Southeast Fisheries Science Center Reference Document MMTD-2023-04

CRUISE RESULTS

NOAA SHIP GORDON GUNTER CRUISE GU-09-03 (054)
10 JUNE 2009 – 13 AUGUST 2009

A CETACEAN ABUNDANCE AND DISTRIBUTION SURVEY OF THE GULF OF MEXICO DEEP WATER (>200 M) WITH AN EMPHASIS ON SPERM WHALES AND THEIR PREY

U.S. DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

National Marine Fisheries Service

Southeast Fisheries Science Center

Pascagoula, Mississippi

February 2023

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 (MMPA) Permit No. 779-1633.

This report was created in 2009 and published at NOAA's Institutional Repository in February 2023.

CRUISE RESULTS

NOAA SHIP GORDON GUNTER CRUISE GU-09-03 (054)
10 JUNE 2009 – 13 AUGUST 2009

A CETACEAN ABUNDANCE AND DISTRIBUTION SURVEY OF THE GULF OF MEXICO DEEP WATER (>200 M) WITH AN EMPHASIS ON SPERM WHALES AND THEIR PREY

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Mississippi Laboratories
P.O. Drawer 1207
Pascagoula, Mississippi 39568-1207

INTRODUCTION

NOAA Ship GORDON GUNTER departed Pascagoula, Mississippi, on 10 June 2009 to conduct a cetacean survey of the northern Gulf of Mexico. The cruise was scheduled to depart on 08 June 2009 but was delayed due to the additional time required to outfit the GUNTER for this survey. Operations were planned for U.S. waters of the northern Gulf of Mexico in depths >200 meters (m), from Key West, Florida to the U.S.-Mexico border (Figure 1).

The U.S. Marine Mammal Protection Act (MMPA) requires that stocks of marine mammal species in U.S. waters be maintained at or above their optimum sustainable population level (OSP), defined as the number of animals which results in the maximum net productivity. To meet this requirement, the National Marine Fisheries Service (NMFS) conducts research to define stock structure, and for each stock, estimates annual human-caused mortality and potential biological removal (PBR), the maximum number of animals that may be removed from a stock due to human activities (*e.g.*, fisheries bycatch) while allowing the stock to reach or maintain its OSP. PBR is calculated following specific criteria using the estimated abundance of the stock, its maximum net productivity rate (theoretical or estimated), and a recovery factor (Barlow *et al.,* 1995; Wade and Angliss, 1997). The NMFS is required to prepare an annual Stock Assessment Report (SAR) for each stock to update abundance, stock structure, maximum net productivity, human-caused mortality, PBR, and status (*e.g.*, Waring *et al.*, 2009).

Abundance estimates in the current stock assessment reports for U.S. Gulf of Mexico oceanic stocks are based on surveys conducted by the Southeast Fisheries Science Center (SEFSC) during 2003 and 2004 (Waring *et al.*, 2009). Data more than 5 years old are considered unreliable for management purposes. A major objective of this survey was to collect data to update these abundance estimates and thereby evaluate the current status of these stocks. Therefore, a visual line-transect and passive acoustic survey was conducted to estimate the abundance and spatial distribution of marine mammals in U.S. oceanic waters of the northern Gulf of Mexico (Figure 1).

A second objective of the survey was to conduct a pilot study to characterize sperm whale prey using fisheries acoustics equipment and a mid-water trawl. Sperm whales are present throughout the Gulf of Mexico year-round. Results from several studies of genetics, individual movements, size distribution, and vocalization patterns clearly show that this population is distinct from others in the North Atlantic Ocean (Waring *et al.,* 2009). Diving studies conducted during Sperm Whale Seismic Study (SWSS; Jochens *et al.*, 2008) demonstrated that the depth range of 400-600 m was most consistently associated with sperm whale dives and acoustic behavior consistent with feeding. The purpose of the prey study was to further build on the extensive data collected during the SWSS project by testing methods to characterize the forage species for sperm whales in the Gulf of Mexico.

To ensure that equipment was functional and that crew was familiar with mid-water trawling operations, Leg 1 was split up into Leg 1-A and Leg 1-B. Leg 1-A was dedicated to calibrating the fisheries acoustics equipment and testing deployment and retrieval of the mid-water trawl. Survey and trawling operations commenced on Leg 1-B.

CRUISE OBJECTIVES

1. Conduct a broadscale visual and passive acoustic survey of oceanic waters (>200 m) to the U.S. Exclusive Economic Zone (EEZ) of the northern Gulf of Mexico to quantify cetacean habitat, abundance, and spatial distribution.

2. Collect biopsy samples from cetacean species from the bow of the GUNTER and from a 7-m boat deployed from the GUNTER.

3. Collect hydrographic profiles, scientific echosounder, and Acoustic Doppler Current Profiler (ADCP) data to quantify the distribution of prey resources associated with cetacean concentrations.

4. Conduct targeted studies of the prey fauna near feeding sperm whales using localized surveys of acoustic backscatter and collection of prey with a research mid-water trawl.

5. Conduct 90 minute (min) counts of sperm whales for more accurate estimation of group size and dive interval.

6. Conduct targeted small boat studies of sperm whales and Bryde's whales including acoustic recordings, photo-identification, length measurements, and scat collection to provide additional biological information on the Gulf of Mexico sperm whale and Bryde's whale stocks.

METHODS

Calibration of Fisheries Acoustics Equipment (EK60)

The scientific echosounders (EK60) aboard the GUNTER have not routinely been calibrated. Calibration is necessary to ensure that the data collected are comparable between different surveys and account for deviations in the behavior of the transducers and receivers over time. Calibrations were planned during Leg 1-A for both the 38 kHz and 120 kHZ transducers. Calibration followed standard guidelines described in the user manuals for the scientific echosounders and recommendations from the manufacturer. Briefly, a spherical standard target is suspended at a depth of approximately 15 m beneath the transducer by attaching it to three reels stationed in a triangular pattern around the vessel. This allows the position of the sphere within the transducer beam to be controlled. During the calibration, the target is moved throughout the circular beam, and the resulting strength (in dB) of the return signal from the transducer is measured. After a large number of returns are measured, a statistical model is used to correct the returns from acoustic targets for variability in the sensitivity of the receiver throughout the beam.

Visual Survey

Visual cetacean surveys were conducted from the 68 m NOAA Ship GORDON GUNTER from 16 June to 13 August 2009. Standard ship-based, line-transect survey methods for cetaceans, similar to those used in the Pacific Ocean, Atlantic Ocean, and Gulf of Mexico, were used (*e.g.*, Barlow, 1995; Mullin and Fulling, 2003; Fulling *et al.*, 2003). The survey was conducted in waters >200 m deep within the U.S. EEZ (Figure 1). Survey lines were stratified in relation to depth and the location of the Loop Current.

A team of trained visual observers was stationed on the flying bridge (height above water = 13.7 m). The flying bridge team consisted of five to seven people rotating through three positions (left observer, data recorder, right observer) at 30 min intervals. The data recorder entered information on sightings using a computerized data entry program interfaced with a global positioning system (GPS) receiver. The left and right side observers searched to the horizon in the arc from 10° right and left of the ship's bow to the left and right beams (90°), respectively, using 25x "bigeye" binoculars. The data recorder searched using unaided eye or 7x hand-held binoculars. At least one observer experienced in ship-based, line-transect methods and identification of cetaceans was present on the flying bridge at all times.

For each cetacean sighting, time, position, bearing and reticle (a measure of radial distance) of the sighting, 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 25x binoculars and close to the ship were estimated. Survey effort data were automatically recorded every 30 seconds and included the ship's position and heading, effort status, observer positions, wind speed and direction, water depth, and temperature. Environmental conditions which could affect the observers' ability to sight animals (*e.g.*, Beaufort sea state, trackline glare) were updated by the data recorder every 10 min. Typically, if a sighting was within a 3.0 nautical mile (nm) strip on either side of the ship, the ship was diverted from the trackline to approach the group to identify species and estimate group-size. Cetaceans were identified to the lowest taxonomic level possible. The group size of each cetacean group encountered was estimated independently by each of the 3 people that were on duty at the time of the sighting. Each observer recorded a best, high and low estimate for each sighting in an individual notebook.

