Beyond THE Tides

The Seasonal Journal of the Blomidon Naturalists Society

SPRING 2024
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Manta Rays & Sea Turtles

The Magic of Vernal Ponds

Minas Basin: The Last 20,000 Years

FROM THE EDITOR

It's spring! Many have eagerly awaited the emergence and return of flowers, plants, and creatures through what has seemed like a long, grey March and early April. We have a small vernal pond by our house, which only attracts ducks in April/May, usually a pair of mallards or black ducks. I eagerly await them. This year along came a pair of hooded mergansers. What fun! Beyond this though, there are so many creatures beneath the water's surface to whom we pay less attention, as both John Brazner and Liz Bateman point out in their articles. Going out on the "Big Night" to spot elusive amphibians in the dark and rain with a flashlight is quite an adventure, but it is hard to figure out the exact night, and it takes a good deal of energy and motivation. Even when swimming is a viable option, our movements scare most things away. It is not surprising that knowledge of underwater settings and creatures is scant compared to what is known about land creatures and habitats. Until the recent development of more sophisticated digital tracking technologies, it was nearly impossible to understand exactly where creatures were going. The articles on sea turtles and manta rays point out that we are only now starting more expansive research on these creatures and their behaviour patterns. Unfortunately, actual human impacts have been way out in front of our understanding of their lives and *how* we are affecting them.

So, this issue is focused on articles that explore our waters, the creatures within them, and the evolution of these waters over time. Elisabeth Kosters' article provides a unique window on earth processes that are much larger in time scales than those of many species, including our own. She reminds us that landscapes are ever-changing and there is no such thing as stasis. There are long-term changes hidden from our senses, but in the waters, there are both long-term and short-term changes that are hard to perceive. This issue delves below the surface and invites you to explore them for yourself this spring, whether it be splashing through a marsh, searching for fairy shrimp in a vernal pool, or exploring the coastline of the Minas Basin. See if you can find the 3600-year-old stump off Grand Pré at the Guzzle!

Alan Warner
editor@blomidonnaturalists.ca

LAND ACKNOWLEDGEMENT AND RECONCILIATION

Blomidon Naturalists Society activities take place in the district of Sipekne'katik in Mi'kma'ki, the traditional, ancestral and unceded territory of the Mi'kmaq. This territory is covered by the "Treaties of Peace and Friendship," first signed in 1726. These treaties did not imply or affirm the surrender or transfer of land to the British, but recognized Mi'kmaq and Wolastoqey title, and a set rules for what was to be a long-standing relationship between nations.

We are grateful above all to the land, air, water, and countless non-human beings that make life possible and inspire us every day. We recognize that outdoor learning, exploration, and recreation would not be possible without access to the natural world, which has been stewarded for thousands of years by the many Indigenous peoples of this land. We have a responsibility to honour and learn about their histories and current cultures, and to actively work in support of reconciliation. We are committed to fostering respectful and sustainable relationships with the Indigenous peoples of this land, with all other organisms, and with the land and the water. We are all Treaty People.

Beyond the Tides is committed and working to include Indigenous voices and perspectives in this publication, and we are committed to a process of relationship-building to facilitate contributions from Indigenous peoples. We also recognize the 400+ year history of communities of African descent and the 50 African Nova Scotian communities in the region today, and are committed to seeking out their perspectives, and those of others not traditionally included in the work of the Society. We invite you to contribute to this process and/or encourage others to do so. We welcome all comments and suggestions.

Cover: Reef Manta Ray & snorkeller
PHOTO: GUY STEVENS

Beyond THE Tides

SPRING 2024, Vol. 51 No. 2

FEATURES—EXPLORING THE WATERS

NATURE SPOTLIGHT

TAKING ACTION

A NEAT PLACE TO EXPLORE

NATURE WATCH

KIDS AND YOUTH

REVIEWS

Printed on Forest Stewardship Council (FSC) Certified Paper

FROM THE PRESIDENT

PHOTO: RYAN HODNETT

I spent my teenage years in southern Ontario. We lived in the country surrounded by fields and forests on the Oak Ridges Moraine. My siblings and I would range widely across the fields and explore the forests. Not too far from the house, in a sugar maple wood, there was a small pond. There was water in it only in winter and spring. The pond was too small for skating in winter, but we would chop a hole in the centre of the ice and drive a heavy post into the muck, with four feet of the post projecting above the ice. When the post was well frozen in place, we attached a long, heavy, straight pole to the top, parallel to the ice, by driving a nail through a hole we drilled near one end of the post. The pole could swing around in a large circle. We tied our sled to the end of the pole, and then we had fun pushing each other around and around as fast as we could. One person would be on the sled with three of us pushing on the pole. We could get the sled going quite fast, and the person sitting on the sled had to really hold on to avoid flying off. We had great fun challenging each other to stay on.

When the ice melted in spring, we would come to the pond and enjoy hearing the chorus of frogs, find salamanders under logs, and catch tadpoles. Once summer arrived, the pond would dry up, various plants would take over, and you would not have known that it had earlier been a pond. We would then wait until the following winter to again enjoy pushing each other around for wild rides on the sled.

At the time, we did not have a name for this kind of pond, which had no inlet or outlet, and only received water from rain and spring run-off. Of course, it was a "vernal pond," and an important breeding ground for amphibians such as frogs and salamanders. As you will discover in this issue, there can also be fairy shrimps in vernal ponds, but we would not have realized what they were, even if we had seen them swimming upside down in the water. This issue helps you appreciate our local waters; do get out and explore them this spring.

