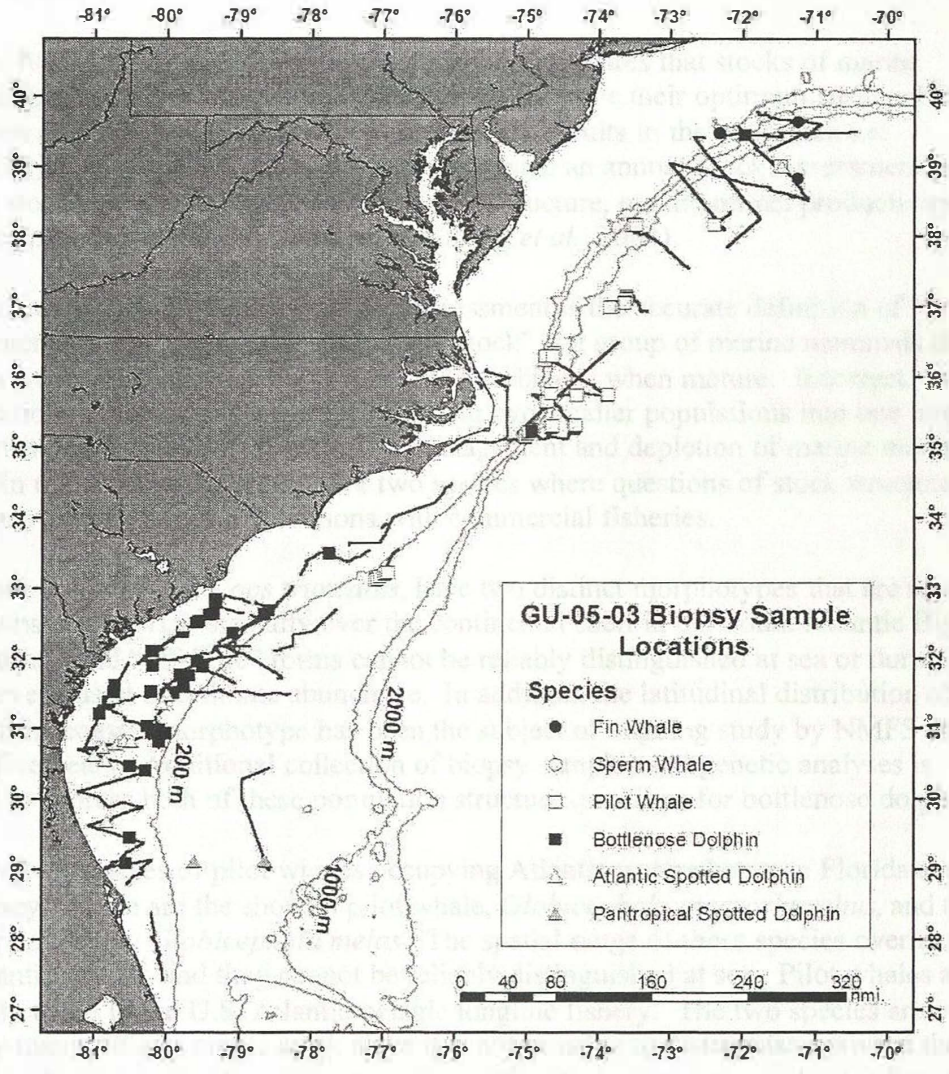
CRUISE RESULTS

NOAA Ship Gordon Gunter Cruise GU-05-03
14 June - 16 August, 2005

A survey of the U.S. mid-Atlantic to collect biopsy samples for analysis of population structure in bottlenose dolphins and pilot whales.



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 14 June 2005 to conduct a marine mammal survey in the U.S. Atlantic Ocean between Florida and New Jersey. Survey operations occurred over the continental shelf south of North Carolina, and in inner slope waters near the continental shelf break north of Cape Hatteras. The survey was focused on sampling efforts supporting the evaluation of population structure for marine mammal stocks, specifically bottlenose dolphins and pilot whales, in U.S. Atlantic waters.

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 defined as the number of animals which results in the maximum net productivity. NOAA Fisheries is required to prepare an annual Stock Assessment Report for each stock to update abundance, population structure, maximum net productivity, human-caused mortality, and status (e.g., Waring *et al.*, 2004).

A critical component of marine mammal assessment is the accurate definition of management units or population stocks. A "stock" is a group of marine mammals that occupies a common spatial arrangement and interbreeds when mature. Incorrect classification of stocks, particularly combining two smaller populations into one larger management unit, can lead to inefficient management and depletion of marine mammal stocks. In the U.S. Atlantic, there are two species where questions of stock structure are particularly critical due to interactions with commercial fisheries.

Bottlenose dolphins, *Tursiops truncatus*, have two distinct morphotypes that are separate populations and overlap spatially over the continental shelf in the South Atlantic Bight. The "coastal" and "offshore" forms cannot be reliably distinguished at sea or during aerial surveys used to estimate abundance. In addition, the latitudinal distribution of stocks of the coastal morphotype has been the subject of ongoing study by NMFS during the last five years. Additional collection of biopsy samples and genetic analyses is required to address both of these population structure questions for bottlenose dolphins.

