NATURE ALBERTA MAGAZINE

FALL 2023
VOLUME 53 | NUMBER 3

A COMMUNITY CONNECTED BY A LOVE OF NATURE

Whooping Cranes
Back from the Brink

Arctic Grayling: A Journey Through Prehistory

The Heroic Half-moon Hairstreak

Leeches Don't Just Suck

PM40015475

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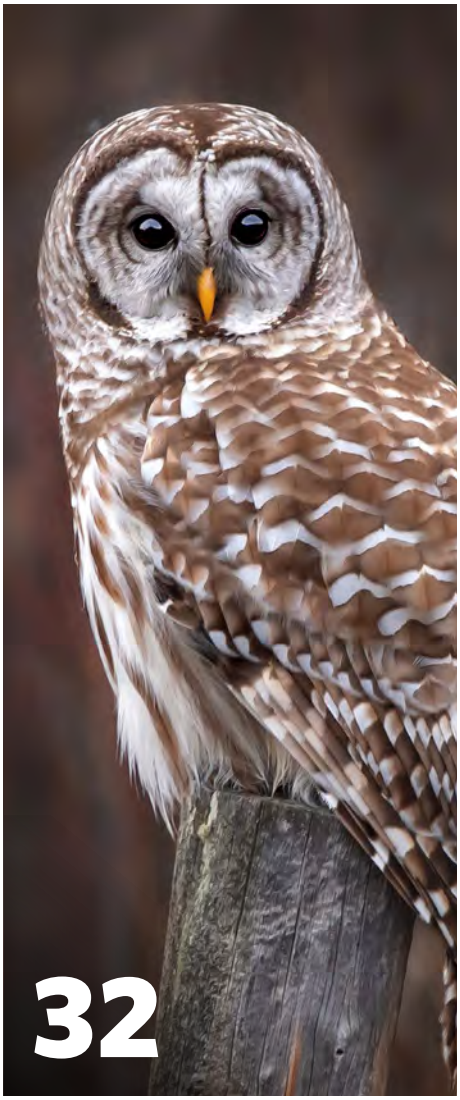

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About Nature Alberta
Alberta is home to incredible natural spaces comprised of beautiful and varied landscapes, and rich biodiversity reflected in our abundant and diverse flora and fauna. Across the province, natural history clubs and their members are engaging Albertans in the conservation and appreciation of this natural heritage. Nature Alberta represents a network of these natural history organizations in Alberta.

Nature Alberta acknowledges that the land we know as Alberta resides within Treaties 6, 7, and 8, as well as portions of Treaties 4 and 10, and is the ancestral and traditional territory of First Nations, Inuit, and Métis peoples. We have a responsibility to care for these lands and waters, and to honour the history and culture of those who have been here for generations.

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SHARING OUR SPACE

Wildlife-Friendly Fences: Part 2

In our Winter 2023 issue, we discussed ways to make barbed-wire fencing safer for wildlife by making it more visible with flagging and reflectors. Wire fence heights are also a problem for wildlife, such as deer species that must jump over or crawl under these fences to move across the landscape. Wires that are strung too close to the ground, too high above the ground, and/or in multiple strands too close together impede these animals, especially juveniles or pregnant females that cannot get over, under, or through. In southern Alberta, pronghorn antelope, clocked at a running speed of 95 km/h, are incapable of jumping over fences, but too big to crawl under. Animals get injured or caught in the barbs, are restricted in their ability to move across the landscape, and are potentially unable to escape the pursuit of a predator. So, what to do?

If the wire fencing cannot be removed, it can be mitigated by replacing barbed wire with smooth or modifying the number of lines to be no more than three, with the top wire set no more than 1 m high and the bottom wire no less than 46 cm from the ground. Other approaches to make high-traffic pathways safer are to clip the top two wires together or to wrap a length of PVC pipe around the top two wires. If fencing is only being used seasonally, determine which sections can be temporarily taken down to create wildlife crossing corridors (and disable electric fencing when not in use). Finally, monitor fence lines as frequently as possible. Let's share our space graciously.

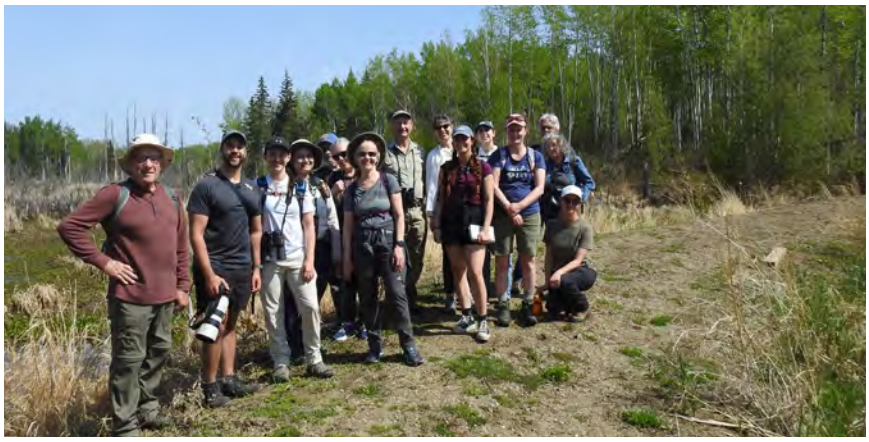
For more information and ideas, visit **bit.ly/aca-fencing**.

—ERIN MCCLOSKEY, ASSISTANT EDITOR

Nature Alberta News

Birding with Lu Fundraiser

Last spring, Nature Alberta Vice-President Lu Carbyn hosted a birding ID lecture at Edmonton's Wild Birds Unlimited store (who generously provided the space for free) and birding field trips to the Lu Carbyn Nature Sanctuary. The events raised $1,645, which was matched four times in Nature Alberta's Endowment Fund for a total of **$6,580**! Thank you to all who supported this fundraiser to ensure Nature Alberta's long-term sustainability.



Participants posed for group photos at the same location where a motion sensor camera once captured a photo of four cougars travelling through the sanctuary together. MARIA MEJIA

May Bird Count Results

The May Bird Count has documented an accumulative 340 species since 1976. This year, 451 people volunteered 1,469 hours to count 174,712 birds, documenting 267 species! No new species were added this year, but some of the unusual sightings included an indigo bunting in Edmonton, a Lewis's woodpecker in Waterton, a Ross's goose in Taber, and a cackling goose in Fort McMurray. Read more about how these numbers stacked up against previous years at **naturealberta.ca/citizen-science**.

Alberta Biodiversity Challenge Results

The Alberta Biodiversity Challenge tabulated observations on iNaturalist from June 8 to 11. Overall, we had 8,195 observations of 1,704 species by 719 observers, identified by 614 volunteer identifiers. Metro Edmonton won the "Battle of Alberta" for number of observations (2,284) and species (748) but Calgary won for overall participation with 238 observers. View detailed results from each participating city and park at **naturealberta.ca/citizen-science**.

2023 Summer Nature Kids Events a Wild Success!

7 Events

56 Experts

846 Participants

26 Community Partners

35 Volunteers

4 Cities

Thank you to our funding partners whose contributions made these events possible:

Alberta Conservation Association

Environment and Climate Change Canada

Nature Canada

North West Redwater Partnership

TD Friends of the Environment Foundation

Freedom to Roam

BY RICHARD SCHNEIDER

Here's a radical idea: What if people were allowed to walk through and explore undeveloped landscapes wherever and whenever they chose? And what if this was considered a basic human right with deep cultural roots and wide public support?

This is not just a naturalist's fanciful dream. "Freedom to roam" exists today in many European countries, including Norway, Sweden, Finland, Iceland, Scotland, Estonia, Latvia, Lithuania, Austria, Czech Republic, Belarus, and Switzerland. In fact, in 2017 Sweden's official tourism board partnered with Airbnb to turn the entire country into an Airbnb listing, to be explored at no charge.

Each country implements the freedom to roam concept in its own way, but the basic rules are similar:

- Non-motorized access is permitted on undeveloped lands without explicit permission, even if it is privately owned.
- Users must not disturb wildlife and must leave the site as they found it.
- Economic pursuits and hunting are not allowed without the landowner's permission.
- Some countries (but not all) provide additional rights, such as the right to camp, fish, and travel on horseback.
- The determination of what is considered undeveloped land available for public access varies by country (but is usually very broad).

In Alberta, the public has open access to virtually all of the Green Zone, which encompasses the boreal forest, Rocky Mountains, and parts of the foothills (subject to access fees in some areas). But gaining access to grassland ecosystems is a different matter, as most of the land is privately owned and has been converted to agricultural use. Instead of freedom to roam, Alberta naturalists are faced with "No Trespassing" signs. Moreover, parks within the grassland region are so few and so small (721 km^2 in total) that the entire lot of them could fit within the boundaries of the city of Calgary (825 km^2).

For anyone wishing to explore Alberta's grasslands, the best opportunity lies within the roughly 20,000 km^2 of Crown grazing leases. The majority of these lands have not been cultivated and so are a good place to observe native grassland plants and animals. Given that these lands are publicly owned, you might expect that everyone would be welcome to visit and explore. But it's more complicated than that.

Over the years, access to grazing leases has been a point of contention between leaseholders and recreational users. Leaseholders have legitimate concerns about hunters accidentally shooting cows and OHV users tearing up the ground. But somehow, naturalists and hikers got lumped in with the rest. (It was probably those ornery birdwatchers, always up to mischief.)

Under current regulations, recreational users must contact the leaseholder to obtain permission for access. Oftentimes this is straightforward, but if you happen to encounter a persnickety leaseholder it can feel like you are applying for a bank loan. I was once asked to produce a signed letter from Nature Alberta proving that my intended purpose of photographing grassland landscapes was legitimate.

Leaseholders also have the right to deny access if cows are in the field, which of course is most of the summer, the

Alberta has over 20,000 km^2 of magnificent prairie landscapes that remain publicly owned.
RICHARD SCHNEIDER

It is important for Albertans to learn about their natural heritage, and the best way to do that is to explore it on foot. RICHARD SCHNEIDER

Cows and hikers get along just fine, as illustrated by this inquisitive crew who came out to greet us as we set out on a walk within a grazing lease. The ability of leaseholders to block hikers from entering public grazing lands if cows are in the field is unjustified. RICHARD SCHNEIDER

period of greatest interest to naturalists. If you have ever visited a provincial park in the foothills, you know this is nonsense. Encountering cows on the road or on a trail is almost inevitable in foothills parks, and everyone gets along just fine. Grassland cows are no different, so this rule is just a barrier to public access.

It's time for a change. The UCP has identified freedom as a central pillar of its government. And we have an entire government department devoted to red tape reduction. What better application of these ideas than to enact freedom to roam legislation in Alberta?

The logical place to start is with Crown grazing leases. Taking a walk on public land should not require online research to figure out who leases what land. It should not require a game of telephone tag with the leaseholder. And it should definitely not require being grilled about your intentions and motives. Instead, our public lands should be considered a provincial treasure, and Albertans should be encouraged to enjoy them through barrier-free foot access.

But why stop there? Why not take the plunge and implement freedom to roam on all undeveloped lands, even those privately owned? Scotland provides an illustrative example of how this can be done. The process began in earnest in the 1990s, when Scotland established a national access forum and developed an access framework. This framework helped to direct the efforts of outdoor enthusiasts and sparked increased public interest and support. In 2003, after several false starts, the Scottish parliament passed legislation that comprehensively codified the freedom to roam concept across the country. Access rights apply to any non-motorized activities, including walking, cycling, horse riding, and wild camping on most undeveloped lands, supported by a formal Outdoor Access Code. If Scotland could do it, why can't we?

A stepwise approach seems best, so Nature Alberta is currently focusing on removing barriers to accessing public lands. If you have ever had trouble gaining access to public land, please send us your story (**exec@naturealberta.ca**). We will compile them and forward them on to Rebecca Schulz, the minister in charge of public lands, as evidence that change is needed. You might think of this as a new spin on "Take Back Alberta." ■

Richard Schneider is a conservation biologist who has worked on species at risk and land-use planning in Alberta for the past 30 years. He currently serves as the Executive Director of Nature Alberta.

Whooping Cranes

Step by Step, Egg by Egg, Towards Recovery

BY HIRA SHAH

Wood Buffalo National Park, Canada's largest national park, stretches across northeastern Alberta and into the Northwest Territories. This park contains a remarkable blend of wetland, forest, and plains and provides a home for some of Alberta's most unique species, including the whooping crane.

The whooping crane is an iconic species for many reasons. It is the tallest bird in North America, standing 1.5 metres high, and has an impressive wingspan of more than two metres. Its name is derived from its distinct trumpeting call. With black wingtips hidden under stark white feathers and a proud crown of crimson, the whooping crane stands out impressively in its wetland home. But it is perhaps most famous for its near-extinction story.

Preceding page: The whooping crane is North America's tallest bird, standing 1.5 m high. SASATA

Left: The whooping crane's black wings tips are visible when it is in flight. JOHN NOLL

To the Brink and Back

The whooping crane was once widely distributed across North America, but by the 1940s, hunting and habitat loss had reduced the species to only 21 birds. At this point, Wood Buffalo National Park was the only remaining nesting grounds for whooping cranes, and this flock later became the source of reintroductions to Florida and Louisiana. Wood Buffalo National Park remains the only place in Canada where whooping cranes nest. This flock migrates to the Aransas National Wildlife Refuge in Texas each winter.

