

Patterns of cetacean occurrence in the deep waters off Virginia and North Carolina



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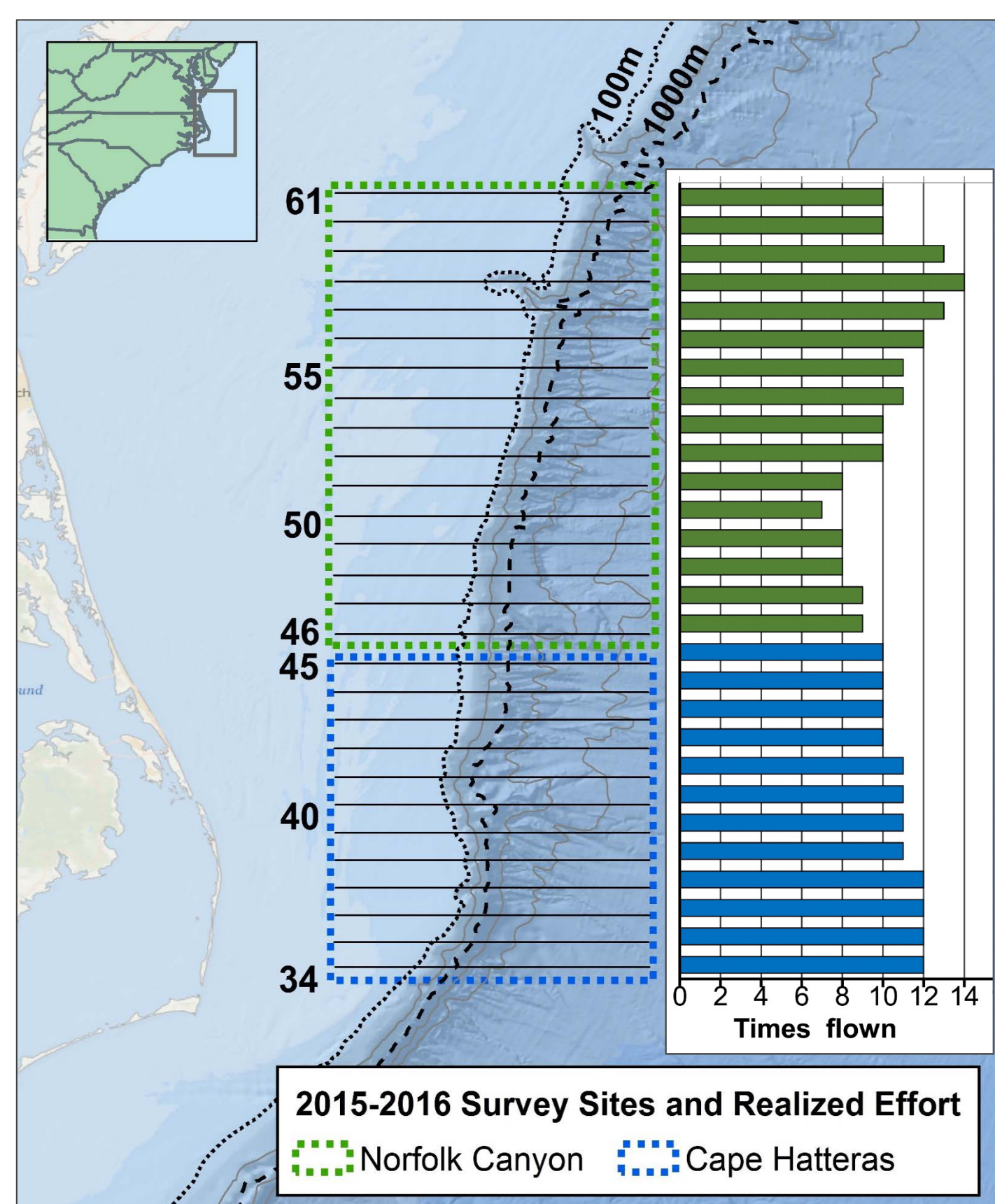
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Abstract

