Vessel Surveys and Visual Species-Verification Trials at the Jacksonville Shallow Water Training Range

2024

ANNUAL PROGRESS REPORT

PREPARED BY

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Rough-toothed dolphins (*Steno bredanensis*). Photo by Megan Bradley, taken under General Authorization Letter of Confirmation 25471 held by Andrew Read (Duke University).

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Science ⚓ Stewardship ⚓ Protection

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Acronyms and Abbreviations

AFTT	Atlantic Fleet Training and Testing
AUTEC	Atlantic Undersea Test and Evaluation Center
CS-SVM	Class-Specific Support Vector Machine
Ggr	*Grampus griseus* (Risso's dolphin)
JSWTR	Jacksonville Shallow Water Training Range
km	kilometer(s)
km^2	square kilometer(s)
M3R	Marine Mammal Monitoring on Navy Ranges
N/A	not applicable
NOAA	National Oceanic and Atmospheric Administration
OBIS-SEAMAP	Ocean Biodiversity Information System Spatial Ecological Analysis of Megavertebrate Populations
OPAREA	Operating Area
photo-ID	photo-identification
PMRF	Pacific Missile Range Facility
R/V	Research Vessel
Sbr	*Steno bredanensis* (rough-toothed dolphin)
Sfr	*Stenella frontalis* (Atlantic spotted dolphin)
SOAR	Southern California Tactical Training Range
Ttr	*Tursiops truncatus* (bottlenose dolphin)
U.S.	United States

1. Introduction

This report describes results from vessel surveys and visual species-verification trials conducted at the Jacksonville Shallow Water Training Range (JSWTR) in the Jacksonville Operating Area (OPAREA). This work continues from the original multi-institutional monitoring program 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 baseline monitoring program began in 2007, with aerial and vessel surveys as well as passive acoustic monitoring within Onslow Bay, North Carolina; it subsequently expanded to include study areas off the coast of Jacksonville, Florida; Cape Hatteras, North Carolina; and Virginia Beach, Virginia. In Onslow Bay, 6 years of monitoring yielded a comprehensive picture of the density, distribution, and abundance of marine mammals and sea turtles as well as provided new insights into residency patterns among pelagic delphinids within this region (Read et al. 2014). Dedicated survey effort within the Onslow Bay site concluded in 2013. Off the coasts of Cape Hatteras and Virginia Beach, more than a decade of surveys and passive acoustic monitoring have also provided information on the complex distribution patterns of the marine mammals and sea turtles within this highly productive area, as well as their species diversity, and has formed the basis for several more recent focused monitoring projects. In addition, more than 9 years of baseline monitoring within the Jacksonville OPAREA have provided similar information on the density and distribution of marine mammals and sea turtles (Foley et al. 2019).

Although the original standardized line-transect visual surveys and archival passive acoustic monitoring have been discontinued in the Atlantic Fleet Training and Testing (AFTT) OPAREAs, that foundational work has provided a robust baseline for several ongoing tagging and behavioral response projects (see Atlantic Behavioral Response Study, Mid-Atlantic Offshore Cetacean Monitoring, and Mid-Atlantic Nearshore & Mid-shelf Baleen Whale Monitoring). The JSWTR was installed in 2018, and a dedicated passive acoustic marine mammal monitoring system (Marine Mammal Monitoring on Navy Ranges [M3R]) was integrated in 2019. Small-vessel surveys resumed on JSWTR in 2018 to support development and calibration of detection and classification algorithms for the M3R system through visual species-verification trials. This report describes vessel monitoring activities, including photo-identification (photo-ID), satellite tagging, biopsy sampling, and visual species verification at the Jacksonville study area in 2024. Photo-ID work for AFTT protected species monitoring for Jacksonville and Cape Hatteras is reported separately (Waples and Read 2025).

2. Methods

2.1 Study Area

The study area within the Jacksonville OPAREA is 5,786 square kilometers (km^2), surrounding the JSWTR, 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 1**).

2.2 Data Collection

In May 2024, the study team employed visual survey methods to support species-verification trials in conjunction with the M3R system in coordination with the Naval Undersea Warfare Center, Division Newport (see **Section 5**). The study team conducted surveys from Research Vessel (R/V) *Shearwater* (**Figure 2**).When the M3R team relayed a possible cetacean location (see Jarvis et al. 2014 for M3R methods), the research vessel transited to the provided location coordinates, and two observers (one port and one starboard) scanned continuously from straight ahead to 90 degrees abeam on both sides of the trackline. The study team recorded the location, species, and behavior of every cetacean group observed, as well as the location and species identity of all sea turtles. The team collected environmental conditions (weather conditions, Beaufort Sea state, depth, and sea-surface temperature) at each sighting and whenever survey conditions changed. The team logged sighting and environmental data on an iPad tablet linked to a Global Positioning System unit.

The study team examined use of the survey area by individual cetaceans using photo-ID and collected biopsy samples for analysis of population structure. The team obtained digital photographs to confirm species identification at each sighting. The team took photographs with Canon or Nikon digital single-lens reflex cameras (equipped with 100- to 400-millimeter zoom lenses) in 24-bit color at a resolution of 6,016 × 4,016 pixels and saved them in .jpg format. The team used remote biopsy-sampling methods to collect small skin and blubber samples using a variety of 27- to 68-kilogram pull crossbows, depending on the species and sampling distance. The team collected biopsy samples with a specialized 2.5-centimeter stainless-steel biopsy tip attached to a modified bolt, typically fired from the survey vessel's bow. Biopsy tips were discharged between 4 and 30 meters from the animal at a maximum velocity of 86.9 meters per second (a typical safe operating velocity for biopsy collection from marine mammals using crossbows [Sinclair et al. 2015]).

Figure 1. The R/V *Shearwater*.

2.3 Data Analysis

The study team mapped vessel survey effort and sighting data using ArcGIS Pro 3.02 (Esri, Redlands, California). All sighting data collected will be posted on the data archive Ocean Biodiversity Information System Spatial Ecological Analysis of Megavertebrate Populations (OBIS-SEAMAP).

2.4 Data Storage

The study team has archived all acoustic, visual survey, and photographic data on digital media, and backed them up on a Duke University network server.

