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Combining remote sensing and in situ measurements to study biophysical interactions in Gulf Stream fronts and eddies

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Fronts and eddies serve as important “hotspots” of marine life, creating important foraging opportunities for upper trophic level predators, particularly in oligotrophic regions. However, few studies have explicitly examined the biophysical mechanisms that enhance foraging opportunities for top predators in these features. We studied Gulf Stream Frontal Eddies (GSFEs), which interact with the coastal shelf off the coast of North Carolina. In particular, we investigated the oceanographic dynamics and prey distributions within GSFEs and the Gulf Stream front at a fine scale, and related these findings to the distribution of seabirds at a larger temporal and spatial scale using remotely sensed data. We conducted boat-based seabird surveys between June 2007 and September 2009. We assessed the distribution of potential seabird prey using 38 kHz and 120 kHz Simrad transducers and measured current regimes using a 300 kHz Acoustic Doppler Current Profiler (ADCP) during the summer and fall of 2009. Finally, we used satellite images of sea surface temperature to examine the distribution of seabirds in relation to broader-scale oceanographic features. GSFEs and the Gulf Stream front were important foraging areas for pelagic seabirds, but seabird species differed in their use of oceanographic habitats. We found differences in the distribution and dispersion of prey in Gulf Stream, eddy and coastal waters and discuss these differences in relation to the distribution and foraging strategies of the seabirds that exploit these features. Our findings directly link the existence of meso-scale oceanographic features to the prey and foraging ecology of upper trophic level marine predators.

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