There are two species of pilot whales occupying Atlantic waters between Florida and New Jersey. These are the shortfin pilot whale, *Globicephala macrorhnychus*, and the longfin pilot whale, *Globicephala melas*. The spatial range of these species overlaps in mid-Atlantic waters, and they cannot be reliably distinguished at sea. Pilot whales are frequently taken in the U.S. Atlantic pelagic longline fishery. The two species are currently managed as a single stock since it is not possible to distinguish between them in either abundance or mortality estimates. It is critical to improve our understanding of the relative spatial distribution of these species so as to accurately assess stock status and mitigate fishery interactions.

The summer 2005 *Gordon Gunter* survey was designed to collect biopsy tissue samples and other data to address the critical issues of population structure in bottlenose dolphins and pilot whales.

CRUISE OBJECTIVES

1. Locate and collect tissue samples (biopsies) of pilot whales and bottlenose dolphins, and other selected cetacean species using a variety of devices including rifles and crossbows in the U.S. Atlantic Ocean.

2. Conduct photographic studies and acoustic recordings of pilot whales to explore methods to distinguish the two species in field data.

3. Capture and satellite tag bottlenose dolphins in continental shelf waters south of North Carolina.

METHODS

Visual Survey

Visual surveys were conducted by three observers stationed on the flying bridge. 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). Two observers were stationed at the port and starboard 25x "bigeye" binoculars and the third observer observed the track line with naked eye and small binoculars, and entered data into a laptop computer.

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 2 min and included the ship's position and heading, effort status, observer positions, and environmental conditions which could effect the observers' ability to sight animals (e.g., Beaufort sea state, trackline glare, etc.). Typically, if a sighting was within a 3.0 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.

Survey speed was usually 18 $km \cdot hr^{-1}$ (~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 (sea state > 6) and rain.

The primary goal of the visual survey effort was to find and identify target species for biopsy sample collection either from the bow of the *Gordon Gunter* or by deploying the small boat. The visual team also assisted the small boat in acquiring and maintaining contact with target groups of cetaceans.

Small Boat Operations

The primary platform for collection of biopsy samples was the small boat carried aboard the *Gunter*. The "R3" was deployed by crane from the deck, and the scientific party included a boat driver, biopsy sampler, photographer, and data recorder. Generally, the small boat was deployed when an appropriate group of pilot whales or bottlenose dolphins was observed by the flying bridge team. The small boat stayed with a pilot whale group to collect biopsy samples from multiple subgroups of a larger aggregation and conduct extensive photo-documentation. Small boat deployment and operations were conducted in accordance with the current small boat guidelines implemented by NOAA fisheries and the NOAA corps.

Biopsy Sampling

Biopsy tissue samples were collected either from the bow of the *Gordon Gunter* or the R3. Skin samples from collected biopsies are genetically analyzed for gender determination, evaluation of population structure, and species identification. 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. 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. Both photographic and video records of biopsy attempts were taken during these operations. Biopsy sampling was attempted after all pertinent group size and biological information was recorded by the observer team. Biopsy samples were stored in DMSO and frozen at –20°C to preserve genetic material for later analysis.

Photo-identification

Extensive photo-documentation activities were undertaken for pilot whales. The goal of this work was to take photographs of physical characteristics such as coloration, head shape, dorsal fin shape, and the appearance of the cape that may allow visual distinction of the two species of pilot whales at sea. Identification photographs were taken for every pilot whale from which a biopsy sample was taken along with associated members of each sub-group. The photographic data will be correlated with the results from genetic analyses of biopsy samples. In addition, identifying features from dorsal fin photographs may be useful in identifying individual animals in future surveys of this area.

Satellite Tagging Attempts

The third leg of the survey was dedicated to efforts to capture bottlenose dolphins on the continental shelf, collect biological samples, and place satellite tags that could track animal movements for several months. The goal of tag deployment is to improve understanding of the seasonal latitudinal movements of bottlenose dolphins south of North Carolina. Capture attempts were made from the small boat employing a "hoop net" which is placed over the head of a bowriding dolphin. The animal is then brought near the boat and placed on a floating pad. Sampling would include skin and blubber,

dolphins. Bottlenose dolphins were observed across the bathymetry gradient offshore of Florida, but were more aggregated into nearshore and offshore concentrations further north (Figure 2). Atlantic spotted dolphins were most abundant in intermediate depth waters over the continental shelf in this region (Figure 2).

The second leg focused its effort in the mid-Atlantic bight along the shelf break targeting pilot whales. Very high densities of pilot whales and other species were encountered in the region just north of Cape Hatteras, North Carolina (Figure 3). Sperm whales were also abundant in this area and regions both further north and offshore. In the northern part of the survey range, aggregations of fin whales were encountered along with lower densities of pilot whales (Figure 3). Common dolphins, Risso's dolphins, and bottlenose dolphins also occurred in high densities near Cape Hatteras, and striped dolphins were abundant in the northern portion of the range (Figure 4).

During leg three, the primary goal of the survey was to observe and tag bottlenose dolphins in nearshore and offshore aggregations. The survey trackline this ran parallel to bathymetry in areas of expected high concentrations. There were 27 sightings of bottlenose dolphins and 31 sightings of Atlantic spotted dolphins during leg 3 (Figure 5). Attempts to capture dolphins using the small boat and hoop nets were made on three different survey days. While we were successful in deploying the small boat, following dolphins, and making capture attempts, generally poor weather conditions precluded successful captures of any animals.

