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CRUISE RESULTS

NOAA SHIP *GORDON GUNTER* CRUISE GU18-02
JUNE – JULY 2018

Trophic Interactions and Habitat Requirements of Rice's Whales

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

February 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.

At the time of data collection, Rice's whales (*Balaenoptera ricei*) were recognized as (Gulf of Mexico) Bryde's whales (*B. edeni*); species denomination was changed to *B. ricei* after recognition of the new species status in 2021 (https://doi.org/10.1111/mms.12776). The Southeast Fisheries Science Center was authorized to conduct marine mammal research activities during the cruise under Marine Mammal Protection Act (MMPA) Permit No. 14450-05.

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CRUISE REPORT

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Funded by the NOAA RESTORE Act Science Program

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July 2019

As part of a Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies (RESTORE) Act Science Program project, the Southeast Fisheries Science Center (SEFSC), in collaboration with Scripps Institution of Oceanography (SIO) and Florida International University (FIU), conducted the first in a series of research cruises dedicated to Rice's whale (*Balaenoptera ricei*) in the Gulf of Mexico (GoMex). The current known habitat area for the Rice's whale near the De Soto Canyon region (roughly from the Florida Panhandle to Tampa) in the northeast GoMex was designated as the primary study area based on previously documented sightings (Figure 1). Rice's whales, the only baleen whale resident to the Gulf of Mexico, are most readily found in a relatively narrow habitat from De Soto Canyon southward along the continental slope, usually between depths of 180 m and 360 m.

The survey was conducted during 21 June – 8 July 2018 (Table 2, Figure 1) aboard the NOAA Ship *Gordon Gunter* along prescribed tracklines oriented along the 180–400 m isobaths, with a focus on the 200 m isobath. A list of participating personnel, including affiliation, is provided in Table 1 and daily survey operations are summarized in Table 2. The survey had originally been scheduled for 10 – 30 May 2018, but was rescheduled due to mechanical issues with the ship.

Cruise Objectives

The primary objective of this cruise was to deploy telemetry tags on Rice's whales. A mix of tag types was available, with a focus on deploying short-term camera and/or acoustic tags that provide detailed information on animal movement and feeding over short durations. Tags are attached via close approach to free-ranging whales with the scientific small boat, *R3*. Additional survey objectives included acoustic recordings via deployed sonobuoys, scientific echosounder surveys (EK60) and cetacean tissue biopsy sampling.

Summary of objectives:

1. Deploy and recover short duration tags (camera and acoustic tags)
2. Collect tissue samples (biopsies) of Rice's whales for genetic, stable isotope, and persistent organic pollutants (POP) analyses
3. Photo/video documentation of Rice's whales
4. Conduct visual surveys to understand Rice's whale spatial distribution
5. Deploy sonobuoys to collect recordings of the sounds produced by Rice's whales and of anthropogenic sounds
6. Collect water samples around Rice's whales to test for environmental DNA (eDNA)
7. Collect data on potential prey distribution based on acoustic backscatter using scientific echosounders (EK60)
8. Periodically collect vertical profiles of hydrographic parameters (e.g., temperature, salinity, oxygen concentration) via CTD and collect continuous underway surface physical oceanographic data.

Visual Survey Operation Methods

Visual surveys were conducted during daylight hours with a goal of maximizing the likelihood of finding Rice's whales for focused data collection. Historic sightings exhibit a near- normal distribution with respect to water depth, with a mean of 225 m. Therefore, four along-bathymetry tracklines spaced 5 km apart were created running approximately along the 180, 200, 230 and 260 m isobaths, and were surveyed with a goal of maximizing whale encounters while minimizing repeated encounters with the same individuals over the course of the survey (Figure 1). In addition, cross-bathymetry tracklines (Figure 1) spaced at 10 km apart from north to south throughout the habitat were primarily surveyed at night using scientific echosounders. Marine mammal sightings were defined as systematic records of cetaceans consisting of one or more individuals observed at the same location and time.

Visual survey effort commenced daily at approximately 0700 CDT and ended at 1930 CDT depending on operational requirements and survey conditions. Survey speed was typically 18 km/hr (10 knots) but varied with ship traffic and sea conditions such as ocean currents. A single team of three observers conducted searches from the vessel's flying bridge with a height above water of 13.9 m. Two marine mammal observers scanned the water using pedestal-mounted 25x150 mm "bigeye" binoculars located on the port and starboard sides. A central data recorder input data using the VisSurvey data acquisition program operating on a laptop computer. The laptop was connected to the ship's network and obtained other survey parameters (e.g., ship's position and heading, wind speed, sea surface temperature, etc.) directly from the Scientific Computing System (SCS). Using the bigeye binoculars, observers relayed the bearing and radial distance of sightings to the data recorder. The location of groups sighted close to the ship without bigeye binoculars were estimated in meters. Observers rotated through the three stations every 30 minutes, with at least a 60 minute break between shifts. Shift durations were extended during sightings that led to focused data collection.

Observers were considered "on effort" whenever the ship was on a prescribed trackline or transit line, at survey speed, and the visual team was actively searching for cetaceans through the bigeyes. Whenever an observer suspected or had in fact seen a marine mammal, a cue (marine mammal, splash, blow, etc.) was immediately entered in the data collection program and the team went "off effort." A cue is a time and location stamp in the database which captures the spatial and temporal data of a sighting. This survey was conducted in "closing mode" with a focus on baleen whale sightings, though sightings of other species were opportunistically recorded. Closing mode entails maneuvering the ship to more closely approach a sighting to improve species identification, obtain accurate group size estimates, and collect photo and video documentation, and potentially to conduct small boat operations for focused data collection. Sightings were identified to the lowest taxonomic level possible while ensuring species identification was recorded conservatively. A baleen whale sighting was recorded as Rice's whale (*B. ricei*) if the three ridges on the head were seen to confirm the species. A baleen whale sighting was recorded as Sei/Rice's whale (*B. borealis/ricei*) when a dorsal fin and one rostral ridge were observed, but it was not possible to confirm 3 rostral ridges, and as Sei/Rice's/Fin whale (*B. borealis/ricei/physalus*) when a dorsal fin was observed, or as Unidentified baleen whale (*Balaenoptera* sp.) when it was not possible to make detailed

observations other than body and head shape distinguishing the sighting from a sperm whale. After sightings were identified to species and group size enumerated, the encounter was closed, and the sighting was entered in the visual data program by the data recorder. For each encounter, time, position, bearing and reticle, species, group size, behavior, and associated animals (e.g., seabirds, fish) were recorded. Group size was counted as the minimum, maximum, and best number of animals for each sighting based upon a consensus among the observers with a complete view of the sighting. Once a baleen whale was sighted, operations were directed by the field party chief (FPC) and included photo and video documentation. Weather dependent, the small boat (*R3*) was deployed to collect photographs, tissue, and water samples and to attempt tagging. In some cases, small-scale scientific echosounder surveys (see below) were conducted in the area following a baleen whale group sighting. In addition, directed surveys were conducted using information from passive acoustic monitoring to guide the ship toward likely locations of whales. During these acoustically directed surveys, the visual team was directed toward potential contacts by the acoustic team. The visual observers were thus considered "off effort" during these surveys.

Basic survey parameters were automatically recorded by the survey program every minute and include the ship's position, heading, effort status, observer positions, and environmental conditions (e.g., wind speed, sea surface temp, etc.). At the start of the survey day and at 20-minutes time intervals thereafter, the survey program prompted observers for an update of the subjective environmental variables (e.g., glare, sea state, cloud cover, etc.) and sighting conditions. All visual survey data were recorded in EDT.

Visual Survey Results

During this cruise, 1,467 km of trackline were visually surveyed (Table 2, Figure 2). Sighting conditions were good during most days, with sea states ranging from 2 to 3 on the Beaufort wind scale (Table 2, Figure 2). A total of 26 baleen whale sightings were recorded (Table 3, Figures 3 and 4), including 12 confirmed Rice's whales (Table 3, Figure 3), four sightings of Sei/Rice's and Sei/Rice's/Fin whales each and six Unidentified baleen whales (Table 3, Figure 4). Baleen whale group sizes ranged from 1 to 11 animals. Note that number of sightings or individuals does not represent unique individuals as some animals were resighted multiple times during the survey. There were an additional 31 opportunistic sightings included several species of dolphins, primarily common bottlenose dolphins (Table 3, Figure 5).