Survey speed was usually18 km/hr (~10 knots) but varied with sea conditions. The effectiveness of visual line-transect survey effort is severely limited during high sea state and poor visibility conditions (*e.g.*, fog, haze, rain). Survey effort was therefore suspended during heavy seas (Beaufort sea state > 6) and rain.

When sperm whales were encountered a group-size based on a "10-min count" was made similar to that for other cetacean species. After this count was made, observers notified the Chief Scientist. Under specified conditions, a "90-min. count" was conducted to estimate group-size following protocols detailed in Barlow and Taylor (2005). Briefly, a 90-min. count was only started in Beaufort sea state <5, good visibility, and usually between 0800 and 1600 hrs. The Chief Scientist independently consulted with the acoustic team monitoring a towed passive acoustic array and the visual team to determine whether there were more sperm whales in the

area than were seen by the visual team. If the decision was made to conduct a 90-min. count, the ship was slowed down to bare steerage and all the observers were called to the flying bridge to participate in the count. A separate laptop computer was used to track all sperm whales that surfaced during the time period. Sperm whales were tracked visually and acoustically for 90 minutes, to estimate group size. Each observer recorded their estimate of group-size independently at the end of the count.

Acoustic Survey

Acoustic line-transect surveys were conducted aboard the GUNTER both in conjunction with visual surveys and during times weather conditions prevented a visual survey. A five-element broadband array was set 450 m astern of the vessel and towed at the survey speed of 10 kt in waters deeper than 100 m.

One towed array is a 100-m Kevlar reinforced cable assembly with high gain hydrophones spaced along the cable. Each element is a piezoelectric ceramic striped cylinder with the cable assembly and strength member passing through the center. Each sensor, along with its associated signal conditioning, filtering, and line drive electronics, is contained within a hydrodynamically shaped tow body assembly. The frequency response is essentially flat at –127 decibels (dB) from about 2 kiloHertz (kHz) to 15 kHz, then climbs to a resonance peak at about 35 kHz with a level of –121 dB, then drops off at roughly –15 dB per octave after resonance. Below 1.5 kHz, the sensors roll off at roughly 6 dB per octave to help reduce low frequency tow and impulse noise. The backup array is a 400-m, two-element, oil-filled array.

The data from the array was fed into the acoustics lab for amplification, filtering, recording, and monitoring. Digital audio tape recordings of signals of interest were made using multi-channel digital tape recorders. These tape recordings were limited to 10 Hz – 24 kHz in bandwidth. The array signals were constantly monitored by 1 or 2 acoustic operators working on a 3- or 4-hour rotational watch during survey effort. Signals were then passed from the recording equipment to a desktop computer for monitoring. The software package "Ishmael" was used to monitor signals. The bearings to signals of interest generated by "Ishmael" were then passed to a second computer for display. This computer was connected to a GPS receiver and was used to record data with an Acoustic Survey software package. This program displayed the ship's current position and track in a graphics display window, overlaying lines of bearing as instructed by the operators. This provided the acoustics team with a clearer picture of how acoustic detections related to visual sightings of cetaceans and other possible sources of sound, such as ship traffic.

Biopsy Sampling

Cetacean biopsy tissue samples were collected either from the bow of the GUNTER or from a 7-m RHIB boat (R3) deployed from the GUNTER. Skin samples from biopsies are genetically analyzed for gender determination, evaluation of population structure, and species identification. Blubber samples can be analyzed for a variety of contaminants. Samples were collected using a modified .22 caliber dart rifle fitted with custom designed biopsy heads that extract a small plug of tissue from the animals. Two types of biopsy tips were used during the cruise. A 6 millimeter (mm) diameter tip was used from both the bow and R3 and only the skin portion of the sample was retained. A 10-mm tip was also used from the bow and the R3 in a limited number of cases

and both skin and blubber were retained from these samples. Data on each sampling attempt were recorded and included GPS location, time, date, sampler and recorder name, species, body location struck, behavioral reaction, and whether or not a sample was obtained. A complete log of the biopsy data is maintained at the Pascagoula and Miami Laboratories. Biopsy sampling was attempted after all pertinent group size and biological information was recorded by the visual team. Biopsy skin samples were preserved in vials containing 20% dimethyl sulfoxide (DMSO) and blubber samples were frozen at –80°C.

Biopsy sampling of squids collected in mid-water trawling activities was initiated during the course of GU-09-03. A mantle sample of each species caught in every trawl was collected. Mantle tissue was preserved in 95% ethanol in glass vials.

Small Boat Operations

The small boat was deployed from the starboard side, main deck of the GUNTER using a crane. The scientific party on the R3 included a boat driver, biopsy sampler, and photographer/data recorder. When possible, the R3 was deployed and left behind to collect biopsy samples while the GUNTER continued to survey ahead to reduce the amount of survey time lost to biopsy operations. In general, the R3 stayed with a cetacean group until at least 2 biopsies were collected. Small boat deployment and operations were conducted in accordance with the current small boat guidelines implemented by the NMFS and the NOAA Corps.

Environmental Data

Environmental data were collected at predetermined stations using a Conductivity Temperature Depth (CTD) unit and expendable bathythermographs (XBT). CTD casts were made up to 750 m deep and recorded vertical profiles of salinity, temperature, and oxygen content. 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). In addition, an ADCP recorded continuously to provide data on water currents and acoustic backscatter due to zooplankton and small fish.

Trawling

Sampling gear consisted of a 53-m headrope length High Speed Midwater Rope Trawl (HSMRT) and a pair of 1.8-m double-foil Suberkrub-type doors. SIMRAD ITI sensors were used to monitor trawl depth and door spread. Stations were chosen adaptively and based upon factors such as depth, acoustic backscatter from the EK60, mesoscale physical oceanographic features, and presence (or history of presence) of feeding sperm whales in the region. Tow duration was a maximum of 55 min, not including deployment and retrieval of the net.

Trawl catch data were electronically recorded at-sea with the Fishery Scientific Computing System (FSCS), version 1.6, developed by NOAA's System Development Branch of the Office of Marine and Aviation Operations. FSCS was linked to the ship's SCS version 4.2.3 which was used to collect metadata, including position, depth, date, time, and meteorological data. Catches were either processed in their entirety or subsampled, depending on the total catch weight. If

catches exceeded 50 pounds, then at least 10% was taken as a subsample. Catches (or subsamples) were sorted by species which were then enumerated and weighed. For specimens identified down to species level, length measurements were also recorded. Specimens that could not be identified to species level were frozen or preserved in formalin and brought back to the Pascagoula Laboratory for identification.

Permit

The SEFSC was authorized to conduct marine mammal research activities during the cruise under Permit No. 779-1633-02 issued to the SEFSC by the NMFS Office of Protected Resources.

RESULTS

Calibration of Fisheries Acoustics Equipment (EK60)

Calibrations of the 120 kHz and 38 kHz transducers of the EK60 were conducted during leg 1-A. We were able to effectively move the calibration sphere through the transducer beam and collect sufficient data points to develop effective calibration models. Significant hardware problems were identified. First, it is apparent that the 120 kHz transducer aboard the GUNTER is installed incorrectly resulting in inverted positions of the sphere in the beam. For example, when the sphere was moved toward the bow of the boat, the receiver interpreted it as moving toward the stern. This problem does not impact the data collected, and a successful calibration of the 120 kHZ transducer was completed. Second, the tranducer in one quadrant of the 38 kHz system aboard the GUNTER is inoperable. This results in an oblong-shaped (as opposed to circular) beam pattern and limited sensitivity of the equipment. While relative back-scatter data can be collected with the system, it is not possible to accurately quantify acoustic target strengths. The 38 kHz transducer must be repaired to collect valid acoustic backscatter data.

