Southeast Fisheries Science Center Reference Document MMTD-2026-06

CRUISE RESULTS

NOAA Ship *Gordon Gunter* Cruise (GU14-04)
July 2 – July 31, 2014

Southeast Gulf of Mexico Sperm Whale Study II

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service Southeast Fisheries Science Center
Marine Mammal and Sea Turtle Division
75 Virginia Beach Drive Miami, Florida 33149

March 2026

This cruise report is used for documentation and timely communication of preliminary results immediately following the conclusion of the survey. Data, as presented here, are subject to change as further auditing and analysis occur. This report was created in 2015 and published at NOAA's Institutional Repository in 2026.

At the time of data collection, Gulf of Mexico was recognized as the geographic location. "On January 20, 2025, President Trump issued an Executive Order that renamed the U.S. portion of the Gulf of Mexico as the "Gulf of America." The U.S. Department of Interior has established the official description for the Gulf of America within the Geographic Names Information System, which contains the official names for United States geographic features."

The Southeast Fisheries Science Center was authorized to conduct marine mammal research activities during the cruise under Marine Mammal Protection Act (MMPA) Permit No. 14450-02.

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Sperm whales (*Physeter macrocephalus*) are endangered marine mammals occurring year-round and widely distributed within the oceanic Gulf of Mexico (waters >200 m deep). While the population is broadly distributed, past surveys have documented the presence of two distinct areas of concentration: 1) near the Mississippi River Delta (northern Gulf), and 2) west of the Dry Tortugas, Florida (southeastern Gulf) (Maze-Foley & Mullin 2006). The concentration of animals in the northern Gulf has been intensively studied during the last decade, and is apparently associated with localized increases in secondary production due to either off-shelf transport of high productivity surface water and/or localized upwelling associated with mesoscale circulation (Jochens et al. 2008). Unlike the northern Gulf aggregation, little is known about the southeastern Gulf sperm whales. This concentration of animals has been observed in multiple seasons in a relatively localized area associated with steep bathymetry and a persistent eddy on the southeastern corner of the Loop Current (Mullin et al. 2003; SEFSC unpublished data). Prior field observations suggest that the southeastern Gulf aggregation is composed of females with young calves and juvenile whales, indicating that this area may be an important calving habitat for Gulf sperm whales. The relationship between this southeastern Gulf aggregation and the northern Gulf aggregation is unknown.

This cruise is a follow on to a similar project conducted by the SEFSC in 2012. The primary objective of this project was to assess the abundance, habitat and spatial distribution of sperm whales of the southeastern Gulf by means of visual and acoustic monitoring, deployment of satellite tags and biopsy sampling. Secondary objectives included collection of data and samples from other cetacean species encountered throughout the study area. This project was conducted jointly by the Bureau of Ocean Energy Management (BOEM) and NOAA Fisheries' Southeast Fisheries Science Center. The data will be used to support environmental assessments associated with potential offshore energy exploration projects in the southeastern Gulf and to improve understanding of potential critical habitat areas for the endangered Northern Gulf sperm whale population.

CRUISE OBJECTIVES

1) Conduct daily visual and passive acoustics monitoring of sperm whales and other cetacean species encountered along the visual transect lines;
2) Deploy satellite telemetry tags on sperm whales;
3) Collect biopsy tissue samples from sperm whales and other cetacean species;
4) Conduct continuous sampling of environmental parameters such as surface water temperature, salinity and depth;
5) Deploy CTD (Conductivity, Temperature, and Depth) and XBT (Expendable Bathythermograph) casts to collect hydrographic profiles;
6) Collect acoustic backscatter data using scientific echosounders (EK60) to characterize secondary production;
7) Deploy a passive acoustic monitoring buoy in the Desoto Canyon area.

SURVEY OPERATIONS AND RESULTS

The study area included the offshore waters along the inner continental slope off the Dry Tortugas (Figure 1). In addition, secondary operational areas were designated in the event that the sperm whale aggregation could not be located during this year's survey. The effort focused on known habitat for the southeastern Gulf sperm whale aggregation.

After severe delays due to mechanical issues, the survey was ultimately scheduled aboard NOAA Ship *Gordon Gunter* from July 2nd until July 31st, 2014 totaling 29 days at sea, distributed between 2 legs:

Leg 1: July 2nd– 16th (15 days)

Leg 2: July 18th – July 31st (14 days)

Further delays due to mechanical issues precluded a departure until 4 July with survey effort beginning on 5 July. A further delay due to *Gordon Gunter's* safe manning status, delayed the departure of leg 2 by another two days. In total, this project lost 29 of the originally scheduled 54 days at sea. Daily survey operations are summarized in Table 1.

Visual Survey

Visual survey effort started at approximately 0630-0700 (CDT) and ended at 1730-1930 (CDT) each day, depending on operations. Visual surveys were conducted by a team of three observers stationed on the vessel's flying bridge (height above water = 13.9 m) and consisted of two observers using 25x150 mm "bigeye" binoculars and a central observer/data recorder. Survey speed was typically 18 km hr^{-1} (10 kt) but varied with sea conditions. Data were recorded using a purpose designed data acquisition program operating on a laptop. Whenever an observer suspected or had in fact seen a marine mammal, a cue was entered on the program, and the team went off effort. Typically, if a sighting occurred within 3 nm, *Gordon Gunter* would divert from the trackline and approach the group to identify species and estimate group size. For each encounter, time, position, bearing and reticle (a measure of radial distance), species, group-size, behavior, bottom depth, sea surface temperature, and associated animals (e.g., seabirds, fish) were recorded. The bearing and radial distance for groups sighted without bigeye binoculars and close to the ship were estimated in degrees and meters respectively. Photographs were obtained from animals that approached the ship. Additionally, biopsy samples were attempted from select adult dolphins that would 'bow ride'. Once a reliable group size estimate and species identification were made, the ship returned to course and speed and the observers went back on effort. The visual team was considered "on effort" when all three observers were standing watch and the vessel was traveling at survey speed, therefore sightings observed on those conditions were considered "on effort." "Off effort" watches were occasionally conducted when the vessel was moving at a slow speed, consequently sightings observed during this period were considered "off effort." Off effort sightings also included sightings performed by non-visual observers casually being at the flying bridge, acoustic detections in which the course and/or speed of the vessel were altered, and new mammal sightings during previous sighting events. Visual survey effort was suspended during high sea states (Beaufort sea state > 5), poor visibility conditions (e.g., fog, haze, rain), or when there was lightning in the area. Survey effort

data were automatically recorded every minute and included the ship's position and heading, effort status, observer positions, and environmental conditions which could affect the observers' ability to sight animals (e.g., Beaufort sea state, trackline glare, etc.).

