

# THE GREAT FLIGHT NORTH

by Brooks Mathewson

High in the canopy of a Costa Rican rain forest, a small songbird, weighing less than a third of an ounce – roughly the equivalent of two quarters – is methodically foraging on insects and berries. As spring approaches, the male Black-throated Green Warbler is busily preparing to leave the mountainous tropical forest that has been his home for the past five months to embark on a northward migration of more than 2,500 miles. The bird's final destination will be the place where he was hatched in central Massachusetts, an Eastern Hemlock forest along the East Branch of the Swift River in the Harvard Forest. This journey will be extremely dangerous, filled with countless obstacles both natural and man-made. Indeed, approximately 85% of all warbler deaths are thought to occur during migration.

Throughout the Neotropics, tens of millions of diverse, colorful songbirds are preparing for similar flights. In the broad-leaved evergreen forests of eastern Puerto Rico, a handsome male Black-throated Blue Warbler with a dark navy-blue back and a pure white belly gleans a spider from the underside of a leaf; 600 miles to the west, in a Black Mangrove forest in Jamaica, an American Redstart fans its jet-black and orange tail to flush an insect, then deftly hawks it out of mid-air. Meanwhile, on the other side of the Caribbean Sea, a black-masked Common Yellowthroat searches for food in the dry, scrubby second-growth forests of the Yucatan Peninsula. Farther south, in the canopy of a tropical evergreen forest in Panama, Chestnut-sided and Bay-breasted warblers forage alongside resident tropical songbirds in diverse mixed-species flocks, while in the cloud forests of the Andean foothills of Ecuador, a Cerulean Warbler hunts for prey in the tops of Kapok trees.

Species from more than a dozen families of songbirds will comprise the mighty river of birds headed north. Agile flycatchers; small, stout vireos; smooth, sleek swallows; diminutive gnatcatchers and kinglets; lyrical thrushes; luminescent grosbeaks, buntings, orioles, and tanagers; and subtly diverse tan and brown sparrows all have the same goal – return to the place where they were born, establish and defend a territory, attract a mate, and raise a new generation.

With the approach of the vernal equinox, photoreceptors in the hypothalamus of our Black-throated Green Warbler detect changes in day length, triggering the release of hormones from the pituitary gland in the brain that cause both physical and behavioral transformations in the bird. One of these important changes is “hyperphagia,” an intense increase in appetite that would put to shame a table full of high school football players at an all-you-can-eat buffet. Consuming the human equivalent of 120,000 calories a day, or, by comparable weight, the amount needed to sustain 60 adult humans, the Black-throated Green Warbler will come close to doubling its body weight in just a few weeks.

The extra food is metabolized and stored as body fat on the warbler's breast. Since it does not need to be bonded to water, fat is lighter than carbohydrates or protein. It is also more efficiently converted into energy. A Black-throated Green Warbler is able to convert one-tenth of an ounce of fat into enough energy for 350 miles of flight. The amount of fat on a migrating songbird is an excellent indicator of its fitness and of the likelihood that it will reach its final destination.

In order to gain enough weight to fuel his journey, the Black-throated Green Warbler must have the right habitat in



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*The voice of the Black-throated Green Warbler is a familiar sound throughout the Eastern Hemlock stands of Massachusetts when it is staking out and defending its nesting territory.*

which to forage. It was originally thought that Neotropical migrants were opportunistic foragers, essentially random winter wanderers in the tropical landscape. However, it is now understood that each songbird species has habitat preferences during the non-breeding season just as it has during the breeding season, and that winter territories are often aggressively defended.

While plant species composition is usually different, structurally, the breeding and non-breeding habitat preferences are generally very similar. Birds that breed in edge habitat, such as Common Yellowthroats, Indigo Buntings, and Yellow Warblers, are more often found in similar habitat in winter (typically tropical pastures and recently abandoned fields). Similarly, Black-throated Green Warblers that prefer contiguous, undisturbed forest habitat in the breeding

season seek comparable types of forest habitat in the winter.

Many Black-throated Green Warblers are unable to find large tracts of mature forest in which to spend the non-breeding season because a large percentage of the Neotropical forest has been cleared for mining, agriculture, firewood, and coffee production. In Central America, only 15% of primary rain forest, cloud forest, sub-montane forest, lowland broadleaf forest, pine woodland, and mangrove forest remains. Although many Latin American governments are shifting to more pro-environmental stances, hundreds of thousands of hectares of forest are still logged each year. This mounting loss of wintering habitat is thought to be one of the major factors contributing to declines in some populations of songbirds.