Soren Bondrup-Nielsen
President, Blomidon Naturalists Society

The primary objective of the Blomidon Naturalists Society is to encourage and develop understanding, appreciation, and stewardship of nature in its members and the interested public. The word 'nature' is interpreted broadly and includes rocks, plants, animals, water, air, and the stars. We are a community grounded in nature exploration, education, and stewardship. We welcome everyone who is curious and wants to learn and share about nature. Our core values are environmental stewardship, building a connection to nature, community engagement and diversity, and collaborative knowledge -sharing.

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The Magic and Mystery of Vernal Pools

Vernal pools provide one of the great natural spectacles that a person can experience in this region–the "Big Night."

BY JOHN BRAZNER

I'm writing this in the dead of winter after a ski through the woodlands on the North Mountain land that I am lucky enough to call home. Part of that ski crossed snow-covered ice on one of the small wetlands, a vernal pool, that lies along the edge of our lower pasture. By the time this is printed, this pool will be teeming with critters, loud with the muck, muck, mucking of wood frogs, and literally vibrating with the piercing shrill of spring peepers after nightfall. Although the deafening chorus of frogs is one of the most exciting and surest signs of spring, a closer inspection of the pool on just the right night is required to reveal one of the great, but underappreciated, natural spectacles that a person can experience in this region–the "Big Night."

The Big Night is the most common time to cross paths with a salamander near a vernal pool. In the early spring, on just the right night, they head en masse from underground overwintering sites to breeding ponds. It's quite an event if you put yourself in the right place at the right time. The slow march of yellow-spotted salamanders is about as good as it gets for salamander-watching in Nova Scotia, although we do have four other species that live in the province. Occasionally, the odd, blue-spotted salamander is mixed in with the yellow-spotted ones, because they also are vernal pool breeders, but are a much rarer find. Yellow-spotted salamanders are distinguished by their large size (up to 20 cm), long life (up to 20 yrs), and of course... their impressive yellow spots. Their blue-spotted relatives are quite a bit smaller (around 10-14 cm) and have more subtle blue-grey flecks on their pitch-black bodies.

The migration of "yellow-spots" to vernal pools for breeding is triggered by the first rainy nights in April or early May when temperatures stay well above freezing for most of the night (about 5-10° C). One of our fine local naturalists, Ian Manning, coordinated the collection of Big Night dates from observers across the province in 2022 (see figure on next page). He found that the timing ranged from 24 March to 19 April that year, with the largest congresses (the established term for a group of breeding salamanders) being between 100 and 150 individuals at any one pool. My own observations over the last decade at one of the pools along the forest edge on our farm is that the Big Night has ranged from 1 April to 12 May, often coming in two pulses. There is often an early small number of especially hearty individuals coming to the pool in April, and a larger bunch coming two to four weeks later when conditions are more ideal for a longer part of the night. I suspect this pattern varies depending on locality. North Mountain pools likely have a different pattern than what you might experience living

Yellow-spotted salamanders in a breeding congress. PHOTO: LANG ELLIOT.

on the Valley floor, down in Yarmouth, or in the highlands of Cape Breton.

The most successful breeding ponds are vernal pools, which are usually quite small (often just 50 to 100 m^2, and almost always well under 10000 m^2 (1 ha)). They are within a 0.5 km of wintering sites, have no permanent inlets or outlets, dry up during most summers, and are typically fish-free. Being fish free is good for the soft-bodied salamanders because they are quite a delicacy for fish such as brook trout. Virtually any wetland in the province can serve as a breeding site, but yellow-spotted salamanders do best in vernal pools in woodland settings.

While playing host to salamander breeding congresses is one of the important roles vernal pools play in Nova Scotia's forested landscape, there are many others. They are hotspots for a wide variety of critters. Many snakes, turtles, mink, herons, owls, and ducks are attracted to vernal pools to feed on the breeding salamanders and frogs, as well as the dense aggregations of their young, and a host of aquatic invertebrates that also thrive in these pools. Although details about the biodiversity of pools in Nova Scotia is sparse, Elizabeth Colburn, in her 2004 book—*Vernal Pools: Natural History and Conservation*—documented over 700 species that are dependent upon vernal pools in New England, most of which are invertebrates. They include everything from dragon and damselflies to a multitude of beetles, giant bugs, caddisflies, and crustaceans such as copepods, to water fleas, and amphipods (aka scuds or sideswimmers), and even mysterious fairy shrimp.

Spotted Salamander Big Night Timing 2022

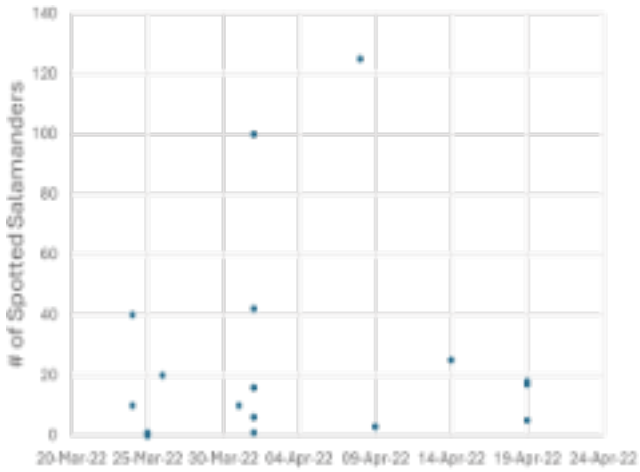


FIGURE: IAN MANNING

Fairy shrimp (our one species is *Eubranchipus intricatus*) are only known to occur in three vernal pools in Nova Scotia. They are dependent on vernal pools to complete their unusual life cycle and are one of the most fascinating critters you can encounter in these habitats. For those of you who had the good fortune of tagging along with Jim Wolford on one of his many spring forays out to the vernal pool along the Joudrey Trail in Blomidon Provincial Park, you are among the lucky few who have seen fairy shrimp first-hand in the province. Checking on the status of fairy shrimp in the pool is a highlight, but just one of the purposes of that annual trip, which continues in honour of Jim.[1] Besides their otherworldly collection of fluttering legs and bulging eyes, they are strange in that they are only around for two to three weeks each year when they mate, lay eggs, and then die back as the pools dry out. The drying is essential for their success. Their

