

Abstract

The North Atlantic right whale (*Eubaleana glacialis*; Muller 1776) is critically endangered. Large variations in their summer distribution and reproductive capacity have led to postulations that variations in their prey field may be contributing to population growth limitations. In summer and autumn, in the Grand Manan Basin region of the Bay of Fundy, as much as two-thirds of the species feeds on their principal prey; the diapausing stage of the copepod *Calanus finmarchicus* (Gunnerus, 1765). In this thesis, I estimate the energy available in the Basin and determine the degree to which the food resource meets the energy demands of the right whales. I provide estimates of the spatial (1 to 10^4 m) and temporal (tidal and monthly) variation in the concentration distribution, stage, size and lipid- and gross-energy content of the prey field. Prey-field energy density reaches a maximum in September (3 kJ m^{-3} ; water-column average) when right whales are most abundant. Energy density varies 25 fold with depth ($\ll 1$ to 20 kJ m^{-3}) and 5 fold at-depth-with-time over a tidal cycle (4 to 20 kJ m^{-3}). Oceanographic sections of energy density also demonstrate tidal influence and provide length-scale estimates (4 to 8 km) of the highly concentrated energy available (reaching 45 kJ m^{-3} to the whales. When the spatially integrated estimate of the total energy ($1.2 \times 10^{14} \text{ J}$) within the measured feeding habitat (280 km^2) is coupled with whale energy-demand, including reproduction costs, and prorated over a year, the habitat can support 200 whales for 95 days. However, prey-field patchiness influences the daily ingestion rate; whales foraging at 1.5 m s^{-1} can meet total demand, including reproduction, with 20 h foraging at the maximum energy density of $4.5 \times 10^4 \text{ J m}^{-3}$. If 2 m s^{-1} foraging is possible, then total demand can be met in 14 h at $4.5 \times 10^4 \text{ J m}^{-3}$ and in 24 h at $3 \times 10^4 \text{ J m}^{-3}$.