The Neotropical migratory songbirds that prefer large contiguous forests but are no longer able to find them are forced to spend the non-breeding season in scrubby second-growth forest with fewer foraging opportunities and increased exposure to potential predators. Even if they are able to survive, birds that just barely make it through the winter due to inadequate resources are unlikely to build up sufficient fat reserves to complete the arduous migration back to their natal homes.

In addition to accumulating fat reserves in preparation for the breeding season, our Black-throated Green Warbler also undergoes a hormonally driven pre-nuptial molt. The change in the bird's appearance is subtle; black feathers on its throat and sides become more vivid, more sharply contrasting with the bird's yellow face and olive-green crown and back. Some species of warblers, including Black-throated Blue, Black-and-white, and Blue-winged, experience similar minor changes in appearance in spring, while others undergo much more dramatic transformations. Bay-breasted Warblers and Blackpoll Warblers are probably the most striking examples from

this group. Nearly identical in size and shape, these two species look remarkably similar in non-breeding plumage, both a drab yellowish to olive green. However, in breeding plumage a male Bay-breasted Warbler possesses a rich, chestnut-brown crown, throat, and flanks, and a black forehead and face, while the male Blackpoll Warbler sports a black cap, white cheeks, and black jaw streaks.

Hormones influence the Black-throated Green Warbler in other ways. By the time the bird arrives in Massachusetts, its testes will have grown to 100 times their non-breeding size. In addition, the warbler experiences increased migratory restlessness, or "Zugunruhe," especially in the evening just prior to sunset. Over the course of several weeks the restlessness builds, until finally one night in late March, about a half-hour after sunset, the Black-throated Green Warbler takes off into the cool, night sky to embark on the first flight of a five-week, several-thousand-mile odyssey.

The bird uses a combination of the setting sun, the North Star, and the earth's magnetic field to point himself in the right direction. One by one, other migrant songbirds that have spent the winter in the same Costa Rican rainforest join him: Acadian and Olive-sided Flycatchers; Wood and Swainson's Thrushes; Red-eyed, Philadelphia, and White-eyed Vireos; Summer Tanagers; and numerous species of warblers, including Ovenbirds, Blackburnians, Magnolias, Black-and-whites, and Worm-eating. As the diverse group gains elevation they find their place amongst Scarlet Tanagers, Baltimore Orioles, Eastern Kingbirds, and Veeries traveling from even more distant forests in Panama, Ecuador, Bolivia, Peru, and Brazil.

Nocturnal migration reduces the risk of predation. It also allows the migrants to fly more efficiently in cooler, less turbulent air. When they are traveling over land, radar has revealed that songbirds usually migrate at an altitude of between 2,000 and 3,000 feet. During periods of unstable weather, flying altitudes are generally

*Male Black-throated Blue Warblers are often found breeding in forest habitats containing dense undergrowth.*

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*The Magnolia Warbler is considered by many, including Edward Forbush, noted ornithologist and second president of the Massachusetts Audubon Society, to be the most beautiful of all the warblers that nests in New England. Forbush writes that while many may prefer the Blackburnian Warbler with its bright orange throat, the Magnolia offers beautiful features that are "distributed to all parts of its graceful form."*

Photo © Brooks Mathewson



lower. Along the way, migrants disperse the seeds of local trees, shrubs, and vines. This is a particularly important ecological service in the tropics because many resident tropical birds rarely travel outside their territories.

Initial migratory flights generally last only a few hours. However, flight time and distance traveled increase as the trip progresses. During the daylight hours, the migrants rest in isolated pockets of remaining Central American forest, forage, and metabolize the lactic acid that has built up in their muscle tissues. While engaged in these activities they must also avoid being eaten by migrating Sharp-Shinned and Cooper's hawks, as well as by resident, often arboreal snakes of many species.

By the middle of April our Black-throated Green Warbler has flown over Honduras, Guatemala, Belize, and part of Mexico. Now on the northern tip of the Yucatan Peninsula, the southern edge of the Gulf of Mexico, the warbler waits with thousands of other migratory songbirds for the right winds that will help propel their non-stop flight across the great

expanse of open sea to the southeastern coasts of the United States. Songbirds are unable to swim and there are few places to rest during the Gulf crossing other than a scattering of fishing boats and a few thousand offshore oil rigs.

High-pressure systems in the southern Atlantic called "Bermuda Highs" that generate winds from the southeast become common by the second and third weeks of April, and within a few days of our little warbler's arrival, such a weather system emerges. Thousands of migrants staging on the Yucatan Peninsula begin the perilous trip. Even with the aid of southeasterly winds the traverse of almost 600 miles takes the Black-throated Green Warbler approximately 18 hours to complete. If a cold front from the north moves in while the bird is in flight, it can prolong the trip or even put a sudden and permanent end to the journey.