The many decades of scientific research, conservation breeding, and recovery management efforts have paid off. The overall crane count across all three populations is now over 600 individuals in the wild. Cross-boundary cooperation between Canada and the United States to support this species is truly an achievement to applaud. However, it's still too early to call the job done. While the whooping crane's journey is often referred to as a conservation success story, this bird still has a long way to go before it can be formally downlisted from Endangered to Threatened under Canada's *Species at Risk Act*.

It Starts With an Egg

The Wilder Institute has been involved in whooping crane conservation since 1992, leading Canada's only conservation breeding program for this species. Cranes bred at the Wilder Institute are released into U.S. whooping crane populations by their partners at the International Crane Foundation and the Louisiana Department of Wildlife and Fisheries. In mid-April, the Animal Care, Health and Welfare team at the Wilder Institute's conservation breeding facility begins to keep an eye out for cranes showing signs of incubating. Whooping crane parental care involves both male and female cranes taking turns sitting on the nest to incubate the eggs. The team uses a remote camera system to confirm whether an egg has been successfully laid so as to not disturb the potential new parents. Whooping crane eggs are olive-coloured with brown splotches and are approximately the size and shape of a large avocado. For the next 29–31 days, the parents will have their feathers full with egg-sitting duties.

In the wild, whooping cranes normally lay and attempt to hatch two eggs. However, the second egg is not laid until a couple days after the first. To encourage additional egg laying from captive breeding pairs, the Wilder Institute team removes the first egg to be incubated by a whooping crane pair that did not successfully breed. This helps maximize reproduction.

During the month of incubation, the cranes and their eggs are inspected daily using the remote video system. Eventually, signs that the chicks are ready to break through their eggs become evident. With eager beaks drilling away at the outer shell, it's an arduous process that can take up to 72 hours. The team is on standby to support only if needed.

Welcome to the World

After finally making their entrance into the world, the whooping crane chicks are welcomed into their new habitat at the Wilder Institute's conservation breeding facility. Strikingly dissimilar to their parents, these fluffy chicks feature rusty orange feathers that they will slowly moult over the next couple of months.

The chicks receive expert care at the breeding facility, including welfare checks, veterinary exams, and a crane-catered diet; all part of the daily routine to ensure healthy body condition.

Clockwise from upper left:

Whooping crane chicks are light brown and look nothing like adults. US FISH AND WILDLIFE SERVICE

A juvenile whooping crane at the Wilder Institute's conservation breeding facility. WILDER INSITITUTE

A whooping crane chick undergoing its initial vet exam at the Wilder Institute's conservation breeding facility. WILDER INSTITUTE

Adult whooping cranes feature a red crown and black beak. GARY LEAVENS

Data-logging eggs were used to study incubation parameters under three different rearing conditions to determine the optimal approach. WILDER INSTITUTE

The future of these chicks won't be decided until later. Some will be released to the wild, while others will remain at the facility as part of the breeding group.

Conservation breeding involves a complex set of factors, with genetics being a key factor. Before any recommendations for future breeding or release are made, the team determines what will maximize genetic diversity for the whooping crane population under human care. This involves genetic analysis as well as consultation with partners across North America to see where these valuable genes are most needed.

Hatching Answers Through Science

Cranes under human care have lower reproductive success than wild cranes. Poor fertility and low hatch rates result in fewer individuals available for reintroduction to the wild. The cause of poor reproductive success has caught the attention of Wilder Institute researchers — why do some whooping crane eggs fail to hatch? How can the conservation breeding program better mimic wild conditions for hatching?

To answer these questions, the Wilder Institute collaborated with the International Crane Foundation and the Patuxent Wildlife Research Centre to test eggs in various incubation environments.[1] However, these weren't ordinary whooping crane eggs. They were artificial data-logging eggs that recorded temperature, humidity, and egg-turning rates by parent cranes. These "smart" eggs were placed in three different environments: whooping crane nests, sandhill crane nests, and artificial incubators.

The study found that eggs incubated by sandhill cranes had the highest hatch rate, while certain artificial incubators had the lowest. Thanks to this research, recommendations were made for improving the conservation breeding program. The artificial incubators could better mimic natural whooping crane incubation by adjusting temperature and having more egg-turning events. Conservation requires continuous research to best support species at risk.

Leaving the Nest

There are many challenges to overcome before a whooping crane is ready for its wild home, but the biggest challenge is surviving in the wild. Once released into the wild, the whooping cranes are responsible for finding their own food, protecting themselves against predators, and successfully surviving the winter months. These resilient birds are proving that they're not interested in going extinct.

With Alberta hosting such an important breeding ground for whooping cranes, it's clear that we have a significant role to play in their conservation. The more we can advocate for this unique bird and its habitat, the closer we are to making its conservation success story a reality. ■

Whooping crane chick and adults at the Wilder Institute's conservation breeding facility. WILDER INSTITUTE

References:

1. Edwards, H.A., S.J. Converse, K.D. Swan, and A. Moehrenschlager (2022). Trading off hatching success and cost in the captive breeding of Whooping Cranes. Animal Conservation., 25: 101-109.

Hira Shah is a science communications specialist with a focus on the field of conservation. She is currently the Conservation Communications Strategist with the Wilder Institute/Calgary Zoo.

Survival Against the Odds

Alberta's Half-moon Hairstreak Butterfly

BY BENNY ACORN

Top: In the Waterton region, the open prairie collides directly with the Rocky Mountains, creating a stark and dramatic landscape. RICHARD SCHNEIDER

Above: A half-moon hairstreak at rest on a silvery lupine, now long past flowering. Perhaps this will be the start of the next generation. BENNY ACORN

Picture a vast mountain meadow still caught deep in the icy talons of the late winter months. The small streams that cross the area are just beginning to flow with meltwater. Sparse trees rim the meadow, bare and skeletal because of the winter cold, with some still bearing the soot stains of recent wildfire. Towering mountains decorated with glittering snow surround the meadow on all sides except to the north, where the alpine gives way to the endless skies of southern Alberta prairie.

This breathtaking scene is the Blakiston Fan, an alluvial plain in Waterton Lakes National Park. It is truly one of the most beautiful and remarkable areas in all of Alberta, where natural beauty is partnered with rich and unique biological diversity. Although you would not expect it, the story of one of Alberta's rarest insects begins here, under the late-winter snow. This is a story of unexpected alliances, remarkable specialization, and perseverance in the face of catastrophic adversity, and it all takes place on the Blakiston Fan.

An Alberta Rarity

Mountain species often have highly specialized habitat requirements, and this is especially true for Alberta's endangered half-moon hairstreak butterfly (*Satyrium semiluna*). Found in Alberta only in the Blakiston Fan, these butterflies begin life as pale green eggs laid at the woody base of a very particular group of plants: the lupines. As winter turns to spring, and wildflowers populate the Blakiston Fan, hairstreak caterpillars feast on the sugar-rich new plant growth.

Naturally, life is not all milk and honey for the young hairstreak caterpillars. Their sugary diet and soft exoskeleton make them an easy, tantalizing meal for all manner of predators. But these perils don't faze our intrepid little butterfly, because it hires the best group of bodyguards in the business: ants! Although ants may not seem that fierce to us, they are some of the toughest movers and shakers of the insect world.

Several ant species build their nests among the roots of lupines, where they serve as the steadfast defenders of hairstreak caterpillars against all manner of threats. For their part, hairstreak caterpillars secrete surplus sugars and nutrients from specialized glands. The mutualistic ant species simply cannot get enough of this sugary soup and guard the juvenile hairstreaks, like humans tend livestock, for the duration of their larval development. This is an example of myrmecophily, a mutually beneficial relationship between ants and other organisms. Myrmecophily is not uncommon in the butterfly family

the half-moon hairstreak belongs to (Lycaenidae).

As the windy Waterton spring gives way to the sweltering heat of summer, the hairstreak larvae, now double in size, enter into their chrysalises around the roots of the lupine. A few weeks later the hairstreaks emerge as adult butterflies. With muted monochrome hues of brown-grey and almost no discernible markings, the nickel-sized half-moon hairstreak is perhaps the least visually interesting butterfly in the province, although it does retain an almost teddy-bear appeal in fuzzy brown cuteness.

Adult hairstreaks only live for about two weeks, considerably less than the nearly year-long period they spend in egg and juvenile form. During this time, they will feed on the nectar of buckwheat and goldenrod, helping to pollinate these plants. In this short span, the butterflies will also mate, and the females will select a lupine upon which to lay their eggs. At this point our story begins anew. Or it would, except that nature is often not so simple.

Our Hero Faces Disaster

In September 2017, the half-moon hairstreak faced a catastrophe. Wildfire raged through nearly half of Waterton Lakes National Park, and the Blakiston Fan was not spared. The fire's impact was still clearly visible to me as I worked there in the summer of 2022, five years after the fire swept the field bare. The mountains that surrounded me were almost completely stripped of trees, creating stark and skeletal scenery. Within the fan, there were large areas where only two or three trees still stood. It will be many decades yet before the park resembles the Waterton I remember from my younger years, though to be truthful, I find the harsh beauty of this time of new growth just as enchanting.

Wildfires play a vital role in maintaining the meadow habitat required by the hairstreak and many other species. However, because Waterton's hairstreak population was small and crammed into a relatively small area, the fire posed a serious threat to its viability. In the years following the fire, Parks Canada surveys yielded observations in the single digits over the butterfly's entire flight period. For a species usually numbering in the hundreds or thousands, even in a small habitat such as the Blakiston Fan, things were looking grim. Much of the plant life the hairstreak relies on was destroyed by the fire and hairstreak population numbers were at an all-time low. This is what motivated the research and

A female half-moon hairstreak perched on her favourite kind of flower, yellow buckwheat.
BENNY ACORN

Evidence of the 2017 wildfire is still visible in many parts of Waterton Lakes National Park.
RICHARD SCHNEIDER

conservation project I was a part of in the summer of 2022, in which Parks Canada partnered with the Wilder Institute/ Calgary Zoo to investigate this enigmatic butterfly and search for conservation solutions.

Fortunately, the challenges faced by the hairstreak were temporary. The lupines on which the hero of our story relies were quick to recolonize their habitat, once again establishing a nutritious resource across the Blakiston Fan for both hairstreak caterpillars and their ant protectors. The population of hairstreaks began to grow once again, and a modest but noticeable cloud of hairstreaks returned to decorate the flowers of buckwheat in the last weeks of July.

The Deadly and Dangerous World of Flowering Plants

There is yet another chapter to the hairstreak's story that merits telling. The lupines were not the only plants eager to capitalize on the aftermath of the 2017 fire, and unfortunately for the hairstreak, the competition was stiff. You may be surprised to know that the world of wildflowers is actually quite cutthroat. Establishing the space needed to thrive and reproduce is a matter of life and death for plants. The plants best suited to conquer disturbed areas, such as recently burned sites, are often plants with invasive tendencies.

On the Blakiston Fan, an invasive plant emerged that met those qualifications handily — a merciless conqueror whose goal is naught but total domination: spotted knapweed. Spotted knapweed is a non-native plant in the aster family, a group that includes many wildflower species well adapted to early post-disturbance landscapes.

Spotted knapweed produces incredible numbers of wind-dispersed seeds that establish quickly, facilitating its entry to new areas. In addition, it's able to inhibit the growth of other plant species, a particularly problematic trait. As the knapweed matures, it releases poisonous compounds into the soil, altering the ground chemistry in ways that prevent the establishment of other species. After only a few years, large swaths of the Blakiston Fan were reduced to a near monoculture of knapweed, with only a small selection of native plants able to eke out a living amongst the forest of the dreaded conqueror. (Also worth noting is the ability of dried knapweed stems to worm their way into one's socks and boot linings, but that is one issue that the hairstreak thankfully does not have to contend with.)

The Article Ends, but the Story Continues

The story of this butterfly is remarkable, but by no means unique in the world of insects. Our province is full of fascinating interactions just as complex as this one, but sadly, similar stories of habitats and species at risk are also far too plentiful. Fortunately, there are steps we can take to provide support. Parks Canada has been working with the Wilder Institute/ Calgary Zoo to investigate the ecology of the hairstreak and test a variety of weed-removal strategies for combating spotted knapweed. If you have the opportunity to visit Waterton Lakes National Park (and you should, the park is truly stunning!) or any other protected area, avoid stepping on wildflowers and ensure you're cleaning footwear between sites to avoid transfer of invasive plant seeds. Even if you never set foot on the Blakiston Fan, you can support local conservation organizations that work to protect the half-moon hairstreak and other species. Simply being aware of the amazing stories of the insect world and helping to share them by reading this publication is meaningful; the first step to conserve is always to care about the subject of conservation.

