Female ruby-throated hummingbird

JIM BRANDENBURG / MINDEN PICTURES

SPECIAL REPORT

Canada's Migratory Birds

Millions of birds travel to and from their Canadian breeding grounds every year. They come from all over the Americas, some travelling thousands of kilometres. With climate change, pesticides and many other challenges, now more than ever they are facing tough headwinds

Flock of ring-billed gulls, Point Pelee National Park, Lake Erie, Ontario

Birds without Borders

Canada provides crucial breeding habitat to millions of migratory birds every year. Thanks to new methods of tracking and counting, we are learning more and more about their extraordinary lives — and the many challenges they face here and abroad

By Brian Banks

ALAMY STOCK PHOTO

The story of birds in Canada — and their increasingly apparent, if uneven, decline — is a story of multitudes in motion: many hundreds of distinctive species, several billion restive individuals, many of which spend just a few months each year within our borders before they and their new offspring depart for wintering grounds in either the U.S., Mexico or Central and South America.

"You really have to consider the full life cycle of those species to understand their true reality," says Bruno Drolet, a senior biologist with Environment and Climate Change Canada, in Quebec City.

For most Canadians, even those who are noticing birds more due to pandemic lockdowns and at-home isolation, anything other than a glimpse of that life cycle may seem out of reach.

But as it turns out, it's not that much easier to attain for committed amateur birders or even for professional biologists.

When Environment and Climate Change Canada published the most recent *The State of Canada's Birds* report in 2019, for example, with nearly 50 years of population trend data for more than 400 species, the project steering committee needed to tap more than a dozen different long-term monitoring programs.

That report contained some stark details: while many species of waterfowl and birds of prey have increased in number since 1970, the populations of more than half of Canada's birds, particularly grassland birds, aerial insectivores and shorebirds, have plummeted by 40 to 60 per cent, on average.

To get this information, the authors drew on two long-running national and continental surveys — the Christmas Bird Count and the North American Breeding Bird Survey — that depend on thousands of volunteer citizen scientists to gather the field data. They also drew on many lesser-known counts that focus on specific regions, habitats or types of birds. Done by professionals with the Canadian Wildlife Service and the United States Fish and Wildlife Service as well as other groups, these counts require planes, helicopters and often arduous, challenging and sometimes dangerous fieldwork. Even after all that, the report comes with a big asterisk: nearly one-quarter of Canada's bird species are not yet well monitored.

The point is not to say that report's findings aren't hugely significant. Rather, it's to underscore the enormity and incomplete nature of the task — and to shine a spotlight on another ascendant Canadian program that combines migratory bird banding, data collection and

On the lookout in Point Pelee National Park

research with creative public engagement and education about birds and conservation: the Canadian Migration Monitoring Network.

This network of nearly 30 independent bird observatories strung across the country from the Bay of Fundy to the tip of Vancouver Island was founded in 1998 as a cooperative venture between the stations, the non-profit conservation organization Birds Canada and the Canadian Wildlife Service (a branch of Environment and Climate Change Canada). It is now coming into its own in important ways.

Most of its member observatories are small non-profits with modest budgets, few staff and lots of committed volunteers. While important locally, what makes them nationally significant — and an example globally — is that belonging to the network requires adhering to standardized data gathering protocols. They submit that data to the network, where it is compiled and analyzed, producing a Canada-wide dataset of trends and other insights for use by other researchers and policy-makers. Doing that turns "these little Davids into a Goliath," says Stuart Mackenzie, migration program manager at Birds Canada and a member of the network's 12-person steering committee.

It also puts another ally in the corner for Canada's birds when there has never been a greater need.

At 42 square kilometres, Pelee Island is the largest island in Lake Erie. But it is probably best known for two things: being the southernmost populated point in the country, as well as a resting and refuelling mecca for hundreds of species of birds travelling to and from Canada via two of the continent's great migratory bird routes, the Atlantic and Mississippi flyways (see page 25).

Those birds also attract many birders and tourists. Springsong Weekend is a highlight for both, traditionally held on Mother's Day weekend in May and hosted by author and bird lover Margaret Atwood. What attendees might not realize is that at the same time Atwood helped launch the event in 2002, she was co-founding the Pelee Island Bird Observatory, along with her longtime partner, the late Graeme Gibson, and Gibson's son, Graeme the younger, who was the observatory's managing director until 2017.

