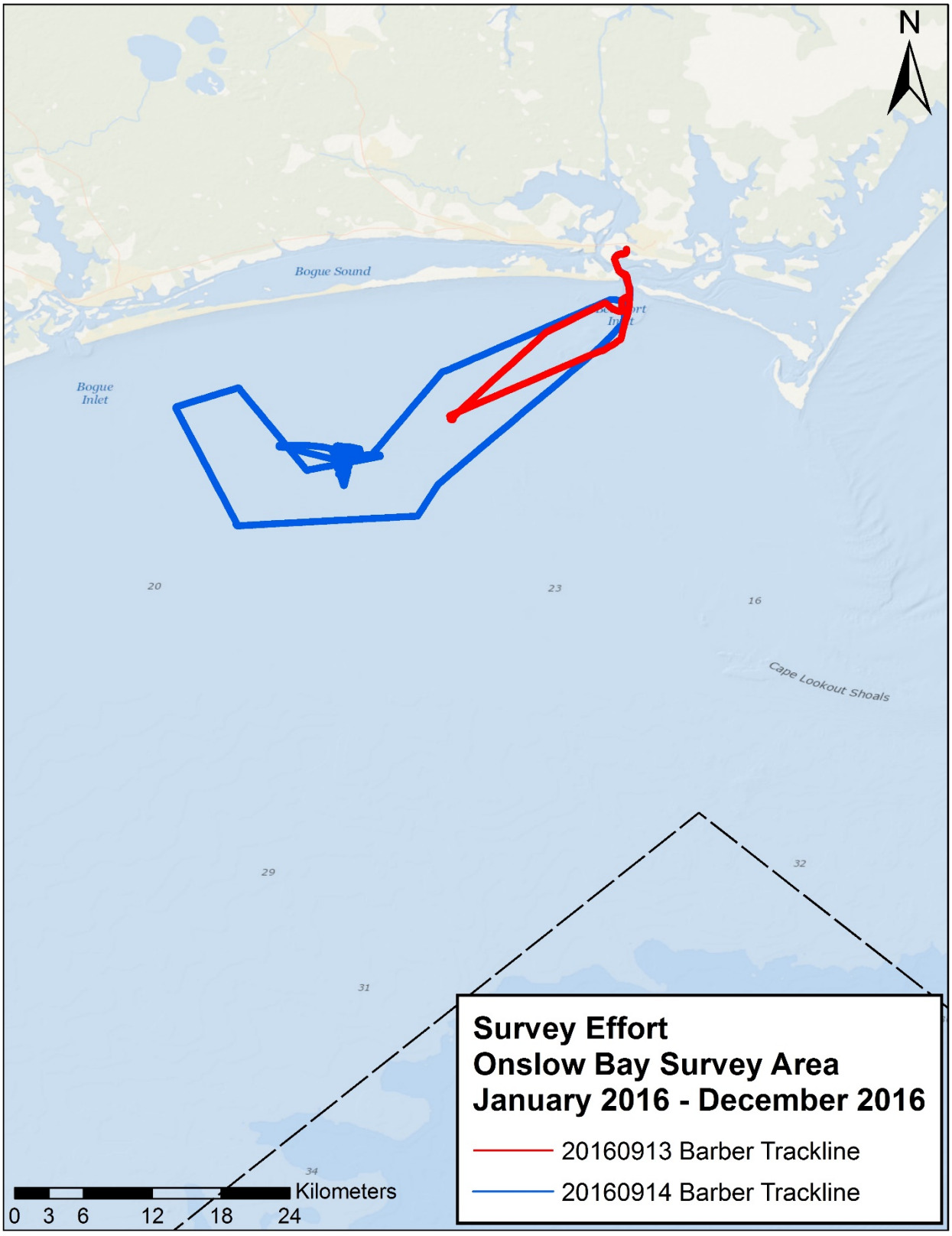

Figure 3. Survey effort during vessel surveys in the Onslow Bay survey area, January 2016–December 2016.

2.2.3 Distributions and Habitat Associations of Cetaceans and Sea Turtles

The distribution of marine mammal sightings and photo identification matches in the Onslow Bay survey area is presented in **Figures 4** and **5**.

2.2.4 Photographic Effort

Since the inception of the monitoring program in Onslow Bay in 2007, eight bottlenose dolphins (*Tursiops truncatus*) and five Atlantic spotted dolphins have been re-sighted **(Table 4 and Figure 5)**, representing approximately six percent of the catalog for bottlenose dolphins (8 of 133) and 6 percent (5 of 86) for Atlantic spotted dolphins. Re-sightings of bottlenose dolphins and Atlantic spotted dolphins in Onslow Bay span up to six and ten years, respectively. Two bottlenose dolphins (Ttr_7-015 and Ttr_8-009) were seen together in both April 2009 and April 2010. One bottlenose dolphin (Ttr_1-004) has now been photographed on three separate occasions: in October 2009, April 2010, and January 2012. Furthermore, one Atlantic spotted dolphin (Sfr_8-004) biopsied and photographed on 12 September 2011 was matched to an animal photographed on 28 June 2001 and on 24 June 2002 during surveys conducted in near-shore waters of Onslow Bay. An additional Atlantic spotted dolphin from the same 12 September 2011 group was matched to Sfr_9-023_MCB, photographed a month earlier on 19 August 2011 during surveys in the coastal waters off Marine Corps Base Camp Lejeune, North Carolina. Atlantic spotted dolphin Sfr_7-013 was first observed during an offshore AFTT Onslow Bay vessel survey on 12 September 2011 and was re-sighted on 25 July 2013 during an acoustic vessel survey in coastal waters of Camp Lejeune. Another Atlantic spotted dolphin (Sfr_2-003), observed on 12 September 2011, was re-sighted during 2016. These numerous re-sightings over multiple years and across seasons support the existence of considerable fine-scale population structure and some degree of residency for both bottlenose and Atlantic spotted dolphins in Onslow Bay. To date, no individuals of any other species have been re-sighted, although the numbers of sightings and catalog sizes for these species are very small. Images of the dorsal fins of stranded pelagic cetaceans in North Carolina are regularly compared with our photo-identification catalogs for Onslow Bay, but to date there have been no matches.

Table 4. Summary of photographs taken of animals in the Onslow Bay survey area, January 2016–December 2016, with photo-identification catalog sizes and total number of matches to date.

Species	Common Name	Images 2016	Catalog Size	Matches
Globicephala macrorhynchus	Short-finned pilot whale	0	27	0
Grampus griseus	Risso's dolphin	0	22	0
Stenella frontalis	Atlantic spotted dolphin	22	86	5
Tursiops truncatus	Bottlenose dolphin	0	133	8
Steno bredanensis	Rough-toothed dolphin	0	12	0

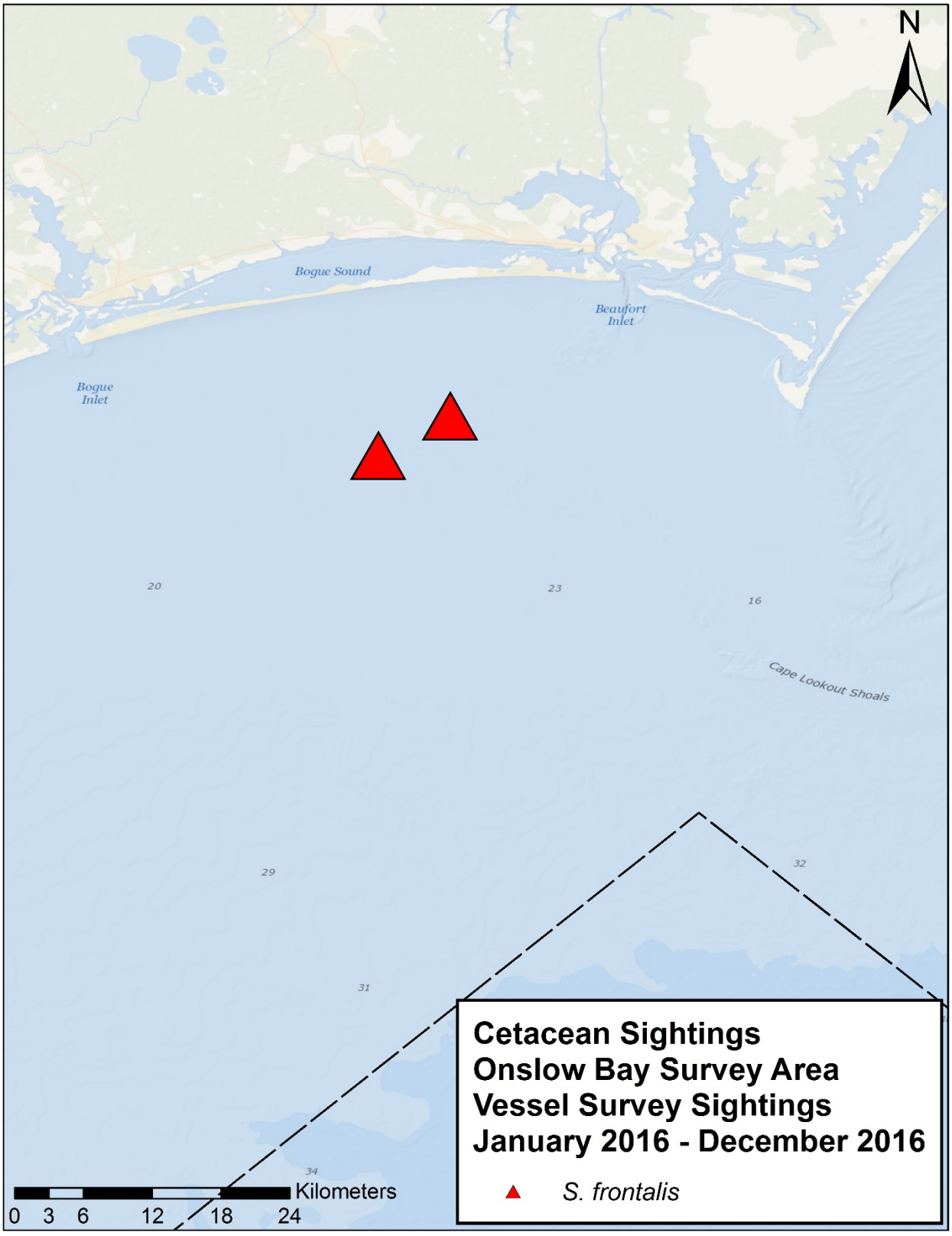

Figure 4. Distribution of all cetacean sightings made during vessel surveys in the Onslow Bay survey area in 2016.

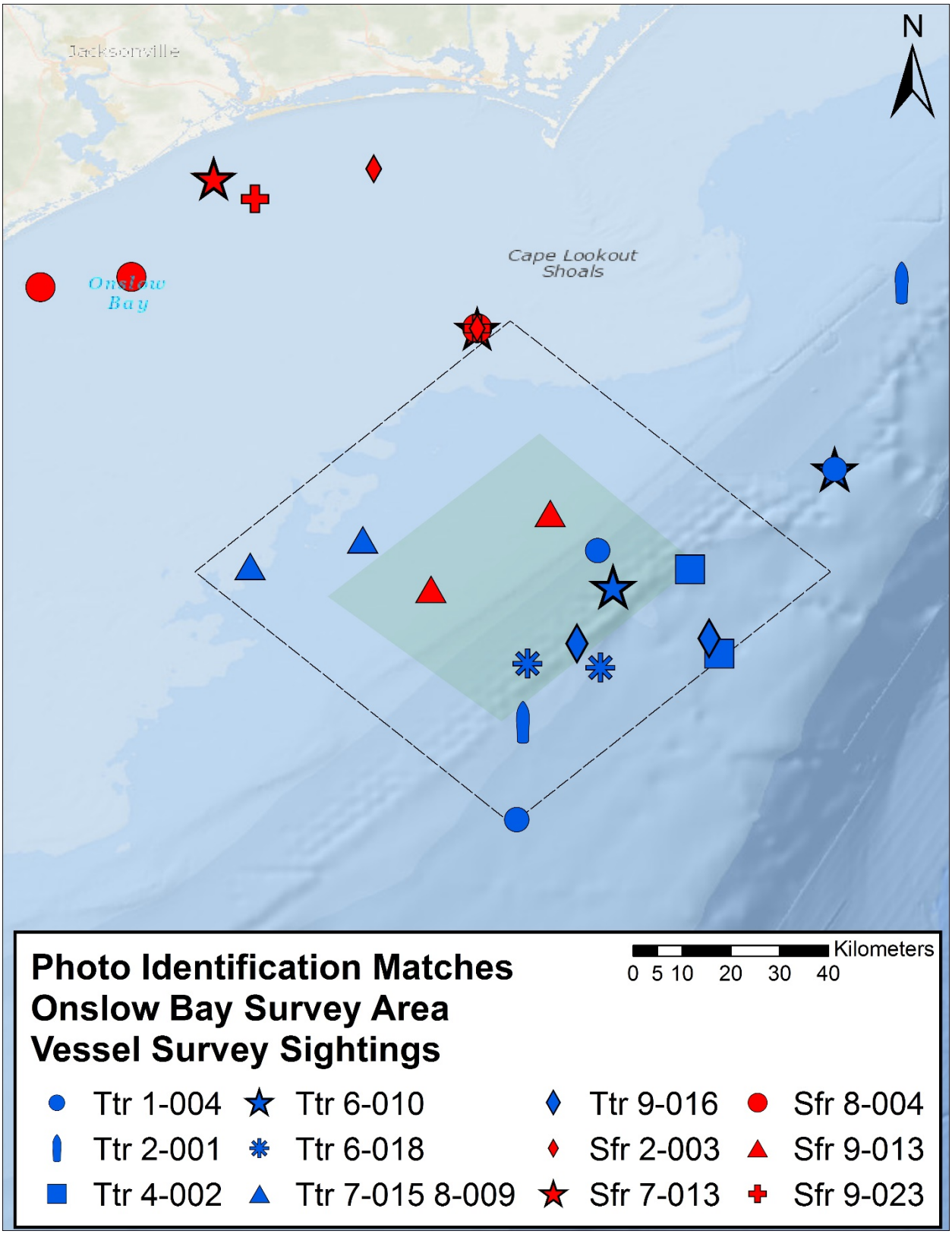

Figure 5. Locations of matched phtot identification matches within the Onslow Bay survey area.

3. Jacksonville Vessel Surveys

3.1 Methods

3.1.1 Study Area

The study area within the JAX OPAREA is 5,786 km^2, surrounding the planned Undersea Warfare Training Range (USWTR), which is approximately 1,700 km^2 in area. The study area straddles the continental shelf break, including some of the Blake Plateau, and includes both shelf and pelagic waters (**Figure 6**).

3.1.2 Data Collection

Vessel survey effort in JAX during 2016 focused on questions of residency and population structure of odontocete cetaceans. In 2016, Duke researchers collaborated with the Naval Surface Warfare Center, Carderock Division in Potomac, Maryland, to utilize paid ship time aboard the R/V *Savannah* (**Figure 7**), based out of the Skidaway Institute of Oceanography in Savannah, Georgia, to conduct vessel surveys. This afforded us the opportunity to stay offshore overnight, allowing for more time on-effort and sightings farther east than daily shore-based trips allow. We deployed the R/V *Exocetus (***Figure 7**) from the R/V *Savannah* in order to approach cetacean groups and obtain photo-ID images and biopsy samples. Additional surveys were conducted from the R/V *Richard T. Barber*, including two days of effort focused on deploying satellite tags (see Baird et al. 2017 for details of tags and tagging methods). All visual surveys were conducted at speeds of approximately 8 to 15 knots (15 to 28 km/hr), with higher speeds utilized during on-effort transiting within the survey area from the R/V *Richard T. Barber*. Two observers (one port and one starboard) scanned constantly from straight ahead to 90 degrees abeam either side of the trackline. The location, species and behavior of every cetacean group were recorded. The location and species of all sea turtles were also recorded. Environmental conditions (weather, BSS, depth, and sea-surface temperature) were collected at each sighting and whenever survey conditions changed. Sighting and environmental data were recorded on an iPad tablet linked to a Global Positioning System unit.

Use of the survey area by individual cetaceans was examined using photo-identification, and biopsy samples were collected for analysis of population structure. Digital photographs were collected to confirm species identification at each sighting. Photographs were taken with Canon or Nikon digital SLR cameras (equipped with 100 to 400-millimeter zoom lenses) in 24-bit color at a resolution of 6016 x 4016 pixels and saved in .jpg format. Remote biopsy-sampling methods were employed to collect small skin and blubber samples using a variety of 27- to 68-kilogram pull crossbows, depending on the species and sampling distance. Biopsy samples were collected with a specialized 2.5-centimeter stainless biopsy tip attached to a modified bolt, typically fired from the bow of the survey vessel.