The half-moon hairstreak really is one of my favourites among all Alberta

Top: Lupines are the preferred food of half-moon hairstreak butterfly larvae. RICHARD SCHNEIDER

Above: The heat of summer covers this mountain meadow with a bed of dried plant matter, providing the half-moon hairstreak with ready and effective camouflage. BENNY ACORN

The tenderness of butterfly romance is on display as these coupling hairstreaks prepare to lay their eggs. BENNY ACORN

insects, and perhaps it will become one of yours. To me, its story is that of an unassuming underdog who manages to triumph over adversity by virtue of ingenuity and choosing the right allies to rely upon; an entomological Frodo Baggins. Yet it is also the sort of story that happens right under our noses all the time; such is the dramatic world of entomology. If you take anything away from this story, I hope it is that fascination with the natural world can be found in even the most unassuming creatures. Alberta's rarest butterfly has flourished because it has chosen its friends wisely, but in the face of such odds as the half-moon hairstreak now faces, they can use all the friends they can get. ■

More Information:

Environment and Climate Change Canada (2016). Recovery Strategy for the half-moon hairstreak (Satyrium semiluna) in Canada. Species at Risk Act Recovery Strategy Series. Environment and Climate Change Canada, Ottawa. 2 parts, pp. 24 and 33.

Crown of the Continent Research Learning Center (2022). The half-moon hairstreak Butterfly Recovery Project in Waterton Lakes National Park [Video]. YouTube. https://www.youtube.com/watch?v=by6kiTrRZzQ

Benny Acorn is one of the directors of the Alberta Lepidopterists' Guild and a lifelong lover of insects. Passionate about butterflies in particular, he has worked with the Wilder Institute/Calgary Zoo to help research and protect the endangered half-moon hairstreak butterfly.

Hiding in Plain Sight

The Legacy of Fossil Fuel Industry Disturbances

BY KEVIN P. TIMONEY

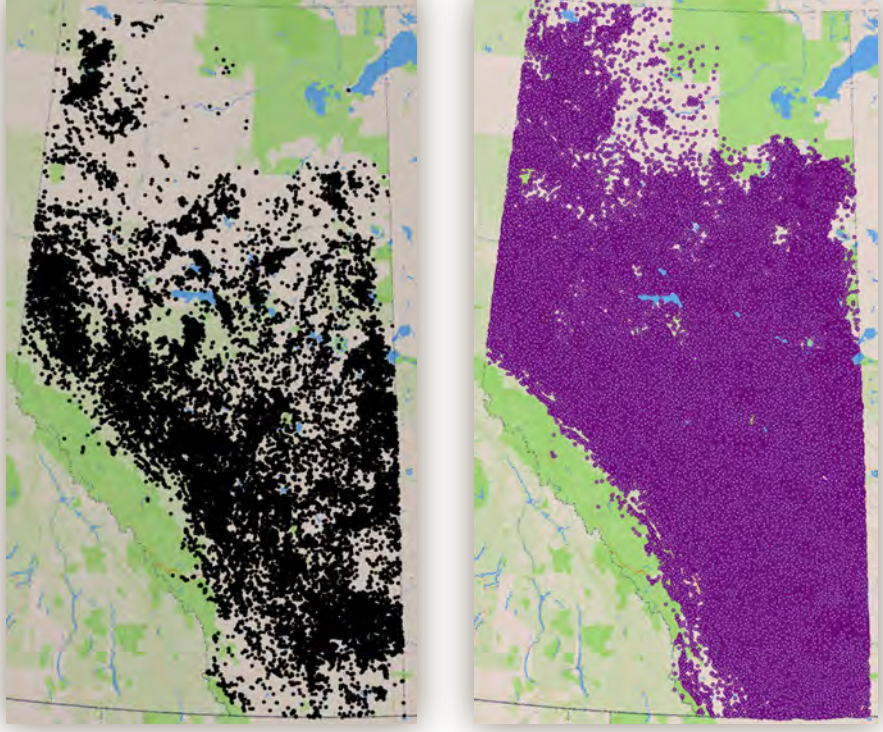
The ability to identify contamination and ecological impairment is becoming increasingly important as the pervasive effects of the fossil fuel industry come to light. Municipalities and individuals are coming into contact with an expanding network of industrial landscape disturbance which presently exceeds 30,000 km² in Alberta (see map on following page). Stories continue to surface of towns and homeowners that discover they have built on or are living alongside contaminated sites, whether that's in Calgary, Sherwood Park, Didsbury or elsewhere.

The Alberta Energy Regulator is failing to inform the public of contaminated sites, so it is important to recognize the telltale signs, or signature, of contamination. In the aftermath of a spill or after abandonment of a wellsite or other industrial disturbance, the ecosystem responds to the altered conditions. The response creates a disturbance signature in the form of persistent shifts in the species present and in the chemical and physical conditions of the site relative to the natural, pre-disturbance conditions.

What clues tell you that you are observing a disturbance signature? First, it's important to dispel two common misconceptions:

1. Green plants mean the vegetation is healthy, right? No. Greenness doesn't connote health; it simply means that a site has abundant nitrogen and water. Golf greens provide an obvious example: the lush non-native turf is underlain by a soil contaminated with high levels of nitrogen, herbicides, pesticides, and fungicides, and in some cases the persistent heavy metal mercury used in fungicides until the 1990s. In contrast, many native, biodiverse communities are green for only brief periods each year and are muted in colour the remainder of the year (e.g., native grasslands).
2. When a site has been revegetated, reclamation has been successful, right? No. Some plant species have a remarkable ability to grow on

Preceding page: Green does not mean healthy. Here a contaminated marsh dominated by common cattail and cyanobacteria has replaced a native bog-fen at the Pace-Spyglass oil spill (58°23′9″ N, 119°06′29″ W). Residual crude oil remains in the wetland. KEVIN TIMONEY



Distribution of 80,417 spills (left) and 504,583 energy industry wells (right), current to April 2023. KEVIN TIMONEY

degraded or contaminated soil. The plants that dominate industrially disturbed sites are an assemblage of disturbance-adapted exotic species and a small number of common pollution-tolerant native species. It takes little or no reclamation for these plants to establish, but the resultant community is neither healthy nor biodiverse, nor does it provide quality wildlife habitat. Its soil has been biologically, chemically, and physically altered to varying degrees.

Identifying Disturbance Signatures

Soil degradation is the common denominator at fossil fuel industrial disturbances, regardless of whether or not a spill has occurred. This degradation takes place at an early stage, as the native vegetation is removed and the topsoil is stripped off, taking with it the rhizosphere (root layer). The rhizosphere is the beating heart of the ecosystem and serves as a store of soil carbon, nutrients, and soil life forms. With the rhizosphere lost, so are the symbiotic relationships that connect the components of the ecosystem, impart resilience to stress, and allow the system to reconstitute after disturbance.

With the living topsoil gone, the site may be overlaid with fill and then compacted beneath heavy machinery during construction and maintenance. It may also be subjected to numerous spills (recorded and unrecorded), chemical applications (herbicides, bactericides, soil "amendments"), used for waste disposal (such as of drilling muds), and invaded by weedy species or seeded with "reclamation" species (typically competitive non-native and agronomic species). The result is a persistently impaired community, fundamentally shifted from the natural condition and normal successional processes.

Industrial disturbance signatures vary in their intensity depending on the type of disturbance. The most common types of disturbance can be placed along a gradient from least to greatest impairment:

1. Low: low-impact seismic lines, conventional seismic lines, and temporary airstrips.
2. Moderate: spills, pipelines, roads, and utility corridors.
3. High: well sites, batteries, waste pits, dumps, tailings ponds, and processing plants.

Identifying a disturbance signature in the field can be challenging. In some cases, you may see residual crude oil or a salt crust, or detect odours such as hydrogen sulphide from leaking or abandoned wells, or see industrial junk such as pipes, equipment, shacks, and debris. Sharp edges bounding a site provide another clue. Industrially disturbed sites have edges that are more abrupt and often more linear than natural edges, and these abnormal transitions will remain long after revegetation has begun. Because most laboratory assays can't be done in the field and indicator animals may be absent during an observation, the best way to identify a disturbance signature lies in identifying the plant species present. Both the presence of unexpected species and the absence of common and normally dominant species convey information.

Most disturbance signatures contain an abundance of weedy exotics, salt-tolerant plants (halophytes), grasses, and composites, many of which are pollution- and disturbance-tolerant. Lichens are absent at most disturbances. Mosses, if present, are cosmopolitan weedy species. The vast majority of native plant species are usually absent from industrial disturbances. Many abandoned contaminated industrial sites are nondescript weedy meadows.

The following species are reliable indicators of industrial disturbance

The soil at this chronic crude oil spill contained an astonishing 21% oil, yet numerous plants persisted, among them: foxtail barley, alsike clover, reed canary grass, common horsetail, scentless chamomile, common plantain, and smooth perennial sow-thistle (58°55′03″ N, 118°56′04″ W). KEVIN TIMONEY

across a range of upland habitats in western Canada. Among the exotic grasses are crested wheat grass, intermediate wheat grass, quack grass, smooth brome, Kentucky bluegrass (native and exotic elements), timothy, creeping foxtail, hard fescue, red fescue, sheep fescue, downy chess, orchard grass, and wild oats. Among the exotic legumes are alsike clover, red clover, alfalfa, bird's-foot trefoil, yellow sweet clover, and white sweet clover. Among the exotic composites, annual hawk's beard, Canada thistle, common dandelion, various sow-thistle species, pineapple weed, and scentless chamomile are good indicators. Other exotics include common plantain, summer cypress, redroot pigweed, and knotweed (*Polygonum monspeliense*). Increased abundance of cyanobacteria (blue-green algae) on land and in water are also good indicators. Native species that are common in some disturbances include aspen, biennial sagewort, common horsetail, common vetch, common yarrow, many-flowered yarrow, fireweed, and narrow-leaved hawkweed.

Ponds, marshes, moist habitats, and salinized soils have their own set of disturbance indicators. Among the grass-like plants (graminoids) are common cattail, small bottle sedge, water sedge, Nuttall's salt-meadow grass, foxtail barley, fowl bluegrass, reed canary grass, rough hair grass, slough grass, bluejoint reedgrass, tufted hairgrass, short-awned foxtail, creeping spike-rush, alpine rush, and toad rush. Non-graminoid indicators include spiked water-milfoil, widgeon grass, marsh cinquefoil, marsh horsetail, meadow horsetail, spearscale saltbush, yellow rattle, and the alga, *Chara*.

Conversely, across a range of habitats in western Canada, there are indicators whose presence indicates a non-disturbed site. These include almost all woody plants, mosses, and lichens, and most native plants. In marshes and meadows, such indicators include awned sedge, common great bulrush, common tall sunflower, cordgrass, few-flowered aster, Macoun's wild rye, narrow reed grass, northern reed grass, oak-leaved goosefoot, prairie bulrush, saline plantain, salt-marsh sand spurry, samphire, sea milkwort, seaside plantain, slender arrow-grass, spangletop, tufted white prairie aster, western willow aster, and western sea-blite.

Among the physical attributes that are observable in the field, good indicators of disturbance include abundant bare ground; decreased organic matter and plant litter; increased depth of active layer on permafrost soils; a replacement of mature pre-disturbance soils by young soils without horizons; soil water repellency; loss of soil structure,

Multiple saline spills at this pipeline site have rendered the soil permanently contaminated near a sour gas plant in northwest Alberta. Note the predominance of barren soil. KEVIN TIMONEY

At this spill site, a formerly healthy bog-fen has been replaced by a pond with impaired chemistry, essentially devoid of life, and posing a risk to wildlife. Note the salt-killed conifers in the distance. KEVIN TIMONEY

Satellite view of the Atlantic No. 3 blowout site 70 years after the spill. Damage is evident in the bare soil patches (labelled "b") and the discoloured stressed vegetation ("s"). Pollution-tolerant grasses and exotics such as brome, Canada thistle, common dandelion, and blue-green algal mats provide a disturbance signature. A red X marks the location of the former Atlantic No. 3 well.

porosity, and permeability; increased soil hardness and compaction; and residual tar, oil, or salt crust.

Readers interested in biotic, chemical, and physical disturbance signatures for other ecoregions can find them described in my new book, *Hidden Scourge*.

What To Do

If you suspect you are living near a contaminated site, you may wish to get laboratory assays done. In soils, depending on the site's history, you can expect elevated concentrations of petroleum hydrocarbons, polycyclic aromatic hydrocarbons, sodium, chloride, calcium, magnesium, and potassium, and heightened levels of electrical conductivity, sodium absorption ratio, pH, sulfate, heavy metals, and radioactivity. In water, again depending on the site's history, you can expect elevated electrical conductivity, salinity, total dissolved solids, chloride, sulfate, sodium, iron, alkalinity, ammonium, naphthenic acids, barium, boron, bromide, lead, lithium, radium, selenium, strontium, vanadium, and endocrine disruptors, and residual tar balls. You can expect decreased pH in the case of acidic fracking water. Although the chemical signature in streams fades quickly as water flows downstream, it can persist in sediments.