Before the Pelee Island Bird Observatory, the younger Gibson first trained as a field ornithologist up the lake at the Long Point Bird Observatory. Founded in 1960, this bird observatory is the oldest in the Americas and the largest in the Canadian Migration Monitoring Network. Many of the monitoring and sampling methodologies used at the network stations were developed there.

ROBERT MCCAW, GETTY IMAGES.

BIGGEST

The **American white pelican** (*Pelecanus erythrorhynchos*) breeds in central Canada, primarily in Alberta, Saskatchewan, Manitoba and Ontario. Most migrate to wintering grounds around the Gulf Coast in the southern U.S. and northern Mexico, though the limited populations that breed west of the Rockies tend to winter in California and the west coast of Mexico. Flying in large Vs at speeds up to 50 km/h, they are distinguished by their massive wingspan, which can exceed 2.5 metres.

GETTY IMAGES. ROBERT MCCAW. ILLUSTRATION: CORY PROULX.

Also, like Gibson, the founders of many other Canadian observatories first trained at Long Point. Even Birds Canada, which now manages the Long Point Bird Observatory as well as the Thunder Cape Bird Observatory on Lake Superior and also serves as the network's administrative home — collecting, analyzing and archiving its stations' migration monitoring data and coordinating network-wide research — is based in nearby Port Rowan and owes its existence to the observatory.

When the Canadian Migration Monitoring Network was formed, it consisted of a dozen migration monitoring stations. By the time the Pelee Island Bird Observatory officially joined in 2005, it had more than 20, and it has grown gradually since. Most are either at coastal sites or next to inland lakes where birds tend to congregate in large numbers during migration, locations also often designated as Important Bird Areas, a globally recognized conservation concept. A few observatories are in big cities, like Victoria, Toronto, Calgary and Montreal, while others are more remote. Many are also located in, and sometimes affiliated with, parks or protected wildlife areas.

In every case, nature abounds. In the Long Point Bird Observatory's long history, for example, it has recorded more than 400 species of birds. In a different extreme, the Observatoire d'oiseaux de Tadoussac, on the north

LOSING GROUND

Burrowing Owl
(*Athene cunicularia*)

Belying its somewhat comical appearance, the burrowing owl is a formidable creature ideally suited to life on the prairie. Slightly larger than a robin, it occupies abandoned small mammal holes and dens and stands practically invisible on lightly grazed lands on its long spindly legs, using its acute 270-degree field of vision to survey for both predators and prey. It winters in Mexico and south Texas, New Mexico, Arizona and California, a one-way voyage of about 2,300 km.

Once abundant in the entire prairie region, burrowing owl populations plummeted as most grassland became cropland, with the rest fragmented and degraded. Wintering habitat has also been reduced significantly. With these changes comes a drop in available prey. Burrowing owls are also particularly vulnerable to pesticides. As ground dwellers, they are affected directly by agricultural spraying, which can cause immediate death. The pervasive toxins in the ecosystem cause drops in birth rates, rises in birth defects and curtailed lifespans. Listed by the Committee on the Status of Endangered Wildlife in Canada as endangered, the population dropped by 90 per cent between 1990 and 2000, and the collapse has continued: in the whole country, perhaps an estimated 300 owls remain. Saskatchewan is home to roughly 100, largely in and around Grasslands National Park, which conserves the unique and crucial mixed-grass ecosystem. Established in 1981, the park is the largest tract of remaining prairie, occupying fewer than a thousand square kilometres along the international border with Montana.

FARTHEST

Breeding in Canada's Arctic, Subarctic and Atlantic regions, the **Arctic tern** (*Sterna paradisaea*) actually winters in Antarctica. That means their trips, which tend to meander, can total well over 25,000 kilometres. Medium-sized with wingspans of 75 centimetres, they are long-lived, from 15 to 30 years. Over their lifespans, they will travel as many as two million kilometres. The seminal publication *The Birds of the Western Palearctic* claims that because of its polar homes, the Arctic tern is exposed to more sunlight than any other creature on Earth.

shore of the St. Lawrence River estuary east of Quebec City, is renowned for the occasional flood of warblers and other returning spring migrants. These are thought to occur when the birds have been blown off course out over the water and return to shore before continuing north. One day in 2018, birders there counted an estimated 500,000 to 700,000 birds, the largest single daily count ever recorded.