Small vernal pool near York Redoubt in Halifax County. PHOTO: JOHN BRAZNER..

dormant eggs (considered cysts, which are fully developed embryos) only hatch out again when the pond re-floods and a variety of other physical-chemical conditions are ideal. For example, water temperature needs to be below 15° C, with dissolved oxygen near saturation, and osmotic conditions diluted, which usually does not occur until spring. As indicators of vibrant and healthy aquatic ecosystems, fairy shrimp can be key organisms to track; however, their absence from most vernal pools in Nova Scotia does not necessarily mean these pools are degraded. Their absence is most likely due to their limited ability to disperse and recolonize our landscape following glaciation.

Fairy shrimp in glass vial at Blomidon Park vernal pool. PHOTO: JOHN BRAZNER.

Hopefully, the incredible biodiversity that is supported by vernal pools is enough to convince you that these are habitats worthy of strong conservation efforts. In addition, consider this: vernal pools, and other small wetlands, play a critical role in preventing the flooding of our communities, reducing erosion along our rivers, and trapping nutrients that would harm downstream waterbodies connected to them. They play a much larger role in flood and nutrient control than their size alone suggests, because small wetlands comprise about seventy percent of all wetlands in Nova Scotia. Unfortunately, their small size makes them particularly hard to track and vulnerable to loss.

Sadly, vernal pools are often lost to a variety of urban, commercial, and other development because they get overlooked, and because pools under 100 m^2 are not protected under the Nova Scotia Wetland Conservation Policy. Vernal pools are embedded throughout our forested landscapes, particularly in treed swamp habitats, and that is the wetland type most frequently altered by development in Nova Scotia. Biologists at Nova Scotia Environment and Climate Change have estimated that approximately 100 hectares of swamp is lost to development each year across the province, meaning many vernal pools are lost with it. Exactly how many is anybody's guess, but our biodiversity is certainly poorer as a result—each loss meaning quieter spring nights and a lower chance of encountering the wonder of a "Big Night." A bit of good news for these small wetlands is that the province has recently decided to protect forested wetlands from wood-cutting on public lands, and is considering restrictions on the way harvesters can operate around vernal pools. But this does nothing to protect these important habitats from forest cutting or other developments on private lands. It must be a major priority of governments and conservation organizations to educate private landowners to be good stewards of vernal pools and other wetlands throughout Nova Scotia.

Blue spotted salamander. PHOTO: IRONCHRIS, COMMONS.WIKIMEDIA.ORG

John Brazner is a biologist who recently retired from the Wildlife Division of the Nova Scotia Department of Natural Resources and Renewables.

Notes

[1] The trip this year will be on Saturday afternoon, May 25, as part of Celebrate Nature, the 2024 Nature Nova Scotia conference hosted by the Blomidon Naturalists in Kentville. For more information and registration, visit: https://naturens.ca/the-celebration-of-nature/

Minas Basin—The Last 20,000 Years

Appreciating and understanding the evolution of landscapes through time can help us to become better environmental stewards.

BY ELISABETH KOSTERS

I first heard about the Minas Basin when I was a graduate student in the Netherlands, doing thesis research in a Dutch tidal estuary. My prof had organized an international symposium, which was also attended by a team from McMaster University in Hamilton, Ontario. They presented their work on the sediments of the Minas Basin. I was completely mesmerized when I realized that the tide range in the Minas Basin was at least three times as high as in "my" estuary. Fifteen years later and midway through a career as a geologist that took me to the US and back to the Netherlands, I found myself visiting Wolfville, walking the dyke along this magnificent tidal estuary about which I had never stopped thinking. Then I moved to Wolfville, and now, some two decades later, I feel confident enough to write about this magical place. This article is a short version of what will be the last chapter of a book about the 350 million year history of the Minas Basin.

Minas Basin during Glacial Times

The earth experienced at least six ice ages (glacial periods), separated by warm intervals (interglacial periods), during the last 2.5 million years. Around the Minas Basin, we only find evidence of the most recent ice age, the "Wisconsinan," which began about 75,000 years ago. Glaciation waxed and waned over this time, peaking 50,000 years ago when it was at least 1.5 km thick over Nova Scotia, and extended out onto the Scotian Shelf. Eighteen thousand years ago during the "Last Glacial Maximum," the global sea level was 120 m lower than today (Figure 1).

From 18,000 years ago, the climate began to warm rapidly. By 10,000 years ago, the continental ice caps had retreated to today's positions, which marked the start of the warm interglacial period that we live in, the "Holocene." The warming that began 18,000 years ago wasn't a gradual process (Figure 2). Around 14,700 years ago, warming increased rapidly for about 2,000 years (the "Bølling-Allerød" warm interval), after which the earth plunged into a 1,000 year long cold interval (the "Younger Dryas"), which lasted until 11,700 years ago. After this, a warmer climate finally became established. Mi'kmaw ancestors may have arrived as early as 14,000 years ago, following caribou and other large game along the edge of the retreating ice cap, establishing settlements along the north shore of the Minas Basin.