Following the calibration, data was collected continuously throughout the cruise using both transducers and stored on hard drives for archiving and later data analysis.

Visual Survey

During the 36 survey days, 4600 kilometers (km) of effort were surveyed in the Gulf of Mexico (Leg 1 – 1036 km; Leg 2 – 1866 km; Leg 3 – 1698 km; Table 1; Figure 1). Two survey days were lost during Leg 1 due to outfitting the GUNTER for trawling and 1 day during Leg 2 due to ITI sensor maintenance.

The number of cetacean group sightings per day was highly variable ranging from 1 to 15. Overall, there were 230 cetacean group sightings (Leg 1 - 51; Leg 2 - 145; Leg 3 - 34). During the survey 18 cetacean species were observed (Table 2). Pantropical spotted dolphins (*Stenella attenuata*) were sighted with greatest frequency (n = 52) followed by sperm whales (*Physeter macrocephalus*) (n = 39) and bottlenose dolphins (*Tursiops truncatus*) (n = 21). Cetaceans were encountered throughout the survey area (Figures 2 - 5).

90-minute Counts

Three 90-minute counts of sperm whale group size were conducted during the survey. Results from these counts will be presented upon completion of the data analysis.

Acoustic Survey

Acoustic operations were maintained as planned throughout the cruise. Performance of the primary five-element array became erratic and it ultimately failed during Leg 1. The source of the malfunction could not be identified and the backup two-element array was put into service and it functioned properly for the remainder of the survey. Results from the acoustic survey will be presented upon completion of the data analysis.

Biopsy Sampling

Biopsy samples (n = 158) were collected from 10 different cetacean species (Figure 6). Bottlenose dolphins (n = 39) and pantropical spotted dolphins (n = 84) were the most frequently sampled species. Seven samples were collected from sperm whales and 1 Bryde's whale was sampled. These samples included 5 blubber samples from 3 species (Table 3).

Biopsy samples (n = 133) were collected from different squid species (Table 4). Field identifications of squid species were considered preliminary. Specimens will be examined by squid experts and species identifications verified .

Biopsy samples from cetaceans and squids were sent to the NMFS Genetics Laboratory in Lafayette, Louisiana, for analysis and archival.

Small Boat Operations

Sperm whales
The R3 was launched 3 times to collect additional sperm whale data/samples and included 7 biopsy samples (Table 3; Figure 5) and 2 scat samples. Photographs of sperm whale flukes were also collected when possible for individual identification.

Killer whales
The R3 was launched for the killer whale sighting which consisted of 2 adult males (Tables 2, 3; Figure 2, 5). A biopsy was collected from each animal, as well as photographs of dorsal fins for individual identification. One animal photographed was previously seen in the Gulf of Mexico 14 years ago.

Bryde's whales
Due to time constraints related to meeting higher priority cruise objectives, there was no dedicated Bryde's whale effort on GU-09-03. Bryde's whales were encountered during the course of normal survey operations (Tables 2, 3; Figures 3, 5). The small boat was launched and 1 animal was biopsied and photographed.

Environmental Data

A total of 175 hydrographic profiles were collected including 101 XBT stations and 74 CTD stations (Figure 7) at 10-20 km intervals throughout the survey effort. Profiles were also collected concurrent with the trawling stations. All data from the CTDs and the SCS are maintained at the Pascagoula Laboratory for analysis, editing, and archiving. The CTD and SCS data are available upon request from Chuck.Schroeder@noaa.gov.

Trawling Operations

Twenty-five mid-water trawls were conducted during GU-09-03 (Figure 8). The SIMRAD ITI depth sensors stopped working early on Leg 2 apparently due to battery failure. The sensors were were offloaded in Pascagoula and sent to SIMRAD for servicing and returned in time for operations at the beginning of leg 3. Therefore, trawls conducted on Leg 2 were blind to depth. The amount of cable out was recorded for each trawl, allowing an estimation of depth fished

Catches were relatively small, and every catch was completely processed (*i.e.*, no trawls were sub-sampled). Sixteen different squid taxa were identified (although some were only identified to the family level) during the course of trawling operations (Table 5.). This included one *Architeuthis* sp. (*n* = 1, 43.5 kg). Total catch by weight (excluding the single *Architeuthis* sp.) was recorded in kilograms (kg) and was dominated by *Pyrosoma* sp. (*n* = 514, 19.2 kg) and *Aurelia aurita* (*n* = 82, 15.7 kg) (Table 6.). Myctophidae was ranked third by weight (n = 4852, 12.8 kg), but was the most frequently caught organism and was collected in 22 of 25 trawls (Table 6.).

LITERATURE CITED

Barlow, J. 1995. The abundance of cetaceans in California waters. Part I: Ship surveys in summer and fall of 1991. Fishery Bulletin 93:1-14.

Barlow, J., S.L. Swartz, T.C. Eagle, and P.R. Wade. 1995. U.S. marine mammal stock assessments: Guidelines for preparation, background, and a summary of the 1995 assessments. NOAA Tech. Mem. NMFS-OPR-6. 73 p.

Fulling, G.L., K.D. Mullin, and C.W. Hubard. 2003. Abundance and distribution of cetaceans in outer continental shelf waters of the U.S. Gulf of Mexico. Fishery Bulletin 101:923-932.

Jochens, A., D. Biggs, K. Benoit-Bird, D. Engelhaupt, J. Gordon, C. Hu, N. Jaquet, M. Johnson, R. Leben, B. Mate, P. Miller, J. Ortega-Ortiz, A. Thode, P. Tyack, and B Würsig. 2008. Sperm whale seismic study in the Gulf of Mexico: Synthesis report. U.S. Dept. of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study MMS 2008-006, 341 pp.

Mullin, K.D. and G.L. Fulling. 2003. Abundance of cetaceans in the southern U.S. North Atlantic Ocean during summer 1998. Fishery Bulletin 101:603-613.

Wade, P.R. and R.P. Angliss. 1997. Guidelines for assessing marine mammal stocks: Report of the GAMMS Workshop April 3-5, 1996, Seattle, Washington. U.S. Dep. Commer., NOAA Tech. Mem. NMFS-OPR-12. 93 p.

Waring, G.T., E. Josephson, C.P. Fairfield, and K. Maze-Foley, eds. 2009. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments -- 2008. NOAA Tech. Mem. NMFS-NE-210.

GU-09-03 (054) Cruise Participants

Name	Title	Sex	Organization	Citizenship
Leg 1-A (10 June - 15 June)				
Anthony Martinez	Chief Scientist	M	NMFS, Miami, FL	US
Carrie Sinclair	FPC	F	NMFS, Pascagoula, MS	US
Lance Garrison	Principal Investigator	M	NMFS, Miami, FL	US
Kevin Barry	Scientist	M	IAPWS, Pascagoula, MS	US
Alyson Azzara	Scientist	F	USM, Stennis Space Center, MS	US
Jesse Wicker	Scientist	M	CIMAS, Miami, FL	US
Wendy Taylor	Gear Specialist	M	NMFS, Pascagoula, MS	US
Kendall Falana	Gear Specialist	M	NMFS, Pascagoula, MS	US
Charles Thompson	Technical Support	M	Stennis Space Center, MS	US
Deborah Epperson	Scientist	F	MMS, New Orleans, LA	US
Carrie Horton	Scientist	F	IAPWS, Pascagoula, MS	US
Melody Baran	Scientist	F	CASU, Miami, FL	US
Leg 1-B (16 June – 26 June)				
Anthony Martinez	Chief Scientist	M	NMFS, Miami, FL	US
Carrie Sinclair	FPC	F	NMFS, Pascagoula, MS	US
Kevin Barry	Scientist	M	IAPWS, Pascagoula, MS	US
Jesse Wicker	Scientist	M	CIMAS, Miami, FL	US
Carrie Horton	Scientist	F	IAPWS, Pascagoula, MS	US
Melody Baran	Scientist	F	CASU, Miami, FL	US
Jen Stevenot	Scientist	F	CASU, Miami, FL	US
Alyson Azzara	Scientist	F	USM, Stennis Space Center, MS	US
Jenny Litz	Scientist	F	NMFS, Miami, FL	US
Tre Glenn	Scientist	M	MMS, New Orleans, LA	US
Emma Jugovich	Scientist	F	CASU, Miami, FL	US
Julia O'Hern	Scientist	F	Texas A&M University	US
Leg 2 (30 June - 21 July)				
Anthony Martinez	Chief Scientist	M	NMFS, Miami, FL	US
Carrie Sinclair	FPC	F	NMFS, Pascagoula, MS	US
Kevin Barry	Scientist	M	IAPWS, Pascagoula, MS	US
Carrie Horton	Scientist	F	IAPWS, Pascagoula, MS	US
Melody Baran	Scientist	F	CASU, Miami, FL	US
Jen Stevenot	Scientist	F	CASU, Miami, FL	US
Alyson Azzara	Scientist	F	USM, Stennis Space Center, MS	US
Jenny Litz	Scientist	F	NMFS, Miami, FL	US
Nicole Vollmer	Scientist	F	Contractor, Lafayette, LA	US
Carol Roden	Scientist	F	MMS, New Orleans, LA	US

