



Hubbard Brook Research Foundation

Migratory Bird Math and Science Lessons



Lesson: Getting to Know You

This lesson is designed to serve as an introduction to New England’s migratory birds as well as to familiarize students with research methods used to study these birds at the Hubbard Brook Experimental Forest. Four species that can be found in our region are highlighted: American Redstart, Bicknell’s Thrush, Black-throated Blue Warbler, and Blackpoll Warbler. Although it may be hard to spot each of these species in your schoolyard, they are important species that represent a diversity of life and habitat characteristics typical of New England’s migratory songbirds. One of these species, Bicknell’s Thrush, is globally rare and is restricted to high elevation spruce-fir forests—habitat that is expected to shrink as global climate warms. All four species are well-studied and a wealth of information exists about these species on the internet and in other published sources.

Summary	Students gain an awareness of the diversity found among Neotropical migratory birds that breed in the forests of New England, as well as an awareness about the methods researchers use to gather such facts.
Subject areas	Life science, biology, environmental science
<u>Skill level</u>	Basic
Objectives	Correctly match facts about habitats and characteristics pertaining to 4 bird species found in the forests of New England. Describe research methods used to gather such facts by reading and answering questions about research on Black-throated Blue Warblers at the Hubbard Brook Experimental Forest, NH.
<u>NH Science Framework Standards</u>	S:SPS1:8:1.3 S:SPS3:11:2.8 S:LS5:11:1.1
Time	One 40-minute class period plus homework assignment
Materials	<ul style="list-style-type: none"> • American Redstart All About Birds.pdf • Bicknell's Thrush All About Birds.pdf • Blackpoll Warbler All About Birds.pdf • Black-throated Blue Warbler All About Birds.pdf • Student Handout - Part I: Getting to Know You (option to choose with or without photos) • Student Reading - Part II: Methods of Bird Research at Hubbard Brook • Student Handout - Part II: Methods of Bird Research at Hubbard Brook • Answer Keys I and II • Introductory Slides Part1 .pdf <p>Optional</p> <ul style="list-style-type: none"> • Short Methods Slideshow.pdf
Assessment	Two student handouts with answer keys are included.

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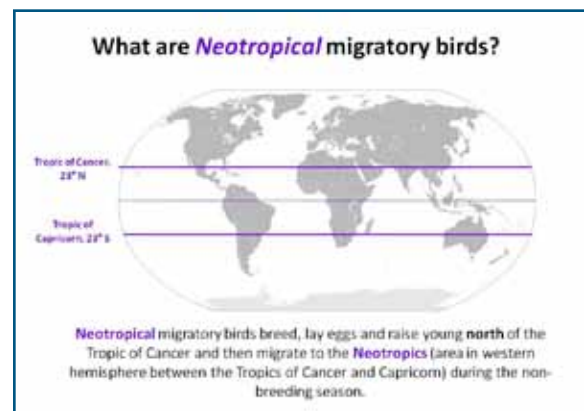
Note to Teachers

Introduce lesson to students:

There are approximately 32 species of Neotropical migratory birds that give birth to and raise their young in the forests of New England. While some of these birds can live in a wide range of forest types, others live in specific forest areas, such as at high elevations or in forests dominated by one or a few species of trees. Some species of birds occur in great numbers while other have small population sizes. To help give you an idea of the diversity of Neotropical migratory birds found in our region, we've selected four species for you to get to know a little better: American Redstart, Bicknell's Thrush, Black-throated Blue Warbler and Blackpoll Warbler. After you've become better acquainted with these birds, you'll learn the techniques that researchers use to study them.

- Students may work individually or in pairs. Teachers may find it useful for students to work in pairs on Part I and individually on Part II.
- For your convenience, two versions of the Student Handout for Part I are included: [With Photos](#) and [Without Photos](#). If the version without photos is used, the teacher may wish to show students the Introductory Slideshow in Support Materials that contains photos of the four bird species.
- Students will read fact sheets from the *All About Birds* website for Part I of the lesson. PDFs of these web pages are included so that it is not necessary for students to have internet access while completing Part I. If students do have access, teachers may wish to have students work directly from the bird guide search page (<http://www.allaboutbirds.org/guide/search>) for this site.

- Permission to create PDFs from the [All About Birds](http://www.allaboutbirds.org) (<http://www.allaboutbirds.org>) web site has been generously granted by the Cornell University Lab of Ornithology (<http://www.birds.cornell.edu>), a world leader in the study, appreciation, and conservation of birds. The All About Birds website is an excellent, free resource for students, teachers and anyone wishing to know more about birds and bird watching.