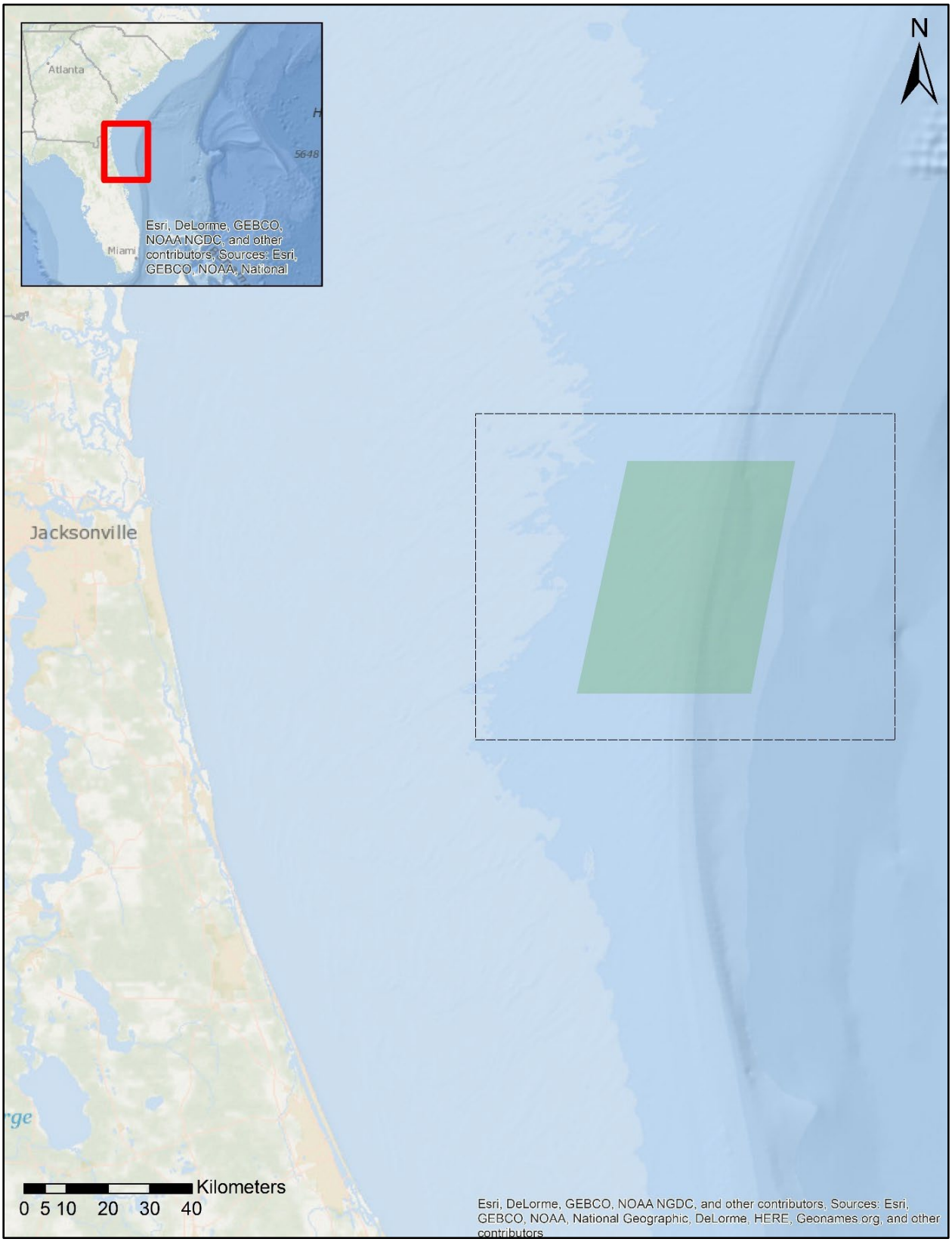


Figure 2. Map of the Jacksonville study area (dashed outline) and the JSWTR site (green shaded box).

3. Results

3.1 Vessel Survey Effort

During 2024, the study team conducted 3 days of vessel surveys within the Jacksonville study area and 2 additional days of opportunistic surveys during transits from Beaufort, North Carolina, totaling approximately 542 kilometers (km) and 30 hours of survey effort (**Table 1**). The study team conducted these surveys in Beaufort sea state 1 to 4, and covered the JSWTR site as well as shelf and pelagic waters between Florida and North Carolina; see **Figure 3** and **Figure 4**. Additional surveys were anticipated in October and November, but the power to JSWTR was down due to Hurricane Milton so those efforts were cancelled.

Table 1. Dates, distances, and durations surveyed during vessel surveys within the Jacksonville survey area in 2024.

Date	Beaufort Sea State	Distance Surveyed (km)	Survey Time (hours:minutes)	At-Sea Time (hours:minutes)	Platform
7-May-2024	3–6	—	—	18:40	R/V *Shearwater*
8-May-2024	3	75.9	4:24	23:23	R/V *Shearwater*
9-May-2024	—	—	—	—	—
10-May-2024	—	—	—	—	—
11-May-2024	3–4	130.5	9:51	18:05	R/V *Shearwater*
12-May-2024	2–4	192.6	10:47	24:00	R/V *Shearwater*
13-May-2024	0–4	143.5	5:03	14:55	R/V *Shearwater*

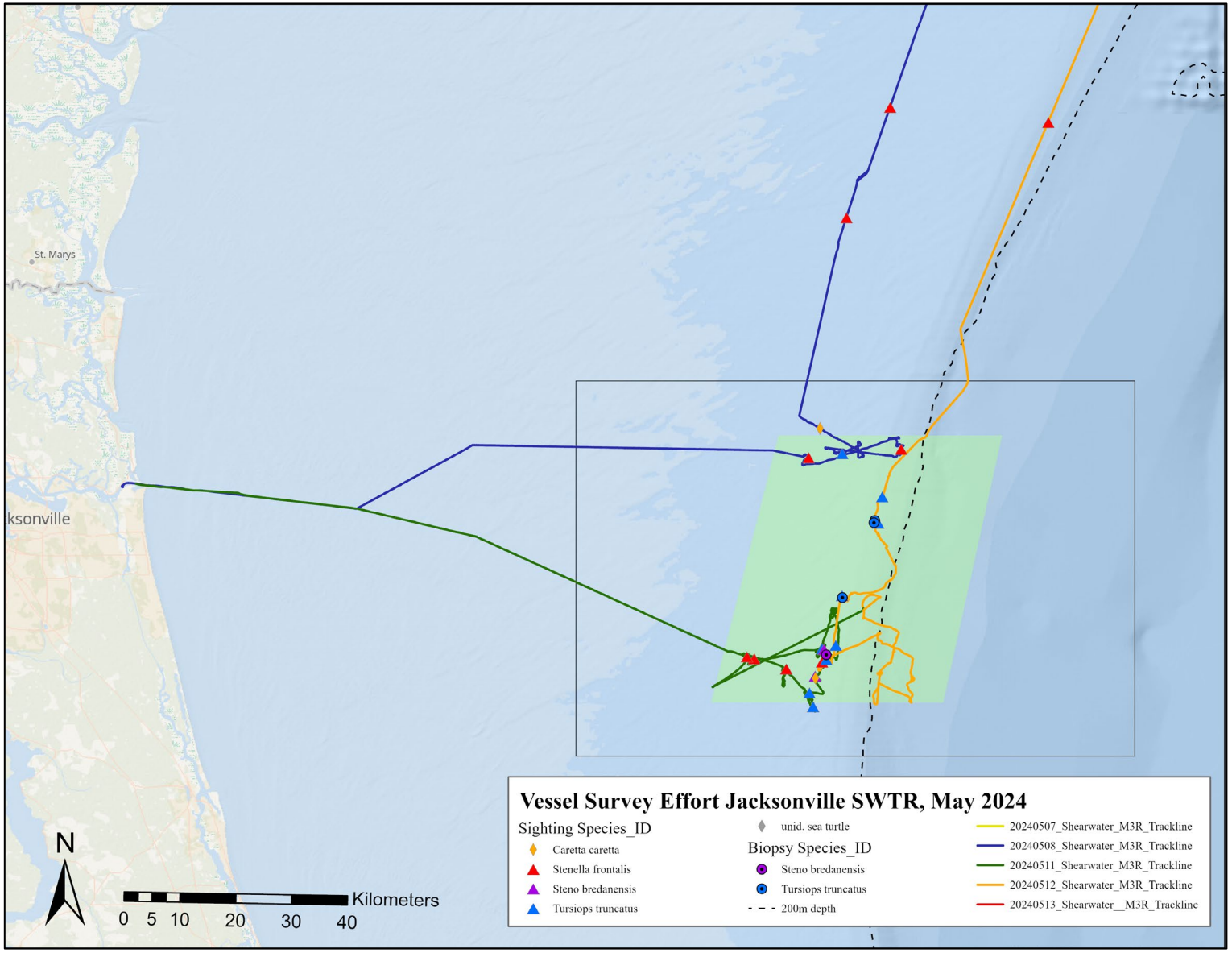


Figure 3. Vessel survey effort conducted by the R/V *Shearwater* for May 2024 within the Jacksonville survey area.

