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Title : The foraging ecology of North Atlantic right whales and its potential energetic implications

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Abstract : The foraging behavior of the endangered North Atlantic right whale (Eubalaena glacialis) was investigated in the lower Bay of Fundy and the southwestern Scotian Shelf during the summers of 2000 and 2001 by monitoring the diving behavior of whales equipped with suction-cup mounted archival tags. The vertical distribution of the right whale's primary prey, the older life stages of the copepod Calanus finmarchicus, was measured at resurfacing locations of the tagged whale using an optical plankton counter. Right whale feeding dives were characterized by rapid descent from the surface to a particular depth between 80 and 175 m, remarkable fidelity to that depth for 5-14 min and then rapid ascent back to the surface. Calanus finmarchicus aggregated in discrete layers above a turbulent bottom mixed layer, and a strong correlation was observed between the average right whale feeding dive depth and the average depth of peak C. finmarchicus abundance ($r = 0.902$, $n = 31$ individuals, $p < 0.0001$). We estimated maintenance metabolic rates for the tagged whales using a simple model based on the Kleiber curve, and compared these to estimated ingestion rates computed from observations or literature values of gape area, swim speed, time at depth, and the abundance and energy content of C. finmarchicus. Of the 22 whales tagged for over an hour, 8 (36%) did not acquire enough energy at the estimated ingestion rates to meet the modeled daily maintenance needs. Biases in our methods (e.g., short attachment durations, limited seasonal and geographic sampling, uncertainty in metabolic rates) make it impossible to determine from these observations if right whale reproduction is limited by nutritional uptake. However, this study has demonstrated a method for producing meaningful estimates of prey consumption by planktivorous whales over time scales of several hours.