Continental ice caps depress the earth's crust beneath them, as shown in Figure 3. The crust is about fifty kilometres thick and is rigid. It floats on a viscous underlying layer, called the "mantle." The weight of the ice caps lowers the earth's crust, pressing it into the mantle, forcing mantle material to flow away. When ice caps melt, mantle material slowly flows back and the earth's surface bounces back up. This process is called "isostatic rebound."

Figure 1. Ice cap extent over Atlantic Canada during the Last Glacial Maximum 18,000 years ago (purple line), and at the start of the Bølling-Allerød warm interval 14,000 years ago (yellow line).[1]

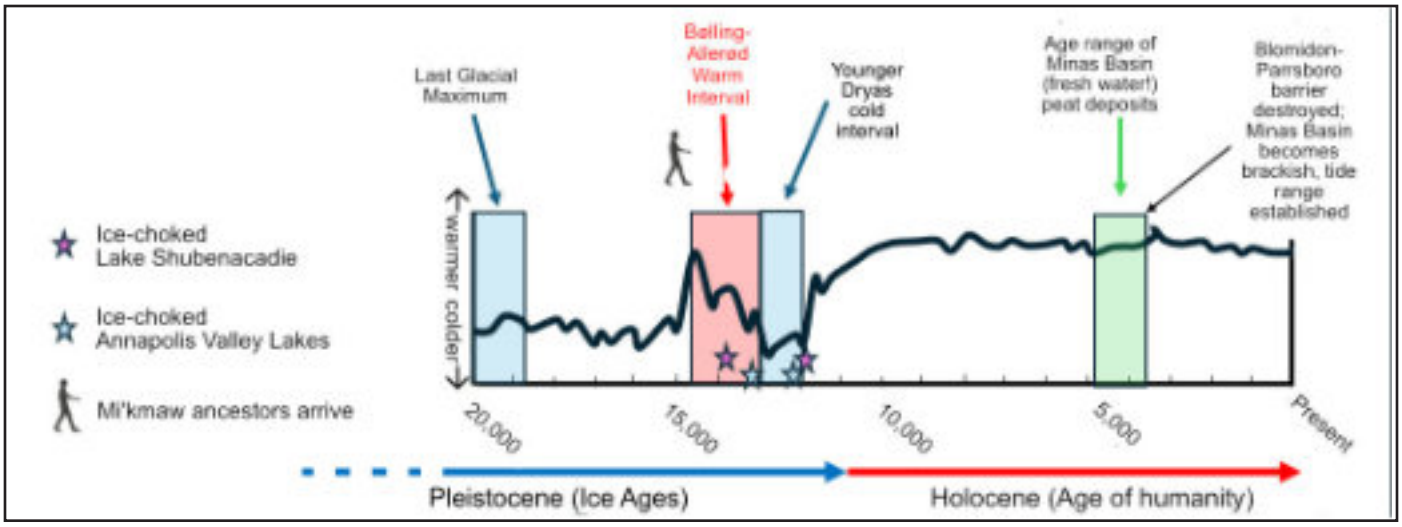


Figure 2. The diagram shows relative mean global temperature fluctuations (dark blue line) during the last 20,000 years,[2] with added details for the Minas Basin. The Mi'kmaw Debert settlement was occupied for 2,000 years during the Younger Dryas cold interval.[3]

When the ice caps began to melt 18,000 years ago, water began returning to the oceans, causing the sea level to rise. During the early Bølling-Allerød warm interval (Figure 2), the sea flooded the western part of the Minas Basin, but then the melting glaciers on land increased isostatic rebound, and the land rose faster than the sea, resulting in the draining of the Minas Basin. In Nova Scotia, most of the isostatic rebound happened between 18,000 and 8,500 years ago, at which time the rate of sea level rise overtook the rate of the isostatic rebound. From that moment, the sea began to flood the land again. Separate small ice caps remained for a longer time on the northern and southern mainland surrounding the Minas Basin, shedding sediment-laden meltwater into the ice-free and barren areas below, and sometimes causing ice-blocked lakes to fill parts of the basin. As temperatures continued to increase, the ice cap and amount of meltwater decreased, vegetation took hold, and the landscape changed. The Minas Basin was flooded by the sea about 3,600 years ago.

Evidence of these processes can be seen along the north shore of the Minas Basin (Figure 4, next page). This area has steep-sided hills bordering a relatively flat lowland. When melting accelerated around 14,000 years ago, gravel-choked meltwater poured down from the still glaciated steep hills. The resulting coastal plain was formed by fan-shaped, meltwater streams descending into the basin and leaving gravel deposits.

As the land rose, river gradients steepened and the Farrells River near Parrsboro cut into its original deposits and laid its sediments down further seaward (Figure 4). As isostatic rebound slowed down and the sea level rose, the river gradient decreased, reducing the river's capacity to transport large boulders, but increasing its capacity to cut its original floodplain in a snake-like fashion, forming a meandering river. Simultaneously, the climate warmed and new vegetation successions were able to establish themselves on the coastal plain. Next time you're in Parrsboro, imagine how big and wild the Farrells River was in early post-glacial times.