Marine Mammal Tissue and Water Sampling

Biopsy operations during this survey were conducted during focused data collection with Rice's whales. Biopsy sampling was performed from the small boat with a crossbow fitted with a custom designed sampling dart and head to extract a small core of tissue. Sampling was conducted by personnel with training and experience to collect biopsy samples from wild cetaceans and as authorized by the Marine Mammal Protection Act (MMPA) research permit issued by the National Marine Fisheries Service (NMFS) Office of Protected Resources to the SEFSC Marine Mammal Program. Data recorded on each sampling attempt included GPS location, time, date, sampler and recorder name, species, body location struck, behavioral reaction, and whether or not a sample was obtained. One biopsy sample was collected during

this cruise, from a Rice's whale on 25 June (Table 2, Figure 6). The sample was sub- sampled into two skin sections: one stored in 20% DMSO for genetic analysis and the other was frozen at -80°C and saved for stable isotopes analysis. The blubber portion of the sample was stored in a Teflon vial and also frozen at -80°C.

Water sampling operations were conducted during this survey as part of a pilot project to develop eDNA sampling methods to test for Rice's whale presence. Water sampling was performed from the small boat using a collapsible 2L bottle dipped into the water in the "footprint" following a Rice's whale surfacing. Additional control samples were collected from the small boat using similar methods in shallow waters outside the known habitat. During this cruise, eight sea water samples were collected in the vicinity of Rice's whale encounters to test for the presence of environmental DNA (Table 2, Figure 6), and two control samples were collected from waters outside the known habitat. Water samples were filtered by vacuum pump within 8 hours using on 0.45 pore size filters. Filter discs were stored in Longmire's solution for later DNA extraction and analysis.

Tag Deployment

Tagging operations during this survey were conducted during focused data collection with Rice's whales. Three tag types were available for deployment on Rice's whales to study their movement patterns and behavior: LIMPET satellite telemetry tags, Acousonde kinematic and acoustic tags, and CATS-Cam kinematic and camera tags, though only Acousonde and CAT-Cam kinematic tag attachments were attempted during this survey. The Model B003B Acousonde (Greenridge Sciences) are 22 cm long, 8 cm wide, 360 g self-contained underwater kinematic and acoustic recorders that are attached to whales via suction-cups. The tag instrumentation includes temperature, light, and pressure sensors, triaxial magnetometers and accelerometers, a compass, and a hydrophone. The Acousonde tag float contained a SPOT 258E satellite transmitter and a VHF transmitter to aid in long-distance and short-distance tag recovery operations, respectively. The CATS Diary Cam WIFI model (Customized Animal Tracking Solutions, Germany) is a 22 cm long, 11 cm wide, 700 g self-contained underwater kinematic, acoustic, and video recorder that is attached to whales via suction-cups. The tag instrumentation includes an accelerator, compass, gyroscope, GPS, temperature, pressure, and light sensors, a HTI-96 min hydrophone and video recorder. The camera uses a CMOS sensor designed for low light conditions with a sensitivity of 3700 mV/lux-sec and a peak dynamic range of 69 dB. The CATS-Cam tag flotation also includes satellite and VHF transmitters to aid in recovery operations. Data recorded on each sampling attempt included GPS location, time, date, sampler and recorder name, species, body location struck, behavioral reaction, and whether or not a sample was obtained.

Tag deployments were attempted on 5 instances during this cruise. One successful tagging event occurred during this cruise. A Rice's whale was tagged with an Acousonde tag at 17:42 CDT on 3 July 2018 at 28° 45.430' N and 85° 42.325' W (Figure 6). The Acousonde tag was set to sample temperature and light sensors at 5 Hz, pressure sensors at 10 Hz, magnetometers at 40 Hz, accelerometers at 800 Hz, and acoustic data at 9110 Hz with no gain added. Constant satellite transmissions were received after 20:00 CDT on 4 July 2018 indicating the tag had

detached from the whale. The tag was successfully recovered at 10:54 CDT on 5 July 2018 at 28° 36.702' N and 85° 42.642' W (Figure 6). Data collection was successful and data were backed up to the PAM SATA hard-drives.

Passive Acoustic Monitoring Methods

Real-time passive acoustic surveys were conducted using directional sonobuoys (AN-SSQ-53G) to detect, localize, and record low-frequency sounds potentially produced by Rice's whales (system set up shown in Appendix 1). Sonobuoys were deployed during daylight hours concurrent with visual surveys (Figure 7). The sonobuoy deployment strategy was to 1) deploy one sonobuoy at the start of each day or occasionally throughout the day along the trackline to monitor the area to determine if calls were present, 2) deploy one sonobuoy opportunistically when the visual team found whales to determine if calls were present, and 3) deploy one or two additional sonobuoys spaced 3–5 km apart (diads and triads) to localize calls when calls were present in scenarios 1 and 2. During 25 and 26 June, sonobuoy diads and triads were deployed in an area with Rice's whale sightings and a high density of calls and attempts were made to localize calls to direct visual observers to the location of the call to verify the source of long-moan calls; however, sonobuoy drift decreased the precision needed for this task. From 27 June on, acoustic chases were implemented in which sonobuoys were deployed in areas with lower density of animals and when calls were detected, a second or third buoy was deployed and the ship was directed as far as 20 km to the site of calling animals to determine if whales were present where the calls were coming from.

The expendable Directional Frequency Analysis and Ranging (DIFAR) sonobuoys contain a compass in the sensor head and transmit four types of continuous signal back to the ship on a VHF radio carrier in an analog multiplexed format. The four signals are acoustic sound pressure, east/west particle velocity, north/south particle velocity, and GPS-based location. The acoustic signal frequency range is approximately 10 Hz to 4,000 Hz, which is well suited for large whale vocalizations that have their greatest sound energy concentrated below 1,000 Hz. Prior to deployment, all sonobuoys were programmed for DIFAR mode without Automatic Gain Control, a hydrophone depth of 122 m, and a broadcast duration of 8 hours (25 and 26 June) or 4 hours (27 June 27 – 7 July). The VHF radio signals transmitted by the sonobuoys were received by one of two omni-directional antennas (Diamond X30 144 MHz [primary] and MORAD Custom 168 MHz [backup]) mounted on the aft mast of the ship at 26 m above the waterline. The signal gain from the 144 MHz and 168 MHz antennas was enhanced by Advanced Receiver Research custom 140–144 MHz and P160VDG 160–170 MHz preamplifiers, respectively, and powered by a 12 V AC to DC converter. The effective radio reception ranges from the sonobuoys was approximately 15–20 km, but reception range was more limited in some survey directions due to close proximity of the antennas to the VSAT dome which blocked signal reception.

The amplified sonobuoy signals were split in the lab and received on up to three WinRadios (G39WSBe), each tuned to the broadcast frequency programmed for one of the deployed sonobuoys. Analog sonobuoy signals from the three WinRadios were digitized with an RME Fireface UC audio interface sampling 16 bits at 48 kHz and were recorded directly to SATA hard drives as multi-channel wav files using Pamguard (Gillespie et al. 2008) v1.13.05 software. The

Pamguard software program was used to record acoustic data, effort, and metadata logs to hard-disk and to process DIFAR signals in real-time. Effort data, detections metadata, and data on the bearing to sounds and the sound types were recorded using Pamguard Logger forms. A custom DIFAR demultiplexing module (Miller et al. 2015) was used for real-time call detection, bearing estimation, and localization when possible. The DIFAR module plots spectrograms and difargrams using the Australian Marine Mammal Center demodulation software, allowing estimation of magnetic bearing angles to calling animals, and maps the true bearings alongside the ship GPS trackline and sonobuoy deployment locations. When the same calls were detected on two or more sonobuoys with a sufficient baseline separation, it was possible to locate the source of the sounds by crossing two or more bearings. Two acousticians conducted real-time monitoring of sonobuoy data and rotated 2 – 2.5 hour shifts from 26 June to 3 July, while only one acoustician was present from 4 July to 7 July. During these final days, no real-time monitoring occurred during meal breaks though recordings continued. All data were backed up to a secondary SATA hard drive.

Passive Acoustics Results

A total of 90 sonobuoys were deployed throughout the survey area over 13 days, yielding 122 hours of multi-channel acoustic recordings (231 sonobuoy-hours) (Table 4, Figure 7). Of the 90 deployed buoys, 88 (98%) successfully broadcast a signal. All sonobuoys were deployed and monitored in real-time during daylight hours (115 hours monitored), though five continued receiving signals after sunset and were only recorded during this time for later processing. Of the 90 sonobuoys, 36 were deployed for monitoring for calls, two were deployed opportunistically near Rice's whale sightings, and 52 were deployed to be diads or triads for call localization. A total of 71 buoys were part of a localizing diad or triad (i.e., monitoring buoys became part of a diad or triad when loud calls were detected). Acoustic recordings and metadata databases were recorded to primary and backup external SATA drives.