Biopsy Sampling

Biopsy samples were collected throughout the survey range, providing critical samples for assessment of population structure in pilot whales and bottlenose dolphins. A total of 160 samples were collected during the survey including 69 samples from bottlenose dolphins and 62 from pilot whales (Table 3). Pilot whale samples were collected primarily from the Cape Hatteras region, while bottlenose dolphin samples were collected from nearshore and offshore aggregations between Georgia and South Carolina (Figure 6). These samples are currently undergoing analysis at the southeast marine mammal population genetics laboratory.

Photo-identification

A total of 2,603 photographs were collected from groups of cetaceans during the surveys. The majority of these images (1,449) were collected from pilot whales associated with the collection of biopsy samples. An additional 354 images were taken of sperm whales. The pilot whale images have been catalogued into a database for use in photo-identification analysis.

Environmental Data

All data from the CTDs, XBTs 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.

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.

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

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.

Waring, G.T., R.M. Pace, J.M. Quintal, C.P. Fairfield, and K.M. Foley (eds.). 2004. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments-2003. NOAA Tech. Mem. NMFS-NE-182. 287 p.

GU-05-03 Cruise Participants

Name	Title	Sex	Organization	Citizenship
Leg 1 (14 June - 4 July)				
Tony Martinez	Field Party Chief	M	NMFS, Miami, FL	US
Melody Baran	Observer	F	JCWS, Pascagoula, MS	US
Kevin Barry	Observer/Biopsy	M	JCWS, Pascagoula, MS	US
Carrie Barry	Observer/Photo-id	F	JCWS, Pascagoula, MS	US
Stephen Claussen	Observer/Biopsy	M	NMFS, Pascagoula, MS	US
Jeff Foster	Observer/Biopsy	M	JCWS, Pascagoula, MS	US
Carrie Horton	Observer	F	JCWS, Pascagoula, MS	US
Lanora Lang	Observer	F	JCWS, Pascagoula, MS	US
Grisel Rodriguez	Observer	F	JCWS, Pascagoula, MS	US
Brenda Rone	Observer/Photo-id	F	JCWS, Pascagoula, MS	US
Jesse Wicker	Observer	M	NMFS, Miami, FL	US
Leg 2 (7 July - 25 July)				
Tony Martinez	Field Party Chief	M	NMFS, Miami, FL	US
Melody Baran	Observer	F	JCWS, Pascagoula, MS	US
Kevin Barry	Observer/Biopsy	M	JCWS, Pascagoula, MS	US
Leslie Burdett	Observer	F	JCWS, Pascagoula, MS	US
Stephen Claussen	Observer/Biopsy	M	NMFS, Pascagoula, MS	US
Carol Fairfield	Observer	F	NMFS, Miami, FL	US
Lanora Lang	Observer	F	JCWS, Pascagoula, MS	US
Grisel Rodriguez	Observer	F	JCWS, Pascagoula, MS	US
Brenda Rone	Observer/Photo-id	F	JCWS, Pascagoula, MS	US
Anna Sellas	Observer/Biopsy	F	JCWS, Pascagoula, MS	US
Jesse Wicker	Observer	M	NMFS, Miami, FL	US
Leg 3 (27 July - 16 August)				
Tony Martinez	Field Party Chief	M	NMFS, Miami, FL	US
Melody Baran	Observer	F	JCWS, Pascagoula, MS	US
Jeff Foster	Observer/Biopsy	M	JCWS, Pascagoula, MS	US
Aleta Hohn	Tagging Spec.	F	JCWS, Pascagoula, MS	US
Stephen Claussen	Observer/Biopsy	M	NMFS, Pascagoula, MS	US
Larry Hansen	Tagging Spec.	M	NMFS, Beaufort, NC	US
Annie Gorgone	Observer/Biopsy	F	NMFS, Beaufort, NC	US
Tom Ninke	Observer/Biopsy	M	NMFS, Beaufort, NC	US
Larry Christian	Observer	M	NC State Univ.	US
Craig Harms	Vetrinarinan	M	NC State Univ.	US
Jesse Wicker	Observer	M	NMFS, Miami, FL	US

Submitted by:

Anthony Martinez
Field Party Chief

Approved by:

Dr. Scott Nichols, Director
Mississippi Laboratories

Dr. Lance Garrison
Principal Investigator

Dr. Nancy Thompson, Director
Southeast Fisheries Science Center

Table 1a. Summary of daily survey effort during GU-05-03 during leg 1.

Date	Survey Event	Survey Effort (km)	Survey Hours	Number of Sightings	Avg. Sea State
14-Jun	Depart Pascagoula, MS	0	0		
15-Jun	Transit to Atlantic Ocean	0	0		
16-Jun	Transit to Atlantic Ocean	0	0		
17-Jun	Transit to Atlantic Ocean	0	0		
18-Jun	Survey Day	99	8.9	10	2.6
19-Jun	Survey Day	111	12.6	18	2.3
20-Jun	Survey Day	205	13.3	6	3.8
21-Jun	Survey Day	167	13.2	10	3.9
22-Jun	Survey Day	102	13.4	22	1.0
23-Jun	Survey Day	89	12.4	39	1.5
24-Jun	Survey Day	169	12.2	2	4.2
25-Jun	No Survey - Weather	0	0		
26-Jun	Survey Day	136	13.3	13	2.4
27-Jun	Survey Day	146	13.2	16	2.8
28-Jun	Survey Day	59	12.4	17	2.4
29-Jun	Survey Day	110	12.6	17	2.3
30-Jun	Survey Day	99	13.3	24	2.0
1-Jul	Survey Day	162	13	23	2.7
2-Jul	Survey Day	147	13.3	12	2.0
3-Jul	Survey Day	223	13.4	0	4.7
4-Jul	In Port – Norfolk, VA	0	0		
	Leg 1 Totals	**2,025**	**190.5**	**229**	**2.7**

Table 1b. Summary of daily survey effort during GU-05-03 during leg 2.