- Before initiating Part I, teachers should introduce the phrase *Neotropical migratory bird*. The slide below is included in [Introductory Slides Part 1](#) in Support Materials and may be displayed overhead. It is taken from the slideshow [Introduction to Neotropical Migratory Birds](#), which is an additional resource included in Slideshows.
- The teacher may wish to precede Part II with a brief discussion that asks students to hypothesize how the type of information provided in Part I has been collected.
- Students will read [Methods of Bird Research at Hubbard Brook Experimental Forest](#) and answer questions.
- If desired, a [Short Methods Slideshow](#), which contains research images (included in Support Materials), may be shown.



Student Procedure

Part I

You will get to know four species of birds—the American Redstart, the Black-throated Blue Warbler, the Blackpoll Warbler, and the Bicknell’s Thrush—by reading fact sheets about them. Then you will match the facts below to the correct bird.

1. Obtain a copy of the Student Handout *Part I: Getting to Know You* and copies of the fact sheets for each of the four species. (Alternatively, go to the Cornell University Lab of Ornithology’s [All About Birds](#) website and search for each bird.)
2. Read each bird’s fact sheet.
3. Below are facts about the four species of birds, divided into five categories: (1) winter habitat, (2) breeding habitat, (3) breeding habitat characteristics, (4) plumage, and (5) conservation status. Match each fact to the correct bird by writing the number of that fact in the appropriate blank space on that bird’s answer chart.
4. Answer the three questions at the bottom of the handout.

Winter Habitat:

1	Caribbean Islands, including Cuba, Haiti, and Dominican Republic
2	Southern tip of Florida, Caribbean Islands, Nicaragua, Costa Rica, Panama
3	Caribbean Islands, southern Mexico, Central America and northern South America
4	Northern portion of South America

Summer Habitat:

1	Alaska and across the northern half of Canada
2	Northeastern United States and southeastern Canada
3	Very restricted range: high mountain peaks from Southeastern Quebec, across northern New England to Nova Scotia
4	Much of Canada and eastward from Minnesota, Iowa, Missouri, Arkansas, Louisiana

Habitat Characteristics:

1	Breeds in shrubby, second-growth deciduous forest
2	Breeds in mature deciduous and mixed conifer and deciduous forest with thick, shrubby understory
3	Breeds in boreal (northern) coniferous forests
4	Breeds in montane coniferous forests (forests of spruce and fir higher up on mountains)

Plumage:

1	Male dark blue on back with black face, throat, and sides. Female dull greenish gray with light underparts and a weak, cream-colored eye stripe.
2	Breeding male with black cap, white cheeks, black mustache stripe, and white throat. White chest with thin black stripes down sides. Fall birds greenish on back and chest, with faint chest stripes. Female lacks cap and is duller.
3	Male black with orange patches on sides of chest, in wings, and in tail. Female and young males with gray head and back, and yellow instead of orange .
4	Upperparts brownish gray, chestnut tail, plain gray face with light streaks, dark lines on side of throat blend into dark triangular spots on throat and breast. Upperparts mostly white. (Males and females are alike.)

Conservation Status:

1	Vulnerable (high conservation priority due to small range and restricted habitat; on Audubon Watchlist)
2	Least Concern (common and widespread; declines seen in some areas, but more data needed)
3	Least Concern (declines seen in some areas, but still widespread and abundant)
4	Least Concern (populations declined in 17 th and 18 th centuries but rebounded in 19 th and 20 th centuries; currently populations are stable)

Part II

You just completed an activity that helped you to get to know the American Redstart, the Black-throated Blue Warbler, the Blackpoll Warbler, and the Bicknell's Thrush. How do we know where these birds live during their breeding and non-breeding seasons? How do we know about each bird's conservation status? What kinds of research do scientists have to do to get this information?

1. Read *Methods of Bird Research at Hubbard Brook Experimental Forest*.
2. Answer the questions on the Student Handout *Part II: Methods of Bird Research at Hubbard Brook*.



Student Handout I (with photos)

Part I: Getting to Know You

Name _____

American Redstart



Robert Royse

Winter (Southern) habitat:	
Summer (Northern) habitat:	
Habitat characteristics:	
Plumage:	
Conservation status:	

Black-throated Blue Warbler



Robert Royse

Winter (Southern) habitat:	
Summer (Northern) habitat:	
Habitat characteristics:	
Plumage:	
Conservation status:	

Blackpoll Warbler



Robert Royse

Winter (Southern) habitat:	
Summer (Northern) habitat:	
Habitat characteristics:	
Plumage:	
Conservation status:	

Bicknell's Thrush



Cornell Lab of Ornithology/
Dan Busby

Winter (Southern) habitat:	
Summer (Northern) habitat:	
Habitat characteristics:	
Plumage:	
Conservation status:	

Answer questions below:

1. Identify one characteristic that all of these birds share in common.

2. List three differences between the American Redstart and the Bicknell's Thrush.

3. Why are all of these birds considered to be *Neotropical migratory birds*?



Student Handout II (without photos)

