



Motus Education

EDUCATOR GUIDE



Birds Canada is the leading national charitable organization dedicated to bird science and conservation in Canada. Our mission is to conserve wild birds of Canada through sound science, on-the-ground actions, innovative partnerships, public engagement, and science-based advocacy.

The Motus Wildlife Tracking System is a program of Birds Canada in partnership with collaborating researchers and organizations.

Resources developed by: Birds Canada
Contact: education@birdscanada.org
Web: birdscanada.org
Web: motus.org

Thank you to our generous funders for supporting the development of the Motus Education resources:



EDUCATOR GUIDE



Explore the journeys of birds and wonders of migration with the **Motus Education** program!



Mark Peck

Birds

are an exciting, and accessible way to connect with nature and learn about our environment. They are familiar, diverse and dynamic, and can be observed in nearly every habitat and location on Earth. Birds are important to humans in many ways, and are key indicators of the health of our environment.

Recent assessments report that one-third of North America's bird populations are at risk, contributing to the rapid biodiversity loss across the globe. There are many natural and human-related risks to birds, wildlife and our environment. To address these dynamic and complex conservation challenges, it is important to understand how birds interact with their environment throughout all stages of their life cycle.



Kerry Lee Morris-Cormier

Migration

is an extraordinary phenomenon, and one of great scientific inquiry. More than 75% of Canada's birds migrate, with billions travelling thousands of kilometers between breeding and wintering grounds, each spring and fall. Birds Canada has been monitoring birds during migration since 1960 through banding activities at Long Point Bird Observatory, and is just one of a broad network of monitoring sites and tracking projects across North America. As research and tracking technologies continue to improve, the international connectivity and migration ecology of birds is better understood.



Motus WTS

The Motus Wildlife Tracking System (motus.org)

is a global, collaborative research network that uses automated radio telemetry to study the movements of birds, bats and large insects. Tiny, digitally encoded tags are safely attached to an animal, and are detected by receiving stations on the landscape. To date, more than 800 receiving stations across the Americas work together to detect signals from nearly 200 species that have been tagged for tracking!

The information gathered through Motus provides ecological insight of a bird's journey. Migration is a critical stage for many birds, a demanding physiological feat combined with unknown threats and risks along the way. Healthy stopover sites, habitat and food resources, are required for birds to rest and refuel, and are a critical factor for survival and success.



Yves Aubrey

Motus offers a unique birds' eye view and global perspective of ecosystem dynamics, highlighting migratory pathways, critical stopover areas, and use of breeding and wintering habitats. Since many species are 'shared' across borderless landscapes through their annual movements, better knowledge of how and where birds are interacting with their niche habitats can aid international collaboration for full life cycle stewardship and conservation efforts.

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Motus Education

The **Motus Education** (motus.org/education) program brings the exciting, real-world science and interactive tracking of the Motus Wildlife Tracking System to the classroom. The goal of the Motus Education program is to inspire and educate students about birds, science, research and conservation.

The Motus Education program materials offer a progression of interactive, multidisciplinary activities, building context for birds, migration and science through a conservation lens. The activities are teacher-facilitated, and can be delivered as a package, or adapted to meet mandated curriculum, time availability, and student interests.

Connecting to Curriculum

Motus Education addresses regionally-mandated curriculum across Grades 7-12 in Canada and the United States. Connections across STEAM support inquiry and project-based learning models.

Broadly, the program addresses foundational skills for [21st Century Learning pedagogies](#), and the [6 Pan-Canadian Global Competencies in Education](#) (Critical Thinking and problem solving; Collaboration; Communication; Creativity and innovation; Global citizenship and sustainability and Connectivity and community). Activities also reflect skills, principles, and learning strategies incorporated in [Common Core US standards](#) and [Next Generation Science Standards](#).

Key concepts: animals, life cycles, habitats, communities, ecosystems, migration, environment, populations, species at risk, conservation, sustainability, technology, science and technology, career exploration

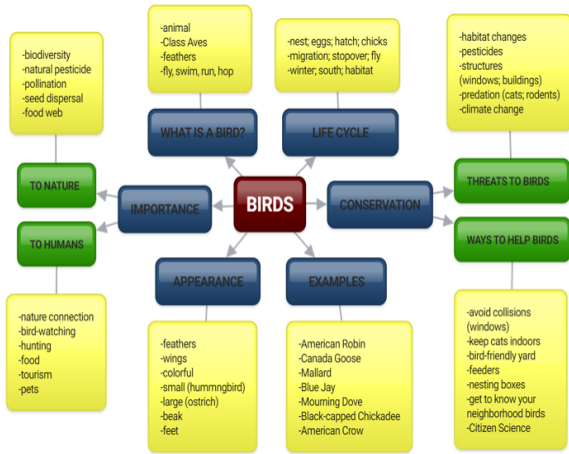


Liza Barney

OBJECTIVES

- Students will build connections to nature through the wonders of bird migration
- Students will build understanding of bird species and ecological connections from a local, regional, and global perspective
- Students will learn about natural and human-related threats to birds, other wildlife, and the environment
- Students will learn about real-world research and explore science and technology as a potential career interest
- Students will connect and collaborate with local community conservation partners on stewardship projects that work towards safe and healthy spaces for birds, including species at risk