Aside from its illustrious literary pedigree, the Pelee Island Bird Observatory's program roster reflects activities typical at many of the Canadian Migration Monitoring Network observatories (prior to COVID-19, which has disrupted every station's activities). At its heart is the daily monitoring through the spring and fall migration seasons. This involves both a 90-minute census walk, counting every bird that's present, followed by the tallying and banding of birds captured in mist nets near a banding station at the island's south end. According to executive director Suzanne Friemann, field staff also conduct a resident breeding bird census, summertime marsh monitoring and northern saw-whet owl migration monitoring in the fall. The observatory also runs a year-round education program — now a staple at most observatories — held off-site in Windsor, where there is a large enough audience to support it.

Elsewhere, programs and activities vary depending on resources and location.

Rocky Point Bird Observatory, for example, with two station locations on the southern tip of Vancouver Island, conducts passerine (i.e., perching or songbird) migration monitoring only in the fall. But its other activities include a year-round sea-watch program that gathers data on area seabirds and a hummingbird banding project at remote locations in B.C.'s southern interior. Like a number of network observatories, it also collects data for a North America-wide project tracking the health and productivity of local breeding birds, called MAPS.

Launched in 1994, Rocky Point joined the Canadian Migration Monitoring Network in 2001. "We've kept building and building," says Ann Nightingale, a longtime board member.

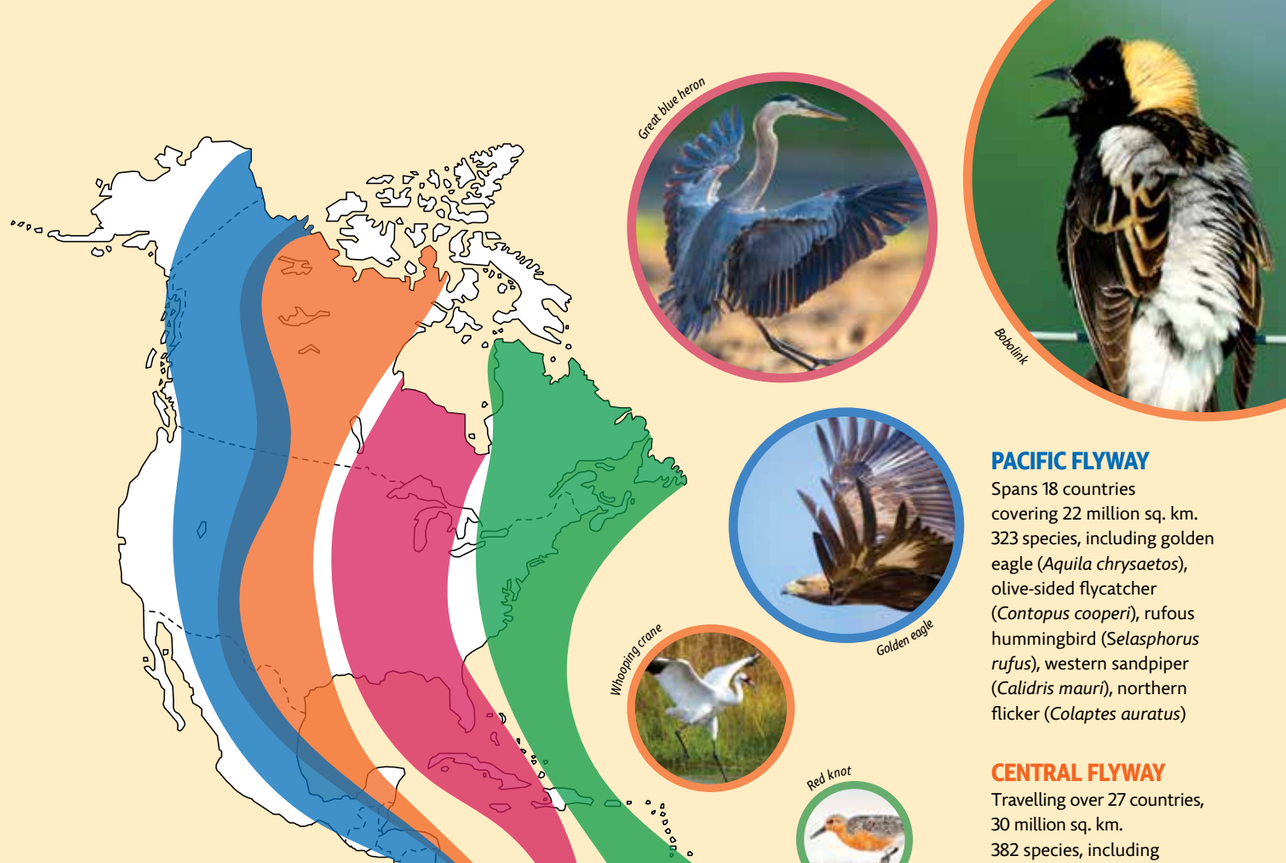
That building process has included a lot of education programming and public outreach. Not only is it important for fundraising, but Nightingale says it's central to the mission of saving birds. "Big actions to protect the environment tend to come at the governmental level. And our best way to influence government to make better decisions for birds is to make people care about birds."

