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# Do foraging beaked whales and sperm whales target the Gulf Stream frontal edge off Cape Hatteras? Using long-term passive acoustic monitoring to explore habitat associations

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Beaked whales (family Ziphiidae) and sperm whales (Physeter macrocephalus) inhabit the continental shelf slope and pelagic waters in the western North Atlantic Ocean, but little is known about their associations with dynamic oceanographic features, such as fronts, which can aggregate prey. Here we analyze data from a multi-year passive acoustic monitoring program to explore associations between the foraging activity of beaked and sperm whales and the presence of the Gulf Stream, the dominant oceanographic feature off Cape Hatteras, North Carolina. From 2012 to 2015 we collected acoustic recordings on the continental slope using an autonomous, bottom-mounted acoustic recording package moored at approximately 900 m depth and sampling at 200 kHz. This effort resulted in 741 recording days spanning all seasons. We detected echolocation signals from Cuvier's beaked whales (Ziphius cavirostris) consistently throughout the year (95% of recording days), and from Gervais' beaked whales (Mesoplodon europaeus) more sporadically (33% of recording days). Sperm whale foraging clicks were detected on 70% of recording days and demonstrated greater seasonal variability than Cuvier's beaked whales, with strong peaks during winter (January - March) and early summer (June - July). We observed a negative correlation between weekly detection rates of Cuvier's beaked and sperm whales, suggesting some degree of temporal segregation in the foraging activity of these species at this site. We are using environmental predictor variables derived from a high-resolution 3D ocean circulation model, reanalyzed over the acoustic monitoring period, to assess relationships between foraging activity and the position and strength of the density gradient demarcating the frontal edge of the Gulf Stream. This approach takes advantage of the temporal resolution and coverage of the environmental model and the unique time series provided by passive acoustic data to better understand habitat preferences of deep-diving odontocetes in an oceanographically dynamic region.



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