Southeast Fisheries Science Center Reference Document MMTD-2024-09

CRUISE REPORT

NOAA Ship *Gordon Gunter* Cruise GU24-02

June – August 2024

Vessel Survey for Abundance and Distribution Summer Research Cruise



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

November 2024

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.

The Southeast Fisheries Science Center was authorized to conduct marine mammal research activities during the cruise under Marine Mammal Protection Act and Endangered Species Act (MMPA/ESA) Permit No. 21938-04.

Introduction

The 2010 *Deepwater Horizon* (DWH) oil spill in the Gulf of Mexico (GoMx) significantly and negatively impacted marine mammal and seabird population dynamics and health. The DWH oil spill settlement provides Natural Resource Damage Assessment (NRDA) Trustees (Trustees) up to $8.8 billion, distributed over 15 years, to restore natural resources and services impacted (injured) by the spill. Given the unprecedented temporal, spatial, and funding scales associated with the DWH NRDA restoration effort, the Trustees recognized the need for robust Monitoring and Adaptive Management (MAM) to support restoration planning and implementation.

The Southeast Fisheries Science Center (SEFSC) conducts standard line-transect shipboard surveys to assess marine mammal and seabird population status (e.g., Gulf of Mexico Marine Assessment Program for Protected Species [GoMMAPPS; Rappucci et al. 2023]). Also, surveys repeated over defined periods provide information on population trends.

Based on the results from the 2017-2018 GoMMAPPS surveys (Rappucci et al. 2023), we needed to know if estimated decreases in sperm whale (*Physeter macrocephalus*) and pantropical spotted dolphins (*Stenella attenuata*) numbers were due to reduced abundance or distribution shifts. We also needed to establish reference abundance estimates and better understand the spatial distribution of these animals to inform future restoration activities. Thus, the first Vessel Survey for Abundance and Distribution of Marine Mammals and Seabirds (VSAD) was implemented in summer of 2023 under the DWH NRDA Restoration Plan (DIVER ID 317). The preliminary results of a second VSAD performed in summer of 2024 are reported here.

For many species of injured or oil impacted seabirds, there are limited monitoring options available to evaluate restoration efficacy across projects. As such, capitalizing on NOAA vessels of opportunity and leveraging GoMMAPPS seabird vessel survey protocols, analytical methods, and the experienced pool of seabird observers is an effective and repeatable monitoring strategy. Thus, as part of the VSAD cruise, in partnership with NOAA, the U.S. Fish and Wildlife Service (USFWS) collected, maintained, and analyzed data on seabird distribution and abundance. This report will focus primarily on the cetaceans and seabird data collected during the second VSAD cruise. Seabird related analytical products are available through USFWS.

The primary objective for the NOAA SEFSC on this survey was to assess the distribution, density, and abundance of oceanic marine mammal stocks. These data will be used to develop seasonally and spatially explicit maps of species density to incorporate into existing spatial density models.

Objectives

1. Conduct a two-team visual line transect survey to assess the abundance and spatial distribution of marine mammal species in the U.S. Gulf of Mexico waters

2. Conduct towed array passive acoustic surveys in conjunction with visual surveys to provide supplemental information on marine mammal species abundance and spatial distribution
3. Conduct targeted surveys within the preferred Rice's whale habitat in the western GoMx
4. Collect visual data to assess the distribution and abundance of seabirds and other marine life
5. Opportunistically recover autonomous passive acoustic moorings in the western GoMx
6. Collect remote biopsy samples from free-ranging marine mammals

Methods

Survey Area

The survey was conducted between 2 June and 13 August 2024 onboard the 68 m NOAA Ship *Gordon Gunter*. Operations occurred primarily in waters from 100 m deep seaward to the U.S. Exclusive Economic Zone (EEZ) from Brownsville, Texas, east into the Straits of Florida (Figure 1a). Surveys were conducted along 7,480 km of predetermined tracklines, which uniformly covered oceanic waters and were oriented approximately perpendicular to bathymetry (Figure 1a). An additional 948 km of survey tracklines were planned in the western GoMx in Rice's whale (*Balaenoptera ricei*) habitat (Figure 1a).

Survey effort totaled 53 days and was divided into three legs, covering different portions of the survey area (Table 1, Figure 1). All three legs departed from and returned to port near Pascagoula, Mississippi. Leg 1 was 15 days in length, from 2 June to 16 June and covered the eastern survey area. Originally planned for 25 days, leg 1 was shortened due to inclement weather and vessel crew member shortage, which resulted in missing coverage on the southeastern tracklines (Figure 1b). Leg 2 occurred as planned from 1 July to 20 July. Due to the uncertainty of a tropical system entering the GoMx, operations were restricted to the northeastern Gulf and therefore, supplemental tracklines were surveyed in Rice's whale habitat (approximately 100-400 m) until 9 July (Figure 1c). Transit toward the offshore-central tracklines began on 10 July, but while underway the ship deviated north for a vessel crew member transfer that occurred on 11 July. Since the transfer was near Pascagoula, MS, the result was additional survey effort between the eastern and central tracklines as well as on the continental shelf (Figure 1b). Survey effort resumed on 12 July in the central GoMx. Leg 3 was 18 days in length from 27 July to 13 August, leaving two days late due to unexpected air traffic delays affecting incoming vessel crew. Leg 3 covered the central and western oceanic GoMx with much reduced effort on the western Rice's whale tracklines (Figure 1b).

Marine Mammal Visual Survey

Standard ship-based, line transect survey methods for marine mammals were used during this survey, with the addition of a second visual team. Methods were similar to previously conducted abundance and distribution surveys in the GoMx, including the GoMMAPPS and the previous year's VSAD survey (GU23-03). This survey was primarily conducted in passing mode, whereby the ship maintains a steady course and speed along the trackline while recording data. There were few diversions from the trackline (also known as closing mode) for species of interest (e.g., Rice's whales) or at the discretion of the field party chief (FPC). Average survey speed was 18 km hr^{-1} (10 kt) but varied with ship traffic and environmental conditions (e.g., wind speed and currents), and operations were conducted in sea state five or less.

Visual survey operations were conducted during daylight hours (approximately 0630 to 1930 CDT) with 8-10 visual observers (Table 2) rotating every 30 minutes through four positions stationed on either the flying bridge or bridge wings of the *Gunter*. Each visual observer utilized pedestal-mounted, 25x150 mm "bigeye" binoculars (hereafter bigeyes) to scan water from near the ship to the horizon, forward of the ship's beam with 10 degrees of overlap on the bow (i.e., the left observer scanned from 10° right to 90° left and the right observer scanned from 10° left to 90° right). The bigeyes were equipped with a bearing ring and reticle scale used to estimate relative bearing and distance from the ship to a point on the water's surface.

Visual observers were considered on-effort when the ship was on a trackline or transit line, at survey speed, and actively searching for marine mammals. Observers were considered off-effort when not actively searching for marine mammals, including situations like safety drills, inclement weather or maneuvering to a new trackline. A centralized data recorder located inside the ship's chemistry laboratory communicated with each team via discreet VHF radio channels. Survey and sighting data were recorded using a custom data acquisition program called VisSurvey installed on a laptop networked with the ship's scientific computer system (SCS).

When an observer had a cue (e.g., marine mammal, splash, blow), relative bearing and distance were relayed to the data recorder and entered in VisSurvey, which captured the spatial and temporal position of the initial observation. The team went off-effort to discuss the cue, determine if it was a marine mammal sighting and if so, attempt to identify the species and estimate group size. Once completed, the species ID was relayed to the data recorder and the cue data was added to the marine mammal sighting in VisSurvey. Estimates of minimum, maximum, and best group size were independently recorded by each observer who viewed the entire sighting. When possible, photographs were collected for species confirmation and/or photographic identification of individuals (e.g., Rice's whales).

In some cases, only one visual team observed a sighting. In other cases, both teams observed the sighting or each team tandemly had different sightings. Based on cue information and descriptions from the visual teams, the data recorder determined if the sightings were the

same or different. If they were determined to be the same sighting, the teams were instructed to work together to determine species. If the data recorder felt the teams were on different sightings, they continued working independently, unaware of the other team's sighting. Finally, it was possible for the visual team to miss a sighting, or have a sighting occur while off-effort. Off-effort sightings typically included those very close to the ship detected by seabird observers, off duty observers, or the ship's crew.

In addition to the sighting information entered into VisSurvey, a supplemental Marine Mammal Sighting Sheet was completed by the observer who made the initial cue. The sighting sheet included details on group behavior and reaction to the research vessel, such as whether the group was attracted to or avoided the ship. It also included information about group composition (presence of calves or neonates), associated bird or fish species, and a section for detailed descriptions of identifying characteristics (e.g., size, coloration, dorsal fin position, blow type) for the recorded marine mammal species.

