

Protected species monitoring in Onslow Bay, NC: January – December 2009



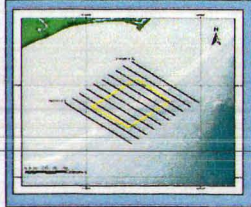
¹McAlarney, R.J., ¹Cummings, E. W., ¹Nilsson, P.B., ²Foley, H., ¹Hardee, R.E., ²Holt, R., ²Williams, L., ²Urian, Kim, ²Johnston, D.J. ¹McLellan, W. A., ¹Pabst, D. A. and ²Read, A.J.
¹Biology and Marine Biology, University of North Carolina Wilmington, ²Nicholas School of the Environment, Duke University



The protected species monitoring program, initiated in response to Onslow Bay, NC being identified as a potential site for the US Navy's Undersea Warfare Training Range (USWTR), is now into its third year. To estimate marine mammal density, distribution, and seasonality, a multi-platform approach was implemented using traditional visual line transect survey methods from aerial and vessel platforms along with passive acoustic monitoring from vessels and moored instruments. From January through December 2009, 20 aerial surveys were completed, covering 15,187 km of trackline, and 22 vessel surveys were completed, covering 1,630 km of trackline. Species sighted included *Tursiops truncatus*, *Stenella frontalis*, *Grampus griseus*, *Globicephala macrorhynchus*, *Physeter macrocephalus*, and *Steno bredanensis* in order of abundance. *T. truncatus* and *S. frontalis* comprised the majority of cetacean groups sighted in both aerial (*T. truncatus* 48 of 94, *S. frontalis* 37 of 94) and vessel (*T. truncatus* 24 of 45, *S. frontalis* 15 of 45) surveys. Approximately 1,275 digital images were taken for species ID and individual recognition during January - December 2009 from the vessel-based surveys. No individuals of any species (*T. truncatus*, *S. frontalis*, *G. griseus*, and *G. macrorhynchus*) have been re-sighted in the USWTR from photo-identification images (but see below). Passive acoustic monitoring techniques have included towing an array during vessel surveys and deploying High-Frequency Acoustic Recording Packages (HARPs) in the USWTR. Towed array results during this time suggested we visually detected approximately 60% of the dolphin groups that were acoustically detected. We have found hundreds of vocal detections in the HARP data, which will provide insights into daily and longer-term vocal variability of marine mammals. This project represents a long term data set used to assess residency and abundance patterns of this offshore area in the waters off North Carolina.

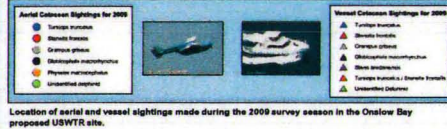
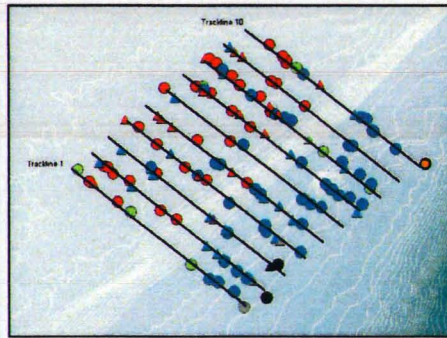
Methods

Ten parallel tracklines 40nm in length running northwest to southeast and spaced 4nm apart were overlaid on the proposed Navy range creating a survey area that included the range and a 5nm border. A standard distance sampling / line transect method was used for both aerial and vessel surveys. Aerial surveys were conducted from a Cessna 337 Skymaster traveling 185km/h at an altitude of approximately 300m in accordance to NOAA Fisheries- Southeast Region (SER) Minimum Aircraft and Crew Provisions Right Whale Data Collection Activities. Each side of the plans was monitored by one observer and was considered an independent strip transect. Vessel surveys were conducted from the flying bridge of either the MV Sensation, a 16m offshore charter fishing vessel, or the R/V Cetus, a modified 12m offshore fishing vessel. Port and starboard observers scanned for marine mammals while a third monitored the trackline and entered data into a software program (VisSurvey) connected to a GPS. Both aerial and vessel survey teams monitored and recorded environmental conditions as well as sightings of marine mammals, sea turtles and vessels in the Navy survey area. When a marine mammal was sighted the observers recorded the initial distance and sighting angle, the survey platform would break from the transect line to collect digital images, record animal behavior and estimate group size and in the case of the vessel, record vocalizations. Dorsal fin images were collected during vessel surveys to build a catalogue of individuals seen in the USWTR range. Final species identification was established after a group review of digital images back at the lab. If no images were obtained, or a definite identification could not be established the sighting was classified as "Unidentified". When possible, the survey vessel towed a 4 element hydrophone array (2-100kHz bandwidth) at 150m distance to acoustically detect cetaceans. Acoustic signals (sampled at 192 kHz) were monitored in real-time and all cetacean sounds were recorded. All data were downloaded and/or entered manually into digital archival databases. Sightings were mapped using ArcGIS 9.2 (ESRI, Redlands, CA). HARPs (0.01-100 kHz bandwidth) also were used to collect passive acoustic data during 2009. One HARP was deployed at 174m depth east of the center of the USWTR box from April 24 - August 9, 2009. This HARP was programmed to record every other five minutes at 200 kHz. Vocal events were located within these recordings using Long-Term Spectral Averages (LTSAs) generated using a Matlab-based acoustic program. On November 9, 2009, two HARPs were deployed (at depths of 171m and 335m). They were set to record for five minutes on and 10 minutes off at 200kHz. These HARPs are currently still recording data.