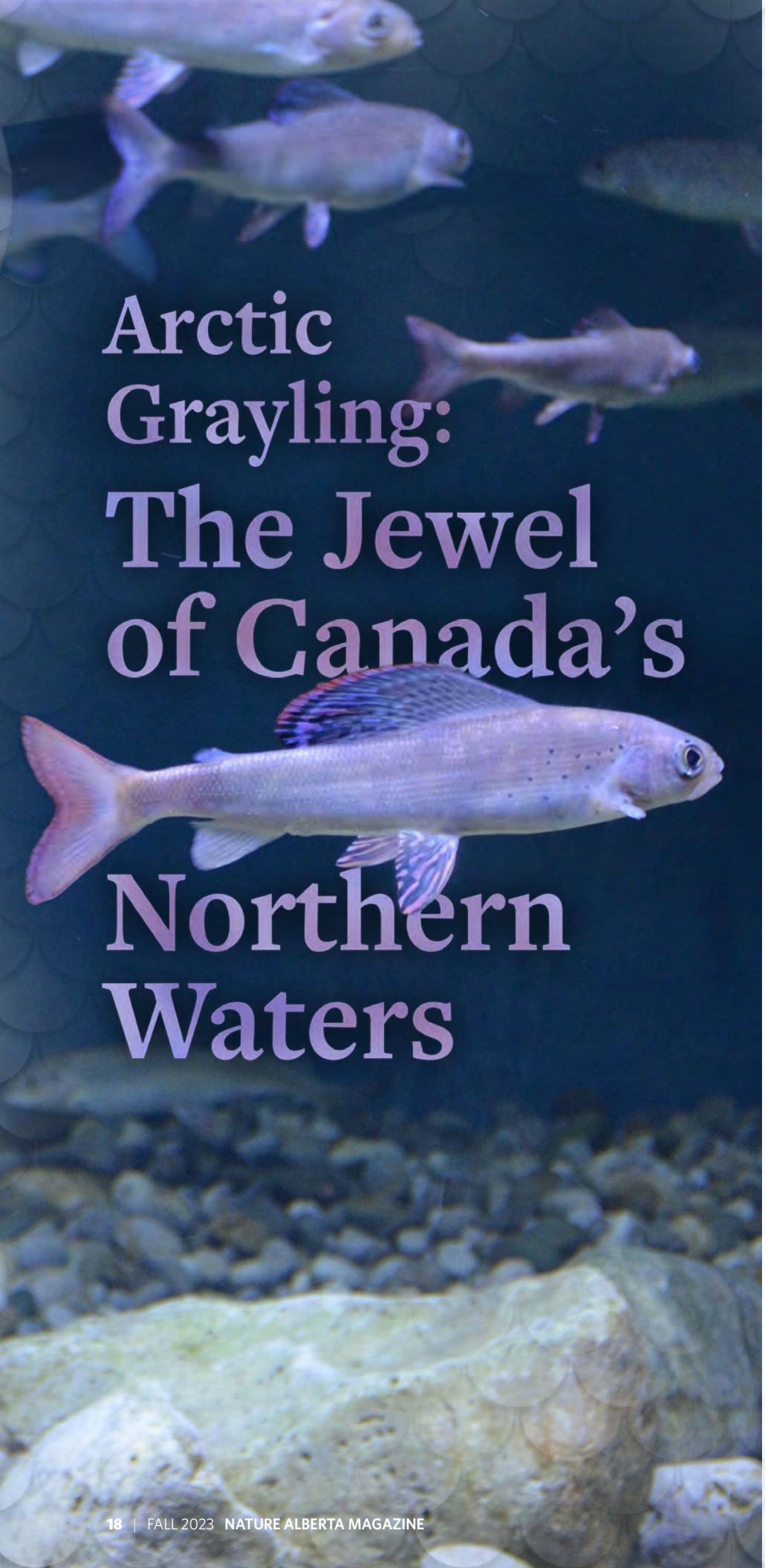
At the landscape level, declines in biodiversity, animal abundance, and wetland extent are typical signatures. In wetlands, the disturbance signature is characterized by lost connectivity with other wetlands and an increased proportion of weedy wet meadows and marshes at the expense of peatlands. In uplands, there is an increase in weedy meadows and a decrease in native grassland, forest, and shrub vegetation, and of woody plants in general.

Knowing how to recognize disturbance signatures provides another tool for naturalists to understand landscape patterns, plant communities, and species occurrences. It may also provide an increased margin of safety for you and your family. ■

Kevin Timoney is an independent ecologist and award-winning author. This article is based on his recent book, *Hidden Scourge: Exposing the Truth about Fossil Fuel Industry Spills*. A compendium of evidence that accompanies the book is available by emailing **lorax.ted@gmail.com**.

This damaged site has received multiple crude oil and saline spills. The soil is hardpan, in which few plants can grow other than the hardy foxtail barley and alsike clover. KEVIN TIMONEY

This saline spill site near Bruderheim is primarily barren hardpan with scattered Nuttall's salt-meadow grass and common dandelion. KEVIN TIMONEY



Arctic Grayling: The Jewel of Canada's Northern Waters

BY JESSICA REILLY

Some people quilt. Some make craft beer. I have a more unusual hobby. I spend my free time studying Arctic grayling, and it captures every ounce of my curiosity. Arctic grayling have striking colouration with large dorsal fins reminiscent of a marine sailfish. They are aggressive feeders and fun to catch on a fly. In studying them, we learn more about the ancient processes that led to the rich mosaic of biodiversity around us today.

Grayling Diversity

Much about the evolution and taxonomy of grayling remains uncertain. They are salmonids (close cousins of whitefish and trout) that first appeared as a distinct subgroup somewhere between 10 to 50 million years ago. Their place of origin remains uncertain; however, Eurasia is a likely candidate given the high diversity of grayling species found there. Today, there are between 13 and 18 species of grayling distributed across freshwater systems in the northern parts of North America, Europe, and Asia.

A distinctive feature of all grayling is their large, colourful dorsal fin. Among the various species you will find a riot of red and electric-blue spots, red stripes, and golden-yellow shading. One of the most striking species is the Upper Yenisei grayling, found near the Mongolian-Russian border. These fish are incredibly vibrant, featuring a dorsal

A school of Arctic grayling. S. SHANKAR

An Arctic grayling showing off its flashy dorsal fin. WALLY LUTZ

fin with large, light-blue splotches and blood-red trim as well as a tail seemingly dipped into a pot of golden paint. Other species, particularly in pristine areas, are not only gorgeous but can obtain sizes that would shock Alberta anglers. Imagine landing a 70-cm Mongolian grayling after a lifetime of catching the typical 25- to 35-cm fish here at home!

Journey to North America

If grayling arose in Eurasia, when and how did they make it over to North America? Their first appearance here was probably 3 to 5 million years ago, during the heyday of woolly mammoths and sabre-toothed tigers. During this period, sea levels were far lower than today because of a cool climate and the buildup of large ice sheets. So low, in fact, that the Bering land bridge formed between Alaska and Siberia, connecting the continents and providing a pathway for grayling from west to east. Since then, sea levels have risen and fallen numerous times, periodically recreating this terrestrial connection. This has led to multiple exchanges of Arctic grayling, with evidence suggesting that the last exchange occurred around 500,000 to 900,000 years ago.

After arriving in North America, Arctic grayling had to achieve another remarkable feat: survival. The northern portion of our continent is a harsh place to call home. Massive ice sheets have grown and receded many times, constantly reshaping the distribution of animals and plants. Today, Arctic grayling are found from Alaska to Hudson Bay and as far south as the Athabasca River watershed in Alberta, with an isolated population in Montana.

An Upper Yenisei grayling in Mongolia. These grayling have bright yellow tails and light blue spots on the dorsal fin. BLAIR REILLY

The approximate current range of native Arctic grayling in Canada and Alaska (in blue). A small disjunct population also exists in Montana. The location of the Caribou Mountains is outlined in red.

The author with a large Beringia-lineage Arctic grayling. LAURA MACPHERSON

Today's distribution represents only a small snapshot of the grayling's history. Turn back the clock and you would see the range of Arctic grayling expanding and contracting, mirroring the available habitat through the many glacial and interglacial periods. The details of these range shifts are murky, but a 200,000-year-old fossil found in Indiana confirms that Arctic grayling once lived much farther south than today. Fossil evidence from Alberta indicates that Arctic grayling once lived just south of Calgary, approximately 22,000 to 50,000 years ago. For some reason, perhaps the re-expansion of ice sheets, these grayling died out.

The Colonization of Alberta

Today, we are living in a relatively warm interglacial period. However, the distribution of wild species still bears the stamp of the most recent glacial period. From around 75,000 to 11,000 years ago, most of Canada was inaccessible for Arctic grayling. So where did they survive the deep freeze? A logical theory is that they persisted in southern, ice-free rivers and lakes in what is now the mid-central United States and then later colonized northward. However, there is now strong fossil, genetic, and geological evidence that small pockets of suitable habitat persisted in the north and provided a safe haven.

For Arctic grayling, one of these refuges is called Beringia, located in modern-day Alaska. As the climate warmed and ice retreated, Arctic grayling dispersed from Beringia back into the Yukon River and then down into the Peace River. They also moved along the Arctic coastline and from there into southeastern inland waters. A relatively new discovery is that Arctic grayling also survived in a refuge located in the Nahanni River valley. Descendants from these Nahanni fish went on to colonize the Liard, Hay, and Peace Rivers. Alberta is a contact zone for grayling originating from both sites, although the majority of fish are of Beringian descent.

Growing up near Edmonton, I was always curious about why the Arctic grayling range stopped at the Athabasca River. To my eye, the habitat in the North Saskatchewan River headwaters looked suitable and there seemed to be plenty of bugs to eat. Now, with an understanding of the long history underlying the grayling's distribution, I would bet that a post-glacial hydrologic highway leading to the North Saskatchewan River did not exist at the right time. Or perhaps grayling did make it to the North Saskatchewan River, but were eliminated through some natural event long ago, leaving no trace.

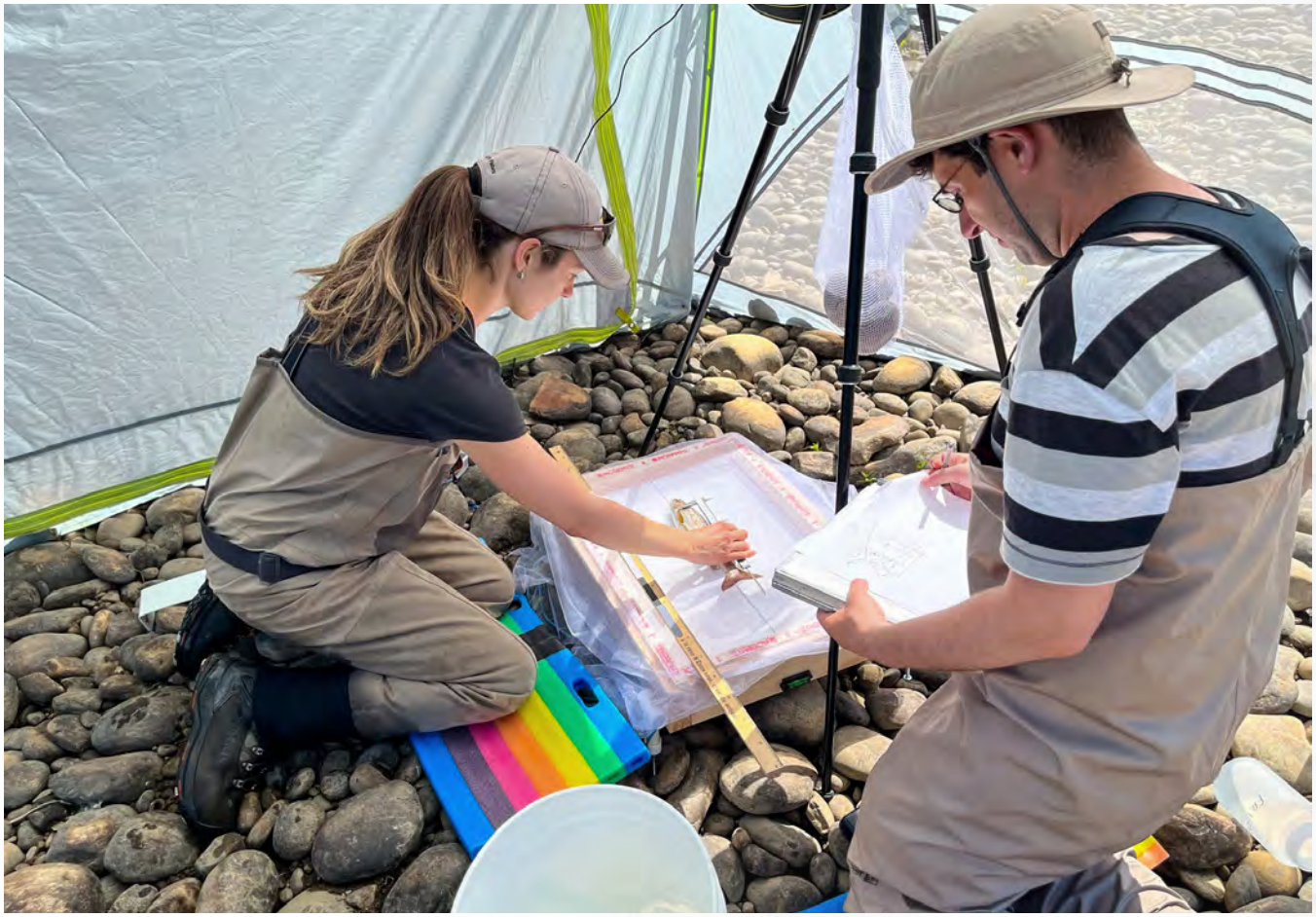
Adventures in Studying Morphology

Many questions about Arctic grayling remain to be answered. Remember those Nahanni and Beringia fish whose descendants eventually wandered into Alberta? It turns out they are genetically very distinct — they haven't shared a common ancestor for roughly 2 to 3 million years. This means that a grayling caught in the Pembina River is more genetically similar to one in Siberia than to one caught in northern Alberta. More work is needed to understand if these fish differ in other ways. Do they look or behave differently? Do they have different roles in the ecosystem? Can they breed with each other? Are Nahanni grayling so distinct that they warrant being called a different species?