Date	Survey Event	Survey Effort (km)	Survey Hours	Number of Sightings	Avg. Sea State
7-Jul	In Port / Depart Norfolk, VA	0	0		
8-Jul	Transit to Survey Area / Weather	0	0		
9-Jul	Survey/Small Boat Ops.	16	11.7	12	1.0
10-Jul	Survey/Small Boat Ops.	58	12.2	22	1.0
11-Jul	Survey/Small Boat Ops.	82	11.9	32	1.9
12-Jul	Survey/Small Boat Ops.	84	11.8	11	2.3
13-Jul	Survey/Small Boat Ops.	17	12.3	33	1.5
14-Jul	Survey/Small Boat Ops.	70	12.2	26	2.8
15-Jul	Survey	131	13.1	21	1.7
16-Jul	Survey/Small Boat Ops.	52	4.6	12	1.6
17-Jul	Survey/Small Boat Ops.	90	13.0	19	1.8
18-Jul	Survey	61	12.6	9	3.2
19-Jul	Survey	122	13.0	4	4.0
20-Jul	Survey/Small Boat Ops.	127	12.9	22	2.5
21-Jul	Survey	211	13.2	21	2.5
22-Jul	Survey	175	11.0	22	4.6
23-Jul	Survey	64	10.4	4	3.0
24-Jul	Survey	86	9.1	3	4.8
25-Jul	In Port - Charleston, SC	0	0		
	Leg 2 Totals	**1,446**	**185.0**	**273**	**2.5**

Table 1c. Summary of daily survey effort during GU-05-03 during leg 3.

Date	Survey Event	Survey Effort (km)	Survey Hours	Number of Sightings	Avg. Sea State
27-Jul	In Port / Depart Charleston, SC	0	0		
28-Jul	Survey/Small Boat Ops.	68	7.8	0	2.0
29-Jul	Survey/Small Boat Ops.	132	10.0	5	2.6
30-Jul	Survey/Small Boat Ops.	117	10.7	5	2.0
31-Jul	Survey/Small Boat Ops.	244	4.4	10	2.0
1-Aug	Survey/Small Boat Ops.	153	9.5	10	3.0
2-Aug	Survey/Small Boat Ops.	155	9.6	5	3.2
3-Aug	Survey/Small Boat Ops.	225	10.5	11	3.1
4-Aug	Survey/Small Boat Ops.	154	9.7	7	3.4
5-Aug	Survey/Small Boat Ops.	175	11.1	7	2.5
6-Aug	Survey/Small Boat Ops.	311	3.3	0	3.1
7-Aug	Survey/Small Boat Ops.	178	10.0	2	4.2
8-Aug	No Survey - Weather	0	0	1	
9-Aug	Survey/Small Boat Ops.	207	11.2	5	2.2
10-Aug	Survey/Small Boat Ops.	197	11.2	1	3.2
11-Aug	Survey/Small Boat Ops.	126	8.4	5	1.7
12-Aug	Transit to Pascagoula	0	0		
13-Aug	Transit to Pascagoula	0	0		
14-Aug	Transit to Pascagoula	0	0		
15-Aug	Transit to Pascagoula	0	0		
16-Aug	Arrive Pascagoula, MS	0	0		
	Leg 3 Totals	**2,442**	**127.4**	**74**	**2.7**

Table 2. Number of marine mammal group sightings for each leg during GU-05-03.

Common Name	Scientific Name	Leg 1	Leg 2	Leg 3	Total
Atlantic spotted dolphin	*Stenella frontalis*	112		31	143
Beaked Whale	*Mesoplodant / Ziphiid*		12		12
Bottlenose dolphin	*Tursiops truncatus*	88	29	27	144
Bottlenose/Spotted dolphin	*T. truncatus/S. frontalis*	10	1	1	12
Common dolphin	*Delphinus delphis*		16		16
Cuvier's beaked whale	*Ziphius cavirostris*		4		4
Fin whale	*Balaenoptera physalus*		4		4
Melon-headed/Pygmy killer whale	*Peponocephala / Feresa attenuata*		1		1
Pantropical spotted dolphin	*Stenella attenuata*			1	1
Pilot whales	*Globicephala sp.*		36		36
Risso's dolphin	*Grampus griseus*		35	3	38
Sperm whale	*Physeter macrocephalus*		59		59
Stenella sp.	*Stenella sp.*	2	1		3
Striped dolphin	*Stenella coeruleoalba*		23		23
Unid. Baleen Whale	*Balaenoptera sp.*		1		1
Unid. Dolphin		17	31	9	57
Unid. Large Whale			5		5
Unid. Odontocete			7	1	8
Unid. Small Whale			5	1	6
Unid. Ziphiid			3		3
Survey Total		**229**	**273**	**74**	**576**

Table 3. Tissue biopsy samples collected during each leg of cruise GU-05-03.