The passive acoustic technicians monitored the signals continuously and manually detected and classified potential cetacean sounds along with anthropogenic noises. At initial data collection, these sounds were broadly categorized as possible Rice's whale vocalizations (e.g., long-moans, downswept pulses, downswept pulse sequences, and others). Low-frequency tonal sounds were detected on 75 (85%) of the 88 successful sonobuoys for a total of 54 acoustic detections of individuals or groups of whales. Long-moans were detected on all 75 sonobuoys while 28 (31%) of them had downswept pulse sequences detected. To verify the source of the long-moan calls, acoustic chases were conducted on 16 acoustic detections, with 13 chases leading to whale sightings near the detection localizations. Post-cruise analyses of these data that incorporate sonobuoy GPS data will be conducted to verify accuracy of real-time bearings and localizations obtained in the field and to more accurately identify the source of recorded sounds when possible. The data will be used to establish a library of species-specific calls for acoustic identification to aid in the interpretation of recordings made in the absence of visual survey data.

Scientific Echosounder (EK60) Data Collection

Multi-frequency scientific echosounders (Simrad EK60) continuously sampled the distribution

and density of secondary productivity throughout the water column throughout each day of the cruise. The EK60 collected data on frequencies of 18 kHz, 38 kHz, 120 kHz and 200 kHz. During daylight hour surveys for whales, the EK60 collected data continuously, except during close approaches to whales and when the small boat was conducting focused data collection with whales and data collection on the 18 kHz frequency was suspended to avoid disturbances to the whales (Figure 8). Additionally, small-scale surveys were conducted in the vicinity of selected Rice's whale encounters to characterize the prey field in the immediate vicinity of encountered whales and to examine correlations between the diving and feeding behaviors of tagged whales and the local structure of the prey field. During this cruise, the small-scale survey design followed a flower pattern of six tracklines approximately equally spaced around a circle (Figure 8). Cross-shelf tracklines that covered the primary known habitat at 10 km spacing were conducted at night to characterize the overall spatial distribution and structure of the potential Rice's whale prey field (Figure 9). EK60 tracklines were surveyed beginning at sunset and until the commencement of acoustic survey effort the following day. The backscatter data were stored on hard drives for archiving and further analysis.

Environmental Data

Environmental data were collected daily using a conductivity, temperature and depth sensor (CTD) unit. CTD casts recorded vertical profiles of salinity, temperature, and oxygen content to a maximum depth of 500 m. Environmental data including water temperature, salinity, and weather conditions (e.g., wind speed, wind direction) were continuously collected via the ship's SCS and recorded in the marine mammal visual sighting database. Twelve CTD stations were sampled at water depths ranging from 184 m to 255 m. Casts were performed almost daily, typically at the beginning of the marine mammal survey day (Table 2, Figure 10).

Data and Sample Disposition

All data collected during GU18-02 including visual survey data, passive acoustic data, EK60 data, SCS data, and CTD data are archived and managed at the SEFSC in Miami, FL. Passive acoustic data back-ups are stored at Scripps Institution of Oceanography in La Jolla, CA. Biopsy sub-samples for genetics and eDNA water samples are archived at the SEFSC Marine Mammal Molecular Genetic Laboratory in Lafayette, LA pending analyses. The sub-samples for stable isotopes and contaminants are archived at the SEFSC Miami Laboratory. The data presented here are preliminary and subject to change as further auditing and analyses continue.

Permit and Funding Source

SEFSC Marine Mammal Program was the primary institution authorized to conduct marine mammal research during this survey under the MMPA research permit #14450-05 issued by the NMFS Office of Protected Resources to the SESFC, in collaboration with researchers from the Scripps Institution of Oceanography and Florida International University.

This survey was funded through a grant from the Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States Act of 2012 (RESTORE Act) and the NOAA RESTORE Science Program through the Gulf Coast Restoration Trust Fund (https://restoreactscienceprogram.noaa.gov/projects/rices-whales). DIFAR sonobuoys used for the acoustic surveys were donated by the Navy's Living Marine Resources program and Sonobuoy Liaison Working Group.

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Miller B, Barlow J, Calderan S, Collins K, Leaper R, Olson P, Ensor P, Peel D, Donnelly D, Andrews-Goff V, Olavarria C, Owen K, Rekdahl M, Schmitt N, Wadley V, Gedamke J, Gales N, Double, M. 2015. Validating the reliability of passive acoustic localisation: a novel method for encountering rare and remote Antarctic blue whales. Endangered Species Research 26:257-269.

Table 1. List of Participants during the GU18-02 survey.

Name	Affiliation	Duty
Anthony Martinez	SEFSC, Miami	Field Party Chief (FPC)
Melissa Soldevilla	SEFSC, Miami	Lead acoustician
Katrina Ternus	Riverside Technology, Inc.	Acoustician
Nikki Vollmer	CIMAS	Samples and lab manager
Kevin Barry	SEFSC, Pascagoula	Marine mammal observer
Melody Baran	CIMAS	Marine mammal observer
Mary Applegate	CIMAS	Marine mammal observer
Carol Roden	CIMAS	Marine mammal observer
Heidi Malizia	CIMAS	Marine mammal observer
Savannah Labua	Florida International University	EK60 technician
Vincent Quiquempois	Florida International University	Camera tag expert (CATS-CAM)

Affiliations: SEFSC = NOAA Southeast Fisheries Science Center; CIMAS = University of Miami's Cooperative Institute for Marine and Atmospheric Studies.

Table 2. Daily operations during GU18-02 including visual survey and sightings, samples collected, tag deployed and CTD casts performed.

Date	Event	Tracklines (km)	Ave. sea state	Num. sights	Num. baleen sights	eDNA sample	Biopsy sample	Tag deployment	CTD casts
21-Jun	Delayed departure	0.0	NA	0	0	0	0	0	0
22-Jun	Delayed departure	0.0	NA	0	0	0	0	0	0
23-Jun	Departed Pascagoula, MS	0.0	NA	0	0	0	0	0	0
24-Jun	Personnel transfer	0.0	NA	0	0	0	0	0	0
25-Jun	Marine mammal ops	124.3	1.3	5	1	5	1	0	1
26-Jun	Marine mammal ops	109.0	2.6	5	6	0	0	0	3
27-Jun	Marine mammal ops	152.6	3.0	3	0	0	0	0	1
28-Jun	Marine mammal ops	155.8	3.1	1	6	0	0	0	1
29-Jun	Marine mammal ops	104.1	3.0	0	2	0	0	0	1
30-Jun	Marine mammal ops	47.1	2.0	1	2	0	0	0	1
1-Jul	Marine mammal ops	116.5	4.1	0	1	0	0	0	1
2-Jul	Marine mammal ops	114.1	2.8	4	2	0	0	0	1
3-Jul	Marine mammal ops	110.8	2.6	1	2	1	0	1	1
4-Jul	Marine mammal ops, personnel transfer	61.6	3.6	2	0	0	0	0	1
5-Jul	Marine mammal ops	118.1	2.5	4	1	0	0	0	0
6-Jul	Marine mammal ops	137.4	2.0	2	3	2	0	0	0
7-Jul	Marine mammal ops	115.1	2.2	3	0	0	0	0	0
8-Jul	Arrived in Key West, FL	0.0	NA	0	0	0	0	0	0
Totals		**1466.6**	**2.7**	**31**	**26**	**8**	**1**	**1**	**12**

Table 3. Marine mammal visual sightings during GU18-02.

Species	Number of sightings
Atlantic spotted dolphin	6
Bottlenose dolphin	17
Bottlenose/Spotted dolphin	3
Rice's whale	12
Sei/Rice's whale	4
Sei/Rice's/Fin whale	4
Spinner dolphin	1
Unid. Baleen Whale	6
unid. dolphin	4
Total	**57**

Table 4. Summary of acoustic survey effort during GU18-02.