Powered by a shared passion for grayling, a team of anglers, academics, and biologists have begun to study the Nahanni and Beringia lineages, looking for differences in appearance. If notable differences exist, such as the shape of the dorsal fin or size of the mouth, it could indicate that these two groups have evolved distinct local adaptations, an important consideration in conservation programs.

To ensure the study was scientifically valid, we couldn't just use snapshots from our cellphones. This type of research requires a very specific photography setup to make sure all the observed variation stems from the fish themselves, not from differences in how the photos were taken. We also needed to find grayling in high enough numbers to achieve a reasonable sample size. Fortunately, Beringia grayling live in fairly accessible rivers in central Alberta. A small legion of experienced anglers from the Northern Lights Fly Fishers Chapter of Trout Unlimited Canada volunteered for the project, schlepping hundreds of pounds of camera gear, buckets, bubblers, safety, and fishing equipment down many kilometres of river and catching grayling. Once caught, the grayling were carefully handled, anesthetized, photographed, and then released unharmed.

The true adventure was journeying to the Caribou Mountains in northern Alberta to repeat the procedure for Nahanni-lineage fish (see map on preceding page). There is exceedingly sparse information on fish populations



To identify differences among grayling lines, researchers use standardized data collection protocols and take high-quality photographs. KEN MONK

from this part of the world, a sign of how inaccessible the area is, particularly in the summer. One of the rivers required a 150-km helicopter flight, with absolutely no roads or cutlines in sight.

After a 1,000-km road trip from Calgary to High Level, the Nahanni-lineage field crew and our mountain of photography equipment was finally on the helicopter tarmac, ready to go. From the air, the terrain was true boreal beauty, with black spruce forests, small pothole lakes rimmed with bright green plant life, and rivers so deeply tannin-stained that they looked like black tea. Over the next day and a half, we managed to catch and photograph all the grayling we needed, with only moderate (human) blood loss due to the raging mosquitoes. Our formal comparison will be complete by early 2024 and we will see if the Beringia and Nahanni lineages do indeed look different from one another.

Arctic Grayling Conservation

Every grayling you see is the product of millions of years of evolution, luck, and survival. Unfortunately, their future in our province is not assured. Because of their sensitivity to changes in water temperature, sedimentation, habitat fragmentation, and vulnerability to angling, there is a chance we could lose these fish purely from human activity. In Alberta, their abundance has been reduced by up to 70% and they have been totally lost in 10 of 58 watersheds.

Arctic grayling are provincially listed as a Species of Special Concern, and several initiatives are underway to protect or restore populations. For example, sport-fishing regulations for Arctic grayling became catch-and-release only across the province in 2014. Some fragmentation issues are also being addressed by replacing stream-roadway crossing structures to reconnect grayling habitat. There have also been extensive efforts in the Pembina River watershed by the Government of Alberta, the Northern Lights Fly Fishers, and other partners to recover the most southern population of native grayling in the province. It's a great beginning, and by nurturing partnerships with angling clubs, Indigenous communities, industry, and conservation groups, together we can accomplish even more to keep these beautiful fish on our provincial landscape. ■

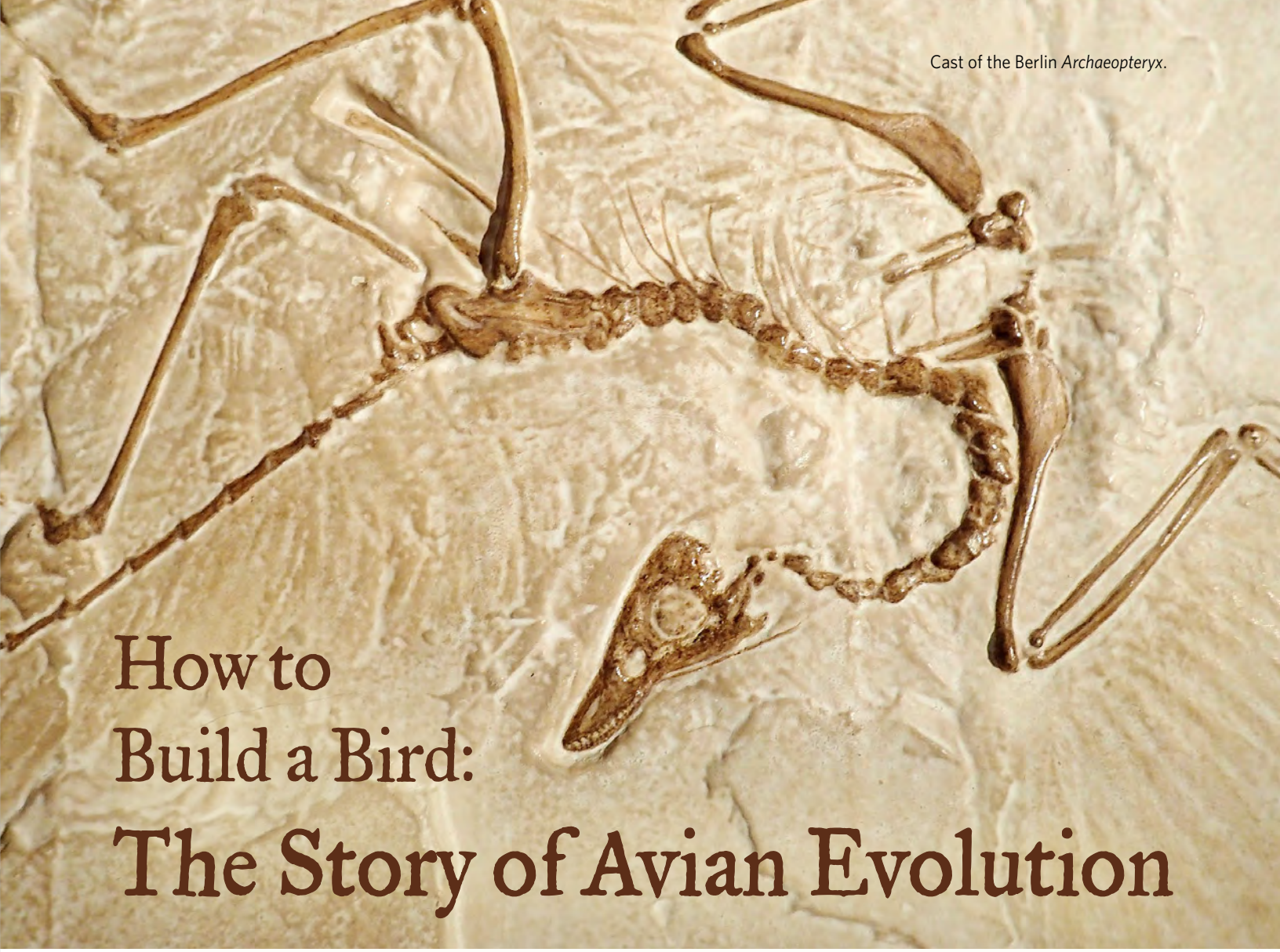
Top left: The Caribou Mountains host the Nahanni lineage of Arctic grayling. This area is one of Alberta's last truly pristine regions. KEN MONK

Top right: A tannin-stained river in the Caribou Mountains, home of the Nahanni-lineage Arctic grayling. KEN MONK

Above: A researcher releasing a Nahanni-lineage Arctic grayling after taking its picture. CAITLIN GIFFORD

Jessica Reilly grew up in Alberta fishing along the Eastern Slopes with her dad. Today, she is a fisheries biologist specializing in conservation genetics and cumulative effects management and works as the Provincial Recovery Specialist for fish species at risk for the Government of Alberta.

Morphology research was supported by the Alberta Conservation Association, Alberta Environment and Parks, Grant MacEwan University, and Trout Unlimited Canada.



Cast of the Berlin *Archaeopteryx*.

How to Build a Bird: The Story of Avian Evolution

BY RICHARD SCHNEIDER AND NICK CARTER

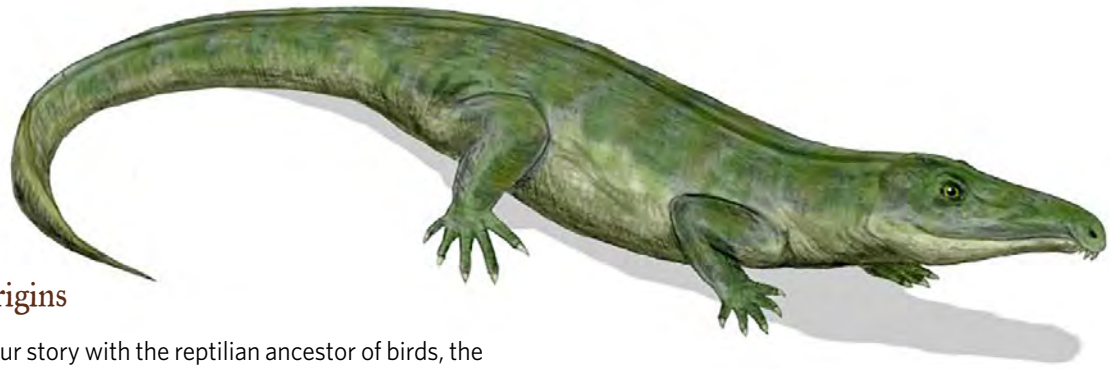
The origin of the avian body plan is not something bird watchers often think about. With so many species to find and identify out there, what does it matter how they originated? However, the story of bird evolution is a fascinating one, and understanding it can bring great enrichment to the hobby of birdwatching.

What Makes a Bird

Let's first consider the attributes that make birds unique. A key feature is the feather, which is not found in any other living animal. Though feathers look a bit like hair — indeed both are made of keratin and grow in skin follicles — they're very different in both structure and development. In addition, birds have a distinctive skeleton featuring lightweight hollow bones, a large keel-shaped breast bone to anchor wing muscles, and a rigid airframe created through the fusion of several bones.

Most of these anatomical features are adaptations for flying. So are some of the unique organ systems of birds, including a highly efficient respiratory system. In birds, air is directed to a system of air sacs that work in combination to supply the lung with fresh air during both inspiration and expiration. This is much more efficient than our mammalian lung, which inflates and deflates with each breath, leaving behind a considerable volume of stale air with each cycle.

Let's now rewind the clock and explore the evolutionary history of birds, paying particular attention to when and how the unique features of today's birds were acquired. This is now one of the best understood evolutionary transitions in the history of life, thanks largely to spectacular fossil discoveries made over the past couple of decades.[1]



Reptilian Origins

We'll begin our story with the reptilian ancestor of birds, the archosaurs. This branch of reptiles arose just before the start of the Mesozoic Era, roughly 250 million years ago. Here we find one of the first preadaptations to flight: the unidirectional lung.[2] Of course, it wasn't used to support flight at that time, nor did it have the full complexity of the modern bird lung. Nevertheless, this is when the basic architecture of the bird respiratory system originated, marking a key point of departure from the simpler in-and-out lungs used by mammals.

Not long after the appearance of archosaurs, the Earth experienced a mass extinction event that wiped out a large proportion of all species. (This was a different extinction event than the one caused by a meteor 66 million years ago). Archosaurs survived the mass extinction, and with the ecological slate largely wiped clean, they rapidly diversified into many lineages. One of these new groups was the dinosaurs, from which birds later descended. The only other descendants of the archosaurs that survived to the present day are the crocodilians, which means that crocodiles are today the closest living relative of birds.