Line Transect Results

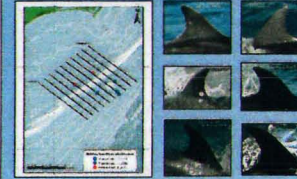
Five cetacean species were observed on effort during aerial and vessel surveys within the USWTR survey area. Bottlenose dolphins (*Tursiops truncatus*) and Atlantic spotted dolphin (*Stenella frontalis*) dominated the sightings and occurred over the widest range of months. Bottlenose dolphins were sighted most frequently from both aerial (48 of 94 sightings) and vessel (24 of 45 sightings) surveys and were observed throughout the study area, with larger groups occurring offshore of the shelf break. Atlantic spotted dolphins were the second most frequently sighted species from both aerial (37 of 94 sightings) and vessel (15 of 45 sightings) surveys and were seen exclusively in shallower waters along the continental shelf. A single on effort sighting of both short finned pilot whales (*Globicephala macrorhynchus*) and Risso's dolphins (*Grampus griseus*) occurred in offshore waters during aerial surveys, and a single on effort sighting of pilot whales, and two sightings of Risso's dolphins occurred in offshore waters during vessel surveys. One group of rough-toothed dolphins (*Steno bredanensis*) were seen during vessel surveys over the shelf break. There were additional off effort sightings of two groups of pilot whales and a single sperm whale (*Physeter macrocephalus*) from the plane during transit to and from the range. Sighting rates were highly dependent on sea state conditions for both platforms.



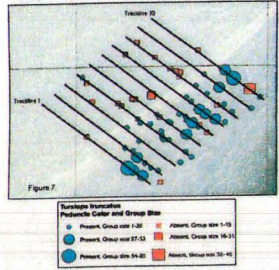
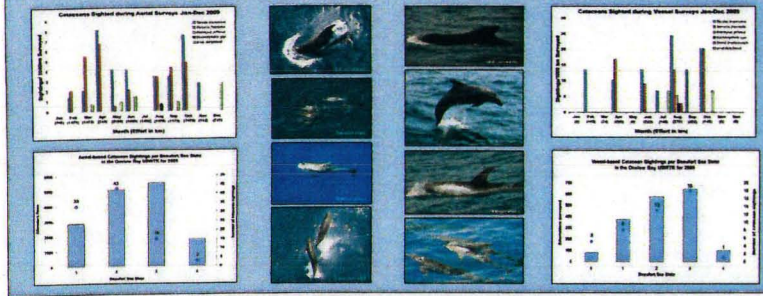
Photographic Effort

Digital photographs were obtained when possible and approximately 1,275 digital images were taken for species identification and individual recognition purposes in 2009. Of the 45 cetacean sightings we recorded in 2009, we obtained images from all but five encounters. We were unable to identify the species encountered in only two of the 45 sightings. Every attempt was made to photograph all animals encountered, primarily to validate species identification, but also to develop photo-identification catalogs for cetacean species in Onslow Bay. Images taken during the vessel-based surveys have been used to identify diagnostic features and for comparison with images taken on the aerial surveys to improve species identification.

Photo-identification is complete through December 2009. We have re-sighted two bottlenose dolphins (ID 9-016 on 25 July 2008 and 17 August 2009-presented below, and ID 4-002 on 15 September 2009 and 1 October 2009) and one spotted dolphin on 9 August 2009 and 1 October 2009. To date, we have not re-sighted any other species photographed. We will continue to take images for photo-identification and add to our existing catalogs. In addition, we compared the identification images of bottlenose and spotted dolphins identified from the USWTR surveys to dorsal fin images taken during monthly surveys conducted in 2000-2003 in the coastal waters up to 15 miles offshore from Masonboro Inlet to New River Inlet. Although we had re-sightings of animals within those surveys, we found no matches to the dolphins identified from the USWTR surveys. We also compare any images of the dorsal fins of stranded cetaceans to our photo-identification catalogs for Onslow Bay, however we have not found any matches to date. It is often difficult to maneuver the vessel to take good quality photo-identification images, especially while towing the passive acoustic array.