Part I: Getting to Know You

Name _____

American Redstart

Winter (Southern) habitat:	
Summer (Northern) habitat:	
Habitat characteristics:	
Plumage:	
Conservation status:	

Black-throated Blue Warbler

Winter (Southern) habitat:	
Summer (Northern) habitat:	
Habitat characteristics:	
Plumage:	
Conservation status:	

Blackpoll Warbler

Winter (Southern) habitat:	
Summer (Northern) habitat:	
Habitat characteristics:	
Plumage:	
Conservation status:	

Bicknell's Thrush

Winter (Southern) habitat:	
Summer (Northern) habitat:	
Habitat characteristics:	
Plumage:	
Conservation status:	

Answer questions below:

1. Identify one characteristic that all of these birds share in common.

2. List three differences between the American Redstart and the Bicknell's Thrush.

3. Why are all of these birds considered to be *Neotropical migratory birds*?

Fact Sheet on American Redstart - page 1 of 3

http://www.allaboutbirds.org/guide/american_redstart/id

If you have internet access we recommend you view the American Redstart fact sheet online.

The screenshot shows the Cornell Lab of Ornithology's 'All About Birds' website. The page is titled 'American Redstart' and features a navigation bar with options like 'Bird Guide', 'Birding Basics', 'Living Bird', and 'Get Involved'. The main content area includes the scientific name *Setophaga ruticilla*, its IUCN conservation status of 'Least Concern', and a description: 'A boldly patterned warbler of second growth woods, the American Redstart frequently flashes its orange and black wings and tail to flush insect prey from foliage.' There are also sections for 'At a Glance' with icons for Habitat (Forest), Food (Insects), Feeding (Tree), Behavior (Foliage Gleaner), and Conservation (Least Concern), as well as 'Cool Facts' and 'Measurements'.

The Cornell Lab of Ornithology
All About Birds WINNER THE 2010 WEBBY AWARDS

Search in: Website Bird Guide

American Redstart
Setophaga ruticilla ORDER: PASSERIFORMES FAMILY: PARULIDAE
IUCN Conservation Status: Least Concern

Similar Species Related Species Go to: American Redstart

A boldly patterned warbler of second growth woods, the American Redstart frequently flashes its orange and black wings and tail to flush insect prey from foliage.

Identification Life History Sound Video Visit Birds of North America for more on this species

At a Glance Range Map

Habitat: Forest Food: Insects Feeding: Tree Behavior: Foliage Gleaner Conservation: LC Least Concern

Cool Facts

- The American Redstart is not particularly closely related to the Painted Redstart and the other redstart warblers of the Neotropics. They all are similarly patterned and forage in similar ways, flashing their tails and wings to startle insect prey. In other parts of the world other unrelated species of birds look and act similarly, such as the fantails of Australia and southeastern Asia.

Measurements


Both Sexes

Length: 4.3-5.1 in / 11-13 cm

Wingspan: 6.3-7.5 in / 16-19 cm

Weight: 0.2-0.3 oz / 6-9 g

Fact Sheet on American Redstart - page 2 of 3




• A young male American Redstart resembles a female in plumage until its second fall. Males in the gray and yellow yearling plumage will try to hold territories and attract mates, singing vigorously. Some succeed in breeding in this plumage, but most do not breed successfully until they are two years old.

• The male American Redstart occasionally is polygynous, having two mates at the same time. Unlike many other polygynous species of birds that have two females nesting in the same territory, the redstart holds two separate territories up to 500 m (1,640 ft) apart. The male starts to attract a second female after the first has completed her clutch and is incubating the eggs.

Other Names

- Petit du Feu, Paruline Ramboyaute (French)
- Candelita, Pavito migratorio (Spanish)


Habitat



Moist second growth deciduous forest, with abundant shrubs.

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American Redstart
Setophaga ruticilla




LEGEND

- Year Round
- Summer (breeding)
- Winter (non-breeding)
- Migration

Map by Cornell Lab of Ornithology
Range data by NatureServe


[View dynamic map of eBird sightings](#)

Food



Insects, some small fruits.

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Round Robin


A blog from the Cornell Lab of Ornithology

Nesting

Nest Description

Nest a tightly woven open cup fitted into branches or fork in tree or shrub. Made of grasses, bark strips, hair, leaves, twigs, or mosses, glued together with spider silk.

Nest Placement



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Nesting Facts

Clutch Size
1-5 eggs


Egg Description
Creamy white with dark speckles around large end.

Condition at Hatching
Helpless with tufts of down.

➤ Fact Sheet on American Redstart - page 3 of 3




Behavior

 Moves rapidly while foraging. Flashes wings and tail to flush insect prey. Frequent flycatching.

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Conservation

status via IUCN: Declines seen in some areas, but still widespread and abundant.

