



Patuxent Wildlife Research Center
Science Brief for Resource Managers

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Science Brief PWRC 2003-33

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Use of Stable Isotopes to Determine the Relative Importance of Horseshoe Crab Eggs to Long-Distance Migrant Shorebirds in Delaware Bay

Description:

Food quality and food availability during stopover are important factors that ultimately define the migratory and often reproductive fitness of migratory birds. In Delaware Bay, eggs of the Atlantic horseshoe crab (*Limulus polyphemus*) have long been believed critical to the maintenance of long-distant migrant shorebird populations. The age-old spectacle of migrant shorebirds feasting on crab eggs may be threatened by a recent increase in the harvest of horseshoe crabs for commercial fishing bait. To better understand the importance of horseshoe crab eggs in the diet of spring-migrant shorebirds, we propose to apply stable isotope methodology to fingerprint foods used by shorebirds during stopover and determine the relative importance of each in the diet. In addition, field measurements will be compared to those obtained in controlled pen feeding trials that will evaluate isotopic turnover rates and end point fractionation signature values of captive red knots and ruddy turnstones held on a strict diet of crab eggs.

Progress to Date:

Noninvasive blood sampling to obtain small quantities of plasma for isotopic signature tracking proved highly successful and was expanded to other species on a large-sample scale in 2002. Signature profiling included red knot, ruddy turnstone, least sandpipers, semipalmated sandpipers and short-billed dowitchers, with smaller samples for dunlin and sanderling. Pen feeding trials with red knots and ruddy turnstones were highly successful and documented rapid weight gains over the same time frame as stopover for both species in Delaware Bay. During periods of hyperphagia and weight gain, red knots consumed an average 18,000 crab eggs per bird

per day. All species showed distinct convergence of $*^{15}\text{N}$ isotope signature with increasing body mass indicating that those shorebirds prominent on the Delaware beaches during May were eating the same diet of dominantly crab eggs. This relationship also indicated that body mass was a direct correlate of time spent eating crab eggs, a novel finding given that strong convergence could be displayed for a sample of birds captured at one point in time.

Management Implications:

This application of stable isotope methods importantly confirms the high degree of dependence of red knots and other shorebirds on horseshoe crab eggs in Delaware Bay during spring stopover. Moreover the pen feeding trials are the first direct evidence that demonstrates that shorebirds can eat crab eggs exclusively and make rapid weight gains to reach migratory fitness in a time frame to keep them on schedule for breeding in the Arctic. These findings support the notion that the status of shorebirds is directly linked to the availability of crab eggs and thus to the status of the horseshoe crab population.

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