During this project, 2,486 km of visual survey effort were accumulated over both survey legs (Figure 2). Survey effort was concentrated in the southern portion of the operating area due to low encounter rates with sperm whales in the northern portion of the survey area at the beginning of the cruise. There were 172 marine mammal sightings from 15 confirmed species during the survey (Table 2). Within the primary operational area, a diverse suite of oceanic dolphin and small whale species were encountered, including pantropical spotted dolphins, Risso's dolphins, beaked whales (Unid. Ziphiids and Mesoplodants), pygmy/dwarf sperm whales, and a variety of other species (Figure 3, Figure 4, Table 2). There were a total of 16 sperm whale group sightings (Figure 5). An estimated total of 106 individual sperm whales were observed in these sightings.

Passive Acoustic Survey

Passive acoustic surveys were conducted mainly during daylight hours when conditions allowed, both simultaneously with visual surveys and occasionally during night and other periods when the visual survey was inactive. Passive acoustic surveys were suspended during portions of the tracklines that occurred in water depths shallower than 75 m and when passing through thunderstorms. Passive acoustic monitoring was conducted using a towed hydrophone array deployed at approximately 300 m behind the ship and 10m depth at standard ship speeds.

A custom-built five-element mixed-frequency oil-filled hydrophone array (Rankin et al. 2013) included paired pre-amplifier and hydrophone elements capable of recording a broad range of frequencies. Sensors 1, 3, and 5 were optimized for greater detection ranges for mid-frequency recordings by using APC International 42-1021 hydrophones with custom-built pre-amplifiers. The APC 42-1021 hydrophones have a -212 dB re V/uPa sensitivity with a flat frequency response (+/- 4 dB) from 1 to 45 kHz. The corresponding pre-amplifiers provided a highpass filter with 45 dB gain above 5 kHz. Sensors 2 and 4 were optimized for recording the full bandwidth of high-frequency echolocation clicks by using Reson TC4013 hydrophones with custom-built pre-amplifiers. The TC4013 hydrophones have a -212 dB re V/uPa sensitivity with a flat frequency response (+/- 2 dB) from 5 to 160 kHz. The corresponding pre-amplifiers provide a highpass filter with 50 dB gain above 5 kHz. Data from sensors 1 and 5 were recorded through an RME Fireface UC audio interface at 16 bit 192 kHz sample rate yielding a recording range of 1-96 kHz, while data from sensors 2 & 4 were recorded through a National Instruments USB-6251 BNC sound card at 16 bit 500 kHz sample rate yielding a recording range of 1-250 kHz.

The Pamguard software program was used to record acoustic data and log comments to hard-disk and to obtain bearings to acoustic detections. All acoustic data were recorded as multichannel .wav files to 2 TB external SATA hard drives, resulting in 4 TB of data collected. Acoustic field technicians monitored data aurally and visually through spectrographic analysis using Ishmael software and attempted to acoustically localize active cetaceans in real-time using Ishmael's hyperbolic bearing calculator and a custom-written acoustic version of VisSurvey.

The acoustic VisSurvey version is capable of receiving and plotting visual sighting information along with acoustic bearings to improve correlation of acoustic and visual detections in real-time.

The passive acoustic technicians monitored the signals continuously and recorded and classified cetacean sounds (e.g., echolocation clicks, whistles, etc.) along with anthropogenic noises. Data on the bearing to the sounds and the sound types and intensity were recorded using Ishmael and Pamguard data collection software. The array was deployed and monitored for approximately 254 hours during the entire survey (Table 1) yielding 201 acoustic detection events (Table 3).

Acoustic detections of marine mammals were made throughout the survey and were correlated with visual sightings when localization was possible. Direct identification of acoustic detections was made through visual verification of species identifications for 110 events. For 91 acoustic-only detections, sounds were broadly categorized as unidentified delphinids, unidentified odontocetes, or sperm whale clicks (Table 3, Figure 6, Figure 7). Visually-verified detections will allow characterization of the acoustic signature of different species, which will be incorporated into classification algorithms to improve identification from acoustic-only encounters.

Tissue Sample Collection

Biopsy samples were collected from cetaceans throughout the survey. Samples were collected from the *Gunter* using a modified 0.22 caliber rifle on bow riding adult animals. From the R3, only sperm whales were sampled using a crossbow. Both devices were fitted with a custom designed sampling head to extract a small core of skin and blubber. All sampling was conducted by personnel with training and experience to collect biopsy samples from wild cetaceans. Photographs were taken to document biopsy sample collection. Biopsy sampling was attempted after all pertinent group size and biological information was recorded by the visual team. Opportunistic squid samples were collected during sperm whale small boat deployments.

For cetaceans, according to tissue type and size, biopsy samples were divided for up to three analyses: genetics, stable isotopes (S.I.), and contaminants (listed below).

Analyses	**Tissue type**	**Storage**	**Temperature**
Genetics	Skin	20% dimethyl sulfoxide (DMSO) vial	Room
Stable isotopes	Skin	2 ml cryovial	-20° C
Contaminants	Blubber	Teflon vial	-80° C

A total of 18 biopsies were collected during the cruise (Table 4, Figure 8). Biopsy samples were subsampled for the analyses listed above, resulting in a total of 53 samples (Table 4).

Satellite Telemetry Tag Deployment on Sperm Whales

Throughout the cruise, the NOAA vessel *R3* (a 7-m RHIB) was launched from *Gordon Gunter* intending to closely approach sperm whales in order to attach satellite telemetry tags. These tags use an implantable anchor design which are deployed from close distance, using a modified compressed gas line launcher (Air Rocket Transmitter System - ARTS). A choice of two different tag electronic packages were deployed using two different types of anchor designs. The tag electronics were purchased from Wildlife Computers, Inc and were either of the SPOT-5 (ARGOS location only) or MK-10A SPLASH (ARGOS location and summary dive data) variants. The large number of mother-calf pairs and generally evasive behaviors of the sperm whales encountered during the cruise limited the opportunity to deploy a large numbers of satellite tags. Six sperm whales were successfully tagged over the course of both legs. The tag deployment positions of each tag are shown in Figure 9.

Passive Acoustic Mooring

NOAA's Ocean Acoustics Program recently funded a United States EEZ-wide effort to start recording low-frequency passive acoustic sounds now and into the future. The aim of this project is to compare sites from widely different regions to determine biological and man-made noise levels using the same type of recording equipment. The Noise Recording Station (NRS) project currently involves a coordinated deployment of 10 NOAA Pacific Marine Environmental Laboratory (PMEL) low-frequency (10-2500Hz) passive acoustic recorders in U.S. waters.

At 1828 UTC on 30 July 2014, NRS-06 was deployed. Instrument NRS-06 is located at 28° 00.4' N latitude by 86° 59.6' W longitude.

Scientific Echosounder (EK60) Data Collection

EK60 data were collected continuously throughout the cruise and stored on hard drives for archiving and further analysis.

Environmental Data

Environmental data were collected at predetermined stations using a CTD unit and XBT. CTD casts recorded vertical profiles of salinity, temperature, and oxygen content to a maximum depth of 1000 m. XBT profiles recorded only temperature up to a depth of 750 m. Constant records of environmental parameters including water temperature, salinity, and weather conditions (e.g., wind speed, wind direction) were collected in situ via the ship's Scientific Computer System (SCS). CTD casts were made on a daily basis (weather dependent), typically at the end of the survey day. Data were collected at a total of 19 CTD stations. XBT casts were made at regular intervals along the trackline throughout the cruise at stations typically spaced 15-20 km apart. A total of 78 XBT stations were sampled (Figure 10).