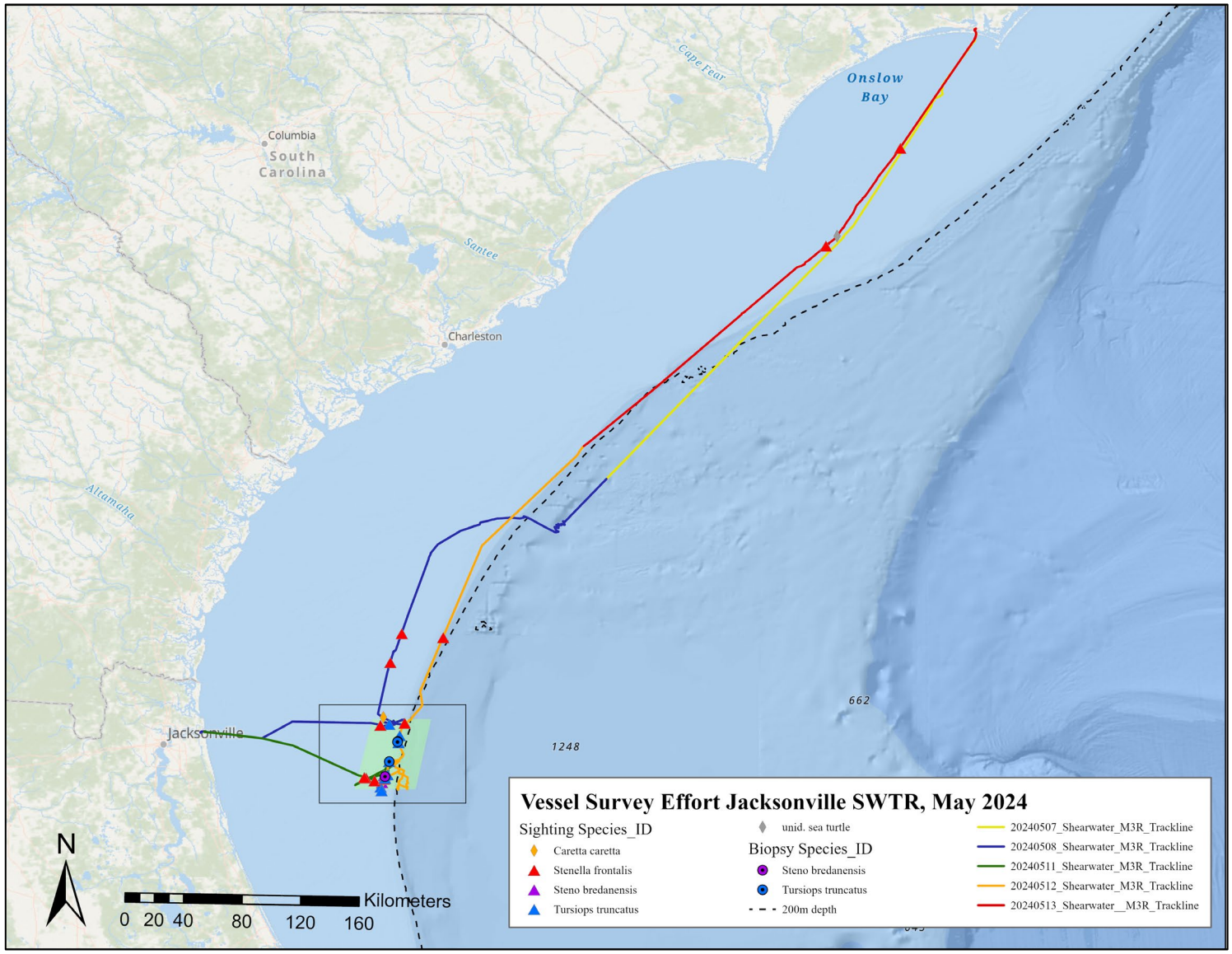


Figure 4. **Vessel survey effort conducted by the R/V *Shearwater* for May 2024 during transits and surveys.**

3.2 Marine Mammal and Sea Turtle Sightings

The study team recorded 22 cetacean sightings during these vessel surveys (**Table 2** and **Table 3**). Atlantic spotted dolphins (*Stenella frontalis*; *n*=11) and bottlenose dolphins (*Tursiops truncatus*; *n*=9) dominated the marine mammal fauna. The team also observed two small groups of rough-toothed dolphins (*Steno bredanensis*; *n*=2), as well as loggerhead sea turtles (*Carreta caretta*; *n=2*) and an unidentified sea turtle (*n*=1) within the survey area during 2024 (**Table 4)**.

3.3 Distributions and Habitat Associations of Cetaceans

The distributions of marine mammal sightings from North Carolina to Florida and within the Jacksonville survey area is similar to previous years (**Figure 5** and **Figure 6).** As in previous years, Atlantic spotted dolphins were restricted to shallow shelf waters. Bottlenose dolphins were also only observed in shallow shelf waters ahead of the continental shelf break; whereas, in previous years, they have been spotted offshore of the continental shelf break as well. However, vessel days during 2024 were very limited and very little surveying occurred east of the shelf break due to sea state conditions (**Figure 3**). The study team also observed rough-toothed dolphins in shallow shelf waters in proximity to bottlenose sightings.

3.4 Biopsy Sampling and Genetic Analyses

The study team collected three biopsy samples within the Jacksonville survey area during 2024. The team obtained one sample from a rough-toothed dolphin and two samples from bottlenose dolphins (**Table 5** and **Figure 7**). The team archived voucher specimens of these samples at the Duke University Marine Laboratory in Beaufort, North Carolina.

Table 2. Cetacean sightings from vessel surveys in the Jacksonville study area in 2024.

Date	Time (local)	Latitude (°N)	Longitude (°W)	Species	Common Name	Group Size	Biopsy Samples	Photo-ID Images
8-May-2024	13:00:00	31.00895	80.19523	*Stenella frontalis*	Atlantic spotted dolphin	7	—	—
8-May-2024	13:41:00	30.83134	80.26555	*Stenella frontalis*	Atlantic spotted dolphin	999	—	—
8-May-2024	15:03:00	30.45194	80.27227	*Tursiops truncatus*	Bottlenose dolphin	8	—	43
8-May-2024	16:00:00	30.45900	80.17751	*Stenella frontalis*	Atlantic spotted dolphin	5	—	123
8-May-2024	17:25:00	30.44555	80.32656	*Stenella frontalis*	Atlantic spotted dolphin	6	—	37
11-May-2024	18:38:00	30.12209	80.41403	*Stenella frontalis*	Atlantic spotted dolphin	5	—	111
11-May-2024	9:44:00	30.13813	80.30503	*Tursiops truncatus*	Bottlenose dolphin	1	—	—
11-May-2024	11:00:00	30.13713	80.30174	*Steno bredanensis*	Rough-toothed dolphin	5	1	202
11-May-2024	13:33:00	30.09411	80.31609	*Steno bredanensis*	Rough-toothed dolphin	3	—	—
11-May-2024	14:48:00	30.06715	80.32516	*Tursiops truncatus*	Bottlenose dolphin	5	—	68
11-May-2024	15:19:00	30.04490	80.31929	*Tursiops truncatus*	Bottlenose dolphin	6	—	71
11-May-2024	15:45:00	30.08377	80.71182	*Stenella frontalis*	Atlantic spotted dolphin	5	—	91
11-May-2024	16:05:00	30.12518	80.42568	*Stenella frontalis*	Atlantic spotted dolphin	13	—	205
12-May-2024	17:13:00	30.11675	80.30494	*Stenella frontalis*	Atlantic spotted dolphin	5	—	156
12-May-2024	18:25:00	30.12067	80.29810	*Tursiops truncatus*	Bottlenose dolphin	9	—	102
12-May-2024	10:43:00	30.14348	80.28281	*Tursiops truncatus*	Bottlenose dolphin	2	—	2
12-May-2024	11:21:00	30.22339	80.27265	*Tursiops truncatus*	Bottlenose dolphin	8	1	54
12-May-2024	12:00:00	30.34019	80.21463	*Tursiops truncatus*	Bottlenose dolphin	8	1	65
12-May-2024	12:36:00	30.38244	80.20804	*Tursiops truncatus*	Bottlenose dolphin	2	—	23
12-May-2024	14:18:00	30.98460	79.94078	*Stenella frontalis*	Atlantic spotted dolphin	2	—	—
13-May-2024	12:41:00	33.38732	77.59154	*Stenella frontalis*	Atlantic spotted dolphin	5	—	26
13-May-2024	3:29:00	33.98690	77.13479	*Stenella frontalis*	Atlantic spotted dolphin	1	—	—

Key: °N = degrees north; °W = degrees west. 999=unknown group size

Table 3. Cetacean sightings by species from vessel surveys in the Jacksonville study area in 2024.

Species	Sightings 2024
Stenella frontalis	11
Steno bredanensis	2
Tursiops truncatus	9
Total	**22**

Table 4. Sea turtle sightings from vessel surveys in the Jacksonville study area in 2024.

Date	Time (local)	Latitude (°N)	Longitude (°W)	Species	Common Name	Group Size
8-May-2024	7:03:00 PM	30.49134	80.30812	*Caretta caretta*	Loggerhead sea turtle	1
11-May-2024	7:19:00 PM	30.08955	80.31551	*Caretta caretta*	Loggerhead sea turtle	1
13-May-2024	1:06:00 PM	33.44394	77.52297	—	Unidentified sea turtle	1

Key: °N = degrees north; °W = degrees west

Table 5. Biopsy samples collected within the Jacksonville study area in 2024.