Other survey parameters were automatically recorded every minute by VisSurvey via the ship's SCS and included the ship's position, heading, speed, and wind speed. At 20-minute intervals, the data recorder requested updates for quantitative (e.g., glare, cloud cover, sea state, swell height) and qualitative (e.g., excellent, good, moderate, fair, poor) survey conditions.

Acoustic Survey

Passive acoustic surveys using a towed hydrophone array were conducted concurrent with visual surveys during daylight hours when environmental conditions allowed. Passive acoustic surveys were suspended in water depths shallower than 75 m, during nearby lightning storms, and during Rice's whale focal follows. Passive acoustic monitoring (PAM) for odontocetes was conducted using a modular towed hydrophone array deployed approximately 300 m behind the ship and weighted with 13.6 kg lead wire. Hydrophone depth averaged 12.5 ± 1.3 m at a standard survey speed of 18 km hr^{-1} through the water.

The custom-built modular towed hydrophone array was deployed as a four-element high-frequency oil-filled end array (Rankin et al. 2013), which included four High Tech, Inc. HTI-96-min hydrophones with custom-built pre-amplifiers. The HTI-96-min hydrophones have a -181 dB re V/uPa sensitivity with a flat frequency response (+/- 5 dB) from 14 to 85 kHz. The corresponding pre-amplifiers provided a highpass filter with 37 dB gain above 2 kHz. The four-element array incorporated a Keller 7SE pressure sensor ahead of the hydrophones in the end array to measure depth, and data were digitized using a Measurement Computing USB-1208LS A/D converter and recorded in the software program Pamguard (v.2.00.20; Gillespie et al. 2008). Data from all four sensors were digitized for recording with a custom 12 channel SailDAQ soundcard (www.sa-instrumentation.com, accessed Jan. 12, 2018) sampling 16 bits at 500 kHz, yielding a recording bandwidth of 1-250 kHz. SailDAQ output from sensors 1 and 4 were

subsequently routed through a custom Magrec amplifier and Mark of the Unicorn (MOTU) Traveler mk3 audio interface for real-time aural monitoring (Appendix A).

While the array was deployed, acoustic signals were monitored by a team of two acoustic technicians who rotated through a primary and on-call secondary position every 1 to 2.5 hours. The software Pamguard (v.2.00.20; Gillespie et al. 2008) was used to control the SailDAQ, to record acoustic data and metadata to hard-disk, and for real-time monitoring including logging effort and encounter details and obtaining bearings to acoustic detections. All acoustic data were continuously recorded as four minute, 4-channel wav files to 8 TB external SATA hard drives. Acoustic field technicians continuously monitored data aurally and visually through spectrographic analysis using both Pamguard and Ishmael (Mellinger 2001) software, and detected and localized acoustically-active odontocetes in real-time using Pamguard's automated click detectors, hyperbolic bearing calculator, and manual target motion analyses as well as Ishmael's hyperbolic bearing calculator for manually-selected whistles. Metadata describing acoustic encounters included individual click detections with corresponding time, localization, and localization quality information.

Seabird Visual Survey

Strip transect survey for abundance and distribution of GoMx seabirds occurred in tandem with the visual marine mammal survey. Two observers rotated every 1 to 2 hours and surveyed one side of the ship using naked eye or handheld binoculars. The strip width was 300 m and the side surveyed was dependent on environmental factors (e.g., glare). Distance and bearing to birds or bird flocks were estimated and entered into a survey data computer, along with information on species and other environmental variables. Photographs of select seabirds were taken when possible.

Autonomous Acoustic Mooring Retrieval

One goal of NOAA SEFSC's Rice's whale PAM project is to improve understanding of Rice's whale presence and habitat use in the western GoMx. As part of the project, eight long-term SoundTrap ST600STD moorings were deployed on 3 March 2024. The VSAD survey was working in the area of these SoundTraps around the time they were due for retrieval and therefore, this survey was leveraged to retrieve these valuable instruments and data.

The SoundTraps continuously record low frequency acoustic data between 20 Hz and 12 kHz for up to 6 months. Once they are retrieved, data can be analyzed for baleen whale vocalizations, including those produced by Rice's whales. The mooring package included a 14" buoyant float, the SoundTrap ST600STD recording device, and an acoustic release all tethered to an anchor weight (Appendix B).

Retrieval of each mooring consisted of moving the *Gunter* to the previously recorded deployment location. A hydrophone was deployed over the side of the ship to communicate

with the acoustic release on the mooring. A unique code was sent via the hydrophone, releasing the mooring from the weights, which allowed it to float to the surface. The visual team worked with the maritime crew and acoustics team to locate the buoy once it surfaced and to maneuver the ship to the buoy for retrieval.

Biopsy Sampling

Biopsy operations were limited to groups of animals that approached the ship or species of special interest. Tissue samples were collected from the ship's bow or a small boat launched from the ship. Sampling devices included a rifle or crossbow, which projected a custom dart and sampling tip designed to extract a small core of skin and blubber (Sinclair et al. 2015). A full depth biopsy core was subsampled for genetics, stable isotopes, and contaminants, yielding a maximum of three subsamples. Minimum data recorded with each biopsy attempt included date, time, geographic location, sampling location, behavioral reaction(s), and subsamples collected. All biopsy sampling was conducted by personnel with training and experience to collect remote biopsy samples from free-ranging marine mammals as authorized by MMPA/ESA Permit No. 21938-04 and the National Marine Fisheries Service (NMFS) Atlantic Institutional Animal Care and Use Committee (IACUC) protocol number IACUC-2020-002.

Environmental Data

Several environmental parameters were collected *in situ* via the ship's SCS. The SCS continuously displayed and recorded the ship's position, heading, and speed along with wind speed and direction, barometric pressure, sea surface temperature and air temperature. The ship's active acoustic systems (e.g., EQ50, EK80, ADCP) were deactivated during daylight hours as they interfered with acoustic monitoring and recordings.

Results

Marine Mammal Visual Survey

Between 3 June and 12 August 2024, a total of 46 on-effort survey days (Leg 1, *n* = 13; Leg 2, *n* = 18; Leg 3, *n* = 15) covering 8,716 km of total trackline (Leg 1 = 2,528 km; Leg 2 = 3,407 km; Leg 3 = 2,781 km) were completed (Table 3, Figure 1b). Days at sea with zero on-effort visual data (*n* = 7) included the mooring retrieval day and days leaving or returning to port (Table 3). An average of 189.5 km day^{-1} of trackline was covered and half the survey days exceeded approximately 200 km or more (median = 198.8 km). The majority of trackline (7,131 km) covered the primary survey area from approximately 100 m water depth to the U.S. EEZ. Additional trackline was completed in eastern and western Rice's whale habitats (approximately 100-400 m water depth), accounting for 1,510 km and 75 km, respectively. Throughout the survey, sea state ranged from 0 to 5, with an average of 2.3 (Table 3, Figure 2).

During the course of the survey, there were 742 sightings of marine mammals (Leg 1, *n* = 128; Leg 2, *n* = 319; Leg 3, *n* = 295) comprising 19 different species (Table 4). Unidentified species accounted for 31% (*n* = 233) of total sightings, with the majority being unidentified dolphins (*n* = 170). The number of sightings per day was variable and ranged from 1 to 54.

Small dolphins from the genus *Stenella* were encountered on 149 occasions during the survey (20% of total groups sighted), where pantropical spotted dolphins were the most frequently sighted (*n* = 53) (Table 4, Figures 3a, b). Atlantic spotted dolphins (*Stenella frontalis*) were identified on nine occasions, in a tight range between 100 and 200 m water depth. Clymene (*Stenella clymene*, *n* = 3) and striped dolphin (*Stenella coeruleoalba*, *n* = 3) sightings were aggregated towards the central regions of the survey area, while spinner dolphins (*Stenella longirostris*, *n* = 7) covered a wider geographic range. *Stenella* spp. (*n* = 74) were sighted throughout the survey area, with higher concentrations of sightings on the eastern and central tracklines compared to the western tracklines (Figures 3a, b). However, fewer *Stenella* spp. were identified on the far offshore portions of the southeastern and central tracklines.

Medium-sized dolphins were found throughout the survey area, generally sighted on the inshore portions of the tracklines (Figures 4a, b). Common bottlenose dolphins (*Tursiops truncatus*) were sighted frequently (*n* = 89, 12%) (Table 4) inshore and throughout the supplemental Rice's whale tracklines in waters ranging from roughly 100 to 500 m. Risso's dolphin (*Grampus griseus*) sightings (*n* = 20) were concentrated in the eastern half of the GoMx, from roughly 200 m out to the U.S. EEZ. Several groups of rough-toothed dolphins (*Steno brenadensis*) were sighted (*n* = 9), spread broadly across the survey area, typically between 200 m and 2,000 m (Figures 4a, b).