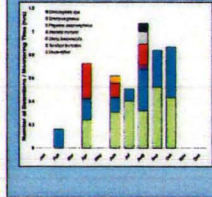


Species	Sightings	Catalog size	Number of Matches
<i>Tursiops truncatus</i>	24	94	2
<i>Stenella frontalis</i>	15	35	1
<i>Globicephala spp.</i>	1	16	0
<i>Grampus griseus</i>	2	7	0
<i>Steno bredanensis</i>	1	12	0



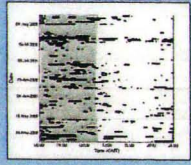
Biological Observations

A review of all images of *Tursiops* sighted over the entire survey period (July 2007 to January 2010) resulted in the identification of two distinct pigmentation patterns. On the dorsal surface of the peduncle of some dolphins, there was an obvious white pigmentation pattern extending from just caudal of the dorsal fin to near the fluke. Other bottlenose dolphins sighted in the survey area lacked this pigmentation pattern and possessed solid gray peduncles. We analyzed the distribution of dolphins that displayed the white peduncle markings, by both group size and distance from shore. Only sightings where conditions permitted clear observations of the peduncle were used in this analysis. This analysis showed that dolphins east of the continental shelf break exhibit a white peduncle and reside in larger groups, while animals on the shelf were more uniform in color and reside in smaller groups.



Passive Acoustic Monitoring

The towed hydrophone array was deployed for 20 surveys in 2009 for a combined visual and acoustic monitoring time of 95.0 hours. Of 69 acoustic detections, 43 dolphin groups (or 62%) were detected visually. Recordings were made of six cetacean species, totaling 19.5 hours of recordings. The majority of the five visually confirmed species were bottlenose dolphins (51%), followed by Atlantic spotted dolphins (28%). Although never seen, a sperm whale was heard during June 2009. The left figure shows the number of detections per monitoring time (hrs) for each species by month.



Visual inspection of the data from the April 24 - August 9, 2009 HARP deployment resulted in 399 vocal events that occurred during 93 days of the 107 days the instrument recorded. Of these vocal events, eight were from sperm whales, seven were possibly from Risso's dolphins, and one was possibly from a beaked whale. The right figure shows when all vocal events occurred during the deployment period (with shading indicating periods of darkness).

Calf Observations

Of the 160 positively identified cetacean sightings recorded in the USWTR range from June 2007 - January 2010, 39 contained at least one cow/calf pair. These sightings were stratified by species and by season to examine calving patterns. All five cetacean species recorded in the range had at least one sighting in which a calf was present. *Tursiops truncatus* had the highest number of calves recorded with a peak in the fall (top table). *Stenella frontalis* was sighted consistently throughout the year but no calves were observed in the summer months. *Globicephala macrorhynchus* was seen primarily in the summer months during which all 5 sightings had calves present. Of the four *Steno bredanensis* sightings only one, which occurred in the summer contained a calf. *Grampus griseus* has only been recorded in the summer months; in two of three sightings calves were present.

For *Tursiops truncatus*, neonates are approximately 50% of maternal total body length (Mead & Potter 1990). Thus, to estimate the relative age of a calf, we scored calves as being either greater than or less than 50% of the associated adult individual's length. To conduct this analysis, at least one image must have contained a calf in close physical association with an adult animal (assumed to be the mother) and both individuals needed to be in a straightened body posture. Twenty of the 39 calf sightings met this criterion. Using Microsoft PowerPoint a line was drawn from the tip of rostrum to the fluke notch for the adult, and this distance was given the value 1.0. The same procedure was done for the calf and the relative total length of the calf was calculated. In *Tursiops truncatus*, small calves (<50% of adult body length) were seen predominantly in the fall. For *Grampus griseus* all sightings were in the summer and all calves were <50% of adult length (bottom table).

Species	Sighting	Season			
		Spring	Summer	Fall	Winter
<i>Tursiops truncatus</i>	39	1	1	1	8
<i>Stenella frontalis</i>	15	1	1	1	1
<i>Globicephala macrorhynchus</i>	5	1	1	1	1
<i>Steno bredanensis</i>	1	1	1	1	1
<i>Grampus griseus</i>	2	1	1	1	1

Species	Sighting	Season			
		Spring	Summer	Fall	Winter
<i>Tursiops truncatus</i>	39	0	1	8	11
<i>Stenella frontalis</i>	15	0	4	3	2
<i>Globicephala macrorhynchus</i>	5	0	2	1	1
<i>Steno bredanensis</i>	1	0	1	0	0
<i>Grampus griseus</i>	2	0	2	0	0

Acknowledgements

For collaborative efforts we thank our colleagues at St. Andrews University (Charles Paxton and David Borchers). For the aerial surveys, we thank Orion Aviation, especially Ed Coffman, and pilots John Estes, Stephanie Funston, Dave Huddle, Larry Latsch, Wayne McKendry, Ron Shreck, and Bob Stice. Vessel surveys were made possible with the expert help of Captain Dale Britt of the MV Sensation and Captain Matt Besch of the R/V Cetus. We would like to thank Julia Burrows, Jennifer Dunn, Jenny Tennesen, Trey and Sara McDonald, Anna and Ross McGregor, Remy Tyson, Lesley Thorne, Barbie Byrd, Caroline Good and Tom Ninkle for help in the field. Lance Garrison modified the data collection software, VisSurvey for our use. This research was conducted under NOAA Scientific Permit (No. 948-1692-00) held by UNCW and a General Authorization from the National Marine Fisheries Service (GA No. 808-1584) to Duke. Funding provided by the US Navy.