Abrupt cold fronts from the north that catch migrant swarms in mid-Gulf are re-





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*The Yellow Warbler is likely the most familiar warbler in Massachusetts. Abundant and widely distributed, this edge-habitat species is found throughout the state and often builds its nests in parks, gardens, and along roadsides.*

*The Yellow-rumped Warbler, pictured here with a mayfly, is usually the most commonly observed warbler in the spring in Massachusetts.*

responsible for “fall-out” events along the coasts of Texas, Louisiana, Mississippi, Alabama, and Florida. During these events, tens of thousands of birds drop out of the sky, exhausted and starving, into the first coastline habitat they reach. While the incredible densities of songbirds provide spectacular bird watching opportunities for humans, fall-outs claim the lives of thousands of migrants. In the days following a fall-out, the vast numbers of birds that were not strong enough to make the passage are revealed as their bodies wash ashore.

Luckily, such an event does not occur this year, and with the wind at his back and enough extra fat to sustain his flight, our little warbler not only crosses the Gulf, but manages to push 15 miles past the edge of land to the more desirable habitat found in the forested wetlands of the Louisiana floodplain. After a few days of intense foraging to restore his depleted fat reserves, the bird resumes his journey. Over the next three weeks he will travel another 1,500 miles from Louisiana to Massachusetts, through a gauntlet of man-made obstacles that reach out into the night.

Migratory warblers have poor nighttime vision and are often attracted to the lights of skyscrapers and communication towers, mistaking them, it is thought, for stars. Window strikes account for hundreds of millions of songbird deaths each year. Thankfully, many cities, including Boston, have initiated “Lights Out” programs that encourage building occupants to turn off or dim their lights during migration season. However, flashing lights from television, radio, and cell phone towers, necessary to prevent collisions with low flying aircraft, account for millions of additional songbird deaths.

Our Black-throated Green Warbler’s loose itinerary for the remainder of his journey is typically one long night of flight followed by two days of rest and foraging. Flying at a speed of 20-40 miles an hour, the bird covers between 150 and



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### **A Word on Hemlocks**

In recent years, an invasive insect pest, the Hemlock Woolly Adelgid, has become increasingly common in central Massachusetts (see *Massachusetts Wildlife* No. 1, 2004). This tiny, aphid-like insect, first introduced in Virginia in the 1950s, causes mortality in Eastern Hemlock trees within 5-15 years of initial infestation. Currently, no effective biological or chemical control has been discovered that can safely be applied on a forest-level scale. As shade-tolerant conifers that retain their lower branches, hemlocks are ecologically different from other trees in the region. Hemlock forests maintain a cool, dark, moist microclimate that provides habitat for a distinct assemblage of diverse wildlife species. Perhaps no bird is more closely associated with this forest type in central Massachusetts than the Black-throated Green Warbler. Although this warbler can breed in other forest types, the loss of the hemlock will likely lead to a reduction in the breeding population of the bird in our region.





*Many male warblers bear striking colors, including the Common Yellowthroat, above left. The Chestnut-sided Warbler, above right, prefers early-successional forest and forest edge for breeding habitat. The species significantly increased in abundance for this reason as forests were first cleared for agriculture and then abandoned during the second half of the nineteenth and first half of the twentieth century. In fact, this bird was so uncommon during the early part of the nineteenth century that John James Audubon only observed the species once in his life! Today the species is in decline, in part due to loss of breeding habitat as the forests of the region mature. Warblers aren't the only Neotropical migrants that breed in Massachusetts: The Wood Thrush, left, is a good example of a species that can be found in the mixed flocks of birds headed North across the Gulf of Mexico every spring, along with flycatchers, vireos, veeries, swallows, gnatcatchers, grosbeaks, buntings, orioles, tanagers, and various sparrows.*

250 miles per night. Finding stopover habitat to replenish his fat reserves after each flight is critical, but not as easy as it once was. As development continues throughout the eastern United States, these refueling sites become scarcer each year; hence even the smallest patches of habitat can be of help. As our warbler makes his way through a human-transformed landscape, he utilizes conservation areas, woodlots, urban parks, and thoughtfully landscaped suburban backyards.

By the first week of May, after traveling over 2,500 miles from Costa Rica to central Massachusetts, our Black-throated Green Warbler arrives back in the place where he was hatched. Here in the cool, moist, dark Eastern Hemlock forest along the East Branch of the Swift River in the Harvard Forest, the bird begins establishing the boundaries of a territory. Only a few other male Black-throated Greens have returned so far, and there are still large areas of desirable interior forest to claim.