Blainville's (*Mesoplodon densirostris*, *n* = 3), Gervais' (*Mesoplodon europeaus*, *n* = 1), and Cuvier's (*Ziphius cavirostris*, *n* = 3) beaked whales were positively identified, along with several sightings of suspected beaked whales (*n* = 21) that were of indeterminate species (unidentified Mesoplodonts and Ziphiids) (Table 4). The majority of confirmed or suspected beaked whales were sighted in oceanic waters with bottom water depths ≥1000 m (Figure 5a). Six species of other smaller whales were sighted, accounting for 19% (*n* = 142) of total sightings and were dominated by dwarf or pygmy sperm whales (*Kogia* spp., *n* = 111) and short-finned pilot whales (*Globicephala macrorhynchus*, *n* = 14) (Table 4). Additional whale sightings included false killer whales (*Pseudorca crassidens*, *n* = 4), pygmy killer whales (*Feresa attenuata*, *n* = 1), and melon-headed whales (*Peponocephala electra*, *n* = 4). Smaller whales were found throughout the survey area in waters with bottom water depths >200 m, but most species were not observed in the eastern portion of the survey, with the exception of *Kogia* spp. (Figure 5b). There were few positively identified small whale sightings in the central-offshore portions of the primary tracklines.

Large whales accounted for the remainder of marine mammal sightings (*n* = 101, 14%) (Table 4). Sperm whales were the most commonly encountered large whale (*n* = 84), typically

seen in deep water with water depths >1,000 m and limited to the central and western portions of the survey area (Figure 6a). Ten Rice's whale sightings were encountered in waters between 100 m and 400 m bottom water depth in discrete areas (Figures 6a, b). Three sightings of Rice's whales occurred outside the eastern core habitat, with one in the western GoMx off of Texas and two in the west-central GoMx near the Flower Gardens Banks National Marine Sanctuary (Figure 6a). Two sightings were observed during leg 1 while on primary tracklines in the eastern GoMx. There were also five sightings in the eastern core habitat during leg 2 on the supplemental tracklines (Figure 6b).

Acoustic Survey

During the survey, over 415 hours of acoustic data were recorded with a towed array yielding 4.45 TB of data and 327 cetacean detections (Table 3). Between survey legs 1 and 2, the *Gunter's* hull and propellers were cleaned, reducing a major source of vessel noise. This led to quieter self-noise and the ability to detect cetaceans out to greater distances, and hence more detections. Of the 327 detections over the cruise, 53 occurred during leg 1, while 111 and 163 were detected during legs 2 and 3, respectively (Table 5). The apparent difference in distribution of acoustic detections between the east (leg 1) and central/west (legs 2&3; Figure 7) is likely biased due to these noise differences, and will be evaluated in further detail during post-processing.

Real-time monitoring acoustic detections were broadly categorized as Risso's dolphin clicks, sperm whale clicks, dwarf/pygmy sperm whale (*Kogia* spp.) clicks, unidentified Ziphiid clicks, unidentified delphinid vocalizations (whistles and clicks), or unidentified odontocetes (clicks only; Table 5, Figure 7). Preliminary acoustic detections include 78 sperm whale encounters, 9 *Kogia* spp. encounters, and 10 unidentified beaked whale encounters. Sperm whale encounters may represent either individuals or groups of individuals. Additional unidentified odontocete encounters may be identified as Risso's dolphin or beaked whale encounters in post-processing. Unidentified acoustic detections of odontocetes were made throughout the survey and were correlated with visual sightings when localization was possible. These recordings with visually-verified species identifications will be reanalyzed and verified in post processing to develop acoustic species classification algorithms for acoustic species identification. Acoustic data will also be used to improve estimates of sperm whale and beaked whale abundance.

Seabird Visual Survey

During leg 1 (2 June – 15 June), leg 2 (1 July – 19 July), and leg 3 (27 July – 12 August), seabird observers logged approximately 167, 221, and 181 hours of effort, respectively. During the survey, observers detected at least 27 species of pelagic, offshore, and coastal open water seabirds. Relatively rare or infrequently detected seabird species for the GoMx included red-

billed tropicbirds (*Phaethon aethereus*), red-footed boobies (*Sula sula*), and white-tailed tropicbirds (*Phaethon lepturus*) (VSAD unpublished data).

Autonomous Acoustic Mooring Retrieval

Mooring retrieval along the Texas shelf break occurred on 2 August 2024. Nine long-term SoundTrap ST600STD moorings were retrieved (Figure 8). Eight were from the most recent deployment in March of 2024. One mooring deployed on the previous VSAD survey in 2023 was also recovered. Moorings were dismantled and cleaned on board. Data from each acoustic recording device was downloaded at the port and offloaded.

Biopsy sampling and sample disposition

During the survey, 10 biopsy samples were collected from pantropical spotted dolphins (*n*=5), common bottlenose dolphins (*n*=1), false killer whales (*n*=2), and Rice's whales (*n*=2) (Figures 3-4, 6). They were subsampled for future analyses including genetics (skin stored in DMSO), stable isotopes (skin frozen at -80°C), and contaminants (blubber frozen at -80°C).

Biopsy samples were stored on board the *Gunter* during the cruise. At the conclusion of the survey, the genetic subsamples were shipped to the NOAA Marine Mammal Molecular Genetics Laboratory in Crowley, Louisiana. Frozen subsamples are currently being stored at the NOAA Mississippi Laboratories in Pascagoula, Mississippi, pending shipment to appropriate facilities for analysis or long-term storage.

Data Management and Archiving

All data other than seabird data collected during GU24-02 including visual survey data, passive acoustic data, and SCS data are managed at the SEFSC in Miami, FL with backup copies at the NOAA Mississippi Laboratory, and archived at the National Centers for Environmental Information (NCEI). Seabird data are maintained by USFWS. The data presented here are preliminary and subject to change as further auditing and analyses continue.

Permit and Funding Source

The Southeast Fisheries Science Center was authorized to conduct marine mammal research activities during the cruise under MMPA/ESA Research Permit No. 21938-04, issued to the SEFSC by the NMFS Office of Protected Resources, and IACUC# Atlantic IACUC-2020-002. The data collection was funded by the Vessel Surveys for Abundance and Distribution of Marine Mammals and Seabirds Project (DIVER ID 317). This project is one of many selected by the Open Ocean Trustee Implementation Group to restore natural resources injured by the 2010 DWH oil spill in the GoMx.

References

Gillespie, D., Gordon, J., Mchugh, R., Mclaren, D., Mellinger, D.K., Redmond P., Thode, A., Trinder, P., Deng, X.Y. 2008. PAMGUARD: Semiautomated, open source software for real-time acoustic detection and localisation of cetaceans. Proceedings of the Institute of Acoustics. 30.

Mellinger, D.K. 2001. Ishmael 1.0 User's Guide. NOAA Technical Memorandum OAR-PMEL-120. Available from: NOAA/PMEL/OERD, 2115 SE OSU Drive, Newport, OR 97365-5258.

Rankin, S., Barlow, J., Barkley, Y., Valtierra, R. 2013. A guide to constructing hydrophone arrays for passive acoustic data collection during NMFS shipboard cetacean surveys. La Jolla (CA): National Marine Fisheries Service. Report No.: NOAA-TM-NMFS-SWFSC-511. 36 pp.

Rappucci, G., Garrison, L.P., Soldevilla, M., Ortega-Ortiz, Reid, J., Aichinger-Dias, L., Mullin, K., Litz, J. 2023. Gulf of Mexico Marine Assessment Program for Protected Species (GoMMAPPS): marine mammals, Volume 1 : report. New Orleans (LA): US Department of the Interior, Bureau of Ocean Energy Management. 104 p. Obligation No.: M17PG00013. Report No.: OCS Study BOEM 2023-042. https://doi.org/10.25923/7hbn-jp82

Sinclair, C., Sinclair, J., Zolman, E.S., Martinez, A., Balmer, B., Barry, K.P. 2015. Remote biopsy field sampling procedures for cetaceans used during the Natural Resource Damage Assessment of the MSC252 Deepwater Horizon Oil Spill. NOAA Technical Memorandum NMFS-SEFSC-670. 28 pp. http://doi.org/10.7289/V5CC0XN0

Tables

The data presented here are preliminary and subject to change as further auditing and analyses are performed.

Table 1. Planned and actual survey dates and days at sea (DAS) for GU24-02.