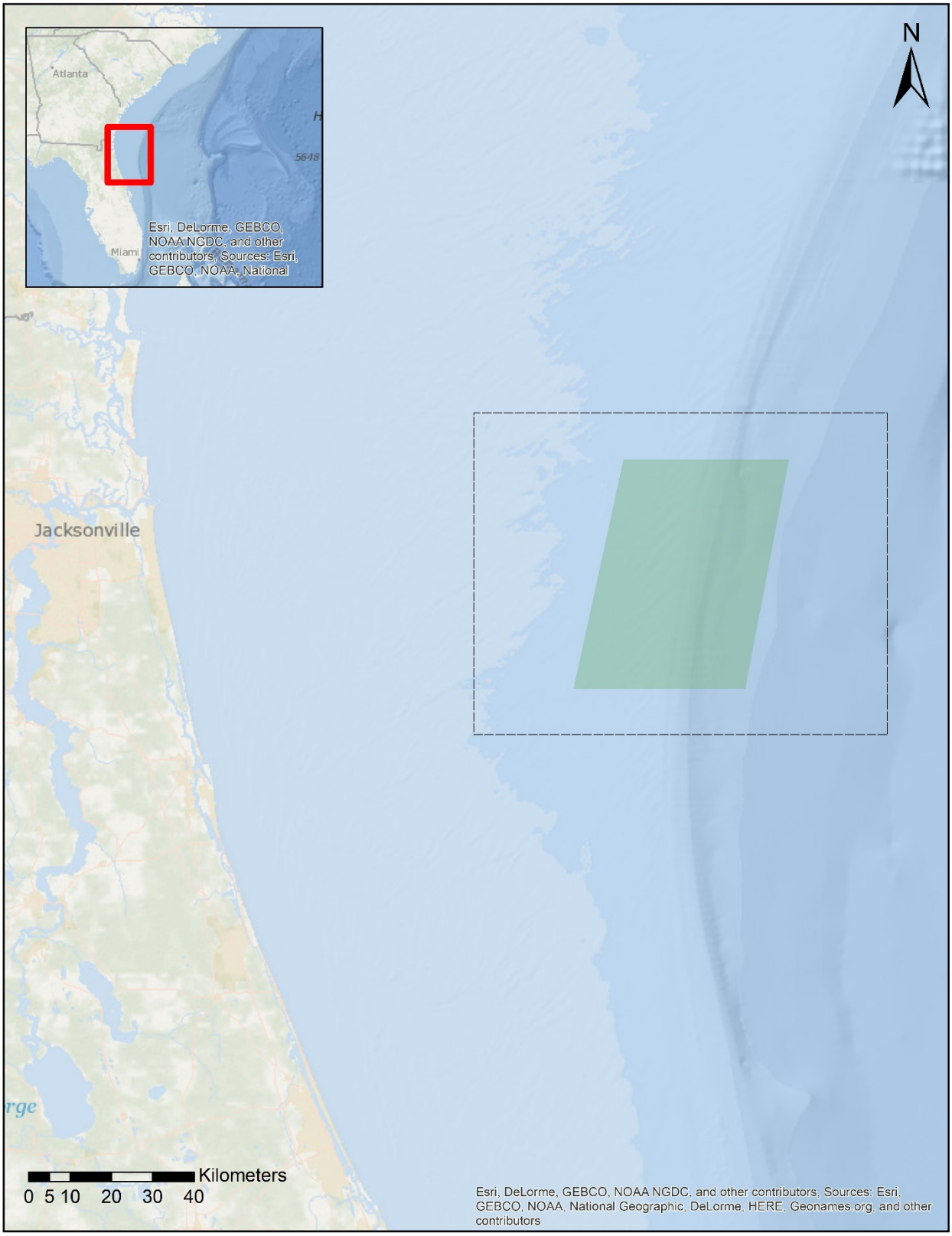

Figure 6. Map of the Jacksonville study area (dashed outline) and the planned USWTR site (shaded box).

Figure 7. The R/Vs *Savannah* and *Exocetus*.

3.1.3 Data Analysis

Vessel survey effort and sighting data were mapped using *ArcGIS* 10.3.2. All vessel sighting data collected will be posted on the data archive OBIS-SEAMAP (http://seamap.env.duke.edu/). Satellite tagging data were processed as outlined in https://www.navymarinespeciesmonitoring.us/index.php/download_file/view/1492/.

3.1.4 Data Storage

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

3.2 Results

3.2.1 Vessel Survey Effort

Fourteen days of vessel surveys were conducted in 2016, totaling 2,136 km, or 130.7 hours, of survey effort (**Table 5**). These surveys were conducted in BSS 0 to 4 and covered the proposed USWTR site and surrounding survey area, including shelf and pelagic waters (**Figure 8**).

Table 5. Dates, distances and durations surveyed during vessel surveys in the Jacksonville survey area in 2016.

Date	Sea State	km Surveyed	Survey Time (hr:min)	At-Sea Time	Platform
28-Feb-16	2	120.9	05:29	10:36	R/V *R.T. Barber*
29-Apr-16	2–4	138.6	08:34	12:05	R/V *R.T. Barber*
01-Jun-16	2–3	201.9	08:23	11:40	R/V *R.T. Barber*
02-Jun-16	3	170.2	06:03	11:37	R/V *R.T. Barber*
20-Jul-16	1–2	183.5	13:03	24:00	R/V *Savannah*
21-Jul-16	1–3	145.7	12:42	24:00	R/V *Savannah*
22-Jul-16	2–4	150.8	12:29	24:00	R/V *Savannah*
02-Aug-16	1–2	136.0	10:36	24:00	R/V *Savannah*
03-Aug-16	3–4	168.0	12:22	24:00	R/V *Savannah*
04-Aug-16	2–4	131.0	12:13	24:00	R/V *Savannah*
05-Aug-16	2–4	116.0	07:55	24:00	R/V *Savannah*
08-Sep-16	2–4	158.0	06:08	09:43	R/V *R.T. Barber*
09-Sep-16	2–4	147.1	07:53	11:02	R/V *R.T. Barber*
10-Sep-16	0–4	167.8	06:50	10:33	R/V *R.T. Barber*

3.2.2 Marine Mammal and Sea Turtle Sightings

Forty-two cetacean sightings of five species were recorded during these vessel surveys. As in previous years, bottlenose (*n*=18) and Atlantic spotted dolphins (*n*=10) dominated the fauna, in addition to five sightings of short-finned pilot whales (*Globicephala macrorhynchus*). Additionally two sightings each of pantropical spotted dolphins (*Stenella attenuata*) and rough-toothed dolphins (*Steno bredanensis*) were recorded, along with five sightings of unidentified delphinids (**Tables 6 and 7**). Twenty-six sea turtles were recorded in the survey area during 2016. As in the past, the loggerhead sea turtle (*Caretta caretta*; *n*=22) was the most frequently recorded species, with a small number of sightings of leatherback sea turtles (*Dermochelys coriacea*; *n*=4) (**Table 8**).

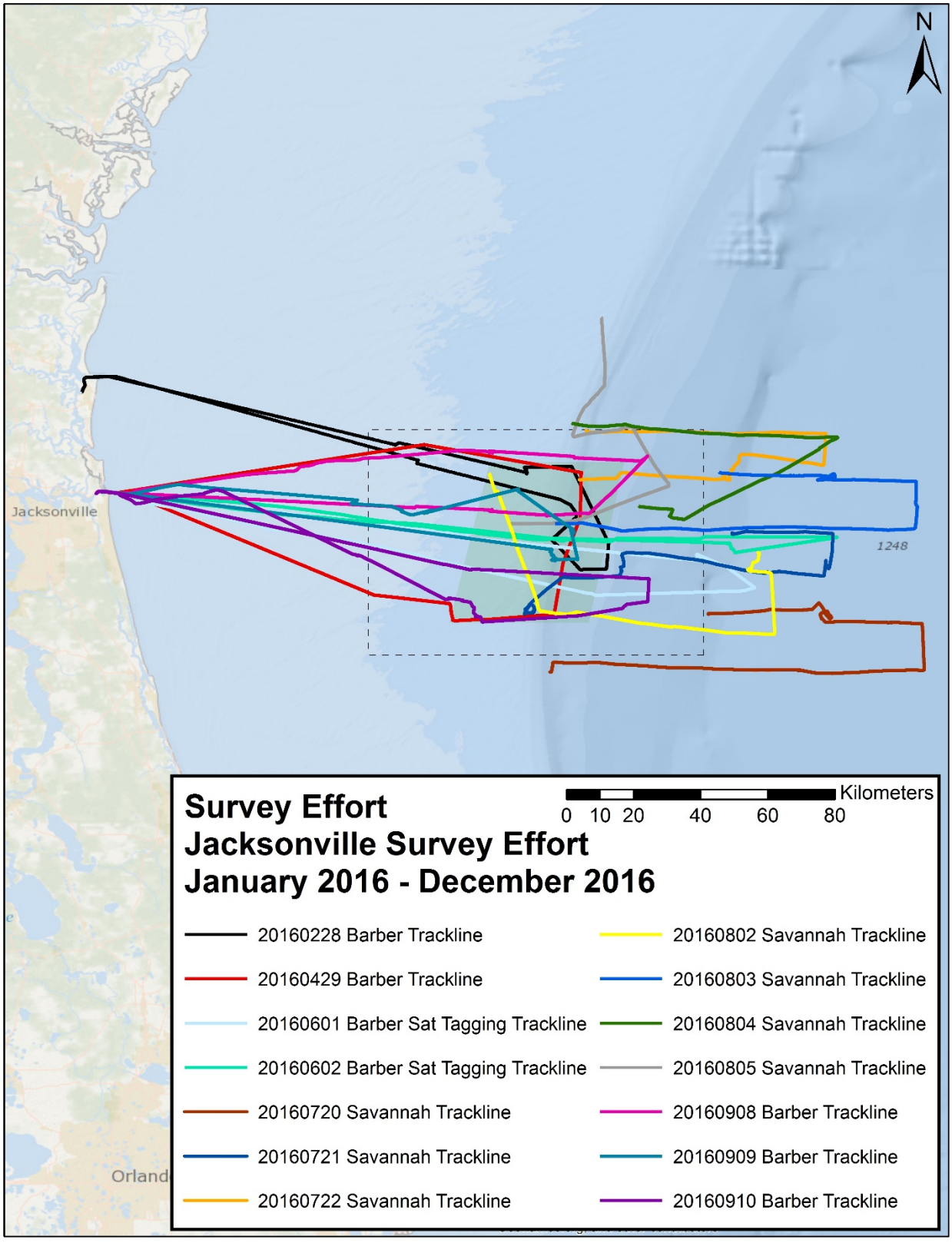

Figure 8. Survey effort during vessel surveys in the Jacksonville survey area in 2016.

Table 6. Cetacean sightings from vessel surveys in the Jacksonville survey area in 2016.

Date	Time	Latitude (°N)	Longitude (°W)	Species	Common Name	Group Size	Biopsy Samples	Photo-ID images	Vessel
28-Feb-16	10:09	30.48606	80.56692	*T. truncatus*	Bottlenose dolphin	1	0	0	R/V *R.T. Barber*
28-Feb-16	15:13	30.46684	80.28163	*T. truncatus*	Bottlenose dolphin	7	1	89	R/V *R.T. Barber*
28-Feb-16	16:25	30.51612	80.54569	Unid. delphinid	Unid. delphinid	2	0	0	R/V *R.T. Barber*
28-Feb-16	16:35	30.53269	80.61892	*S. frontalis*	Spotted dolphin	3	0	4	R/V *R.T. Barber*
28-Feb-16	16:39	30.53269	80.61892	*T. truncatus*	Bottlenose dolphin	2	0	6	R/V *R.T. Barber*
29-Apr-16	09:58	30.10230	80.48485	*S. frontalis*	Atlantic spotted dolphin	15	2	128	R/V *R.T. Barber*
01-Jun-16	9:43	30.28890	80.43475	*S. frontalis*	Atlantic spotted dolphin	24	0	96	R/V *R.T. Barber*
01-Jun-16	11:40	30.21968	79.82380	*G. macrorhynchus*	Short-finned pilot whale	6	1	225	R/V *R.T. Barber*
01-Jun-16	17:22	30.22622	80.55756	*T. truncatus*	Bottlenose dolphin	5	0	13	R/V *R.T. Barber*
02-Jun-16	14:22	30.24549	79.72188	*G. macrorhynchus*	Short-finned pilot whale	1	0	16	R/V *R.T. Barber*
02-Jun-16	14:45	30.25077	79.72727	*G. macrorhynchus*	Short-finned pilot whale	5	1	96	R/V *R.T. Barber*
20-Jul-16	16:42	30.05548	79.47838	Unid. delphinid	Unid. delphinid	30	0	0	R/V *Savannah*
21-Jul-16	07:22	30.07762	80.25806	*S. frontalis*	Atlantic spotted dolphin	80	2	135	R/V *Savannah*
21-Jul-16	10:49	30.17633	80.02982	*T. truncatus*	Bottlenose dolphin	18	2	83	R/V *Savannah*
21-Jul-16	15:55	30.21128	79.47415	*G. macrorhynchus*	Short-finned pilot whale	8	2	82	R/V *Savannah*
21-Jul-16	19:28	30.29564	79.68701	*T. truncatus*	Bottlenose dolphin	6	0	29	R/V *Savannah*
22-Jul-16	07:57	30.43716	80.05210	*T. truncatus*	Bottlenose dolphin	30	0	0	R/V *Savannah*
22-Jul-16	10:05	30.43555	79.74976	*G. macrorhynchus*	Short-finned pilot whale	25	3	152	R/V *Savannah*
22-Jul-16	14:00	30.49174	79.47784	Unid. delphinid	Unid. delphinid	5	0	0	R/V *Savannah*
02-Aug-16	09:50	30.37172	80.34294	*T. truncatus*	Bottlenose dolphin	5	0	0	R/V *Savannah*
02-Aug-16	10:45	30.26113	80.30515	*T. truncatus*	Bottlenose dolphin	10	0	0	R/V *Savannah*
02-Aug-16	12:31	30.07610	80.20054	*T. truncatus*	Bottlenose dolphin	3	0	0	R/V *Savannah*
02-Aug-16	13:11	30.07388	80.11182	*T. truncatus*	Bottlenose dolphin	4	0	0	R/V *Savannah*
02-Aug-16	13:17	30.07188	80.09896	*T. truncatus*	Bottlenose dolphin	12	0	0	R/V *Savannah*
02-Aug-16	17:50	30.19649	79.67407	*S. attenuata*	Pantropical spotted dolphin	40	1	76	R/V *Savannah*
03-Aug-16	08:27	30.30272	80.04820	*T. truncatus*	Bottlenose dolphin	3	0	10	R/V *Savannah*
03-Aug-16	16:34	30.43404	79.47936	*S. attenuata*	Pantropical spotted dolphin	80	0	73	R/V *Savannah*

Date	Time	Latitude (°N)	Longitude (°W)	Species	Common Name	Group Size	Biopsy Samples	Photo-ID images	Vessel
04-Aug-16	08:10	30.57917	80.04168	Unid. delphinid	Unid. delphinid	4	0	0	R/V *Savannah*
04-Aug-16	08:24	30.58217	80.01175	Unid. delphinid	Unid. delphinid	4	0	0	R/V *Savannah*
04-Aug-16	17:23	30.33719	79.89231	*T. truncatus*	Bottlenose dolphin	5	0	5	R/V *Savannah*
08-Sep-16	9:19	30.50682	80.37480	*S. frontalis*	Atlantic spotted dolphin	11	1	107	R/V *R.T. Barber*
08-Sep-16	13:46	30.35195	80.36888	*S. frontalis*	Atlantic spotted dolphin	6	1	100	R/V *R.T. Barber*
09-Sep-16	8:48	30.37927	80.73085	*S. frontalis*	Atlantic spotted dolphin	13	1	68	R/V *R.T. Barber*
09-Sep-16	10:08	30.35033	80.53422	*T. truncatus*	Bottlenose dolphin	8	1	52	R/V *R.T. Barber*
09-Sep-16	12:41	30.29966	80.15237	*T. truncatus*	Bottlenose dolphin	6	1	52	R/V *R.T. Barber*
09-Sep-16	14:15	30.22171	80.20000	*S. bredanensis*	Rough-toothed dolphin	16	2	252	R/V *R.T. Barber*
10-Sep-16	9:30	30.23364	80.73869	*S. frontalis*	Atlantic spotted dolphin	10	0	53	R/V *R.T. Barber*
10-Sep-16	10:37	30.11389	80.48835	*T. truncatus*	Bottlenose dolphin	7	0	13	R/V *R.T. Barber*
10-Sep-16	11:04	30.11118	80.44833	*T. truncatus*	Bottlenose dolphin	2	0	634	R/V *R.T. Barber*
10-Sep-16	11:21	30.09174	80.41813	*S. bredanensis*	Rough-toothed dolphin	50	2	0	R/V *R.T. Barber*
10-Sep-16	15:32	30.19265	80.42415	*S. frontalis*	Atlantic spotted dolphin	5	0	5	R/V *R.T. Barber*
10-Sep-16	16:17	30.24739	80.67875	*S. frontalis*	Atlantic spotted dolphin	2	0	0	R/V *R.T. Barber*

Table 7. Numbers of cetacean sightings for each species observed in the Jacksonville survey area in 2016.