Date	Time (local)	Latitude (°N)	Longitude (°W)	Species	Sample #
11-May-2024	5:33:00 PM	30.13713	80.30174	*Steno bredanensis*	ZTS-24-003
12-May-2024	4:36:00 PM	30.22339	80.27265	*Tursiops truncatus*	ZTS-24-004
12-May-2024	6:18:00 PM	30.34019	80.21463	*Tursiops truncatus*	ZTS-24-005

Key: °N = degrees north; °W = degrees west

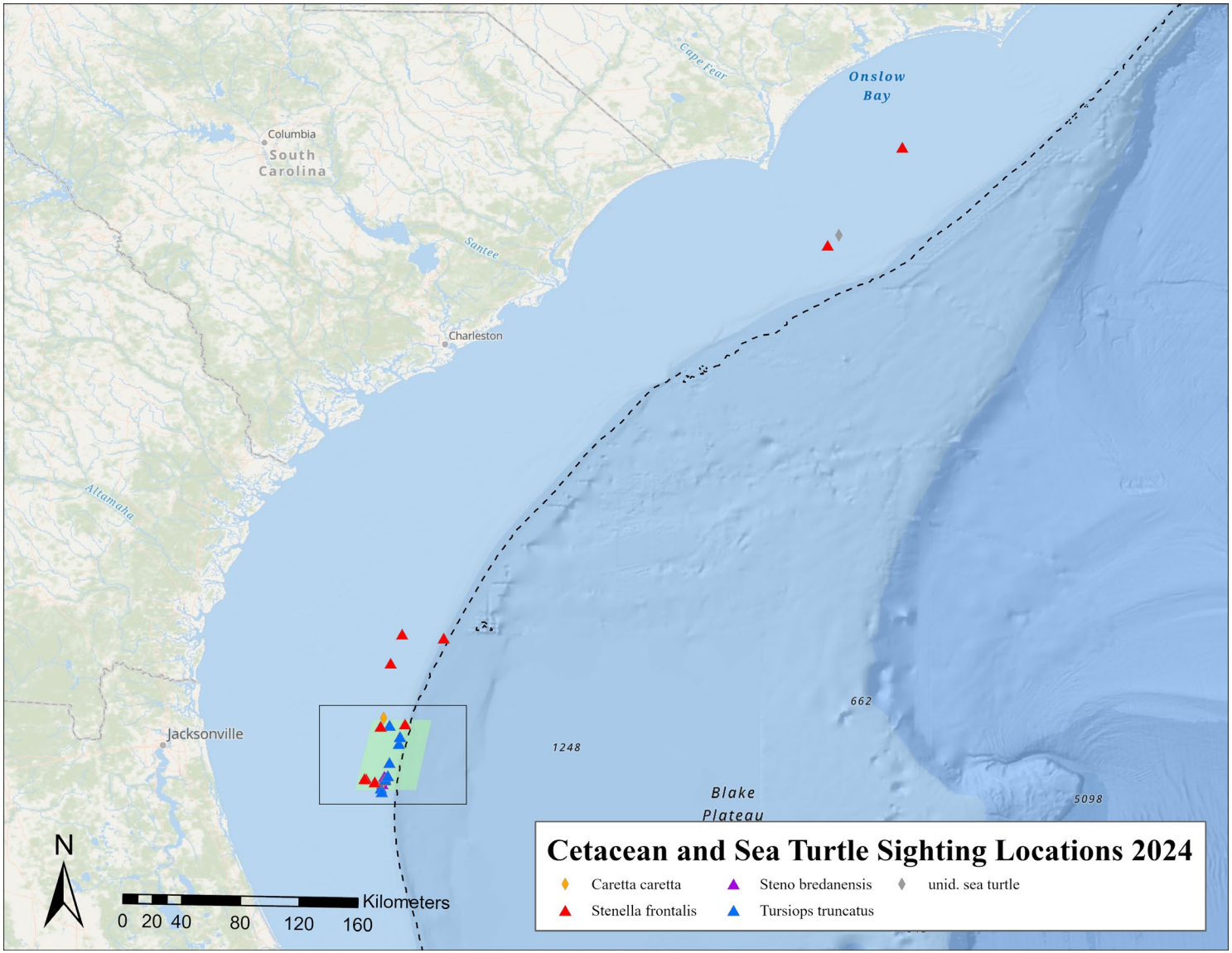


Figure 5. Distribution of all cetacean and sea turtle sightings during vessel surveys in 2024. Dashed line represents the 200m isobath.

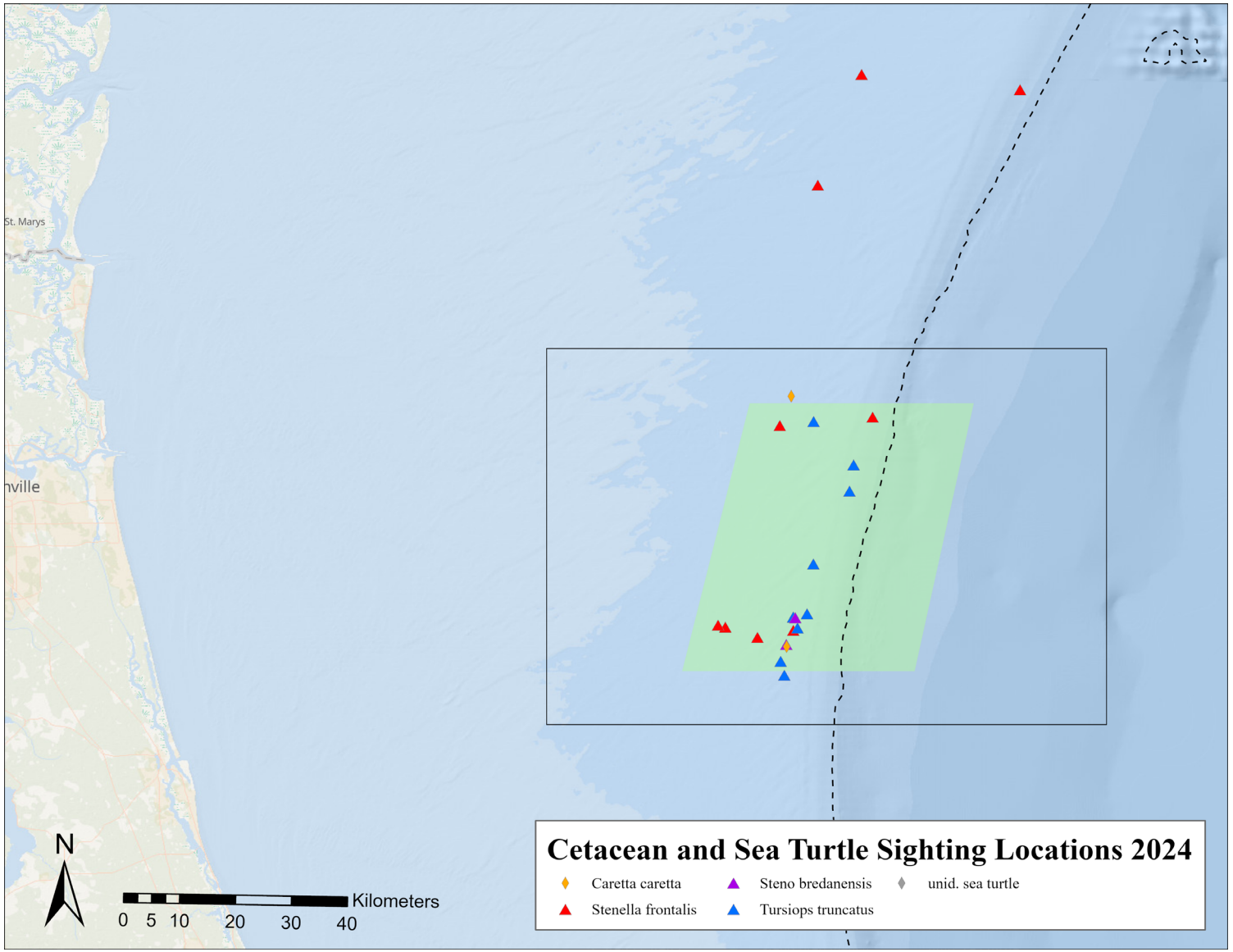


Figure 6. **Distribution of all cetacean and sea turtle sightings during vessel surveys within the Jacksonville survey area in 2024. Dashed line represents the 200m isobath.**