Growth is a constant theme across the network, according to Patti Campsall, executive director of the Lesser Slave Lake Bird Observatory. Located in a provincial park on the eastern shore of Lesser Slave Lake northwest of Edmonton, its original banding station underwent a major expansion in 2006 when it partnered with Alberta Parks on an education and research centre that doubles as a visitor centre for the park.

Dubbed the Boreal Centre for Bird Conservation, the centre is used by the observatory to run a year-round education program for school kids in the area and other special events. Simultaneously, it has fostered expansion of the observatory's research field station activities to include collaborative projects with universities across North America. In the most recent of those, researchers from Columbia University in New York teamed with the observatory's field staff to capture American robins during spring migration, outfit them with tiny GPS units and then release them back to the wild. Those devices linked directly to NASA satellites, enabling the researchers to track the birds' habitat use en route to their final breeding destinations.

"What's happened with our station is a trend that I've seen happening to a lot of the stations," says Campsall, who also sits on the Canadian Migration Monitoring Network steering committee. "There's a real evolution from the core banding programs." *(Continued on page 26)*

GETTY IMAGES



THE GREAT FLYWAYS

The massive bird migration that occurs each spring, filling Canada's skies with millions of birds headed to their northern breeding grounds, is a wonder of nature. Four flyways span as far south as Argentina to the Canadian Arctic, connecting different summer and winter grounds. Birds of all kinds share them, though each species has its own timing, staging, route and stopovers suited to its specific demands and needs. Related species often come together for various stages of the journey, splitting off as their disparate destinations grow closer. Some migrating birds use a different flyway for their north- and southbound trips. Species numbers given are approximations.

GETTY IMAGES, MAP: CORY PROULX.

PACIFIC FLYWAY

Spans 18 countries
covering 22 million sq. km.
323 species, including golden eagle (*Aquila chrysaetos*), olive-sided flycatcher (*Contopus cooperi*), rufous hummingbird (*Selasphorus rufus*), western sandpiper (*Calidris mauri*), northern flicker (*Colaptes auratus*)

CENTRAL FLYWAY

Travelling over 27 countries,
30 million sq. km.
382 species, including whooping crane (*Grus americana*), ruby-throated hummingbird (*Archilochus colubris*), bobolink (*Dolichonyx oryzivorus*), buff-breasted sandpiper (*Calidris subruficollis*), Sprague's pipit (*Anthus spragueii*)

MISSISSIPPI FLYWAY

Spans 31 countries,
32 million sq. km.
325 species including great blue heron (*Ardea herodias*), purple finch (*Haemorhous purpureus*), common grackle (*Quiscalus quiscula*), brown-headed cowbird (*Molothrus ater*), red-breasted nuthatch (*Sitta canadensis*)

ATLANTIC FLYWAY

Flying over 46 countries,
34 million sq. km.
395 species, including red knot (*Calidris canutus*), cerulean warbler (*Setophaga cerulea*), ruddy turnstone (*Arenaria interpres*), Bicknell's thrush (*Catharus bicknelli*), lesser yellowlegs (*Tringa flavipes*)

FASTEST

Peregrine falcons (*Falco peregrinus*) have been seen everywhere in Canada, though they are sporadically located. Arctic-nesting peregrine falcons breed from the Yukon coast of the Beaufort Sea as far north as Baffin, reaching all the way east to Labrador. Covering as many as 500 kilometres in a day, they have been tracked travelling from Edmonton to Mexico in just eight days.

