



Migrating Songbirds on Block Island

Key findings from ongoing research into stopover ecology

The Nature Conservancy has named Block Island one of the “Last Great Places” in the Western Hemisphere. A diversity of habitats here supports a diversity of wildlife, including a vast array of songbirds. With the passing of autumn cold fronts, Block Island receives hundreds of thousands of birds as they migrate along the New England coastline—creating a living laboratory for biologists.

Years of research have revealed how songbirds use Block Island. And, more generally, this work has shown how migrating songbirds choose the foods so important to their flights, how they decide when they are prepared to continue their journeys, and how they move through the regional landscape. This document summarizes major findings to date from the McWilliams lab at the University of Rhode Island.

A sweet suite of options—Block Island offers a rich berry menu for migrating songbirds

Researchers on Block Island first documented that many insect-eating and seed-eating birds shift to feasting on fruits during fall migration. Such “diet-switching” has since been widely observed and understood as a strategy to use nutritious, and seasonally abundant, fruits to prepare for migration. Further research on Block Island has shown that fruits help birds fatten for their flights, and that the type of fruits that birds select matters, for important nutritional reasons.

Building fat stores of good quality is necessary for animals that must burn large amounts of high-energy fuel to complete their migrations (McWilliams et al. 2004. *Journal of Avian Biology* 35:377-393). Studies show that the fruit-rich habitats of Block Island produce birds with higher fattening signatures

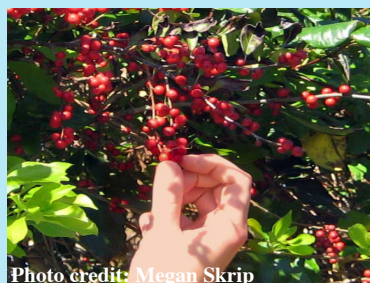


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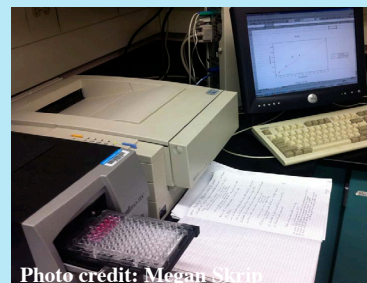


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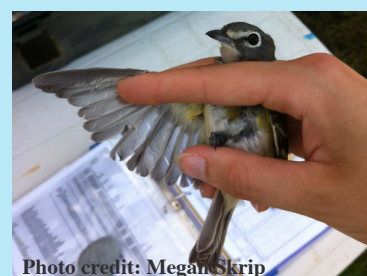


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Answering diverse questions requires using a variety of techniques. Clockwise from top: Researchers perform berry exclusion studies to investigate consumption patterns of fruits by wild birds; chemical analyses in the lab reveal the nutritional components of these fruits; blood sampling reveals birds’ physiological state, and how they are preparing for migration; radio-telemetry allows researchers to learn where individual birds go and how they use a landscape.

in their blood than similar, but fruit-poor, habitats on the mainland (Smith & McWilliams. 2010. *Auk* 127:108-118).

Fruit consumption monitoring on Block Island indicates which fruits wild birds decide to eat; chemical analyses of those fruits even suggest how birds are making those dietary decisions. Arrowwood *Viburnum* fruits are highly prized on Block Island, presumably due to their unique combination of abundant, high-quality fats and many antioxidants, compounds that protect birds’ cells from damage during endurance exercise like migratory flights (Pierce & McWilliams. 2014. *Integrative & Comparative Biology* 54:903-912).