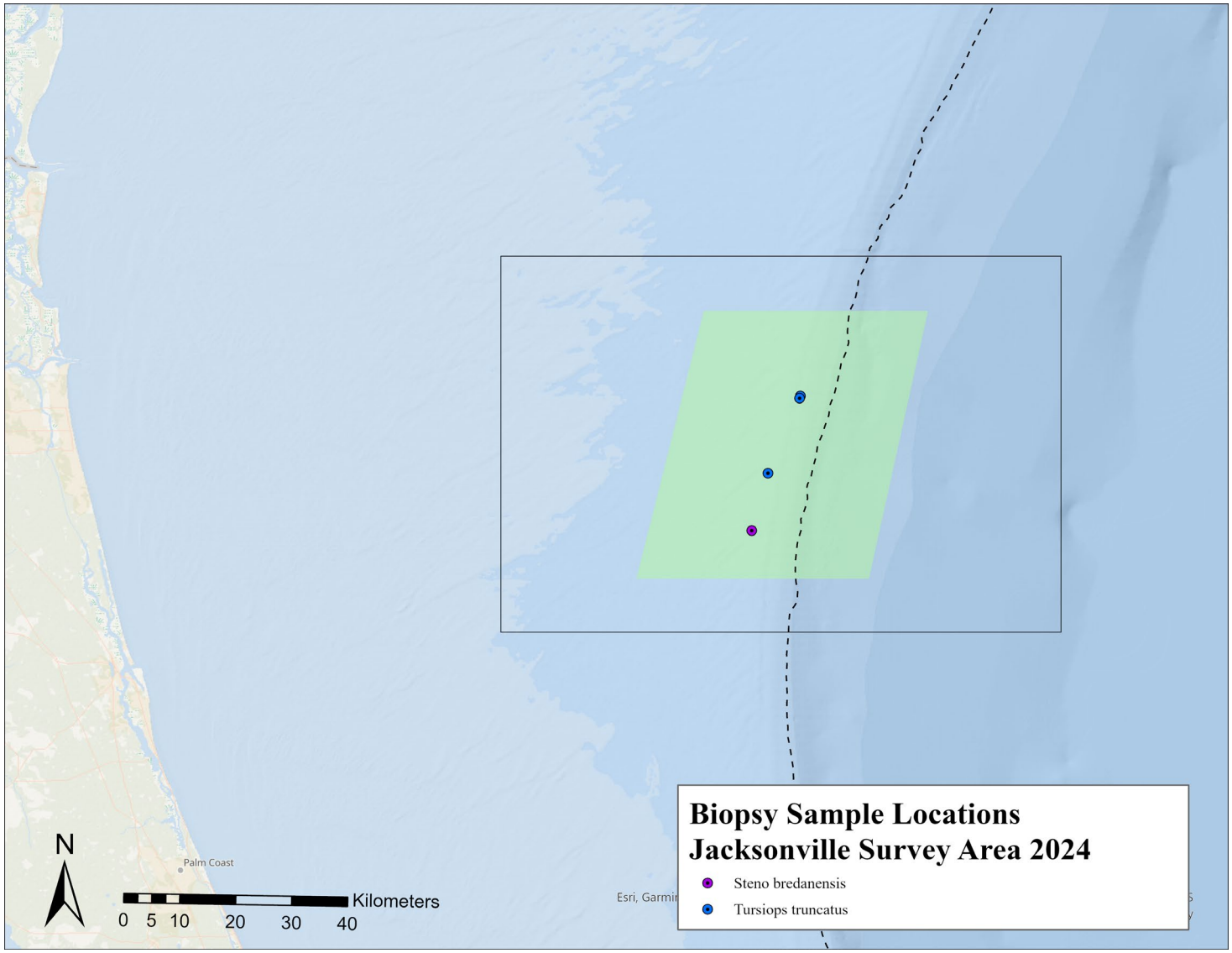


Figure 7. Locations of biopsy samples collected within the Jacksonville survey area in 2024. Dashed line represents the 200m isobath.

3.5 Satellite Tagging

During May 2024, the survey team coordinated with Jessica Aschettino from HDR Inc. to deploy satellite tags; however, as offshore sea conditions were not amenable, no tagging effort was attempted during the trip.

3.6 Photographic Effort

The study team collected more than 1,300 digital images for species confirmation and individual identification during May 2024. The team coded and graded all images for distinctiveness and photographic quality. Photo-ID analysis identified 16 new Atlantic spotted dolphins,18 new bottlenose dolphins, and 5 new rough-toothed dolphins; these individuals have been added to the existing catalogs (**Table 6**). Three dolphins were matched to the catalog (**Table 7**).

Table 6. Summary of photographs taken of animals within the Jacksonville survey area during 2024, with photo-ID catalog sizes and total numbers of catalog matches to date.

Species	Common Name	Images	Catalog Size	Matches to Date
Globicephala macrorhynchus	Short-finned pilot whale	0	52	0
Grampus griseus	Risso's dolphin	0	73	1
Stenella frontalis	Atlantic spotted dolphin	749	285	29
Tursiops truncatus	Bottlenose dolphin	428	233	34
Steno bredanensis	Rough-toothed dolphin	202	85	11
Pseudorca crassidens	False killer whale	0	15	0

Two Atlantic spotted dolphins were matched to the catalog in 2024. Sfr 6-025 was first observed during June 2016 and had not been re-sighted until 2024, giving a re-sighting interval of nearly 8 years. Sfr 7-049 was first observed during May 2021 and was not re-sighted until 2024.

During 2024, one bottlenose dolphin was re-sighted from previous years. Ttr 1_023 was added to the catalog in May 2021, re-sighted twice that same month, and sighted again during May 2024. Re-sightings provide evidence that these pelagic cetaceans are residents of the JSWTR area, and they may be experiencing repeated exposure to disturbance. A detailed summary of re-sightings made to date can be found in the study team's 2023 Annual Report (Alvarez et al. 2023)

A new false killer whale (*Pseudorca crassidens*) catalog was created after 15 distinct individuals were identified in 2023. During 2024, the study team compared this new catalog with a catalog created from seabirding trips conducted by Kate Sutherland and Brian Patteson off Cape Hatteras, North Carolina, but no matches were made. The study team contacted additional colleagues within the area, but none had an extant false killer whale catalog. The team then compared its catalog to that of L'Observatoire des Mammifères Marins de l'Archipel Guadeloupéen in Guadeloupe, but could not confirm any matches.

Table 7. Photo-ID matches of delphinids observed within the Jacksonville survey area.

ID[a]	Year[b]													
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2021	2022	2023	2024
Ttr 1-017	—	—	—	—	—	—	—	—	—	—	X[m]	—	—	—
Ttr 1-018	—	—	—	—	—	—	—	—	—	—	X[m]	—	—	—
Ttr 1-023	—	—	—	—	—	—	—	—	—	—	X[m]			X
Ttr 6-007	—	—	—	—	X	—	—	—	X	—	—	—	—	—
Ttr 6-010[c]	—	—	—	X	X	—	—	—	—	—	—	—	—	—
Ttr 6-029	—	—	—	—	—	—	—	X	—	—	—	X	—	—
Ttr 6-036[c]	—	—	—	X	X	—	—	—	—	—	—		—	—
Ttr 6-037[c]	—	—	—	—	X	—	—	—	X	—	—	—	—	—
Ttr 6-038[c]	—	—	—	—	X	—	—	—	X	—	—	—	—	—
Ttr 6-043	—	—	—	—	—	—	—	—	—	—	X	X	X	—
Ttr 6-047	—	—	—	—	—	—	—	—	—	—	X[m]	—	—	—
Ttr 6-048	—	—	—	—	—	—	—	—	—	—	X[m]	—	—	—
Ttr 6-050	—	—	—	—	—	—	—	—	—	—	X[m]	—	—	—
Ttr 6-051	—	—	—	—	—	—	—	—	—	—	X[m]	—	—	—
Ttr 7-010	—	—	—	X	—	—	—	—	—	—	—	X	—	—
Ttr 7-022[c]	—	—	—	—	—	—	X	—	X	—	—	—	—	—
Ttr 7-030[c]	—	—	—	—	—	—	X[y]	—	X	—	—	—	—	—
Ttr 7-031[c]	—	—	—	—	—	—	X	—	X	—	—	—	—	—
Ttr 7-042	—	—	—	—	—	—	—	—	—	—	X[m]	—	—	—
Ttr 7-043	—	—	—	—	—	—	—	—	—	—	X[m]	—	—	—
Ttr 7-047	—	—	—	—	—	—	—	—	—	—	X[m]	—	—	—
Ttr 7-051	—	—	—	—	—	—	—	—	—	—	—	X[m]	—	—
Ttr 7-053	—	—	—	—	—	—	—	—	—	—	—	X[m]	—	—
Ttr 7-060	—	—	—	—	—	—	—	—	—	—	—	—	X[c]	—
Ttr 8-018	—	—	—	—	—	—	—	—	—	—	X[m]	—	—	—