Species	Sightings 2016
Globicephala macrorhynchus	5
Stenella attenuata	2
Stenella frontalis	10
Steno bredanensis	2
Tursiops truncatus	18
Unidentified delphinid	5
Total	**42**

Table 8. Sea turtle sightings from vessel surveys in the Jacksonville survey areain 2016.

Date	Time	Latitude (°N)	Longitude (°W)	Species	Common Name	Group Size	Vessel
28-Feb-16	10:04	30.49536	80.60060	*C. caretta*	Loggerhead sea turtle	1	R/V *R.T. Barber*
28-Feb-16	10:44	30.45683	80.48776	*C. caretta*	Loggerhead sea turtle	1	R/V *R.T. Barber*
28-Feb-16	11:34	30.38112	80.18795	*C. caretta*	Loggerhead sea turtle	1	R/V *R.T. Barber*
28-Feb-16	15:19	30.46268	80.28066	*C. caretta*	Loggerhead sea turtle	2	R/V *R.T. Barber*
28-Feb-16	16:49	30.52873	80.63338	*C. caretta*	Loggerhead sea turtle	1	R/V *R.T. Barber*
28-Feb-16	16:56	30.52873	80.63338	*C. caretta*	Loggerhead sea turtle	1	R/V *R.T. Barber*
29-Apr-16	09:21	30.11422	80.59218	*C. caretta*	Loggerhead sea turtle	1	R/V *R.T. Barber*
29-Apr-16	09:28	30.11191	80.57180	*C. caretta*	Loggerhead sea turtle	1	R/V *R.T. Barber*
29-Apr-16	15:41	30.51394	80.47346	*C. caretta*	Loggerhead sea turtle	1	R/V *R.T. Barber*
29-Apr-16	16:04	30.52682	80.54669	*C. caretta*	Loggerhead sea turtle	1	R/V *R.T. Barber*
22-Jul-16	19:00	30.56265	80.04207	*D. coriacea*	Leatherback sea turtle	1	R/V *Savannah*
02-Aug-16	12:38	30.07485	80.18806	*C. caretta*	Loggerhead sea turtle	1	R/V *Savannah*
08-Sep-16	09:19	30.49862	80.60707	*D. coriacea*	Leatherback sea turtle	1	R/V *R.T. Barber*
08-Sep-16	09:30	30.50473	80.53933	*C. caretta*	Loggerhead sea turtle	1	R/V *R.T. Barber*
08-Sep-16	09:34	30.50662	80.51804	*C. caretta*	Loggerhead sea turtle	1	R/V *R.T. Barber*

Date	Time	Latitude (°N)	Longitude (°W)	Species	Common Name	Group Size	Vessel
08-Sep-16	11:21	30.49202	80.14775	*C. caretta*	Loggerhead sea turtle	1	R/V *R.T. Barber*
08-Sep-16	14:26	30.35503	80.42558	*C. caretta*	Loggerhead sea turtle	1	R/V *R.T. Barber*
08-Sep-16	14:34	30.35772	80.47991	*D. coriacea*	Leatherback sea turtle	1	R/V *R.T. Barber*
09-Sep-16	09:53	30.36225	80.48102	*C. caretta*	Loggerhead sea turtle	1	R/V *R.T. Barber*
09-Sep-16	14:27	30.22200	80.20218	*C. caretta*	Loggerhead sea turtle	1	R/V *R.T. Barber*
09-Sep-16	16:14	30.28112	80.46717	*C. caretta*	Loggerhead sea turtle	1	R/V *R.T. Barber*
10-Sep-16	10:02	30.20392	80.66910	*C. caretta*	Loggerhead sea turtle	1	R/V *R.T. Barber*
10-Sep-16	10:17	30.16004	80.58464	*C. caretta*	Loggerhead sea turtle	1	R/V *R.T. Barber*
10-Sep-16	10:28	30.13216	80.53082	*D. coriacea*	Leatherback sea turtle	1	R/V *R.T. Barber*
10-Sep-16	15:51	30.20892	80.50781	*C. caretta*	Loggerhead sea turtle	1	R/V *R.T. Barber*
10-Sep-16	15:55	30.21477	80.53435	*C. caretta*	Loggerhead sea turtle	1	R/V *R.T. Barber*

3.2.3 Distributions and Habitat Associations of Cetaceans and Sea Turtles

The distribution of marine mammal and sea turtle sightings in the Jacksonville survey area is presented in **Figures 9 through 16**. Similar to our observations in previous years, bottlenose dolphins were encountered throughout the survey area, including deeper pelagic waters (**Figure 10**), whereas Atlantic spotted dolphins were restricted to the relatively shallow shelf waters (**Figure 11**). Short-finned pilot whales and pantropical spotted dolphins were found exclusively in deeper pelagic waters (**Figures 12 and 13)**. Rough-toothed dolphins were observed either at or inshore of the shelf break (**Figure 14**). The majority of all sea turtles were observed over the continental shelf (**Figure 16**).

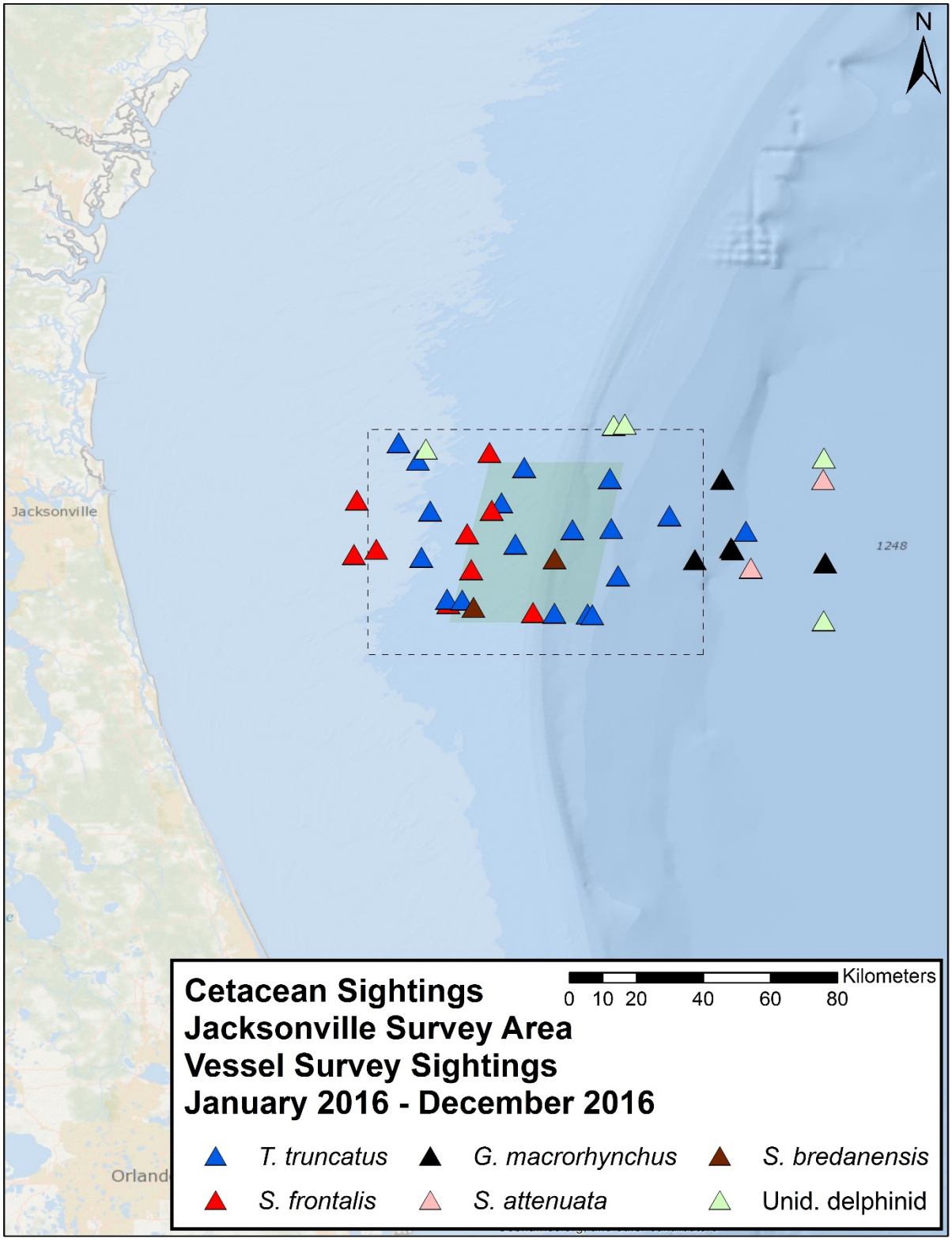

Figure 9. Distribution of all cetacean sightings made during vessel surveys in the Jacksonville survey area in 2016.

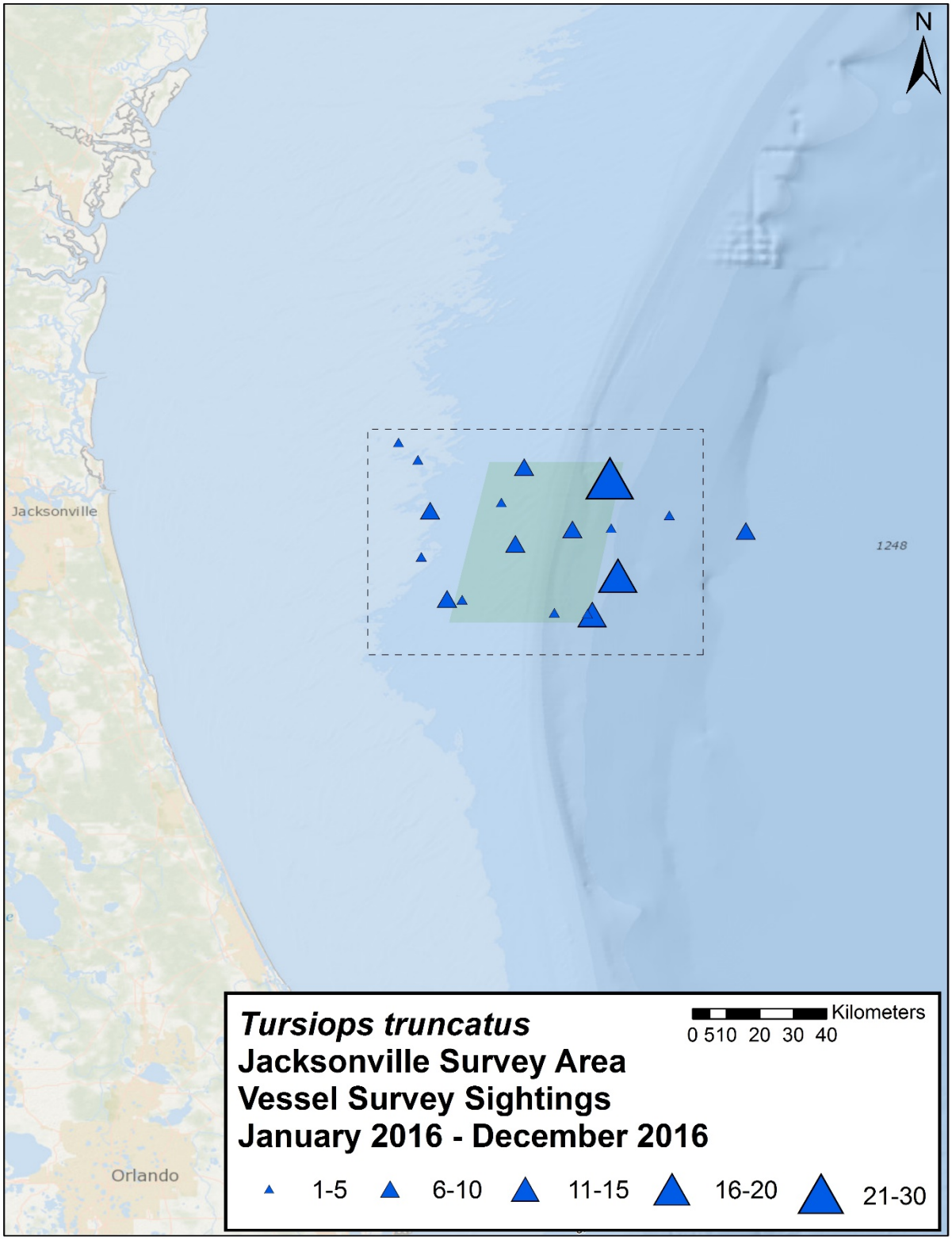

Figure 10. Distribution of bottlenose dolphin sightings, indicating group size, made during vessel surveys in the Jacksonville survey area in 2016.

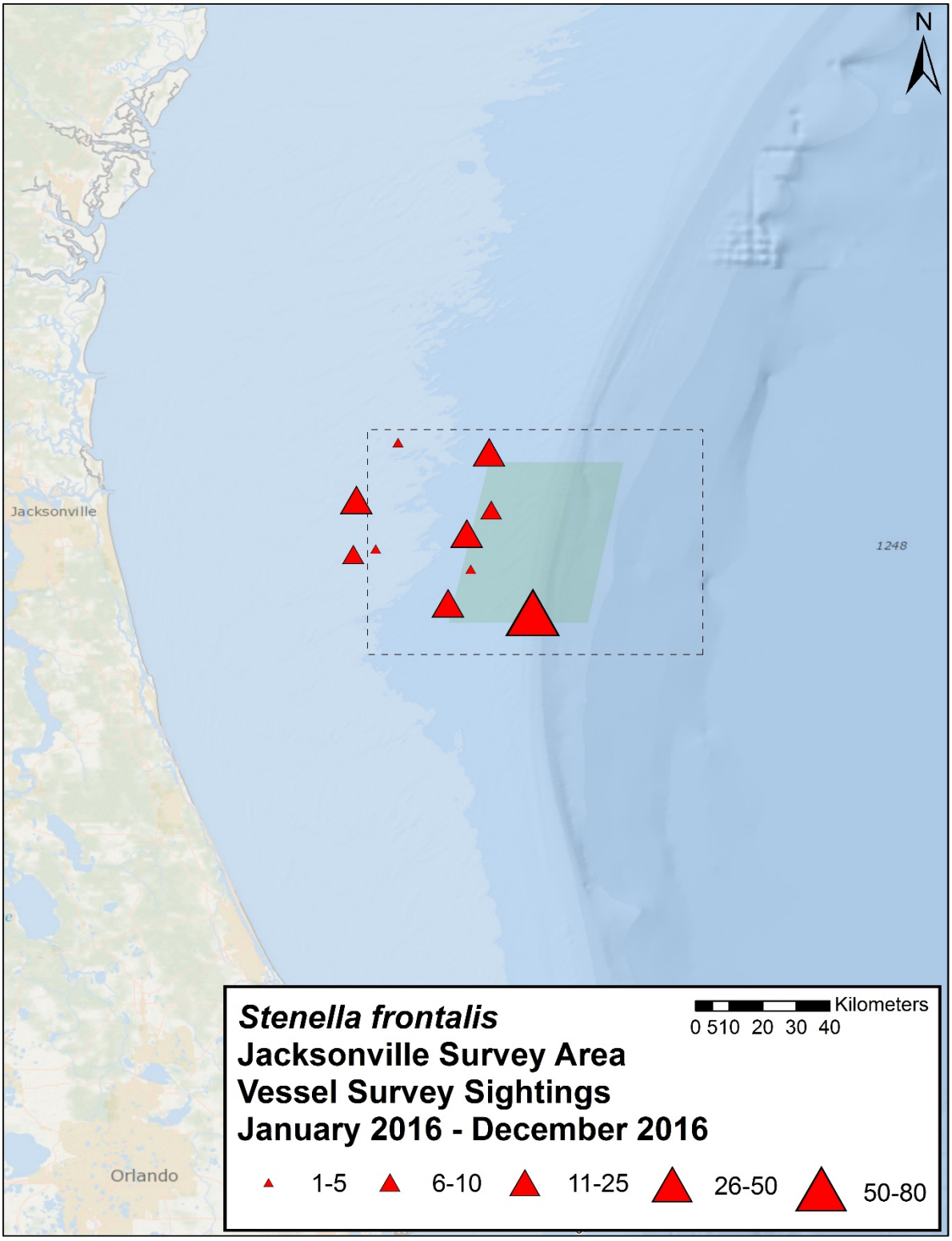

Figure 11. Distribution of Atlantic spotted dolphin sightings, indicating group size, made during vessel surveys in the Jacksonville survey area in 2016.