Net work: Song sparrow caught for banding, Richmond, B.C.

GETTY IMAGES

From a network standpoint, however, the observatories' core banding and census migration monitoring activities are still key — and point the way to a future where the Canadian Migration Monitoring Network observatories and their data might have the biggest scientific impact in helping inform bird conservation efforts in Canada and throughout the western hemisphere.

Recall that asterisk in *The State of Canada's Birds* report and the nearly 25 per cent of bird species that are not yet well monitored. According to the report, these include a range of species, such as Arctic-nesting birds, pelagic seabirds, sea ducks, certain owls and "cryptic or very rare birds."

Another known unknown, to borrow a phrase, is the exact status of scores of birds that breed every year in the boreal — the massive band of relatively undisturbed forest that runs through central and northern Canada from Newfoundland to the Yukon. Many are the songbirds that winter in Central and South America.

The main issue from a conventional monitoring perspective is that the North American Breeding Bird Survey methodology — the gold standard in field data collection — relies on roadside surveys. Yet there are no roads beyond the southern fringes of the boreal and, hence, no surveys. As Erica Dunn, a now retired Canadian Wildlife Service research scientist who co-chairs the Canadian Migration Monitoring Network's steering committee and also heads its science subcommittee, explains, this means any trends for boreal breeding species based on data from the Breeding Bird Survey "may not be representative of the whole region."

The network's founders recognized this problem when the network was first proposed. As a result, while observatories may see a lot of birds, the timing and structure of their banding and census work is chiefly designed to target these neotropical migrants after they leave or are returning to the boreal — to obtain accurate counts of those birds passing through the stations and then plug that data in models to come up with overall population estimates.

A big part of what has taken place in the network's first 20 years of operation has been expanding that database (in terms of both time and geographical coverage) and then attempting to validate its potential to serve as an accurate proxy for actual field surveys in the boreal. As a control, researchers started by comparing their long-term population indexes for migratory birds that breed in southern Canada with results in the North American Breeding Bird Survey. A high correlation would affirm the validity of the network data and modelling and, for the most part, that's what was found.

"Results indicated that migration monitoring is indeed measuring a similar population signal to BBS for species breeding primarily in the south, particularly in spring," wrote the authors of the network's *Ten-Year Report on Monitoring Landbird Population Change*, published in 2008. "However, this relationship breaks down for species breeding primarily north of BBS coverage. By inference, these results further support the notion that migration monitoring can be used to effectively monitor the status of boreal/northern breeding birds where BBS coverage is weak."

That's only step one, however. Observatory counts alone may produce trends for specific points in the migration, but they don't indicate where those birds originated or where they might end up on their return.

"When a bird hits a net at a banding station, you have no idea where it's coming from," says Keith Hobson, a professor of biology at Western University in London, Ont., and a principal investigator with that school's Advanced Facility for Avian Research.

To solve that puzzle, scientists like Hobson look to basic chemistry. It turns out that patterns in stable hydrogen isotopes in rainfall vary by location. When that water enters the food web, those signatures are imprinted in the feathers of birds (and other animal tissues) that

FENG YU / ALAMY STOCK PHOTO. ORIOL ALAMANY / NPL / MINDEN PICTURES. ILLUSTRATION: CORY PROULX.

TOO MUCH CHANGE

The many impacts on migratory birds of the global climate crisis

Migratory birds are extremely vulnerable to the effects of global heating. Over the past 60 years, their populations throughout North America have declined precipitously, with a net loss of more than three billion birds. A closer look at the numbers reveals that while resident species populations have generally stayed the same, the number of migratory birds has collapsed. And the greater the migration distance, the greater the threat. Here's why.

Ivory gull

MANY HABITATS

Migratory birds depend on multiple sites for their survival: their breeding grounds, their wintering zones and the crucial rest-and-refuel layovers on the migration route. Climate change is altering conditions in all three. With the Arctic climate changing faster than anywhere else, the 80-plus bird species that breed in the Arctic suffer disproportionately. Canada's endangered ivory gulls (*Pagophila eburnea*) are a prime example: the sea ice on which they forage to survive is retreating every year. The population has shrunk by 90 per cent over the last 20 years.