ID[a]	Year[b]													
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2021	2022	2023	2024
Ttr 8-034	—	—	—	—	—	—	—	—	—	—	—	—	X[c]	
Ttr 9-025	—	—	—	—	—	—	—	—	—	—	X[m]	—	—	—
Ttr 9-028	—	—	—	—	—	—	—	—	—	—		X[m]	—	—
Ttr DU 1-001	—	—	—	—	—	—	—	—	—	—	X[m]	—	—	—
Ttr DU 7-028	—	—	—	—	—	—	—	—	—	—	X[m]	—	—	—
Ttr DU 8-011	—	—	—	—	—	—	—	—	—	—	X[m]	—	—	—
Sfr 1-008	—	—	—	—	—	X	—	—	—	—	X	—	—	—
Sfr 1-022	—	—	—	—	—	—	—	—	—	—	X	X	—	—
Sfr 2-002	—	X	—	—	—	—	—	—	X	—	—	—	—	—
Sfr 2-006	—	—	—	X	—	—	—	X	—	—	—	—	—	—
Sfr 3-001	—	X	X	—	—	—	—	—	—	—	—	—	—	—
Sfr 6-024[c]	—	—	—	—	—	—	—	X	X	—	—	—	—	—
Sfr 6-006[c]	—	—	—	—	—	X	—	—	X[m]	—	—	—	—	—
Sfr 6-010	—	X	—	—	—	—	—	—	X	—	—	—	—	—
Sfr 6-025	—	—	—	—	—	—	—	X	—	—	—	—	—	X
Sfr 7-008[c]	—	—	—	—	X	—	—	X	X	—	—	—	—	—
Sfr 7-010	—	—	—	—	X	—	—	—	X	—	—	—	—	—
Sfr 7-013[c]	—	—	—	—	—	X	—	—	X[m]	—	—	—	—	—
Sfr 7-014[c]	—	—	—	—	—	X	—	—	X[m]	—	—	—	—	—
Sfr 7-015	—	—	—	—	—	X	—	—	X	—	—	—	—	—
Sfr 7-035[c]	—	—	—	—	—	—	—	X	X	—	—	—	—	—
Sfr 7-040	—	—	—	—	—	—	—	—	—	—	X	X	—	—
Sfr 7-049	—	—	—	—	—	—	—	—	—	—	X	—	—	X
Sfr 8-005	—	—	X[m]	—	—	—	—	—	—	—	—	—	—	—
Sfr 8-027	—	—	—	—	—	X	—	—	—	—	X	—	—	—
Sfr 8-037[c]	—	—	—	—	—	—	—	—	X[y]	—	—	—	—	—
Sfr 8-038[c]	—	—	—	—	—	—	—	—	X[m]	—	—	—	—	—

ID[a]	Year[b]													
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2021	2022	2023	2024
Sfr 8-052	—	—	—	—	—	—	—	—	—	—	X^m	—	—	—
Sfr 9-011[c]	—	—	—	—	X	—	—	—	X	—	—	—	—	—
Sfr 9-037[c]	—	—	—	—	—	—	—	—	X^m	—	—	—	—	—
Sfr 9-040[c]	—	—	—	—	—	—	—	X	X	—	—	—	—	—
Sfr DU 1-003[c]	—	—	—	—	—	—	—	—	X^m	—	—	—	—	—
Sfr DU 6-010[c]	—	—	—	—	—	—	—	—	X^m	—	—	—	—	—
Sfr DU 7-008[c]	—	—	—	—	—	—	—	—	X^m	—	—	—	—	—
Sfr DU 8-014[c]	—	—	—	—	—	—	—	—	X^y	—	—	—	—	—
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	—	—	—	—	—	—
Sbr 7-007	—	—	—	—	—	—	—	X	—	—	X	—	—	—
Sbr 7-019	—	—	—	—	—	—	—	—	X	—	X	—	—	—
Sbr 7-029	—	—	—	—	—	—	—	—	—	—	X	—	X	—
Ggr 1-013	—	—	—	—	—	—	—	—	X	—	X	—	—	—

[a] Ggr = *Grampus griseus* (Risso's dolphin); Sbr = *Steno bredanensis* (rough-toothed dolphin); Sfr = *Stenella frontalis* (Atlantic spotted dolphin); Ttr = *Tursiops truncatus* (bottlenose dolphin)

[b] X = sighted; X^m = re-sighted within same month; X^y = re-sighted within same year

[c] Observed together in multiple sightings

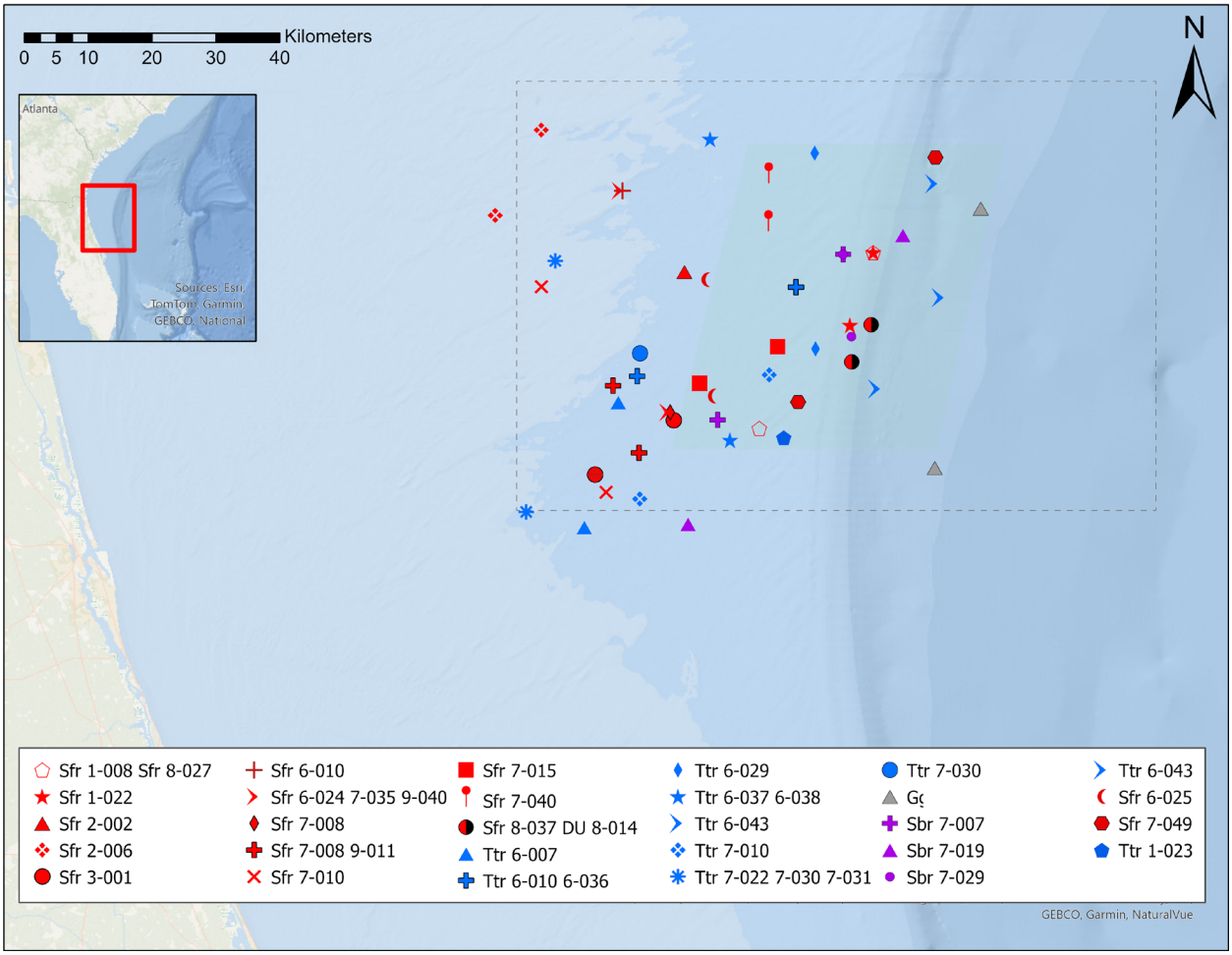


Figure 8. Locations of photo-matched delphinids within the Jacksonville survey area to date, excluding same- or next-day re-sightings.