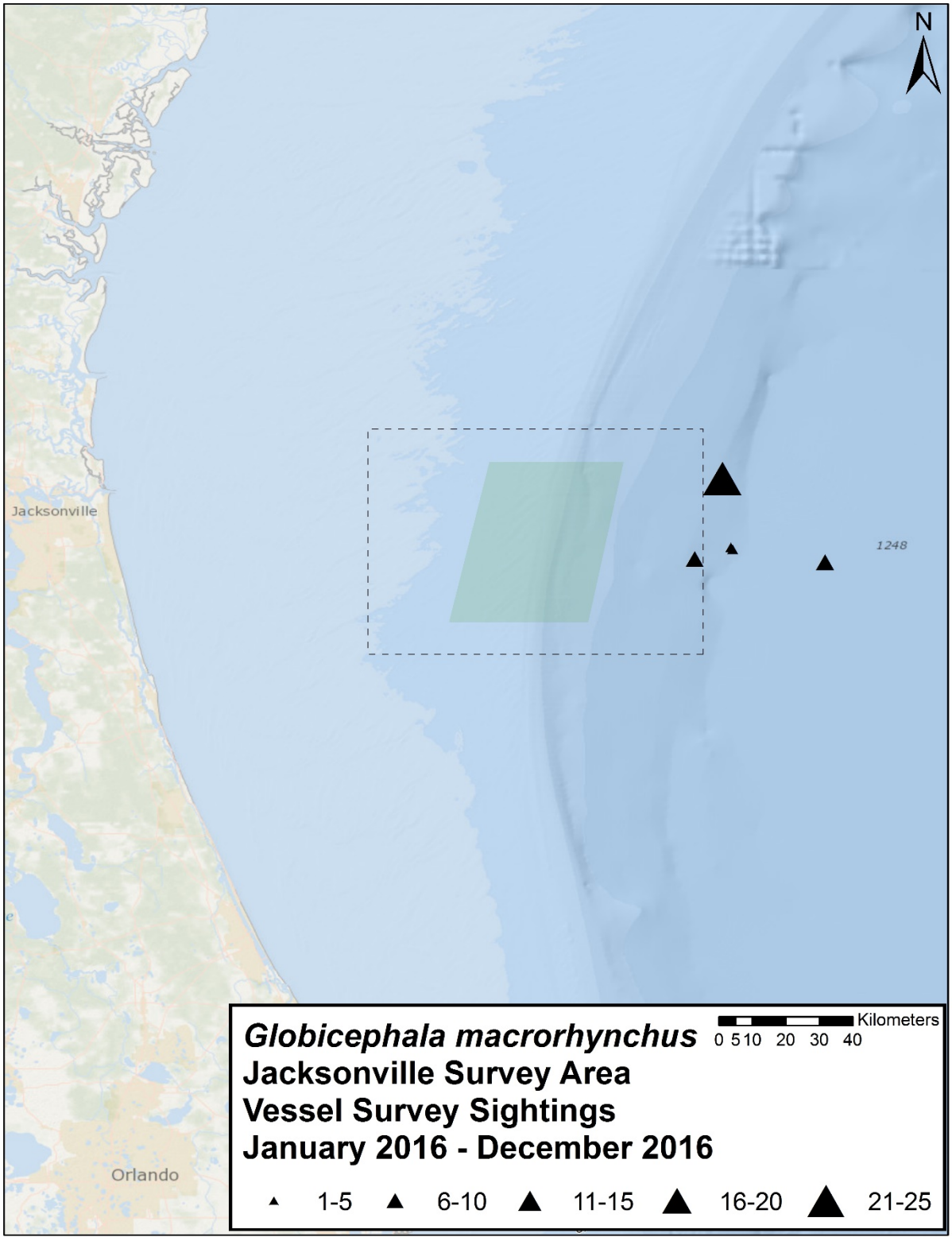

Figure 12. Distribution of short-finned pilot whale sightings, indicating group size, made during vessel surveys in the Jacksonville survey area in 2016.

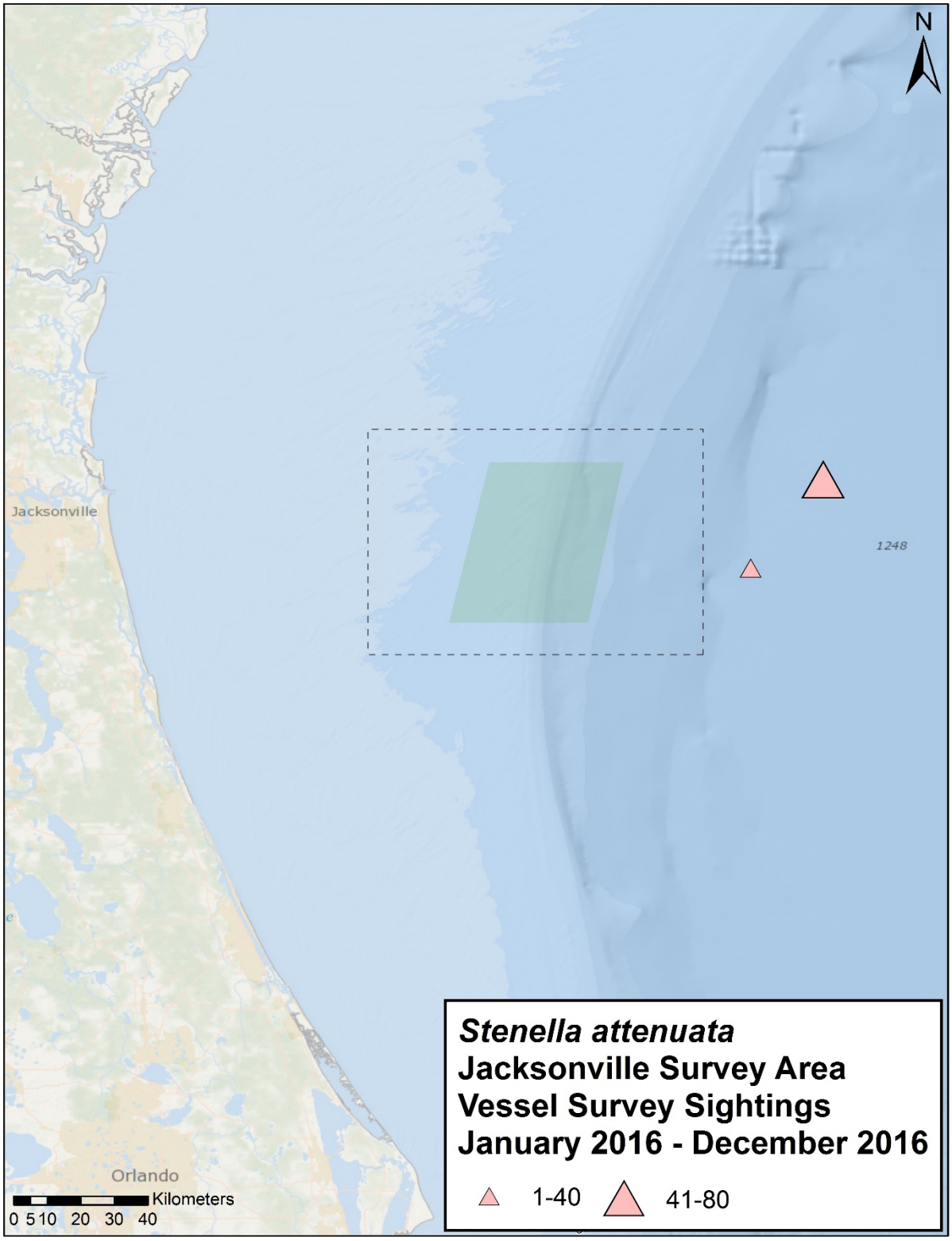

Figure 13. Distribution of pantropical spotted dolphin sightings, indicating group size, made during vessel surveys in the Jacksonville survey area in 2016.

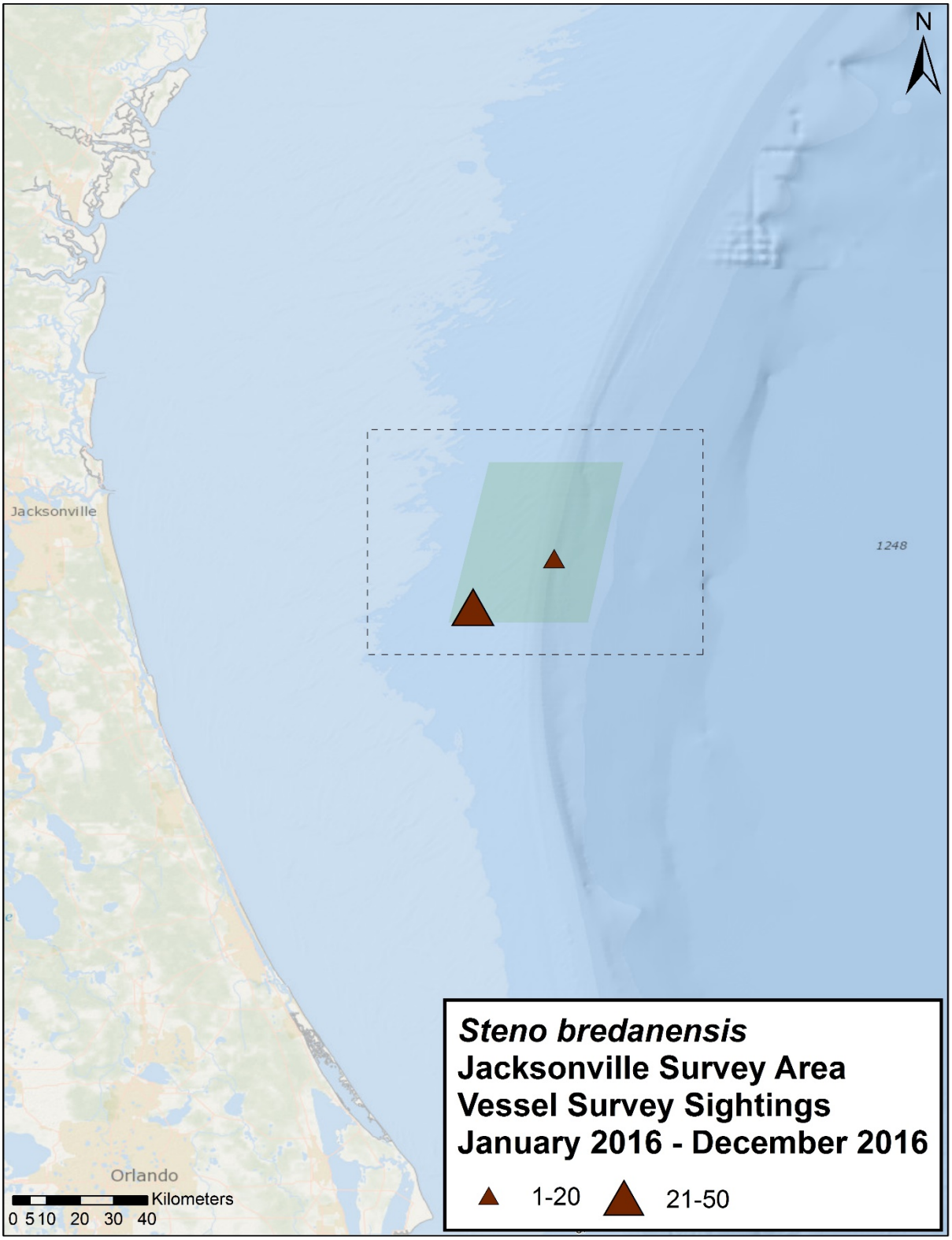

Figure 14. Distribution of rough-toothed dolphin sightings, indicating group size, made during vessel surveys in the Jacksonville survey area in 2016.

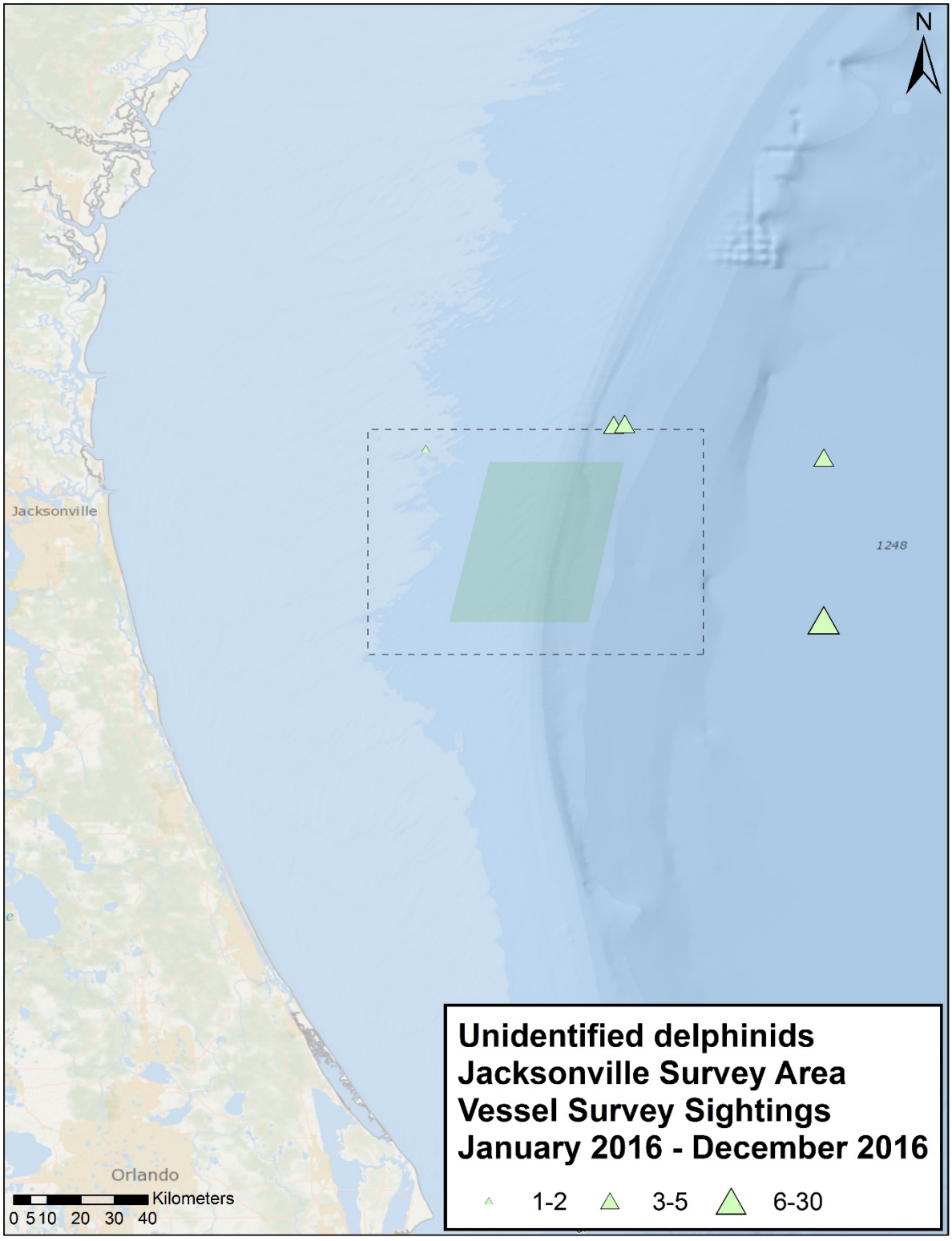

Figure 15. Distribution of unidentified delphinid sightings, indicating group size, made during vessel surveys in the Jacksonville survey area in 2016.