Species	Leg 1	Leg 2	Leg 3	Total
Atlantic Spotted Dolphin	11	2	2	15
Bottlelnose Dolphin	58	4	7	69
Fin Whale		5		5
Pantropical Spotted Dolphin			8	8
Pilot Whale		62		62
Sperm Whale		1		1
Survey Total	**69**	**74**	**17**	**160**

Figure 1. Survey effort along the U.S. Atlantic coast during *Gordon Gunter* cruise GU-05-03 during June-August, 2005. Locations of marine mammal sightings (all species) are indicated by black circles. The 200, 1000, and 2000 meter bathymetry contours are indicated.

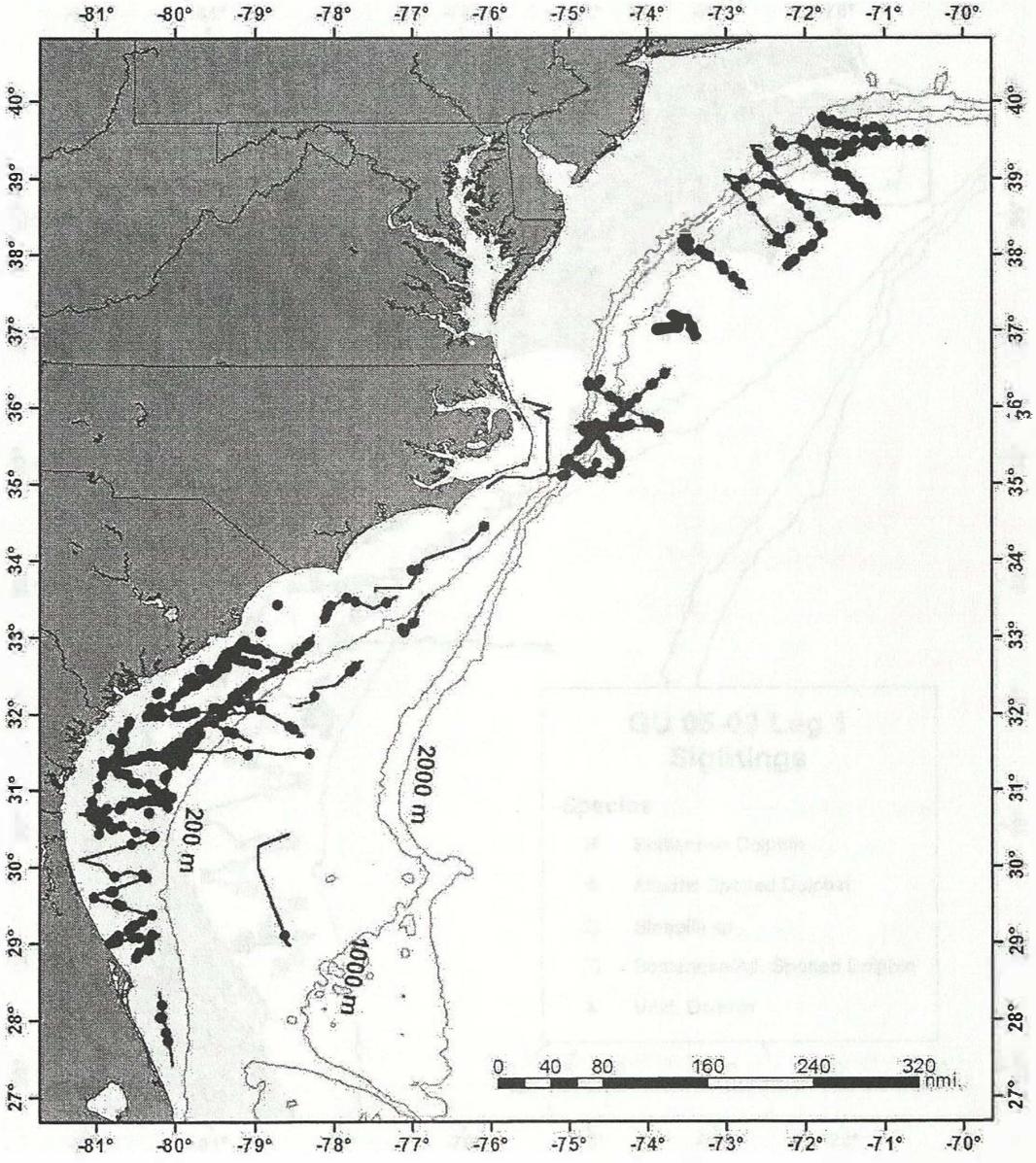


Figure 2. Survey effort and marine mammal sightings (symbols) during leg 1 of cruise GU-05-03. Operations in Atlantic water occurred during 18 June – 2 July, 2005 on the continental shelf between Florida and South Carolina.