MINDS-ON BIRDS



Mind Mapping

Get 'minds-on' birds and build collective knowledge through a mind-mapping exercise. Students each contribute a bird word or concept to generate a large 'vocabulary' about birds. As a guided activity, or in small groups, organize the words into a concept map. Keep map active to assess knowledge building progress.

KWL: What do I know? What do I want to know? What did I learn?

Use the Mind Map to generate the base for a KWL assessment, for students to understand what they know, build curiosity for what they WONDER and want to know, and to assess what they have learned about birds.

Go Birding!

Get to know your local bird life by exploring your schoolyard and neighbourhood!

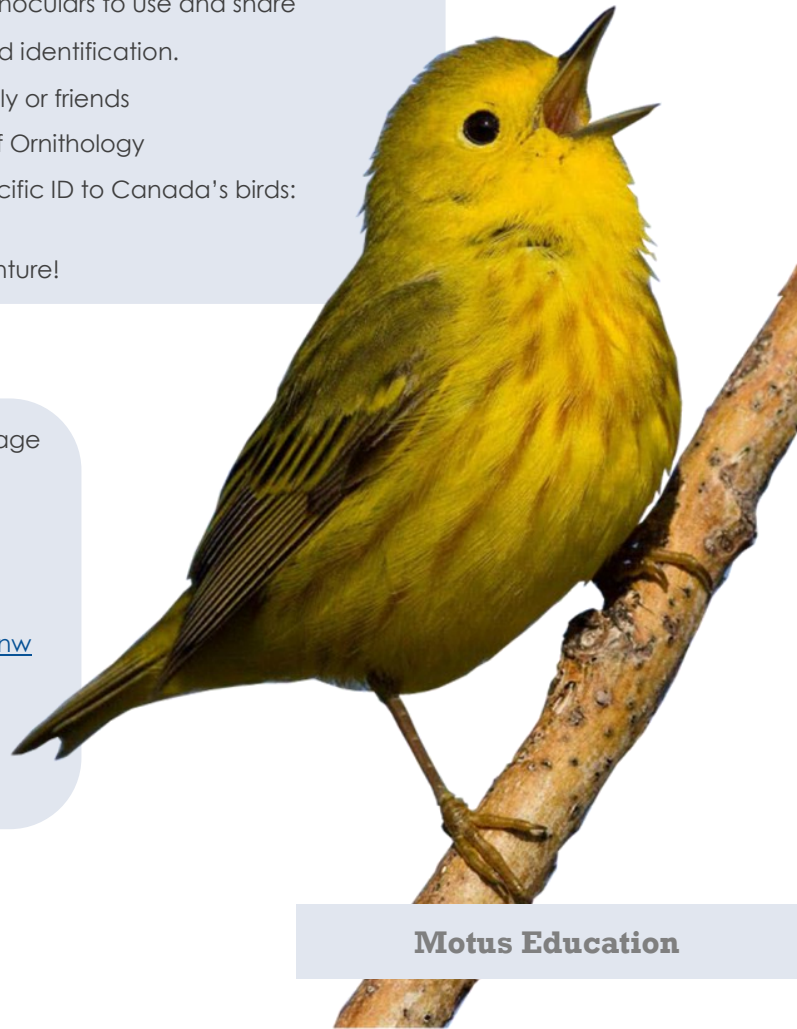
Compare bird diversity in different habitats, or across the seasons throughout the year. It's fun and easy, and you don't need to be an expert. Get started with a few items:

- Binoculars—students can bring or borrow a pair of binoculars to use and share
- Bird ID—there are plenty of resources to help with bird identification.
 - Field guides—find at the library; borrow from family or friends
 - Apps—download [Merlin Bird ID](#) by Cornell Lab of Ornithology
 - Quick Guide—download a date and region specific ID to Canada's birds: birdscanada.org/education/checklists
- Invite a local bird-watcher to join your birding adventure!