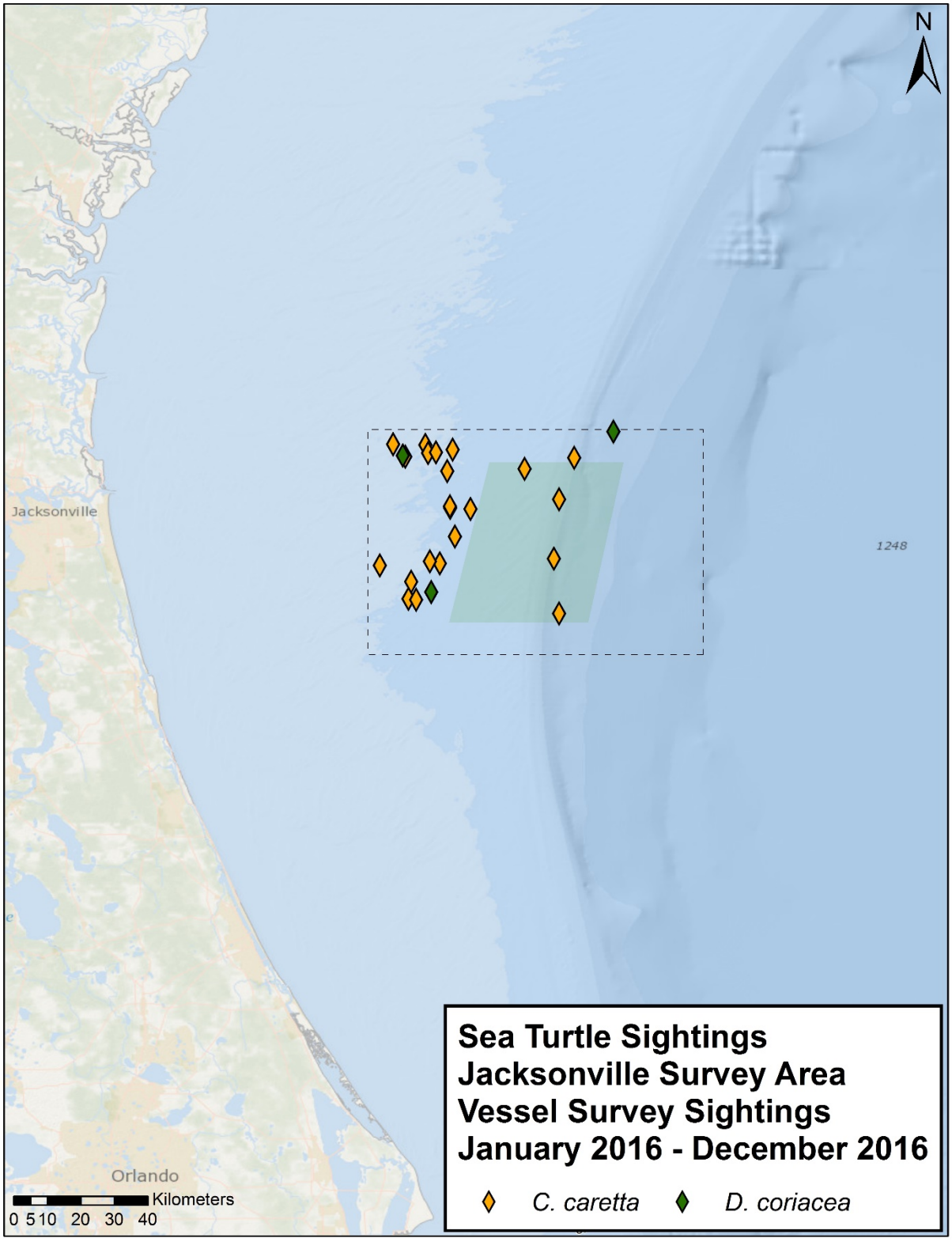

Figure 16. Distribution of sea turtle sightings made during vessel surveys in the Jacksonville survey area in 2016.

3.2.4 Satellite Tagging

Four satellite tags were deployed on short-finned pilot whales and one on an Atlantic spotted dolphin in the Jacksonville survey area in June 2016 (**Table 9**, **Figure 17**). For short-finned pilot whales, two tags were deployed on individuals within the same group on one day (one depth-transmitting and one location-only tag), and on the next day tags were deployed on individuals that were in different groups (also one depth-transmitting and one location-only tag). An analysis of the distance between the two pairs of individuals suggested that both pairs of tagged whales acted in concert. The mean distance apart between the individuals in the two pairs were 3.11 and 3.50 km, respectively, over the periods of tag overlap. Tags transmitted from 11.8 days (the Atlantic spotted dolphin) to 47.2 days (one of the short-finned pilot whales, **Table 10**). In general the tagged individuals all remained relatively close to where they were tagged (**Table 11**), with the spotted dolphin remaining in shelf waters (median depth=36 m, **Figure 18**), and the pilot whales remaining over slope waters (median depths ranging from 688 to 799 m, see **Table 12** and **Figures 19 through 22**). Dive data were obtained from both of the depth-transmitting tags deployed on short-finned pilot whales, with data from 12.6 days (GmTag163) and 11.2 days (GmTag165).

Table 9. Tag deployments on odontocete cetaceans in the Jacksonville survey area in June 2016.

Date	Time	Latitude (°N)	Longitude (°W)	Species	Common Name	Sighting #	Tag Type [1]	Tag # [2]
01-Jun-16	09:57	30.28289	80.43805	*S. frontalis*	Atlantic spotted dolphin	1	satellite - SPOT	SfTag001
01-Jun-16	11:52	30.22385	79.82004	*G. macrorhynchus*	Short-finned pilot whale	2	satellite - SPOT	GmTag162
01-Jun-16	13:03	30.22762	79.81328	*G. macrorhynchus*	Short-finned pilot whale	2	satellite - Mk10	GmTag163
02-Jun-16	14:24	30.24696	79.72234	*G. macrorhynchus*	Short-finned pilot whale	1	satellite - SPOT	GmTag164
02-Jun-16	14:53	30.25456	79.72902	*G. macrorhynchus*	Short-finned pilot whale	2	satellite - Mk10	GmTag165

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

[2] Gm=*Globicephala macrorhynchus* (short-finned pilot whale); Sf=*Stenella frontalis* (Atlantic spotted dolphin)

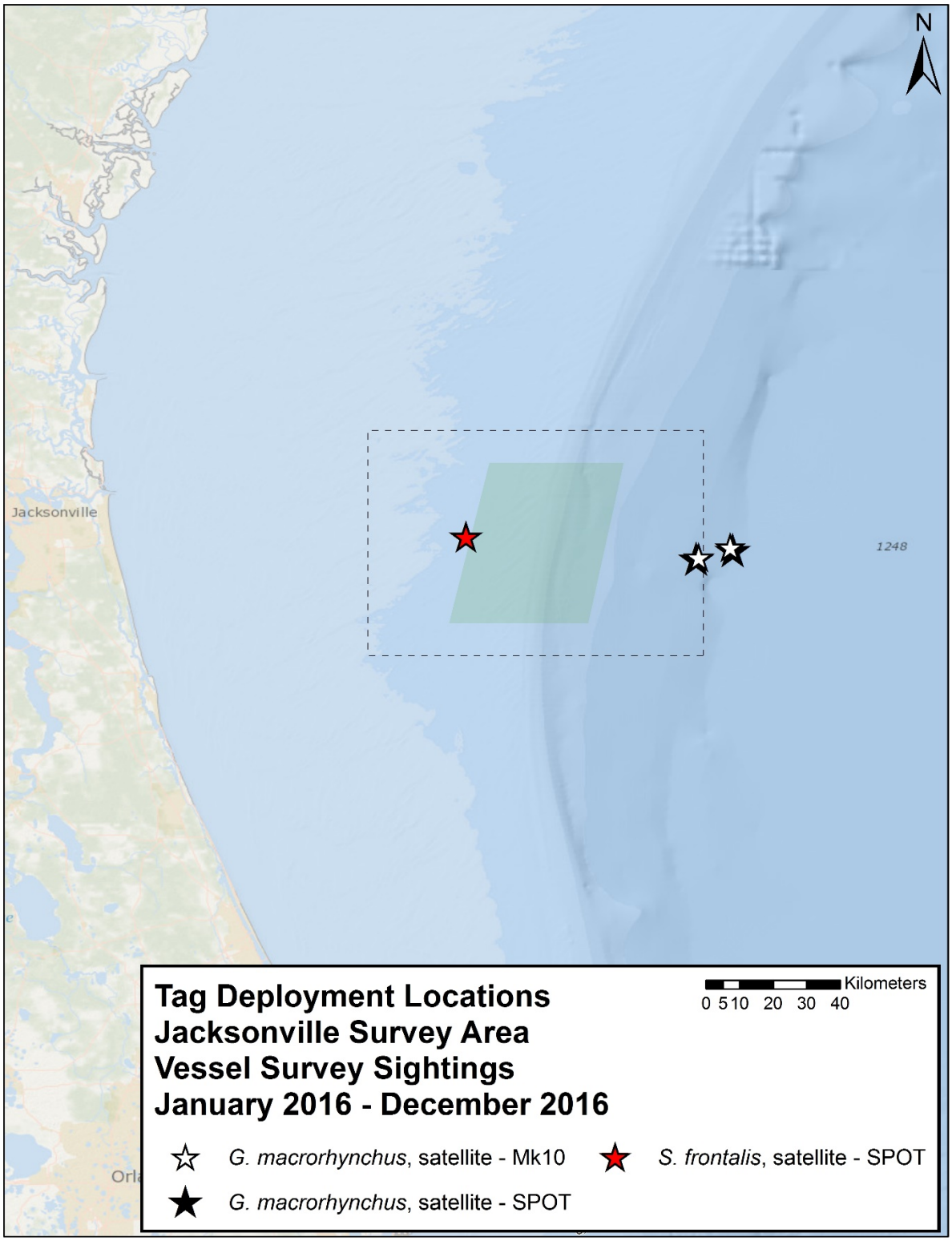

Figure 17. Locations of tag deployments in the Jacksonville survey area in June 2016.

Table 10. Summary of satellite tag deployments in the Jacksonville survey area in June 2016.

Deployment	Tag Type[1]	Animal ID[2]	ARGOS ID	Last Transmission	Duration
01-Jun-16	SPOT	SfTag001	98361	13-Jun-16	12 days
01-Jun-16	SPOT	GmTag162	53660	12-Jul-16	40 days
01-Jun-16	Mk10	GmTag163	85582	10-Jul-16	39 days
02-Jun-16	SPOT	GmTag164	109827	19-Jul-16	47 days
02-Jun-16	Mk10	GmTag165	53649	02-Jul-16	30 days

[1] Mk10=location and dive data tag; SPOT=Smart Position and Temperature (location only) tag
[2] Gm=*Globicephala macrorhynchus* (short-finned pilot whale); Sf=*Stenella frontalis* (Atlantic spotted dolphin)

Table 11. Information on movements in relation to tagging location for individuals satellite-tagged in the Jacksonville survey area in June 2016.

Animal ID[1]	Number of Locations After Filtering	Mean (SD) Distance from Tagging Location (km)	Maximum Distance from Tagging Location (km)	Total Distance Traveled (km)
SfTag001	158	13.5 (8.9)	38.9	703.6
GmTag162	332	116.5 (59.8)	293.6	3185.7
GmTag163	267	115.9 (52.6)	226.0	2393.0
GmTag164	295	138.5 (75.8)	301.6	4523.1
GmTag165	142	110.9 (80.9)	297.2	2260.6

[1] Gm=*Globicephala macrorhynchus* (short-finned pilot whale); Sf=*Stenella frontalis* (Atlantic spotted dolphin)

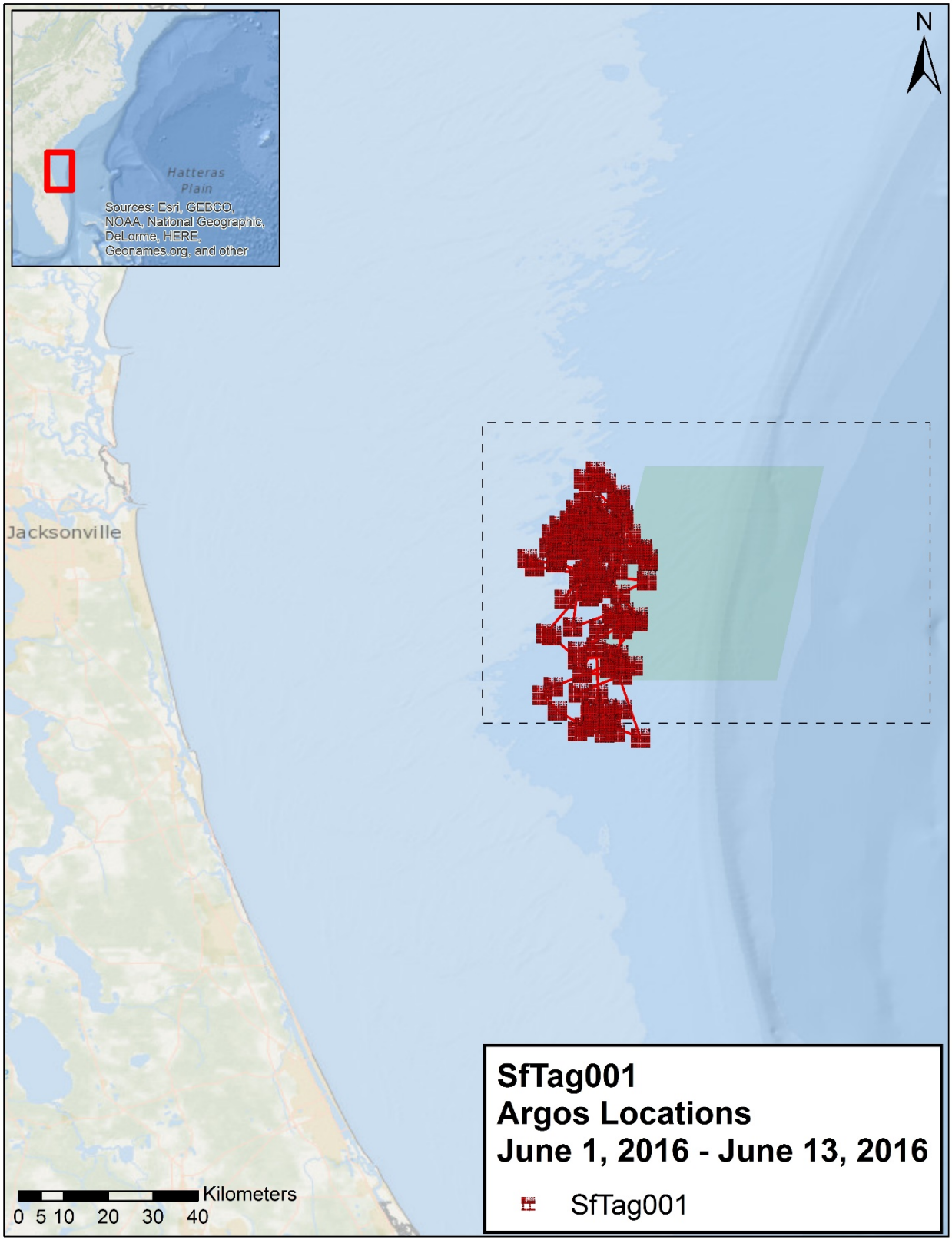

Figure 18. Filtered Argos locations of satellite-tagged Atlantic spotted dolphin SfTag001 in the Jacksonville survey area.

Table 12. GIS analyses of satellite tag data from deployments in the Jacksonville survey area in June 2016.

Animal ID[2]	Depth (m)		Distance from Shore (km)			Distance from 200-m Isobath (km)	
	Median	Max	Min	Median	Max	Median	Max
SfTag001	36.2	44.8	68.5	85.4	96.3	40.3	52.8
GmTag162	799.1	892.9	73.9	152.7	263.5	55.6	147.8
GmTag163	796.4	890.0	93.0	154.6	266.1	51.5	147.6
GmTag164	788.5	1205.6	67.7	156.9	347.7	53.5	274.7
GmTag165	688.3	897.5	68.2	164.2	306.8	39.7	190.2

[1] Mk10=location and dive data tag; SPOT=Smart Position and Temperature (location only)
[2] Gm=*Globicephala macrorhynchus* (short-finned pilot whale); Sf=*Stenella frontalis* (Atlantic spotted dolphin

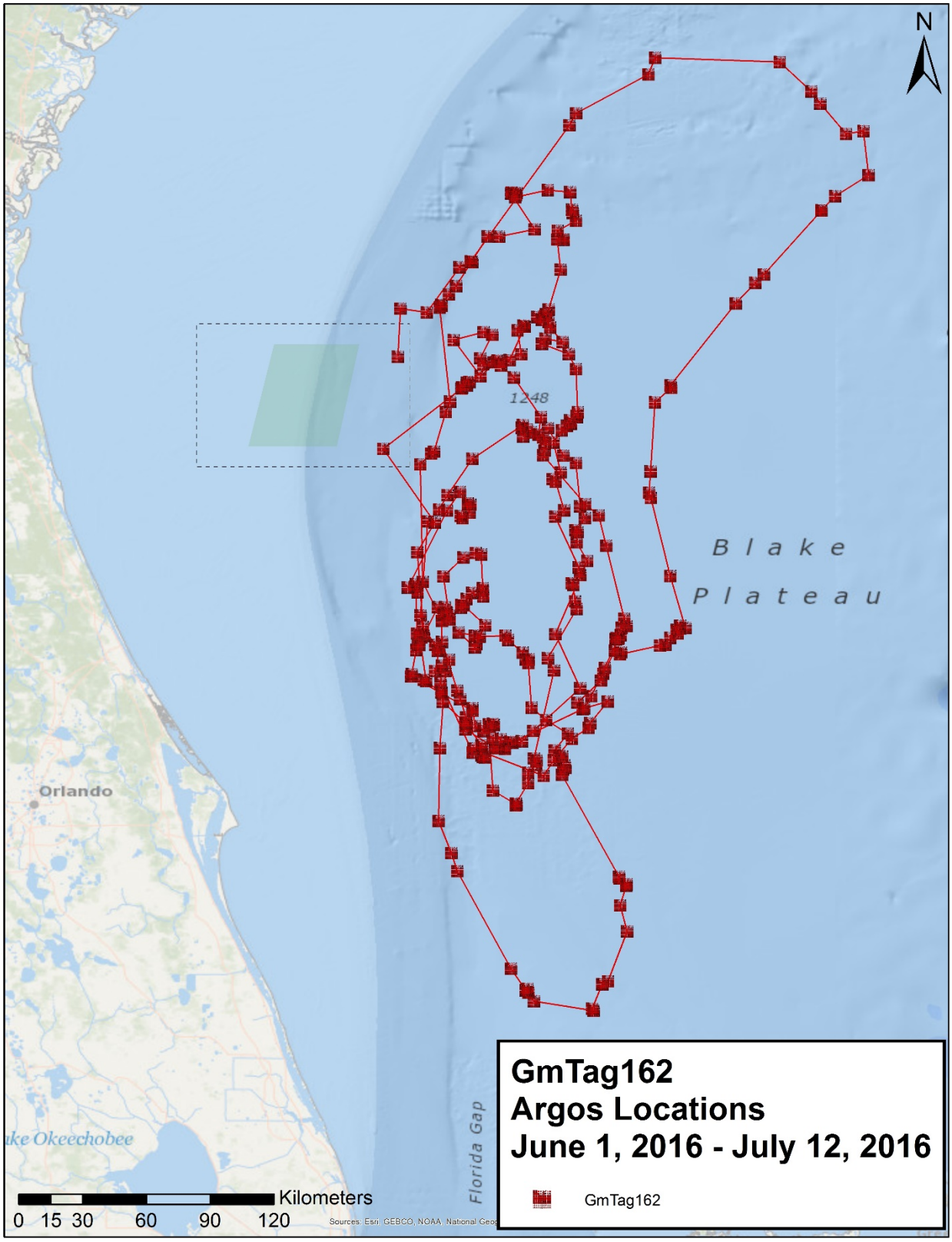

Figure 19. Filtered Argos locations of satellite-tagged short-finned pilot whale GmTag162 in the Jacksonville survey area.