Emma Jugovich	Scientist	F	CASU, Miami, FL	US
Julia O'Hern	Scientist	F	Texas A&M University	US
Paula Olsen	Scientist	F	SWFSC, La Jolla, CA	US

Leg 3 (27 July - 13 August)

Anthony Martinez	Chief Scientist	M	NMFS, Miami, FL	US
Carrie Sinclair	FPC	F	NMFS, Pascagoula, MS	US
Kevin Barry	Scientist	M	IAPWS, Pascagoula, MS	US
Carrie Horton	Scientist	F	IAPWS, Pascagoula, MS	US
Melody Baran	Scientist	F	CASU, Miami, FL	US
Jen Stevenot	Scientist	F	CASU, Miami, FL	US
Alyson Azzara	Scientist	F	USM, Stennis Space Center, MS	US
Barbie Byrd	Scientist	F	NMFS, Beaufort, NC	US
Jesse Wicker	Scientist	M	CIMAS, Miami, FL	US
Nicole Vollmer	Scientist	F	Contractor, Lafayette, LA	US
Emma Jugovich	Scientist	F	CASU, Miami, FL	US
Julia O'Hern	Scientist	F	Texas A&M University	US
Keith Mullin	Principal Investigator	M	NMFS, Pascagoula, MS	US
Tom Jefferson	Scientist	M	SWFSC, La Jolla, CA	US

Submitted by:

Approved by:

_____
Carrie Sinclair
Field Party Chief

_____
Lisa Desfosse, Ph.D.
Director, Mississippi Laboratories

_____
Anthony Martinez.
Chief Scientist

_____
Bonnie Ponwith, Ph.D.
Director, SEFSC

Table 1. Summary of survey effort in the Gulf of Mexico during NOAA Ship GORDON GUNTER Cruise GU-09-03 (054) during June – August 2009.

LEG 1 Date	Survey Event	Survey Effort (km)	Number of Sightings	Number of Biopsies	Avg. Sea State
08-Jun	In port – Outfitting	0			
09-Jun	In port – Outfitting	0			
10-Jun	Depart Pascagoula, MS	0			
11-Jun	Calibrate EK60	0			
12-Jun	Calibrate EK60	0			
13-Jun	Trawl Gear shakedown	0			
14-Jun	Trawl Gear shakedown	0			
15-Jun	Arrive, Pascagoula, MS	0			
16-Jun	Depart Pascagoula, MS	0			
17-Jun	Transit	0			
18-Jun	Survey	158.5	3	3	2.9
19-Jun	Survey	180.5	4	0	1.8
20-Jun	Survey	16.4	12	8	1.0
21-Jun	Survey	115.6	15	10	1.8
22-Jun	Survey	94.2	8	5	3.0
23-Jun	Survey	192.5	0	0	3.8
24-Jun	Survey	177.3	1	1	3.3
25-Jun	Survey	101.5	8	4	2.1
26-Jun	Arrive, Pascagoula, MS	0			
Leg 1 Totals		**1036.5**	**51**	**31**	

Table 1 (cont.)

LEG 2 Date	Survey Event	Survey Effort (km)	Number of Sightings	Number of Biopsies	Avg. Sea State
30-Jun	Depart Pascagoula, MS	0	-	-	-
1-Jul	Survey	47.5	9	10	2.9
2-Jul	Survey	86.9	10	3	3.2
3-Jul	Survey	52.3	14	2	2.9
4-Jul	Survey	135.8	12	9	3.0
5-Jul	Survey	128.8	7	7	3.1
6-Jul	Equipment maintenance (science)	0	-	-	-
7-Jul	Survey	145.4	1	0	3.5
8-Jul	Survey	165.6	8	5	3.6
9-Jul	Survey	95.8	5	0	2.3
10-Jul	Survey	149.7	8	6	2.3
11-Jul	Survey	16.0	9	4	2.3
12-Jul	Survey	123.2	12	11	1.9
13-Jul	Survey	135.7	11	12	1.3
14-Jul	Survey	183.6	8	5	2.6
15-Jul	Survey	N/A	8	6	N/A
16-Jul	Survey	123.9	10	5	2.8
17-Jul	Survey	130.1	3	3	3.9
18-Jul	Survey	42.1	5	1	2.7
19-Jul	Survey	103.1	13	9	2.1
20-Jul	Survey - Trawling	0	-	2	-
21-Jul	Arrive Pascagoula, MS	0	-	-	-
Leg 2 Total		**1865.5***	**145**	**100**	-

* Total does not reflect survey effort for 15 July 2009

Table 1 (cont.)

LEG 3 Date	Survey Event	Survey Effort (km)	Number of Sightings	Number of Biopsies	Avg. Sea State
26-Jul	Depart Pascagoula, MS	0			
27-Jul	Trawling	0			
28-Jul	Trawling	0			
29-Jul	Trawling	0	2	2	
30-Jul	Trawling	0			
31-Jul	Survey	157.6	2	0	4.0
1-Aug	Survey	195.4	0	0	4.0
2-Aug	Survey	210.4	0	0	2.6
3-Aug	Survey	218.4	0	0	3.6
4-Aug	Survey	156.5	0	0	3.5
5-Aug	Survey	135.0	8	14	2.4
6-Aug	Survey	171.0	8	5	1.4
7-Aug	Survey	207.9	4	0	2.9
8-Aug	Survey	101.3	6	4	2.1
9-Aug	Survey	144.7	4	2	4.0
10-Aug	Trawling	0			
11-Aug	Trawling	0			
12-Aug	Trawling	0			
13-Aug	Arrive Pascagoula, MS Survey concluded	0			
Leg 3 Total		**1698.2**	**34**	**27**	
Survey Total		**4600.2***	**230**	**158**	

* Total does not reflect survey effort for 15 July 2009

Table 2. Cetacean sightings during each leg of GU-09-03 (054) aboard NOAA Ship GORDON GUNTER during June – August 2009.