 **LC**
Least Concern

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Credits

- Sherry, T. W., and R. T. Holmes, 1997. American Redstart (*Setophaga ruticilla*). In The Birds of North America, No. 277 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D.C.

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[All About Birds](#) | [Bird Guide](#) | [American Redstart](#)

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Fact Sheet on Bicknell's Thrush - page 1 of 2

http://www.allaboutbirds.org/guide/Bicknells_Thrush/id

If you have internet access we recommend you view the Bicknell's Thrush fact sheet online.

The screenshot shows the Cornell Lab of Ornithology's 'All About Birds' website page for Bicknell's Thrush. The page features a navigation bar with 'Bird Guide', 'Birding Basics', 'Living Bird', and 'Get Involved'. The main content area includes a title 'Bicknell's Thrush', its scientific name *Catharus bicknelli*, and its IUCN Conservation Status: Vulnerable. A photograph of the bird is shown on the left, and a text block on the right states: 'Only recently considered a separate species from the Gray-cheeked Thrush, the Bicknell's Thrush has one of the most restricted breeding and wintering ranges of any North American bird.' Below this, there are tabs for 'Identification', 'Life History', 'Sound', and 'Video'. A 'Range Map' section shows the bird's distribution in North America, with a legend indicating 'Year Round', 'Summer (breeding)', 'Winter (non-breeding)', and 'Migration'. The 'At a Glance' section includes icons for Habitat (Forest), Food (Insects), Feeding (Shrub), Behavior (Ground Forager), and Conservation (Vulnerable). The 'Cool Facts' section lists: 'Bicknell's Thrush has an unusual mating system. Both males and females mate with different partners. Each nest has young from different males, and males may have young in several nests. More than one male feeds at most nests.' and 'Males do not hold strict territories, and several different males may sing from the same area within one hour.' The 'Habitat' section includes a forest icon and text: 'Breeds in montane fir and spruce forests, usually associated with recently disturbed areas.' and 'Winters in broadleaf montane forests.'

Fact Sheet on Bicknell's Thrush - page 2 of 2

Forest

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Food

Insects and other arthropods, fruit.



Insects


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Nesting

Nest Description

Open cup of twigs and moss in small tree.

Nest Placement



Shrub

Nesting Facts


Clutch Size
3-4 eggs.

Egg Description
Bluish green with light brown speckling.

Condition at Hatching
Naked and helpless.

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Behavior




Ground Forager

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Conservation

status via IUCN Population data are difficult to gather, but because of the small range and restricted habitat, it is considered a high conservation priority. Listed on the Audubon Watchlist.




Vulnerable

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Credits

- Rimmer, C. C., K. P. McFarland, W. G. Ellison, and J. E. Goetz. Bicknell's Thrush (*Catharus bicknelli*). In *The Birds of North America*, No. 592 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

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Round Robin

A blog from the
Cornell Lab of Ornithology

[All About Birds](#)
[Bird Guide](#)
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Birding Basics

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Fact Sheet on Blackpoll Warbler - page 1 of 3

http://www.allaboutbirds.org/guide/Blackpoll_Warbler/id

If you have internet access we recommend you view the Blackpoll Warbler fact sheet online.

The screenshot shows the Cornell Lab of Ornithology's 'All About Birds' website. The page is titled 'Blackpoll Warbler' and features a navigation bar with options like 'Bird Guide', 'Birding Basics', 'Living Bird', and 'Get Involved'. A search bar is visible at the top right. The main content area includes a photograph of a Blackpoll Warbler, its scientific name (*Dendroica striata*), and its IUCN conservation status (Least Concern). A 'NestWatch' advertisement is also present. Below the main text, there are tabs for 'Identification', 'Life History', 'Sound', and 'Video'. A 'Range Map' section is also visible. The 'At a Glance' section includes icons for Habitat (Forest), Food (Insects), Feeding (Tree), Behavior (Foliage Gleaner), and Conservation (Least Concern). The 'Cool Facts' section lists interesting details about the bird's song and migration. The 'Measurements' section provides data for both sexes, including length, wingspan, and weight.

Blackpoll Warbler
Dendroica striata | ORDER: PASSERIFORMES | FAMILY: PARULIDAE
IUCN Conservation Status: Least Concern

One of the most common birds of the northern boreal forest, the Blackpoll Warbler flies all the way to South America to spend the winter.

At a Glance

- Habitat: Forest
- Food: Insects
- Feeding: Tree
- Behavior: Foliage Gleaner
- Conservation: LC (Least Concern)

Cool Facts

- The song of the male Blackpoll Warbler is one of the highest-pitched of all birds.
- Part of the fall migratory route of the Blackpoll Warbler is over the Atlantic Ocean from the northeastern United States to Puerto Rico, the Lesser Antilles, or northern South America. This route averages 3,000 km (1,864 mi) over water, requiring a potentially nonstop flight of up to 88 hours. To accomplish this flight, the Blackpoll Warbler nearly doubles its body

Measurements

Both Sexes

Length	5.5 in 14 cm
Wingspan	3.3-5.1 in 21-23 cm
Weight	0.4-0.5 oz 12-13 g

Fact Sheet on Blackpoll Warbler - page 2 of 3

mass and takes advantage of a shift in prevailing wind direction to direct it to its destination.

