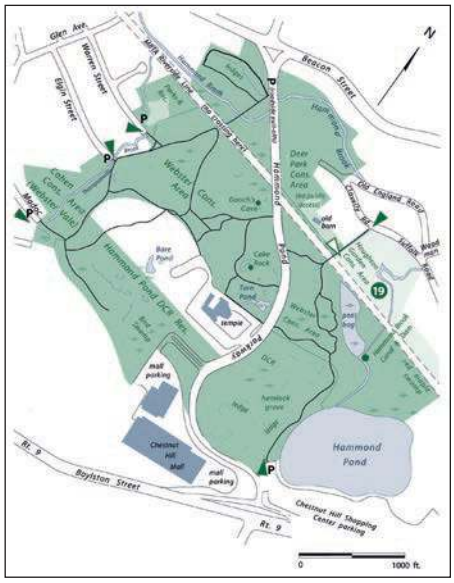
A Ramble in Webster Woods

By Eric Olson, Senior Lecturer in Ecology at Brandeis University

Editor's Note: The following article is written as a companion piece to the letter from Edwin Webster elsewhere in this newsletter. Its intent is to show one of the many ways we can appreciate the park. As the author notes, "Naturalist-educators simply cannot do what we do without wild green canvases to walk out into, with a group of curious locals in tow, looking for opportunities to celebrate rich local biodiversity."

On a recent fall Conservators' outing in Webster Woods, I chose to weave into the walk three questions that, to an evolutionary ecologist, come under the heading of life history theory. The life history of a species of course includes birth, growth, and reproduction. But it also considers the "why" of key details such as "why that number of eggs in a nest, and not more?" We are such visual creatures that we tend to focus on form, size, and color when we consider the evolution of life; but life history theory reminds us that organisms live within energy and resource budgets. Details like egg number for a bird, or seed number for a wildflower, take close study to document, but like color and form are also sculpted by natural selection. To illustrate, here are three questions I discussed as I led my group through Webster Woods this fall: 1) why do birds migrate? 2) why do most — but not all — salamanders lay eggs in ponds? And 3) why does the magnificent cecropia moth only live a week?



Map of Webster Woods

The "why" of bird migration. Those of us lucky enough to have lived in the tropics for a time have direct experience with the bewilderment of riches such places present. Our local species of hummingbird, the delightful Ruby-throat, takes a thousands-of-miles journey north from as far as Panama, to build its tiny nests and zip through our flower beds here in Newton. But in Panama and surrounding nations in South and Central America, the field guides show not just a few more kinds of hummingbirds, there are *pages and pages* of hummingbirds! Fifty-four species in Costa Rica! An unbelievable 150 species in Colombia! Almost none of these hummers are long-distance migrants.

Much the same pattern holds true of the orioles — our brilliant Baltimore Oriole has eight or so relatives in Nicaragua, handsome bright birds that never migrate and are doing just fine, thank you. Migration takes a lot of energy, and long-distance travel over unfamiliar ground is risky; those facts and all those handsome stay-put species demand we seek an answer: why migrate?

This question has intrigued ecologists for years, and the details of bird reproduction provide essential clues. Migration may be risky but so is staying put, and the old saying "don't put all your eggs in one basket" definitely applies here. The tropical forests are rich with predators that relentlessly seek out nests and prey on eggs and chicks. There are hawks and owls both here and there, but let me mention boas and other arboreal snakes, then add in clever bandits like capuchin monkeys, and need I say more?

Baltimore Oriole

There are hazards in the jungle that birds just never have to worry about up here, and as expected by this risk argument, on average a female oriole in Massachusetts lays more eggs per nest than her close relatives in the tropics. The life history trait "egg number per nest" reflects relative risk, and a tropical oriole must hold egg-making resources in reserve in case her first (and second, etc.) nest attempt is foiled by predators.

There's another benefit to migration: the northern spring is when moths and butterflies by the thousands hatch and lay eggs, and their caterpillars grow quickly on new tender leaves. Plus, those long June days mean that parents start provisioning nestlings around 5 a.m. and keep right on bringing in food well into the evening. Low risk — wouldn't you migrate, if you were an oriole? It suddenly

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Eric Olson describes some of what he has discovered in Webster Woods.

looks like we should turn it around and ask of all those tropical home-bodies, "why stay?" The persistence of these species tells us it must be about equally effective over the long haul, to stay put and spend energy re-nesting if monkeys snatch your eggs. We conclude that *migration is a lifestyle choice*. Or as ecologists would say, one of two available life history pathways.

Salamanders and ponds — to go or not to go? This story is also about a migration of sorts, and here again egg number proves to be central. Contrast the red-backed, the most common salamander in our local woods, with the spotted salamander. Both inhabit the under-log and leaf-litter world of Webster Woods, but only spotted salamanders migrate early each spring over several hundred yards distance, from their forest floor hideouts to nearby vernal pools. In Webster Woods, many make the trek to Bare Pond, Newton's biggest vernal pool.