Common Name	Species	Leg 1	Leg 2	Leg 3	Total
Bryde's whale	*Balaenoptera edeni*	1	2	0	3
Sperm whale	*Physeter macrocephalus*	1	31	7	39
Dwarf sperm whale	*Kogia sima*	0	1	0	1
Pygmy/dwarf sperm whale	*Kogia sima/breviceps*	0	3	1	4
Pilot whale	*Globicephala sp.*	0	4	3	7
Risso's dolphin	*Grampus griseus*	6	5	1	12
Rough-toothed dolphin	*Steno bredanensis*	0	2	3	5
Bottlenose dolphin	*Tursiops truncatus*	9	6	6	21
Atlantic spotted dolphin	*Stenella frontalis*	1	1	2	4
Spinner dolphin	*Stenella longirostris*	0	3	0	3
Striped dolphin	*Stenella coeruleoalba*	0	2	0	2
Pantropical spotted dolphin	*Stenella attenuate*	8	41	3	52
Clymene dolphin	*Stenella clymene*	2	0	0	2
Stenella sp.		3	2	0	5
False killer whale	*Pseudorca crassidens*	0	0	1	1
Killer whale	*Orcinus orca*	0	1	0	1
Pygmy killer whale	*Feresa attenuate*	0	1	0	1
Melon-headed whale	*Peponocephala electra*	0	2	0	2
Melon-headed/pygmy killer whale	*P. electra / F. attenuate*	0	1	0	1
Cuvier's Beaked whale	*Ziphius cavirostris*	1	0	0	1
unid. dolphin		11	19	4	34
unid. large whale		0	2	0	2
unid. Mesoplodont		1	1	0	2
unid. Odontocete		6	12	3	21
unid. Ziphiid		1	0	0	1
Total		**51**	**142**	**34**	**227**

Table 3. Cetacean biopsies (n = 158) collected during GU-09-03 in the U.S. Gulf of Mexico.

Species	**Leg 1**	**Leg 2**	**Leg 3**	**Total (blubber samples)**
Bottlenose dolphin	14	13	12	39 (3)
Atlantic spotted dolphin	2	0	4	6 (1)
Bryde's whale	0	1	0	1
Rough-toothed dolphin	0	4	5	9 (1)
Spinner dolphin	0	5	0	5
Striped dolphin	0	1	0	1
Pantropical spotted dolphin	12	68	4	84
Sperm whale	3	2	2	7
Killer whale	0	2	0	2
Melon-headed whale	0	4	0	4
Survey Total	**31**	**100**	**27**	**158 (5)**

Table 4. Squid biopsies collected (n = 133) during GU-09-03 in the U.S. Gulf of Mexico

Species	Leg 1	Leg 2	Leg 3	Total
Architeuthis sp.	0	0	1	**1**
Abralia spp.	0	13	10	**23**
Abralia redfieldi	0	1	0	**1**
Abralia veranyi	2	2	0	**4**
Abralia verifieldi	1	0	0	**1**
Cranchia scabra	1	5	3	**9**
Cranchiidae	0	7	6	**13**
Enoploteuthis sp.	0	3	2	**5**
Heliocranchia sp.	1	0	0	**1**
Heteroteuthis	0	0	4	**4**
Histioteuthis spp.	3	10	12	**25**
Lepidoteuthidae	0	0	2	**2**
Lycoteuthidae	0	0	1	**1**
Octopoteuthidae	0	0	2	**2**
Ommastrephidae	0	3	8	**11**
Onychoteuthidae	0	0	1	**1**
Pyroteuthis sp.	1	8	4	**13**
unid. squid	0	4	12	**16**
Survey Total	**9**	**56**	**68**	**133**

Table 5. Squid taxa caught in trawl tows (n = 25) during GU-09-03 in the U.S. Gulf of Mexico.

Taxon	Frequncy of Occurence	Number	Weight (kg)
Architeuthis sp.	1	1	43.5
Histioteuthis spp.	11	86	3.263
Cephalopoda	1	2	1.328
Abralia spp.	18	160	0.655
Ommastrephidae	9	341	0.463
Pyroteuthis sp.	12	108	0.240
Cranchiidae	14	42	0.218
Cranchia scabra	12	33	0.170
Enoploteuthis	4	6	0.056
Carangidae	4	16	0.037
Onychoteuthidae	1	1	0.125
Octopodoteuthidae	1	2	0.046
Lycoteuthidae	1	1	0.005
Heteroteuthis sp.	4	6	0.011
Heliocranchia sp	1	1	Unk
Lepidoteuthidae	1	2	Unk

Table 6. Top ten species by weight caught in trawl tows (n = 25), excluding the giant squid (*Architeuthis sp.*) during GU-09-03 in the U.S. Gulf of Mexico.

Taxon	Frequncy of Occurence	Number	Weight (kg)
Pyrosoma	15	514	19.244
Aurelia aurita	4	82	15.669
Myctophidae	22	4852	12.800
Gonostoma elongatum	16	2447	11.115
Chauliodus sloani	20	1262	7.371
Gonostoma atlanticum	4	555	3.485
Histioteuthis spp.	11	86	3.263
Argyropelecus aculeatus	21	375	2.042
Argyropelecus sp.	13	99	1.651
Cephalopoda	1	2	1.328

Figure 1. Survey effort during GU-09-03 in U.S. waters of the northern Gulf of Mexico.

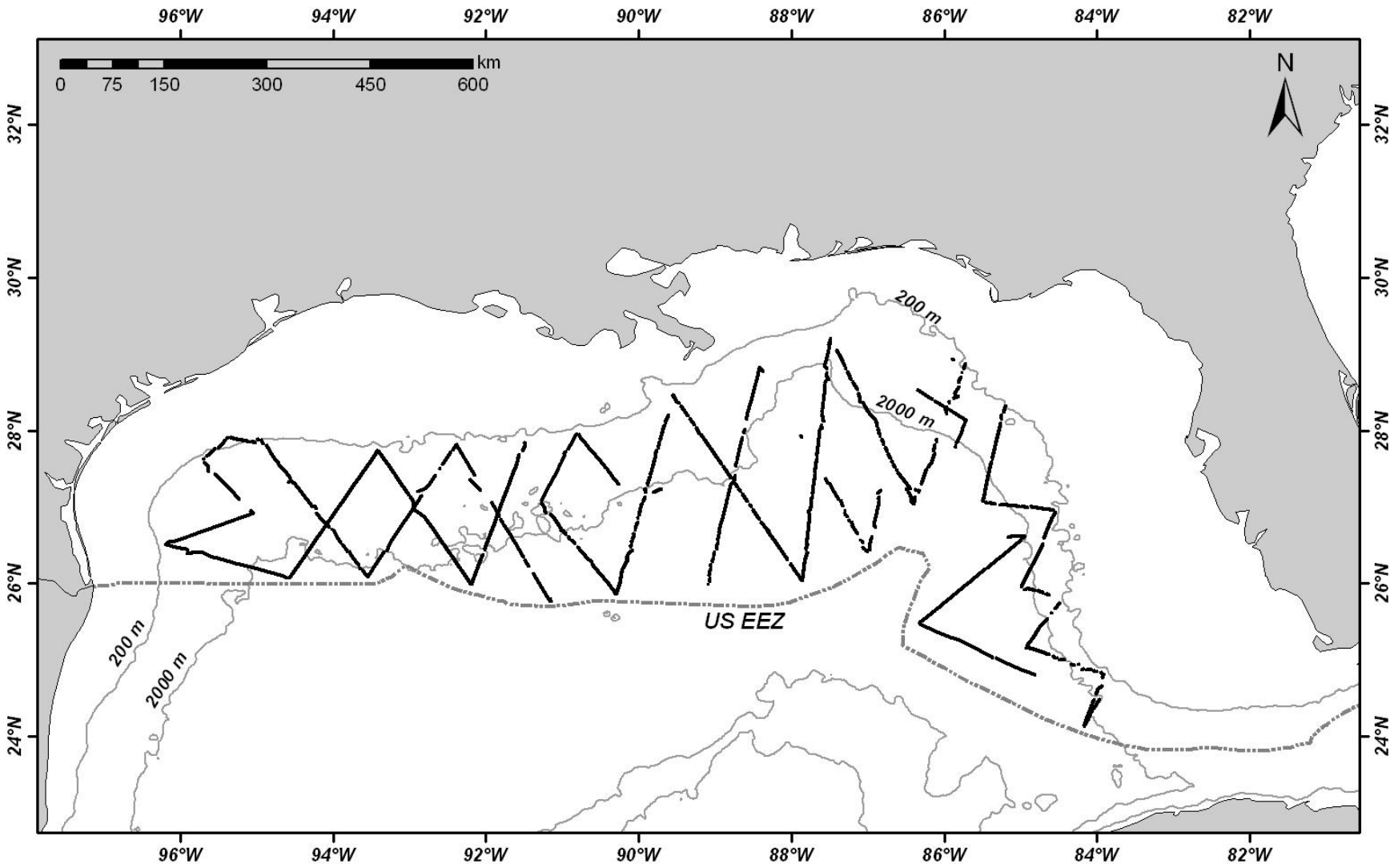

Figure 2. Locations of all marine mammal sightings during GU-09-03.