Other Names

- Paruline rayée (French)
- Chipe gorda negra (Spanish)

Habitat



Forest

Breeds in boreal coniferous forest (primarily spruce) and woodland, mixed coniferous-deciduous second growth, tall shrubs, and alder thickets; in migration and winter found in a variety of forest, woodland, scrub and brushy habitats.

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Food



Insects

Insects and spiders, fruit during migration.

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Nesting

Nest Description

Open cup of twigs and lichens, lined with grasses, fine plant fibers, and feathers. In small tree.

Nest Placement



Tree

Nesting Facts

Clutch Size
3-5 eggs

Egg Description
White, buff, or pale green with brown spots all over and purplish blotches around the larger end.

Condition at Hatching
Helpless.

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Behavior



Foliage Gleaner

Prey usually gleaned from foliage or twigs.

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Blackpoll Warbler

Dendroica striata



LEGEND

- Year Round
- Summer (breeding)
- Winter (non-breeding)
- Migration

Map by Cornell Lab of Ornithology
Range data by NatureServe

[View dynamic map of eBird sightings](#)

Project FeederWatch

Embrace the winter. Count feeder birds for science!



Fact Sheet on Blackpoll Warbler - page 3 of 3

Conservation
status via IUCN: Common and widespread. Some declines have been noted, but more data are needed.

LC
Least Concern

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Credits

- Hunt, P. D., and B. C. Eliason. 1999. Blackpoll Warbler (*Dendroica striata*). In *The Birds of North America*, No. 431 (A. Poole and F. Gill, eds.), The Birds of North America, Inc., Philadelphia, PA.

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[All About Birds](#) [Bird Guide](#) [Blackpoll Warbler](#)

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Fact Sheet on Black-throated Blue Warbler - page 1 of 3

http://www.allaboutbirds.org/guide/Black-throated_Blue_Warbler/id

If you have internet access we recommend you view the Black-throated Blue Warbler fact sheet online.

The screenshot shows the Cornell Lab of Ornithology's 'All About Birds' website. The page is titled 'Black-throated Blue Warbler' and features a navigation menu with options like 'Bird Guide', 'Birding Basics', 'Living Bird', and 'Get Involved'. A search bar is visible at the top right. The main content area includes a photograph of the bird, its scientific name *Dendroica caerulescens*, and its IUCN conservation status of 'Least Concern'. A 'Project FeederWatch' banner is also present. Below the main text, there are tabs for 'Identification', 'Life History', 'Sound', and 'Video'. A 'Range Map' link is also visible. The 'At a Glance' section provides a quick overview of the bird's habitat (Forest), food (Insects), feeding behavior (Shrub), and behavior (Foliage Gleaner). The 'Measurements' section lists the bird's length, wingspan, and weight.

Black-throated Blue Warbler
Dendroica caerulescens | ORDER: PASSERIFORMES | FAMILY: PARULIDAE
IUCN Conservation Status: Least Concern

Similar Species | Related Species | Go to: [Black-throated Blue Warbler](#)

A bird of the deep forest, the Black-throated Blue Warbler breeds in the northeastern United States and southeastern Canada. On migration to its Caribbean wintering grounds it can be seen in a variety of habitats, including parks and gardens.

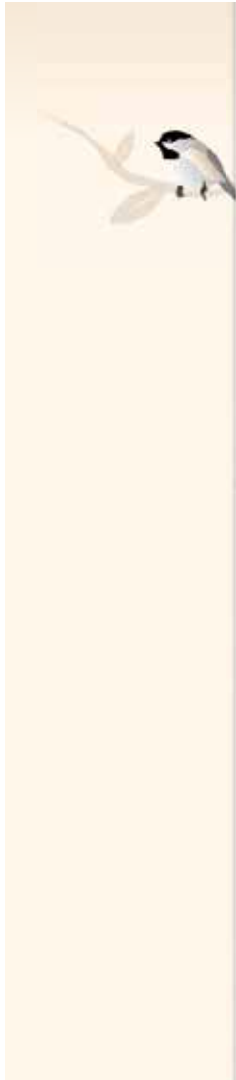
Project FeederWatch
Embrace the winter. Count feeder birds for science!

Identification | Life History | Sound | Video | Visit Birds of North America for more on this species.

