

Sperm whale spatial organization and behavior in the northern Gulf of Mexico.

Cruise Plan

I. Cruise Logistics (dates are weather dependent)

A. General schedule

Coordinate with offshore industry in development of communication protocols in May and June

Mobilization and building of towed hydrophone arrays in Galveston, Texas, on 7-10 June 2004.

Driving to St. Petersburg, Florida, with all the equipment, 11-12 June 2004. The vessel is docked in the marina downtown in St. Petersburg.

Mobilization and vessel preparation in St. Petersburg, Florida, 13-17 June 2004

Departure planned as soon as the vessel is ready, most likely on 17 or 18 June.

Return planned for afternoon/evening of 11 August 2004

Demobilization in St. Petersburg, Florida, 12-13 August 2004

Driving back to Galveston with all research equipment on 14-15 August 2004

B. Cruise legs

Leg 1: leaves St. Petersburg, Florida, around 17-18 June 2004, arrives in Gulfport, Mississippi, on June 30 early morning or 29 June late.

Re-supply for fuel, water, and food on 30 June and 1 July

Leg 2: leaves Gulfport on 2 July 2004, arrives Gulfport late on July 14.

Re-supply for fuel, water, and food on 15-16 July.

Leg 3: leaves Gulfport 17 July 2004, arrives Gulfport late on July 29.

Re-supply for fuel, water, and food on 30-31 July.

Leg 4: leaves Gulfport 1 August 2004, arrives St. Petersburg late on August 11.

C. Research Vessel

Hunter 46 "Summer Breeze" chartered from "Sailing Florida with Sunsail" in St. Petersburg, FL. Vessel registration numbers are FL 2077 ME (State registration) and FRN 0008736589 (FCC registration).

D. Research Permits

Activities will be conducted in accordance with federal permits from NOAA Fisheries to Texas A&M University-Galveston (permit 821-1588-00) for Photo-ID, Photogrammetry, and Survey activities,
Dan Engelhaupt (permit 909-1465-03) for Biopsy and Genetic Typing activities.

II. Personnel

SWSS PIs who will participate in this cruise will be Jonathan Gordon (leg 1 and 4) and Nathalie Jaquet (all legs). Bernd Würsig will tentatively participate in leg 3. A certified captain, Steve Brown (who has experience with sperm whale research from small vessels), will skipper the

vessel for the entire duration. Five observers will participate in some or all legs. They have extensive experience with sperm whale research, from both the SWSS cruises of 2002 and 2003, and from small vessels (mainly motor-sailers, but also 8m fishing vessels).

Field Party Chief	Jonathan Gordon (legs 1 and 4), Nathalie Jaquet (legs 2 and 3)
Captain	Steve Brown
Observers	Thomas Gordon (all legs) Ricardo Antunes (all legs) Trudi Webster (all legs) Christoph Richter (legs 1 and 2) Raul Diaz-Gamboa (legs 2, 3 and 4, responsible for all biopsy samplings)

III. Cruise Plan

We have planned 50 days at sea in four cruise legs to investigate sperm whale distribution, abundance and spatial organization in parts of the northern Gulf of Mexico. Each leg will be separated by two days on shore to re-supply. The focus area will be between the Mississippi Canyon and the DeSoto Canyon (Figure 1). On trips in and out of the port in St. Petersburg, FL, we will conduct some limited surveying of the area between the 500 and 1500-m isobaths in a zig-zag pattern as we sail to or from the focus area.

Survey Tracks: It is not feasible to determine survey tracks in advance as they will be influenced by many practical issues, including weather, logistical considerations and encounters with and tracking of sperm whale groups. Figure 1 indicates the overall study area, which is bounded by the 500 and 1500m contours. This area has been sub-divided into four survey areas. Two are of higher interest, one of moderate interest, and one of lower interest. The locations of oil platforms also are shown with those in waters over 500m being highlighted. We will use the *Distance* program to shape survey tracks in each area (likely in a zig-zag pattern). The tracks will be designed so the ratio of survey effort per unit area between blocks is approximately 35, 35, 20, 10. As an example, likely survey tracks for the first leg from St. Petersburg to Gulfport are shown.

Leg 1: From St. Petersburg (27.5°N Latitude) we are planning to head west to the 500-m isobath, and then north-west to survey the area between the 500 and 1500m isobaths. While transiting to and surveying in the focus area, we will systematically follow zig-zag tracklines determined by the program *Distance*. We expect also to survey in the eastern part of the focus area during this leg. The first leg will end in Gulfport.