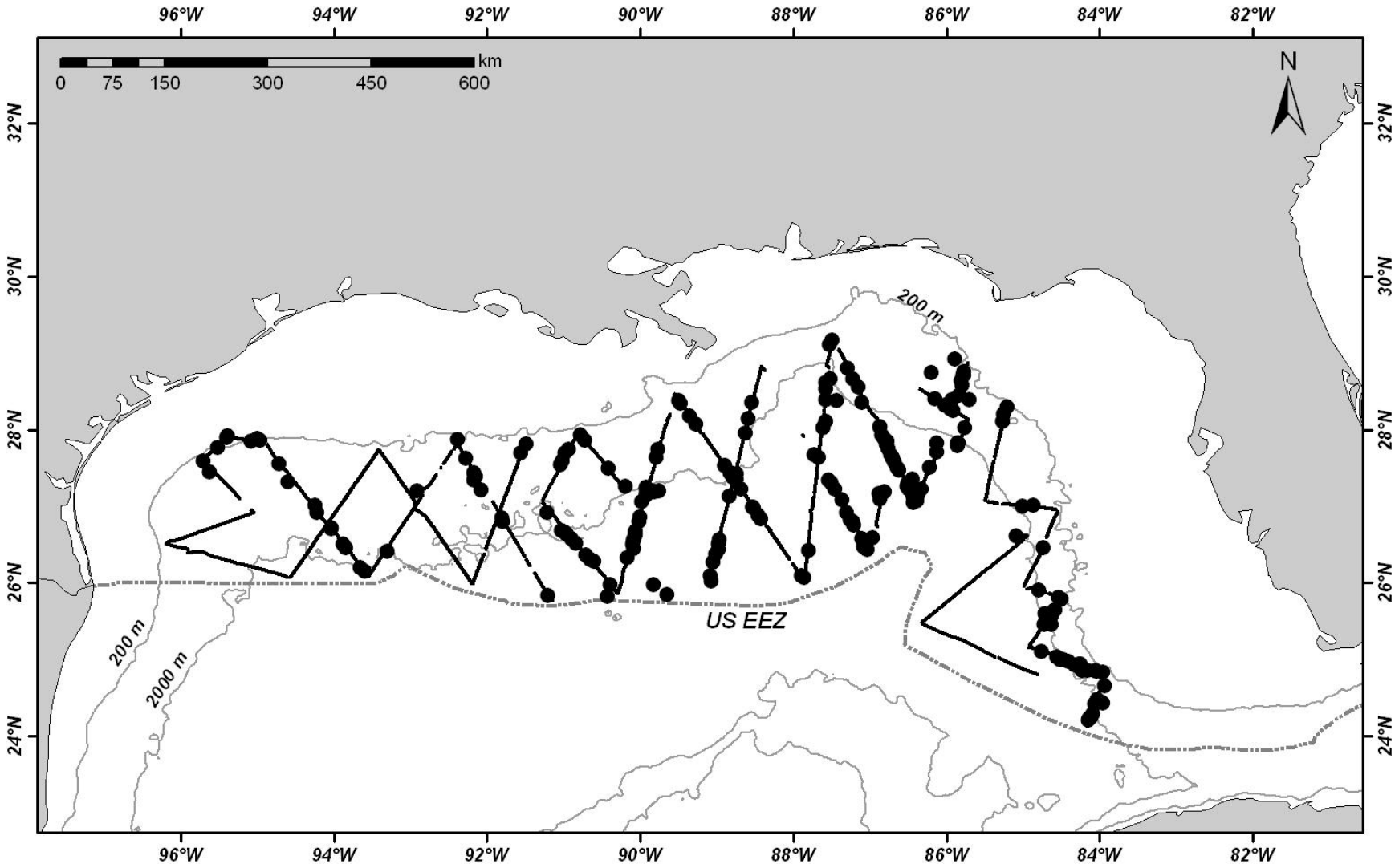

Figure 3. Locations of large whale and beaked whale sightings during GU-09-03.

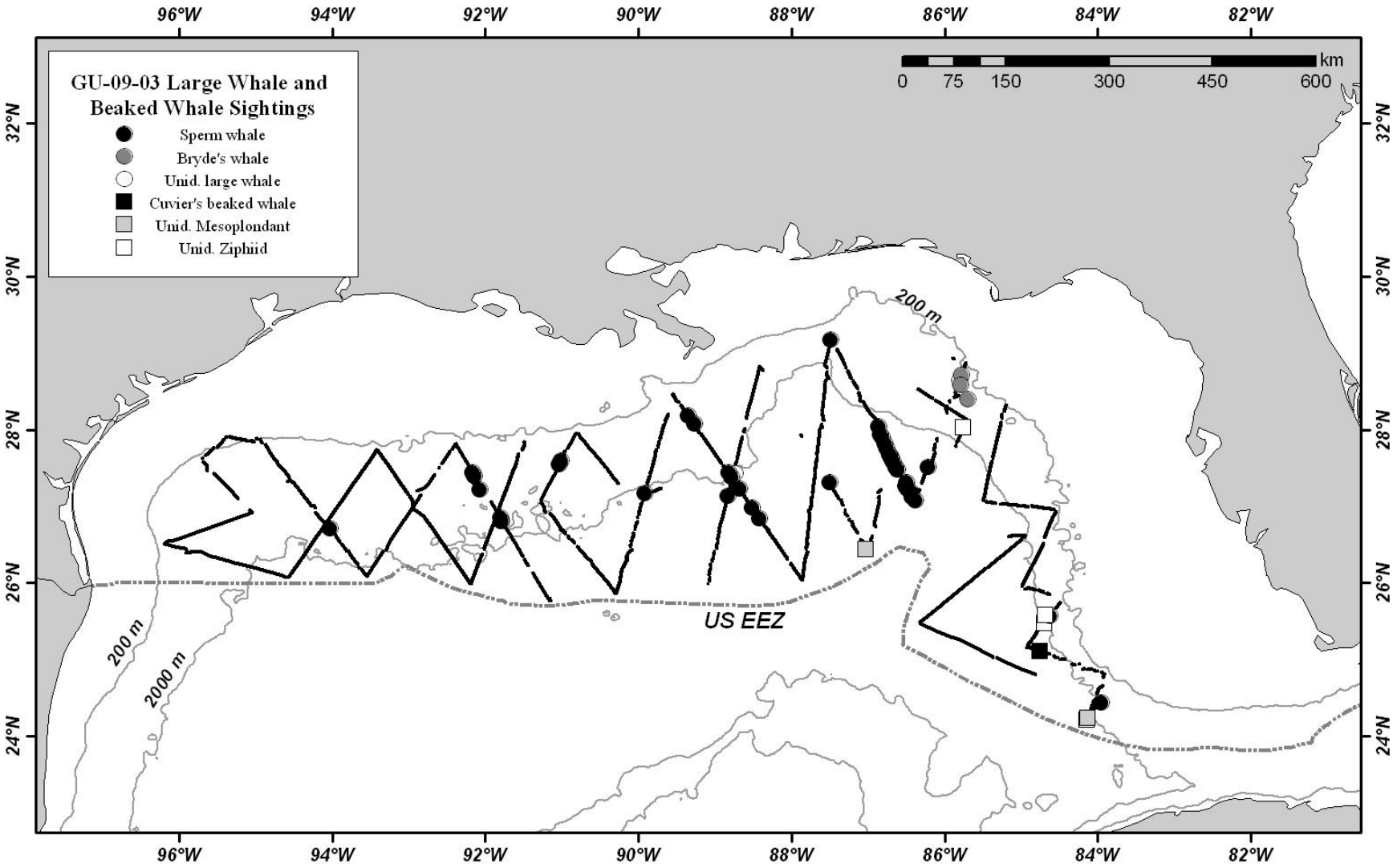

Figure 4. Locations of small whale sightings during GU-09-03.

