Small-Vessel Surveys for Protected Marine Species in Navy OPAREAs off the U.S. Atlantic Coast: 2017 Annual Progress Report

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Cover Photo Credit:

Bottlenose dolphin (*Tursiops truncatus*). Photographed by Ellie Heywood, Duke University, taken under General Authorization Letter of Confirmation 19903 held by Duke University.

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Acronyms and Abbreviations

AFTT	Atlantic Fleet Testing and Training
F/V	fishing vessel
JAX	Jacksonville
km	kilometer(s)
OPAREA	Operating Area
Photo-ID	Photo-identification
R/V	research vessel
U.S.	United States
USWTR	Undersea Warfare Training Range

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 the coast of 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. More than eight 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 eight 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.

This report describes vessel survey monitoring activities, including photo-identification (photo-ID) and biopsy-sampling, at the Jacksonville study area in 2017. Fieldwork at Cape Hatteras in 2017 was dedicated to the Satellite-Tagging and Behavioral Response Study Projects, and is reported separately (Baird et al. 2018, Southall et al. 2018), but here we report on photographic identification work and summaries for multiple tagging projects and Atlantic Fleet Testing and Training (AFTT) protected species monitoring for Cape Hatteras and Jacksonville.

2. Jacksonville Vessel Surveys

2.1 Methods

2.1.1 Study Area

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

2.1.2 Data Collection

Vessel survey effort in JAX during 2017 focused on questions of residency and population structure of odontocete cetaceans. Surveys were conducted from the research vessel (R/V) *Richard T. Barber* and fishing vessel (F/V) *Jodie Lynn II* (**Figure 2**) at speeds of approximately 8 to 15 knots (15 to 28 kilometers [km]/hour), with higher speeds utilized during transiting within the survey area. 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 conditions, Beaufort sea state, 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.

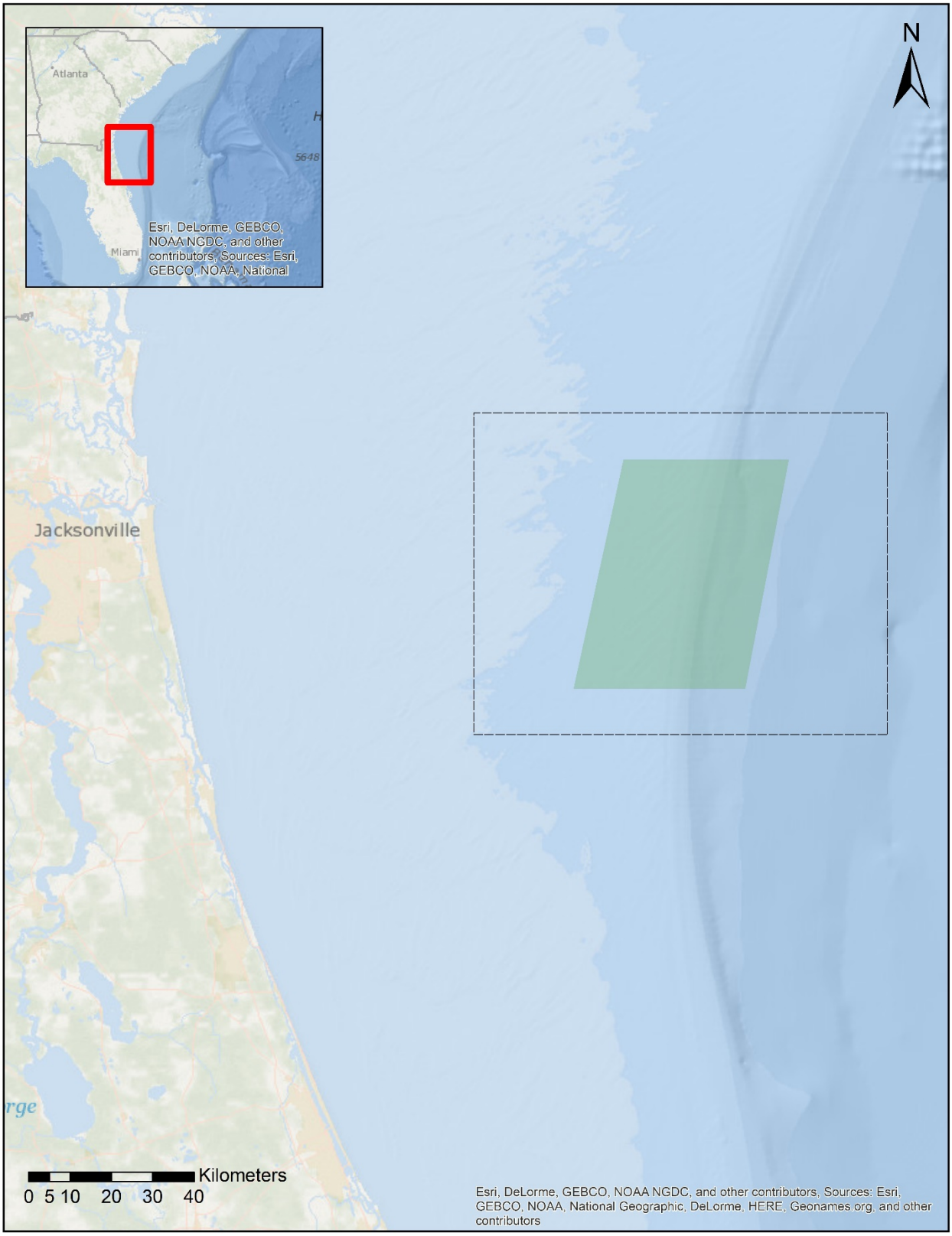

Figure 1. Map of the Jacksonville study area (dashed outline) and the planned USWTR site (shaded box).

Figure 2. The R/V *Richard T. Barber* (left) and F/V *Jodie Lynn II* (right).

Use of the survey area by individual cetaceans was examined using photo-ID, 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 × 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.

2.1.3 Data Analysis

Vessel survey effort and sighting data were mapped using *ArcGIS* 10.5. All sighting data collected will be posted on the data archive OBIS-SEAMAP.

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

Ten days of vessel surveys were conducted in 2017, totaling 1,424 km, or 66.1 hours, of survey effort (**Table 1**). These surveys were conducted in Beaufort sea state 0 to 4 and covered the proposed USWTR site, including shelf and pelagic waters. Survey effort in waters east of the shelf break was attempted on every trip with favorable conditions (**Figure 3**).

Table 1. Dates, distances and durations surveyed during small-vessel surveys in the Jacksonville survey area in 2017.

Date	Sea State	km Surveyed	Survey Time (hr:min)	At-Sea Time	Platform
14-Feb-17	2–4	81.6	04:00	10:18	R/V *R.T. Barber*
17-Feb-17	2–4	126.1	04:51	09:34	R/V *R.T. Barber*
12-Jun-17	0–3	197.0	08:24	10:58	F/V *Jodie Lynn II*
13-Jun-17	0–3	175.0	08:02	10:50	F/V *Jodie Lynn II*
14-Jun-17	0–2	181.0	08:07	10:56	F/V *Jodie Lynn II*
19-Jul-17	1–3	124.0	06:35	09:35	R/V *R.T. Barber*
20-Jul-17	2–3	157.0	08:05	10:53	R/V *R.T. Barber*
21-Jul-17	1–3	133.0	04:03	06:36	R/V *R.T. Barber*
07-Nov-17	2–4	130.4	06:42	09:56	R/V *R.T. Barber*
08-Nov-17	2	119.1	07:17	10:28	R/V *R.T. Barber*

2.2.2 Marine Mammal and Sea Turtle Sightings

Thirty-seven cetacean sightings of four species were recorded during these vessel surveys. As in previous years, common bottlenose (*Tursiops truncatus*) (*n*=16) and Atlantic spotted dolphins (*Stenella frontalis*) (*n*=18) dominated the fauna, in addition to two sightings of Risso's dolphins (*Grampus griseus*) and one of rough-toothed dolphins (*Steno bredanensis*) (**Tables 2 and 3**). Thirty sea turtles were recorded in the survey area during 2017. As in the past, the loggerhead sea turtle (*Caretta caretta*; *n*=25) was the most frequently recorded species, with small numbers of sightings of leatherback sea turtles (*Dermochelys coriacea*; *n*=2) and unidentified sea turtles (*n*=3) (**Table 4**).

2.2.3 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 4 through 9**. Similar to our observations in previous years, bottlenose dolphins were encountered throughout the surveyed area, including one sighting in deeper pelagic waters (**Figure 5**), whereas Atlantic spotted dolphins were restricted to the relatively shallow shelf waters (**Figure 6**). Risso's dolphins were found exclusively in deeper pelagic waters (**Figure 7)**. Rough-toothed dolphins were observed inshore of the shelf break (**Figure 8**). The majority of all sea turtles were observed over the continental shelf (**Figure 9**).

2.2.4 Biopsy Sampling

Twelve biopsy samples were collected in the Jacksonville survey area during 2017 from Atlantic spotted dolphins (*n*=8), bottlenose dolphins (*n*=2), and rough-toothed dolphins (*n*=2) (**Table 5** and **Figure 10**). Skin samples will be analyzed for sex identification. Voucher specimens of these samples are archived with the National Marine Fisheries Service's Southeast Fisheries Science Center in Lafayette, Louisiana.