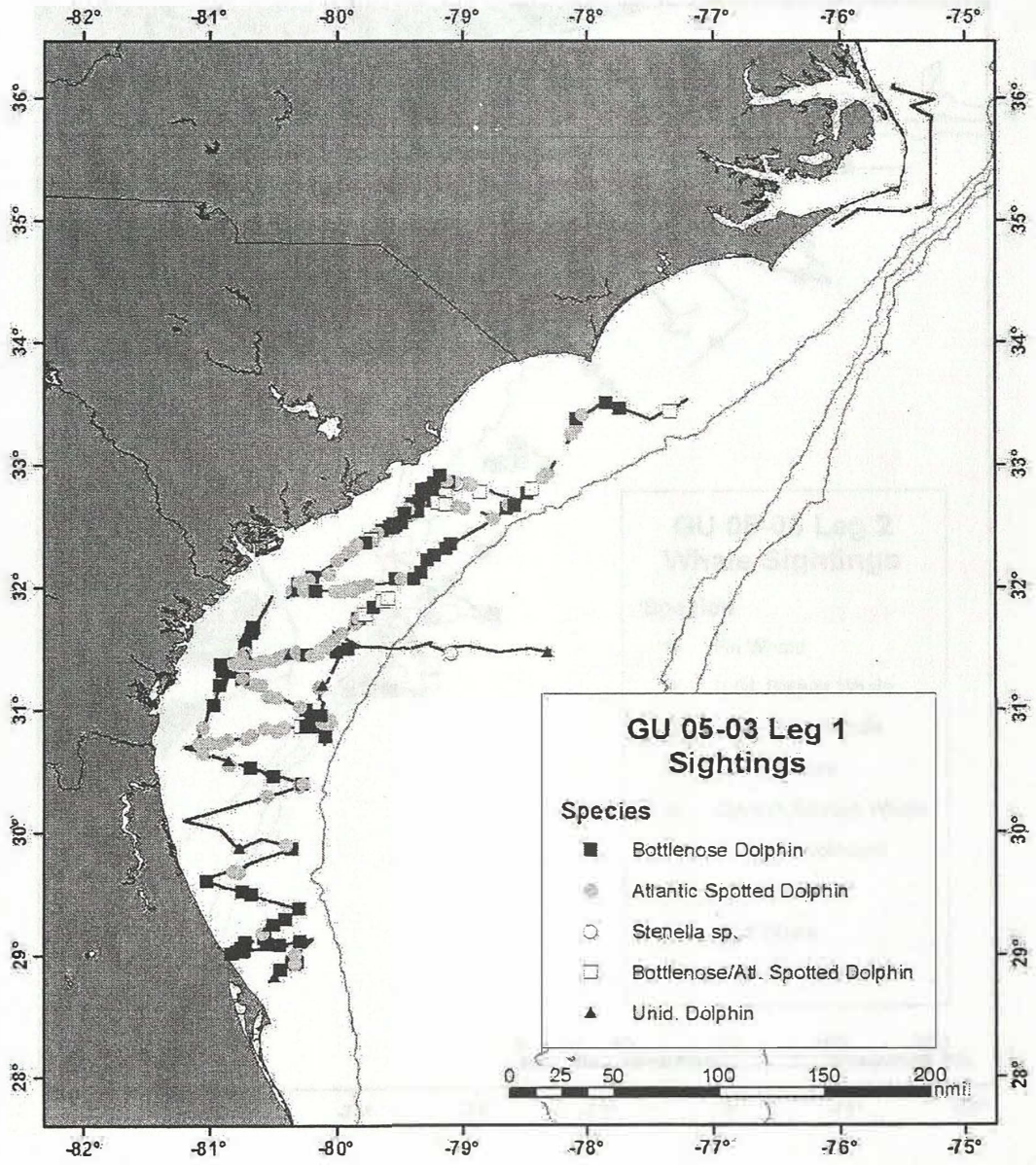


Figure 3. Survey effort and whale sightings (symbols) during leg 2 of cruise GU-05-03. Operations in Atlantic water occurred during 5 July – 24 July, 2005 along the shelf break between Virginia and New Jersey.