EARLY BIRDS…

Birds are migrating earlier. A huge study of 96 migratory species in Canada showed more than a third are arriving earlier and in many cases laying their eggs an average of a week earlier each decade. Many also head south later in the fall. The problem is,

with the changing conditions in each locale, their arrival is mistimed. Prey might no longer be available in quantity; indeed, the many spring food sources that have not yet begun to adapt to rising temperatures (plant blooms, larvae and insects) will be sparse. The results are shrinking populations of less resilient birds, a particularly dire development for voyagers undertaking long and demanding migrations.

MOVING TARGETS

As temperatures rise, migrating birds in search of their usual springtime conditions are moving northward or to higher elevations. One study of warblers found on average they were already wintering more than 100 km north of where they did two decades ago. *The Ontario Breeding Atlas* points out that even species in southern Canada, including the tufted titmouse (*Baeolophus bicolor*) and the northern mockingbird (*Mimus polyglottos*), are shifting north. The changes throw off the delicate ecological balance that has evolved over millennia.

DANGERS ARE CHANGING

Warmer climatic conditions bring other new threats to migratory birds. Unfamiliar and threatening parasites are attacking species even as new and aggressive competitor-species are joining the fight for diminishing food and nesting resources. New and unfamiliar predators lurk too, for whom migratory birds may have no evolved defences.

Tufted titmouse

Blackpoll warbler

ROBERT MCCAW; GLENN BARTLEY; ILLUSTRATION: CORY PROULX.

develop there. "Because most birds in North America moult their feathers on the breeding grounds before they migrate, those feathers carry a signal of where they came from," says Hobson.

Several years ago, working with feather samples collected (harmlessly) from birds captured at network banding stations during spring migration, Hobson and others were able to determine roughly where those birds came from. Over time, they've used that data to create maps that show the "catchment areas" for different species of birds banded at each observatory.

"We've created these origin maps for about 15 species now," Hobson says. "It sounds pretty simple: where do you come from? But just knowing and describing that ... opens up a huge number of possibilities. I think the scientific worth of these stations has really increased because of that."

Is that information accurate enough that Environment and Climate Change Canada might begin to incorporate the network's population trend data when it next assesses the conservation status of those species, either individually or in the next report on the state of Canada's birds?

That door seems to be open — and a new pilot study in which the federal department has partnered with the network's science committee, focused on the blackpoll warbler, may seal the deal.

The blackpoll is a migratory songbird that breeds in spring and summer throughout the boreal and winters in South America — and its southbound route is particularly epic. Blackpolls, which weigh less than a loonie, begin the trip by flying east, out over the Atlantic Ocean, then travel nonstop for several days before landing either in the Caribbean Islands or the northeastern coast of South America. The 2,000-to-2,500-kilometre journey is the longest recorded overwater flight of any songbird.

The relevant measurements in this study, however, have to do with their population levels in the boreal. Based on the Breeding Bird Survey data, their situation is dire, with their population having plummeted 83.8 per cent between 1970 and 2016. Yet data gathered by network observatories since the 1990s indicates relatively healthy and stable blackpoll populations in western and central Canada, with a decline only in the East.

The goal of the joint study is "to understand the discrepancy," says Environment and Climate Change Canada's Bruno Drolet, who is also a member of the network steering committee and who ran the observatory at Tadoussac for three years in the early 2000s.

Based on the Breeding Bird Survey reports, Drolet says the blackpoll is a candidate for assessment and potential listing by the Committee on the Status of Endangered Wildlife in Canada. "One of the pitfalls we want to avoid at all costs is to declare a bird as a species at risk, where in fact it's not at risk at all, because of bad data," he explains.

To be clear, his department isn't looking solely at the network's data only to address data gaps involving boreal birds. Under the auspices of a Canadian Wildlife Service boreal monitoring strategy, work is now underway on a lengthy, elaborate and expensive plan to deploy a boreal monitoring ground survey to count birds during the breeding season. In a paper published last year in the journal *Plos One*, the department laid out what it believes to be the most cost-effective, statistically accurate sampling methodology to follow. Now, Drolet says he and his colleagues in other regions are working on its implementation.

"The challenge is titanic. And the resources are limited. So, it might take 20 years to cover the entire boreal," he says — even longer to build up a time series to assess trends.

According to Dunn, the magnitude of that task underscores the potential value that the network's migration monitoring surveys can bring to the table. She's hopeful the early progress they're making in the blackpoll warbler pilot will soon result in Environment and Climate Change Canada looking more closely at the data that Hobson and others have so far compiled for another dozen or more boreal breeding migrants.