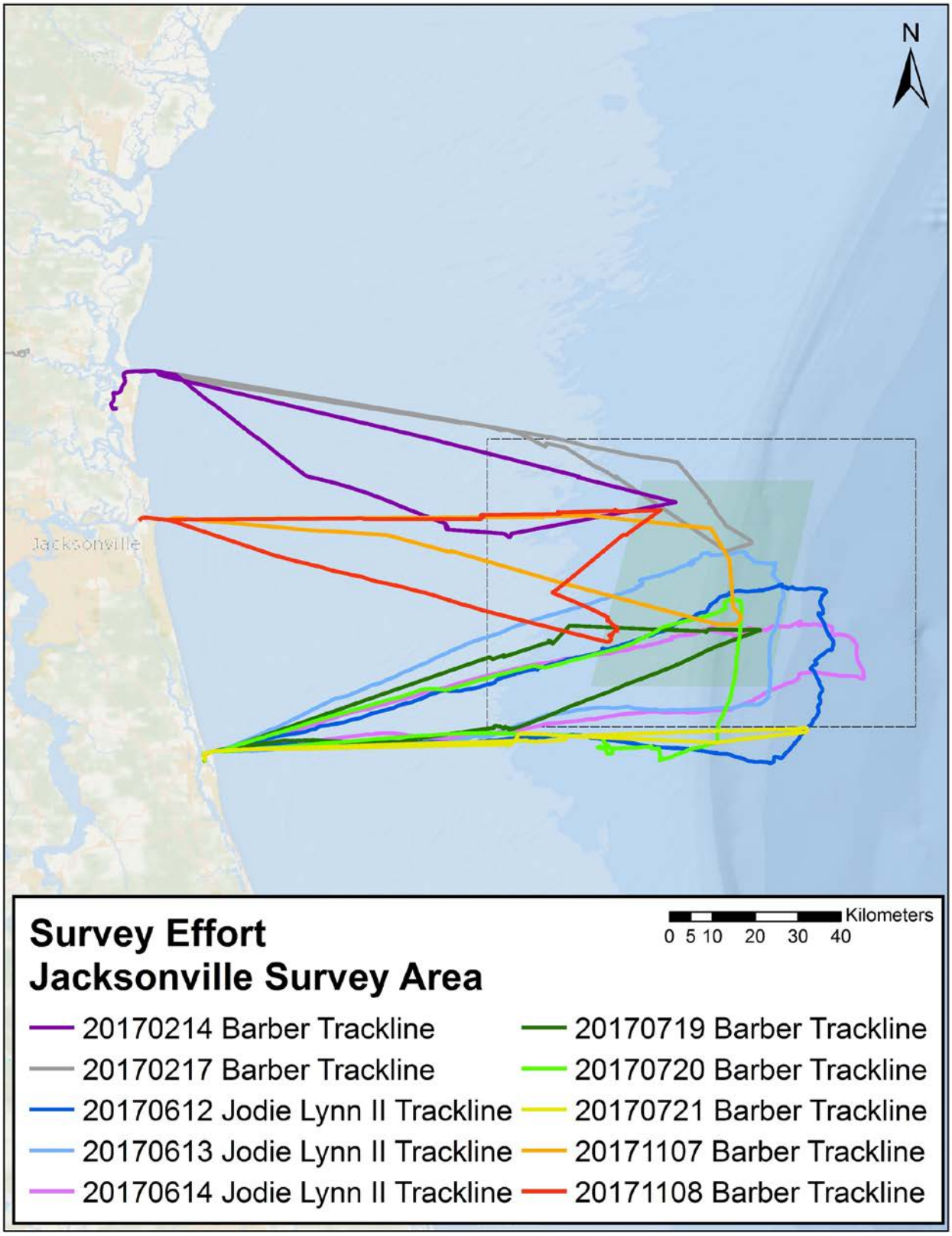

Figure 3. Survey effort during small-vessel surveys in the Jacksonville survey area in 2017.

Table 2. Cetacean sightings from small-vessel surveys in the Jacksonville survey area in 2017.

Date	Time (local)	Latitude (°N)	Longitude (°W)	Species	Common Name	Group Size	Biopsy Samples	Photo-ID images	Vessel
14-Feb-17	10:30	30.38729	80.78665	*T. truncatus*	Bottlenose dolphin	4	0	70	R/V *R.T. Barber*
14-Feb-17	11:36	30.36830	80.66455	*T. truncatus*	Bottlenose dolphin	6	1	47	R/V *R.T. Barber*
14-Feb-17	14:24	30.48598	80.50559	*S. frontalis*	Atlantic spotted dolphin	2	0	22	R/V *R.T. Barber*
14-Feb-17	15:17	30.53439	80.69341	*T. truncatus*	Bottlenose dolphin	2	0	0	R/V *R.T. Barber*
17-Feb-17	11:02	30.55280	80.57747	*S. frontalis*	Atlantic spotted dolphin	8	0	12	R/V *R.T. Barber*
17-Feb-17	11:56	30.48361	80.42724	*T. truncatus*	Bottlenose dolphin	3	0	37	R/V *R.T. Barber*
12-Jun-17	07:47	29.94157	80.60566	*T. truncatus*	Bottlenose dolphin	6	0	17	F/V *Jodie Lynn II*
12-Jun-17	11:56	30.25516	80.06724	*T. truncatus*	Bottlenose dolphin	6	0	55	F/V *Jodie Lynn II*
12-Jun-17	14:12	30.12663	80.45686	*S. frontalis*	Atlantic spotted dolphin	40	1	78	F/V *Jodie Lynn II*
12-Jun-17	15:20	30.08521	80.60318	*S. frontalis*	Atlantic spotted dolphin	2	0	2	F/V *Jodie Lynn II*
13-Jun-17	07:28	29.94523	80.72360	*S. frontalis*	Atlantic spotted dolphin	3	0	31	F/V *Jodie Lynn II*
13-Jun-17	07:58	29.98991	80.57505	S. frontalis	Atlantic spotted dolphin	8	0	28	F/V *Jodie Lynn II*
13-Jun-17	08:42	30.00136	80.34775	*T. truncatus*	Bottlenose dolphin	1	0	16	F/V *Jodie Lynn II*
13-Jun-17	09:36	30.02523	80.11281	*G. griseus*	Risso's dolphin	50	0	467	F/V *Jodie Lynn II*
13-Jun-17	11:33	30.28454	80.10382	*G. griseus*	Risso's dolphin	18	0	267	F/V *Jodie Lynn II*
13-Jun-17	13:12	30.30987	80.27411	*T. truncatus*	Bottlenose dolphin	12	0	10	F/V *Jodie Lynn II*
13-Jun-17	13:53	30.27181	80.38122	*S. frontalis*	Atlantic spotted dolphin	5	2	62	R/V *R.T. Barber*
14-Jun-17	12:40	30.17323	80.22945	*S. frontalis*	Atlantic spotted dolphin	30	1	248	R/V *R.T. Barber*
14-Jun-17	13:33	30.15058	80.31321	*T. truncatus*	Bottlenose dolphin	3	0	47	R/V *R.T. Barber*
14-Jun-17	14:07	30.13191	80.39661	*T. truncatus*	Bottlenose dolphin	5	0	24	R/V *R.T. Barber*
19-Jul-17	09:32	29.96224	80.68730	*T. truncatus*	Bottlenose dolphin	6	1	160	R/V *R.T. Barber*
19-Jul-17	14:57	30.13987	80.56520	*S. frontalis*	Atlantic spotted dolphin	2	1	47	R/V *R.T. Barber*
19-Jul-17	15:51	30.10808	80.69181	*T. truncatus*	Bottlenose dolphin	3	0	18	R/V *R.T. Barber*
20-Jul-17	08:47	29.94604	80.45977	*S. bredanensis*	Rough-toothed dolphin	50	2	520	R/V *R.T. Barber*
20-Jul-17	11:08	29.92355	80.35743	*T. truncatus*	Bottlenose dolphin	1	0	0	R/V *R.T. Barber*
20-Jul-17	11:24	29.91687	80.34055	*T. truncatus*	Bottlenose dolphin	6	0	141	R/V *R.T. Barber*

Date	Time (local)	Latitude (°N)	Longitude (°W)	Species	Common Name	Group Size	Biopsy Samples	Photo-ID images	Vessel
20-Jul-17	13:35	30.22551	80.20212	*S. frontalis*	Atlantic spotted dolphin	40	1	97	R/V *R.T. Barber*
20-Jul-17	15:21	30.08859	80.58046	*S. frontalis*	Atlantic spotted dolphin	21	0	100	R/V *R.T. Barber*
21-Jul-17	08:03	29.92630	80.65880	*S. frontalis*	Atlantic spotted dolphin	45	0	117	R/V *R.T. Barber*
21-Jul-17	11:18	29.94032	80.53691	*S. frontalis*	Atlantic spotted dolphin	13	0	264	R/V *R.T. Barber*
21-Jul-17	11:34	29.93314	80.60389	*S. frontalis*	Atlantic spotted dolphin	4	0	85	R/V *R.T. Barber*
21-Jul-17	11:46	29.93608	80.61818	*S. frontalis*	Atlantic spotted dolphin	2	0	14	R/V *R.T. Barber*
07-Nov-17	08:20	30.33113	80.77926	*S. frontalis*	Atlantic spotted dolphin	7	0	31	R/V *R.T. Barber*
07-Nov-17	14:42	30.40627	80.58541	*T. truncatus*	Bottlenose dolphin	1	0	13	R/V *R.T. Barber*
08-Nov-17	09:44	30.14339	80.44342	*S. frontalis*	Atlantic spotted dolphin	25	2	210	R/V *R.T. Barber*
08-Nov-17	14:50	30.41401	80.55183	*S. frontalis*	Atlantic spotted dolphin	6	0	144	R/V *R.T. Barber*
08-Nov-17	15:42	30.40050	80.71333	*T. truncatus*	Bottlenose dolphin	5	0	34	R/V *R.T. Barber*

Table 3. Numbers of cetacean sightings for each species observed in the Jacksonville survey area in 2017.

Species	Sightings 2017
Grampus griseus	2
Stenella frontalis	18
Steno bredanensis	1
Tursiops truncatus	16
Total	**37**

Table 4. Sea turtle sightings from small-vessel surveys in the Jacksonville survey area in 2017.