As the continental ice cap melted, it sent massive numbers of icebergs into the Minas Basin and, at times, these choked the basin's outlets. In the southwest Minas Basin, remaining ice choked the drainage from the Annapolis Valley, leading to

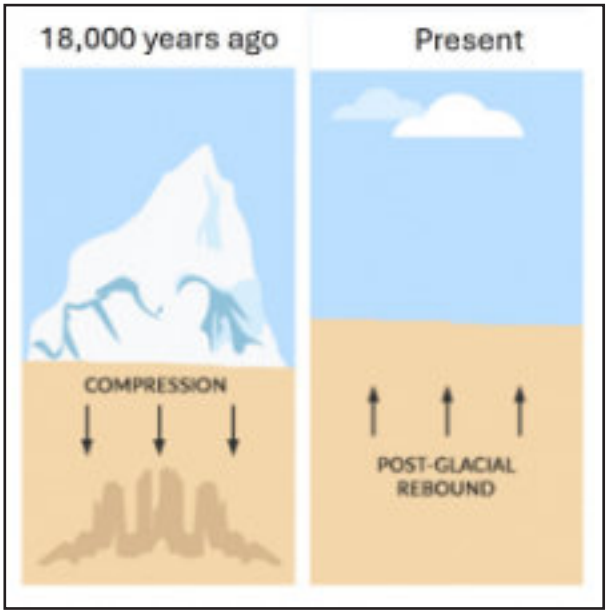


Figure 3. The weight of thick ice caps depresses the earth's crust. When the climate warms and the ice cap melts, the earth's surface bounces back up. This process is called "isostatic rebound."

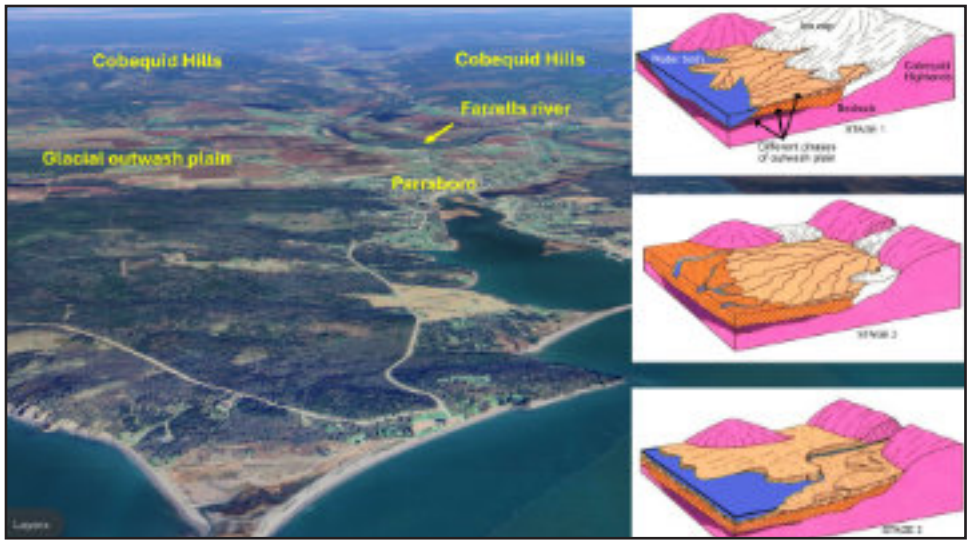


Figure 4. Google Earth image of the Parrsboro glacial outwash plain. The right hand cartoons illustrate three stages of climate warming and the landscape features that formed as a result.[4]

temporary glacial lakes both 15,000 and 12,000 years ago. The Shubenacadie River mouth became so choked with ice, both 14,000 years ago and again 12,000 years ago, that it temporarily reversed direction, draining directly into the Atlantic Ocean. The unique shape of the Minas Basin—a triangular lowland surrounded by hills with a narrow opening to the sea—was the reason these blockages could happen repeatedly.

Part of the southern edge of the Minas Basin is formed by what is known as the "Ridge," which causes Wolfville's Main Street to be shady on winter mornings and afternoons. During early deglaciation, ice and snow stayed on the ground here longer than elsewhere. The result is a messy wedge of sediment glued against the rocky core of the Ridge, stuck between the warmer, melting surface and frozen soil and ice remnants clinging to the shady hillside. Separate chunks of ice sat on the top of this wedge and melted out, leaving a pock-marked surface. Except for the part of Wolfville along Main Street, most of Wolfville's residential neighbourhoods are built on this bumpy terrace, a mixture of stiff clay, sand, and gravel. This mixture is the reason why many properties in this part of town have drainage issues.

Minas Basin as a Freshwater Lake

Ten thousand years ago the climate really warmed up and we entered the Holocene—the age of humanity. Ice caps had completely disappeared by 11,000 years ago, and by 8,500 years ago, the land was no longer rising significantly. Ice no longer choked the Bay of Fundy, and it became fully inundated by the sea. As salt water entered the Bay of Fundy, freshwater coastal vegetation gradually died off and was replaced by salt marshes.

Peat is dead freshwater plant material that hasn't decayed because it is deprived of oxygen below a stable water table. It can begin to form along the edges of lakes, eventually filling the whole body of water. Scientists were long puzzled by the fact that peat deposits along the Minas Basin were about 3,600 years old, while no peats younger than 6,000 years exist around the Bay of Fundy. This observation can be explained by assuming that a gravel barrier existed across the Minas Channel from roughly Parrsboro to Blomidon during the early Holocene, and that it was breached by the ocean as the tide range increased.[5] Remember: the sea level was lower when the massive Parrsboro glacial delta accumulated (Figure 4). East of Burntcoat Head across Cobequid Bay, the remains of a massive early Holocene gravel beach have been identified below the surface. It was washed over as the sea rose and the tide range increased.