Citizen Science

Participating in a Citizen Science project is a great way to engage with birds while contributing data to conservation science. Get started with the following programs at school or at home:

- **Project FeederWatch:** feederwatch.org
- **Great Backyard Bird Count:** birdcount.org
- **Project NestWatch (Canada):** birdscanada.org/volunteer/pnw
- **NestWatch (US):** nestwatch.org
- **Schoolyard Bird Blitz (Canada):** birdscanada.org/birdblitz
- **eBird:** ebird.org



STUDENT ACTIVITIES

motus.org/education



Migration Presentation

What is migration? Where do birds go? Why do we track bird movements? This interactive, student-led presentation is guided by slide scripts, providing a comprehensive knowledge base that supports subsequent Motus Education activities. Print the presentation script file, cut each script tab and distribute to students. Participants read their corresponding script tab in chronological order with the presentation slide. Guiding questions are provided to support classroom discussion and interest.



Virtual Field Trip to Long Point Bird Observatory

Visit the Long Point Bird Observatory in Ontario, Canada from your classroom! Students will connect with biologists at the LPBO field station to explore the wonders of migration, observe banding of wild birds and learn about tracking science for conservation! This is a seasonal program, available between 8:30 am—12:30 pm Eastern Time during spring (April 15-June 15) and fall migration (August 15—November 15). Programs are approximately 45-60 minutes. Register by contacting: education@birdscanada.org



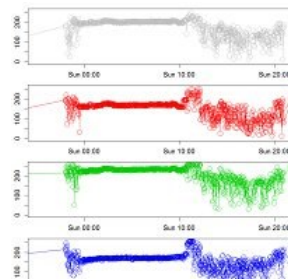
Species Case Studies

Become a species expert by exploring a Motus research project and the process of tracking birds for science and conservation. Choose a species of interest and work through the Case Study as a class, or break into smaller Case Study groups and compare the migratory strategies of different species. The guided mapping activity lends to deeper extension activities that students can explore in STEAM, careers and for conservation in the community.



Explore Motus Wildlife Tracking System

The Motus Wildlife Tracking System website offers navigation tools to explore a diversity of research projects, species and animal tracks. Use the guided activity to get started, and extend the investigation based on findings. Students can develop species fact cards of a tracked species of interest, or compare migratory strategies of species from a variety of locations.



Data Science

There are many ways to interpret and analyse information collected from bird movements. Students dive deeper into the scientific process by working with real data in the 'R' platform through this introductory, guided activity.

Note: 'R' is an open source platform for statistical and graphic analytics. Please read the 'R for Beginners' file to determine the accessibility and applicability of this activity for students.

EXTENSION ACTIVITIES



Ecological Connections

Design a food web model to display connections of a species of interest to their ecological community.



Bird Art:

Sketch or model a bird species using pencil; paints; clay; or using computer graphics (using software such as Adobe Illustrator).



Bird Inquiry:

Investigate a human-related threat to birds and present information in a creative communication (infographic, popular news article, skit, memes, comic, graphic, brochure, powerpoint presentation, poem, short story, game, quiz, appeal letter, blogpost etc.)



Connecting Communities Through Birds:

Connect with another school that shares the wintering, migratory or breeding range of a tracked species. You could write a letter to inform the school of the bird, exchange posts on social media, or arrange a classroom-to-classroom video chat.



Career Connections:

Write a professional profile for one of the personnel on the project team. Find this information on the Motus website project pages in Case Study. Consider reaching out for an interview about their career path, organization or research.



Citizen Science:

Participate in Citizen Science to learn more about birds in your area and contribute observations for science and conservation. Try Project FeederWatch, Project NestWatch (Canada), NestWatch (US), Great Backyard Bird Count, and eBird.



Stewardship & Conservation:

Initiate or participate in a stewardship activity that helps reduce or mitigate impacts of threats to birds in your community.

GLOSSARY



Aerial Insectivore	An animal (bird, bat, insect) that feeds on insects while in flight
Alternate plumage	The feather molt of birds during non-breeding periods
Altricial young	Birds born naked, blind and dependent on parental care (Ex. most songbirds)
Aves	The class of animals known as “birds”
Biodiversity	‘Bio’ means Life; ‘Diversity’ means variety; the variety of life forms
Bird Banding	A technique used to study and track individual birds by attaching a numbered metal band to the leg and releasing it back into the wild
Breeding	To mate and produce offspring
Breeding Behavior	Behavior exhibited to attract a mate (bright plumage, singing, drumming, dancing)
Breeding Plumage	The feather molt used during the breeding season (males are usually more colorful)
Brood	The number of birds hatched from a single clutch of eggs
Brood Patch	The patch of featherless skin on underside of birds for incubation during nesting
Call	Short and simple bird sounds. Communicate location, hunger, danger
Camouflage	The colouration of an organism that matches its environment to conceal itself
Climate Change	A change in regional or global climate patterns
Clutch	The number of eggs a female lays in a single nesting attempt
Conservation	The preservation, protection, or restoration of wildlife and the natural environment
Copulation	The mating process which fertilizes the egg to initiate development of embryo
Courtship	Displays or rituals performed to attract a mate
COSEWIC	Committee of the Status of Endangered Wildlife in Canada (www.cosewic.ca)
Diurnal	Birds that are active during the day and sleep at night
eBird	A global Citizen Science database of bird observations (www.ebird.org)
Ecosystem	Combination of all living and non-living things that interact in an environment
Egg	The hard-shelled structure laid by birds containing embryo, yolk, and white
Endangered	A species that is in danger of becoming extinct
Environment	An area characterised by conditions in the climate, soil, terrain, and living organisms
Extinction	A species that is no longer living on Earth
Field Marks	Visible characteristics of a bird (color, wing bars, bill shape)
Feathers	External, ‘feathered’ projections of the skin unique to birds. Aid in flight, insulation, waterproofing, camouflage and courtship.
Fledge	When young birds leave the nest
Flyway	Flight route used by migratory birds between their wintering and breeding locations