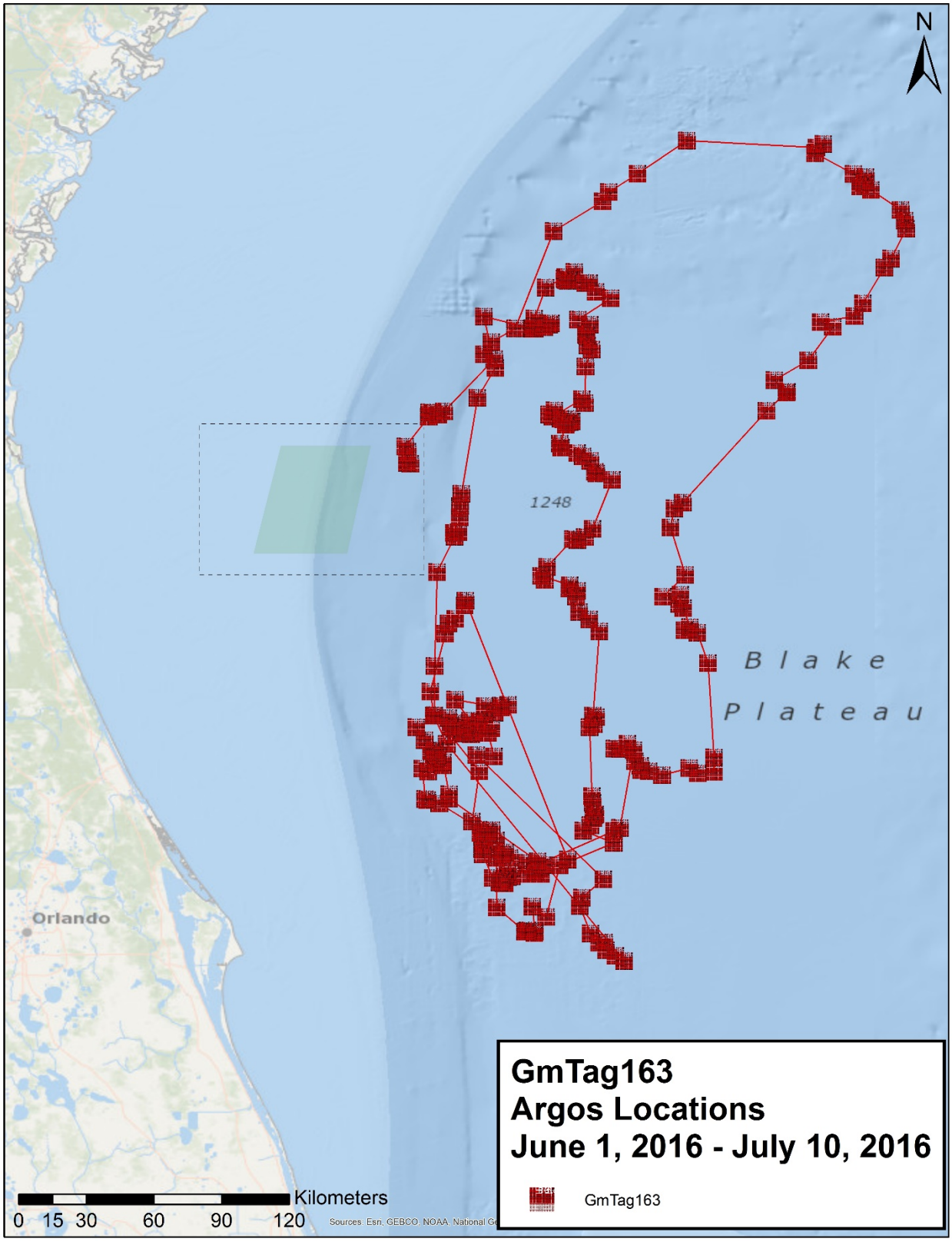

Figure 20. Filtered Argos locations of satellite-tagged short-finned pilot whale GmTag163 in the Jacksonville survey area.

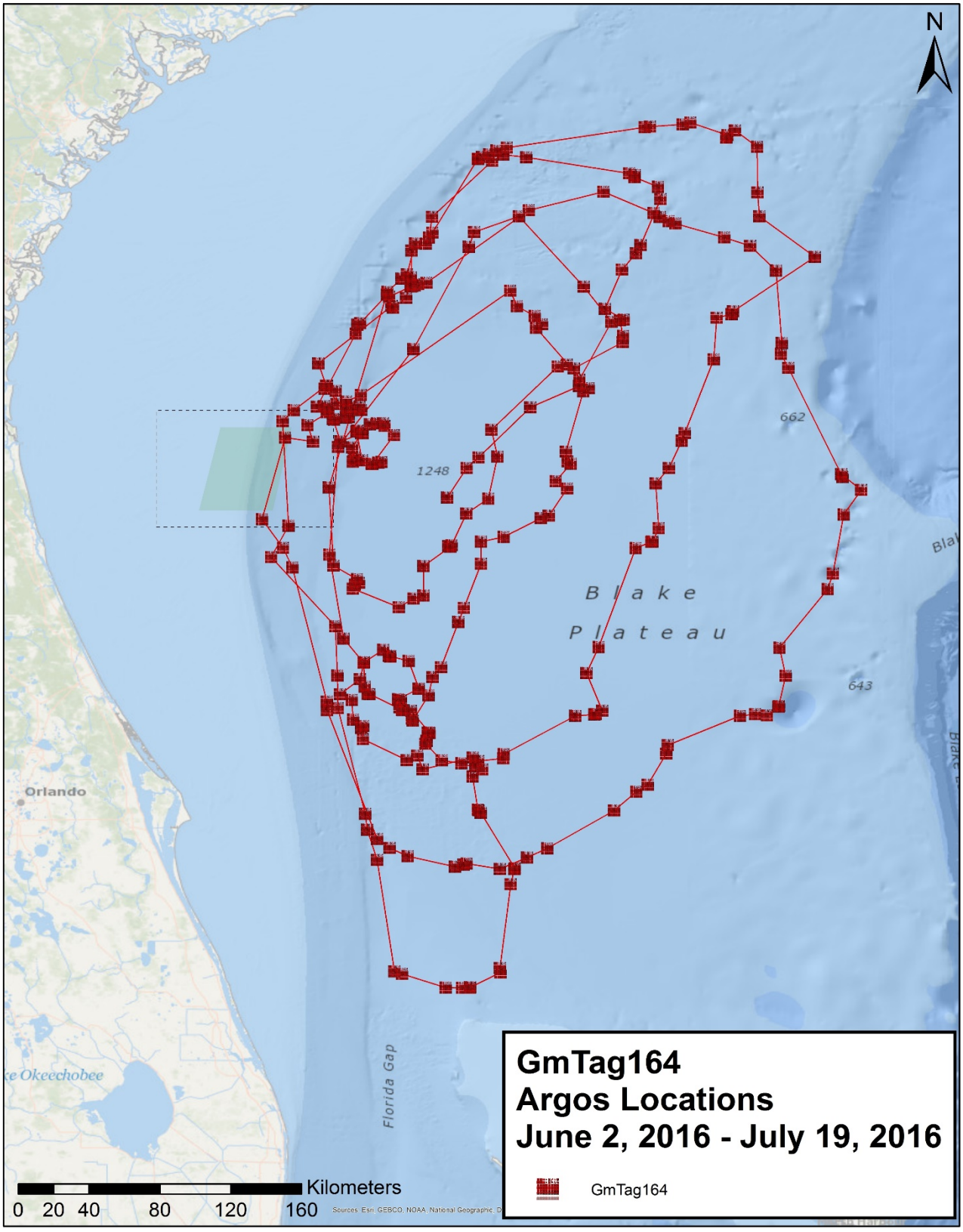

Figure 21. Filtered Argos locations of satellite-tagged short-finned pilot whale GmTag164 in the Jacksonville survey area.

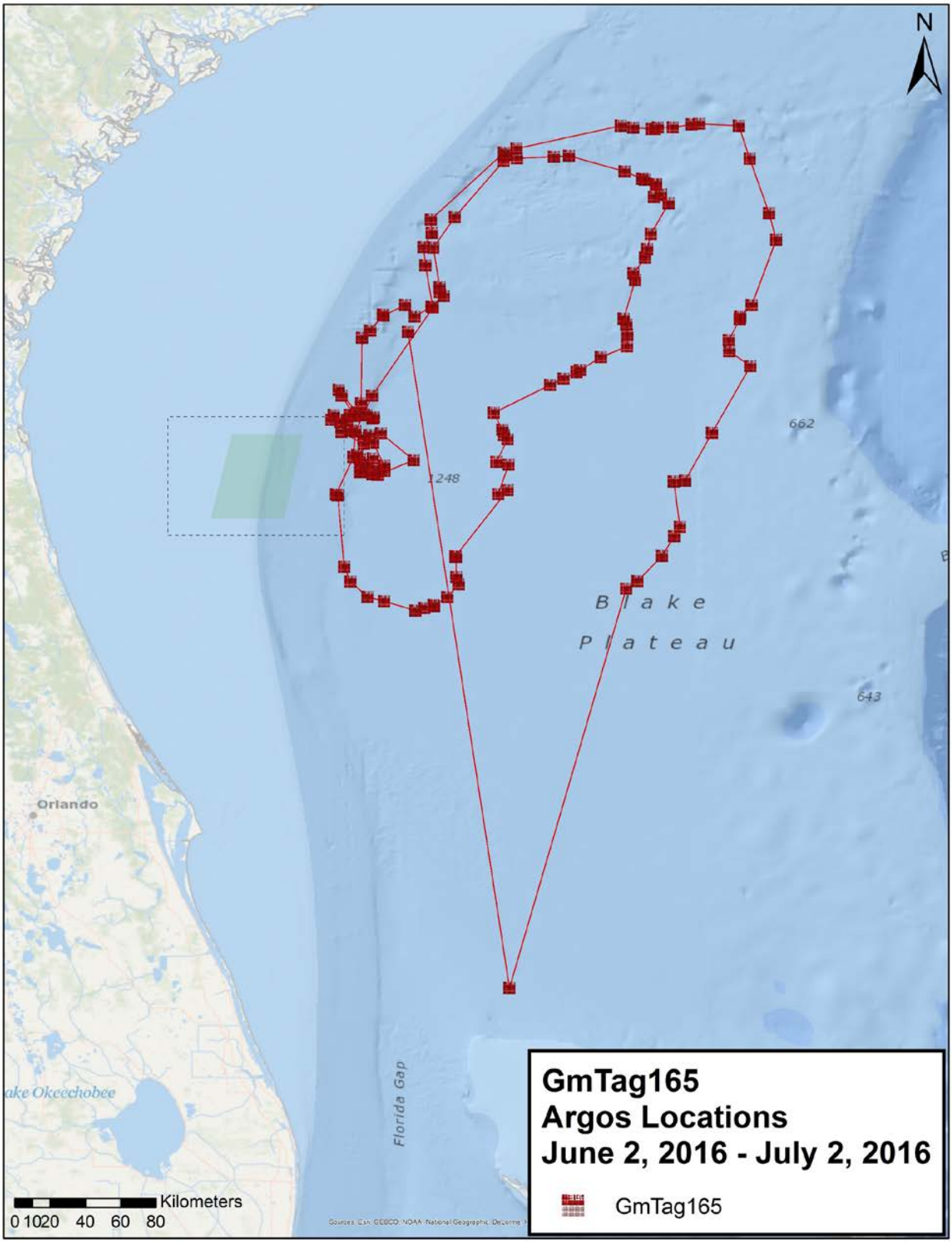

Figure 22. Filtered Argos locations of satellite-tagged short-finned pilot whale GmTag165 in the Jacksonville survey area.

3.2.5 Biopsy Sampling

Twenty-four biopsy samples were collected in the Jacksonville survey area during 2016 from short-finned pilot whales (*n*=7), Atlantic spotted dolphins *(n*=7), bottlenose dolphins (*n*=5), rough-toothed dolphins (*n*=4), and pantropical spotted dolphins (*n*=1) (**Table 13** and **Figure 23**). Skin samples will be analyzed for sex determination. Voucher specimens of these samples are archived with the National Marine Fisheries Service's Southeast Fisheries Science Center in Lafayette, Louisiana.

Table 13. Biopsy samples collected in the Jacksonville survey area in 2016.

Date	Time	Latitude (°N)	Longitude (°W)	Species	Sample #
28-Feb-16	15:24	30.46124	80.27882	*T. truncatus*	ZTS-16-001
29-Apr-16	10:26	30.08218	80.47925	*S. frontalis*	ZTS-16-003
29-Apr-16	10:50	30.06104	80.47458	*S. frontalis*	ZTS-16-004
01-Jun-16	13:32	30.23379	79.81974	*G. macrorhynchus*	ZTS_16_007
02-Jun-16	15:09	30.26452	79.73281	*G. macrorhynchus*	ZTS_16_008
21-Jul-06	08:25	30.07826	80.27345	*S. frontalis*	ZTS_16_011
21-Jul-06	08:41	30.07365	80.28150	*S. frontalis*	ZTS_16_012
21-Jul-06	11:05	30.19157	80.02223	*T. truncatus*	HJF_16_001
21-Jul-06	11:28	30.20054	80.01912	*T. truncatus*	DMW_16_001
21-Jul-06	16:26	30.20504	79.47245	*G. macrorhynchus*	ZTS_16_013
21-Jul-06	16:44	30.20256	79.46994	*G. macrorhynchus*	ZTS_16_014
22-Jul-16	10:58	30.45542	79.72751	*G. macrorhynchus*	ZTS_16_015
22-Jul-16	11:07	30.46027	79.72438	*G. macrorhynchus*	ZTS_16_016
22-Jul-16	11:40	30.47737	79.71096	*G. macrorhynchus*	ZTS_16_017
02-Aug-16	18:51	30.20776	79.66907	*S. attenuata*	ZTS_16_018
8-Sep-16	10:22	30.50641	80.37206	*S. frontalis*	ZTS-16-019
8-Sep-16	13:57	30.35005	80.37419	*S. frontalis*	ZTS-16-020
9-Sep-16	9:03	30.37214	80.74110	*S. frontalis*	ZTS-16-021
9-Sep-16	10:20	30.34731	80.54046	*T. truncatus*	ZTS-16-022
9-Sep-16	12:58	30.29177	80.14971	*T. truncatus*	ZTS-16-023
9-Sep-16	14:15	30.22190	80.20007	*S. bredanensis*	ZTS-16-024
9-Sep-16	15:11	30.23103	80.20781	*S. bredanensis*	ZTS-16-025
10-Sep-16	11:35	30.08715	80.41719	*S. bredanensis*	ZTS-16-026
10-Sep-16	11:59	30.07048	80.41210	*S. bredanensis*	ZTS-16-027