At a Glance | Range Map

Habitat: Forest | Food: Insects | Feeding: Shrub | Behavior: Foliage Gleaner | Conservation: LC Least Concern

Measurements
Both Sexes
Length: 4.3-5.1 in / 11-13 cm
Wingspan: 6.7-7.9 in / 17-20 cm
Weight: 0.3-0.4 oz



Cool Facts

- The sexes of the Black-throated Blue Warbler look so different that they were originally described as two different species.
- On the wintering grounds the sexes use slightly different habitats. The male is most common in forest at lower to mid-elevations, while the female uses shrubbier habitat at higher elevations.

8-12 g

Other Names

- Paruline bleue à gorge noire (French)
- Reinta azul negra (Spanish)

Habitat



Forest

- Breeds in mature deciduous and mixed coniferous-deciduous woodlands with a thick understory, often in hilly or mountainous terrain.
- Winters in dense tropical forests.
- On migration, found in variety of habitats, including forest, forest edges, parks, and gardens.

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Food

Insects and some small fruits.



Insects

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Nesting

Nest Description

Nest an open cup of strips of bark, held together with spider web and saliva. Places in fork of low shrub.

Nest Placement



Shrub

Nesting Facts

Clutch Size
2-5 eggs

Egg Description
Creamy white with dark speckles concentrated at the large end.

Condition at Hatching
Helpless with tufts of down.

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Behavior

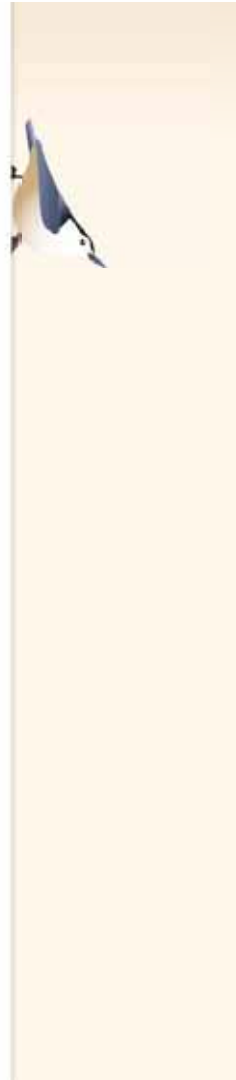
Black-throated Blue Warbler *Dendroica cyanescens*



Map by Cornell Lab of Ornithology
Range data by NatureServe

[View dynamic map of eBird sightings](#)

NestWatch
Combine **fun** backyard discoveries with **real science!**





Foliage Gleaner

Forages mostly in lower to mid-levels of forest, taking insects mostly from the underside of leaves.

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Conservation

status via IUCN



Least Concern

Probably decreased markedly with destruction of eastern forests in 17th and 18th centuries. With the beginning of abandonment of farms in New England in the late 19th and 20th centuries, populations rebounded. Currently populations seem stable.

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Credits

- Holmes, R. T. 1994. Black-throated Blue Warbler (*Dendroica caerulescens*). In *The Birds of North America*, No. 87 (A. Poole, and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D.C.

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Birding Basics

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Student Reading

Part II: Methods of Bird Research at Hubbard Brook

In the first part of this lesson, you learned about the conservation status of four bird species. To be able to identify the conservation status of a particular bird, researchers need to know its population size throughout its range. There are several ways to estimate this, and some of these methods rely on ordinary citizens. For example, research projects such as the North American Breeding Bird Survey ask skilled amateur birders as well as professional biologists to volunteer to count the species of birds seen on one particular day. Scientists compile this data to learn many things, including the distribution and abundance of different species of birds during the breeding season. Other projects, such as Project FeederWatch, ask the general public to count and report on the numbers and species of birds seen at personal home bird feeders during the winter months. This allows scientists to learn the abundance and distribution of birds during the winter when birds are not breeding.

In addition, data are collected by professional avian researchers, such as those who work at the Hubbard Brook Experimental Forest. Hubbard Brook researchers collect data not only to estimate population size, but to understand the multiple environmental factors that affect populations of individual bird species as well as the bird community as a whole.

Population census:

The Hubbard Brook Experimental Forest is owned by the United States Forest Service and is a 3,160 hectare (about 7,800 acres) reserve within the White Mountains of New Hampshire. In 1969, Dr. Richard Holmes of Dartmouth College established a 10 hectare study plot there (almost as big as 19 football fields) and began monitoring the bird community, going back each year to count all of the birds on the plot. He and his field crew

counted every individual of every species! The method used to accomplish this is called a *standardized timed census*: Researchers spread out 100 meters apart from each other and walk transects at the same time through the study plot. Each person tries to walk at the same speed and records the species, gender, age, activity, time of observation, and location of every bird seen or heard within 50 meters on each side of her or his transect.