Leg	Planned Dates	Planned DAS	Actual Dates	Actual DAS	Comments
1	1 – 25 June	25	2 – 16 June	15	Weather, *Gordon Gunter* crew shortage
2	1 – 20 July	20	1 – 20 July	20	Restricted operational area until 10 July due to Hurricane Beryl
3	25 July – 13 August	20	27 July – 13 August	18	Delayed *Gordon Gunter* crew arrival

Table 2. Survey participants, affiliations, and primary duties for GU24-02. Affiliations: SEFSC = NOAA Southeast Fisheries Science Center; CIMAS = Cooperative Institute for Marine and Atmospheric Studies; OHC = Office of Habitat Conservation; USFWS = U.S. Fish and Wildlife Service

Name	Legs	Affiliation	Duty
Carrie Sinclair	1, 2, 3	SEFSC, Pascagoula, Mississippi	Field party chief (FPC)
Gina Rappucci	1, 2, 3	CIMAS, Miami, Florida	Data manager
Laura Dias	1, 2	CIMAS, Miami, Florida	Marine mammal observer
Matt Maiello	1, 3	SEFSC, Miami, Florida	Marine mammal observer
Mary Applegate	1, 2, 3	CIMAS, Miami, Florida	Marine mammal observer
Rachel Hardee	1, 2, 3	CIMAS, Miami, Florida	Marine mammal observer
Tom Ninke	1, 2, 3	CIMAS, Miami, Florida	Marine mammal observer
Heidi Malizia	1, 2	CIMAS, Miami, Florida	Marine mammal observer
Richard Holt	1, 2	CIMAS, Miami, Florida	Marine mammal observer
Mridula Srinivasan	1	SEFSC, Miami, Florida	Marine mammal observer
Eric Weissberger	1	OHC, Silver Spring, Maryland	Marine mammal observer
Jesse Wicker	2, 3	CIMAS, Miami, Florida	Marine mammal observer
Paula Olson	2, 3	CIMAS, Miami, Florida	Marine mammal observer
LTJG Emily Ruhl	3	NOAA Corps, Miami, Florida	Marine mammal observer
Melody Baran	3	CIMAS, Miami, Florida	Marine mammal observer
Amy Brossard	3	CIMAS, Miami, Florida	Marine mammal observer
Shannon Merkle	1, 2, 3	CIMAS, Miami, Florida	Acoustician
Jonathan Reid	1, 2, 3	Marine Conservation Research, Ltd.	Acoustician
Chris Haney	1	USFWS/Terra Mar	Seabird observer
Jon Andrew	1	USFWS/Terra Mar	Seabird observer
Nick Metheny	2, 3	USFWS/Terra Mar	Seabird observer
Kate Sutherland	2, 3	USFWS/Terra Mar	Seabird observer

Table 3. Summary of daily survey effort during GU24-02 including visual and acoustic effort, average sea state, number of marine mammal sightings, number of biopsies collected, number of acoustic detections, and number of acoustic moorings recovered.

Survey Leg	Date	Visual Effort (km)	Average sea state	Visual sightings	Biopsies	Acoustic Effort (hr)	Acoustic detections	Moorings recovered
Leg 1	2-Jun	0	NA	0	0	0	0	0
	3-Jun	203.1	3.1	14	0	8.3	6	0
	4-Jun	167.0	3.4	11	0	11.5	13	0
	5-Jun	172.5	2.6	13	0	12.8	5	0
	6-Jun	205.8	2.1	8	0	13.2	2	0
	7-Jun	176.7	1.3	19	0	5.7	2	0
	8-Jun	224.1	1.9	11	0	12.7	0	0
	9-Jun	184.6	2.0	9	0	8.2	3	0
	10-Jun	182.0	2.9	1	0	12.2	0	0
	11-Jun	198.4	3.0	10	0	12.9	7	0
	12-Jun	203.6	2.1	10	1	6.1	1	0
	13-Jun	202.4	2.8	7	0	12.8	6	0
	14-Jun	206.2	3.2	8	1	12.0	8	0
	15-Jun	201.9	2.8	7	0	8.0	0	0
	16-Jun	0	NA	0	0	0	0	0
Leg 2	1-Jul	0	NA	0	0	0	0	0
	2-Jul*	174.8	2.7	16	0	0	0	0
	3-Jul*	177.1	2.2	16	0	0	0	0
	4-Jul*	190.4	0.8	38	0	0	0	0
	5-Jul*	220.1	2.6	16	0	0	0	0
	6-Jul*	155.5	1.3	23	0	0	0	0
	7-Jul*	188.4	1.5	20	0	0	0	0
	8-Jul*	221.0	3.6	3	0	0	0	0
	9-Jul*	182.3	4.5	4	0	0	0	0

Survey Leg	Date	Visual Effort (km)	Average sea state	Visual sightings	Biopsies	Acoustic Effort (hr)	Acoustic detections	Moorings recovered
	10-Jul	181.6	2.1	13	0	12.8	15	0
	11-Jul	211.5	2.3	26	0	6.8	8	0
	12-Jul	171.9	1.3	33	0	11.7	18	0
	13-Jul	161.1	2.3	26	3	13.2	15	0
	14-Jul	228.0	2.8	14	1	12.9	7	0
	15-Jul	217.7	2.4	18	0	12.9	9	0
	16-Jul	210.1	2.4	1	0	13.1	6	0
	17-Jul	202.3	2.3	31	0	13.1	16	0
	18-Jul	200.7	2.0	15	0	12.1	9	0
	19-Jul	112.4	2.5	6	0	8.1	8	0
	20-Jul	0	NA	0	0	0	0	0
Leg 3	27-Jul	0	NA	0	0	0	0	0
	28-Jul	191.6	2.4	15	0	13.1	22	0
	29-Jul	226.1	3.1	1	0	2.7	0	0
	30-Jul	220.9	2.2	10	0	13.0	11	0
	31-Jul	207.1	2.6	29	0	13.1	31	0
	1-Aug	221.9	2.9	3	0	12.9	9	0
	2-Aug**	0	NA	10	0	0	0	9
	3-Aug	177.7	1.0	54	0	12.2	15	0
	4-Aug	203.3	2.1	24	0	12.8	10	0
	5-Aug	199.2	1.1	40	0	12.8	5	0
	6-Aug	226.5	1.6	13	0	12.8	3	0
	7-Aug	172.1	2.7	5	1	10.1	5	0
	8-Aug†	75.3	1.6	5	1	4.5	4	0
	9-Aug	194.1	2.6	12	2	12.6	14	0
	10-Aug	197.1	1.1	36	0	12.6	13	0
	11-Aug	206.5	1.8	32	0	12.5	13	0

Survey Leg	Date	Visual Effort (km)	Average sea state	Visual sightings	Biopsies	Acoustic Effort (hr)	Acoustic detections	Moorings recovered
	12-Aug	61.9	2.0	6	0	4.1	6	0
	13-Aug	0	NA	0	0	0	0	0
Total		**8,716.2**	**2.3**	**742**	**10**	**415.1**	**325**	**9**

* Eastern Rice's whale survey effort. Acoustics not recording due to shallow water

** Mooring recovery; visual sightings recorded opportunistically off-effort

† Western Rice's whale survey effort

Table 4. Marine mammal sightings during GU24-02.

Species	Leg 1	Leg 2	Leg 3	Total
Atlantic spotted dolphin (*Stenella frontalis*)	4	3	2	9
Blainville's beaked whale (*Mesoplodon densirostris*)	0	2	1	3
Clymene dolphin (*Stenella clymene*)	1	1	1	3
Common bottlenose dolphin (*Tursiops truncatus*)	10	58	21	89
Common bottlenose or Atlantic spotted dolphin (*T. truncatus/S. frontalis*)	1	6	3	10
Cuvier's beaked whale (*Ziphius cavirostris*)	1	2	0	3
Dwarf sperm whale (*Kogia sima*)	0	0	20	20
False killer whale (*Pseudorca crassidens*)	0	4	0	4
Gervais' beaked whale (*Mesoplodon europeaus*)	1	0	0	1
Melon-headed or Pygmy killer or False killer whale (*Peponocephala electra/Feresa attenuata/P. crassidens*)	0	1	0	1
Melon-headed or Pygmy killer whale (*P. electra/F. attenuata*)	0	1	6	7
Melon-headed whale (*Peponocephala electra*)	0	1	3	4
Pantropical spotted dolphin (*Stenella attenuata*)	10	22	21	53
Pygmy killer whale (*Feresa attenuata*)	1	0	0	1
Pygmy or Dwarf sperm whale (*Kogia* spp.)	4	17	68	89
Pygmy sperm whale (*Kogia breviceps*)	0	2	0	2
Rice's whale (*Balaenoptera ricei*)	2	5	3	10
Risso's dolphin (*Grampus griseus*)	11	7	2	20
Rough-toothed dolphin (*Steno bredanensis*)	1	5	3	9
Short-finned pilot whales (*Globicephala macrorhynchus*)	2	8	4	14
Sperm whale (*Physeter macrocephalus*)	11	28	45	84
Spinner dolphin (*Stenella longirostris*)	4	2	1	7
Stenellid dolphin (*Stenella* spp.)	16	34	24	74
Striped dolphin (*Stenella coeruleoalba*)	0	1	2	3
Unidentified baleen whale (Mysticeti)	0	1	0	1
Unidentified dolphin (Delphinidae)	35	101	34	170
Unidentified large whale	2	1	3	6
Unidentified mesoplodont (*Mesoplodon* spp.)	1	0	6	7
Unidentified odontocete (Odontoceti)	12	5	17	34
Unidentified small whale	0	1	0	1
Unidentified ziphiid (Ziphiidae)	0	6	8	14
Grand Total*	**128**	**319**	**295**	**742**

*Total number of sightings per leg does not equal sum of species sightings as one sighting was mixed species.