Date	Monitoring Effort (h)	Recording Effort (h)	Number of Sonobuoys Deployed	Number of Successful Sonobuoys	Number of Acoustic Detections
25-Jun	5.28	6.89	3	3	1
26-Jun	12.50	14.48	8	8	6
27-Jun	5.10	5.10	3	3	2
28-Jun	12.14	12.03	13	12	9
29-Jun	9.04	9.04	7	7	6
30-Jun	9.72	9.72	6	6	4
1-Jul	7.40	7.40	8	8	3
2-Jul	11.24	12.98	8	8	4
3-Jul	10.58	10.58	7	7	2
4-Jul	4.51	5.33	5	5	4
5-Jul	7.19	7.66	7	6	6
6-Jul	10.49	11.13	8	8	5
7-Jul	9.72	9.89	7	7	2
Total	**114.92**	**122.25**	**90**	**88**	**54**

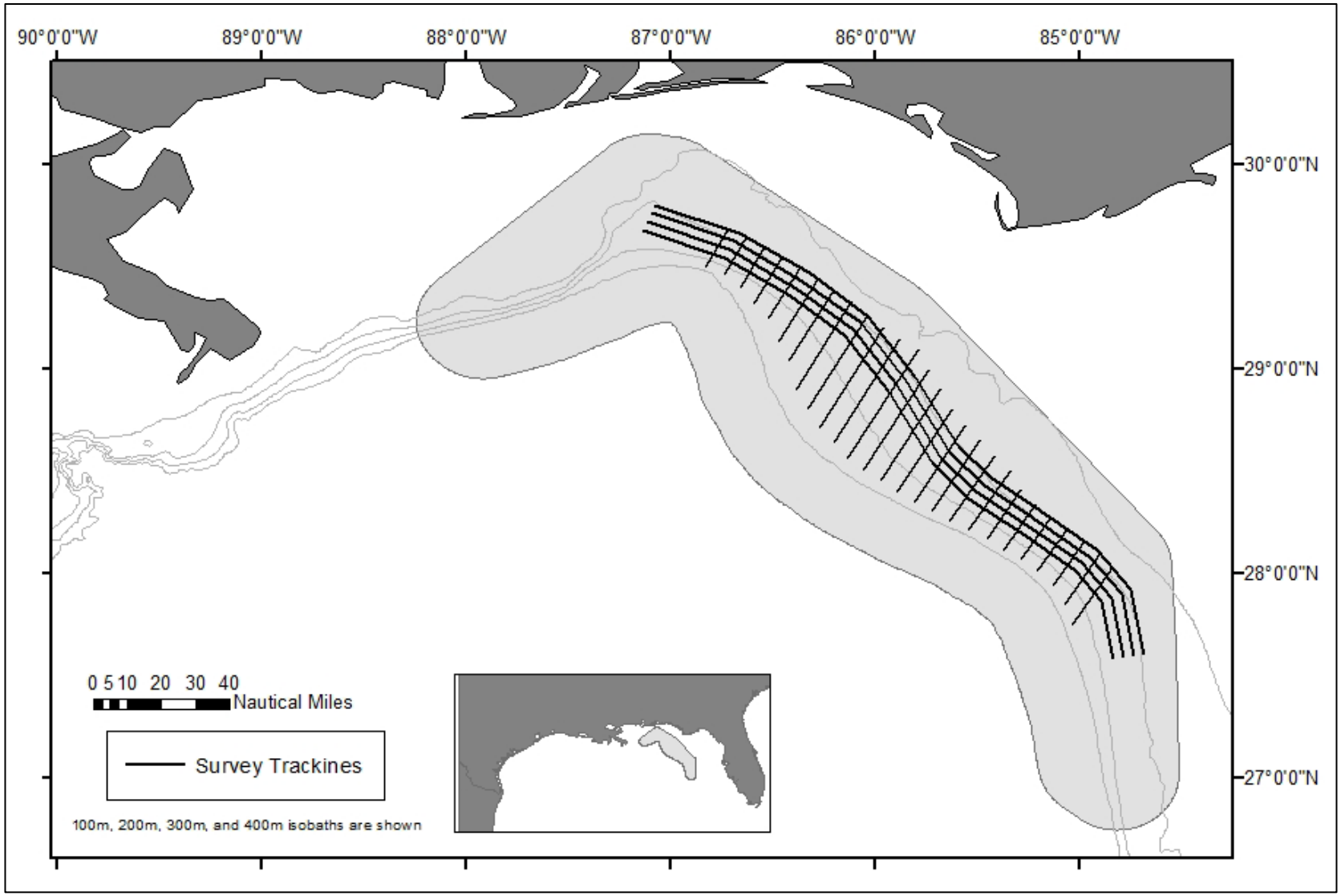


Figure 1. Rice's whale primary habitat and planned along-bathymetry and cross-bathymetry tracklines for the GU18-02 cruise.

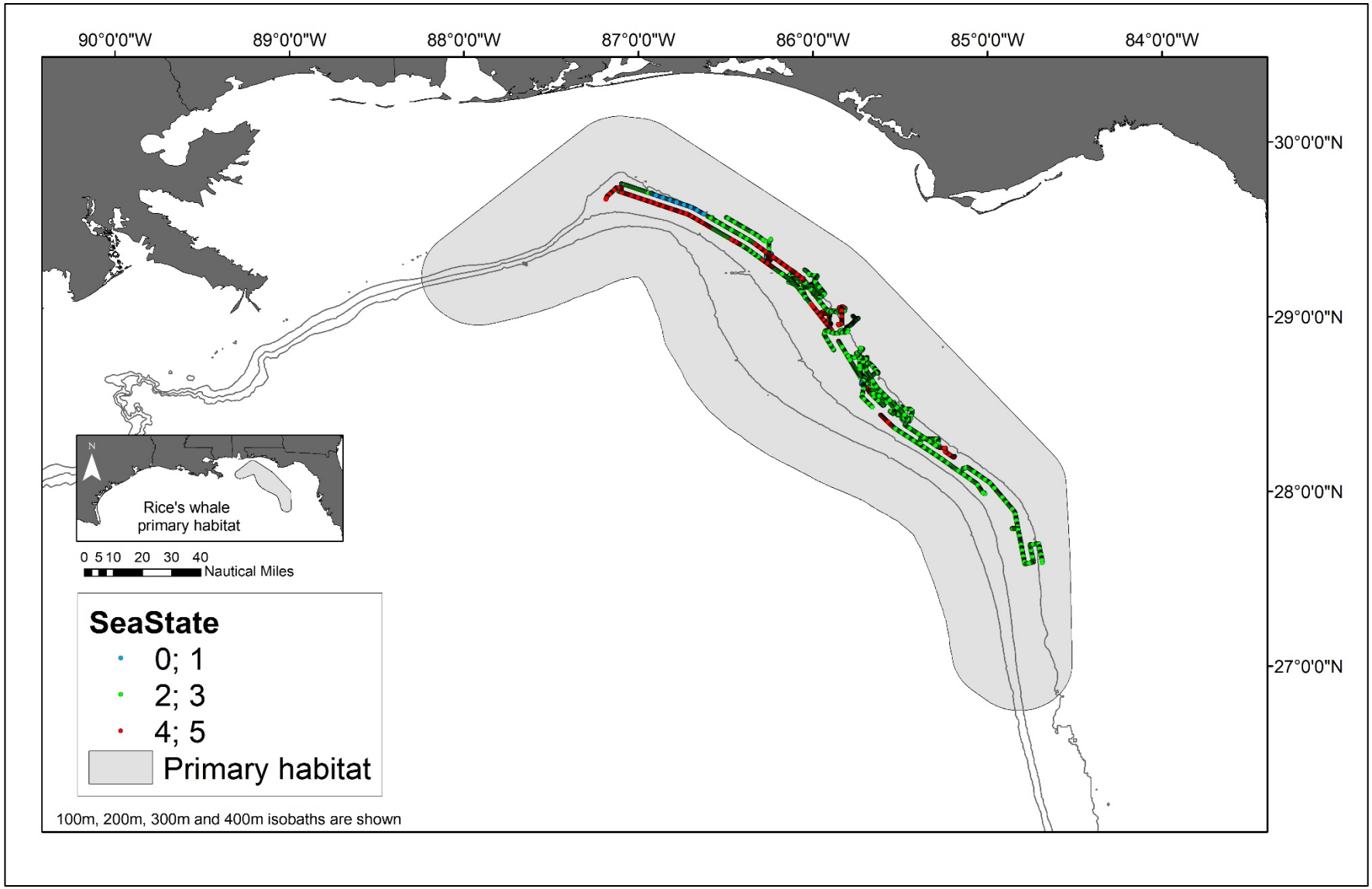


Figure 2. Visual Survey effort and Sea state during the GU18-02 survey.