Long-term aerial surveys, supported by the U.S. Navy's marine species monitoring program, have provided insights into the abundance and distribution of cetaceans in the U.S. mid-Atlantic. Since 2011, line transect surveys conducted offshore of Cape Hatteras have contributed to the identification of this area as a "hot spot" for cetacean diversity (Roberts *et al.* 2016). In 2015, effort was expanded north to include waters surrounding Norfolk Canyon off Virginia. These adjacent sites cover a 21,000 km² area from Avon, NC north to Cape Charles, VA. Aerial survey effort conducted in 2015 and 2016, representing 20,523 km of trackline, revealed similar species diversity across areas, with 14 (Norfolk Canyon) and 13 (Cape Hatteras) species found at each site. Bottlenose dolphins and short-finned pilot whales were the most frequently sighted species at both sites. Bottlenose dolphins were sighted both on and off the continental shelf, while pilot whales were sighted exclusively offshore of the shelf break. Balaenopterids were more commonly encountered at the Norfolk site, with 18 sightings, including fin (11 sightings), humpback (4 sightings) and minke (3 sightings) whales, than at Cape Hatteras (4 fin and 2 humpback whale sightings). In contrast, deep divers were more commonly sighted at Cape Hatteras, with 30 sightings, including Cuvier's (18 sightings), Gervais' (2 sightings) and mesoplodont (3 sightings) beaked whales; sperm whales (4 sightings); and kogiids (3 sightings). At Norfolk Canyon, 15 sightings of deep divers included a single sighting of True's beaked whale, 4 sightings of Cuvier's and 2 sightings of mesoplodont beaked whales, and 8 sightings of sperm whales. Seasonal sighting rates corrected for effort peaked during the fall in the Norfolk Canyon site while the Cape Hatteras site peaked in the spring. Effort in both survey sites continues through 2017 allowing further refinement of patterns in cetacean habitat utilization.

Survey Design



Aerial surveys conducted off Cape Hatteras from April 2011 to December 2014 resulted in 354 cetacean sightings comprised of 18 species (Roberts *et al.* 2016). Established in 2015, the Norfolk Canyon survey site allows further examination of pelagic cetacean populations along the continental slope. Concurrent survey effort in each site from 2015-2016 are presented.

Goal

To compare species diversity and abundance (corrected for effort) across the Cape Hatteras and Norfolk Canyon sites.