Data and Sample Disposition

All data collected during GU14-04 including visual survey data, passive acoustic data, EK60 data, SCS data, XBT and CTD data are archived and managed at the Southeast Fisheries Science Center in Miami, FL with backup copies at the SEFSC Pascagoula Laboratory. Biopsy samples are being distributed to the analyses laboratories.

Permit and Funding Source

The Southeast Fisheries Science Center was authorized to conduct marine mammal research activities during the cruise under MMPA Research Permit No. 14450-02, issued to the SEFSC by the NMFS Office of Protected Resources. The project was funded through Interagency Agreement # GM-11-03 between NMFS SEFSC and the BOEM.

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List of Participants

Position	Leg 1	Leg 2	Affiliation
FPC	Anthony Martinez	Anthony Martinez	SEFSC – FTE
Data Manager	Laura Dias	Laura Dias	CIMAS U. of Miami
Visual Observer 1	Jesse Wicker	Jesse Wicker	CIMAS U. of Miami
Visual Observer 2	Melody Baran	Melody Baran	IAP/Riverside
Visual Observer 3	Carol Roden	Carol Roden	IAP/Riverside
Visual Observer 4	Amy Whitt	Amy Whitt	IAP/Riverside
Visual Observer 5	Tom Ninke	Tom Ninke	IAP/Riverside
Visual Observer 6	Blakely Rice	Blakely Rice	U. of Miami
Visual Observer 7	Joel Ortega-Ortiz	Sabrina Stevens	CIMAS U of Miami / IAP/Riverside
Visual Observer 8	Matt Maiello	Kevin Barry	SEFSC – FTE
Acoustician 1	Cory Hom-Weaver	Cory Hom-Weaver	Bio-waves, Inc.
Acoustician 2	Kerry Dunleavy	Kerry Dunleavy	Bio-waves, Inc.
Acoustician 3	Katrina Ternus	Katrina Ternus	IAP/Riverside

Table 1. Daily survey operations and effort during GU14-04

Survey Leg	Date	Visual Effort (km)	Acoustic Effort (Hours)	Sperm Whale Tags Deployed
Leg 1	7/5/2014	88.9	6.80	
	7/6/2014	115.1	11.75	
	7/7/2014	127.0	11.66	
	7/8/2014	173.9	12.26	
	7/9/2014	91.7	11.39	
	7/10/2014	121.9	12.09	
	7/11/2014	134.0	11.71	
	7/12/2014	132.7	12.32	
	7/13/2014	185.1	17.07	
	7/14/2014	137.2	23.57	1
	7/15/2014	22.9	15.72	1
Leg 2	7/21/2014	83.4	11.51	
	7/22/2014	124.2	11.31	
	7/23/2014	128.5	12.92	2
	7/24/2014	109.1	11.26	2
	7/25/2014	86.7	11.38	
	7/26/2014	189.0	12.03	
	7/27/2014	124.7	12.48	
	7/28/2014	124.7	11.94	
	7/29/2014	181.6	12.72	

Table 2. Marine mammal sightings during each leg of GU14-04

Species	Leg 1	Leg 2	Total
Atlantic spotted dolphin	1	1	2
Blainville's beaked whale	0	1	1
Bottlenose dolphin	3	3	6
Clymene dolphin	1	0	1
Cuvier's beaked whale	1	1	2
Fraser's dolphin	1	0	1
Melon-headed whale	1	0	1
Pantropical spotted dolphin	21	28	49
Pilot whales	1	1	2
Pygmy/Dwarf sperm whale	4	4	8
Risso's dolphin	2	12	14
Rough-toothed dolphin	1	0	1
Sperm whale	6	10	16
Spinner dolphin	1	3	4
Stenella sp.	0	4	4
Striped dolphin	2	3	5
unid. dolphin	16	14	30
Unid. Mesoplondant	3	2	5
unid. odontocete	6	3	9
unid. small whale	2	0	2
Unid. Ziphiid	3	6	9
Total	**76**	**96**	**172**

Table 3. Acoustic-only and combined visual/acoustic detections during GU14-04

Species	Acoustic Only	Visual and Acoustic	Total
Sperm Whale	12	16	28
Melon-headed Whale	0	2	2
Short-finned pilot whale	0	1	1
Fraser's dolphin	0	1	1
Bottlenose dolphin	0	6	6
Risso's dolphin	0	7	7
Stenella sp.	0	2	2
Pantropical spotted dolphin	0	47	47
Atlantic spotted dolphin	0	1	1
Striped dolphin	0	5	5
Spinner dolphin	0	3	3
Clymene dolphin	0	1	1
Unid. Dolphin	67	18	85
Unid. Odontocete	12	1	13
Grand Total	**91**	**111**	**202**

Table 4. Biopsy samples collected and storage types during GU14-04

Species	Total Samples Collected	Genetics (Skin - DMSO)	Stable Isotopes (Skin - Frozen)	Contaminants (Blubber − Frozen)
Sperm Whale	11	11	11	10
Pantropical Spotted Dolphin	3	3	3	3
Striped Dolphin	1	1	1	1
Spinner Dolphin	1	1	1	1
Bottlenose Dolphin	2	2	2	2
Total	**18**	**18**	**18**	**17**