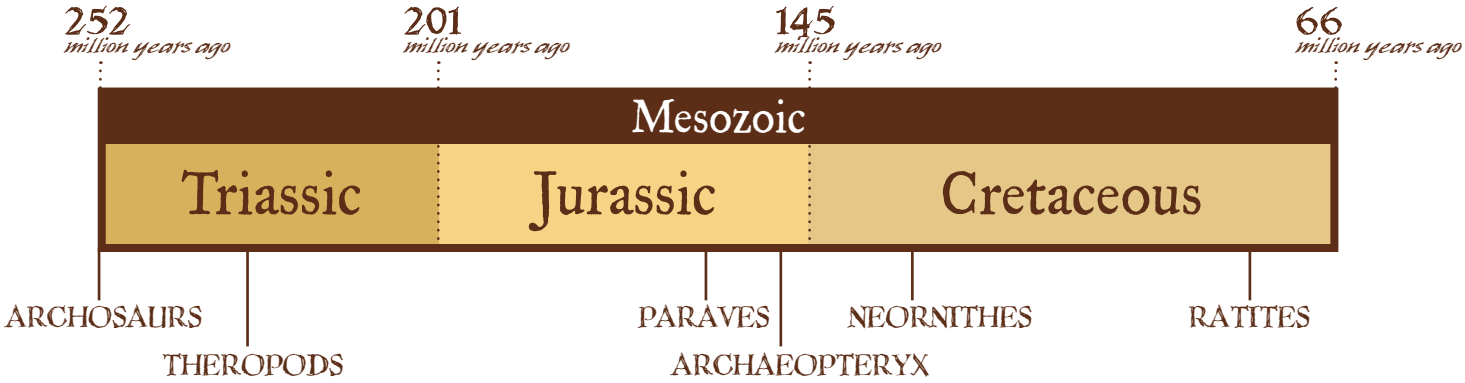
Top: Archosaurs were the reptilian ancestors of dinosaurs. The unidirectional lung, a key feature of modern birds, arose within this group. NOBU TAMURA

Above: Crocodilians are the closest living relatives of birds. These two groups are the only surviving members of the Archosaurs. TIMOTHY GONSALVES

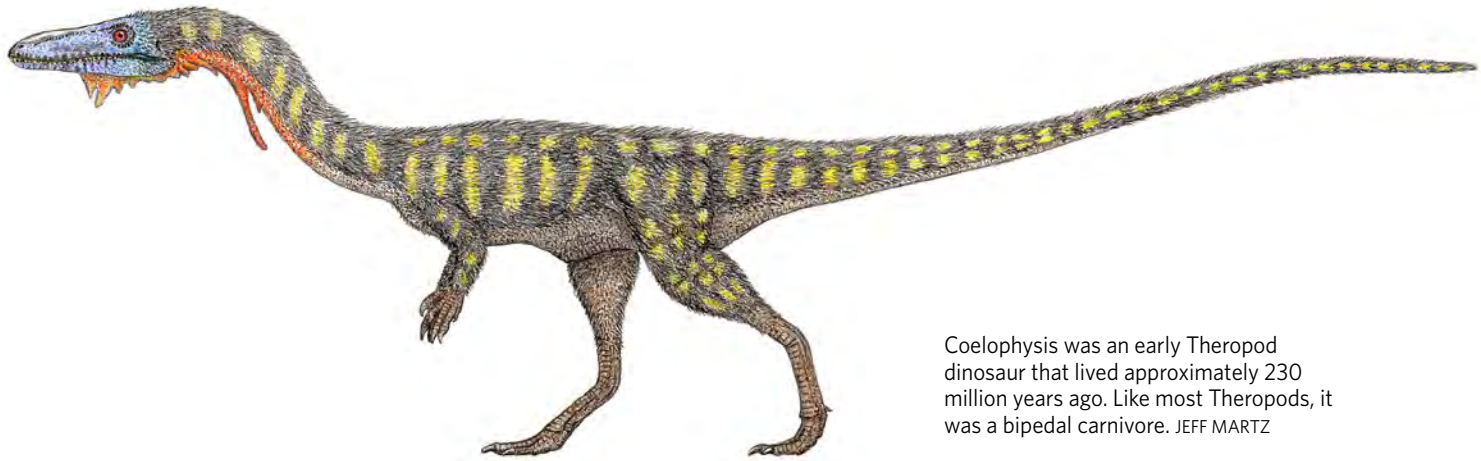
Birds are Dinosaurs

The early stages of dinosaur evolution saw the development of another critical preadaptation for flight: feathers.[3] Recently discovered fossils indicate that feathers were present in several dinosaur lineages and possibly in their close relatives, the pterosaurs. These early feathers were not used for flying. They were single-filament structures that would have looked a bit like fur and were presumably used for insulation and display. More complex forms of feathers evolved later, particularly within the avian dinosaur lineage.

The branch of dinosaurs directly ancestral to birds were the Theropods, originating around 230 million years ago. Theropods were bipedal, which was another useful preadaptation for flight in that it left the arms free to evolve into wings. Most members



A timeline illustrating key points in the evolution of the bird body plan during the Mesozoic. RICHARD SCHNEIDER



Coelophysis was an early Theropod dinosaur that lived approximately 230 million years ago. Like most Theropods, it was a bipedal carnivore. JEFF MARTZ

of this group were carnivorous. Indeed, the dominant predators for much of the Mesozoic were Theropods, including iconic dinosaurs such as *Tyrannosaurus* and *Allosaurus*.

As the Mesozoic Era progressed, many of the fundamental features of the avian body plan took shape within the branch of Theropods that eventually gave rise to birds.[4] These features arose through stepwise transformations over millions of years. A key change was the progressive hollowing of bones, which reduced skeletal weight. Another was the fusion of the collar bones into a single wishbone (furcula), which would later be important in providing stability for flapping wings. The respiratory system became increasingly efficient, with the expansion and refinement of the air sac system. And there was progressive development of warm-bloodedness, with a higher metabolic rate.

By the mid-Jurassic, around 160 million years ago, the avian branch of Theropod dinosaurs — the Paraves — had acquired almost all the adaptations necessary for flight. However, it should be noted that none of these preadaptations evolved to support flight. Evolution does not plan ahead. Instead, each new attribute was in some way helpful to the animals that existed at the time.

Though the Paraves had acquired a large suite of preadaptations for flying, they were not yet capable of powered flight. One of the well-known families is the dromaeosaurs, or "raptors," made famous in the *Jurassic Park* movies. Some early raptors were tree-dwellers that may have been capable of gliding. *Microraptor* of China, which bore wings on the front and hind limbs, is one of many examples. Others became larger, ground-based predators. *Velociraptor* from Mongolia is the most famous example, but several raptor species have also been found in Alberta.

Birds Take Flight

Some members of the Paraves were very birdlike in appearance, with small body size, crouched posture, folding wings with vaned feathers, large eyes, and braincases approaching the proportions seen in modern birds. At this point, the line between birds and dinosaurs begins to blur, forcing us to think about what we mean by the word "bird."

By historical convention, the dividing line between reptiles and birds has long been associated with *Archaeopteryx*, initially discovered in Germany in 1861. *Archaeopteryx* possessed a curious mixture of classic bird features, such as feathers and wings, but also retained sharp claws on the hands, a long bony tail, teeth, and other reptilian characteristics. To the scientists of the day, working with a very limited fossil record, *Archaeopteryx* was seen as the critical "missing link" in bird evolution. Thus, it was taken to be the first bird and this label has carried

An artist's rendition of a *Velociraptor*. Despite its feathers and wing-like arms, *Velociraptor* was a ground-based predator that could not fly. FRED WIERUM

Archaeopteryx lived approximately 150 million years ago and has long been considered the first true bird. Given new fossil finds, we now know that there is no clear dividing line between dinosaurs and birds.

through to modern times. However, based on recent fossil discoveries it is now clear that no real dividing line exists between dinosaurs and birds — it's an evolutionary continuum.[5] This implies that the choice of what to label the "first" bird is largely arbitrary.

Whether *Archaeopteryx* could fly, rather than glide, remains a point of debate, but recent research suggests that it could. In either case, it is around this time, 150 million years ago, that the avian branch of dinosaurs did acquire powered flight.[1] By this time, all the necessary anatomical preadaptations for flight were in place, so it was mainly a matter of applying existing attributes to a new purpose. The details of this process are still being refined, but it's clear this was not a one-off event involving a single species. Rather, this was a period of intense evolutionary experimentation involving flight that involved multiple species.

To be clear, early birds like *Archaeopteryx* had nowhere near the flight ability of modern birds.[6] Much evolutionary tinkering was still required before the modern bird form was reached. Like an avian Model T, *Archaeopteryx* had all the fundamental components and was able to get from point A to B. But it was still a long way from a Ferrari.

Many of the refinements that occurred after early birds began to fly involved the perfection of muscle-driven flight.[1] A key feature was the development of a keeled sternum to support large flight muscles. Another was the development of a pulley-like system involving the shoulder joint that provided more power to the upstroke when flying. The tail was reduced in size and eventually fused into a single, small, triangular bone. There was also further increase in metabolism and refinement of the respiratory system, which were needed to meet the high energy demands of flight.

Modern Birds

A treasure trove of new fossils from China show that highly diverse avian fauna existed by the early Cretaceous, around 130 million years ago.[1] This included the Neornithes group, directly ancestral to modern birds, as well as several other bird lineages, such as Enantiornithes, which were "cousins" to today's birds. The Enantiornithes were in fact the most abundant, widespread, and diverse bird group during this period. However, all members of the Enantiornithes went extinct during the mass extinction that marked the end of the Cretaceous, 66 million years ago, leaving no representatives among today's birds.

The differentiation of the Neornithes into the major orders of modern birds began in the late Cretaceous. The first to branch off were the ratites, represented today by birds such as ostriches and rheas. Next was the fowl group (Galloanseres), including both waterfowl and landfowl. The evolutionary branching of the remaining bird orders is complex and has not been fully worked out.

The mass extinction event at the end of the Cretaceous caused by a meteor impact was an important driver of bird evolution. This event served as a filter, weeding out many

Protopteryx was a primitive bird that existed 130 million years ago. This fossil illustrates the exquisite feather detail present in many recent fossils from northern China. TIOURAREN

Birds evolved into many unique forms following their origin as a distinct lineage 150 million years ago. The first to branch off were the ratites, of which ostriches are a modern example. PAUL HOWZEY

early bird lineages and killing off all other dinosaurs. Exactly why certain bird lineages survived and others did not remains unclear.

With many ecological niches available to exploit after the mass extinction, the surviving bird lineages underwent another evolutionary radiation, producing many new forms. But these new forms were simply variations and refinements of the basic bird body plan, which was completed in the mid-Cretaceous. Attributes arising after the last common ancestor (the Neornithes) are not found in all birds, and so are not foundational. What makes matters confusing is that many attributes of modern birds arose independently within different bird orders, in a process called convergent evolution. For example, swallows and swifts look very similar, but swallows are a type of songbird whereas swifts are related to hummingbirds. More generally, adaptations for specific lifestyles (e.g., nocturnal, raptorial, pelagic) have evolved multiple times.

In summary, the avian body plan was pieced together over 250 million years of evolution rather than in one burst of innovation. Many key attributes — including the unidirectional lung, feathers, warm-bloodedness, and lightweight bipedal skeleton — evolved at an early stage of evolution for reasons

Modern birds are the only lineage of dinosaurs to survive the Cretaceous mass extinction. RICK PRICE

that had nothing to do with flight. But once these preadaptations were in place, they became a winning platform that not only allowed dinosaurs to fly under their own power, but to survive the late Cretaceous extinction event and become the Earth's most diverse terrestrial vertebrate, with over 10,000 species.

The story of birds is complex yet fascinating, and we are fortunate to live in a time when new discoveries are always around the corner. The next time you see a chickadee at your bird feeder, consider that you are looking at a type of dinosaur — an intriguing thought. They've survived a lot since the Cretaceous, and now we must think and act accordingly so that the species we have left will continue to thrive. ■

References

1. Brusatte, S. et al. (2015). The Origin and Diversification of Birds. Current Biology: 25.
2. Brocklehurst, R. et al. (2020). Respiratory evolution in archosaurs. Philosophical Transactions B: 375.
3. Benton, M. et al. (2019). The early origin of feathers. Trends in Ecology & Evolution: 34.
4. Xu, X. et al. (2014). An integrative approach to understanding bird origins. Science: 346.
5. Cau, A. (2018). The assembly of the avian body plan: A 160-million-year long process. Bollettino della Societa Paleontologica Italiana: 57.
6. Voeten, D. et al. (2018). Wing bone geometry reveals active flight in Archaeopteryx. Nature Communications: 9.

Richard Schneider is a conservation biologist who has worked on species at risk and land-use planning in Alberta for the past 30 years. He currently serves as the Executive Director of Nature Alberta.

Nick Carter is a writer, photographer, and naturalist from Edmonton. From birds and bugs to flowers and fossils, Nick is always seeking out the natural wonders of this province and sharing his enthusiasm with others.

A medicinal leech, the only leech in Alberta known to regularly bite humans. CLAUDIE B.

Bloodsucking Leeches

More Than Just a Horror Icon

BY CHERYL TEBBY

There are not many creatures in the animal kingdom that invoke more immediate feelings of revulsion and abhorrence than leeches. Squishy and cold, emerging from the watery depths to feed on warm blood... It's understandable why leeches may inspire nightmares.

Popular depictions of leeches often include concentric rows of sharp, fang-like teeth, or maybe an elongate ventral sucker that enables them to cling to their victim like the sticky-hand toys found in birthday "goody bags." But in real life, leeches are a little more prosaic, much less horror-movie monster.

Leeches belong to the phylum Annelida, the segmented worms, and are in the same taxonomic class as earthworms. Their most notable features are their two suckers. The front sucker may have calcified "teeth" for feeding, whereas the rear sucker functions only as a suction cup for grip. Oftentimes both suckers are used for locomotion on a solid surface, creating a movement pattern like that of an inchworm. In open water, leeches are graceful swimmers and can be spotted swimming in an undulating motion. In terms of appearance, leeches are usually dully coloured but can sport attractive spots and stripes. They have simplistic eyes in multiple pairs or rows.