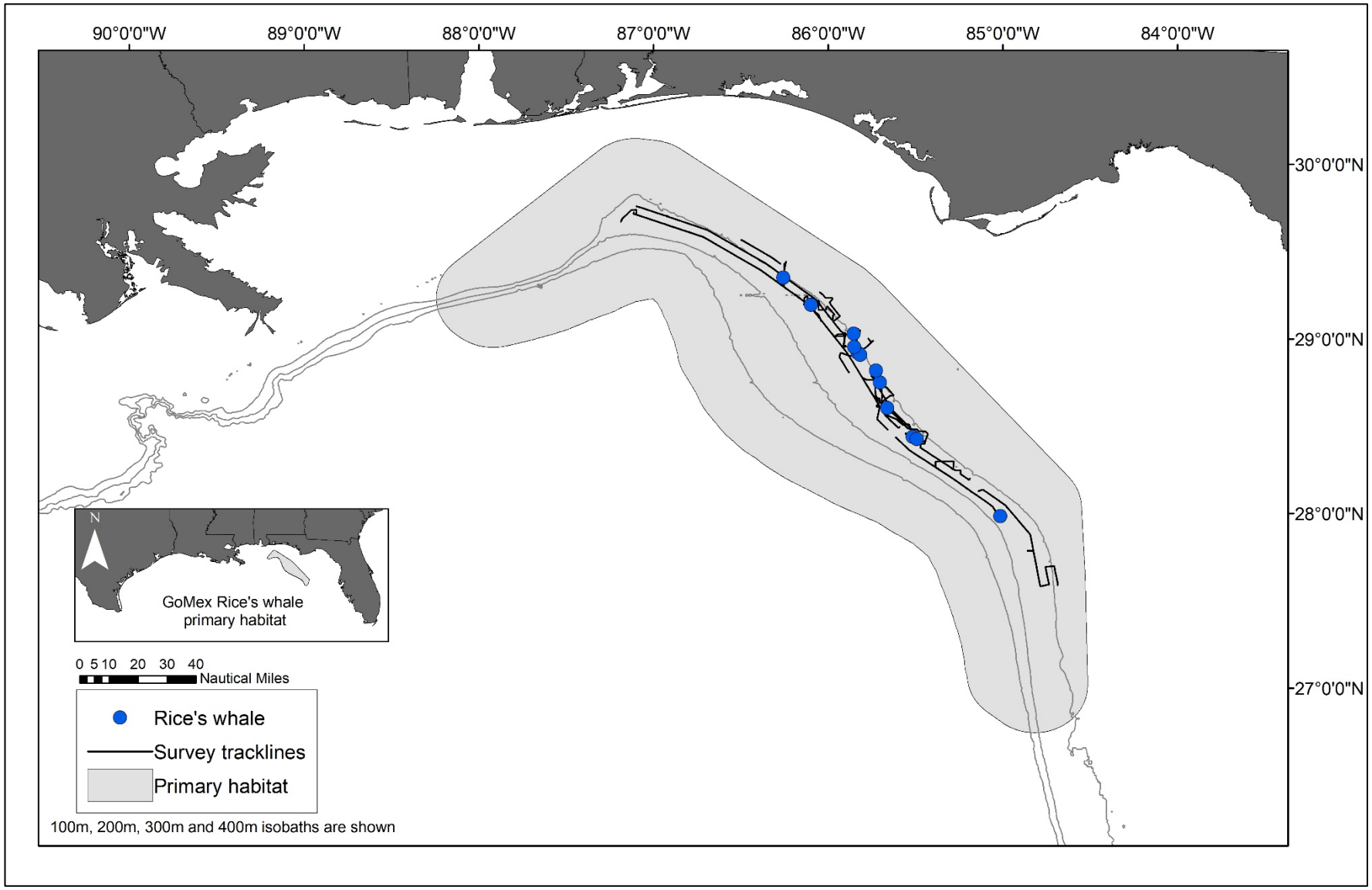


Figure 3. Rice's whale sighting locations during the GU18-02 survey.

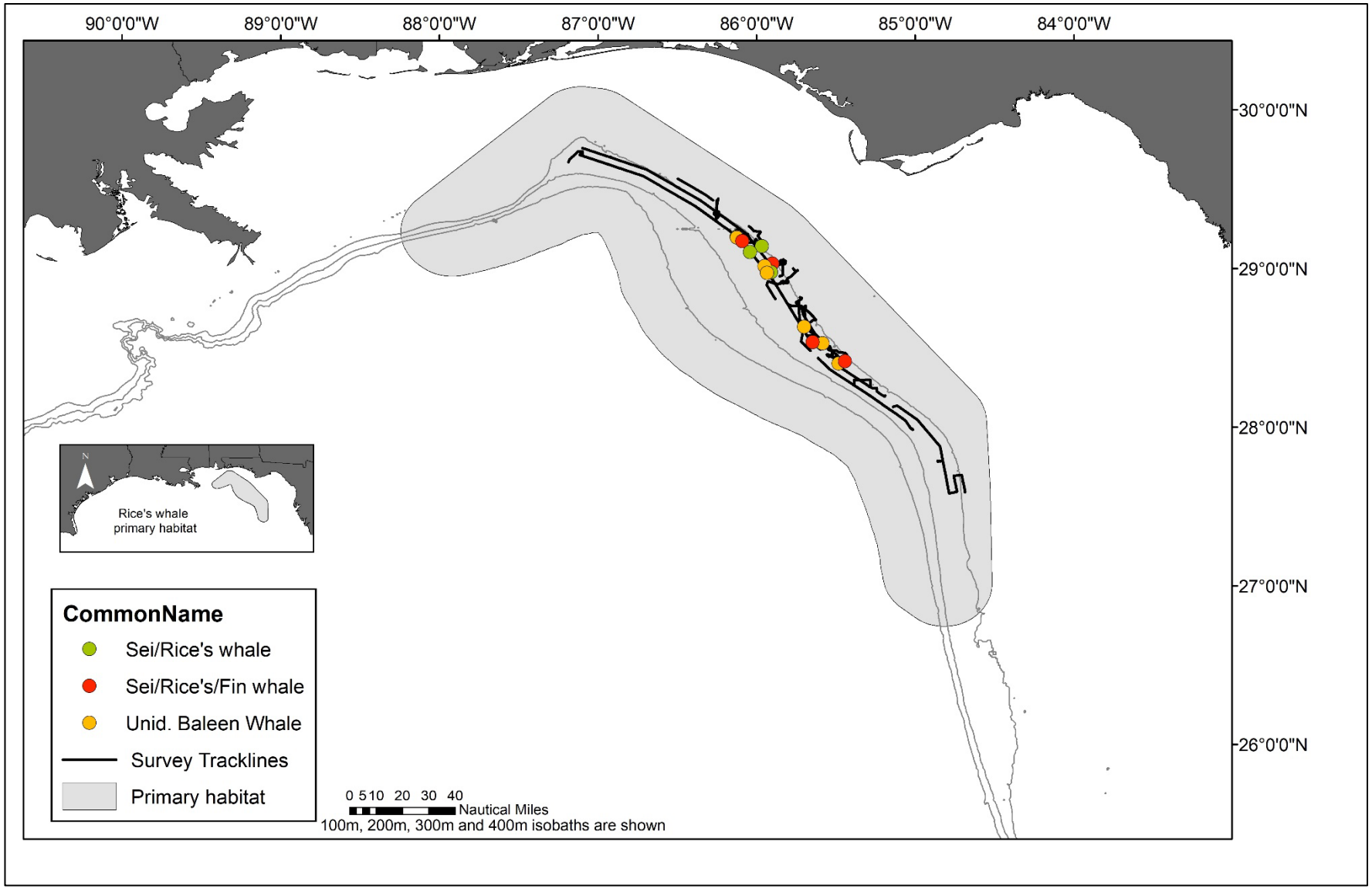


Figure 4. Baleen whale sighting locations during the GU18-02 survey that were not confirmed as Rice's whales.