Food Chain	Direct links of energy transfer between organisms
Food Web	The combined interactions between different species in an ecological community
Habitat	A place where an animal makes its home and meets all of its needs for survival (food, water, shelter, and space)
Hatch	Process of baby bird breaking out of an egg
Herbivores	Primary consumers; organisms that eat plants (primary producers)
Incubation	The process of keeping eggs warm (or cool) to maintain temperature for development
Invasive Species	A plant or an animal that is non-native to the environment and is having a negative impact on the dynamics of the natural community
IUCN	International Union for the Conservation of Nature; global authority on the status of natural world and the measures needed to safeguard it (www.iucn.org)
Juvenile	A young bird that has fledged the nest and is independent of parental care
Migration	Movement of a species from one place to another; usually for breeding, foraging, and survival
Molt	The process of losing and replacing feathers for breeding and migration
Motus WTS	Motus Wildlife Tracking System, a large-scale network of automated radio telemetry receivers to track small animals across the landscape
Nanotag	Small radio transmitters that emit a unique signal (frequency). Affixed to small animals (birds, bats, insects) to determine location and date/time when detected by a receiver
Neotropical Migrant	A long-distant migrating bird that winters in the tropics and breeds north of 23 °N
Nest	Shelter prepared by birds for laying eggs and raising young
Nocturnal	Birds that are active at night and sleep during the day
Ornithology	The scientific study of birds
Plumage	The colour and colour patterns of feathers
Population	The number of individuals of a particular species in a defined area
Precocial young	Birds born fully feathered, mobile, and active (Ex. ducks, geese, shorebirds)
Preen	To clean and position feathers with a beak
Roost	A place for temporary rest or sleep
Scrape	A shallow depression used by ground birds as a nest (Ex. Killdeer)
Songs	Loud vocalizations used to attract mates or as territorial defense
Species	Individuals of the same organism that can breed and produce fertile offspring
Stewardship	Responsible activities to protect and enhance the environment
Stopover	A brief stay during the course of a migration to rest and build energy reserves
Taxonomy	The classification of organisms to assign names and relationships (Kingdom; Phylum; Class; Order; Family; Genus; Species)
Threatened	A species at risk of becoming endangered
Wintering	To spend the winter; often the non-breeding stage

RESOURCES



MOTUS WILDLIFE TRACKING SYSTEM

- Motus Wildlife Tracking System: <https://motus.org/>
- Motus Education: <https://motus.org/education/>

LIFE HISTORY OF BIRDS

- Cornell Lab of Ornithology All About Birds: <https://www.allaboutbirds.org/guide/>
- Audubon Guide to North American Birds: <https://www.audubon.org/bird-guide>

CONSERVATION AND POPULATION STATUS

- COSEWIC Assessment and Status of birds in Canada (2011) https://wildlife-species.canada.ca/species-risk-registry/sar/index/default_e.cfm
- International Union for Conservation of Nature Red List: <https://www.iucnredlist.org/>
- Birdlife Data Zone: <http://datazone.birdlife.org/species/search>
- US Fish and Wildlife Service: <https://www.fws.gov/endangered/>
- The State of the Birds (United States of America, 2014): <http://archive.stateofthebirds.org/2014/>
- State of North America's Birds (2016): <https://www.stateofthebirds.org/2016/>
- State of Canada's Birds Report (2019): <http://nabci.net/resources/state-of-canadas-birds-2019/>

NATURAL AND HUMAN-RELATED THREATS

- A Synthesis of Human-related Avian Mortality in Canada: <https://www.ace-eco.org/vol8/iss2/art11/>
- Quantifying Human-related Mortality of Birds in Canada: <https://www.ace-eco.org/issues/view.php?sf=4>
- Audubon Climate Report: <http://climate.audubon.org/>
- USFWS Threats to Birds: <https://www.fws.gov/birds/bird-enthusiasts/threats-to-birds.php>