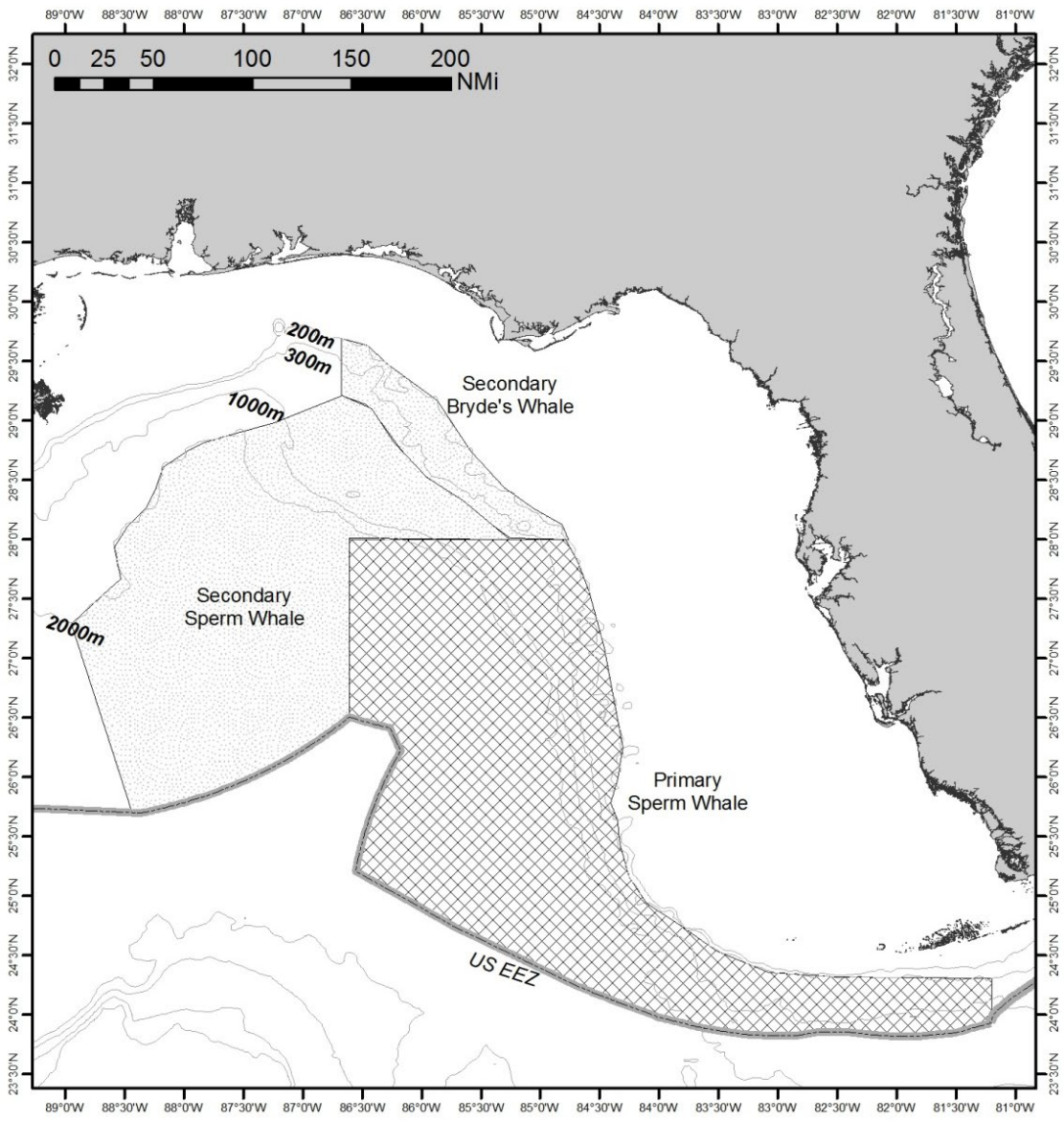

Figure 1. Primary and secondary planned operational areas for GU14-04

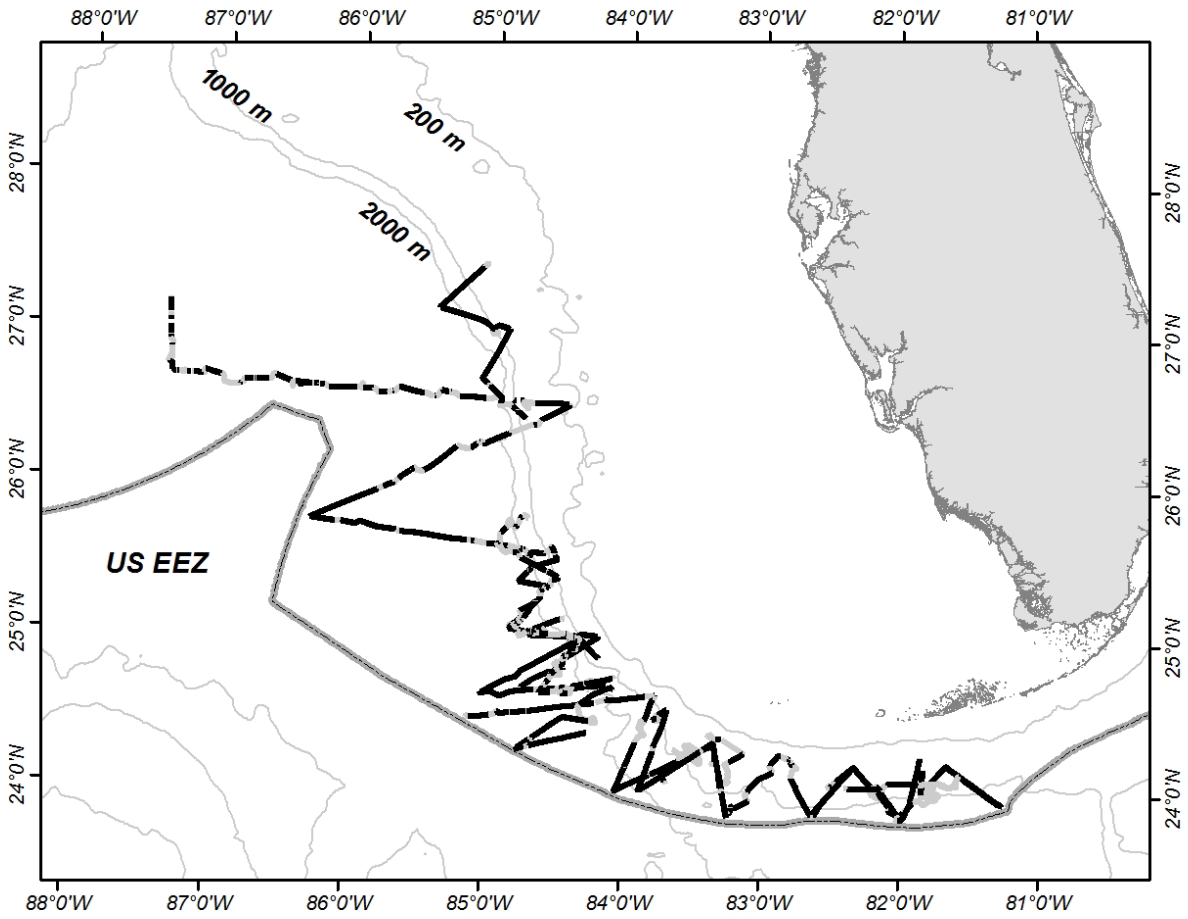

Figure 2. Survey effort accomplished during GU14-04