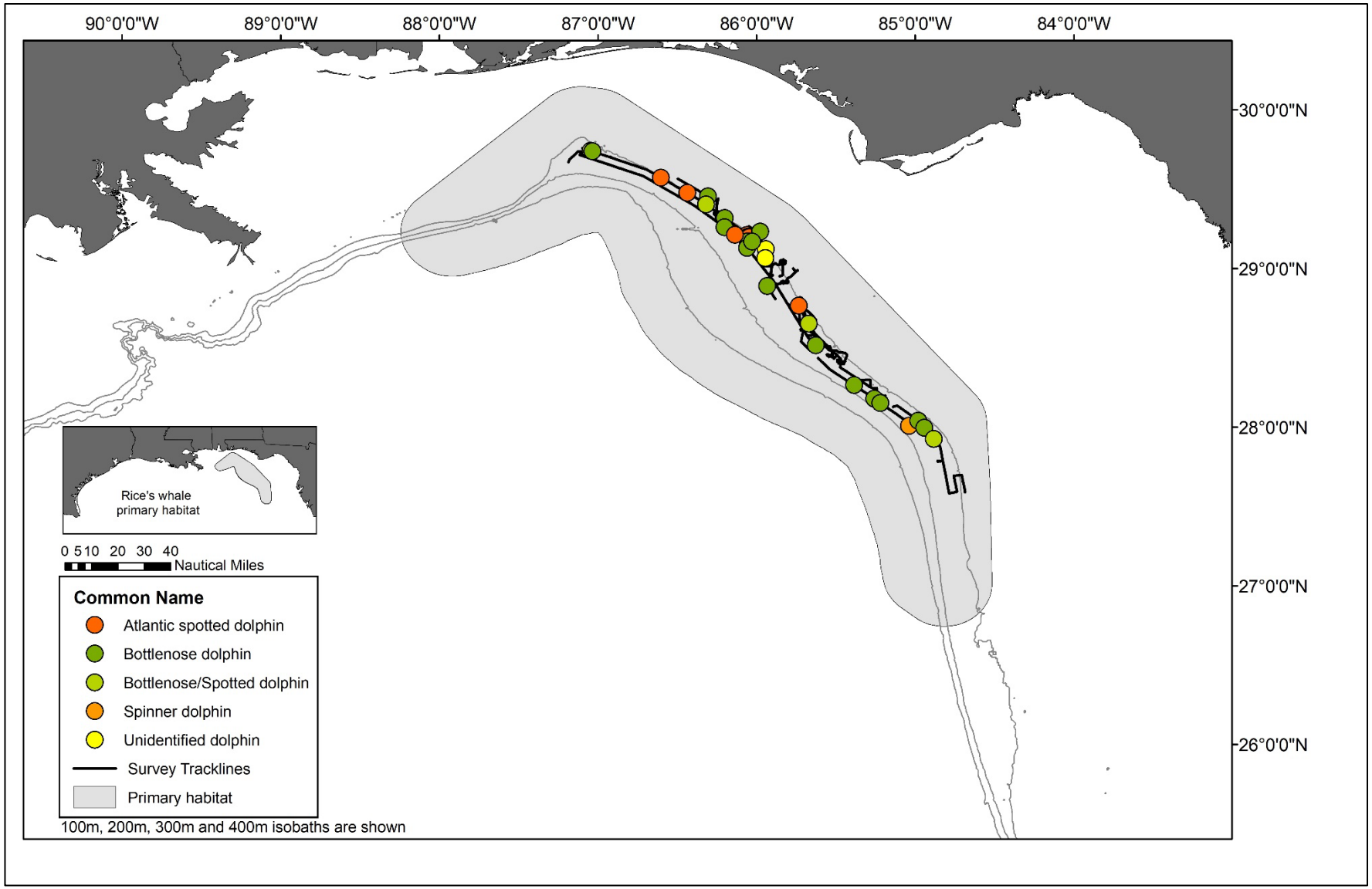


Figure 5. Dolphin sighting locations during the GU18-02 survey.

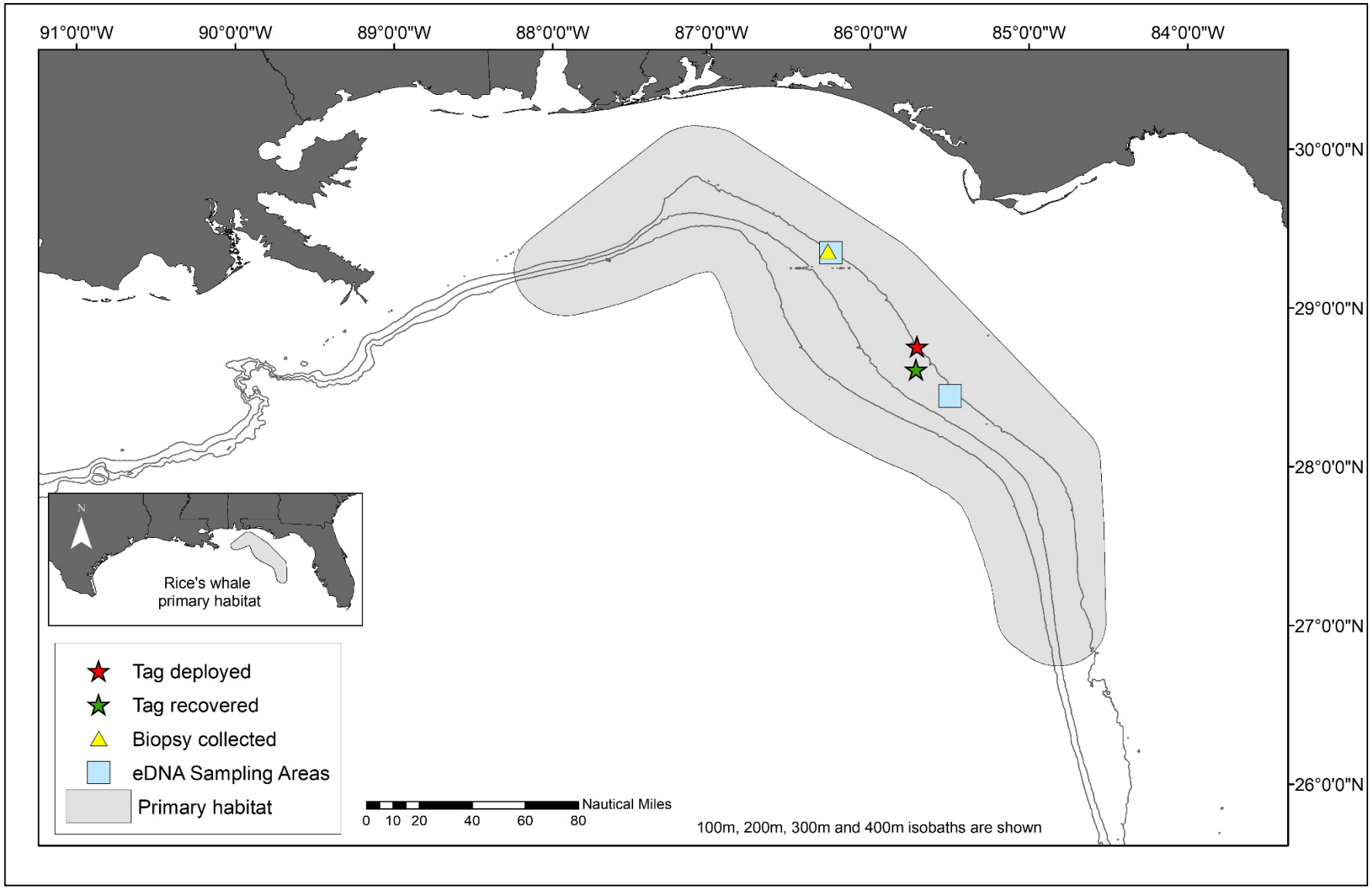


Figure 6. Acousonde tag deployment and recovery sites and sampling event locations during the GU18-02 survey. This includes a biopsy sample collected from one Rice's whale, one tagged whale, and eight water samples taken for the eDNA pilot study.