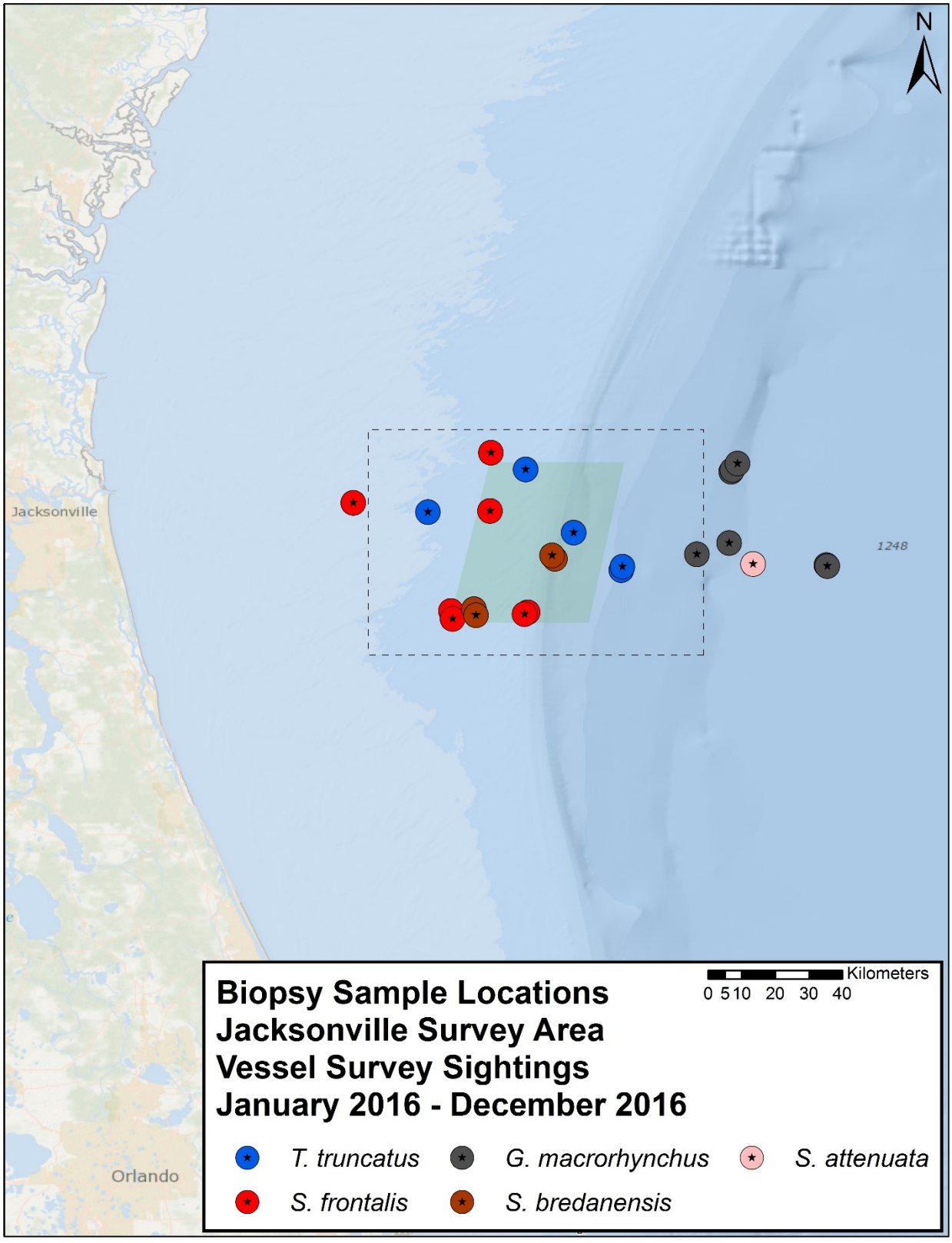

Figure 23. Locations of biopsy samples collected in the Jacksonville survey area in 2016.

3.2.6 Photographic Effort

Over 2,650 digital images were collected for species confirmation and individual identification during 2016, and 110 newly identified dolphins were cataloged (**Table 14**). Photo-identification catalogs for bottlenose and Atlantic spotted dolphins in the Jacksonville survey area currently consist of 114 and 154 individuals, respectively. Seventeen new individuals were added to the Jacksonville short-finned pilot whale catalog in 2016, for a catalog size of 29. A new catalog for rough-toothed dolphins in the Jacksonville survey area was made this year, consisting of 43 individuals. To date, three individual Atlantic spotted dolphins have been re-sighted within the Jacksonville survey area (**Figure 24**). Sfr 3-001 was observed first on 10 October 2010 and again on 19 March 2011; Sfr 8-005 was photographed during surveys on two consecutive days: 18 March 2011 and 19 March 2011; Sfr 7-008, first cataloged in 2013, was re-sighted on 29 April 2016 (**Table 15**). In addition, two bottlenose dolphins were sighted together on 25 January 2012 and 18 July 2013 (**Table 15** and **Figure 24**). The Risso's dolphin (*Grampus griseus*) photo-identification catalog consists of 36 individuals, but we have not identified any re-sightings. Eight individual rough-toothed dolphins have been re-sighted, as they were seen on consecutive days in September of 2016 (**Table 15**).

Table 14. Summary of photographs taken of animals in the Jacksonville survey area in 2016, with photo-identification catalog sizes and total number of matches to date.

Species	Common Name	Images 2016	Catalog Size	Matches
G. macrorhynchus	Short-finned pilot whale	571	29	0
G. griseus	Risso's dolphin	0	36	0
S. frontalis	Atlantic spotted dolphin	696	154	3
T. truncatus	Bottlenose dolphin	384	114	2
S. bredanensis	Rough-toothed dolphin	854	43	8

Table 15. Photo-identification matches of delphinids observed in the Jacksonville survey area.

ID	Jacksonville, Florida							
	2009	2010	2011	2012	2013	2014	2015	2016
Ttr 2-004^				X	X			
Ttr 6-010^				X	X			
Sfr 3-001		X	X					
Sfr 7-008					X			X
Sfr 8-005			X[m]					
Sbr 1-001								X[m]
Sbr 1-002								X[m]
Sbr 6-001								X[m]
Sbr 6-002								X[m]
Sbr 7-001								X[m]
Sbr 7-002								X[m]
Sbr 7-003								X[m]
Sbr 7-004								X[m]

^ Observed together in multiple sightings

[m] Re-sighted within same month

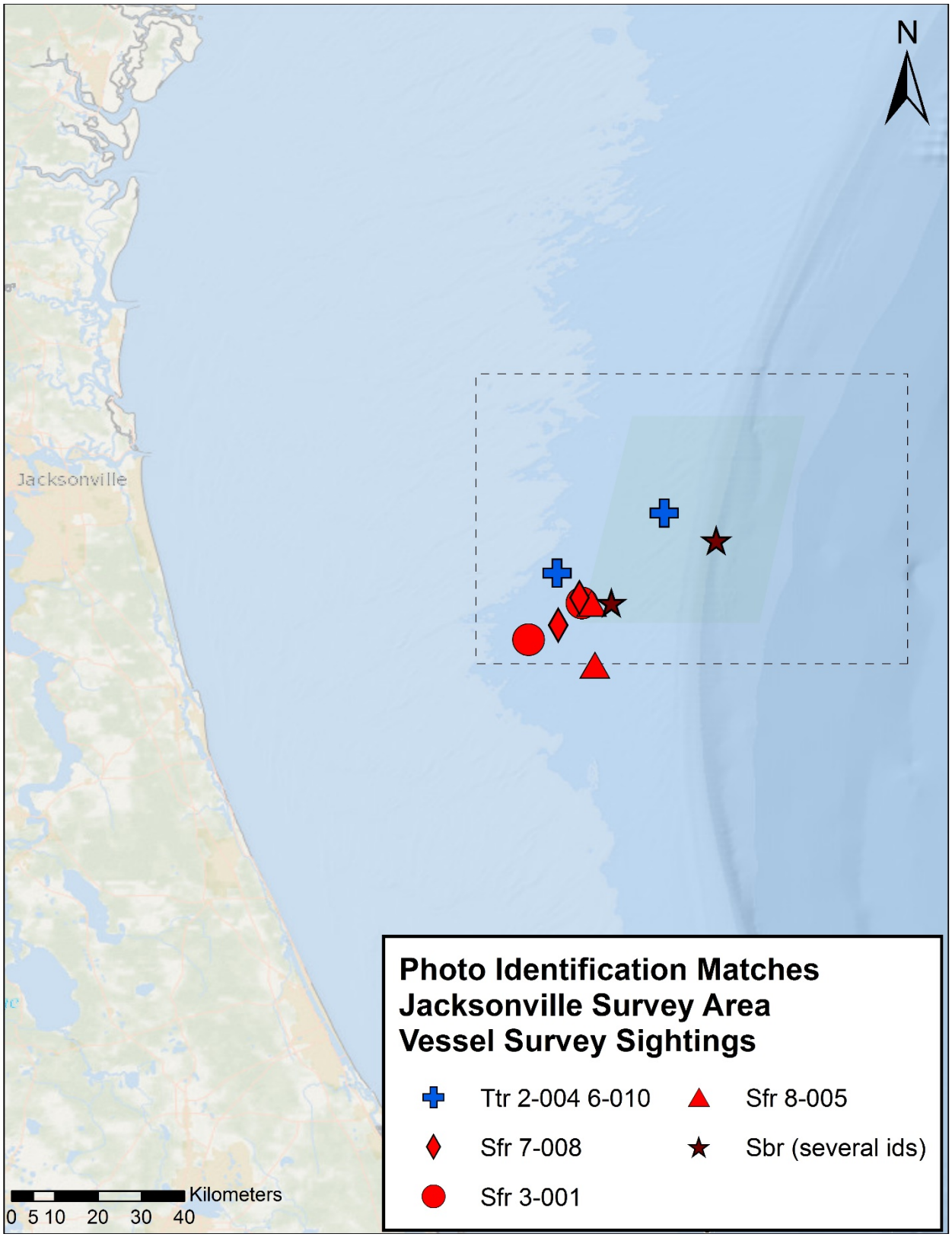

Figure 24. Locations of photo-matched dolphins within the Jacksonville survey area.

The Jacksonville short-finned pilot whale photo-identification catalog has been compared to both the Onslow Bay and Cape Hatteras short-finned pilot whale photo-identification catalogs, and no matches have been identified.

We also compared the short-finned pilot whale photo-identification catalogs from both the Jacksonville and Onslow Bay survey areas with catalogued individuals from The Bahamas, where the Bahamas Marine Mammal Research Organization has been conducting surveys since 1991. More recently in The Bahamas, a U.S. Department of Defense's Strategic Environmental Research and Development Program project evaluating the behavioral ecology of deep-diving odontocetes of the area was conducted, and the short-finned pilot whale was one of the six target species.

Collectively, short-finned pilot whales have been observed on ten occasions in the Onslow Bay and Jacksonville survey areas since surveys commenced in 2007. The Onslow Bay survey area has a short-finned pilot whale photo-identification catalog of 27 individuals, while the Jacksonville photo-identification catalog contains 29 individuals. To date, 12 short-finned pilot whales from these areas have been matched to the Bahamas catalog: five were observed in the Onslow Bay survey area and seven in the Jacksonville survey area (**Figure 25**). Five individuals were observed in the same group in both The Bahamas (02 June 2009) and Onslow Bay (18 August 2009), observed just over two months apart. Interestingly all seven of the JAX matches were observed on the same day in the same group in both The Bahamas (17 September 2007) and in the Jacksonville survey area (26 September 2009). Additionally, three of these seven individuals observed in the Jacksonville survey area in 2009 were again observed in The Bahamas on 22 August 2015. We will continue to compare these catalogs for matches as photo-identification continues, as well as comparing the Cape Hatteras short-finned pilot whale photo-identification catalog to The Bahamas photo-identification catalog.

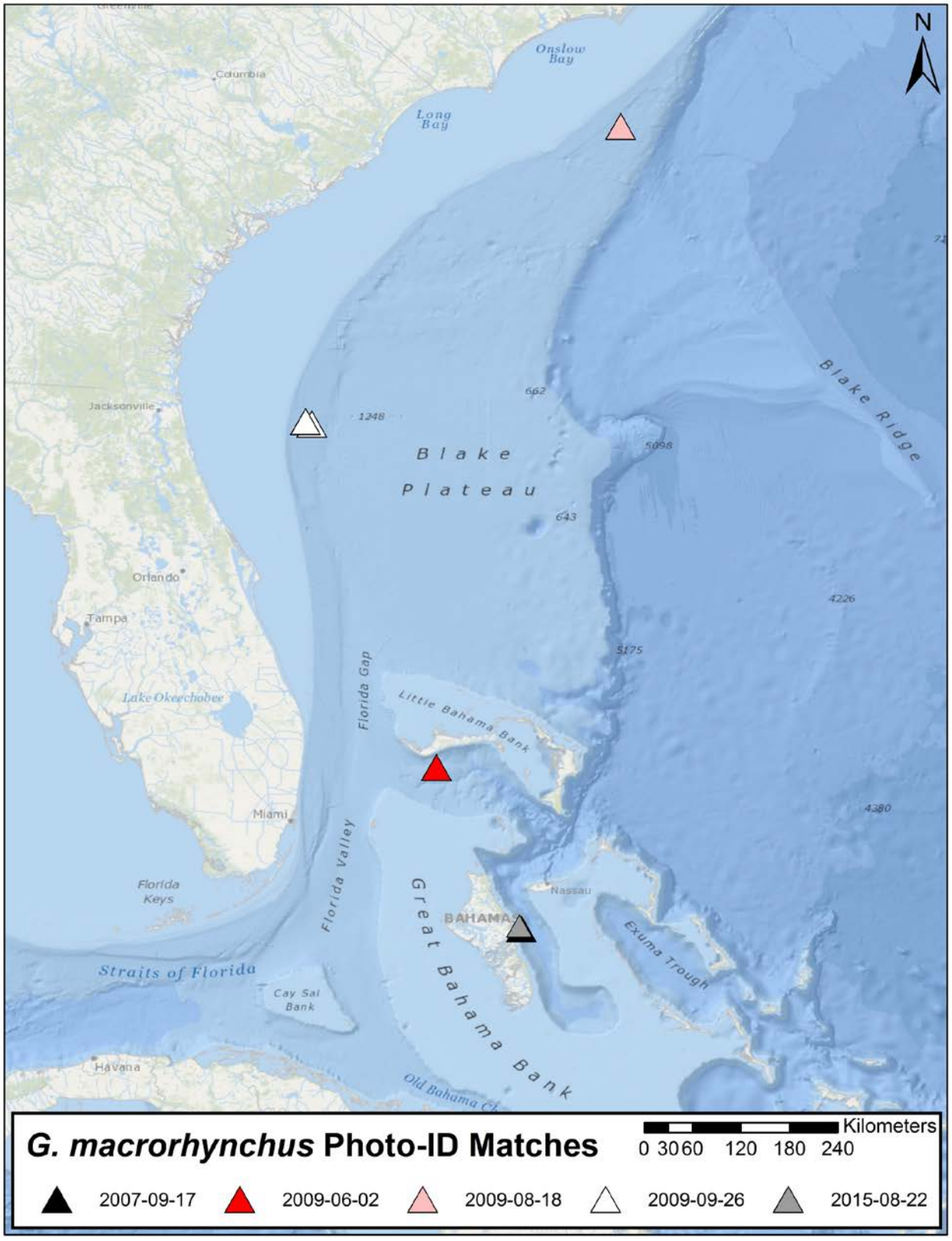

Figure 25. Locations of photo-matched short-finned pilot whales between the Onslow Bay, Jacksonville, and Bahamas photo-ID catalogs.

4. Cape Hatteras Vessel Surveys

4.1 Photographic Effort

Nearly 3,000 digital images were obtained to determine species confirmation and identify individual animals during fieldwork in 2016. Images of 414 newly identified animals were added to seven existing photo-identification catalogs of bottlenose dolphins, Atlantic spotted dolphins, short-finned pilot whales, sperm whales (*Physeter macrocephalus*), Cuvier's beaked whales (*Ziphius cavirostris*), short-beaked common dolphins (*Delphinus delphis*), and Risso's dolphins. In 2016, a new photo-identification catalog was established for the Clymene dolphin *(Stenella clymene*). To date, photo-identification catalogs for 11 species have been assembled from both AFTT marine species monitoring and tagging surveys, with 177 individuals re-sighted across all species (**Table 16**).

Table 16. Summary of images collected during all fieldwork in the Cape Hatteras survey area in 2016, with photo-identification catalog sizes and total matches to date.