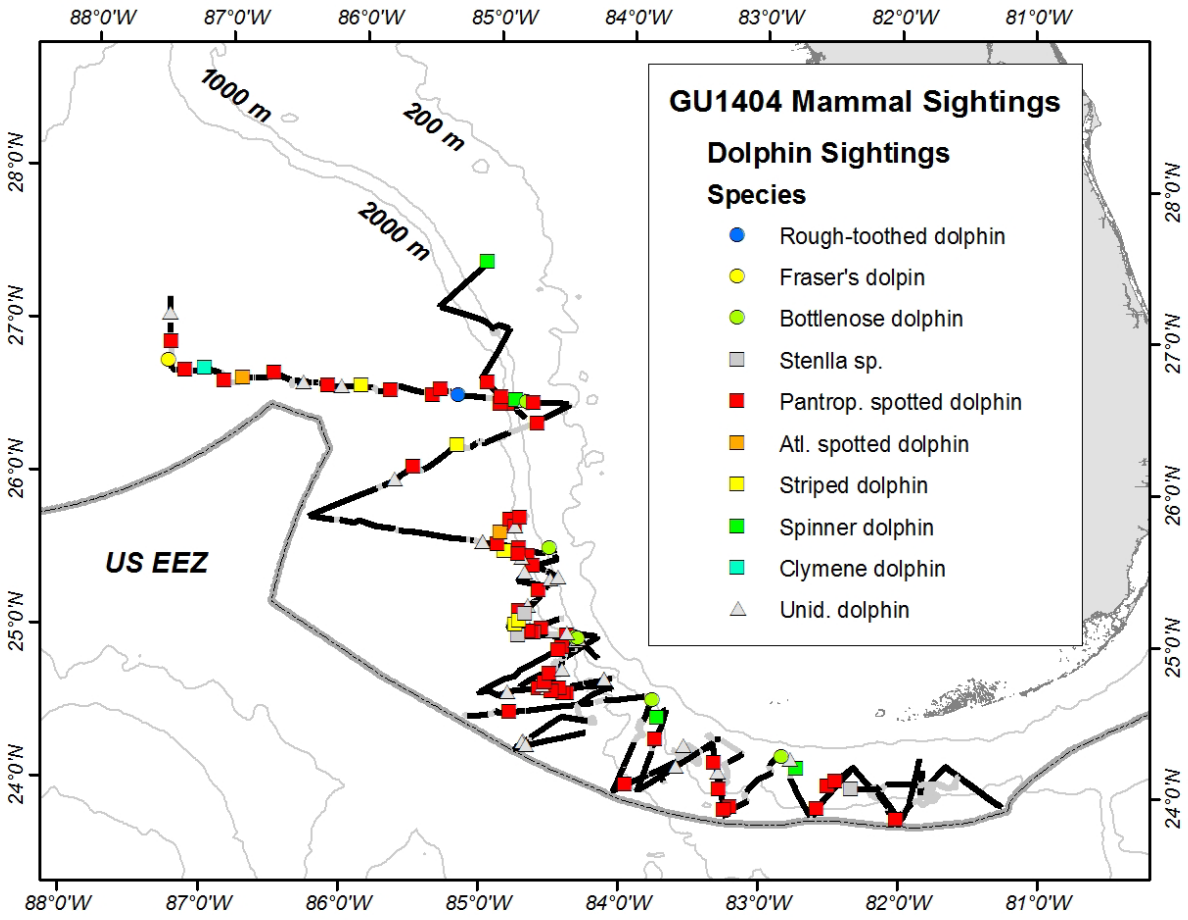

Figure 3. Dolphin sighting locations during GU14-04

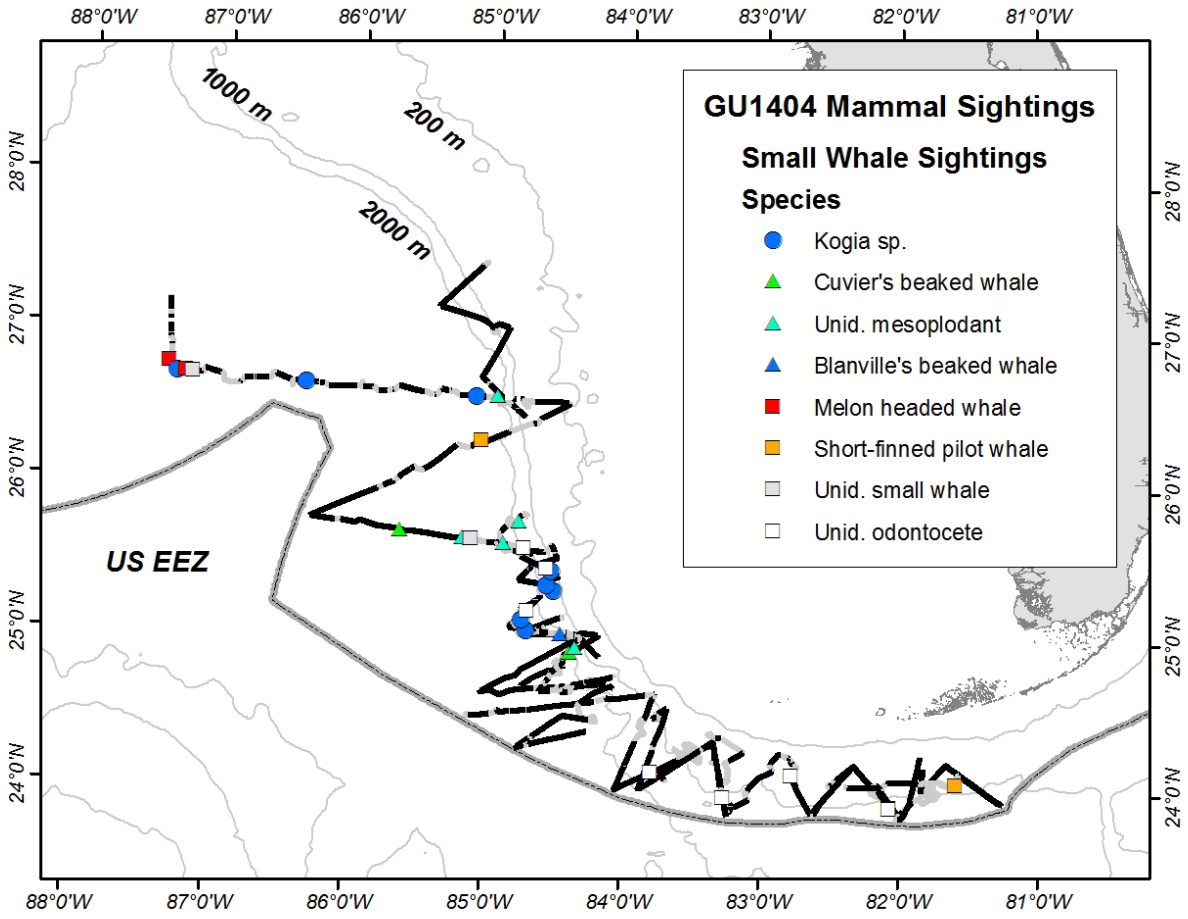

Figure 4. Small whale sightings during GU14-04