The existence of a gravel barrier across the Minas Channel would explain why the Minas Basin remained a freshwater, peat-filled lake until about 3,600 years ago. Peat remains are found all around the Minas Basin. At the Guzzle off Grand Pré, you can see remains of peat deposits, and if you walk out far enough at low tide, you'll see tree trunks on the edge of the tidal channel (Figure 5). These are the remains of 3,600-year-old white pines, a freshwater tree. Mi'kmaw oral history substantiates the hypothesis that the Minas Basin turned rather abruptly into a saltwater estuary. Here is a short version of the Mi'kmaw story as told by Elder Gerald Gloade of the Mi'kmawey Debert Cultural Centre:

> *One day, Kluskap wanted to take a bath and asked Beaver to help him. Beaver happily agreed and built Kluskap a dam, and the water pooled behind it. After his bath, Kluskap asked Beaver to remove the dam so the tub could be drained, but Beaver refused. Kluskap got angry and threw a few rocks at Beaver (Five Islands and the*

Brother Islands), but Beaver still refused to take out his dam. Then Kluskap asked the whale to help him, and the whale flipped her tail, and the dam broke.[6]

Elder Gloade places the locale at Advocate Harbour… who knows?

Figure 5. The stump of an old pine tree that grew about 3600 years ago in the Minas Basin before the rising sea overwhelmed the gravel barrier across the Minas Channel. This stump is visible at low tide to the northeast of the Guzzle near Grand Pré. PHOTO: ALAN WARNER.

The Mi'kmaq had already lived here for nearly 10,000 years when the Minas Basin was transformed from a freshwater lake to a tidal estuary. They also witnessed the earlier, ice-dammed glacial lakes. While we don't know how fast the Minas Channel barrier was destroyed, the legend suggests that it was a catastrophic event that changed their way of life drastically: the entire freshwater, non-tidal ecosystem that they depended on changed to a saline tidal estuary within a human lifetime. Many Indigenous histories across the world are accurate records of catastrophic natural events that happened during rapid, post-glacial warming.

Why Did the Minas Channel Barrier Breach?

To answer this question, we must first talk about tides. The tides that race across the world's oceans are waves, defined by their wavelength and wave height.[7]

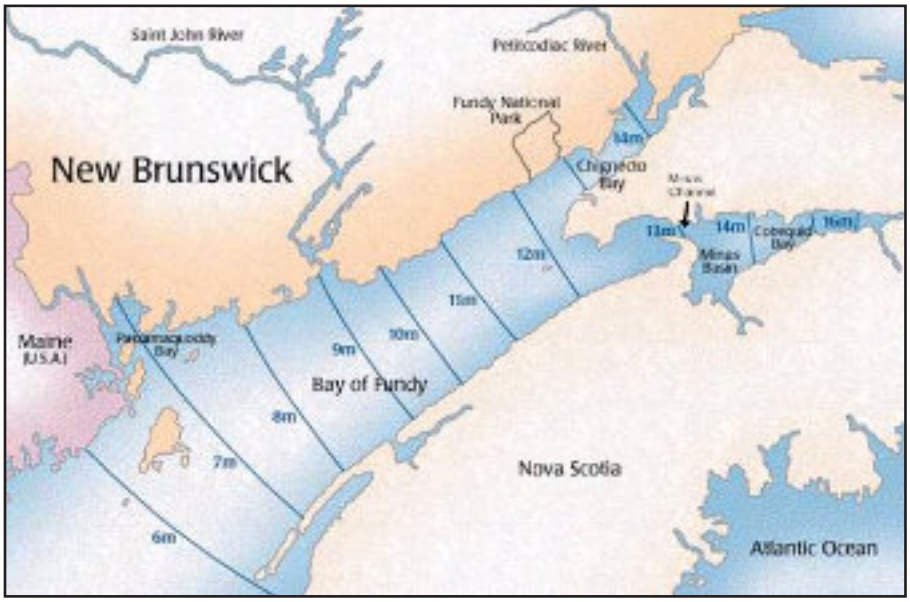


Figure 6. Tidal wave propagation in the greater Bay of Fundy. The height of the wave (tide) increases from zero off Maine to as much as 14 m in Chignecto Bay and 16 m in Cobequid Bay. A good simulation of this tidal system can be found at the University of Massachusetts-Dartmouth website.[8]

As the ice caps melted and the sea level rose, the length of the Gulf of Maine/Bay of Fundy increased until it approached the same wavelength as the wave that is the tide, forming a "standing wave" (Figure 6). A standing wave is a wave established around a fixed point (the "node"). Imagine sitting in your bathtub and pushing the water over the edge. If you do it well, you'll sit with the water around your belly button, as the water splashes out of each end of the tub. You have achieved "resonance" by creating a standing wave. Your belly is the node of the wave. In nature, it takes a lot longer to establish a standing wave. As the length of the Gulf of Maine/Bay of Fundy increased, it began to approach the wavelength of the tidal wave, growing in height. This process increased the chance that the Minas Channel barrier would be breached. When it did breach and the Minas Basin Lake became connected to the Bay of Fundy, the tide range began to increase even more because the length of the Bay now approached the wavelength of the tidal wave, and resonance became achievable. The Bay of Fundy narrows towards the end and the water is forced upwards, since a tidal wave retains most of its energy for a long time. The Bay of Fundy tidal system hasn't quite achieved resonance in these 3,600 years, which is why the tide range

will still increase until the end of this century. Around the greater Bay of Fundy shorelines, communities are preparing for anthropogenic sea level rise, but the amount of sea level rise due to the still increasing tide range will be even higher than the CO2-fueled sea level rise.

Minas Basin as a Tidal Estuary

When the early Holocene Minas Basin Lake became connected to the Bay of Fundy, and became the tidal Minas Basin, a whole new set of natural dynamics evolved. The tide enters the Minas Channel as a jet (Figure 7). The current is strongest and fastest along the north shore (the preferred location for tidal power generation), then heads to Burntcoat Head, enters Cobequid Bay, loops counter clockwise around and back along Economy Point to the centre of the Minas Basin, where it does a clockwise loop before hugging Cape Blomidon as it exits (this is a very simplistic description of a very complex physical system).