Although the standardized timed census is still used several times each year to assess the entire bird community, Dr. Holmes and his colleagues decided to focus more intently on the population ecology of one species—the Black-throated Blue Warbler. They expanded the study plot to 64 hectares (about the size of 120 football fields), and since 1986 all of the Black-throated Blue Warblers on the plot have been monitored. The scientists use their monitoring to measure the average number of young produced by each nesting pair of birds every year. They compare this information to environmental factors such as predator abundance, food availability, and food density, in order to understand how these factors affect the nesting success of warblers.

Reproduction

Each year, a team of field workers arrive at Hubbard Brook in early May and await the spring arrival of migratory birds. They survey the study area daily, listening carefully for the characteristic song of the Black-throated Blue Warbler. Males arrive first, and when they do their territory locations are mapped. They are then monitored on a daily basis to detect when the females arrive (males follow around their females to guard them, making it easy to figure out whether a male is paired with a female or not).

The arrival of females is always an exciting time, because at this point the warblers are monitored even more intently in order for the researchers to find their nests. Females can be sneaky during the nest-building phase,

by being quiet or moving through dense vegetation where it is hard to track them. But over the years researchers at Hubbard Brook have figured out the best nest-finding strategies. First, they find the female, either by watching the male, looking for movement in the understory, or by listening for “chip” notes that are produced by the female. Then, they watch to see if she picks up spider webs, birch bark, dead grass or any other material that could be used to build a nest. If she does, then the researcher will try to follow the female back to her nest, all the while being as quiet as possible so as not to disturb her. Of course, sometimes it takes a few tries before the nest is found.

Once a nest is located, a flag is placed on a nearby tree and the nest is visited every few days to determine when the female starts to lay eggs, how many eggs she lays, and if the nest gets depredated—attacked by a predator—or if it survives. When the nestlings are 6 days old, they are briefly removed from the nest so that the researchers can place bands on their legs, measure and weigh them, and collect small blood samples. Each band is a small aluminum ring with a unique number that can be used to identify the bird if it gets caught again. A few days after banding, the nests are visited again to determine if the nestlings were successful in leaving the nest—a process called “fledging.” The researchers use this fledging information to determine the reproductive success of the warbler population, which they define as the average number of young produced (i.e. that “fledge”) per warbler pair in a given year.

Predators

While monitoring the reproductive activities of Black-throated Blue Warblers, the researchers also collect data on predator abundance, food availability, and warbler density. For instance, throughout the breeding season predator surveys are conducted in the core area of warbler territories, often near nests. Researchers stand at particular points and spend 5 minutes continuously watching for potential nest predators, noting their location on a data sheet. At Hubbard Brook, the most common nest predators are chipmunks and red squirrels, although there are other predators like jays and hawks that warbler parents also

have to contend with. All of these are noted in the surveys, and the data are ultimately used to determine the abundance of different kinds of predators within a warbler’s territory, as well as across the study area as a whole.

Food

Researchers also conduct insect surveys to determine the amount of food available to warblers during the breeding season. Black-throated Blue Warblers primarily forage by gleaning insects off leaves. They have a particular preference for moth and butterfly larvae (also known as caterpillars), energy-rich food items that they eat themselves and also feed to their young. Every two weeks, researchers examine a few hundred leaves of a variety of plant species throughout the study area, carefully looking for and counting the number of caterpillars that they see. These data are then used to determine the relative abundance of caterpillars, both across the forest and through time.

Density

In order to determine the number of Black-throated Blue Warblers within the study area, the researchers have to mark each individual so that the same one isn’t counted twice. A standard method in bird studies is to capture birds in mist-nets and to place a numbered aluminum and several colored plastic bands on their legs in a unique combination. The bands are of negligible weight and do not impede the birds’ movements. They are essential for the purposes of this study because individuals can then be identified by looking at them through a pair of binoculars and noting what band combination they have—for instance, red-aluminum-white-blue or black-aluminum-blue-black. Usually, males are caught early in the season when they are defending their territories. Researchers lure them into a net by playing a recording of another male’s song. Females don’t respond to playback as readily, so they are usually caught later in the season while they are getting on or off their nest. In the end, the total number of individually marked birds within the study area is used as a measure of warbler density.



Student Handout II

Part II: Methods of Bird Research at Hubbard Brook

Name _____

1. Describe one research project for which ordinary citizens help collect data. What is the name of this project, and what do people do to help?
2. What year did Dr. Holmes begin his research at the Hubbard Brook Experimental Forest?
3. What species of bird did he choose to focus his research on?
4. How do researchers know when the male Black-throated Blue Warblers have arrived each spring?
5. Describe one way researchers locate Black-throated Blue Warbler nests.
6. What are two types of data researchers collect from the nestlings?
7. List predators of the Black-throated Blue Warbler and describe how researchers determine their abundance.

8. What do Black-throated Blue Warblers like to eat, and how do researchers determine the amount of food available to these birds?