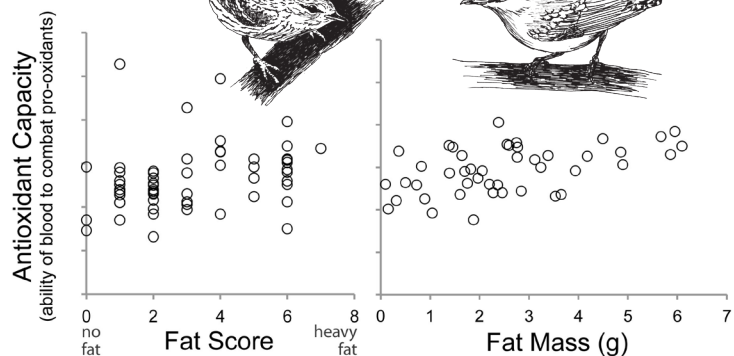
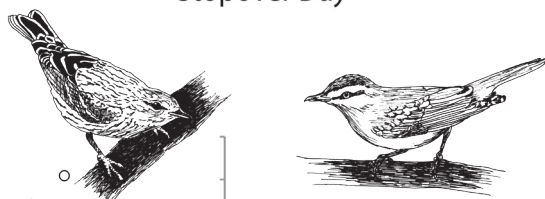
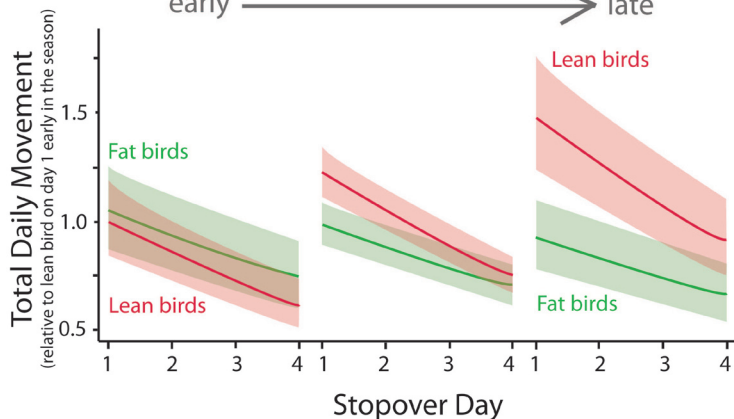
Native fruits commonly eaten by migratory songbirds on Block Island, ranked by consumption rate:

Common Name	Scientific Name	Nutrient Content ¹		Antioxidant Content ²	
		Fat	Carbohydrate	Anthocyanins	Vit. E
Arrowwood Viburnum	<i>Viburnum dentatum</i>	High	High	High	High
Virginia Creeper	<i>Parthenocissus quinquefolia</i>	Med	High	Med	Low
Winterberry	<i>Ilex verticillata</i>	Low	High	Med	Low
Northern Bayberry	<i>Myrica pennsylvanica</i>	High	High	Med	High
Black Chokeberry	<i>Aronia melanocarpa</i>	Low	High	Low	High

¹Nutrient Content for fat and carbohydrate is “High” if > 40% dry wt, “Med” if btw 20-30%, and “Low” if < 5%. ²Anthocyanin content is “High” if ca. 7%W/W by the pH-differential method, “Med” if ca. 2%, and “Low” if < 1%; vitamin E (alpha-tocopherol) content is “High” if > 100 µg/g dry wt and “Low” if < 100 µg/g. Protein content is adequate for all species (Langlois & McWilliams. 2010. *Auk* 127:850-862).

Migrating songbirds consume a variety of native fruits on Block Island. Birds eat Arrowwood fruits most, choosing these fruits while others are still abundant. Notably, Arrowwood fruits are a rich source of fats, carbohydrates, and two main kinds of dietary antioxidant: anthocyanins, which give the berries color, and vitamin E. Sources: Smith et al. 2007. *Wilson Journal of Ornithology* 119:419-428; Bolser et al. 2013. *Wilson Journal of Ornithology* 125:97-108; Alan et al. 2013. *Wilson Journal of Ornithology* 125:513-525

Thrush Migration Season
early → late



Get ready, get fat, go! Body composition & migratory songbirds' stopover decisions

Besides investigating what birds choose to eat on stopover, understanding migration physiology also requires studying the condition of migrating birds, and how their energy stores affect their behavior and chemical makeup. Recent experimental evidence with radio-marked Hermit Thrushes (left, top panel) shows that movement activity among lean birds intensifies as the migration season progresses, presumably as they increase foraging in response to declining fruit resources, and fat birds leave Block Island sooner than lean birds (Smith & McWilliams. 2014. Behavioral Ecology 25:1423-1435). In both groups of birds, activity is greatest on the first day of stopover and decreases thereafter, as birds become more familiar with the location of resources.