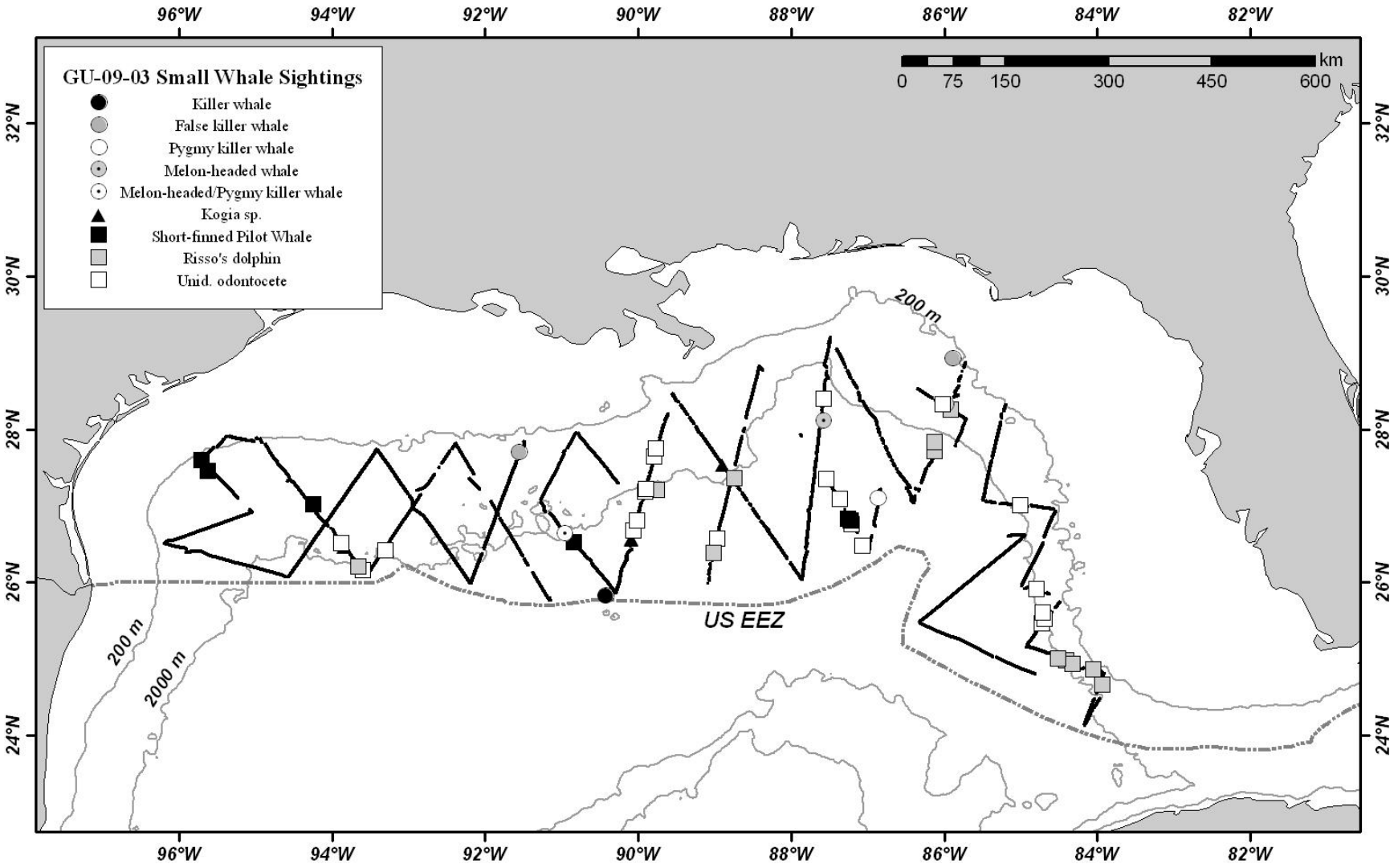

Figure 5. Locations of dolphin sightings during GU-09-03.

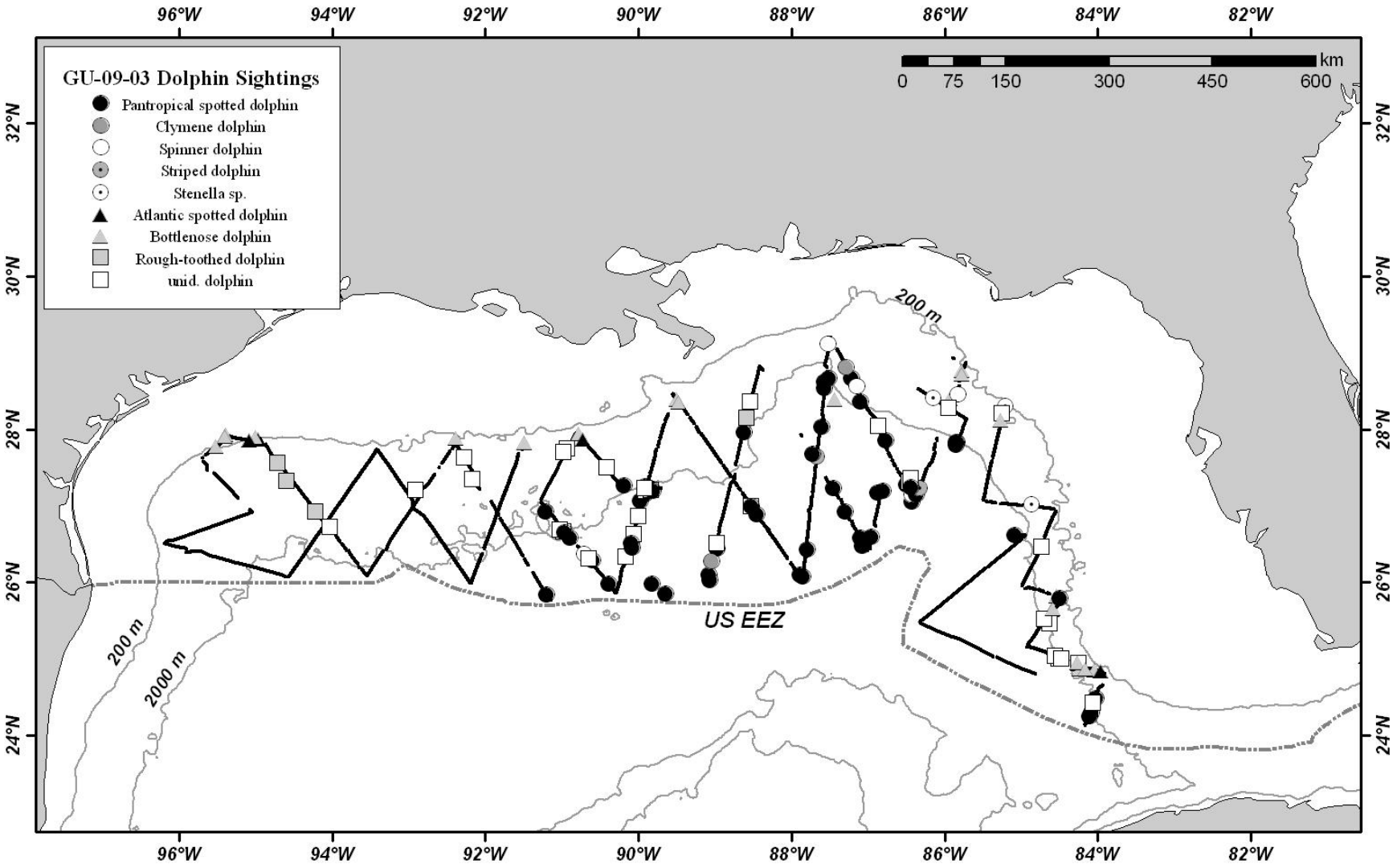

Figure 6. Locations of biopsy samples collected during GU-09-03.