9. What must researchers know to measure the density of Black-throated Blue Warblers? How do they accomplish this?

10. The methods you just read about are also used for studying many other species of birds, including the others included in Part I of this lesson.

a. Out of those 4 species, which has the highest conservation priority?

b. Why is this? (What characteristics of this species contribute to its small population size?)

c. If you were a scientist and were asked to predict whether the population of this bird will decrease, increase, or remain stable, what would you try to find out to make your decision? Explain how one of the methods described in the reading could be used to help you.

Answer Key - Part I

Getting to Know You

American Redstart

Southern (winter) habitat:	3
Northern (summer) habitat:	4
Northern habitat characteristics:	1
Plumage:	3
Conservation status:	3

Black-throated Blue Warbler

Southern (winter) habitat:	2
Northern (summer) habitat:	2
Northern habitat characteristics:	2
Plumage:	1
Conservation status:	4

Blackpoll Warbler

Southern (winter) habitat:	4
Northern (summer) habitat:	1
Northern habitat characteristics:	3
Plumage:	2
Conservation status:	2

Bicknell's Thrush

Southern (winter) habitat:	1
Northern (summer) habitat:	3
Northern habitat characteristics:	4
Plumage:	4
Conservation status:	1

1. Identify one characteristic that all of these birds share in common.

Answers will vary, but should communicate that all of the birds breed in the forests of New England.

2. List three differences between the American Redstart and the Bicknell's Thrush.

Answers will vary but will most likely include plumage, conservation status and habitat characteristics.

3. Why are all of these birds considered to be Neotropical migratory birds?

All of these birds breed north of the Tropic of Cancer and migrate to a wintering ground south of the Tropic of Cancer.



Answer Key - Part II

Methods of Bird Research at Hubbard Brook

1. Describe one research project for which ordinary citizens help collect data. What is the name of this project, and what do people do to help?

The North American Breeding Bird Survey: volunteers count the species of birds seen on one particular day. Project FeederWatch: volunteers count and report on the numbers and species of birds seen at personal home bird feeders during the winter months.

2. What year did Dr. Holmes begin his research at Hubbard Brook?

1969

3. What species of bird did he choose to focus his research on?

Black-throated Blue Warbler (BTBW)

4. How do researchers locate individual male Black-throated Blue Warblers each spring?

They listen for the male BTBW song.

5. Describe one way researchers locate Black-throated Blue Warbler nests.

Researchers follow the males, as BTBW males follow the females around, guarding them from mating with other males.

6. What are two types of data researchers collect from the nestlings?

Aluminum bands are placed on legs of birds, blood samples are collected, and birds are weighed.

7. List predators of the Black-throated Blue Warbler and how researchers determine their abundance.

Chipmunks, red squirrels, blue jays, and hawks prey upon the BTBW. To determine their abundance, researchers stand at particular points and spend 5 minutes continuously watching for potential nest predators, noting their location on a data sheet.

8. What do Black-throated Blue Warblers like to eat, and how do researchers determine the amount of food available to these birds?

During the breeding season, BTBW like to eat insects, especially caterpillars, and they do so by gleaning them off of leaves. To determine the abundance of caterpillars, researchers examine a few hundred leaves of different plant species throughout the study area every two weeks, carefully looking for and counting the number of caterpillars that they see. Those data are then used to determine the relative abundance of caterpillars, both across space and through time.

9. What must researchers know to measure the density of Black-throated Blue Warblers? How do they accomplish this?

In order to determine the number of Black-throated Blue Warblers within the study area, researchers mark each individual so that the same one isn't counted twice. To do so, birds are captured in mist-nets and a numbered aluminum band and several colored plastic bands are placed on one leg of each bird in a unique combination. Researchers can identify individuals by looking through a pair of binoculars and noting what band combination each bird has. The total number of individually marked birds within the study area is used as a measure of warbler density.

10. The methods you just read about are also used for studying many other species of birds, including the others included in Part I of this lesson.

a. Out of those 4 species, which has the highest conservation priority?

Bicknell's Thrush

b. Why is this? (What characteristics of this species contribute to its small population size?)

It has a very restricted (small) suitable habitat: high in spruce-fir areas on mountain peaks in northeastern North America.

c. Describe ways in which the technology and methods you've just read about have increased our understanding of this bird's population size.

Bird banding has allowed researchers to figure out the small population size of Bicknell's thrush. Close observation of this bird has taught us that it only nests in spruce-fir forests high up on mountains in the Northeast.

d. If you were a scientist who was asked to predict whether the population of this bird will decrease, increase or remain stable, what would you try to find out? Hint: think about the facts you gathered for this bird in Part I.

Answers will vary, but students should mention that scientists would want to know about the habitat quality in the thrush's breeding area and in its wintering grounds as well as the quality of food and rest areas along its migration route. Are there threats to these habitats? Are people working to conserve these habitats? Etc.