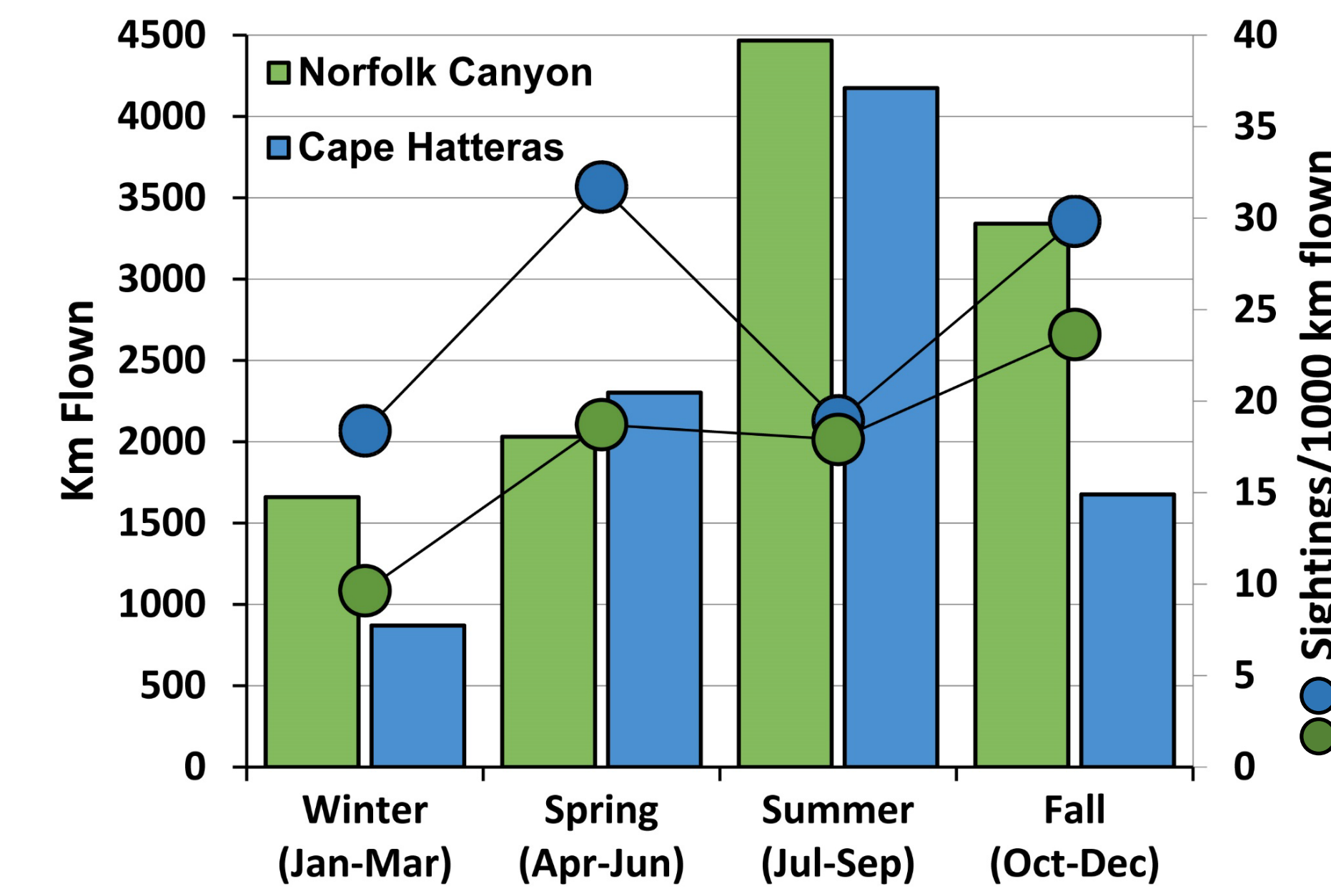
Results

Survey effort varied by location and season with 11,500 km flown in Norfolk Canyon and 9,000 km flown in Cape Hatteras.

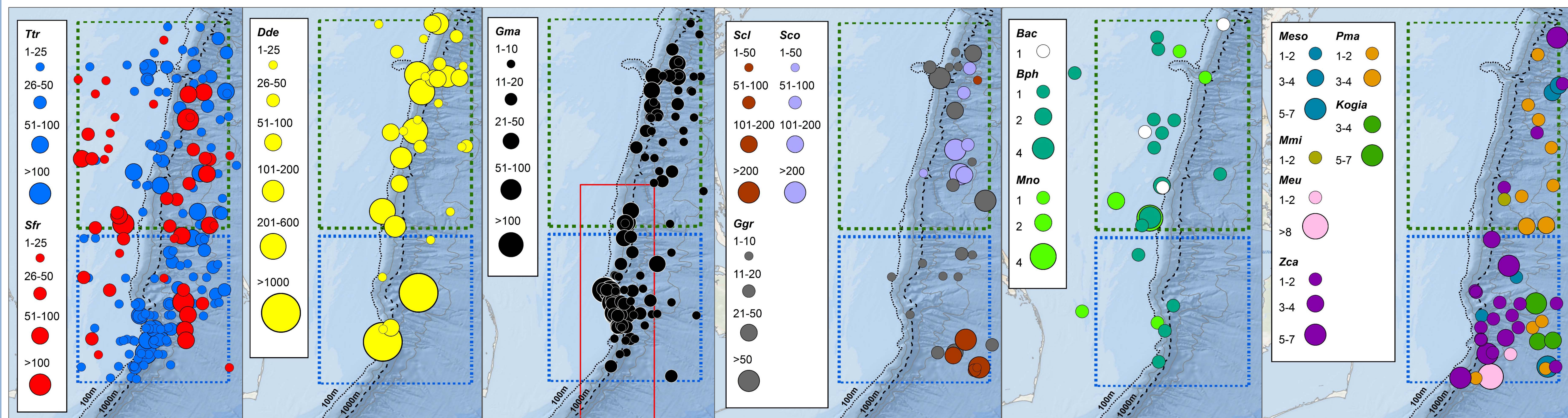
Eleven species were present in both survey areas.

Total number of sightings were similar across both survey areas, but over 2,000 more individuals were observed in the Cape Hatteras site.

Effort corrected sighting rates were highest in fall in Norfolk Canyon and in spring and fall in Cape Hatteras. Across seasons effort corrected sighting rates were higher in Cape Hatteras than in Norfolk Canyon despite higher average BSS in Cape Hatteras in all seasons.