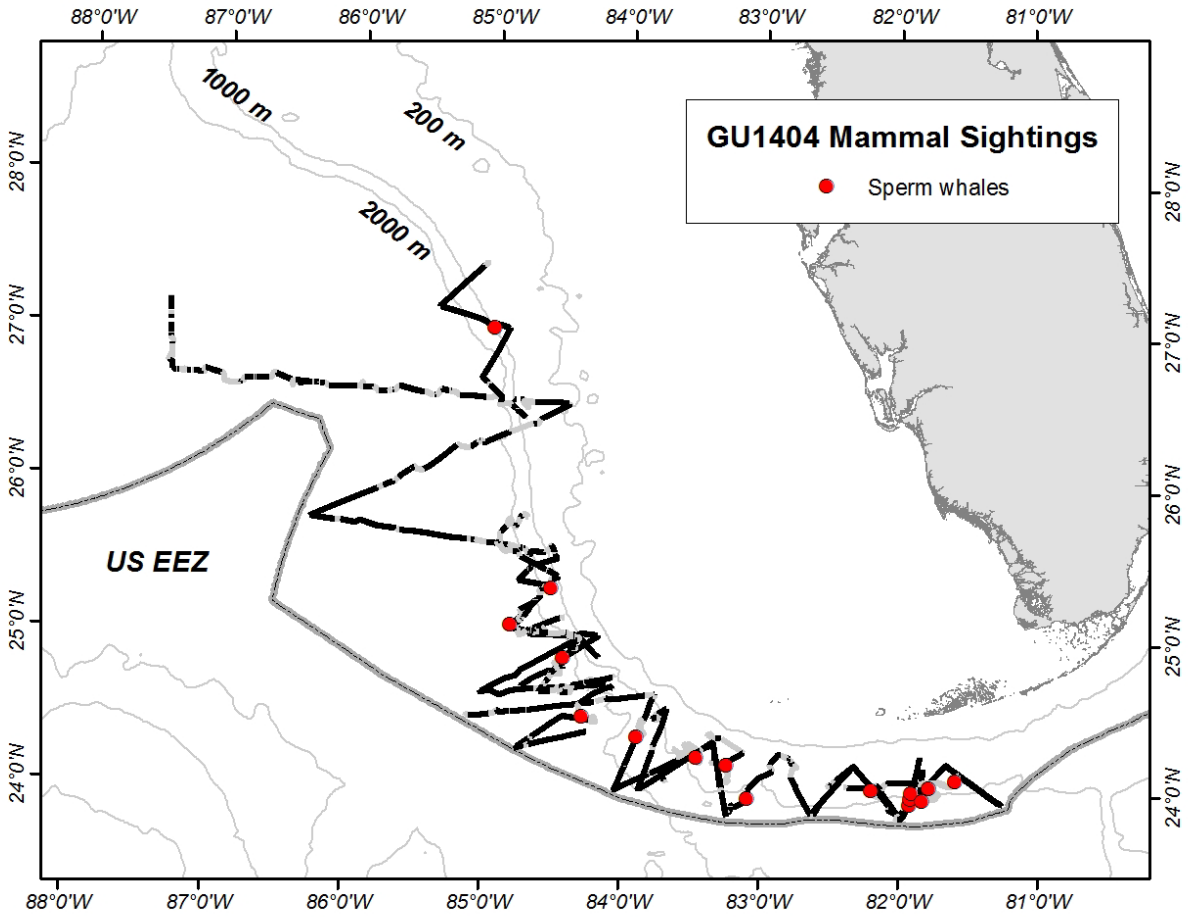

Figure 5. Large whale sightings during GU14-04

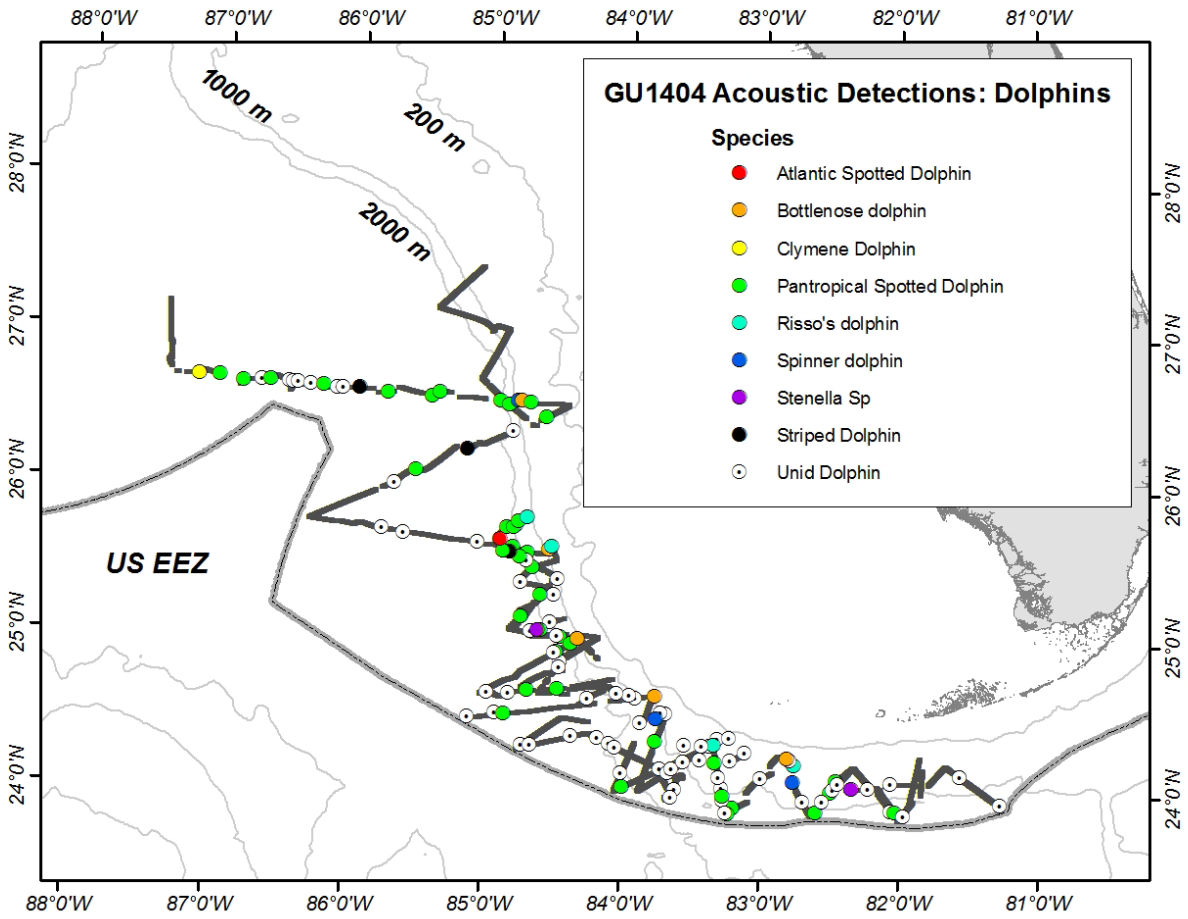

Figure 6. Passive acoustic survey effort and dolphin detections