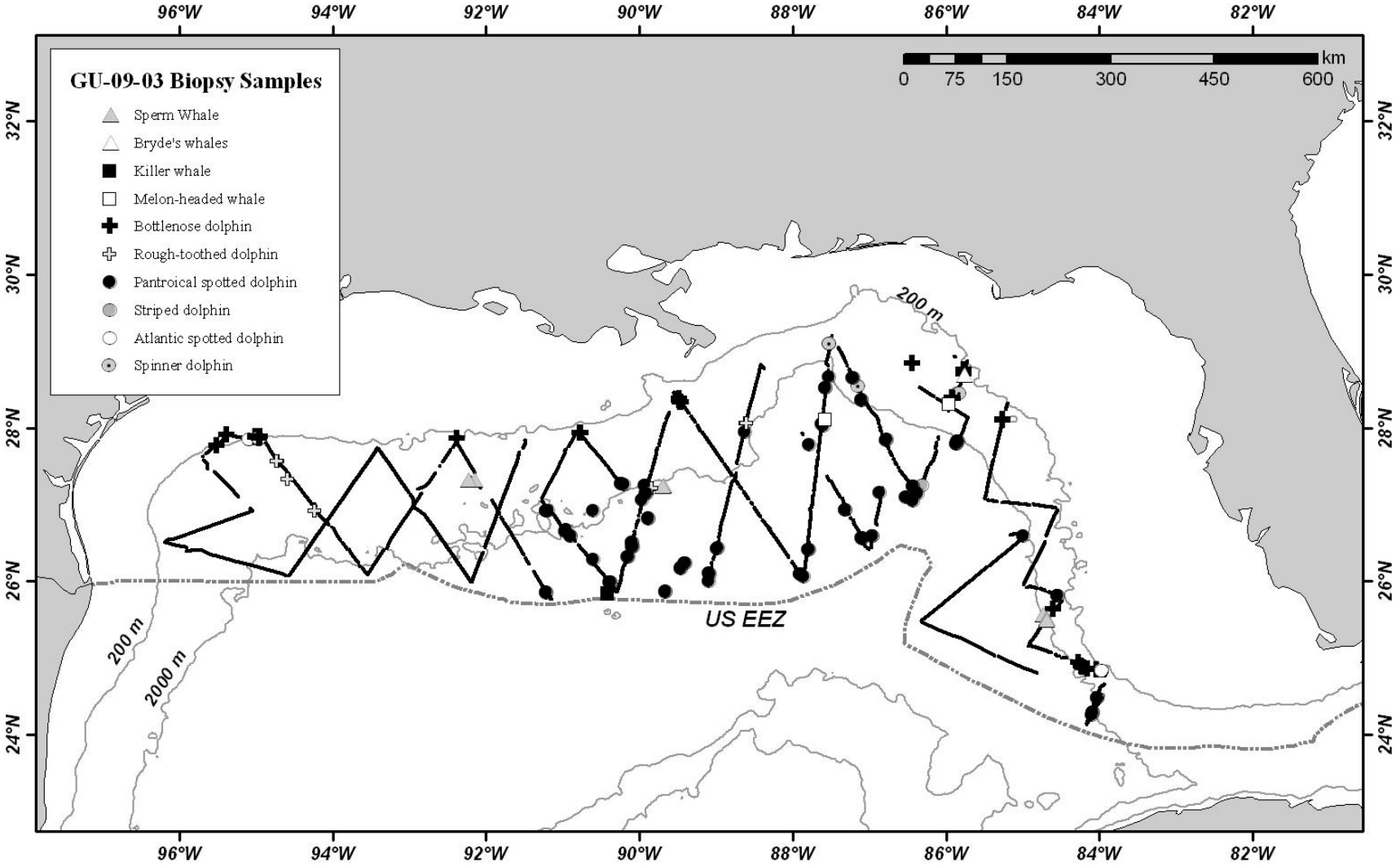

Figure 7. Locations of CTD and XBT stations during GU-09-03.

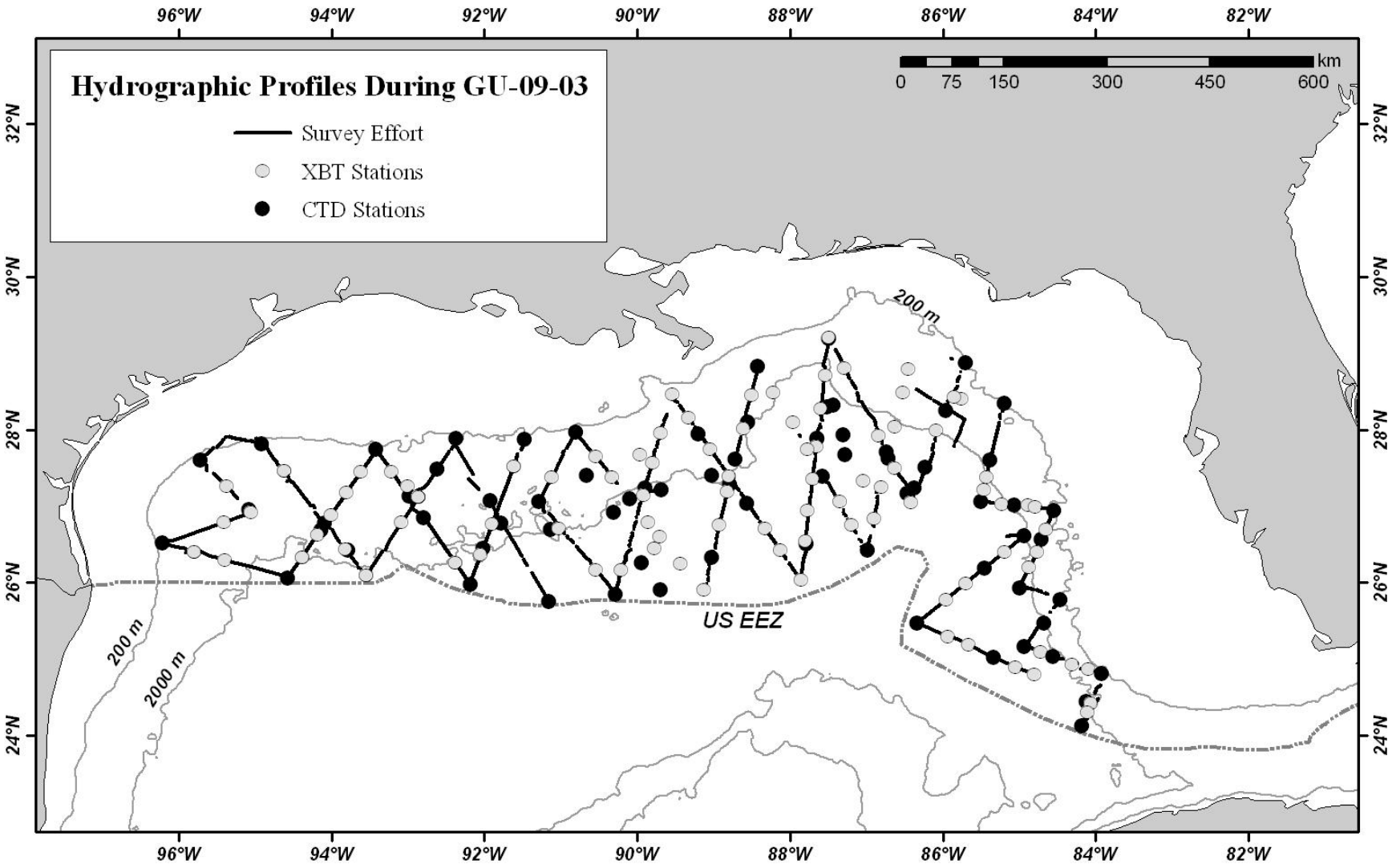

Figure 8. Locations of trawl stations during GU-09-03