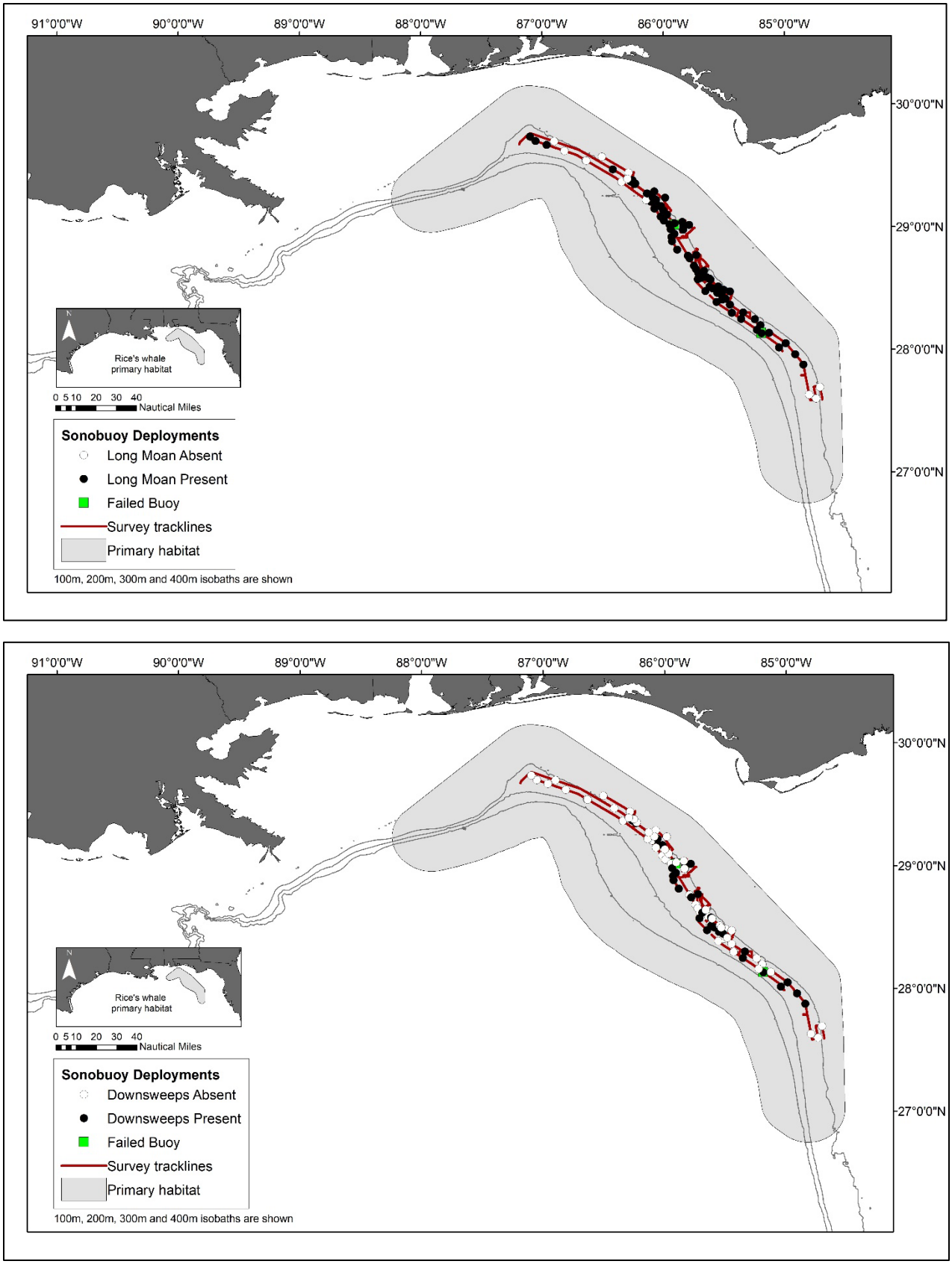


Figure 7. Sonobuoy deployments and Rice's whale acoustic detections during GU18-02.

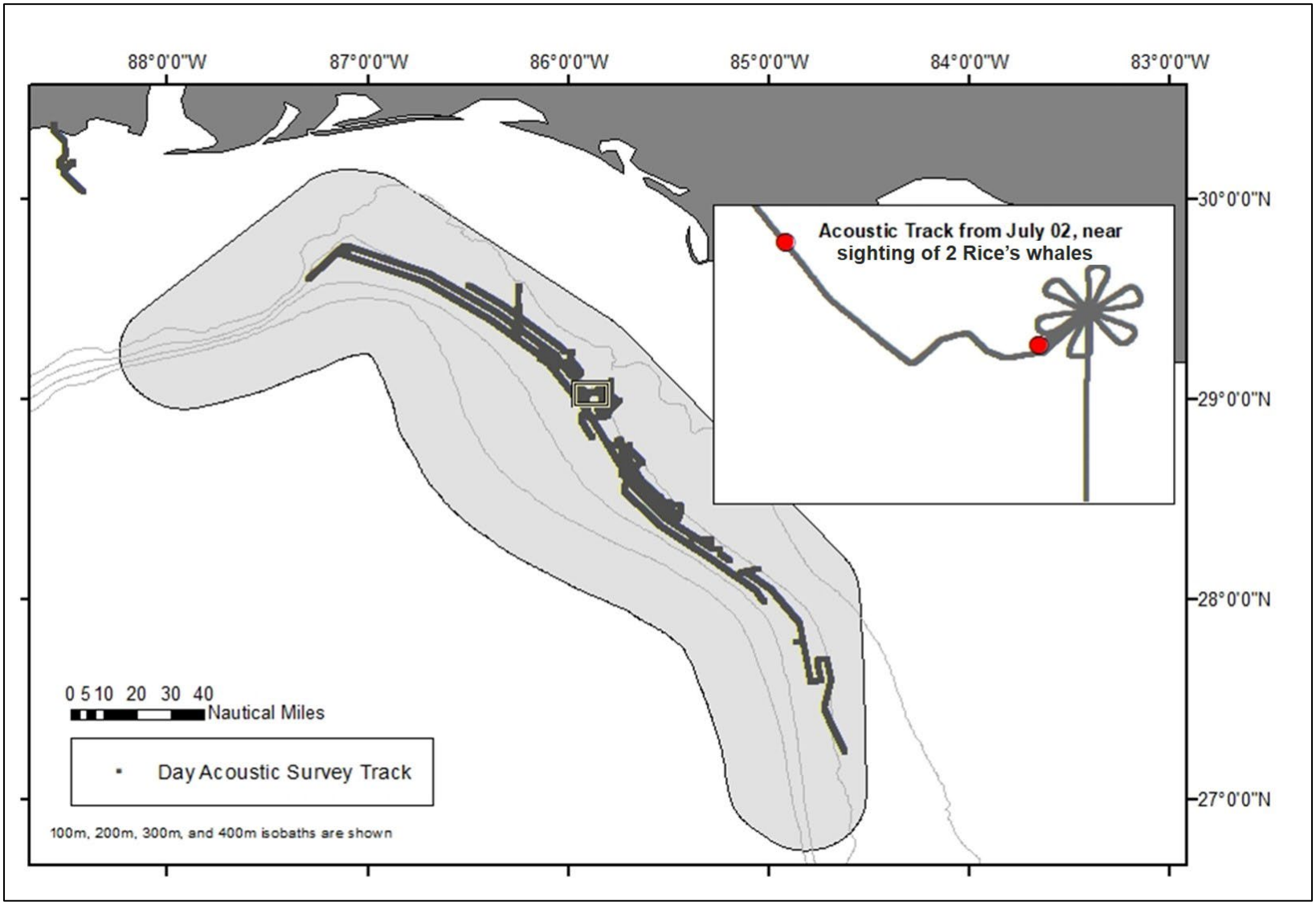


Figure 8. Day time scientific echosounder surveys with inset showing detailed survey near a Rice's whale sighting on 2 July.

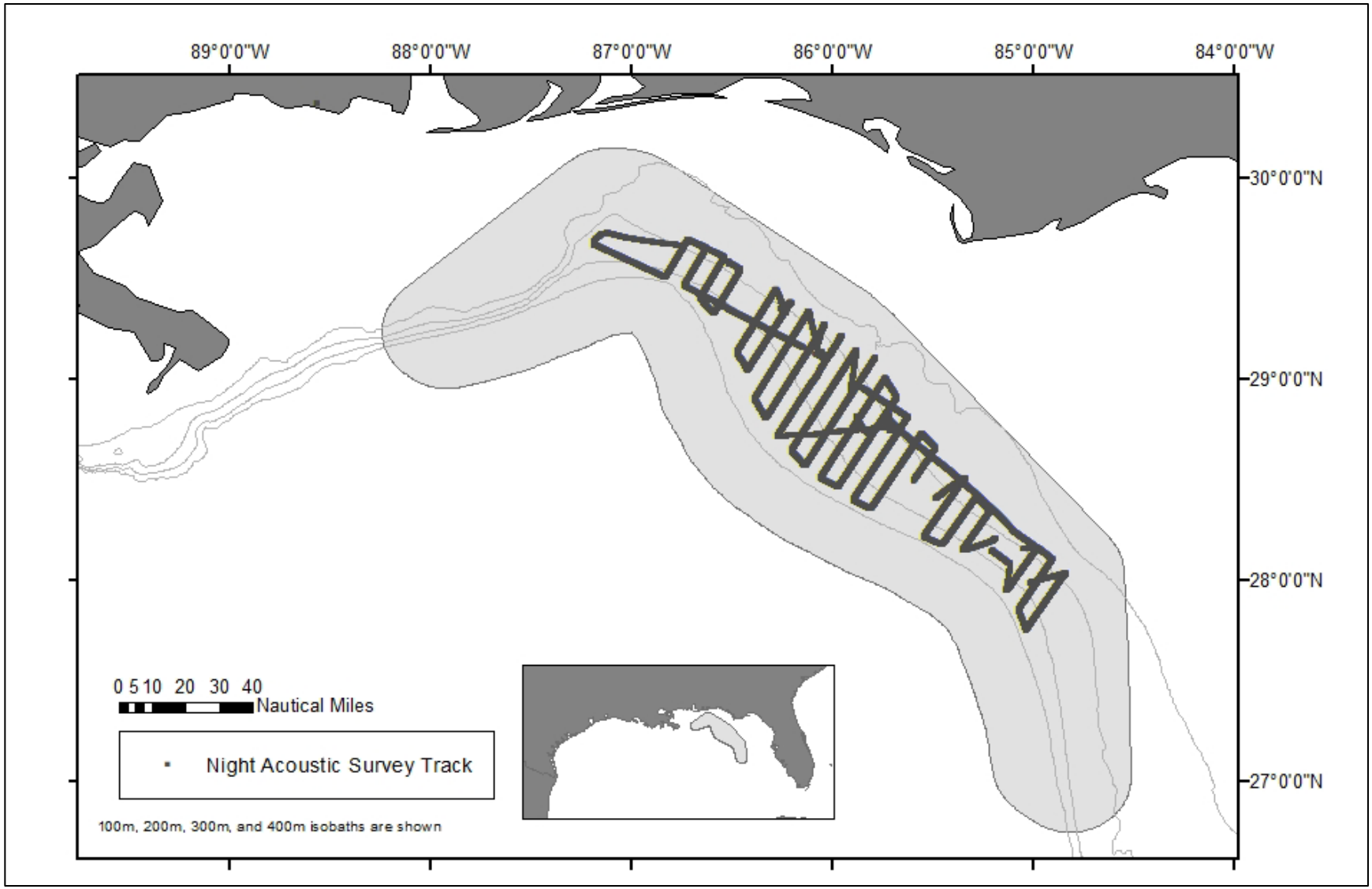


Figure 9. Night-time tracklines surveyed with scientific echosounders during GU18-02.