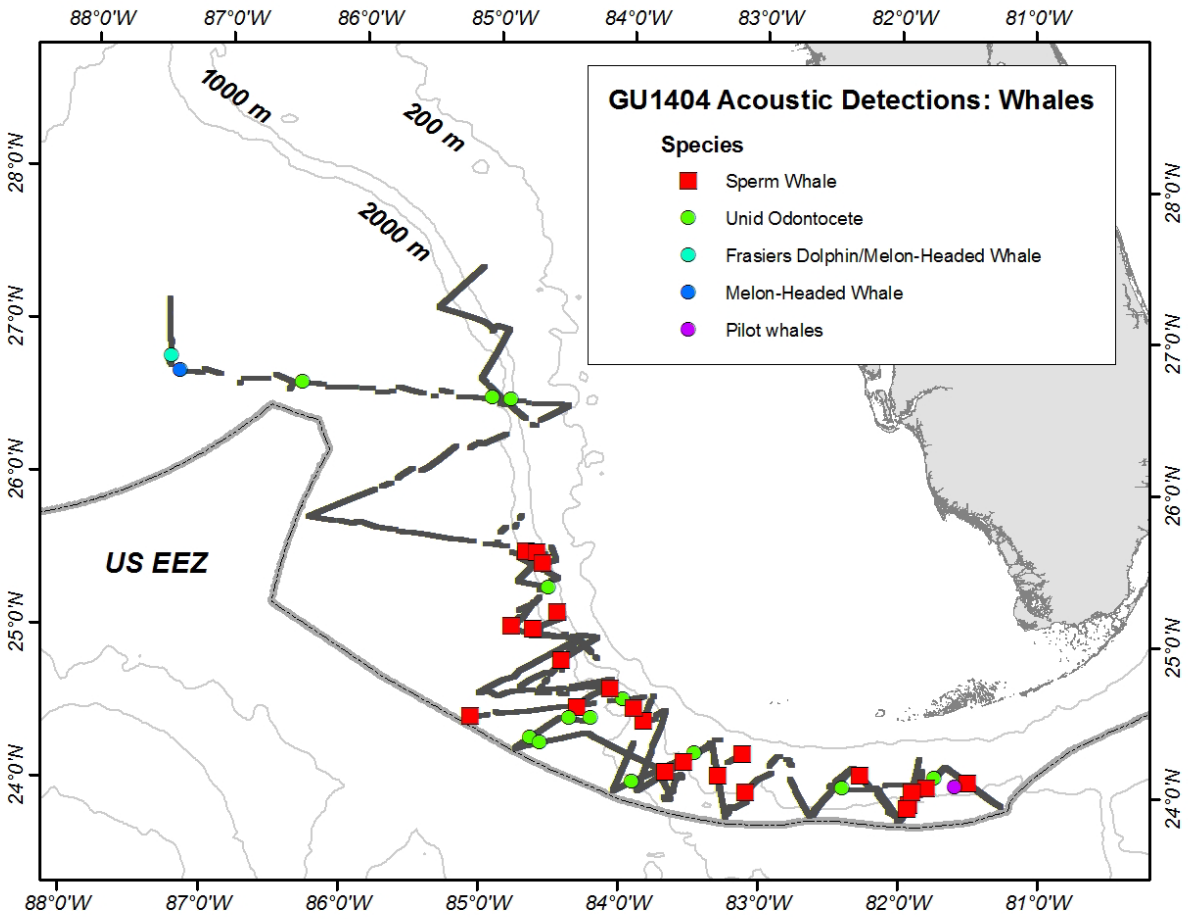

Figure 7. Passive acoustic survey effort and whale detections

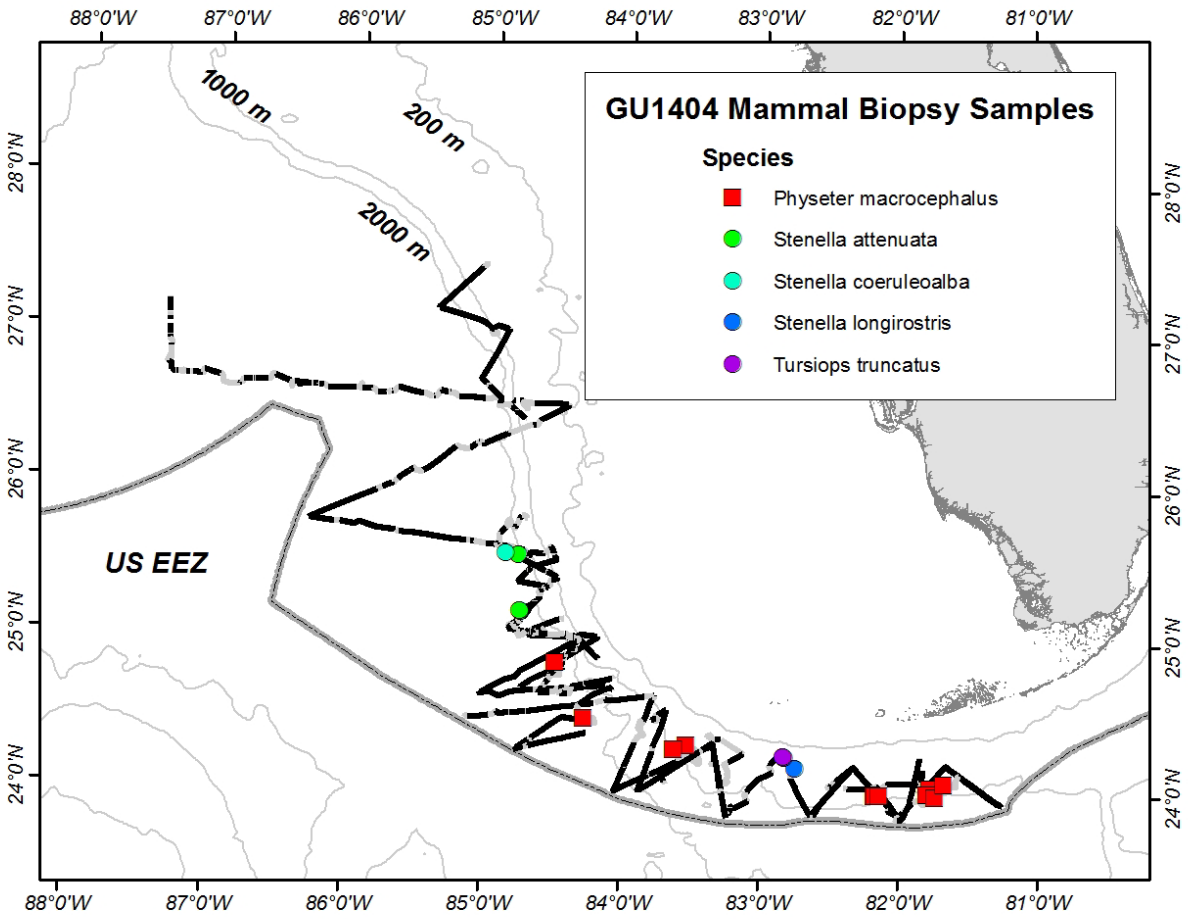

Figure 8. Biopsy sample locations during GU14-04