Table 5. Towed array marine mammal acoustic detections during each leg of GU24-02

Species	**Leg 1**	**Leg 2**	**Leg 3**	**Total**
Sperm whale	15	22	40	77
Kogiidae	2	1	6	9
Ziphiidae	0	3	7	10
Risso's dolphin	0	0	0	0
Odontocete	14	29	11	54
Delphinid	22	56	97	175
Total	**53**	**111**	**161**	**325**

Figures

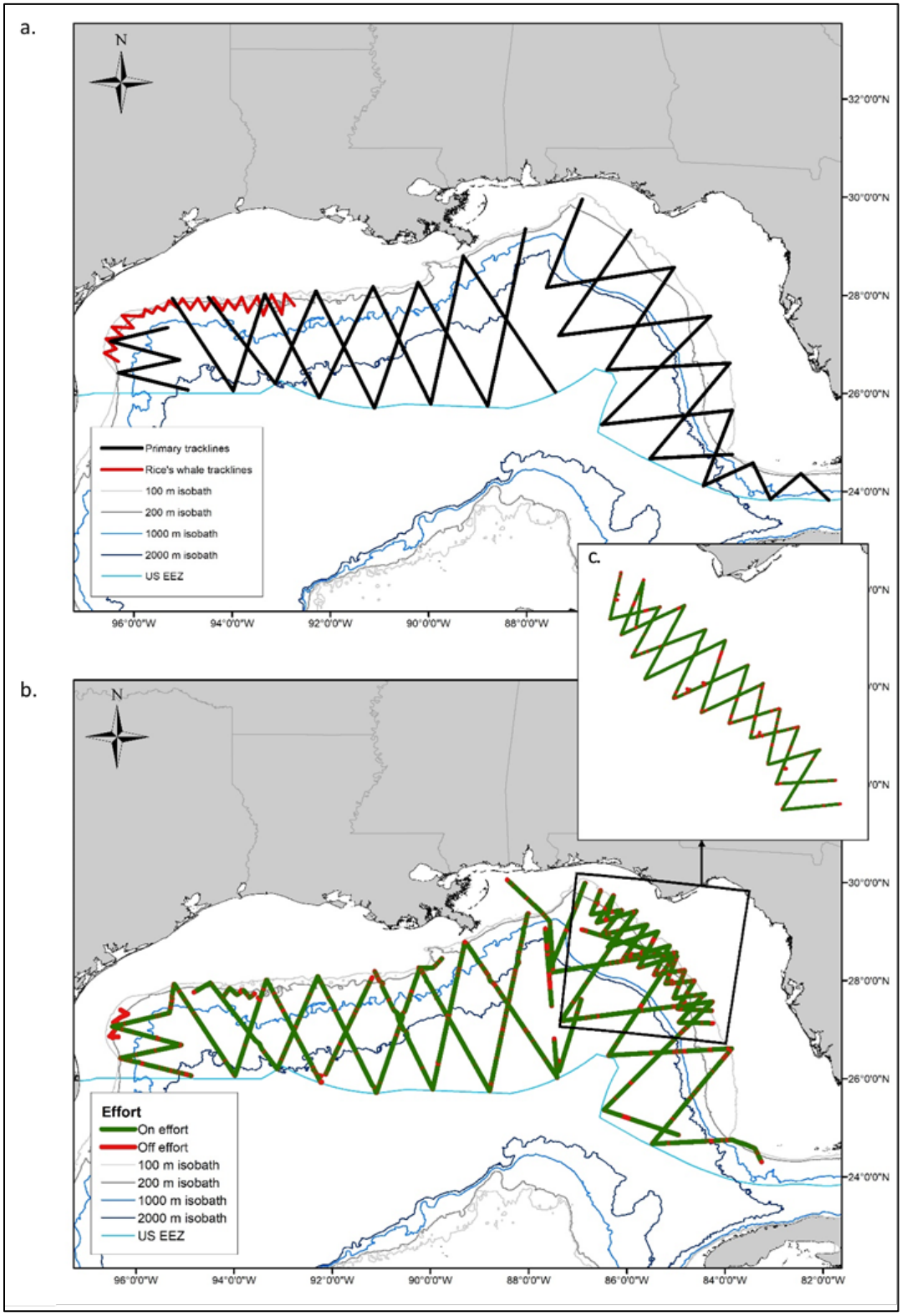


Figure 1. Planned (a) and completed (b, c) survey tracklines during GU24-02.

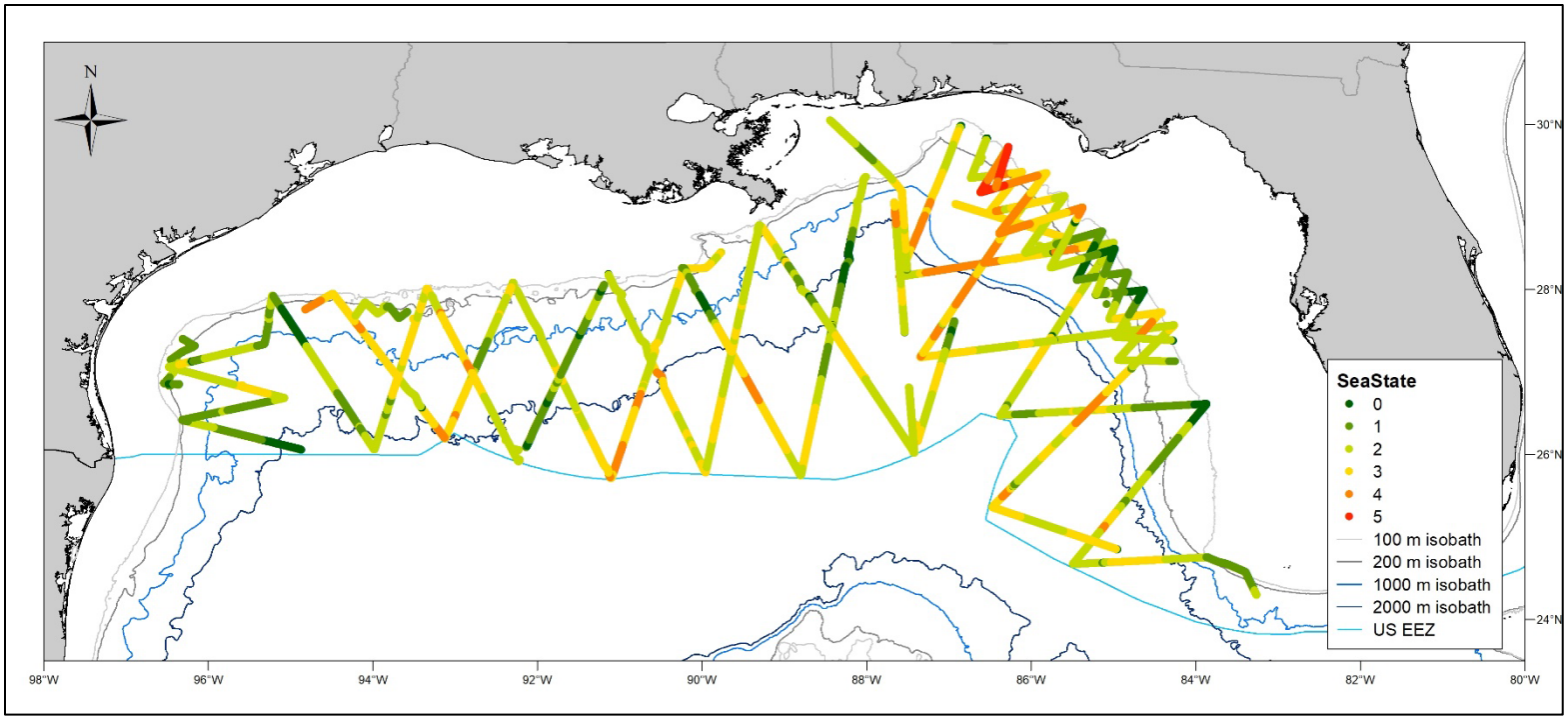


Figure 2. Sea state recorded on associated tracklines during GU24-02.