Leg 2: The second leg will leave Gulfport, heading south back to the 500-m isobath and then heading west. We will survey systematically (in a zig-zag pattern) the slope between about the 500m and 1500m isobaths until approximately 90.2°W Longitude (just west of the Mississippi Canyon). Once the west side of the Mississippi Canyon is reached, we will survey back east along the 500 to 1500m area and then go into Gulfport.

Leg 3: The third leg will again leave and arrive in Gulfport and will survey the slope between the DeSoto Canyon and the 90.2°W Longitude.

Leg 4: The last leg will survey in the focus area eastward toward DeSoto Canyon, until time to return to port. On the trip back into St. Petersburg, we will again make the opportunistic survey southward along the slope between the 500 and 1500m isobaths until we turn east to finish in St. Petersburg.

The area around production platforms from $\sim 87.5^{\circ}\text{W}$ to $\sim 90.2^{\circ}\text{W}$ Longitude is of particular interest during this cruise. Thus, on legs 1 and 4, additional track-lines will be allocated to this area so that it receives approximately twice the level of coverage of other areas. Legs 2 and 3 will be spent totally in this area.

During the survey, whenever a sperm whale group is encountered, we will break the survey and spend 2 to 3 days tracking the group. This will allow us to identify most (or all) individuals in the group, obtain detailed data of their small scale movement patterns over several days, identify the percentage of first year calves and large males, and measure the length of most individuals. Coda repertoires also will be recorded. After two-three days, we will leave the group and return to survey/search mode. This plan will allow us to spend a large amount of time in the region of largest interest, the Mississippi River Delta area, and will allow us to survey most of the slope off the west coast of Florida and to the west side of the Mississippi Canyon.

The above describes our general approach. However, this may be adapted to take advantage of opportunities that may arise. Such opportunities may be, for example:

- a. Making calibrated recordings of rig noise is a research priority. Time will be spent monitoring and recording when close to rigs. Appropriate protocols for contacting rigs in such situations will be worked out before-hand.
- b. If we are informed by industry that a seismic survey is likely to be initiated in an area, we may attempt to find, follow and record the behavior of any groups in that area as the survey starts.

Coordination with Industry

Because we hope to spend some time observing whales near offshore platforms, we are coordinating with the industry to develop protocols for contacting oil/gas platforms to inform them of our work and presence, and to request information on current platform activities that might relate to noise production. As a basic protocol, subject to refinement with industry, we have four levels of interaction. First, we will provide the Offshore Operators Committee (OOC) with advance information on our planned study regions and times of operation (Figure 1 and description of the four Legs above) and a description of our vessel (Figure 2), so the OOC can provide general notice to operators of when we might be in an area. Second, if we will be sailing directly towards a facility for an extended time while we are within approximately 5 nm of it, we will attempt to contact the facility so they will know who we are. Third, if we will be working within 1 nm of a facility, we will contact the operators of such facilities as soon as practical. Fourth, we will not get within 500m of a facility without obtaining prior permission of the operator. Even if we do not approach within 1 nm of a facility, we may be conducting recording of industrial sounds and so will contact several operators within an area we are working. We will seek to obtain from them information on what activities are being conducted so we can better evaluate what activity might be causing which observed industrial sound(s) and also to help determine how far away we are from the sound source(s).

We are coordinating with the International Association of Geophysical Contractors (IAGC) to obtain information on possible seismic surveys in the focus area during our cruise period. IAGC has provided information on the approximate areas of seismic surveys for the first few of weeks in June and phone contacts for companies operating in the Gulf during the summer. IAGC will provide updates during the period mid-June to mid-August. We also are coordinating with MMS to obtain information they have available on activities in our study area.

Acoustic Monitoring

The vessel will be equipped with one 200m array for continuous monitoring and one 100m array to serve as a spare, and that also can be used in tandem with a shortened 200m array for more accurate tracking. Survey speed will average 5 knots. A watch system will be established to provide round-the-clock coverage and to achieve sufficient overlap between watches to ensure continuity. While surveying and searching for whales, the person on watch will listen carefully for 1 minute every 15 minutes and enter his/her assessment of number of sperm whales, water noise, seismic noise, cetacean vocalizations, etc., in a pre-prepared form in the *Logger* data collection software. All members of the team (including the captain) have extended experience monitoring for sperm whales and other cetacean vocalizations. Once sperm whales are detected, we will use a directional hydrophone to obtain a bearing to the group of whales, and the vessel will be diverted from the survey mode and will enter tracking mode.