Territories further from the edge of the forest offer nest locations that are less vulnerable to predators such as Eastern Chipmunks, Eastern Gray and Red Squirrels, Raccoons, Blue Jays, and American Crows. Nests in these interior territories are also less likely to be victims of the Brown-headed Cowbird, a brood parasite that lays its eggs in the nests of other birds. During the first few days of plotting out his football field-sized territory the warbler sometimes sings his distinctive, buzzy “zee zeee zeee zo-zeee” song more than 400 times an hour from mid-canopy perches.

Each night brings the arrival of new competing males. Initially, these new arrivals respect the Black-throated Green Warbler's territory and seek out different space within the forest. However, by the fourth day, territories have become much harder to come by and the male must begin chasing off desperate “claim-jumping” intruders. Most retreat when chased, but in a few instances



territorial clashes involve physical encounters including wing strikes, head jabs, and even mid-air battles in which the combatants lock beaks and feet as they tumble through the air. This year the Black-throated Green Warbler is strong and emerges victorious from each conflict, his territory successfully defended.

Many other migrant songbird species also arrive throughout the first weeks of May. Overnight the sounds of the forest change as fresh new voices are added to its choir. Now the mellifluous flute-like song of the Hermit Thrush; the rapidly ascending “teacher, teacher, teacher” song of the Ovenbird; and the slow, steady, up-and-down song of the Blue-headed Vireo all greet the dawn. Each species occupies a slightly different habitat. The secretive brown Ovenbirds walk along the forest floor looking for invertebrates to prey upon, while similarly camouflaged Hermit Thrushes, bobbing their rufous tails, alternate their searches for invertebrates and small amphibians and reptiles between the forest floor and the understory. High above, in the top of the thick, dark canopy,

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bright orange and black Blackburnian Warblers glean insects from the foliage, while Blue-headed Vireos hunt for prey in the mid-canopy.

Species still in the midst of their migrations also arrive overnight to rest and refuel in the Eastern Hemlock forest. In a few days these Cape May, Tennessee, Bay-breasted, Blackpoll, and Palm Warblers will be many miles farther north, headed for the great boreal forest of northern New England and Canada. Other arrivals are local breeders who slightly missed their mark when landing in the late hours of the night; they quickly disperse to their preferred habitats of different forest composition and age. Red-eyed Vireos, Black-and-White Warblers, Scarlet Tanagers, American Redstarts, and Wood Thrushes seek out nearby mature mixed deciduous forest; Black-throated Blue Warblers return to forests with dense undergrowth of Mountain Laurel; Yellow-rumped Warblers find mature stands of Eastern White Pine; Veeries seek wet deciduous woodland; Chestnut-sided Warblers find young, early-successional forest.

On his sixth morning in the Eastern Hemlock forest, our male Black-throated Green Warbler awakes to find the first females have arrived. Within a few days one chooses him as a mate. The female decides where the nest will be built and handles the bulk of its construction while the male follows close behind, intermittently flying off to re-affirm territorial boundaries. It generally takes the female about a week to build the cup-shaped nest made of twigs, grass,

*In the fall, Blackpoll Warblers are quite drab in comparison to how they looked in the spring when the males sported a black cap, white cheeks, and black jaw streaks, but they are still one of the most commonly observed warblers in Massachusetts during autumn. For many of these birds, this is the last opportunity to accumulate the fat reserves required to fuel their nonstop flight back to their non-breeding homes in South America. The journey can take more than 80 hours.*

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*The Blackburnian Warbler, like the Black-throated Green Warbler, is closely associated with Eastern Hemlock-dominated forests in Massachusetts. A glimpse of the male's bright orange throat is a spectacular treat, and usually difficult because the bird spends most of its time high atop the tallest trees in the forest.*

spider webs, and the bark of white birch trees, and lined with mosses, feathers, hair, and fine plant material. Within a day of completion, she will begin laying four eggs, one per day. Throughout the nesting cycle, the male Black-throated Green Warbler will help raise the brood of young warblers, an undertaking that presents a unique set of challenges, different from those of migration, but equally daunting.

Within only a few short months, it will be time for our Black-throated Green Warbler to begin his long journey back to Costa Rica. If he is lucky, over the course of his lifetime the bird could make the trip back and forth a half dozen times, covering more than 30,000 miles. Not bad for a bird that is small enough to rest in the palm of one's hand. For now, though, he flies up to his tallest perch and proudly delivers his song. The bird's buzzy notes represent more than simply a declaration

of the boundaries of a territory; instead, they are a celebration of perseverance and endurance, and the blessed arrival of another spring.



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