Date	Time (local)	Latitude (°N)	Longitude (°W)	Species	Common Name	Group Size	Vessel
17-Feb-17	14:48	30.53878	80.42323	*C. caretta*	Loggerhead sea turtle	1	R/V *R.T. Barber*
17-Feb-17	15:01	30.55156	80.48958	*C. caretta*	Loggerhead sea turtle	1	R/V *R.T. Barber*
17-Feb-17	15:05	30.55692	80.50935	*C. caretta*	Loggerhead sea turtle	1	R/V *R.T. Barber*
17-Feb-17	15:22	30.58108	80.62724	*C. caretta*	Loggerhead sea turtle	1	R/V *R.T. Barber*
12-Jun-17	07:54	29.94600	80.55407	*D. coriacea*	Leatherback sea turtle	1	F/V *Jodie Lynn II*
12-Jun-17	07:55	29.94598	80.54650	unidentified sea turtle	unidentified sea turtle	1	F/V *Jodie Lynn II*
12-Jun-17	08:04	29.94110	80.47666	*C. caretta*	Loggerhead sea turtle	1	F/V *Jodie Lynn II*
12-Jun-17	08:24	29.92130	80.32761	unidentified sea turtle	unidentified sea turtle	1	F/V *Jodie Lynn II*
12-Jun-17	08:35	29.91437	80.25050	*C. caretta*	Loggerhead sea turtle	1	F/V *Jodie Lynn II*
12-Jun-17	12:53	30.24374	80.19413	*C. caretta*	Loggerhead sea turtle	1	F/V *Jodie Lynn II*
12-Jun-17	15:24	30.08377	80.61029	*C. caretta*	Loggerhead sea turtle	1	F/V *Jodie Lynn II*
13-Jun-17	07:26	29.94375	80.70322	*C. caretta*	Loggerhead sea turtle	1	F/V *Jodie Lynn II*
14-Jun-17	07:25	29.95667	80.64809	*C. caretta*	Loggerhead sea turtle	1	F/V *Jodie Lynn II*
14-Jun-17	07:50	29.98177	80.47159	*C. caretta*	Loggerhead sea turtle	1	F/V *Jodie Lynn II*
14-Jun-17	13:43	30.14445	80.32726	unidentified sea turtle	unidentified sea turtle	1	F/V *Jodie Lynn II*
14-Jun-17	13:53	30.13687	80.35708	*C. caretta*	Loggerhead sea turtle	1	F/V *Jodie Lynn II*
14-Jun-17	14:00	30.13247	80.37857	*C. caretta*	Loggerhead sea turtle	1	F/V *Jodie Lynn II*
14-Jun-17	14:58	30.10099	80.56043	*C. caretta*	Loggerhead sea turtle	1	F/V *Jodie Lynn II*
19-Jul-17	09:55	29.96162	80.66740	*C. caretta*	Loggerhead sea turtle	1	F/V *Jodie Lynn II*
19-Jul-17	10:07	29.96360	80.66268	*C. caretta*	Loggerhead sea turtle	1	R/V *R.T. Barber*
19-Jul-17	15:47	30.11053	80.67718	*C. caretta*	Loggerhead sea turtle	1	R/V *R.T. Barber*
20-Jul-17	07:55	29.95122	80.68693	*D. coriacea*	Leatherback sea turtle	1	R/V *R.T. Barber*
20-Jul-17	14:07	30.20508	80.21354	*C. caretta*	Loggerhead sea turtle	1	R/V *R.T. Barber*
20-Jul-17	14:35	30.17452	80.32773	*C. caretta*	Loggerhead sea turtle	1	R/V *R.T. Barber*
21-Jul-17	08:51	29.94351	80.48447	*C. caretta*	Loggerhead sea turtle	1	R/V *R.T. Barber*
21-Jul-17	11:57	29.93513	80.65549	*C. caretta*	Loggerhead sea turtle	1	R/V *R.T. Barber*
08-Nov-17	12:06	30.26127	80.54352	*C. caretta*	Loggerhead sea turtle	1	R/V *R.T. Barber*

Date	Time (local)	Latitude (°N)	Longitude (°W)	Species	Common Name	Group Size	Vessel
08-Nov-17	14:10	30.41941	80.43239	*C. caretta*	Loggerhead sea turtle	2	R/V *R.T. Barber*
08-Nov-17	15:09	30.40980	80.58192	*C. caretta*	Loggerhead sea turtle	1	R/V *R.T. Barber*

Table 5. Biopsy samples collected in the Jacksonville survey area in 2017.

Date	Time (local)	Latitude (°N)	Longitude (°W)	Species	Sample #
14-Feb-17	11:54	30.36181	80.65528	*T. truncatus*	ZTS_17_002
12-Jun-17	14:34	30.12699	80.45268	*S. frontalis*	HJF_17_001
13-Jun-17	14:08	30.25510	80.38742	*S. frontalis*	HJF_17_002
13-Jun-17	14:15	30.25348	80.39091	*S. frontalis*	HJF_17_003
14-Jun-17	13:03	30.17893	80.22439	*S. frontalis*	HJF_17_004
19-Jul-17	10:11	29.96476	80.66279	*T. truncatus*	ZTS_17_006
19-Jul-17	14:58	30.14020	80.56519	*S. frontalis*	ZTS_17_007
20-Jul-17	9:45	29.91934	80.45577	*S. bredanensis*	ZTS_17_008
20-Jul-17	10:05	29.92053	80.46188	*S. bredanensis*	ZTS_17_009
20-Jul-17	13:52	30.20999	80.20621	*S. frontalis*	ZTS_17_010
8-Nov-17	09:59	30.15857	80.43886	*S. frontalis*	ZTS_17_011
8-Nov-17	10:53	30.18748	80.44859	*S. frontalis*	ZTS_17_012

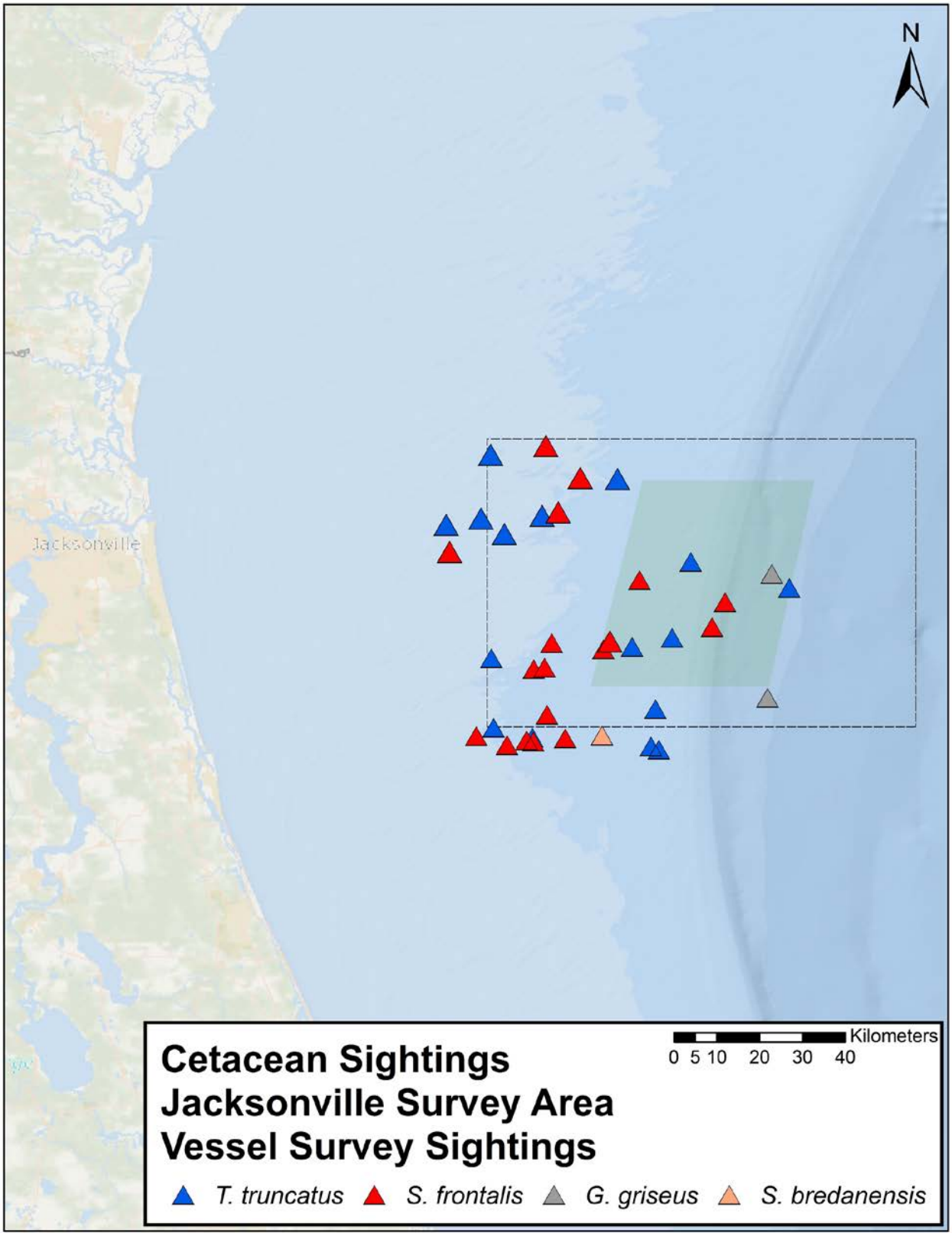

Figure 4. Distribution of all cetacean sightings made during small-vessel surveys in the Jacksonville survey area in 2017.