An Undeserved Reputation

Despite their negative reputation, leeches have done much for humankind. For instance, species of the blood-feeding genus *Hirudo* were used for centuries for bloodletting in efforts to cure a number of illnesses. Leeches were perfect for this popular medical procedure because their saliva contains multiple proteins that increase blood flow and also prevent blood clotting. Additionally, leech saliva contains an anesthetic, making their bite painless. Bloodletting is no longer considered to be an effective cure-all; however, leeches still have a place in modern medicine because of their ability to stimulate circulation. In particular, leeches are used after microsurgeries such as digit reattachment or tissue transplants to restore blood flow to targeted areas.

Leeches are also useful for environmental monitoring. The gut of a leech contains the DNA of fauna in the surrounding area, allowing scientists to track the presence and absence of rare or endangered animals as well as the presence or absence of invasive species.[1]

A close-up view of a leech sucker. ANNA PHILLIPS

Above left: This fish has picked up four Piscicolidae passengers. EMILIO CONCARI

Above right: Leeches are capable swimmers and can move quickly to find a suitable surface to hide on, including hip waders, making for easy specimen collection. CHRISTIAN FISCHER

What makes them especially useful for this purpose is their ease of collection — if they aren't plucked off of submerged rocks and vegetation, they're stuck on the collector themselves!

Leeches in Alberta

In Alberta, there are four families of leeches. Only one of these families, the Hirudinidae, contains true biting leeches, and within this family, only one species is known to regularly bite and take a blood meal from humans. This is *Macrobdella decora*, commonly called the North American medicinal leech. It possesses muscular ridges or "jaws" in its anterior sucker that allows it to bite its warm-blooded host. It is worth noting that other leech species may opportunistically feed on open wounds or thin or damaged skin if given time to attach.

Members of the Piscicolidae family are seldom seen by anyone but anglers, as they exclusively parasitize fishes. They are perhaps the most distinctive of Alberta's leeches, as their flattened, circular anterior sucker stands out from their cylindrical body.

Lastly, the Glossiphoniidae and Erpobdellidae families include the leeches you are most likely to scoop up in samples from shallow water bodies. They prey mainly on smaller aquatic invertebrates, which they swallow whole. They are not particularly selective in what they eat — small crustaceans, worms, and fly larvae are all fair game. All species of glossiphoniids possess a piercing proboscis rather than jaws, allowing them to tackle larger invertebrates and to parasitize larger aquatic animals, including turtles and waterfowl. For example, *Theromyzon* species (otherwise known as "duck leeches") attach to the eyes and nasal passages of ducks and swans, and in large numbers may even cause the fatality of trumpeter swan cygnets.[2] These leeches, when attached to people, are not feeding but instead are mistaking the cool smooth skin of swimmers and waders as submerged rock or wood to rest on.

If you are unlucky enough to have been found by a hungry medicinal leech, then the easiest course of action is to just let them finish feeding, whereby they will drop off after an hour and leave behind a clean wound. Alternatively, using a fingernail or flat card to quickly break the seal around the narrow anterior sucker works to interrupt the feeding. But stressing a feeding leech using salt or fire will cause it to regurgitate and may subsequently result in an infection.

A duck leech, which parasitizes various waterfowl species. JOE HOLT

Leech Diversity

Although Alberta leeches do not deserve their creepy reputation, it's a different story in tropical areas. For instance, the South American *Tyrannobdella rex* is a small but aptly named leech with oversized teeth. This tiny *T. rex* (measuring less than 7 cm) favours the nose and mucous membranes of mammals, including

Leeches are a normal part of wetland ecosystems, and while they parasitize some species, they are food for others, like this sandpiper. JOANE REDWOOD

Wetlands like this are prime habitat for leeches. CHRISTIAN FISCHER

humans, where it remains for weeks following satiation. In Alberta, leeches are more mundane, serving as both predator and prey in aquatic ecosystems.

Currently, both Erpobdellidae and Glossiphoniidae are under taxonomic revision, and certain long-standing species are no longer considered valid in North America.[3] Meanwhile, new species have likely been hiding in plain sight.[4] A major challenge is that leeches are notoriously difficult to examine and identify when collected by standard aquatic sweep net protocols. Those wishing to perform accurate identifications must take special care to preserve leech colour and eye patterns through specific preservation measures, and should rely on using the most current taxonomic keys — what few there are! Fortunately, DNA barcoding is now helping to fill in the large gaps left by conventional morphological identification.

Love or hate them, fear or ignore them, leeches are cosmopolitan in aquatic habitats. While their feeding methods might evoke primitive fears, leeches are just one of the many invertebrates that make up the ecology of our wetlands. If only for the fun of filling in missing taxonomic pieces, I hope that fellow naturalists learn that leeches don't suck as much as they once thought, and will instead view them with a bit more curiosity. ■

Cheryl Tebby is an Alberta Biodiversity Monitoring Institute aquatic taxonomist, and assists with the identification of countless numbers of aquatic invertebrates collected annually by the ABMI.

References:

1. Lynggaard, C., A. Oceguera-Figueroa, S. Kvist, M.T.P. Gilbert, and K. Bohmann (2022). The potential of aquatic bloodfeeding and nonbloodfeeding leeches as a tool for iDNA characterisation. Molecular Ecology Resources, 22: 539-553.
2. Tuggle, B.N. (1986). The occurrence of Theromyzon rude (Annelida: Hirudinea) in association with mortality of trumpeter swan cygnets (Cygnus buccinator). Journal of Wildlife Diseases, 22: 279-280.
3. Iwama, R.E., A. Oceguera-Figueroa, D. De Carle, C. Manglicmot, C. Erseus, N.M.S. Miles, M.E. Siddall, and S. Kvist (2019). Broad geographic sampling and DNA barcoding do not support the presence of Helobdella stagnalis (Linnaeus, 1758) (Clitellata: Glossiphoniidae) in North America. Zootaxa, 4671: 1-25.
4. Anderson, K., G. Braoudakis, and S. Kvist (2020). Genetic variation, pseudocryptic diversity, and phylogeny of Erpobdella (Annelida: Hirudinida: Erpobdelliformes), with emphasis on Canadian species. Molecular Phylogenetics and Evolution, 143: 106688.

Book Review

REVIEW BY RICHARD SCHNEIDER

Lorne Fitch is many things. He's a retired provincial fish and wildlife biologist with an intimate understanding of Alberta's landscapes and species. He's a passionate advocate for the conservation of Alberta's natural heritage. And perhaps above all, he is a master storyteller. These attributes all come together in his delightful new book, *Streams of Consequence*.

Streams of Consequence is a collection of essays and stories about Alberta's natural world, told from the heart. In this book, Fitch takes readers on a grand tour of Alberta's landscapes and species. We travel through prairies, mountains, forests, and rivers. Along the way, we stop in to visit with familiar species such as meadowlarks and beavers, as well as lesser-known species such as short-horned lizards and hare-footed locoweed. We also journey through time, from when Alberta was a wilder place through to today.

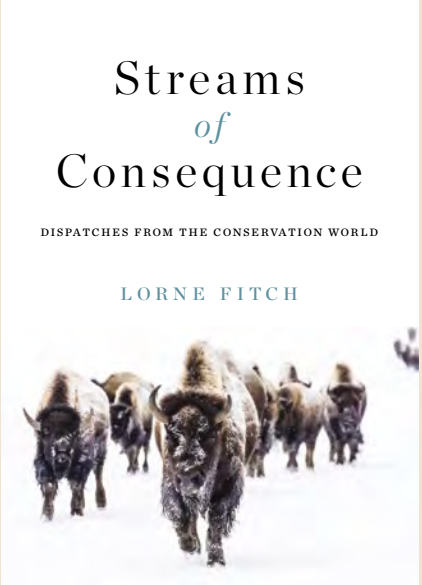
Besides serving as a guide to Alberta's natural history, *Streams of Consequence* helps readers understand how ecological systems function. Using stories and relatable metaphors, Fitch conveys ecological concepts in a highly digestible form. We learn not only what's out there, but also how it works.

Last but not least, Fitch introduces readers to important conservation issues within the province. Given his decades of experience as a government biologist, he is able to provide a unique insider's viewpoint on these issues and how they have been dealt with over the years. Moreover, with his five decades in the field, Fitch is able to compare the current state of Alberta's biodiversity with its state in the past. Rather than a "snapshot" of biodiversity, we are presented with a "movie." This long-term perspective is critical — we can't make sense of the present without understanding how we got here; nor can we effectively plan for the future.

Discussions about conservation issues often become bogged down in technical detail, but Fitch again uses stories and analogies to keep the narrative engaging and accessible for general readers. We gain insight to what we have lost over time, and why. This is offset with examples from around the province of ideas that have worked and people who have made a real difference. Fitch does not leave us mired in despair. We learn what is possible and what needs to happen on a broader scale to effectively steward our natural heritage.

In summary, *Streams of Consequence* is highly recommended for anyone with an interest in nature and a desire to see it protected. The book is a pleasure to read, brimming with interesting information and infused with humor and wit. Fitch's essays and insights into nature and stewardship cast him as a modern-day Aldo Leopold. His writing helps us understand and celebrate our natural bounty, and provides a guide for how we can do better in conserving it, both as individuals and as a society. ■

Richard Schneider is a conservation biologist who has worked on species at risk and land-use planning in Alberta for the past 30 years. He currently serves as the Executive Director of Nature Alberta.



Streams of Consequence: Dispatches from the Conservation World

By Lorne Fitch

Rocky Mountain Books, 2023, 232 pp.

Available at rmbooks.com

Nature Kids: My BIG Alberta Backyard

BY SARA LORENZ

Alberta is a great place to live. It's a big, beautiful province full of all kinds of natural wonders. In **My Big Alberta Backyard**, we introduce you to the unique and interesting wild spaces that you can find in your province, and the diverse wildlife that live there. As autumn winds blow in and the leaves begin to change colour, Halloween is fast approaching! So this time, let's learn about some wonderfully **spooky animals that live in Alberta**.

Animals of Autumn

At Easter we think of rabbits and chicks, and we see lots of pictures of bright red cardinals around Christmastime. As Halloween approaches, images of spooky animals can be found in decorations, on clothes, and even on our candy bars! We are lucky that so many diverse creatures crawl, slither, and soar in our Big Alberta Backyard. Let's learn about some spooky species, like toads, bats, crows, and owls, and the essential role each fascinating animal plays in our ecosystems.

A Western toad basks in the autumn sunlight with its black warts on display. RICK SCHNEIDER

Toads

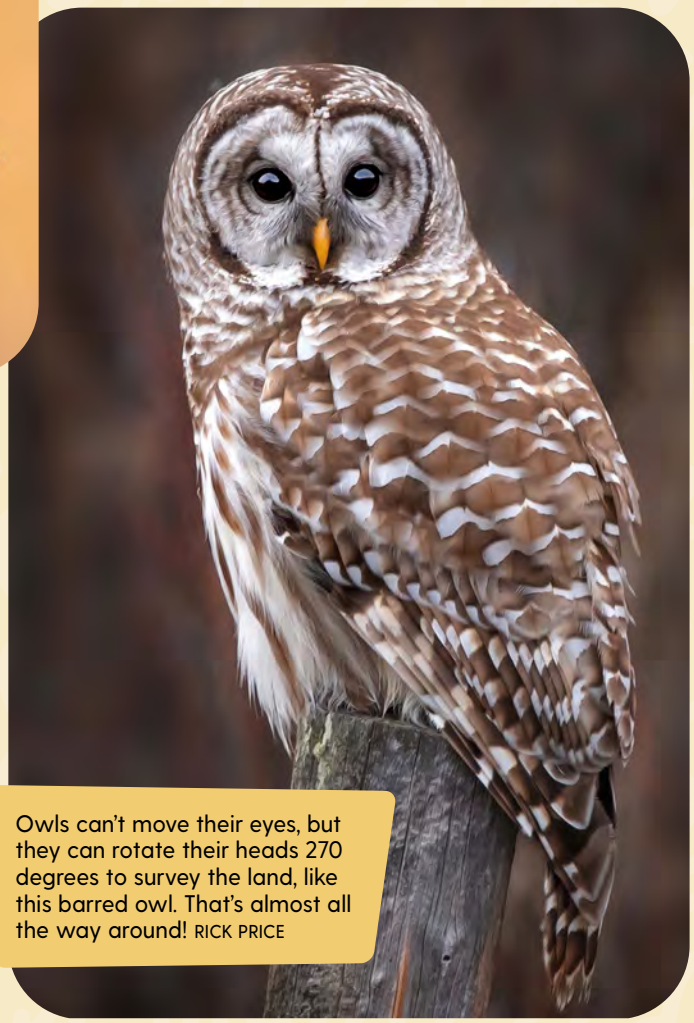
With their warty skin and webbed toes, toads have long had a place in fantastical folklore. You've probably read stories in which someone was magically turned into a toad as a curse! In Alberta, we have the real thing: three species of "true toads," known for their bumpy skin – the Canadian toad, the Great Plains toad, and the western toad – as well as the smoother-skinned plains spadefoot toad. Toads are important to the food web. They eat many types of creepy-crawly insects and arachnids, like spiders, and are themselves eaten by lots of spooky animals, like snakes. Toads cycle nutrients by eating insects and algae and transferring that energy to the predators who eat them. Toads also have thin skin, which is very sensitive to changes and pollution in their habitat. Scientists can learn a lot about the health of an ecosystem from studying toads.