"This is really an exciting development for the network," says Dunn. "This is really what we've been working for, working towards, for 20 years. And we're finally in a position to get there."

SMALLEST

The diminutive **ruby-throated hummingbird** (*Archilochus colubris*), which normally weighs less than a nickel, doubles its weight as it prepares to travel the 3,500 kilometres between wintering grounds in Central America and breeding grounds in central Canada. For many, the voyage includes a perilous 800-km leg over the Gulf of Mexico. Adult males travel first and are followed by females and youngsters. Unlike many migratory birds that travel in flocks, often in echelons, these tiny hummingbirds go it alone, travelling close to the ground, always on the watch for food sources, resting each night.

GETTY IMAGES

Mud, Slime and Migration

Every spring, en route to Alaska, up to a million migrating western sandpipers stop off at mudflats near Vancouver in search of nutritious bio-slime. Now, plans for a massive container terminal nearby could destroy this crucial habitat

By Kerry Banks

Western sandpipers during their refueling stopover at crucial mudflats near Tsawwassen, B.C.

MATTHIAS BREITER / MINDEN PICTURES

Each April, about a million western sandpipers descend on a vast expanse of mudflats near the Fraser River estuary on B.C.'s south coast. The sight and sound of this avian phenomenon ranks among the continent's great wildlife spectacles. Whirling through the air in synchronized motion, the huge flocks create gusts of wind with their flapping wings that sound like roaring jets.

The sandpipers (*Calidris mauri*) gather here to stock up on nutrients for the last stage of their northerly migration from their winter haunts in Latin America. From here, these little birds, weighing less than a granola bar, will fly 1,000 kilometres northward to nesting grounds in Alaska.

The scientific community has long recognized that the Fraser estuary, a broad, fertile plain that empties into the Salish Sea 30 km south of Vancouver, is one of Canada's most vibrant ecological sites and a key habitat for more than 500 species. But just how vital this area really is and the complexity of the nourishment it provides became apparent only recently as a result of some startling discoveries.

FOR THE **BIRDS**

Migratory birds are suffering and they need Canadians' help. Here's what you can do to make a difference

BE A CITIZEN SCIENTIST

Knowledge is power, and for any scientist or researcher, data rules supreme. But tracking migratory birds is no easy thing: vast numbers of hundreds of species, traversing an entire continent on their own unique schedules, would seem impossible to monitor. Collective efforts are the solution. By joining a bird survey, you can help bring the most up-to-date sightings to the experts. Thanks to websites like iNaturalist.ca, it is simpler than ever to get the information you gather to researchers who need it. Hiker or hunter, you will be joining a community of like-minded nature-lovers who are making a difference and lending migratory birds a much-needed hand.

CREATE AND PROTECT HABITAT

Migrating birds need safe, natural spaces all along their journey. In addition to the large stopover areas they return to every year, small islands of habitat can make the difference between survival and death — even urban green spaces can make a difference. Seek out local bird and nature clubs. They will have projects and events where you can pitch in, to help retain and create vital habitat.

Western sandpiper

These findings have made the western sandpipers the focal point of a standoff between environmentalists and the Vancouver Fraser Port Authority, which wants to build an expanded container terminal just north of the mudflats. The fate of the development — and perhaps even the western sandpipers as a species — may rest on the conclusions of an environmental assessment that is now in its final stages. A decision by the independent panel appointed by the Minister of Environment and Climate Change is expected sometime this summer.

Known as Roberts Bank Terminal 2, the $3.5-billion project involves construction of a 177-hectare island that would double capacity for container trade with Asia. Plans call for the wharf to sit atop a massive, nine-storey-high concrete base and be connected to an existing artificial island that hosts a coal terminal and a container terminal that is itself connected to the mainland by a pier near the mouth of the Fraser River.

In public hearings in 2019, conservationists listed several threats posed by the project, including obstructing migrating young chinook salmon as they exit the river into the protective embrace of saltwater eelgrass beds where they gain strength before embarking on their ocean migration. The expected rise in truck traffic was also cited as a danger to barn owls that hunt by the roadsides at night, and there are fears that the increased ship traffic will harm endangered southern resident orcas by introducing sound pollution that is believed to interfere with the orcas' echolocation.