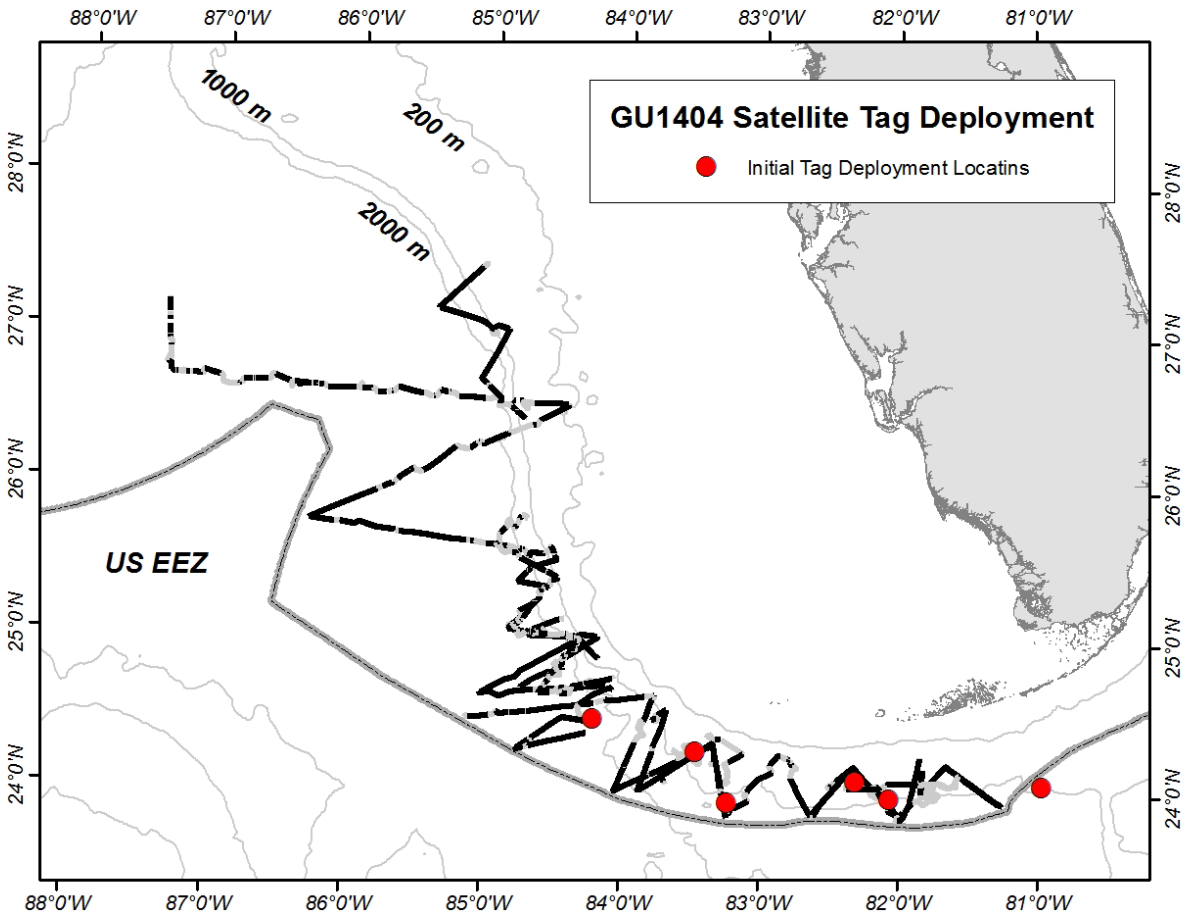

Figure 9. Sperm whale tag deployment locations during GU14-04

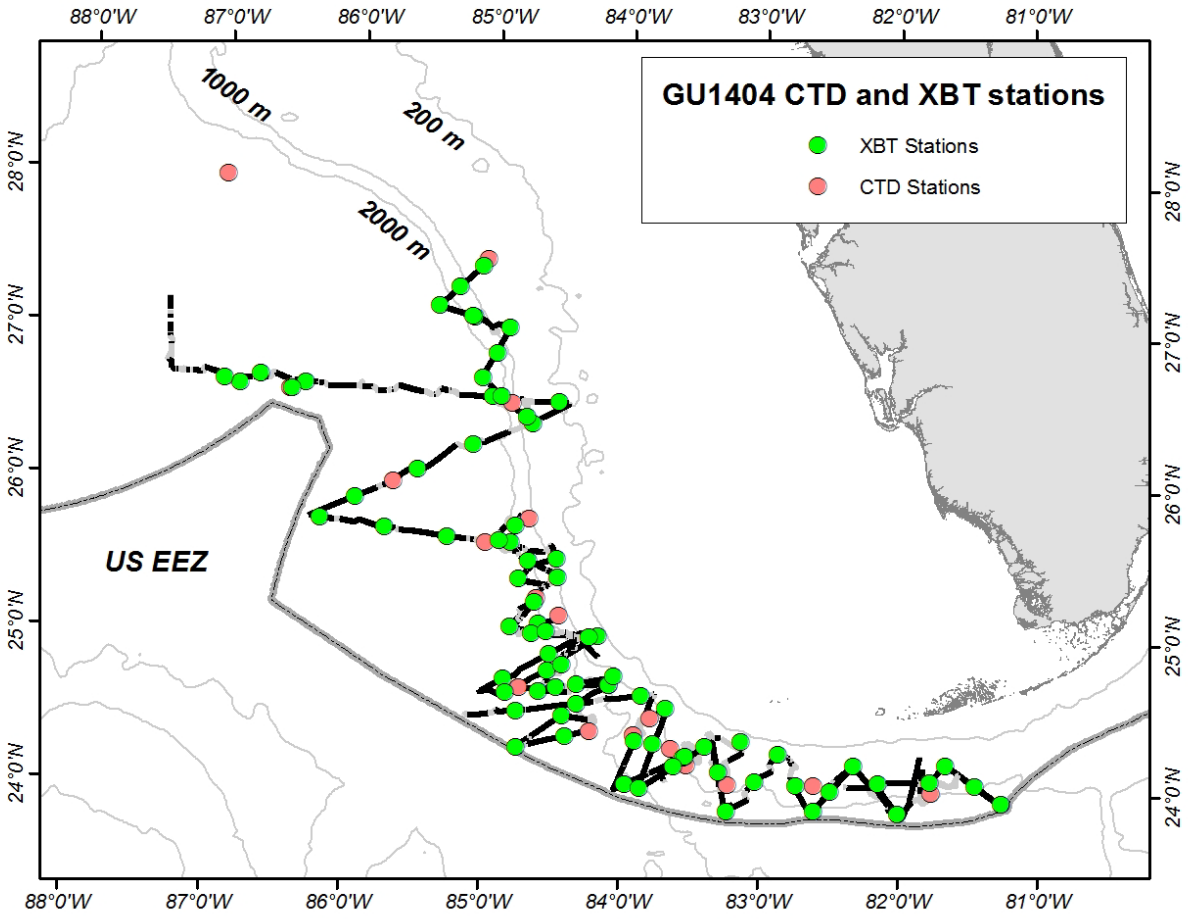

Figure 10. Hydrographic profile sampling stations during GU14-04