Yellow-spotted salamander

During migration spotted salamanders are out in the open, exposed to predators like skunks and foxes, plus sudden changes in the weather like late-winter snows. These then mate and lay their eggs in ponds that by definition go bone dry each year. Females never know if a pool holding their precious eggs will last long enough for their tadpoles to metamorphose into air-breathing adults. Sometimes they do, often they don't.

In contrast, red-backed salamanders never migrate; they lay their eggs snug under logs. Isn't that a better choice? Again, here, why migrate?

Egg number again provides needed insight. In their moist log habitats, non-migratory red-backs can lay only about eight eggs each year, and each egg is surprisingly large for such a small amphibian. True for all amphibians, these eggs

Bare Pond, a vernal pool in Webster Woods, in the spring and summer.

first produce a tadpole — but red-backed tadpoles never hatch! They remain inside their egg membranes, tiny tailed creatures in tiny gelatinous aquaria, and they metamorphose prior to hatching. The eggs must be large and therefore few, because females use a lot of energy to provision each egg with enough yolk for their wee tadpoles to complete development.

The result is that very small adult-form salamanders eventually hatch and immediately start their independent existence. Salamanders so small are easy prey for many predators, but since they start life tucked under logs and in other shelters, they never need to emerge for the long risky trek to open water.

In contrast spotted salamanders do make the annual trek, and the great bonus is that females lay as many as 100 small eggs each year, in a single gelatinous mass. Tiny tadpoles hatch from these eggs and swim out into warming vernal pools teeming with life including fairy shrimp, mosquito and midge larvae, and many other small aquatic bugs. The

Eric Olson looks for salamanders under one of Webster Woods' many fallen logs.

tadpoles grow fast and fat dining on such an abundance of food, and if the pond holds water for long enough, dozens

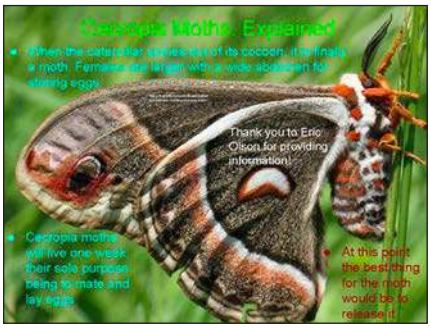
Red-backed salamander

of robust new salamanders can eventually emerge and wander off through the forest. But "hold water long enough" turns out to be a big if.

Here we see sharp trade-offs: for eggs laid under logs the free-swimming tadpole stage must be dispensed with, and as a result, females must stock each egg with plentiful yolk. But the gain is, there's no need for adults to take annual risky cross-country treks. Just a few young are born each year, and they're tiny, but they're already snug in good habitat! Back and forth we go, every life history path has pros and cons. In those species that do seek a vernal pool each year, females can lay smaller eggs and therefore a lot more of them. Their tadpoles hatch into a world of abundant food, so they need little maternal provisioning. These start life as free tadpoles and — with luck — make it to good-sized adult ready for life in the forest.

Spotted salamander eggs

And finally, what about those flash-in-the-pan cecropia moths? What a life history: eight days in the egg, 45 or so days feeding as a caterpillar. Then August to May (ten months!) in a tough cocoon, silked tight to a branch, adults emerge in June as spectacular big moths with 400 eggs in the abdomen of every female. A female "calls" for a mate with her powerful pheromones, and once mated she has about 8 nights to find a hundred or so host trees on which



Graphic courtesy of Julian Phillips

to lay her eggs. Then she dies. No mouth parts, no stomach, no feeding, just egg laying.

This life history is relatively easily told: at about the size of your hand, cecropia are among the largest insects in the Northeast, so it's not easy to hide such a large insect for long. They must be quite conspicuous to both birds and bats, and life is likely short. The solution arrived at is a poignant one: take just about every ounce of host plant energy consumed by the caterpillar the summer before and convert it into hundreds of tough-shelled little eggs the next summer. Female cecropias are fast-flying egg delivery vessels. "Only eight days?!" people exclaim, upon hearing this life history. "What's the point??" some ask.

The point is to make more moths, and this life history obviously works because I can find wild cecropia moths every year, *right here in Newton*. And that, dear reader, is actually "the point" of all these stories — more birds, more salamanders, and more handsome moths. It is not so simplistic for us humans, thankfully! We are long-lived and reflective enough. We plan our own life stories to a good degree, and uniquely among all the world's living things, we can seek a better answer to that "what's the point?" question.

For me, and I hope for you too, part of my "point" is to share these kinds of stories, life histories we biologists call them, with others, in the hope that we will protect our local wild places in perpetuity. For as that famous saying goes, "In the end we will conserve only what we love; we will love only what we understand; and we will understand only what we are taught." (Baba Dioum, 1968.) A walk through Webster Woods will bring these thoughts to life. ◆