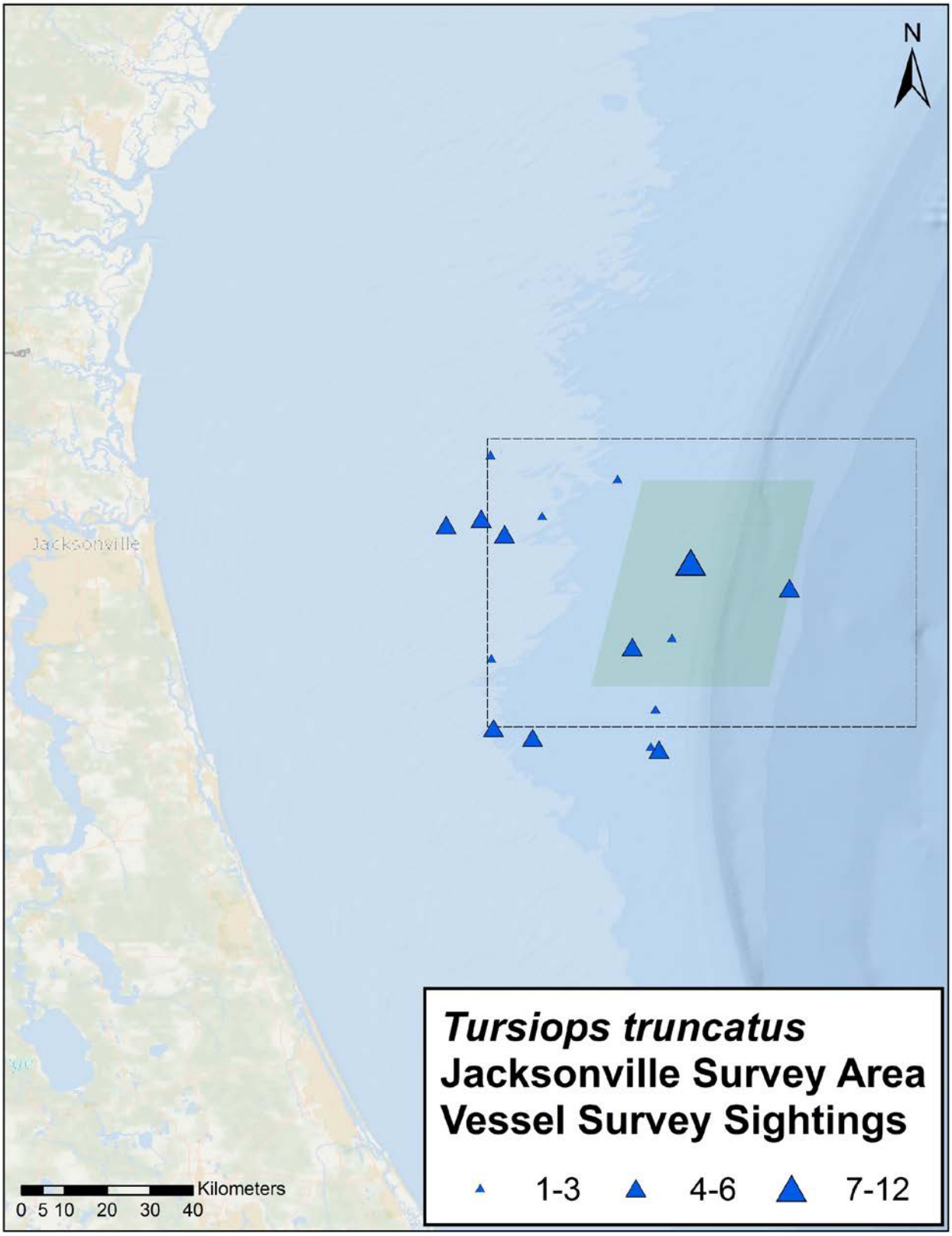

Figure 5. Distribution of bottlenose dolphin sightings, indicating group size, made during small-vessel surveys in the Jacksonville survey area in 2017.

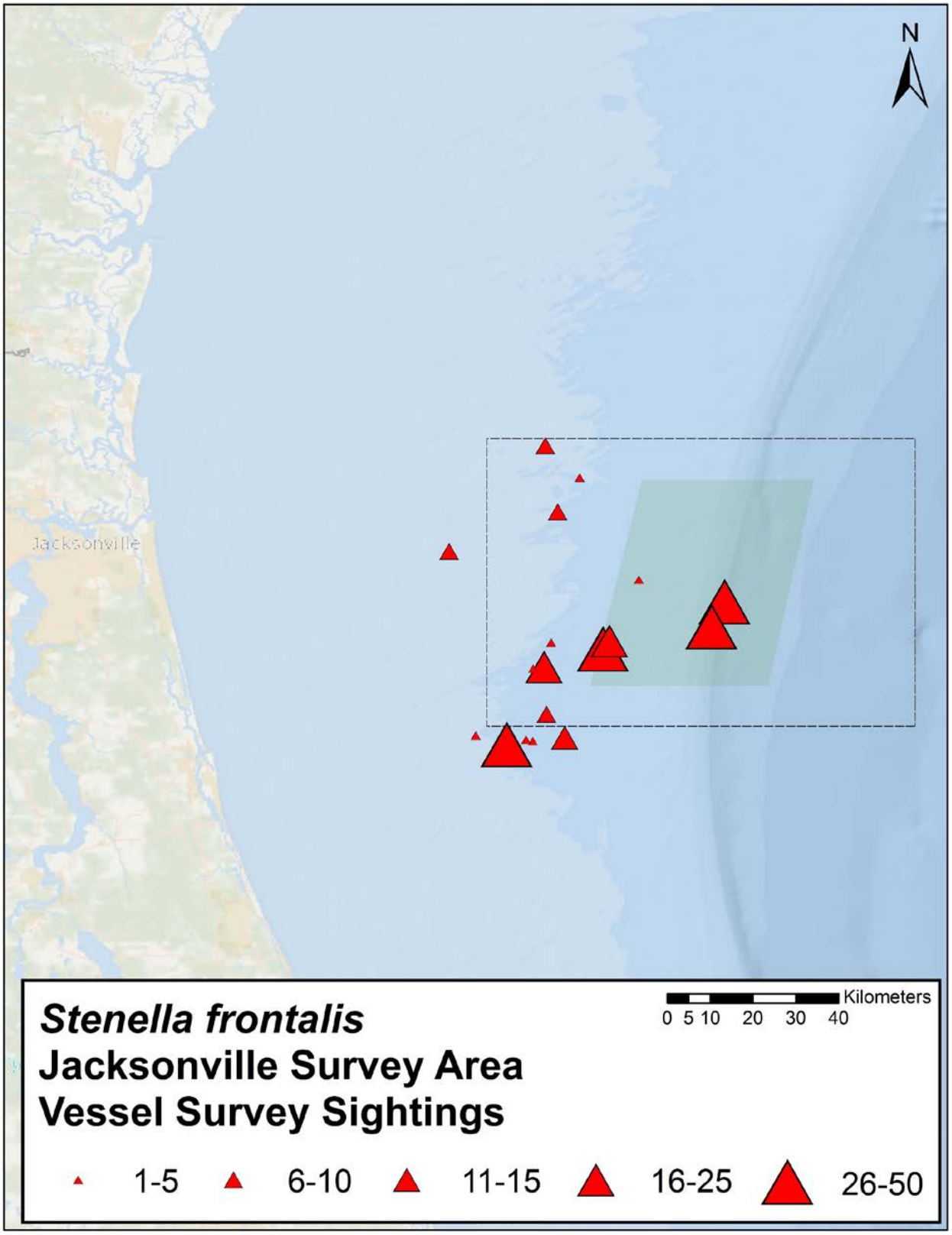

Figure 6. Distribution of Atlantic spotted dolphin sightings, indicating group size, made during small-vessel surveys in the Jacksonville survey area in 2017.

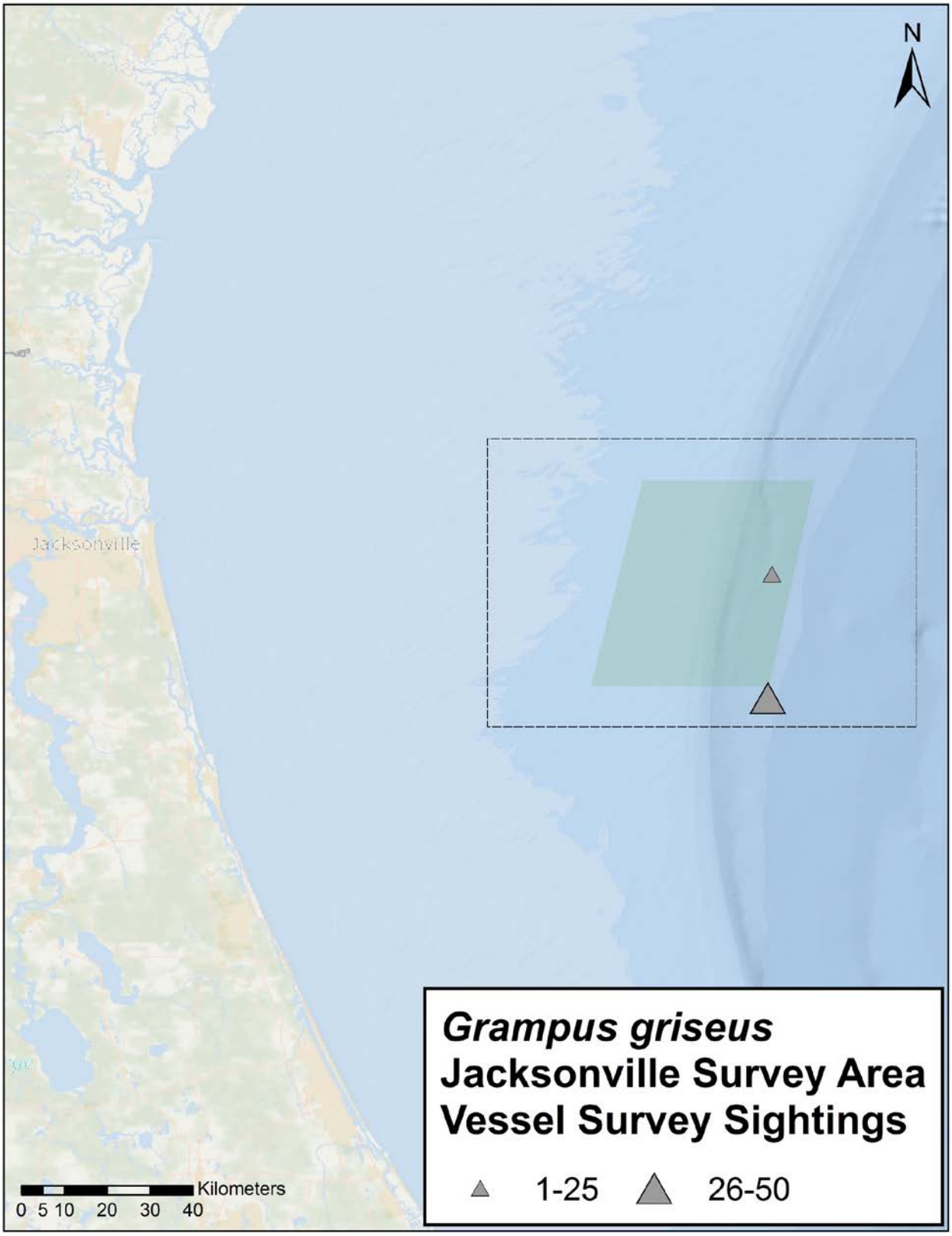

Figure 7. Distribution of Risso's dolphin sightings, indicating group size, made during small-vessel surveys in the Jacksonville survey area in 2017.

