

THE NUTRITIONAL ECOLOGY OF SONGBIRDS: HOW FOOD QUALITY,  
DIET PREFERENCES, AND FOOD LIMITATION INFLUENCE NUTRIENT  
STORAGE AND USE DURING MIGRATION.

BY

BARBARA JEAN PIERCE

A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE  
REQUIREMENTS FOR THE DEGREE OF  
DOCTOR OF PHILOSOPHY  
IN  
ENVIRONMENTAL SCIENCES

UNIVERSITY OF RHODE ISLAND

2003

## ABSTRACT

Birds during migration alternate between periods of fasting during active flight and then intense re-feeding at stopover sites as they prepare for their next flight. At stopover sites, birds must select foods that satisfy their elevated nutrient and energy requirements even though food quantity and quality at these sites is often unpredictable. The primary goals of my research were to (1) examine the effects of food quality, food quantity, and digestive physiology on the dynamics of nutrient reserves in a small migratory songbird (Manuscript I), (2) determine how nutrient preferences and diet influence the composition of nutrient reserves in a small migratory songbird (Manuscript II-III) and (3) examine the patterns and energetic consequences of seasonal changes in composition of nutrient reserves in small migratory songbirds (Manuscript III-IV).

When we fasted or food-restricted white-throated sparrows (*Zonotrichia albicollis*) and then provided them *ad libitum* grain or fruit diets, food limitation caused a reduction in lean and fat reserves with about 20% of the decline in lean mass composed of digestive organs. After food limitation, grain-fed birds increased food intake and regained body mass by the second day of refeeding whereas fruit-fed birds did not. These results support the gut-limitation hypothesis and suggest that fruit may be inadequate food for migrating birds.

Using cafeteria-style choice experiments, we determined that red-eyed vireos (*Vireo olivaceus*) prefer diets with more long-chain unsaturated fatty

acids and these preferences did not change seasonally. Fatty acids that predominated in the diet also predominated in the tissues of birds fed the diet. However, fatty acid composition of lipid stores in vireos fed a diet rich in unsaturated fat varied with season suggesting that both selective metabolism of fatty acids and diet influence composition of lipid stores in birds. Vireos fed a diet containing less unsaturated fat had mass-specific peak metabolic rates ( $MR_{\text{peak}}$ ) that were 25% higher than those of vireos fed a diet rich in unsaturated fat. Thus, vireos can manipulate the fatty acid composition of their body fat by selectively feeding, and fatty acid composition of their body fat influences their aerobic performance.