Bats

Autumn is a time of many changes in the natural world, such as shorter days and longer nights. Many spooky animals come to mind when we celebrate Halloween because they are nocturnal – they are most active at nighttime. Alberta is home to nine species of bats.* Bats don't need night vision to hunt, as they use echolocation. Bats make unique noises and then listen to the echo to help them travel through the darkness of night, hunting insects. Bats can eat their body weight in bugs each night – that's thousands of bugs! This maintains insect populations, which keeps the food web healthy.

Bats aren't only unique for their use of echolocation; they also roost and sleep upside down, like this little brown bat! JASON HEADLEY

Halloween colours! An American crow's striking black plumage contrasts against an orange autumn landscape.



Owls can't move their eyes, but they can rotate their heads 270 degrees to survey the land, like this barred owl. That's almost all the way around! RICK PRICE

Crows

The caw of a crow creates a spooky soundtrack. Crows are very smart animals that can use natural elements like rocks and sticks as tools. They can also mimic other bird sounds and even human voices! Crows travel together with their families. Most crows migrate in October. They leave Alberta to go somewhere warmer for the winter. However, during the warmer months of the year they help take care of our ecosystems. Like bats and toads, they eat many insects. But crows are also scavengers, which means they clean up our natural environment by eating animal and plant matter that is dead and decaying. This is a vital part of the natural cycle of life!

Owls

The haunting hoot of an owl puts a listener in mind of dark forests and mist-covered meadows in the moonlight at Halloween. Numerous species of owl live in Alberta.* Like bats, most owls are nocturnal hunters. But unlike some other spooky animals we've learned about, owls are perched at the top of the food chain. Not many other animals try to eat them. For this reason, they are top predators. They even eat other predators, like bats! Owls help all other spooky species thrive by keeping their populations balanced.

* Which bat and owl species live in Alberta?

For a list of the nine bat species that hang out in Alberta, visit **albertabats.ca/batprofiles**

Meet Alberta's many owl species at **naturealberta.ca/owls**

Spooky Season Species

Autumn is a fascinating season. With so many changes in the natural world – like longer nights, colourful leaves, dying plants, and cooler weather – this season can feel magical. Toads, bats, crows, and owls are just some of the important animals in Alberta we think of along with this spooky season. From the smallest spiders and slithery snakes to predators like wolves at the top of the food chain, each animal contributes to Alberta's ecosystems. This spooky season, let's celebrate the creepy creatures that make Alberta's natural landscapes special! ■

Sara Lorenz is an editor who loves to explore Alberta's natural landscapes. She feels most at peace in Alberta's wild places and has been passionate about camping and hiking in our parks since childhood.

Nature Kids OUT AND ABOUT

BY ERIN MCCLOSKEY, ASSISTANT EDITOR

Spiders and their webs make for fun Halloween decorations, but real webs are fascinating feats of animal architecture! Did you know that although all spiders produce silk, not all spiders make webs? Different species use silk for making webs, hunting, netting, fishing, luring, lassoing, wrapping prey, making anchors or ladders, protecting eggs or young, or even "flying" (some tiny species can travel great distances by releasing a strand of silk that gets picked up by a breeze like a kite!). Web-making spiders construct five different types of web. When you're out exploring nature, look carefully and see how many of these different webs you can identify.

Spiral Orb Webs

A beautiful design and brilliant hunting tool. Sticky strands spiral around spokes like a wheel. When an insect gets snared on the strands, the web vibrates to let the weaver know that dinner has arrived. When the web becomes damaged, the spider eats it and builds a new one!

Sheet Webs

Sheet webs look like small, flat, bowl- or dome-shaped hammocks. A few strands stretch vertically above the sheet. These "knock-down lines" catch flying insects and knock them down onto the sheet, where they're entangled in its dense layers like a net (this web isn't sticky). The spider, hiding somewhere inside the sheets, moves in quickly for the kill.

Triangle Webs

A triangle web is a rare and special find in Alberta, because only one species in Alberta produces this style of web. It looks like a few sections of a full spiral orb. The top of the triangle is attached to a long line that the spider stretches and holds taut. When an insect lands on the web, the spider lets go, trapping the prey in falling silk stands.

Funnel Webs

These dense webs are flat on the surface with a funnel- or tube-shaped hole like a cave for the spider to hide in. When prey lands on the web, the spider surprise attacks, speeding across the surface of the web to deliver a deadly bite and drag dinner back into its lair. The funnel web even has a back exit in case the spider needs to make a quick escape!

Cobwebs and Meshwebs

No haunted house is complete without cobwebs: tangled, messy, super-sticky webs (that seem to catch as much dust as prey!) in corners of rooms – ANY corner, including tops of walls and under stairs. Meshweb spiders are their outdoor cousins whose webs are found covering plants, under forest litter and rocks, and in barns and caves.

Nature Kids ASK STUART

WITH HELP FROM ERIN MCCLOSKEY, ASSISTANT EDITOR

Welcome to **Ask Stuart**, a regular feature in which Stuart, our Nature Kids mascot (who just happens to be a swift fox), responds to questions asked by kids across Alberta. From time to time Stuart will also ask local experts to help him answer these questions. If you have a question you would like to ask Stuart, send it to **naturekids@naturealberta.ca** and it may be featured in a future issue.

Q Which nocturnal animals are we likely to see on Halloween night?

Bats, owls, crows, toads, spiders, and wolves are the wild animals we traditionally associate with Halloween. However, by October 31st, many of these creatures are either hibernating or have migrated to warmer places. Alberta's four toad species (Canadian toad, Great Plains toad, western toad, and plains spadefoot toad) burrow into the ground before it freezes and go dormant. Outdoor-dwelling spiders may have died off, while some species hibernate, but you might still find a few lingering in dark corners of haunted houses. (And check out the Winter 2023 edition of Ask Stuart to read about spiders that spend winter active under the snow!) Among our more common bat species, the little brown myotis, the hoary bat, and the silver-haired bat begin migration south by late August or early September, while the northern myotis and the big brown bat will be hibernating in caves, mines, or old buildings by the end of October. Crows will have flown south for the winter, but common ravens are hardier and, along with several of Alberta's owl species, remain year-round residents, as do wolves. Depending on where in Alberta you live, your Halloween night could be accompanied by the spooky sounds of hooting owls, cackling ravens, and howling wolves! ■

Q Why do larch trees change colour and drop their needles?

Larch, or tamarack, is a deciduous conifer. Like many coniferous trees, it has needles instead of leaves; but unlike evergreens, it's deciduous, meaning it sheds at the end of the growing season. While evergreens use their needles for photosynthesis (turning sunlight into food) even in winter, larch saves resources by losing its needles, making the tree more resistant to insects and fires. Larch turns a beautiful golden yellow in autumn, but by Halloween has likely lost all its needles, leaving it looking bare and spooky – just right for the season! – and making way for other pine trees to take the stage as the iconic trees of winter and Christmastime. ■

Alberta's Elusive Wild Cats

BY MARGOT HERVIEUX

Anyone who spends time in the country occasionally sees coyotes and foxes, but people rarely glimpse our wild cats. Lynx, bobcats, and cougars all live in parts of Alberta, but their lifestyles make them less visible.

All cats, from house cats to tigers, share some common characteristics. They have rounded heads with short noses, long tails (in most cases), and retractable claws. Our cats fit that model, except that lynx and bobcats have short tails. Cougars can reach 2.7 m from nose to tail and are light brown in colour. Lynx grow to about a metre in length and have silver-gray fur and distinctive ear tufts. Bobcats are similar in size to the lynx but have a light brown, spotted coat, shorter legs, and small ear tufts.

Cats are very effective predators, using the ambush technique, laying in wait for prey and then rushing out to make the kill. Prey are usually hit from behind and dispatched with a bite to the back of the neck.

Cougars specialize in catching deer and other ungulates. These large cats were once the most widespread mammal in the western hemisphere, living from northern Canada all the way to the southern tip of Argentina. Human pressure has reduced their numbers through eastern Canada and the U.S., but there are still pockets with cats across the western and southern parts of their former range.

Lynx are creatures of the boreal forest and mountains. Their thick fur and large feet allow them to cope well with snowy winters. Their favourite food is snowshoe hare, but they will also eat grouse, small mammals, and fresh carrion. Lynx are so closely tied to their prey that their numbers increase and decrease with the ten-year population cycle of the snowshoe hares.

Watch for bobcats in the river valleys and coulees of southern Alberta. Their favourite prey is cottontail rabbits, but they will also take a variety of other small mammals. They will even go after deer and pronghorn on occasion. Bobcats are also becoming well established within the city of Calgary, where they can move through sheltered yards and find abundant prey.

All Alberta's cats are solitary except when the females have kittens. Cougars will breed at any time during the year, but the kittens are most often born in the spring. Lynx and bobcats mate in late winter and have their kittens in May or June. Cougar kittens are weaned in about six weeks and stay with their mothers for up to two years. Lynx and bobcat kittens are weaned at two months but only stay with their mothers through their first winter. They all usually have litters of two to four kittens.

It is rare to see wild cats but, like all large predators, they warrant our respect. Lynx and bobcats are rarely a risk to humans, but anyone living, working, or recreating in cougar habitat should be conscious of the big cats. If you are travelling on foot in the bush, make noise and consider carrying a walking stick or pepper spray. In rural areas, pets and small livestock are safer if brought in at night. If you do meet a cougar, face the animal but avoid eye contact and back away slowly. Running or playing dead may encourage an attack. If the animal becomes aggressive, respond like a predator, not prey, and fight back! For more information on living with cougars, visit alberta.ca/cougars or call your local Fish and Wildlife office.

One of the reasons I love living in rural Alberta is because of the wild spaces. I may not often see wild cats or other secretive residents, but it means a lot to know they are there. ■

Margot Hervieux is a founding member of the Peace Parkland Naturalists and an honorary member of Nature Alberta. A version of this article originally appeared in her "Naturally Yours" column in the *Peace Country Sun*, which she has been writing for 15 years. You can read more of her archived columns at **peacecountrysun.com**.

BOB COOPER

MEET A MEMBER CLUB

BY LISE MAYNE

Calgary Area Nestbox Monitors Society

The **Calgary Area Nestbox Monitors Society (CANMS)** is a group of about 100 volunteers in the Southern Alberta region. Our mission is to provide nestboxes for native cavity-nesting birds, to monitor the birds' activities, and to collect data. These activities are important for the conservation of these avian species due to habitat loss. Natural cavity-supplying trees have been cleared through human activities such as logging, agriculture, and development. Our focus is on mountain bluebirds and tree swallows.

CANMS began with seven members and 743 boxes. Founders Don Stiles, his son Andrew, and Ray and Agnes Woods monitored for over 40 years. Today, members monitor 5,000 boxes, covering 2,000 km in ranges of favourable habitat, from the foothills of the Rockies west of Calgary to east of Didsbury and Olds. Some monitors have 500 boxes! About one-third of members band birds, and all members monitor birds' activities, from nesting attempts to numbers of eggs, hatchlings, and fledglings. This data is collated in an annual report and shared with our members as well as others near and far, including: Nature Alberta, Ellis Bird Farm, Southern Alberta Nest Monitors Association, the North American Bluebird Society, and Cornell University Lab of Ornithology.

Monitoring begins in mid-April. We clean and maintain the boxes and prepare for the arrival of birds from the southern U.S. and Mexico. Mountain bluebirds usually begin nesting in early May, and by June, two to seven eggs appear. Banding reveals that most pairs return to within 5 km of their previous banding site, sometimes to the same box.

BOB COOPER

Tree swallows arrive in mid-June. Fortunately, many bluebird pairs have already established nests and some babies are soon to fledge. The tree swallows often use bluebird nests for their eggs, which hatch in July.

In August the nests are empty and we compile our data. We meet each fall to receive the extensive reports produced by volunteers. Everyone is delighted to recount their season's experiences. In 2022, our bluebirds showed a remarkable success rate: 5,836 birds. Tree swallows are more numerous than bluebirds, with 12,072 fledglings last year, down a bit from 2021.

Certified CANMS members have banded 45,405 mountain bluebirds and 39,559 tree swallows, from 1981 to 2019. Our data over years also provides insight into stressors on the birds, including cold snaps in the spring, extreme heat events in the summer, and predation. Threats include ravens, raccoons, skunks, coyotes, house wrens, and unfortunately, humans. Sadly, vandalism occurred on 14 trails last year; in one case 17 boxes were destroyed.

Why monitor? For the joy of seeing the process of development, from egg to chick to fledgling; to enjoy the environments where bluebirds thrive; for exercise; and to contribute to the preservation of natural species. We hope to ensure that these iconic birds always find a home in Alberta. To join us, reach out to **canms@shaw.ca**. ■

Lise Mayne is the Secretary of the Calgary Area Nestbox Monitors Society.

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