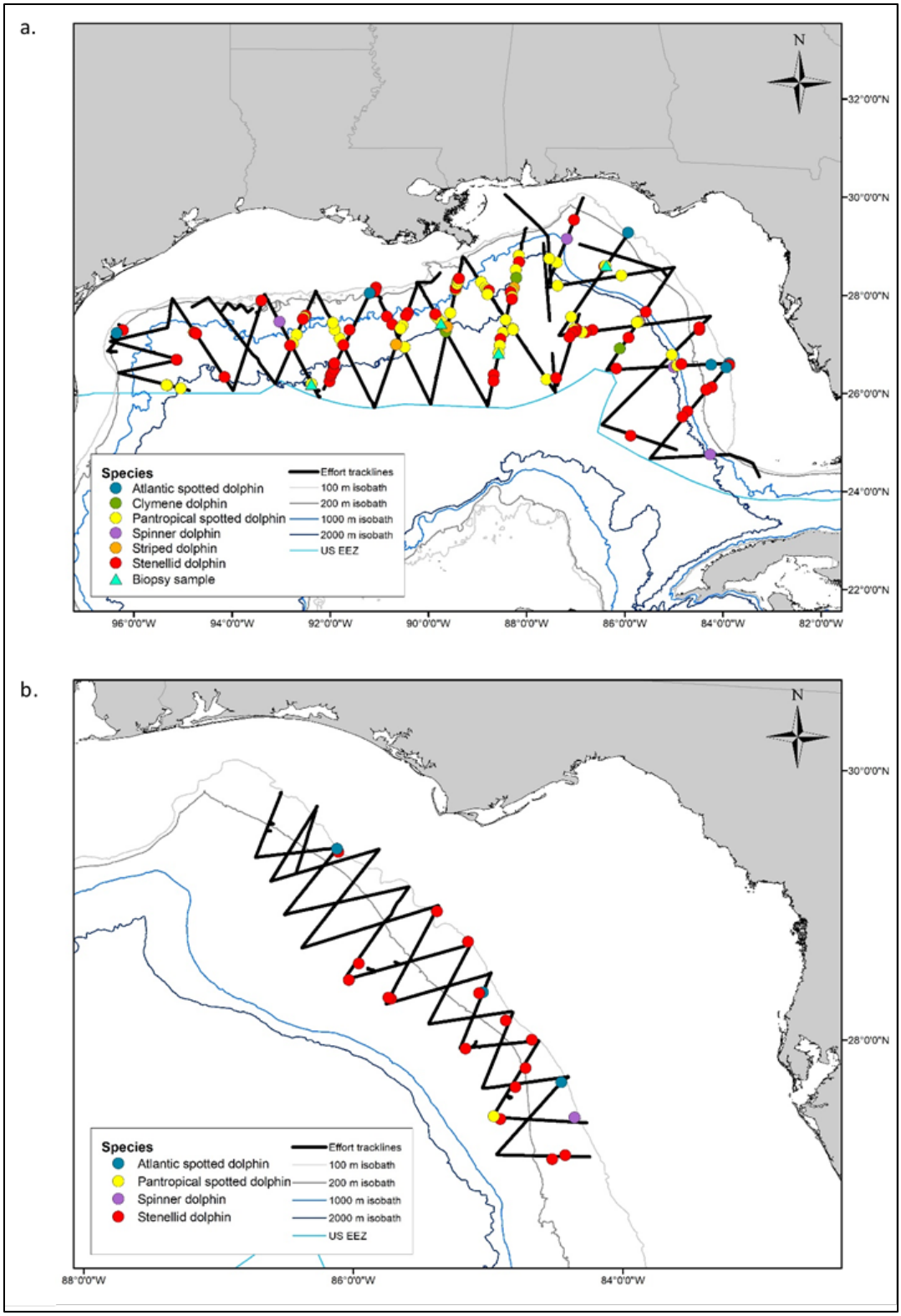


Figure 3. Sighting locations of small dolphins in the genus *Stenella* during GU24-02.

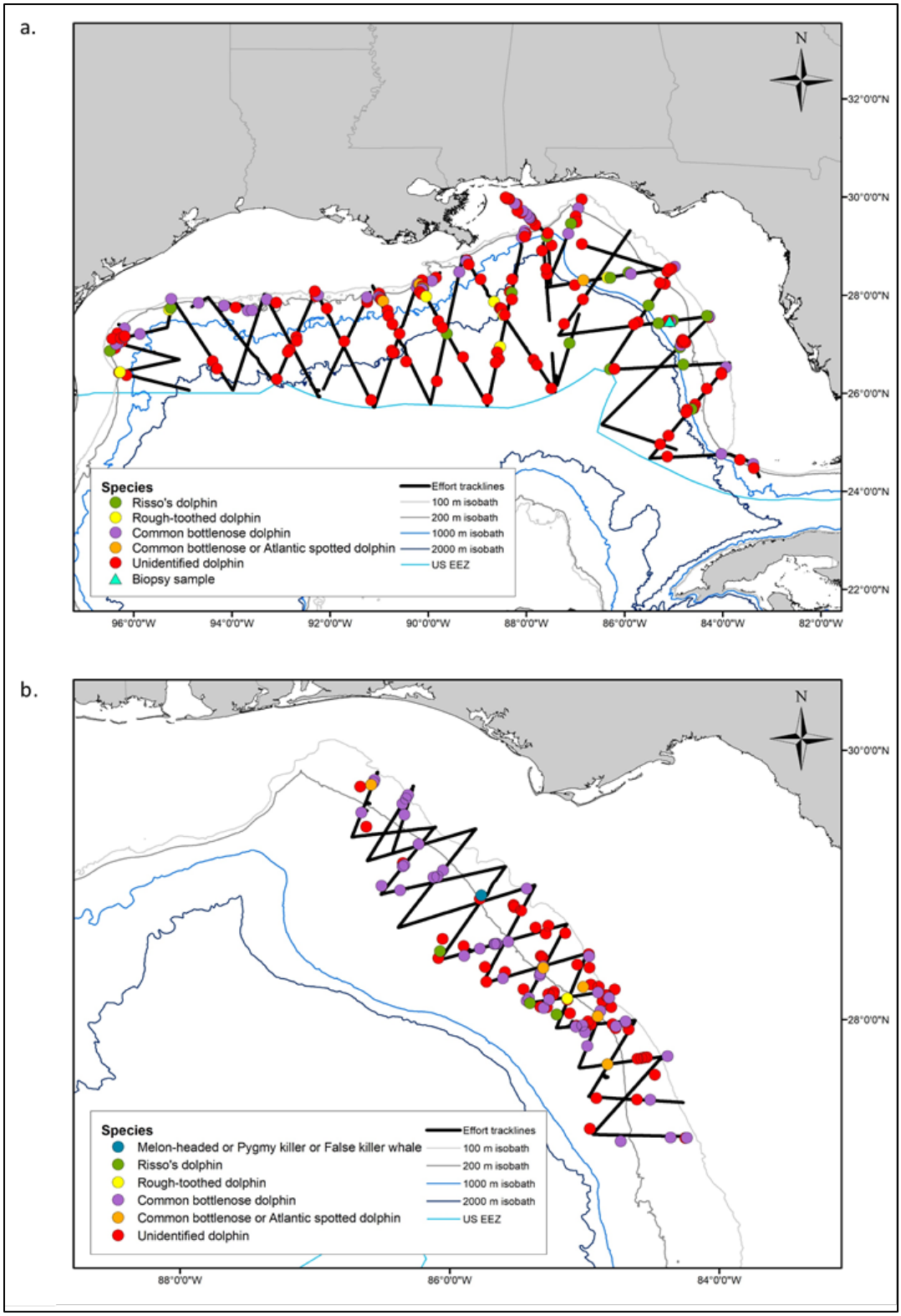


Figure 4. Sighting locations of medium sized dolphin species during GU24-02.

