CETACEAN OCCURRENCE OFF VIRGINIA’S OUTER CONTINENTAL SHELF

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Abstract

One hundred four kilometers (km) east of Naval Station Norfolk (NSN), the world’s largest U.S. Navy base, lies the continental shelf break and the Norfolk Canyon – areas known to have considerable cetacean species diversity based on previous broad-scale stock and population surveys. These waters also play a vital role in the U.S. Navy’s training and testing operations given their complex bathymetry and proximity to NSN. In 2015, the U.S. Navy initiated a multi-year study to provide a more detailed assessment of species occurrence, diversity, population, and habitat use in the Norfolk Canyon region, and to examine medium-scale movements and dive behavior of large whales. Between April 2015 and August 2017, twenty-five small-boat surveys using photo-ID, biopsy sampling, and satellite-monitored tagging techniques were conducted. There were 401 sightings of 14 cetacean species recorded (including sightings over the continental shelf en route to the study area). Priority species encountered were fin whales (Balaenoptera physalus) (n=16), sperm whales (Physeter macrocephalus) (n=23), minke whales (Balaenoptera acutorostrata) (n=5), humpback whales (Megaptera novaeangliae) (n=3), sei whales (Balaenoptera borealis) (n=1), and Curvier’s beaked whales (Ziphius cavirostris) (n=1). The species most often sighted were pilot whales ( Globicephala sp.) (n=153), bottlenose dolphins (Tursiops truncatus) (n=112), and short-beaked common dolphins (Delphinus delphis) (n=57). Additional observations of Atlantic spotted dolphins (Stenella frontalis) (n=14), Risso’s dolphins (Grampus griseus) (n=10), striped dolphins (Stenella coeruleoalba) (n=4), and harbor porpoise (Phocoena phocoena) (n=2) were also recorded. Fifteen LIMPET-configured satellite-monitored tags (SPOT6 and SPLASH) have been deployed to date on fin whales (n=7) and sperm whales (n=8). Preliminary tag data suggest site-fidelity to the Norfolk Canyon by sperm whales over periods of weeks, while fin whales show a mix of both minimal and extreme movement patterns within and outside of the study area. Future efforts will provide more detail on habitat use in this region.

Background and Methods

Primary objectives:
- Describe which cetacean species occur over the outer continental shelf, shelf break, and continental slope and how occurrence fluctuates seasonally.
- Study the baseline behaviors and ecological relationships of offshore cetaceans within the study area.
- Determine whether individual cetaceans exhibit site fidelity within specific regions of the study area.
- Investigate the seasonal extent of cetacean movements within and around the U.S. Navy Virginia Capes (VACAPES) operating area.
- Determine whether cetaceans spend significant time within or primarily move through areas of U.S. Navy live-fire or Anti-Submarine Warfare training areas.

Satellite tagging:
- Wildlife Computers (Redmond, Washington) Smart Position and Temperature (SPOT6) Argos satellite-linked tags in the Low Impact Minimally Percussive External-electronics Transmitter (LIMPET) configuration (Andrews et al. 2008)* (Figure 4) were utilized.
- The tags were remotely deployed using a DAN-INJECT JMS25 pneumatic projector (www.dan-inject.com).
- Two 6.8-centimeter surgical-grade titanium darts with six backwards-facing metal plates were used to attach tags to the dorsal fin or just below the dorsal fin.
- Maximum tag attachment duration was expected to be less than 30 days; therefore, tags were programmed to transmit the number of transmissions and locations received during attachment rather than to extend battery life.
- Based on satellite availability in the tags, were programmed to transmit for 22 hours/day with an unlimited number of transmissions for the first 40 days.
- Locations of tagged individuals were approximated by the Argos system using the Kalman filtering location algorithm (Argos Users Manual © 2007-2015 CSL), and unrealistic locations (i.e., those on land) were manually removed using tools provided through Movebank (www.movebank.org).

Results

- 25 offshore surveys completed between April 2015 and August 2017 (Figures 5 & 6).
- 401 cetacean sightings with confirmed species identification (Figures 5 & 6).
- Priority Species:
  - 23 sperm whale (44 individuals)
  - 16 fin whale (32 individuals)
  - 5 minke whale (6 individuals)
  - 3 humpback whale (3 individuals)
  - 1 sei whale (2 individuals)
  - 1 Curvier’s beaked whale (5 individuals)
- 15 satellite tags deployed:
  - 5 SPOT6 and 2 SPLASH on fin whales
  - 2 SPOT6 and 6 SPLASH on sperm whales

Satellite tag results:
- Satellite tags transmitted 3.6-39.0 days (mean=19.1 days) (Table 1).
- Sperm whales had a higher percentage of locations within the VACAPES range compared to fin whale tag locations (Table 1).
- Fin whale movements show majority of locations over the continental shelf, with the exception of one individual – HDRA0307 (Figure 7).
- Sperm whale movements show ranges closer to shelf edge and canyons, with some staying very close to initial tagging location (Table 1 & Figure 8).
- Mean fin whale dive duration ranged from 8.8-10.4 minutes and mean dive depth ranged from 27.6-52.4 meters (Table 2).
- Mean sperm whale dive duration ranged from 25.8-38.2 minutes and mean dive depth ranged from 437.5-886.7 meters (Table 2).

Conclusions

- Endangered Species Act-listed sperm and fin whales were frequently observed in the study area.
- High cetacean species diversity overlaps with areas utilized for U.S. Navy training exercises.
- Preliminary sighting locations and satellite tag data support different habitat use patterns and ranges for each species of interest, which is an important consideration to potential impacts.
- Incorporation of switching state space modeling will provide insight into foraging ecology.
- Future study is needed to assess patterns of residency for individuals of all species using a combination of photo-ID and satellite tagging techniques, a critical element with respect to population consequences.