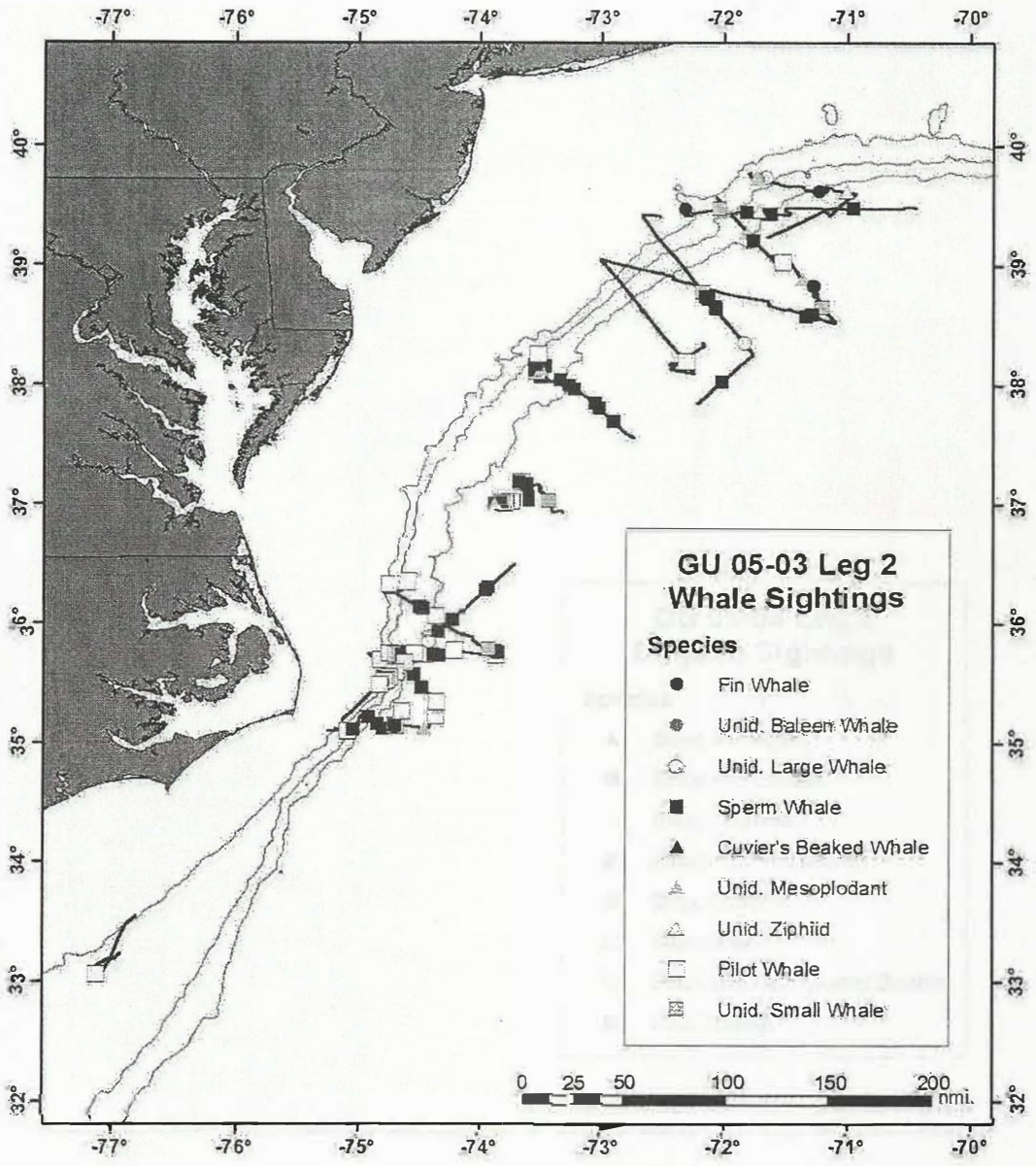


Figure 4. Survey effort and dolphin sightings (symbols) during leg 2 of cruise GU-05-03. Operations in Atlantic water occurred during 5 July – 24 July, 2005 along the shelf break between Virginia and New Jersey.