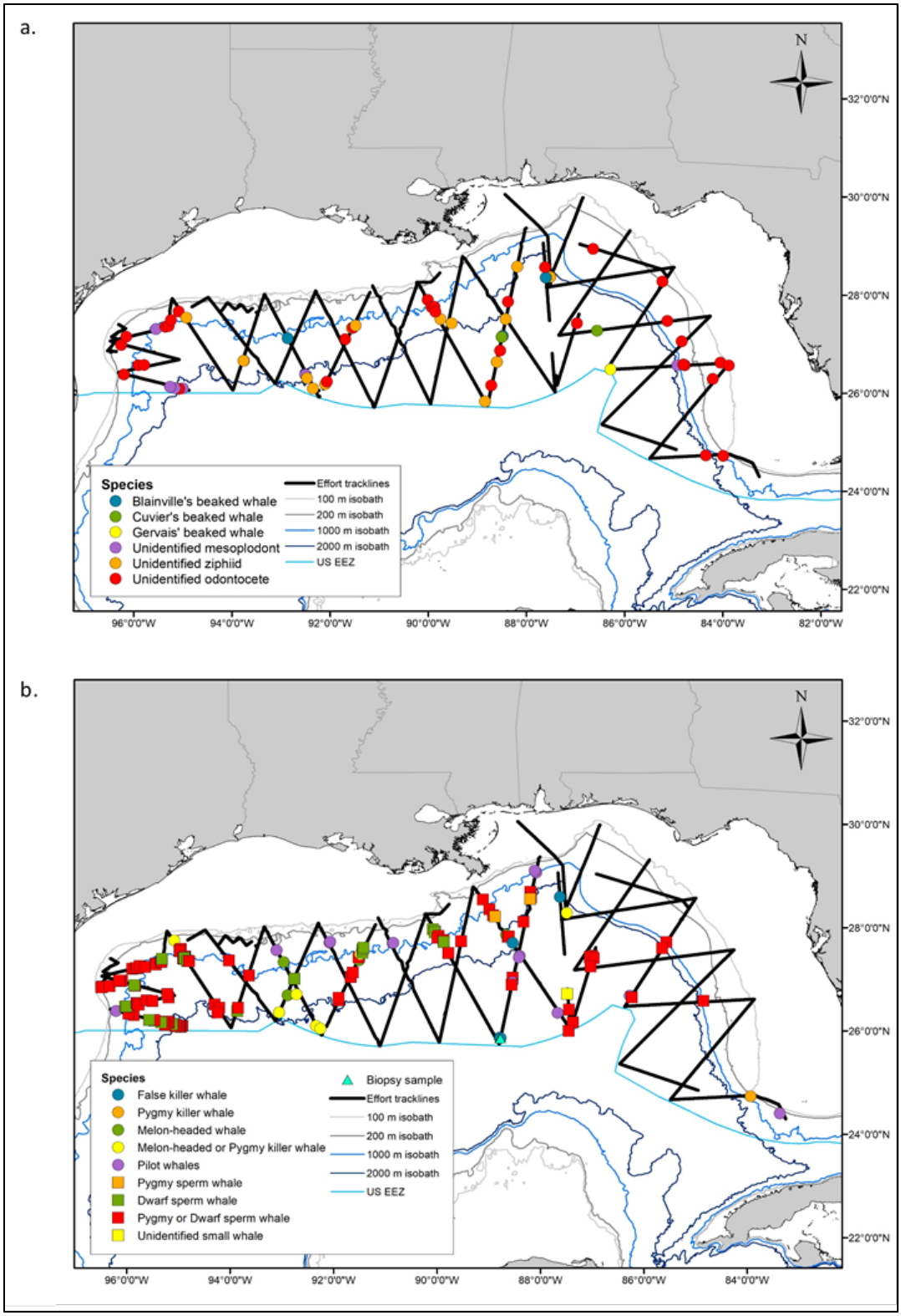


Figure 5. Sighting locations of beaked whales (a) and other small whales (b) during GU24-02.

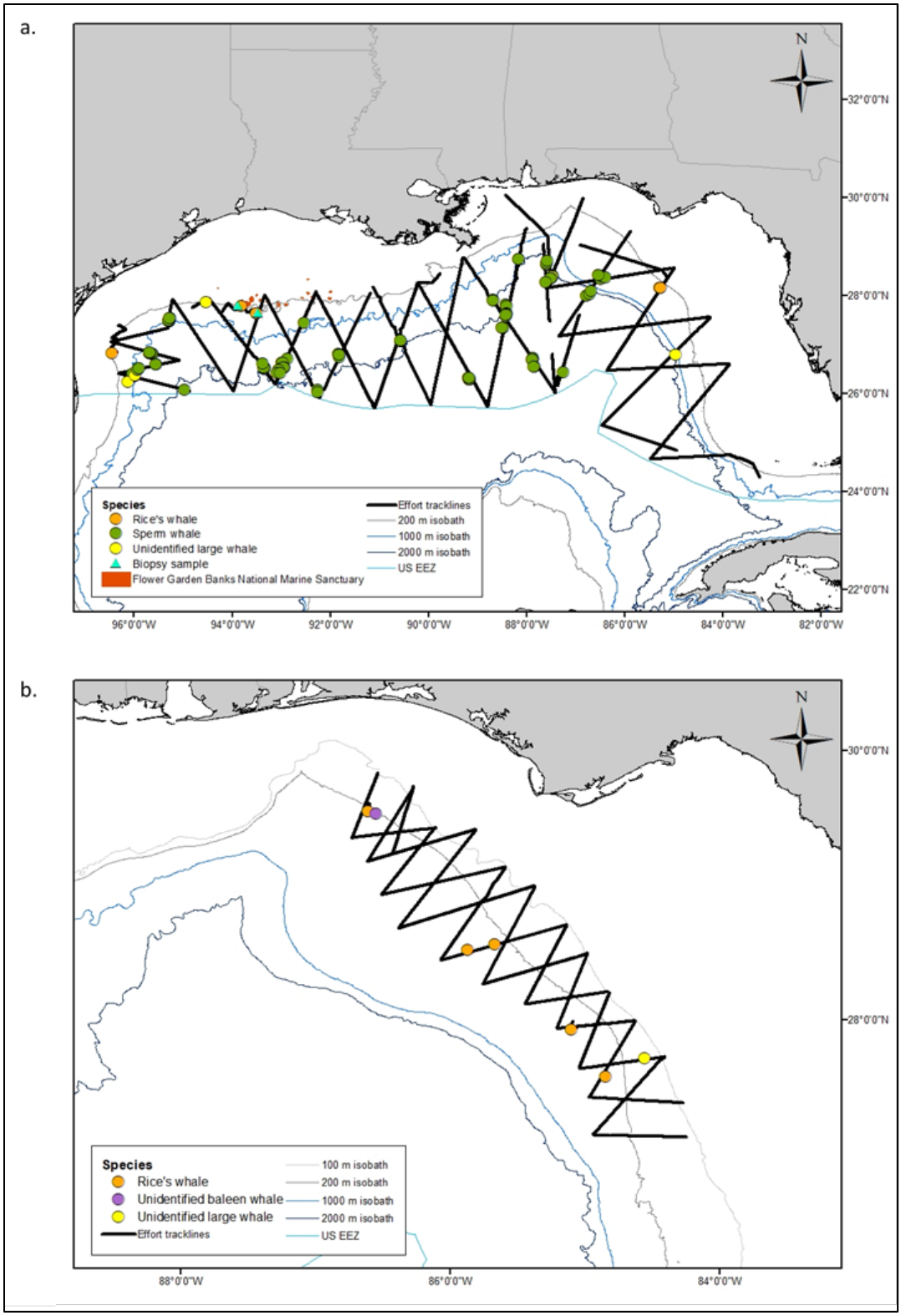


Figure 6. Sighting locations of large whale species during GU24-02.

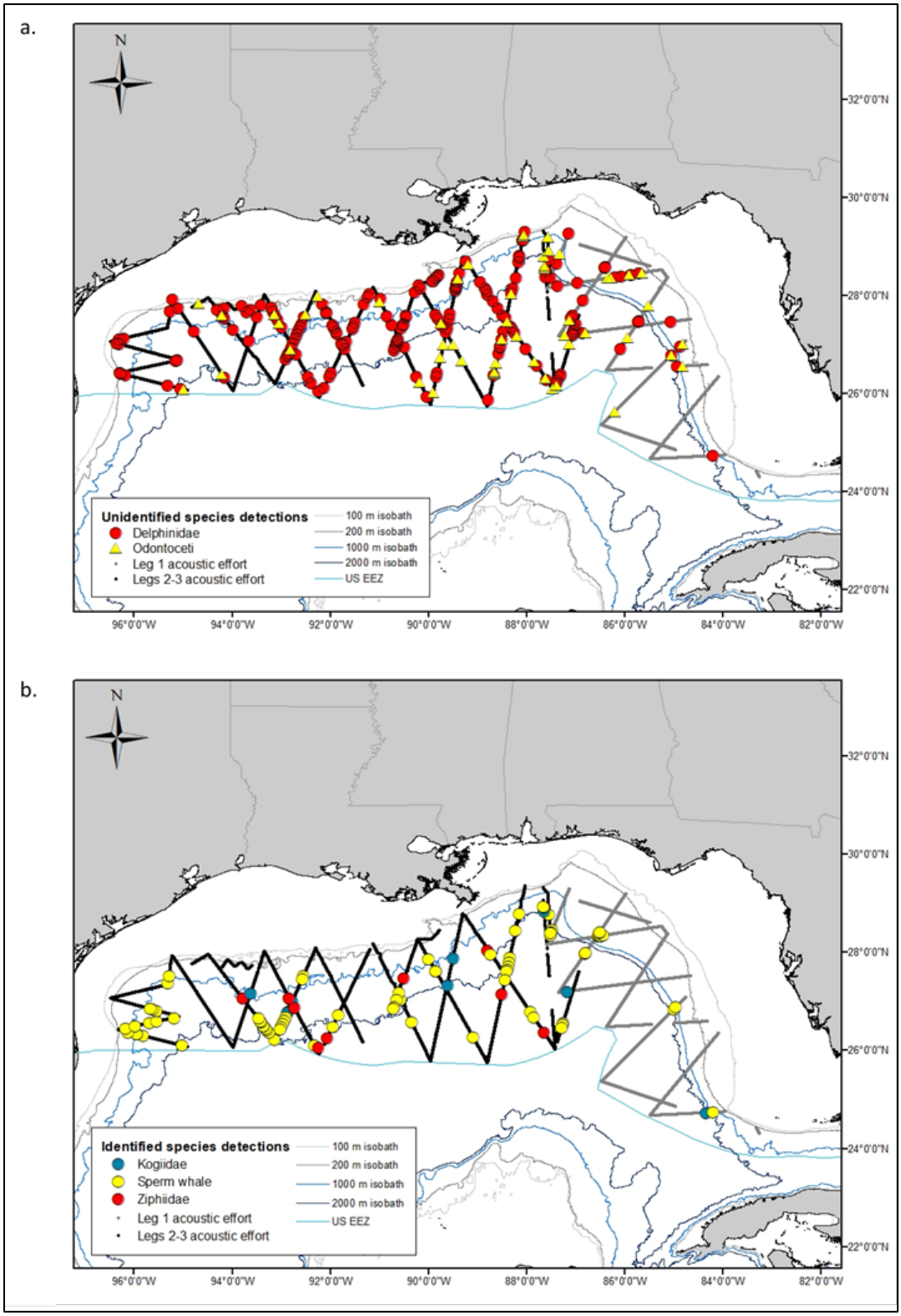


Figure 7. Passive acoustic towed array survey effort and detections during GU24-02.