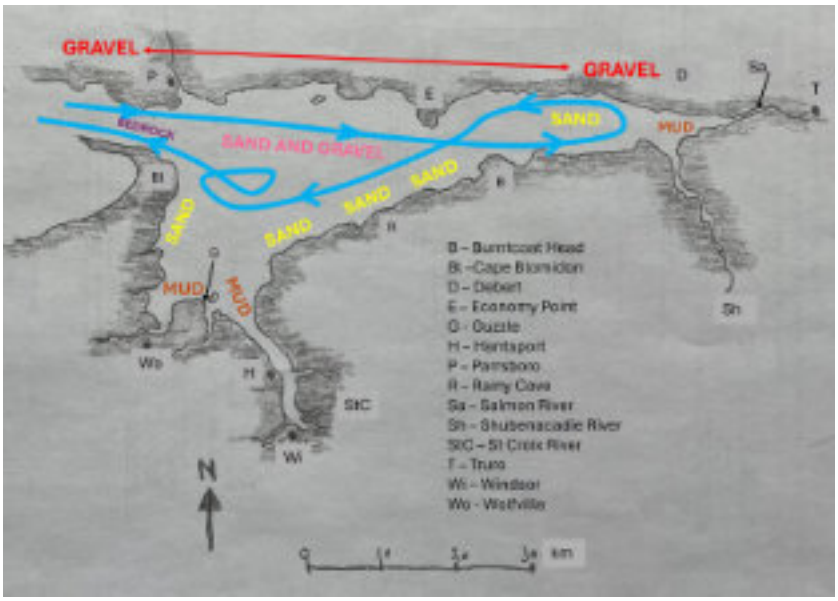


Figure 7. Map of tidal currents and surface sediments in today's Minas Basin. The blue arrow is a simplified representation of tidal circulation in the Minas Basin. Dominant surface sediment composition is also indicated. Cobequid Bay is the extent of the Minas Basin east of the line from Economy to Burntcoat Head.[9]

The tidal wave travels at a speed of about 300 km/hr. As it approaches Truro, its velocity is slowed down by friction against the shallowing bottom. However, it does maintain its energy, and as the upper portion of the wave races forward, its lower portion slows down, and the wave breaks. In Cobequid Bay, this happens just east of Burntcoat Head. In the St. Croix and other small rivers, the tidal wave travels upstream without breaking for quite a distance: the "tidal bore."

The tide enters the Minas Channel with a speed of about 10 m/sec, and that's so fast that no sediment can be deposited here: the bottom of the channel is bedrock. This explains why there is no physical evidence of the gravel barrier that may have closed off the Minas Basin until about 3,600 years ago.

Anywhere you walk on a tidal flat in the Minas Basin, there is no more than ten metres of soft sediment between your feet and the bedrock. The sediments on top of the bedrock are mostly those that were deposited in freshwater glacial lakes that existed before the Minas Basin became a saltwater estuary. On top of these is a pile of up to six metres of sediments deposited under the current tidal regime. Their surface variability is stunningly interesting. In areas with faster currents, we find coarser sediments (gravel and sand) than in areas with slower currents, where mud is able to settle (Figure 7). Cobequid Bay is a dead end and the tidal currents turn around and mix with the fresh water of the Shubenacadie and Salmon rivers. The Shubenacadie River is tidally influenced for as much as 30 km upstream from its mouth, and while a true tidal bore hardly forms there, riding the chaotic incoming tide in a raft or kayak is still a very wild and recommended experience.

Figure 8. Google Earth image of the tidal flats at Rainy Cove. See location on Figure 7.

Fine muddy sediments can settle only in areas with the slowest currents, mostly in the southern Minas Basin.

Muddy tidal flats support, among many other species, the Corophium shrimp, so these are areas where migratory birds congregate in late summer to fatten up on their way to their southern wintering grounds.

Complex tidal sand flats exist in the upper Cobequid Bay and along the eastern shore of the Minas Basin at Rainy Cove near Pembroke (Figure 8). The structure of these tidal sediment bodies changes with the seasons, after extreme events such as hurricanes and winter ice formation. Another factor that changes the structure constantly is the variation in tide range throughout the lunar month. I include one example of the fascinating insights that one tidal sand bar provides (Figure 9).

Anthropogenic Minas Basin

When the Minas Basin became an estuary about 3,600 years ago, the freshwater peat-forming marshes died off and were replaced by salt marshes. This change was witnessed by the early Mi'kmaq. Salt marshes produce massive amounts of primary carbon, which form the basis of the food chain. Most of the original salt marshes were then locked away behind dykes in the mid-1700s, thus the estuarine ecosystem was drastically changed again.

The rate of global warming since the beginning of the industrial era is comparable to the rate of global warming between 18,000 and 10,000 years ago. This recent warming is explained by massive fossil fuel burning, which has caused the global sea level to rise about 1.5 m since the mid-1800s. This rapid climate warming confronts us with complex and unpredictable changes. Given these insights it is irresponsible that the current Nova Scotia government has abandoned the Coastal Protection Act, creating the false impression that staying safe is a simple matter. This history of the complex evolution of the Minas Basin over the past 20,000 years underscores this point.

Elisabeth Kosters is a retired sedimentary geologist who studied and worked in the US, the Netherlands, and Canada.

Notes

[1] Dalton, A.S. et al (2020). An updated radiocarbon-based ice margin chronology for the last deglaciation of the North American ice sheet complex. *Quaternary Science Reviews.* https://doi.org/10.1016/j.quascirev.2020.106223

[2.] Badgeley, J.A., Steig, E.J., Hakim, G.J. & Fudge, T.J. (2020). Greenland temperature and precipitation over the last 20 000 years using data assimilation. *European Geosciences Union.* https://doi.org/10.5194/cp-16-1325-2020-supplement.