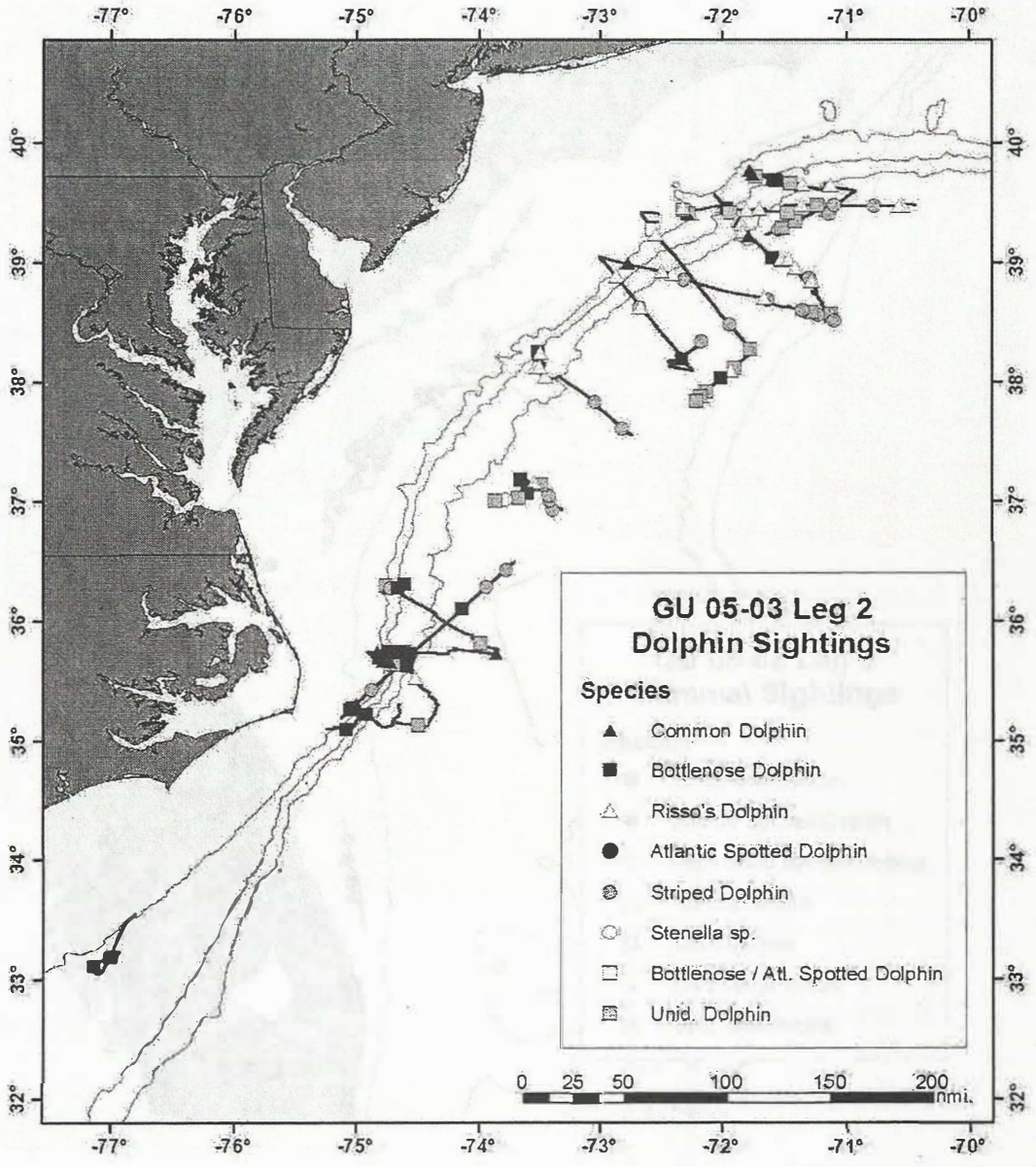


Figure 5. Survey effort and mammal sightings (symbols) during leg 3 of cruise GU-05-03. Operations in Atlantic water occurred during 28 July – 11 August, 2005 on the continental shelf between Georgia and South Carolina.

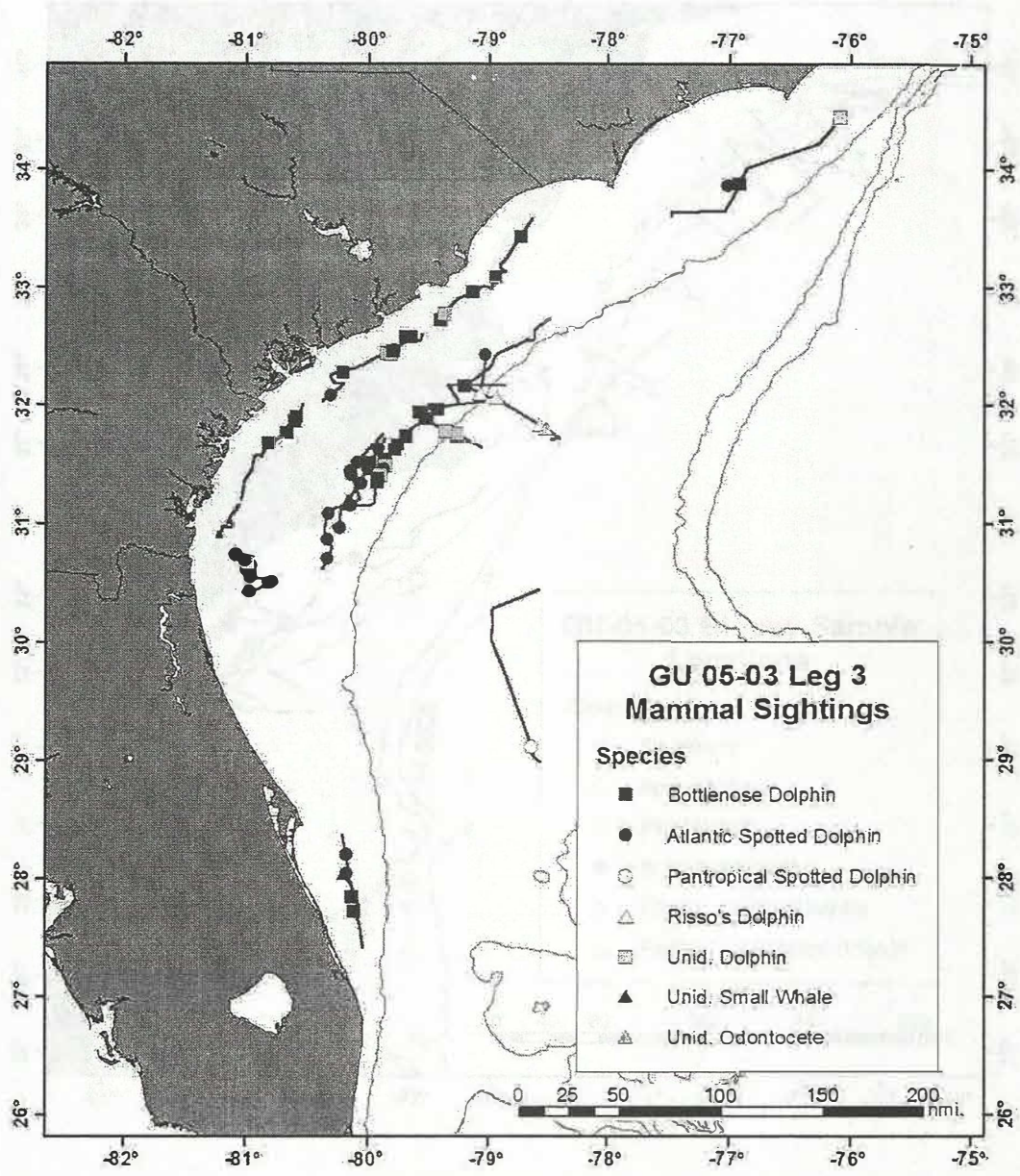


Figure 6. Biopsy samples collected during *Gordon Gunter* cruise GU-05-03.