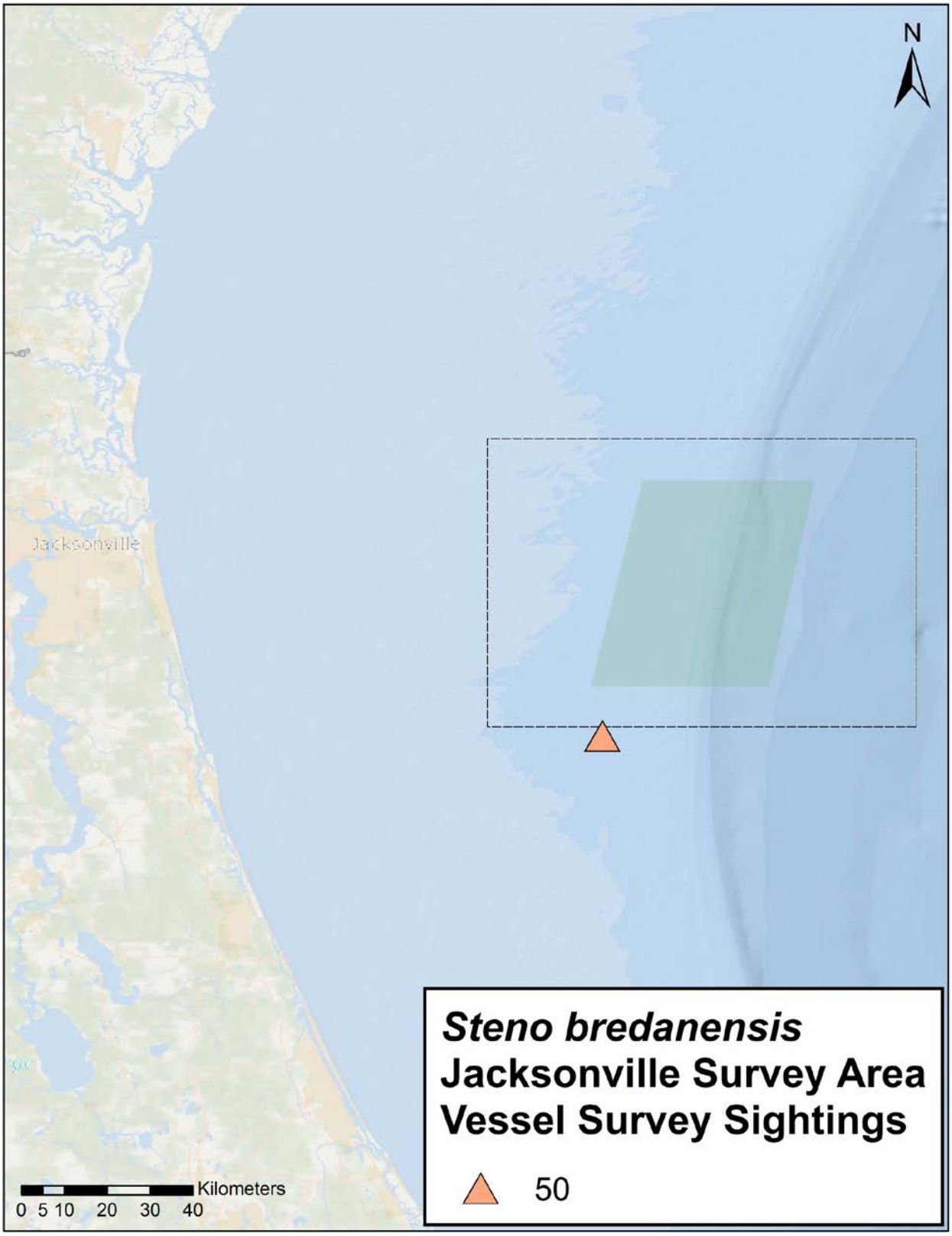

Figure 8. Distribution of rough-toothed dolphin sightings, indicating group size, made during small-vessel surveys in the Jacksonville survey area in 2017.

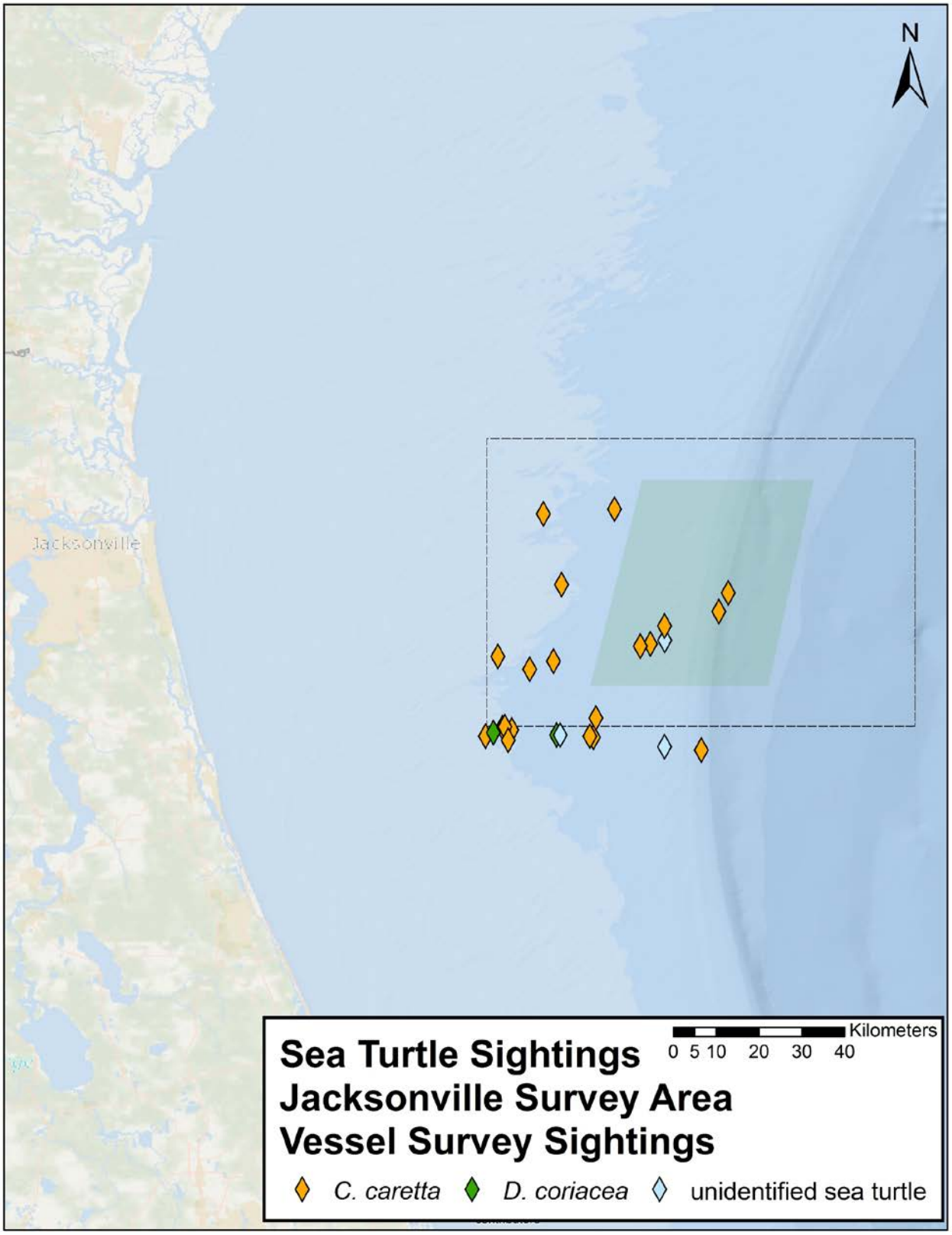

Figure 9. Distribution of sea turtle sightings made during small-vessel surveys in the Jacksonville survey area in 2017.