| Species | Norfolk Canyon | | Cape Hatteras | |
|-----------------------------------|----------------|-------------|---------------|-------------|
| | Sightings | Individuals | Sightings | Individuals |
| <i>Balaenoptera acutorostrata</i> | 3 | 3 | | |
| <i>Balaenoptera physalus</i> | 11 | 15 | 4 | 4 |
| <i>Megaptera novaeangliae</i> | 4 | 8 | 2 | 2 |
| <i>Delphinus delphis</i> | 28 | 2980 | 6 | 4605 |
| <i>Globicephala macrorhynchus</i> | 44 | 580 | 56 | 1688 |
| <i>Grampus griseus</i> | 10 | 256 | 11 | 122 |
| <i>Stenella coeruleoalba</i> | 7 | 1098 | | |
| <i>Stenella clymene</i> | 1 | 20 | 5 | 850 |
| <i>Stenella frontalis</i> | 31 | 1422 | 16 | 806 |
| <i>Tursiops truncatus</i> | 59 | 1365 | 88 | 1818 |
| <i>Kogia</i> spp. | | | 3 | 13 |
| <i>Mesoplodon europaeus</i> | | | 2 | 14 |
| <i>Mesoplodon mirus</i> | 1 | 2 | | |
| Mesoplodont beaked whale | 2 | 7 | 3 | 10 |
| <i>Physeter macrocephalus</i> | 8 | 13 | 4 | 5 |
| <i>Ziphius cavirostris</i> | 4 | 12 | 18 | 42 |
| Totals | 213 | 7781 | 218 | 9979 |



Bottlenose and spotted dolphins

Distance from shore (>34km) and water depth (>34m) suggest the majority of sightings are of the offshore ecotype of bottlenose dolphins.

(Torres *et al.* 2013)

A high concentration of bottlenose dolphins were sighted at the shelf break in Cape Hatteras.

Spotted dolphins were distributed across both shallow and deep waters but absent over the continental shelf break.

In the Onslow Bay survey area, 175km south, spotted dolphins were observed exclusively inside the 100m isobaths.

Both the heavily spotted and lightly spotted ecotypes of *S. frontalis* were recorded at both sites. Both color patterns were observed in shallow and deep waters.

Common dolphins

Most sightings occurred along or offshore of the continental shelf break.

Highest number of sightings at both sites occurred in the late winter and early spring months.

This species was commonly sighted in Norfolk Canyon with an average group size of 106 individuals. While sighted only six times in Cape Hatteras, two groups represented 4,500 individuals.

Common dolphins have been sighted more times in Norfolk Canyon in two years than have been observed in the previous six years in Cape Hatteras.

This species preference for temperate waters may account for difference in distribution. (See OBIS SEAMAP)

Short-finned pilot whales

Short-finned pilot whales are the second most frequently observed species at both sites, second only to bottlenose dolphins.

Sightings occurred exclusively along or offshore of the continental shelf break at both sites.

All sightings in Norfolk Canyon were of groups with fewer than 50 individuals. Groups of multiple hundreds were observed in Cape Hatteras.

In Cape Hatteras the highest density of pilot whales was observed within the Cape Hatteras Special Research Area (CHSRA), an area of high commercial fishing activities.

(See red outline)

Other Pelagic delphinids

Sightings of clymene dolphins are consistent with this species' tropical to subtropical distribution in deep pelagic waters.

During this study period, striped dolphins were only recorded in Norfolk Canyon. Prior to 2015 four sightings of this species were observed in the northern portion of the Cape Hatteras site.

Risso's dolphins were sighted a similar number of times at both sites, although group sizes were higher in Norfolk Canyon.

Discussion

The designation of these two survey sites does not follow any physical or oceanographic feature but rather reflects boundaries defined for AFTT monitoring. The high degree of species overlap observed indicates that there is suitable habitat for most species across both survey sites.

Species diversity was high in both the Norfolk Canyon and Cape Hatteras sites.

Despite less effort in higher average sea states, seasonal sighting rates were always higher at Cape Hatteras than at Norfolk Canyon. This result support identification of Cape Hatteras as a site of high density and diversity of cetaceans along the US Atlantic coast.

Baleen whales

Baleen whales were more commonly sighted in the Norfolk Canyon site than in Cape Hatteras.

Two fin whales with acute propeller injuries were observed.

A group of four humpback whales and four fin whales were observed during one sighting within 3km of each other.

While not present during the 2015-16 season, minke whales have been observed on two occasions in Cape Hatteras since surveys began in 2011.

Deep diving species

Three species of beaked whales have been identified from the air.

The Cape Hatteras region has among the highest densities of beaked whales in the world. (McLellan *et al.* submitted)

Beaked whales were much less commonly sighted in the Norfolk Canyon survey area.

Information on sperm whales presented in poster by Cummings *et al.*

Kogia spp. sightings include: mom calf pair, inking and group of seven individuals. Acoustic detections suggest species may be more prevalent in the area. (Hodge *et al.* prep)