Extended acoustic recordings will be made whenever codas (stereotyped patterns of clicks produced by socializing whales) are heard during monitoring. Sperm whales have been reported to have coda dialects that vary between clans, and analysis of coda vocalizations should provide a perspective on sperm whale social and cultural structure in this region to complement information provided by genetics.

Visual Monitoring

During survey mode in daytime, two observers will be on watch. The observers will use unaided eyes and handheld binoculars (Fujinon 7X50) to look for sperm whales. All marine mammal and sea-turtle sightings will be recorded as well as estimates of group-size and behavior. If baleen whales are sighted within reach of our vessel, we will momentarily break the survey and attempt to close up on them for species identification and behavior observations. Furthermore, search effort and sighting conditions will be entered into the *Logger* software in pre-prepared forms. The persons on watch will rotate every two hours.

Photo-ID, Photogrammetry, Behavior Observations

Once a group of sperm whales has been detected, at least 5 people will be working during daylight hours. A variety of tasks will be performed. One person maneuvers the vessel relative to whale movements; one takes identification photographs at the bow; one is positioned just behind the photographer to measure the distance between the photographer and the sperm whale with a laser range finder; and one records data on presence of first year calves or large mature males, size of clusters, ID number, distance to the whale, presence or absence of a callus, presence or absence of defecation in the slick, and behavior of the whales (all will be recorded into a custom program running on a palmtop computer). If squid beaks or sloughed skin are observed in the wake or in the slick, these will be retrieved using a dip net. On the appropriate opportunistic

basis with whales not biopsied previously, one person (see below) will take biopsies from the flukes of sperm whales. When conditions are suitable (calm weather), we will deploy someone aloft at the mast spreaders in a bosun's chair. When the vessel is alongside an individual whale, this observer will take photographs of sperm whales and the horizon. This will allow the distance of blow-hole to dorsal fin to be measured, and thus the total length to be calculated. This method will be useful to measure individuals with missing portions in their tips, as these cannot be measured with the photogrammetry method involving the fluke width. The mast spreaders should also be an excellent observation spot, and the person in the spreaders will be able to direct the research vessel onto distant whales when no animals can be seen from the deck. We will use two-way radios for communication between the bow, wheel and spreaders.

To obtain an additional measure of sperm whale total length, we will record sperm whale vocalizations during the first few minutes of their dives.

Whenever individual sperm whales with S-tags are sighted, we will attempt to photograph the side of the whale to obtain information on the color-code of the tag. We also will record information on the condition of the tag area as well as of the tag itself. We then will attempt to take an identification photograph of this individual. We are expecting to receive the list of color-codes for each whale from Dr. Bruce Mate before the beginning of our cruise.

Genetic Sampling

Raul Diaz-Gamboa will conduct genetic biopsy sampling in coordination with photo-identification of sperm whales. A small plug of tissue (6 mm x 40 mm) will be taken from the underside of the flukes by a crossbow-propelled dart with a sterilized coring tip. The dart is free-floating and will be retrieved immediately after sampling, using the dip-net. Biopsy samples will be preserved in super-saturated DMSO solution. Up to 500 biopsy samples from sperm whales in the Gulf of Mexico can be collected under the National Marine Fisheries Service Marine Mammal Protection Act/Endangered Species Act permit no. 909-1465-03 held by Dan Engelhaupt. The amendment No. 3 to this permit (April 2, 2004) has included Raul Diaz-Gamboa as a Co-investigator to this permit.

We wish to avoid redundancy of data and thus we wish to avoid biopsying the same animal on multiple occasions. To achieve this, we will reduce biopsy effort south of the Mississippi River Delta area, where most biopsies have been taken in the past. We will also coordinate with Dan Engelhaupt to obtain photo-identifications of the sperm whales he has biopsied in the past, including during the S-tag cruise of 2004. Furthermore, we will keep track of all sperm whales biopsied during our surveys (using digital photographs), and we will not re-biopsy a group for which we have already many animals biopsied. We will also limit biopsy sampling effort to a few hours with each group.

We will record behavioral responses to biopsy sampling. Detailed observations of behaviors including small-scale movement patterns, vocalizations, and percentages of fluke-ups in relation to shallow-dives will be recorded before, during and after each biopsy session. As sperm whales have strong social bonds, the effect of biopsying an individual is unlikely to be limited to this individual, and thus it is important to also investigate potential effects on behaviors and movement patterns of the group.