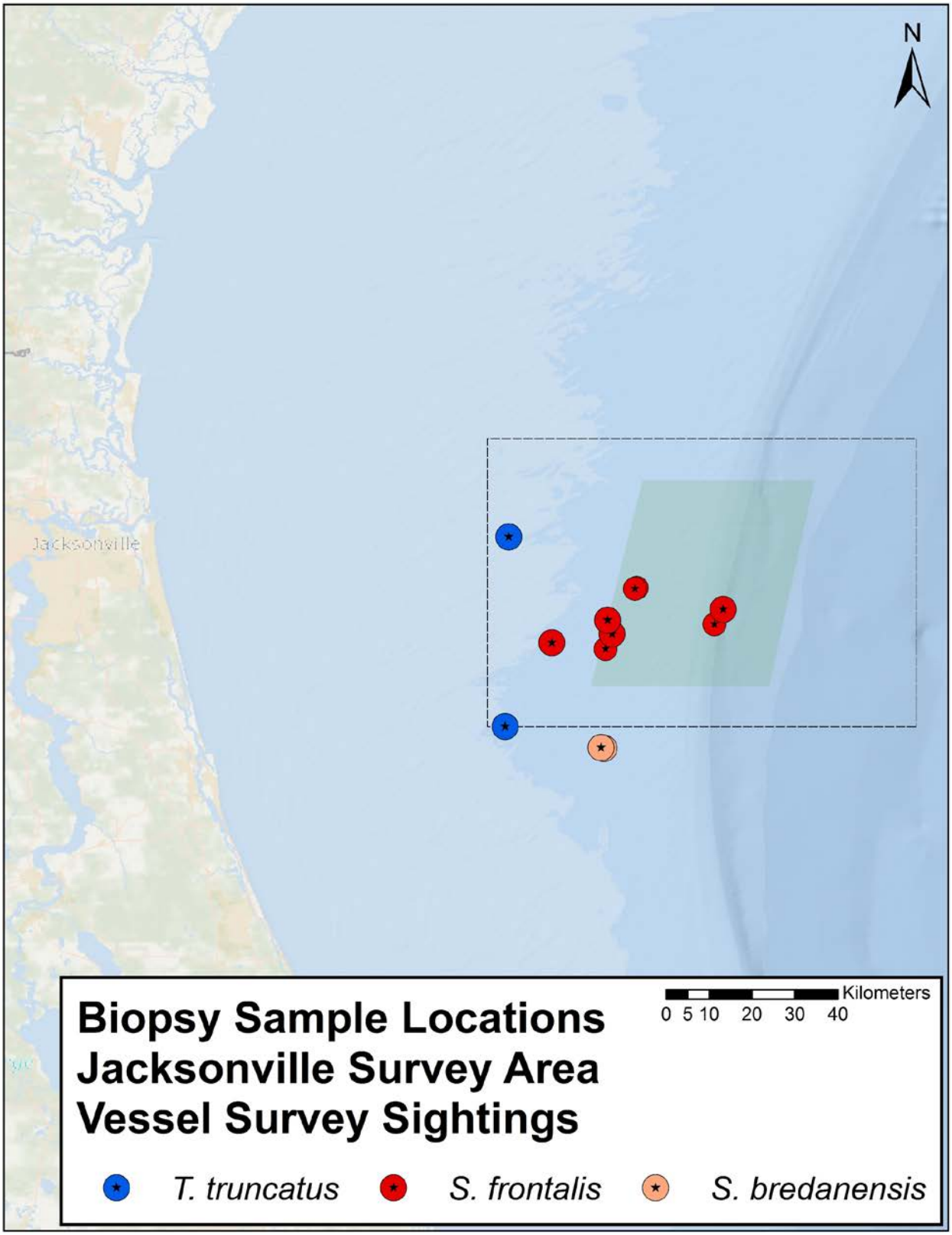

Figure 10. Locations of biopsy samples collected in the Jacksonville survey area in 2017.

2.2.5 Photographic Effort

Over 3,500 digital images were collected for species confirmation and individual identification during 2017, and 94 newly identified dolphins were cataloged (**Table 6**). Photo-ID catalogs for bottlenose and Atlantic spotted dolphins in the Jacksonville survey area consist of 132 and 199 individuals, respectively. Eleven new individuals were added to the Jacksonville rough-toothed dolphin catalog in 2017 for a catalog size of 54, while 20 new individuals were added to the Risso's dolphin catalog, which includes 56 unique individuals.

Table 6. Summary of photographs taken of animals in the Jacksonville survey area in 2017, with photo-identification catalog sizes and total number of matches to date.

Species	Common Name	Images 2017	Catalog Size	Matches
G. macrorhynchus	Short-finned pilot whale	0	29	0
G. griseus	Risso's dolphin	734	56	0
S. frontalis	Atlantic spotted dolphin	1592	199	20
T. truncatus	Bottlenose dolphin	689	132	8
S. bredanensis	Rough-toothed dolphin	520	54	8

To date, twenty individual Atlantic spotted dolphins have been re-sighted within the Jacksonville survey area with several interesting sighting histories (**Figure 11**). Sfr 7-008 and 9-011 were first observed together in 2013. In 2016, 7-008 was observed without 9-011, but they were again photographed together in July 2017, making Sfr 7-008 the first individual to be sighted three times within the Jacksonville survey area since surveys commenced in 2009. Eight Atlantic spotted dolphins were observed on consecutive days this year in July (**Table 7**). Three of these eight individuals also had been observed together in July of 2014, for a total of four Atlantic spotted dolphin individuals sighted three times. One pair of dolphins (Sfr 8-037 and Sfr DU 8-014) was seen together in consecutive months this year, in addition to the first trio (Sfr 6-024, Sfr 7-035, and Sfr 9-040) match documented, photographed together in both 2016 and 2017. We matched our longest resighting within the Jacksonville survey area this year, with Sfr 2-002 being seen in July 2010 and again in November 2017, for over seven years between sightings. Finally, Sfr 7-010 and Sfr 7-015 were both resighted in 2017.

Eight bottlenose dolphins have been resighted in Jacksonville. Two pairs of bottlenose dolphins have been resighted together: one in January 2012 and July 2013 and another (Ttr 6-037 and 6-038) in September 2013 and February 2017. Ttr 6-007, first cataloged in 2013, was resighted in 2017. There has also been one bottlenose dolphin trio resighted in the Jacksonville survey area, first seen together in 2015 and again in 2017 (**Table 7** and **Figure 11**).

We have not identified any resightings in either the short-finned pilot whale (*Globicephala macrorhynchus*) or the Risso's dolphin catalog. Eight individual rough-toothed dolphins have been resighted, as they were seen on consecutive days in September of 2016 (**Table 7**).

Table 7. Photo-identification matches of delphinids observed in the Jacksonville survey area.

ID[1]	Jacksonville, Florida								
	2009	2010	2011	2012	2013	2014	2015	2016	2017
Ttr 6-007					X				X
Ttr 6-010^				X	X				
Ttr 6-036^				X	X				
Ttr 6-037^					X				X
Ttr 6-038^					X				X
Ttr 7-022^							X		X
Ttr 7-030^							X		X
Ttr 7-031^							X		X
Sfr 2-002		X							X
Sfr 3-001		X	X						
Sfr 7-008^					X			X	X
Sfr 9-011^					X				X
Sfr 7-010					X				X
Sfr 7-015						X			X
Sfr 8-005			X^m						
Sfr 8-037^									X^y
Sfr DU 8-014^									X^y
Sfr 6-006^						X			X^m
Sfr 7-013^						X			X^m
Sfr 7-014^						X			X^m
Sfr 8-038^									X^m
Sfr 9-037^									X^m
Sfr DU 1-003^									X^m
Sfr DU 6-010^									X^m
Sfr DU 7-008^									X^m
Sfr 6-024^								X	X
Sfr 7-035^								X	X
Sfr 9-040^								X	X
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	

[1] Sfr=*Stenella frontalis* (Atlantic spotted dolphin); Ttr=*Tursiops truncatus* (bottlenose dolphin); Sbr = *Steno bredanensis* (rough-toothed dolphin)

^ Observed together in multiple sightings

^{m} - resighted within same month

y - resighted within same year

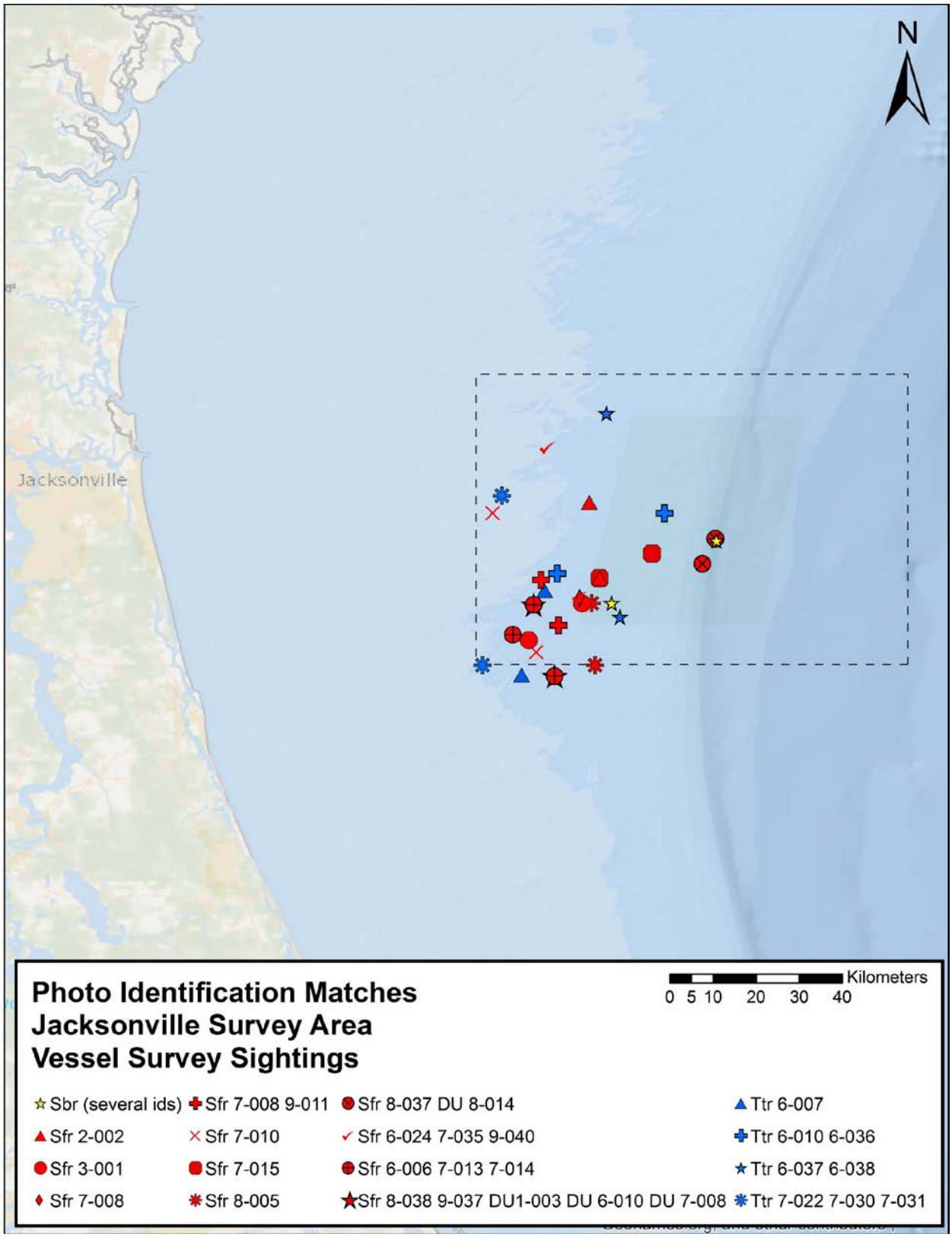

Figure 11. Locations of photo-matched dolphins within the Jacksonville survey area.