Also, fat birds appear to accumulate higher levels of antioxidants in their blood than lean birds. Ongoing blood-sampling research shows that long-distance migrants on Block Island, such as Blackpoll Warblers and Red-eyed Vireos, build their ability to combat oxidative damage as they build their fat stores (left, bottom panel; Skrip et al., in prep).

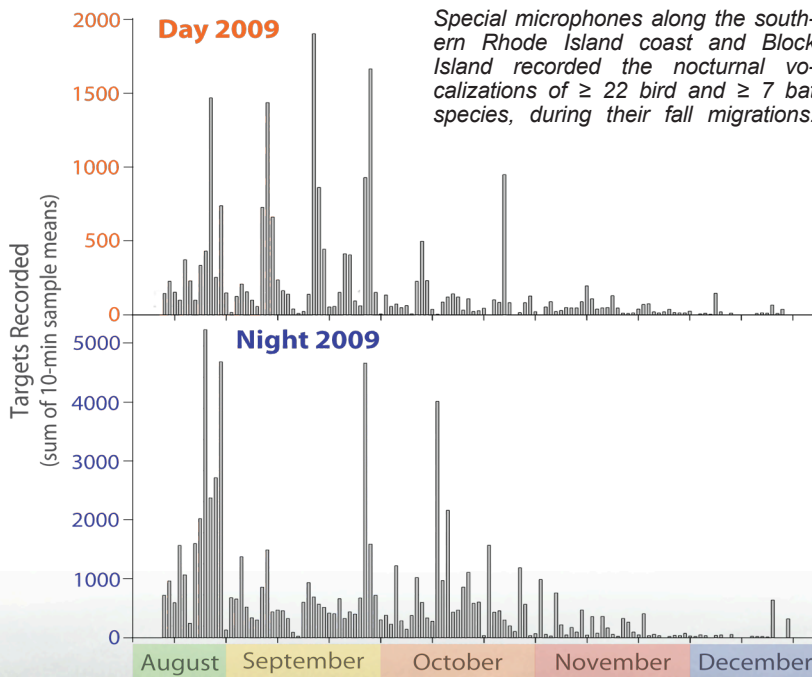
Photo credit: Adam Smith



Special microphones along the southern Rhode Island coast and Block Island recorded the nocturnal vocalizations of ≥ 22 bird and ≥ 7 bat species, during their fall migrations.

Tracking regional migration patterns—radar and acoustic monitoring place Block Island in context

Hundreds of thousands of birds use Block Island during fall migration. How might they be affected by future offshore wind power? As part of the Rhode Island Ocean Special Area Management Plan, radar monitoring stations on Block Island documented the flights of birds and bats during the 2009 migration seasons (right). Radar studies are limited, however, by their inability to identify the species of animals flying overhead. Thus, during the autumn migrations of 2010 and 2012, researchers recorded the nocturnal vocalizations of songbirds and bats over the southern Rhode Island coast and Block Island; they describe the weather patterns associated with peaks in passage (Smith et al. 2014. PLOS One 9:e92218; Smith & McWilliams, in prep). These studies allowed the development of statistical models that can predict nights of high and low migratory activity, based on wind speed and direction, temperature, and precipitation, thereby identifying periods of high risk for animals during migration.



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Block Island Landbird Migration Research Group logo: Adam Smith

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