4. Summary: 2009–2024

Since the beginning of vessel-based visual monitoring within the Jacksonville study area in 2009, 16,780km have been surveyed (**Table 8**). The team has made 484 cetacean sightings (**Table 9**) and 312 sea turtle sightings (**Table 10**), and collected 142 biopsy samples (**Table 11**). Additionally, photo-ID catalogs have been created and annually maintained for six cetacean species (**Table 12**).

Table 8. Vessel survey effort from July 2009 through December 2024 within the Jacksonville survey area.

Effort	2009–2010	2011	2012	2013	2014	2015	2016	2017	2018	2021	2022	2023	2024	Total
Survey Hours	127.1	20.9	58.6	58.7	66.8	44.2	130.7	66.1	15.3	123.6	78.3	69.8	30.08	**890.18**
Survey Distance (km)	2,074	346	937	1,022	1,227	858	2,136	1,424	315	3,942	475	1,481	542.56	**16,780**

Table 9. Cetacean sightings by species from July 2009 through December 2024 during vessel surveys within the Jacksonville survey area.

Species	Sightings												
	2009–2010	2011	2012	2013	2014	2015	2016	2017	2018	2021	2022	2023	2024
Balaenoptera acutorostrata	0	0	0	0	0	0	0	0	0	0	0	1	0
Eubalaena glacialis	0	0	0	0	1	0	0	0	0	0	0	0	0
Globicephala macrorhynchus	3	0	0	0	0	0	5	0	1	0	0	0	0
Grampus griseus	2	0	0	1	1	1	0	2	0	3	0	0	0
Pseudorca crassidens	0	0	0	0	0	0	0	0	0	0	0	1	0
Stenella attenuata	0	0	0	0	0	0	2	0	0	0	0	0	0
Stenella frontalis	35	6	14	9	20	10	10	18	4	41	8	19	11
Steno bredanensis	0	0	0	0	0	0	2	1	0	2	0	1	2
Tursiops truncatus	19	6	23	15	18	10	18	16	0	38	21	15	9
Tursiops/Stenella mix	0	0	0	0	1	0	0	0	0	0	0	0	0
Unidentified delphinid	13	0	4	3	4	0	5	0	0	1	5	3	0
Total	**72**	**12**	**41**	**28**	**45**	**21**	**42**	**37**	**5**	**85**	**34**	**40**	**22**

Table 10. Sea turtle sightings by species from July 2009 through December 2024 during surveys within the Jacksonville survey area.

Species	Sightings												
	2009–2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2021**	**2022**	**2023**	**2024**
Caretta caretta	52	20	41	33	31	22	22	24	0	7	3	6	2
Dermochelys coriacea	8	3	4	1	3	2	4	2	0	0	0	0	0
Lepidochelys kempii	1	0	1	0	0	0	0	0	0	0	0	0	0
Unidentified sea turtle	8	3	3	1	0	0	0	3	0	1	0	0	1
Total	**69**	**26**	**49**	**35**	**34**	**24**	**26**	**29**	**0**	**8**	**3**	**6**	**3**

Table 11. Biopsy samples collected from July 2009 through December 2024 during vessel surveys within the Jacksonville survey area.

Species	2009–2010	2011	2012	2013	2014	2015	2016	2017	2018	2021	2022	2023	2024	Total
Globicephala macrorhynchus	0	0	0	0	0	0	5	0	1	0	0	0	0	**6**
Grampus griseus	0	0	0	1	2	0	0	0	0	0	0	0	0	**3**
Pseudorca crassidens	0	0	0	0	0	0	0	0	0	0	0	3	0	**3**
Stenella attenuata	0	0	0	0	0	0	1	0	0	0	0	0	0	**1**
Stenella frontalis	0	0	19	6	19	3	7	8	0	1	0	0	0	**63**
Steno bredanensis	0	0	0	0	0	0	4	2	0	0	0	0	1	**7**
Tursiops truncatus	0	0	12	5	10	5	5	2	0	12	5	1	2	**59**
Total	**0**	**0**	**31**	**12**	**31**	**8**	**22**	**12**	**1**	**13**	**5**	**4**	**3**	**142**

Table 12. Summary of images collected during all vessel surveys within the Jacksonville survey area from 2009 through 2024, with photo-ID catalog sizes and total matches to date.

Species	2009–2010		2011		2012		2013		2014		2015		2016		2017		2018		2021		2022		2023		2024	
	C	M	C	M	C	M	C	M	C	M	C	M	C	M	C	M	C	M	C	M	C	M	C	M	C	M
Globicephala macrorhynchus	0	0	0	0	0	0	12	0	12	0	12	0	29	0	29	0	52	0	52	0	52	0	52	0	52	0
Grampus griseus	1	0	1	0	1	0	7	0	22	0	36	1	36	1	56	1	56	1	73	1	73	1	73	1	73	1
Stenella frontalis	21	0	36	0	58	2	74	2	109	2	117	2	153	3	199	20	204	22	257	25	266	27	285	27	301	29
Tursiops truncatus	19	0	25	0	43	0	53	2	80	2	102	2	113	2	131	8	131	8	186	14	221	20	233	23	251	24
Steno bredanensis	0	0	0	0	0	0	0	0	0	0	0	0	43	0	54	8	54	8	78	11	78	11	85	12	90	12
Pseudorca crassidens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0	15	0

Note: No surveys occurred during 2019–2020.
Key: C= catalog size; M=matches

5. Marine Mammal Monitoring on Navy Ranges Species-Verification Trials

The following excerpt is derived from Dolan et al. (2025)