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. As reported in Foley et al. (2017), seven short-finned pilot whales from the Jacksonville catalog were observed in both the Bahamas in 2007 and the Jacksonville survey area in 2009. Three of these seven individuals were resighted again in the Bahamas in 2015. Five short-finned pilot whales first photographed together in the Bahamas in June 2009 were resighted in Onslow Bay two months later. Despite continuing to compare these catalogs for matches, no additional resightings have been found this year.

3. Cape Hatteras Vessel Surveys

3.1 Photographic Effort

Over 6,000 digital images were obtained to determine species confirmation and identify individual animals during tagging fieldwork supporting the Atlantic Behavioral Response Study in 2017 (Baird et al. 2018, Southall et al. 2018). Images of 594 newly identified animals were added to six existing photo-identification catalogs of bottlenose dolphins, short-finned pilot whales, sperm whales (*Physeter macrocephalus*), Cuvier's beaked whales (*Ziphius cavirostris*), common dolphins (*Delphinus delphis*), and Risso's dolphins. To date, photo-identification catalogs for 11 species have been assembled across multiple AFTT marine species monitoring projects, with 384 individuals resighted across all species (**Table 8**).

Table 8. Summary of images collected during all fieldwork in the Cape Hatteras survey area in 2017, with photo-identification catalog sizes and total matches to date.

Species	Images 2017	Catalog Size	Matches
Balaenoptera physalus	0	1	0
Delphinus delphis	50	44	1
Globicephala macrorhynchus	2,393	1,144	339
Grampus griseus	0	47	6
Kogia sp.	0	1	0
Megaptera novaeangliae	0	2	0
Physeter macrocephalus	141	17	1
Stenella clymene	0	3	0
Stenella frontalis	14	24	0
Tursiops truncatus	66	325	17
Ziphius cavirostris	3,373	112	20

Photo-analysis of the images taken in the Cape Hatteras survey area is ongoing. To date, 17 bottlenose dolphins have been resighted, with multiple years between resights for 13 of the 17 dolphins (**Table 9**). The longest time between resights spans more than five years, with Ttr_7-024 first photographed in May 2007 and then re-sighted in June 2012. Another individual, Ttr_9-016, was photographed on three occasions during a five-year period, with sightings in May 2011, June 2014, and August 2016. We have also photographed bottlenose dolphins associating in the same groups over multiple years. Ttr_6-018 and Ttr_9-013 were photographed together in March 2012 and May 2013. Ttr_6-102 and Ttr_8-024 were seen in the same group in September 2013 and resighted together almost three years later in May 2016. Ttr_7-076 and Ttr_8-032 were photographed together three times over a two-year period, with sightings in May 2014 and in March and August of 2016. Ttr_6-099 was also present in the groups in May 2014 and August 2016.

A single match of a common dolphin off the coast of Cape Hatteras has been made; Dde 7-002 was first photographed on 27 May 2007 and then resighted nearly five years later on 15 March 2012.

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

The photo-ID catalog for Risso's dolphins increased from 9 to 47, and 6 of these individuals (including GgTag017) were sighted together on two consecutive days in August 2016.

The photo-ID catalog for Cuvier's beaked whales more than doubled during this reporting period, increasing from 50 to 112 distinct individuals currently in the catalog. The number of resighted Cuvier's beaked whales more than tripled with 20 whales matched to the catalog, including 11 of the satellite-tagged whales (**Table 9**). Interestingly, 4 of the 20 matches were made across survey platforms by systematically comparing the vessel-based and aerial-based Cuvier's beaked whale photo-ID catalogs.

With increased tagging effort in the Cape Hatteras study area in the last few years (Baird et al 2016, Baird et al. 2017, Baird et al 2018), there is an increase in the number of Cuvier's beaked whales that have been sighted over multiple years, with nine of the 20 matched whales seen across years. Zca_005 was initially sighted in May of 2014, was re-sighted in June of 2015, and was sighted a third time in June 2017. Zca_006 was first photographed in May 2014 and was D-tagged at that time, although the tag was never recovered. In June 2015, Zca_006 was re-sighted and satellite-tagged (ZcTag040), and it was sighted again in August 2017. Zca_008R was first observed in May 2014, and was seen again in October 2014 with a small calf, confirming that she is an adult female. She was satellite tagged in May 2016 (ZcTag047) and seen two days after tagging. During 2017, we photographed her on two more occasions, in June and August; this female represents the Cuvier's beaked whale that has the most resights in the Cape Hatteras area, with six sightings over three years. The longest time between resights spans over four years with M-004 first photographed by the aerial-based team in May of 2013 and subsequently observed by the vessel-based team in August of 2017.

Table 9. 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	2017
Ttr 1-001				X		X[y]						
Ttr 6-018^							X	X				
Ttr 6-020						X		X				
Ttr 6-038								X			X	
Ttr 6-099^									X		X	
Ttr 6-102^								X			X	
Ttr 7-024		X					X					
Ttr 7-031						X[y]						
Ttr 7-038						X[y]						
Ttr 7-058								X[y]				
Ttr 7-076^									X		X[y]	
Ttr 8-024^								X			X	
Ttr 8-032^									X		X[y]	
Ttr 9-013^							X	X				
Ttr 9-016						X			X		X	
Ttr 9-027 (TtTag015)									X[m]			
Ttr 9-036										X		X
Dde 7-002		X					X					
Pma-004								X[m]				
Ggr 6-002											X[m]	
Ggr 6-004											X[m]	
Ggr 6-005											X[m]	
Ggr 6-006 (GgTag017)											X[m]	
Ggr 7-004											X[m]	
Ggr 9-002											X[m]	
Zca-001r								X		X		
Zca-003r (ZcTag029)									X[m]			
Zca-005									X	X		X
Zca-006 (ZcTag040)									X	X		X
Zca-008r (ZcTag047)									X[y]		X[m]	X[y]
Zca_019 (ZcTag043)									X	X		
Zca_024 (ZcTag046)											X	X
Zca_029 (ZcTag054)												X[y]

ID[1]	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Zca_030 (ZcTag055)												X[y]
Zca_037 (ZcTag068)												X[y]
Zca_040												X[y]
Zca_042 (ZcTag062)												X[y]
Zca_051r (ZcTag058)												X[y]
Zca_053r												X[m]
Zca_054r												X[y]
Zca_056r												X[m]
M-001 (ZcTag030)									X[y]			
M-002									X	X		
M-003									X	X		
M-004								X				X

[1] Dde=*Delphinus delphis* (common dolphin); Ggr= *Grampus griseus* (Risso's dolphin) Pma=*Physeter macrocephalus* (sperm whale); Ttr=*Tursiops truncatus* (bottlenose dolphin); Zca=*Ziphius cavirostris* (Cuvier's beaked whale)

m - resighted within same month

y - resighted within same year

^Observed together in multiple sightings

We are also beginning to document individual Cuvier's beaked whales associating over time. Zca_024 and Zca_008R were satellite tagged in the same group in May 2016 (ZcTag046 and ZcTag047, respectively) and were seen together again in June 2017. We have confirmed that Zca_008R is an adult female and believe that Zca_024 is an adult male, due to the heavy amount of scarring on its body.

During this reporting period, we added more than 420 new individuals to the short-finned pilot whale catalog and made more than 170 new matches. In part, this reflects additional photo-identification effort conducted to address the backlog of images taken during previous field seasons.

Two of the 11 short-finned pilot whales that were satellite tagged in 2017 were matched to our existing catalog. Gma_7-023 and Gma_7-047 were photographed in the same group in June 2012 and were subsequently photographed together in May 2017 when both were satellite tagged (GmTag175 and GmTag176, respectively). Twenty-five of the 60 short-finned pilot whales that have been satellite tagged in the Hatteras study area between 2014 and 2017 have either been matched to the photo-ID catalog or resighted during subsequent field efforts.

The high resighting rate of short-finned pilot whales in the Hatteras study area continued during 2017. To date, 30 percent (339 of 1,144) of the pilot whales in the catalog have been resighted, an increase from the last reporting period when the resighting rate of pilot whales was 22 percent (160 of 718). While many individuals have been resighted within the same year (62 of

the 339 matches), the majority of resights occur across multiple years (277 of the 339 matches). More than 125 short-finned pilot whales have been seen on three or more occasions and two animals have been seen seven times. Gma_6-078 was sighted seven times between May 2007 and May 2015, and Gma_9-027 was also photographed seven times between May 2008 and May 2017.

We are also documenting individual short-finned pilot whales returning to the Cape Hatteras area over extended periods of time. At least 105 of the 277 pilot whales who have been seen in multiple years have a span of five or more years between their first and last sightings. Gma_1-072 has the longest interval between sightings, with its initial sighting in August 2007 and its second and most recent sighting in May 2017. We are also documenting individual short-finned pilot whales in association over relatively long times. Gma_8-075 and Gma_9-094 were first photographed in the same group in May 2007 and were later seen together in December 2015. Four pilot whales (Gma_1-023, Gma_1-030, Gma_7-016 and Gma_7-112) were observed together in May of 2008 and again in May of 2015. Another two pilot whales (Gma_9-010 and Gma_9-118) were photographed in the same group four times between 2007 and 2014. We plan to explore short-finned pilot whale social structure in the coming year.