Calibrated recordings

Obtaining calibrated recordings of noises produced by oil/gas platforms is a research priority which will be addressed on an opportunistic basis. Recordings will be made on a laptop PC using a data acquisition card and a calibrated hydrophone and amplifier.

Habitat Characterization

In-situ habitat characterization work will be possible by manually deploying a small CTD to a depth of about 50 meters. If practical, CTD casts will be taken on a daily basis. Sea surface temperature from a depth of approximately 1 m will be recorded every hour by a sensor already present in the hull of the vessel. As we will have the location of each sperm whale photo-identified, as well as the track of groups of whales for up to three consecutive days, we will be able to relate sperm whale distribution and movements to slope gradient and water depths. Additionally, the remote sensing activity of the study will provide ocean color and SSH images that will be related to sperm whale distribution and movements, once back at the lab. SSH fields also will be provided by TAMU to the ship approximately weekly as an aid to cruise planning.

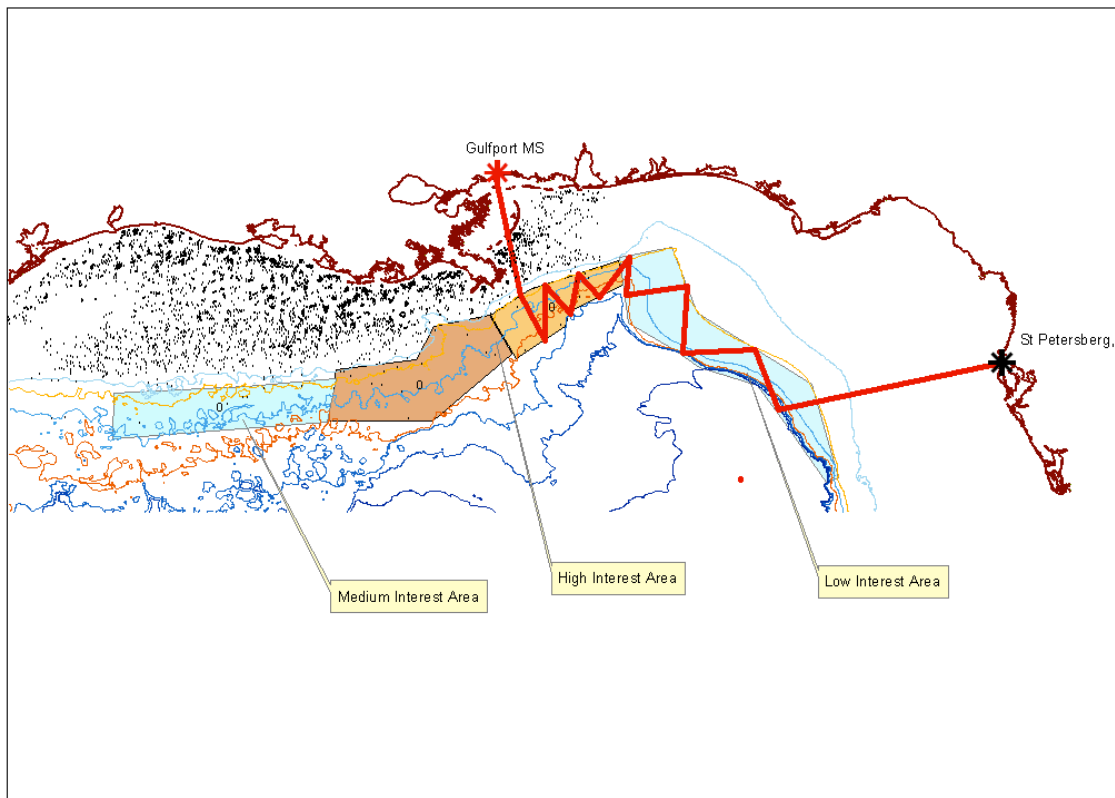


Figure 1. Study area for the SWSS Mesoscale Population Study cruise and a possible cruise track for Leg 1 showing the scale of effort in the different sub-regions of the study area. The areas of medium interest (left area in blue), high interest (focus areas; middle two areas in browns), and low interest (right area in blue) are indicated. Black dots show locations of platforms.



Figure 2. Research vessel *Summer Breeze*, a Hunter 46 sailboat, 46 foot in length.