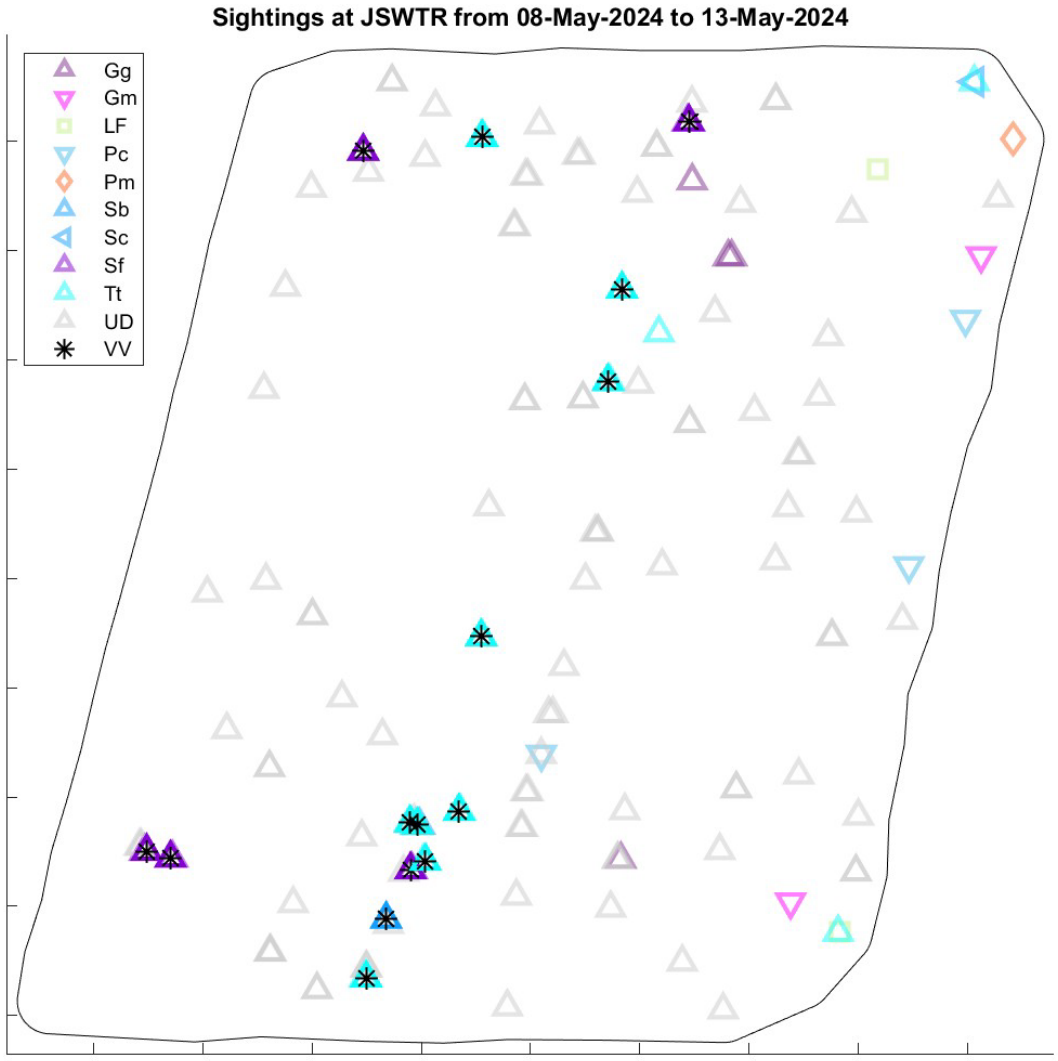
The M3R program began in 2000, with the development of a system to use the bottom-mounted hydrophones of the U.S. Navy's test and training ranges to detect, classify, localize, and monitor marine mammals in real time by listening for their vocalizations. Each of the ranges has 100 to 200-plus widely spaced hydrophones, and the systems consist of rack-mounted computer nodes and monitoring displays connected with Gigabit networks. The M3R system is currently installed at the Atlantic Undersea Test and Evaluation Center (AUTEC), Southern California Tactical Training Range (SOAR), Pacific Missile Range Facility (PMRF), JSWTR, and Canadian Forces Maritime Experimental and Test Ranges Nanoose Range. The M3R program collects continuous archive data and periodic broadband recordings from each of these ranges; it uses these data, along with field tests, for collaborative studies on marine mammal behavior, distribution, abundance, foraging, and habitat use. These data are useful for understanding the effects of U.S. Navy activities and the long-term health of the populations, as well as for the development of detection, classification, localization, and density estimation algorithms.

JSWTR has 223 active hydrophones mounted at depths ranging from 25 to 255 meters over a span of 2,000 km^2 (**Figure 9**), making it the largest M3R system to date. In contrast to the AUTEC, PMRF, and SOAR deep-water ranges on which the M3R system is deployed, JSWTR is a shallow-water range that is likely to have different species present than those typically found on the deep-water ranges. The M3R system runs nearly continuously year-round, archiving data from all range hydrophones simultaneously in real time when no range activities would preclude its operation. Detection, classification, and localization reports are stored to binary archive files for later playback and analysis. The M3R system employs three detector/classifiers: a Fast Fourier Transform-based detector, a Class-Specific Support Vector Machine (CS-SVM) detector/classifier, and a Blainville's beaked whale (*Mesoplodon densirostris*) foraging click matched filter (Jarvis et al. 2008). The CS-SVM classifier at JSWTR currently includes six classes: Blainville's beaked whale foraging and buzz clicks, goose-beaked whale (*Ziphius cavirostris*) foraging and buzz clicks, sperm whale clicks, and "generalized dolphin" clicks.

M3R personnel completed one species-verification trial during 8 to 12 May 2024 in collaboration with Duke University and HDR Inc. Another species verification-trial was scheduled for October 2024 but was cancelled due to hurricane activity. During the May trial, M3R personnel used the M3R passive acoustic monitoring displays to look for species of interest and direct the on-water team to the locations of the animals. Communication was via satellite texts. Upon finding the animals, Duke University and HDR Inc. crew members verified the species; collected behavioral and environmental data, photographs for their photo-ID catalogs, and biopsy samples; and placed satellite tags on individuals. The focal species for these efforts were Short-finned pilot whales, Bottlenose dolphins, Atlantic spotted dolphins, Risso's dolphin, and Rough-toothed dolphins.

During this trial, all five focal species were acoustically identified by M3R, with three visually verified by the on-water team (bottlenose dolphins, Atlantic spotted dolphins, and rough-toothed dolphins; **Table 13, Figure 9**). A total of 125 acoustic detections were logged, including 9 for bottlenose dolphins, 2 for short-finned pilot whales, 6 for Atlantic spotted dolphins, 4 for Risso's dolphins, 3 for false killer whales, and 3 for rough-toothed dolphins. A total of 97 acoustic detections were unable to be identified to the species level and remained classified as unidentified delphinid species or unidentified low-frequency biological source (sounds produced at less than 1 kilohertz). Snapping shrimp were persistently present during all trials, but not explicitly monitored. Each acoustic detection may represent either a single animal or a group of animals; however, note that each detection is not necessarily a new individual or a new group, as the same animal or group could be detected more than once over the course of the day. Additionally, individuals could potentially move between groups. Data shown in **Table 13** were extracted from field test logs during 2024.

Of these acoustic detections, 10 cases occurred in which M3R directed the on-water team to animals of interest. "Directed" detections are considered those in which a location was sent, and the field team decided to go to the location. The on-water team visually verified 9 groups of bottlenose dolphins, 6 groups of Atlantic spotted dolphins, and 2 groups of rough-toothed dolphins. Numerous photographs, underwater footage, and behavioral data were collected from all verified species. One biopsy was collected from the group of 5 rough-toothed dolphins, and 2 biopsies were taken from two different groups of bottlenose dolphins. No animals were successfully tagged due to a combination of weather restrictions and staffing limitations.



Key: Species included Risso's dolphin (Gg), short-finned pilot whale (Gm), false killer whale (Pc), sperm whale (Pm), rough-toothed dolphin (Sb), striped dolphin (Sc), Atlantic spotted dolphin (Sf), bottlenose dolphin (Tt), unknown delphinidae species (UD), and unknown biological low frequency source (LF; <1 kilohertz). Detections that were visually verified (VV) by Duke University are overlaid with an asterisk.

Figure 9. Acoustic detections and visual species verifications at JSWTR from 8 to 13 May 2024.

Table 13. Species acoustically identified with the M3R system at JSWTR, extracted from field test logs during 2024.

Species			Acoustic Detections Logged	Acoustic Detections Directed	Acoustic Detections Visually Verified	No. of Individual Tags Deployed	No. of Individual Biopsies
ID	**Common Name**	**Scientific Name**					
Tt	Bottlenose dolphin	*Tursiops truncatus*	9	6	9	0	2
Sf	Atlantic spotted dolphin	*Stenella frontalis*	6	6	6	0	0
Gg	Risso's dolphin	*Grampus griseus*	4	0	0	0	0
Sb	Rough-toothed dolphin	*Steno bredanensis*	2	2	2	0	1
Pc	False killer whale	*Pseudorca crassidens*	3	0	0	0	0
Sc	Striped dolphin	*Stenella coeruleoalba*	1	0	0	0	0
Gm	Short-finned pilot whale	*Globicephala macrorhynchus*	2	0	0	0	0
Pm	Sperm whale	*Physeter macrocephalus*	1	0	0	0	0
LF	Unknown low-frequency biological source	N/A	2	0	0	0	0
UD	Unidentified dolphin	Delphinidae sp.	95	3	0	0	0
		Total	**125**	**10**	**17**	**0**	**0**

Key: N/A = not applicable

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