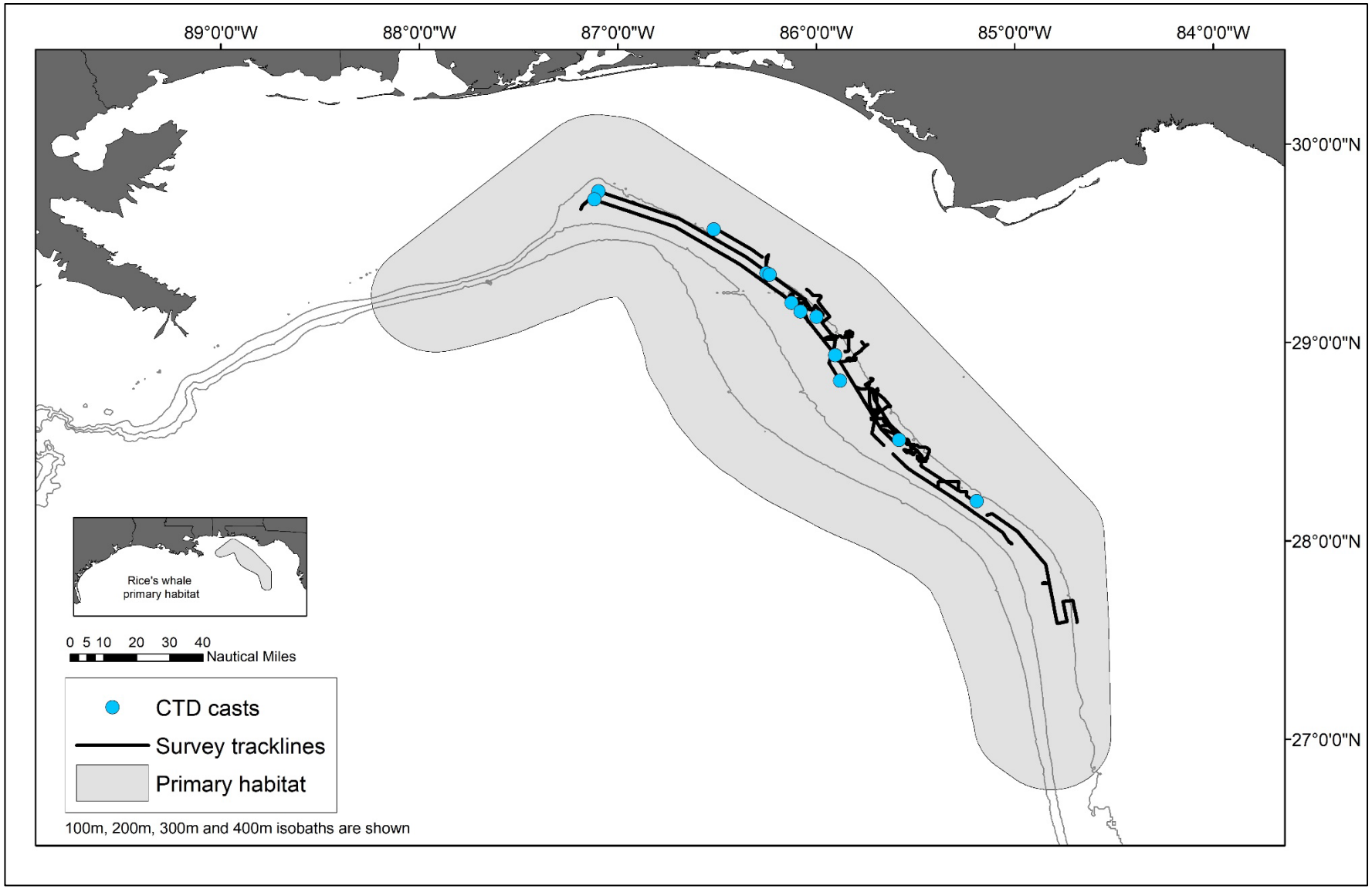
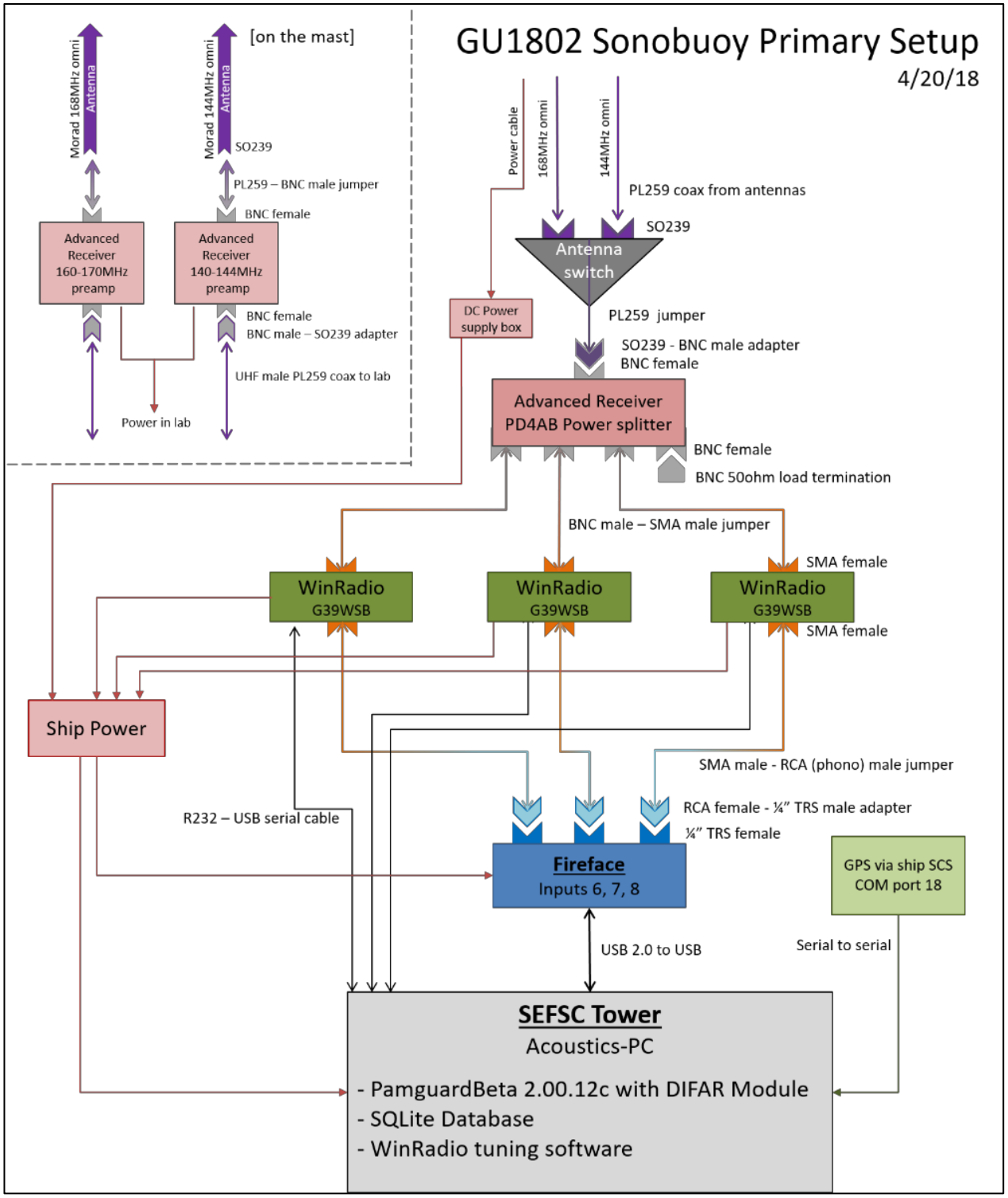


Figure 10. CTD cast locations during the GU18-02 survey.



Appendix A. Sonobuoy system setup used during the GU18-02 survey.