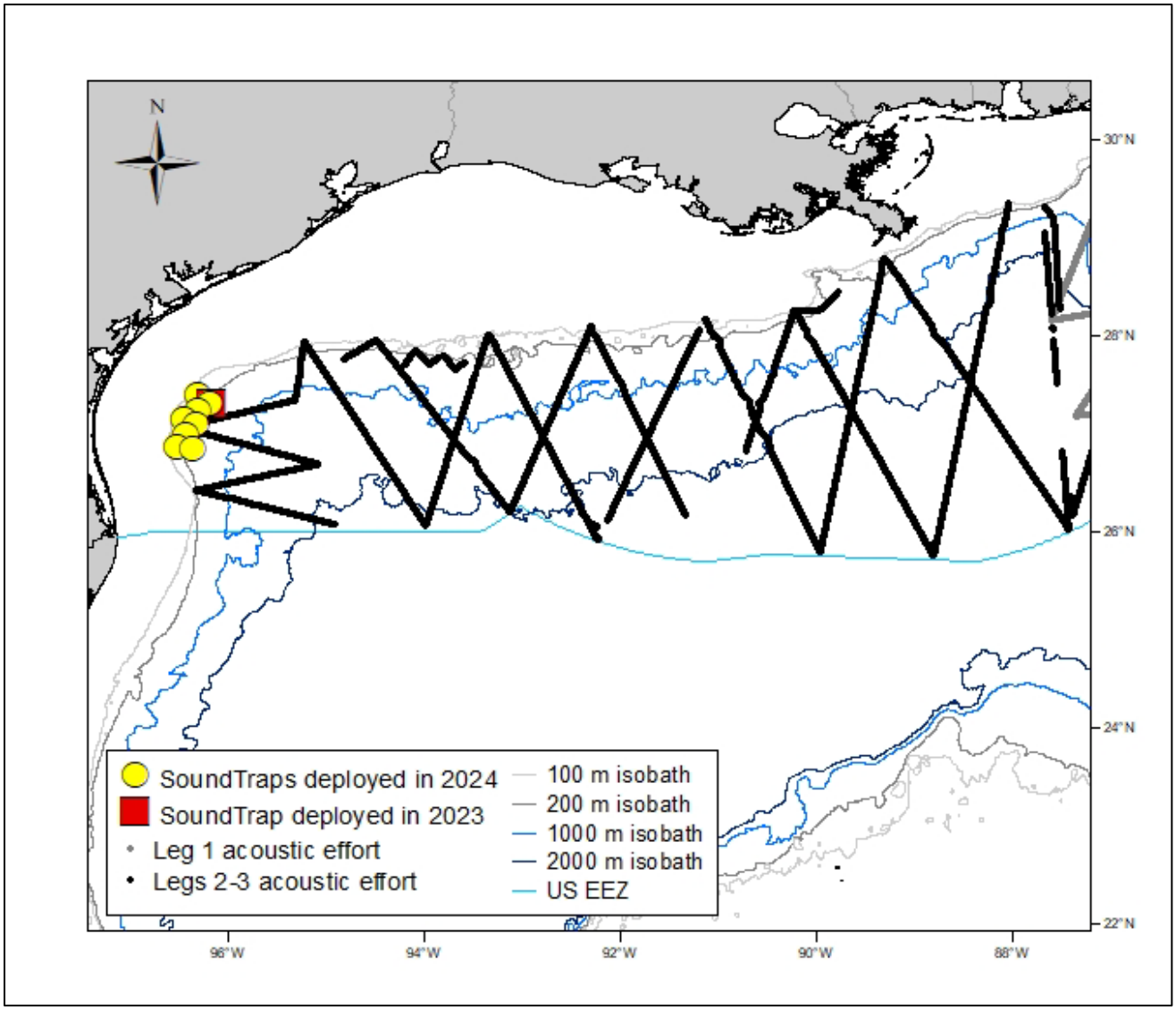
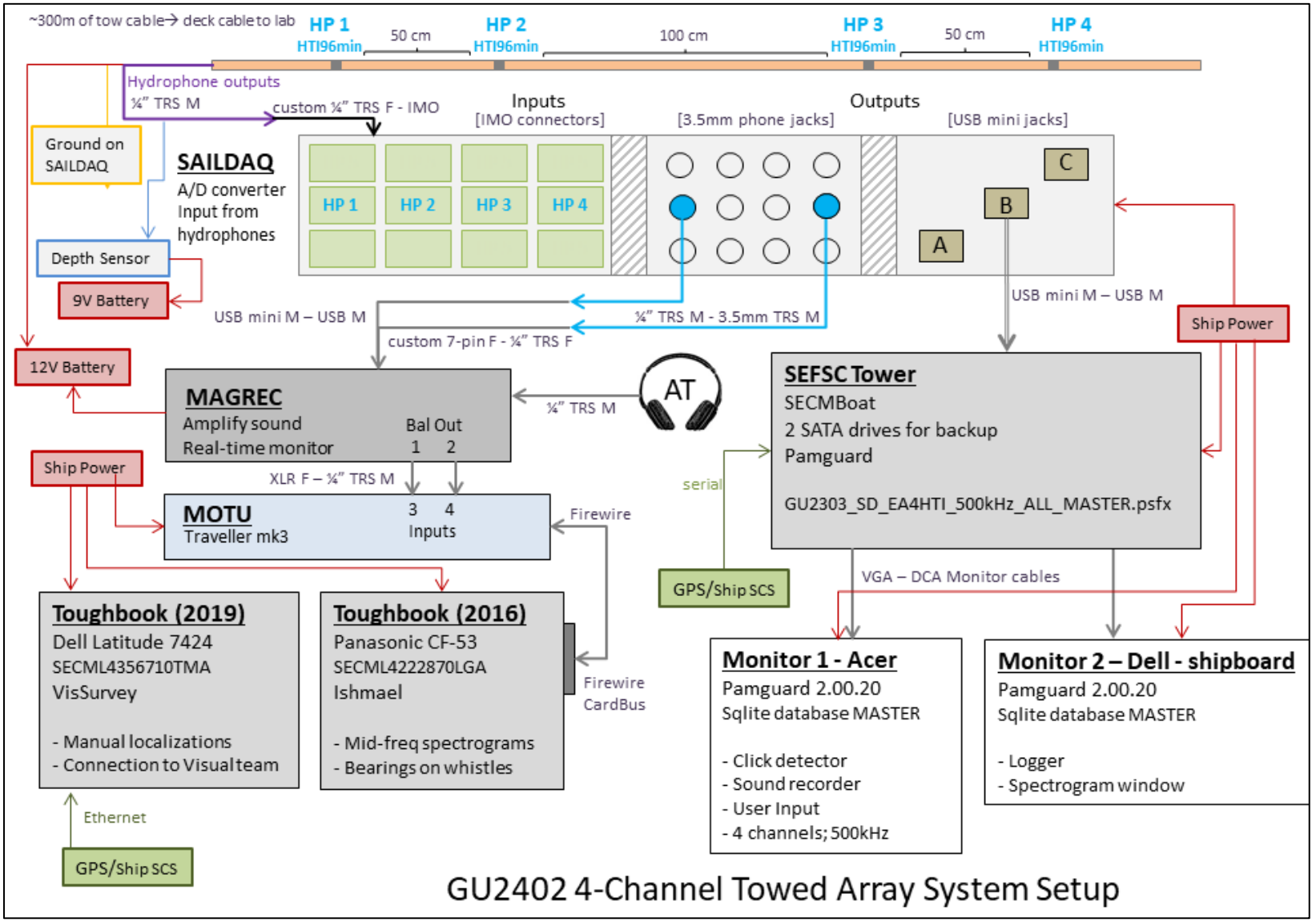


Figure 8. Autonomous acoustic moorings recovered during GU24-02.

Appendix A. Diagram of the acoustic setup used during GU24-02, including towed hydrophone array, acoustic recording hardware, data inputs, and software.



Appendix B. Diagram of a typical autonomous acoustic mooring package.