4. Summary Tables

Total small-vessel survey effort conducted since the beginning of the monitoring program in the Cape Hatteras and Jacksonville study areas, including all AFTT protected species monitoring and tagging effort, is reported in **Tables 10 and 11**. The annual numbers of sightings by species for both cetaceans and sea turtles in each survey area are presented in **Tables 12 through 15**. The number of biopsy samples collected to date in each survey area is reported in **Tables 16 and 17**. **Tables 18 and 19** summarize the photo-ID catalog sizes and matches by species to date and images taken during the reporting period in the survey areas.

Table 10. Annual small-vessel survey effort from July 2009 through December 2017 in the Cape Hatteras survey area.

	2009-10	2011	2012	2013	2014	2015	2016	2017	Total
Survey Hours	26.3	179.9	86.8	63.2	121.7	134.5	57.3	115.2	784.9
km Surveyed	296.4	1097.4	1049.4	878.7	921.9	990.8	456.7	888.5	6579.8

Table 11. Small-vessel survey effort from July 2009 through December 2017 in the Jacksonville survey area.

	2009-10	2011	2012	2013	2014	2015	2016	2017	Total
Survey Hours	127.1	20.9	58.6	58.7	66.8	44.2	130.7	66.1	573.1
km Surveyed	2,073.5	345.7	937.4	1,021.7	1,227.4	858.2	2,135.5	1424.2	10,023.6

Table 12. Cetacean sightings by species from July 2009 through December 2017 during small-vessel surveys in the Cape Hatteras survey area.

Species	Sightings							
	2009-10	2011	2012	2013	2014	2015	2016	2017
Balaenoptera physalus	0	0	1	2	0	0	0	0
Delphinus delphis	0	6	11	3	4	4	3	3
Globicephala macrorhynchus	9	33	52	35	26	53	16	32
Grampus griseus	1	2	2	0	1	2	2	0
Kogia sp.	0	0	0	0	0	1	0	0
Mesoplodon sp.	0	0	0	1	0	0	1	4
Physeter macrocephalus	0	1	4	3	2	4	0	2
Stenella clymene	0	0	0	0	0	0	1	0
Stenella frontalis	0	8	2	3	3	3	0	3
Stenella/Delphinus mix	0	1	0	0	0	0	0	0
Tursiops truncatus	23	27	54	38	14	47	32	21
Tursiops/Stenella mix	0	1	0	0	0	0	0	0
Ziphius cavirostris	0	3	1	2	16	13	7	26
Unidentified baleen whale	0	0	0	0	0	1	0	0
Unidentified beaked whale	0	0	0	4	3	1	0	2
Unidentified small whale	0	0	0	0	0	1	0	0
Unidentified delphinid	1	0	3	1	0	1	0	1
Total	**34**	**82**	**130**	**92**	**69**	**131**	**62**	**94**

Table 13. Cetacean sightings by species from July 2009 through December 2017 during small-vessel surveys in the Jacksonville survey area.

Species	Sightings							
	2009-10	2011	2012	2013	2014	2015	2016	2017
Eubalaena glacialis	0	0	0	0	1	0	0	0
Globicephala macrorhynchus	3	0	0	0	0	0	5	0
Grampus griseus	2	0	0	1	1	1	0	2
Stenella attenuata	0	0	0	0	0	0	2	0
Stenella frontalis	35	6	14	9	20	10	10	18
Steno bredanensis	0	0	0	0	0	0	2	1
Tursiops truncatus	19	6	23	15	18	10	18	16
Tursiops/Stenella mix	0	0	0	0	1	0	0	0
Unidentified delphinid	13	0	4	3	4	0	5	0
Total	**72**	**12**	**41**	**28**	**45**	**21**	**42**	**37**

Table 14. Sea turtle sightings by species from July 2009 through December 2017 during small-vessel surveys in the Cape Hatteras survey area.

Species	Sightings							
	2009-10	2011	2012	2013	2014	2015	2016	2017
Caretta caretta	2	0	2	7	0	2	0	0
Chelonia mydas	0	0	0	1	0	0	0	0
Dermochelys coriacea	0	0	0	0	0	4	0	0
Unidentified sea turtle	0	0	1	0	0	0	0	0
Total	**2**	**0**	**3**	**8**	**0**	**6**	**0**	**0**

Table 15. Sea turtle sightings by species from July 2009 through December 2017 during small-vessel surveys in the Jacksonville survey area.

Species	Sightings							
	2009-10	2011	2012	2013	2014	2015	2016	2017
Caretta caretta	52	20	41	33	31	22	22	24
Dermochelys coriacea	8	3	4	1	3	2	4	2
Lepidochelys kempii	1	0	1	0	0	0	0	0
Unidentified sea turtle	8	3	3	1	0	0	0	3
Total	**69**	**26**	**49**	**35**	**34**	**24**	**26**	**29**

Table 16. Biopsy samples collected from 2011 through 2017 of vessel surveys in the Cape Hatteras survey area.

Species	2011	2012	2013	2014	2015	2016	2017	Total
Balaenoptera physalus	0	0	3	0	0	0	0	3
Delphinus delphis	0	5	2	0	1	0	0	8
Globicephala macrorhynchus	4	33	10	5	14	4	3	73
Grampus griseus	0	0	2	0	0	0	0	2
Physeter macrocephalus	0	0	1	1	0	0	0	2
Stenella frontalis	6	0	2	2	2	0	0	12
Tursiops truncatus	14	10	13	2	1	0	0	40
Ziphius cavirostris	0	0	2	0	2	0	1	5
Total	**24**	**48**	**35**	**10**	**20**	**4**	**5**	**146**

Table 17. Biopsy samples collected from July 2009 through December 2017 during small-vessel surveys in the Jacksonville survey area.

Species	2009-10	2011	2012	2013	2014	2015	2016	2017	Total
Globicephala macrorhynchus	0	0	0	0	0	0	5	0	5
Grampus griseus	0	0	0	1	2	0	0	0	3
Stenella attenuata	0	0	0	0	0	0	1	0	1
Stenella frontalis	0	0	19	6	19	3	7	8	62
Steno bredanensis	0	0	0	0	0	0	4	2	6
Tursiops truncatus	0	0	12	5	10	5	5	2	39
Total	**0**	**0**	**31**	**12**	**31**	**8**	**22**	**12**	**116**

Table 18. Summary of images collected during all small-vessel surveys in the Cape Hatteras survey area from 2009 through 2017 with photo-identification catalog sizes and matches to date.

Species	2009–2016		2017	
	Catalog Size	Matches	Catalog Size	Matches
Balaenoptera physalus	1	0	1	0
Delphinus delphis	30	1	44	1
Globicephala macrorhynchus	718	160	1,144	339
Grampus griseus	9	0	47	6
Kogia sp.	1	0	1	0
Megaptera novaeangliae	2	0	2	0
Physeter macrocephalus	14	1	17	1
Stenella clymene	3	0	3	0
Stenella frontalis	24	0	24	0
Tursiops truncatus	274	9	325	17
Ziphius cavirostris	50	6	112	20

Table 19. Summary of images collected during all small-vessel surveys in the Jacksonville survey area from 2009 through 2017 with photo-identification catalog sizes and matches to date.

Species	2009-10		2011		2012		2013		2014		2015		2016		2017	
	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	0	0	0	0	0	0	12	0	12	0	12	0	29	0	29	0
G. griseus	1	0	1	0	1	0	7	0	22	0	36	0	36	0	56	0
S. frontalis	0	0	41	0	60	2	77	2	111	2	118	2	154	3	199	20
T. truncatus	0	0	21	0	41	0	52	2	80	2	100	2	114	2	132	8
S. bredanensis	0	0	0	0	0	0	0	0	0	0	0	0	43	8	54	8

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6. Literature Cited

Foley, H.J, D.M. Waples, R.W. Baird, Z.T Swaim, D.L. Webster, and A.J. Read. 2017. *Small Vessel Surveys for Protected Species in Navy OPAREAs off the U.S. Atlantic Coast, January 2016-December 2016.* Prepared for U.S. Fleet Forces Command. Submitted to Naval Facilities Engineering Command Atlantic, Norfolk, Virginia, under Contract No. N62470-10-D-8006, Task Orders 04, 07, and 34 issued to HDR, Inc., Virginia Beach, Virginia. August 2017.

Baird, R.W., D.L. Webster, Z.T. Swaim, H.J. Foley, D.B. Anderson, and A.J. Read. 2018. *Spatial Use by Cuvier's Beaked Whales and Short-finned Pilot Whales Satellite Tagged off Cape Hatteras, North Carolina: 2017 Annual Progress Report*. Prepared for U.S. Fleet Forces Command. Submitted to Naval Facilities Engineering Command Atlantic, Norfolk, Virginia, under Contract No. N62470-15-D-8006, Task Order 50, issued to HDR Inc., Virginia Beach, Virginia. March 2018.

Read, A.J., S. Barco, J. Bell, D.L. Borchers, M.L. Burt, E.W. Cummings, J. Dunn, M. Fougeres, L. Hazen, L.E. Williams-Hodge, A-M Laura, R.J. McAlarney, P.B. Nilsson, D.A. Pabst, C.G.M. Paxton, S.Z. Schneider, K.W. Urian, D.M. Waples, and W.A. McLellan. 2014. Occurrence, distribution and abundance of cetaceans in Onslow Bay, North Carolina, USA. *Journal of Cetacean Research and Management* 14:23–35.

Southall, B.L, R.W. Baird, M. Bowers, W. Cioffi, C. Harris, J. Joseph, N. Quick, T. Margolina, D. Nowacek, A. Read, R. Schick, J. Shearer, and D.L. Webster. 2018. Atlantic Behavioral Response Study (BRS) – 2017 Annual Progress Report. Prepared for U.S. Fleet Forces Command. Submitted to Naval Facilities Engineering Command Atlantic, Norfolk, Virginia, under Contract No. N62470-15-D-8006, Task Order 50, issued to HDR Inc., Virginia Beach, Virginia. March 2018