James Casey, the Fraser River estuary specialist with Birds Canada, also notes that many seabirds in the area would be exposed to a risk of "chronic oiling" from the heightened ship traffic. "Oil drops the size of a quarter that come in contact with birds can cause mortality."

The threat to the western sandpipers came into focus due to ground-breaking research by Bob Elner, now a scientist emeritus at Environment and Climate Change Canada. Up until about 15 years ago, it was assumed that sandpipers were feeding on tiny crustaceans, worms and insects. Instead, Elner learned the shorebirds were actually gorging on biofilm, a thin layer of slime that rests atop the mud. The sandpipers ingest this glop by furiously dabbing at it with their hairy tongues at a jackhammer pace of 120 times per minute. All told, the flocks slurp up an incredible

GLENN BARTLEY. ILLUSTRATION: CORY PROULX.

REDUCE HAZARDS

You can do a lot to protect passing birds from some serious threats. Start by avoiding pesticides: the harm these chemicals are doing to species up and down the food chain has been well documented. Windows too can be hazards. If you notice a bird-strike problem at home, there are many products (glass coverings, silhouettes, spinners) that will deter birds from themselves. Also, keep an eye on your pets when they are outdoors. Long migrations are hard enough without Whiskers harassing resting birds during a layover.

DRINK BIRD-FRIENDLY COFFEE

Changes to how coffee is grown over the past few decades mean most coffee crops now destroy the wintering grounds they used to support (less shade, more pesticides). South American mountain forests have been denuded to keep up with growing demand. By buying bird-friendly coffee (and getting your local to stock it) you will contribute to a growing movement that is returning shade to coffee plantations in crucial bird wintering regions. Look for beans with a "Bird Friendly" stamp, a certification program initiated by the Smithsonian Migratory Bird Center. The words "shade-grown" on their own mean little.

TWEET, TWEET

On Twitter, Insta, Facebook, TikTok, everywhere, spread the word. Advocate for these extraordinary passersby. Let your elected officials know you care. Municipalities can ensure crucial lands are protected, encourage bird-friendly construction and reduce office tower lighting. Higher levels of government are responsible for creating and supporting conservation areas and enforcing policies that will afford dwindling migratory bird populations a better chance at survival.

Bob Elner on the essential slimy mudflats

20 tonnes of biofilm every day during their stopover on the Roberts Bank mudflats, which is one of six feeding spots visited by the sandpipers on the migration up the Pacific coast.

The key nutrients in the biofilm are single-cell, carbohydrate-rich algae called diatoms, which Elner estimates make up to 70 per cent of the sandpipers' diet. However, an even more surprising discovery was the transformation that the diatoms undergo in spring when they bloom in response to freshwater emanating from the Fraser River and increased sunlight. Suddenly, they begin producing massive amounts of omega-3 fatty acids, which the sandpipers use to boost their endurance for the long migrations. "The sandpipers," says Elner, "rely on the fatty acids as fuel to get them to the breeding grounds as fast as possible."

Pat Baird, a Vancouver marine biologist who has spent years studying migratory birds, says these fatty acids provoke a transformation in the sandpiper's bodies, changing their wing muscles to allow them to handle long-distance flights, ramping up immunity levels and suppressing inflammation. "What Elner has learned was never known before," she says. "It's a new paradigm. It's huge." Strong circumstantial evidence now suggests that sandpipers and other shorebirds likely consume diatoms to fuel up for their long-distance flights in other estuaries around the world.

Baird suspects the proposed port expansion will disrupt the outflow from the Fraser River, altering the water's delicate balance of turbidity, temperature and salinity and destroying the fatty-acid-producing diatoms. As the birds have nowhere else in the estuary where they can go to feed on biofilm so rich in fatty acids, the repercussions could prove disastrous for the sandpipers' entire Pacific migration. "If you destroy one link in the chain, you could bring down the whole system," she says.

In fact, Elner believes the destruction of mudflats for development on the other side of the Pacific has resulted in recent crashes of shorebird populations that follow the East Asian-Australasian Flyway. He hopes something similar won't transpire here, but for now he and others can only wait for the government's verdict. Improbably, the future of an entire North American bird species may rest on federal authorities taking seriously the secrets that Elner uncovered in West Coast mud.

RON WATTS. ILLUSTRATION: CORY PROULX.