Species	Images 2016	Catalog Size	Matches
Balaenoptera physalus	0	1	0
Delphinus delphis	116	30	1
Globicephala macrorhynchus	1,498	718	160
Grampus griseus	482	9	0
Kogia spp.	0	1	0
Megaptera novaeangliae	0	2	0
Physeter macrocephalus	0	14	1
Stenella clymene	148	3	0
Stenella frontalis	0	24	0
Tursiops truncatus	374	274	9
Ziphius cavirostris	360	50	6

Photo-analysis of the images taken in the Cape Hatteras survey area is ongoing. To date, nine bottlenose dolphins have been photographed on multiple occasions, spanning several years (**Table 17**). Bottlenose dolphin Ttr 1-001 was first photographed on 20 July 2009, re-sighted on 30 May 2011, and then photographed for a third time on 27 June 2011. Ttr 6-018 and Ttr 9-013 were photographed together in both March 2012 and May 2013. Ttr 6-020 was observed in May 2011 and then again in October 2013. Ttr 7-031 and Ttr 7-038 were photographed on two separate occasions in 2011, and Ttr 7-058 was observed twice within 2013. Ttr 9-016 was initially photographed in 2011 and then again in June 2014. Ttr 9-027, first observed on 11 June 2014 (TtTag015), was observed a second time on 16 June 2014.

Table 17. Photo-identification matches of individual odontocete cetaceans, excluding short-finned pilot whales, in the Cape Hatteras survey area.

ID[1]	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Ttr 1-001				X		X[y]					
Ttr 6-018^							X	X			
Ttr 6-020						X		X			
Ttr 7-031						X[y]					
Ttr 7-038						X[y]					
Ttr 7-058								X[y]			
Ttr 9-013^							X	X			
Ttr 9-016						X			X		
Ttr 9-027 (TtTag015)									X[m]		
Dde 7-002		X					X				
Pma-004								X[m]			
Zca-001r								X		X	
Zca-003r (ZcTag029)									X[m]		
Zca-005									X	X	
Zca-005r									X[y]		
Zca-006 (ZcTag040)									X	X	
Zca-008r (ZcTag047)									X		X

[1] Dde=*Delphinus delphis* (short-beaked common dolphin); Gm=*Globicephala macrorhynchus* (short-finned pilot whale); Pma=*Physeter macrocephalus* (sperm whale); Sf=*Stenella frontalis* (Atlantic spotted dolphin; Ttr=*Tursiops truncatus* (bottlenose dolphin); Zca=*Ziphius cavirostris* (Cuvier's beaked whale)

m - re-sighted within same month

y - re-sighted within same year

^Observed together in multiple sightings

A single match of a short-beaked common dolphin off Cape Hatteras has been made; Dde 7-002 was first photographed on 27 May 2007 and then re-sighted nearly five years later on 15 March 2012 (**Table 17)**.

A single sperm whale match has been made; Pma-004 was observed on 27 and 29 May in 2013.

Six Cuvier's beaked whale matches have been made to date; two were made during this reporting period. Zca_003r, was satellite-tagged on 13 May 2014 (ZcTag029) and photographed again five days later. Zca_005r was photographed in May and October of 2014. Zca_006 was first photographed on 26 May 2014 and was DTagged at that time, although the tag was never recovered. On 14 June 2015 it was re-sighted and satellite-tagged (ZcTag040). Zca_001r was photographed in a group of four animals on 05 October 2013 and was photographed again on 14 June 2015 in a group of five to seven whales. This individual represents our longest re-sighting of a beaked whale and is also an inter-seasonal match (**Table 17**). Zca_005 was

initially sighted in May of 2014 and was re-sighted in June of 2015. Finally, Zca_008r was first seen in October of 2014 and was re-sighted and satellite-tagged in May of 2016 (ZcTag047).

None of the five short-finned pilot whales that were satellite-tagged in 2016 were matched to the existing catalog. Six of the 19 short-finned pilot whales equipped with satellite tags in 2015 were either re-sighted or matched to the catalog. GmTag 122 was first seen in May of 2012; it was satellite-tagged on 16 May of 2015 and then sighted for a third time on 24 May 2015. Interestingly, Gma_2-011 (a female) was seen in the same three sightings as GmTag122 over the three-year span. GmTag127 was satellite-tagged on 19 May 2015 and then re-sighted on both 24 and 25 May 2015. GmTag128 was first sighted on 01 June 2015 and was subsequently satellite-tagged on 16 June 2015. GmTag135 was also initially sighted in June of 2015 and was later instrumented with a satellite tag in October 2015. GmTag136 was DTagged in May of 2012, re-sighted for the first time in May of 2015 and subsequently re-sighted and satellite-tagged in October of 2015. GmTag142 was first photographed in July of 2010; it was seen again in July of 2013 and then satellite-tagged in October of 2015. In addition, GmTag097, who was satellite-tagged on 11 September 2014, was re-sighted on 24 May 2015.

The relatively high re-sighting rate of short-finned pilot whales in the Hatteras study area continued during 2016. To date more than 22 percent (160 of 718) of the pilot whales in the catalog have been re-sighted, up from last reporting period when the re-sighting rate of pilot whales was at 17 percent (61 of 367). Many individuals have been re-sighted on multiple occasions within the same year (57 of the 160 matches) and in different seasons; Gma_7-198, Gma_7-208 and Gma_7-211 were all sighted in May and October of 2015 and Gma_6-085 was sighted twice in May 2015 and on a third occasion in December 2015. In addition, nearly 65 percent of matches are re-sights between multiple years (103 of the 160 matches). Sixteen of the short-finned pilot whales in our catalog have been sighted on four or more occasions and one individual, Gma_9-027, has been photographed in six separate sightings between May of 2008 and May of 2015.

5. Summary Tables

Total survey effort conducted since the beginning of the monitoring program, including all AFTT protected species monitoring and Deep Divers tagging effort in each survey area is reported in **Tables 18 through 20**. The annual numbers of sightings by species for both cetaceans and sea turtles in each survey area are presented in **Tables 21 through 26**. The number of biopsy samples collected to date in each survey area is reported in **Tables 27 through 29**. **Tables 30 through 32** summarize the catalog sizes and matches by species to date and images taken during the reporting period in the survey areas.

Table 18. Duration and distance surveyed during Year 1 (July 2009–December 2010), Year 2 (2011), Year 3 (2012), Year 4 (2013), Year 5 (2014), Year 6 (2015), and Year 7 (2016) in the Cape Hatteras survey area.

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Total
Survey Hours	26.3	179.9	86.8	63.2	121.7	134.5	57.3	669.7
km Surveyed	296.4	1097.4	1049.4	878.7	921.9	990.8	456.7	5,691.3

Table 19. Duration and distance surveyed during Year 1 (June 2007–June 2008), Year 2 (July 2008–June 2009), Year 3 (July 2009–June 2010), Year 4 (July 2010–December 2011), Year 5 (2012), Year 6 (2013), Year 8 (2015), and Year 9 (2016) in the Onslow Bay survey area.

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 8	Year 9	Total
Survey Hours	170.7	109.0	105.7	53.6	31.5	14.6	9.08	6.9	501.08
km Surveyed	2,333.6	1,742.4	1,555.8	754.1	496.8	185.6	122.1	124.5	7,314.9

Table 20. Duration and distance surveyed during Year 1 (July 2009–December 2010), Year 2 (2011), Year 3 (2012), Year 4 (2013), Year 5 (2014), Year 6 (2015), and Year 7 (2016) in the Jacksonville survey area.

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Total
Survey Hours	127.1	20.9	58.6	58.7	66.8	44.2	130.7	507.0
km Surveyed	2,073.5	345.7	937.4	1,021.7	1,227.4	858.2	2,135.5	8,599.4

Table 21. Numbers of cetacean sightings for each species observed during Year 1 (July 2009–December 2010), Year 2 (2011), Year 3 (2012), Year 4 (2013), Year 5 (2014), Year 6 (2015), and Year 7 (2016) of vessel surveys in the Cape Hatteras survey area.

Species	Sightings						
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Balaenoptera physalus	0	0	1	2	0	0	0
Delphinus delphis	0	6	11	3	4	4	3
Globicephala macrorhynchus	9	33	52	35	26	53	16
Grampus griseus	1	2	2	0	1	2	2
Kogia sp.	0	0	0	0	0	1	0
Mesoplodon sp.	0	0	0	1	0	0	1
Physeter macrocephalus	0	1	4	3	2	4	0
Stenella clymene	0	0	0	0	0	0	1
Stenella frontalis	0	8	2	3	3	3	0
Stenella/Delphinus mix	0	1	0	0	0	0	0
Tursiops truncatus	23	27	54	38	14	47	32
Tursiops/Stenella mix	0	1	0	0	0	0	0
Ziphius cavirostris	0	3	1	2	16	13	7
Unidentified baleen whale	0	0	0	0	0	1	0
Unidentified beaked whale	0	0	0	4	3	1	0
Unidentified small whale	0	0	0	0	0	1	0
Unidentified delphinid	1	0	3	1	0	1	0
Total	**34**	**82**	**130**	**92**	**69**	**131**	**62**

Table 22. Numbers of cetacean sightings for each species observed during Year 1 (June 2007–June 2008), Year 2 (July 2008–June 2009), Year 3 (July 2009–June 2010), Year 4 (July 2010–December 2011), Year 5 (2012), Year 6 (2013), Year 8 (2015), and Year 9 (2016) in the Onslow Bay survey area.

Species	Sightings							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 8	Year 9
Globicephala macrorhynchus	1	0	2	0	0	1	0	0
Grampus griseus	3	0	3	0	1	0	0	0
Mesoplodon sp.	0	0	0	0	2	0	0	0
Stenella frontalis	6	17	17	9	1	0	2	2
Steno bredanensis	0	0	1	0	0	0	0	0
Tursiops truncatus	23	14	29	7	7	6	3	0
Unidentified delphinid	3	2	3	0	0	0	0	0
Unidentified small whale	0	0	0	0	1	0	0	0
Total	**36**	**33**	**55**	**16**	**12**	**7**	**5**	**2**

Table 23. Numbers of cetacean sightings for each species observed during Year 1 (July 2009–December 2010), Year 2 (2011), Year 3 (2012), Year 4 (2013), Year 5 (2014), Year 6 (2015), and Year 7 (2016) in the Jacksonville survey area.

Species	Sightings						
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Eubalaena glacialis	0	0	0	0	1	0	0
Globicephala macrorhynchus	3	0	0	0	0	0	5
Grampus griseus	2	0	0	1	1	1	0
Stenella attenuata	0	0	0	0	0	0	2
Stenella frontalis	35	6	14	9	20	10	10
Steno bredanensis	0	0	0	0	0	0	2
Tursiops truncatus	19	6	23	15	18	10	18
Tursiops/Stenella mix	0	0	0	0	1	0	0
Unidentified delphinid	13	0	4	3	4	0	5
Total	**72**	**12**	**41**	**28**	**45**	**21**	**42**

Table 24. Numbers of sea turtle sightings for each species observed during Year 1 (July 2009–December 2010), Year 2 (2011), Year 3 (2012), Year 4 (2013), Year 5 (2014), Year 6 (2015), and Year 7 (2016) of vessel surveys in the Cape Hatteras survey area.

Species	Sightings						
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Caretta caretta	2	0	2	7	0	2	0
Chelonia mydas	0	0	0	1	0	0	0
Dermochelys coriacea	0	0	0	0	0	4	0
Unidentified sea turtle	0	0	1	0	0	0	0
Total	**2**	**0**	**3**	**8**	**0**	**6**	**0**

Table 25. Numbers of sea turtle sightings for each species observed during Year 1 (June 2007–June 2008), Year 2 (July 2008–June 2009), Year 3 (July 2009–June 2010), Year 4 (July 2010–December 2011), Year 5 (2012), Year 6 (2013), Year 8 (2015), and Year 9 (2016) in the Onslow Bay survey area.

Species	Sightings							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 8	Year 9
Caretta caretta	19	49	47	3	2	1	0	0
Dermochelys coriacea	0	0	2	0	0	0	0	0
Unidentified sea turtle	1	0	1	0	0	0	0	0
Total	**20**	**49**	**50**	**3**	**2**	**1**	**0**	**0**

Table 26. Numbers of sea turtle sightings for each species observed during Year 1 (July 2009–December 2010), Year 2 (2011), Year 3 (2012), Year 4 (2013), Year 5 (2014), Year 6 (2015), and Year 7 (2016) in the Jacksonville survey area.

Species	Sightings						
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Caretta caretta	52	20	41	33	31	22	22
Dermochelys coriacea	8	3	4	1	3	2	4
Lepidochelys kempii	1	0	1	0	0	0	0
Unidentified sea turtle	8	3	3	1	0	0	0
Total	**69**	**26**	**49**	**35**	**34**	**24**	**26**

Table 27. Biopsy samples collected to date during Year 2 (2011), Year 3 (2012), Year 4 (2013), Year 5 (2014), Year 6 (2015), and Year 7 (2016) of vessel surveys in the Cape Hatteras survey area.

Species	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Total
Balaenoptera physalus	0	0	3	0	0	0	3
Delphinus delphis	0	5	2	0	1	0	8
Globicephala macrorhynchus	4	33	10	5	14	4	70
Grampus griseus	0	0	2	0	0	0	2
Physeter macrocephalus	0	0	1	1	0	0	2
Stenella frontalis	6	0	2	2	2	0	12
Tursiops truncatus	14	10	13	2	1	0	40
Ziphius cavirostris	0	0	2	0	2	0	4
Total	**24**	**48**	**35**	**10**	**20**	**4**	**141**

Table 28. Biopsy samples collected during Year 4 (July 2010–December 2011), Year 5 (2012), Year 6 (2013), Year 8 (2015), and Year 9 (2016) in the Onslow Bay survey area.

Species	Year 4	Year 5	Year 6	Year 8	Year 9	Total
Globicephala macrorhynchus	0	0	3	0	0	3
Grampus griseus	0	5	0	0	0	5
Stenella frontalis	2	2	0	0	0	4
Tursiops truncatus	0	8	7	0	0	15
Total	**2**	**15**	**10**	**0**	**0**	**27**

Table 29. Biopsy samples collected during Year 1 (July 2009–December 2010), Year 2 (2011), Year 3 (2012), Year 4 (2013), Year 5 (2014), Year 6 (2015), and Year 7 (2016) in the Jacksonville survey area.

Species	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Total
Globicephala macrorhynchus	0	0	0	0	0	0	5	5
Grampus griseus	0	0	0	1	2	0	0	3
Stenella attenuata	0	0	0	0	0	0	1	1
Stenella frontalis	0	0	19	6	19	3	7	54
Steno bredanensis	0	0	0	0	0	0	4	4
Tursiops truncatus	0	0	12	5	10	5	5	37
Total	**0**	**0**	**31**	**12**	**31**	**8**	**22**	**104**

Table 30. Summary of images collected during all vessel surveys in the Cape Hatteras survey area, January 2009–December 2016, with photo-identification catalog sizes and matches to date.

Species	2009-2015		2016	
	Catalog Size	Matches	Catalog Size	Matches
Balaenoptera physalus	1	0	1	0
Delphinus delphis	30	1	30	1
Globicephala macrorhynchus	367	61	718	160
Grampus griseus	8	0	9	0
Kogia sp.	1	0	1	0
Megaptera novaeangliae	2	0	2	0
Physeter macrocephalus	13	1	14	1
Stenella clymene	0	0	3	0
Stenella frontalis	24	0	24	0
Tursiops truncatus	221	9	274	9
Ziphius cavirostris	42	4	50	6

Table 31. Summary of images collected during all vessel surveys in the Onslow Bay survey area, June 2007–December 2016, with photo-identification catalog sizes and matches to date.

Species	Year 1		Year 2		Year 3		Year 4		Year 5		Year 6		Year 8		Year 9	
	Catalog Size	Matches	Catalog Size	Matches	Catalog Size	Matches	Catalog Size	Matches	Catalog Size	Matches	Catalog Size	Matches	Catalog Size	Matches	Catalog Size	Matches
G. macrorhynchus	8	0	8	0	16	0	16	0	16	0	23	0	23	0	27	0
G. griseus	5	0	5	0	7	0	7	0	22	0	22	0	22	0	22	0
S. frontalis	3	0	29	0	49	1	68	2	78	3	78	4	86	4	86	5
S. bredanensis	0	0	0	0	12	0	12	0	12	0	12	0	12	0	133	8
T. truncatus	52	0	78	0	106	5	112	5	139	7	126	8	133	8	12	0

Table 32. Summary of images collected during all vessel surveys in the Jacksonville survey area, January 2009–December 2016, with photo-identification catalog sizes and matches to date.

Species	Year 1		Year 2		Year 3		Year 4		Year 5		Year 6		Year 7	
	Catalog Size	Matches	Catalog Size	Matches	Catalog Size	Matches	Catalog Size	Matches	Catalog Size	Matches	Catalog Size	Matches	Catalog Size	Matches
G. macrorhynchus	0	0	0	0	0	0	12	0	12	0	12	0	29	0
G. griseus	1	0	1	0	1	0	7	0	22	0	36	0	36	0
S. frontalis	0	0	41	0	60	2	77	2	111	2	118	2	154	3
T. truncatus	0	0	21	0	41	0	52	2	80	2	100	2	114	2
S. bredanensis	0	0	0	0	0	0	0	0	0	0	0	0	43	8

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