[3] Stea, R.R. (2011). Chapter 8: Geology and paleoenvironmental reconstruction of the Debert-Belmont site. In T. Bernard, L.M. Rosenmeier, and S.L. Farrell (eds.), *Ta"n Wetapeski"K: Understanding from Where We Come.* Truro, N.S.:Confederacy of Mainland Mi'kmaq, 21 pages. https://mikmawarchives.ca/documents/tan-wetapeksik-understanding-from-where-we-come

[4] Swift, D.J. & Borns Jr., H.W. (1967). Genesis of the raised fluviomarine outwash terrace, north shore of Minas Basin, Nova Scotia. *Atlantic Geology, 3(1),* 17-23.

[5] Shaw, J., Amos, C.A., Greenberg, D.A., O'Reilly, C.T. , Parrott, D.R., & Patton, E. (2010). Catastrophic tidal expansion in the Bay of Fundy, Canada. *Canadian Journal of Earth Sciences, 47,* 1079-1091.

[6] www.mikmaweydebert.ca/

[7] *Wavelength* is the distance over which a wave repeats itself, such as the distance between two adjacent crests or troughs. So, the wavelength of the tide is the distance between the location where the tide is high at time A and the next location where it is high at time B. The wavelength of the tide is about the same distance as the distance of the Gulf of Maine/Bay of Fundy between Georges Bank and Burntcoat Head. *Wave height* is the distance between the height of the wave crest and an adjacent wave trough, and this height equals the *tide range*. A *standing wave* is a wave whose peak height doesn't move in space because its wavelength is about the same as (resonates with) the length of the basin through which it moves.

[8] Find the Bay of Fundy tide simulation at: http://fvcom.smast.umassd.edu/research_projects/GB/Tidal_simulation/m2_curr_el.gif

[9] Amos, C.L. (1978). The postglacial evolution of Minas Basin, NS: A sedimentological interpretation. *Journal of Sedimentary Pology, 8(3),* 965-982; and Greenberg, D.A. (1984). The effects of tidal power development on the physical oceanography of the Bay of Fundy and Gulf of Maine. Canadian Technical Report of Fisheries and Aquatic Sciences, unpublished report, 12 p.

Figure 9. Cut through of a sand bar on the tidal flat at Rainy Cove, showing sediment deposition by tidal currents during Spring and Neap tide. More sediment is deposited during Spring tide when the tide ranges are higher and tidal currents faster than during Neap tide. Spring tide deposits are thus thicker than Neap tide deposits. We can see the deposit of each tidal current because they are separated by a thin layer of flaky rock fragments, the last to settle out of suspension when the current slows towards high tide. You can see these shale flakes in the inset, which shows the same feature without the interpretation.

Piecing Together Sea Turtle Mysteries

The best hope for a cold-stunned, stranded sea turtle is to be found quickly.

BY KATHLEEN MARTIN

A fisherman had called the Canadian Sea Turtle Network's toll-free turtle hotline to report the sighting of a leatherback sea turtle. We were about to hang up when he added as an afterthought, "Well, I saw some little hard-shell ones floating around out there too."

"You did?" I was immediately hungry for details.

"Yeah. We see them from time to time. They're right small. About the size of a dinner plate."

I'd had a few calls like this over the years—tantalizing bits of information about a size-class of sea turtle that didn't seem to interact with fishing gear and wasn't recorded elsewhere. The sea turtles that we see swimming in Atlantic Canadian waters are typically the unmistakable leatherback, the giants of the reptile world, or loggerheads, distinctly orangey brown in colour, which are sometimes spotted and photographed from the deck of a longline fishing boat offshore. The rest of our information on the Atlantic Canadian sea turtle population comes from accidental bycatch reports in fisheries—again, invariably limited to leatherbacks and loggerheads.

"I'd love a photo," was my consistent response to these calls. None materialized, which was unsurprising.

Lexie was found on a beach just outside of Saint John, N.B., in Dec. 2020. PHOTO: M. LEVESQUE.

Although I trusted the fishermen's reports, photographing a swimming sea turtle—even a leatherback—can be challenging, their heads sometimes dart above water for only a split second before disappearing again. It was frustrating not to be able to identify the species and be able to record the data as more than anecdotal.

Though we don't have photo evidence of tiny turtles swimming off our coast, we do have a different kind of evidence: handfuls of dead ones washing up on Maritimes shores, typically between October and January—many of them in the upper Bay of Fundy. They are almost never found alive. In 25 years, only two turtles have survived more than 48 hours after being found on the shore.

The phenomenon at work is called "cold stunning," and it impacts juvenile, hard-shelled sea turtles. In Atlantic Canada, that means loggerhead, green, and Kemp's ridley sea turtles.

What is Cold Stunning?

Sea turtles are ectotherms. This means they are not able to regulate their body temperature internally. Instead, it is regulated externally by the water or air temperature around them. Water temperatures fluctuate in the ocean for a variety of reasons—familiar ones like time of year or weather events, as well as marine-specific ones like a patch of warm water, such as a warm-core eddy, suddenly dissipating when it meets a colder front.

Cold stunning happens when juvenile, hard-shelled sea turtles are exposed to rapidly cooling waters. Although they can manage brief dips in water temperature, several days of cold water below about 10° C

Scottie (above left) on the day she was found on the shore in Scots Bay. A healthier Scottie in Bermuda (above right) just before release back into the ocean. PHOTOS: CANADIAN SEA TURTLE NETWORK AND BERMUDA AQUARIUM MUSEUM AND ZOO.

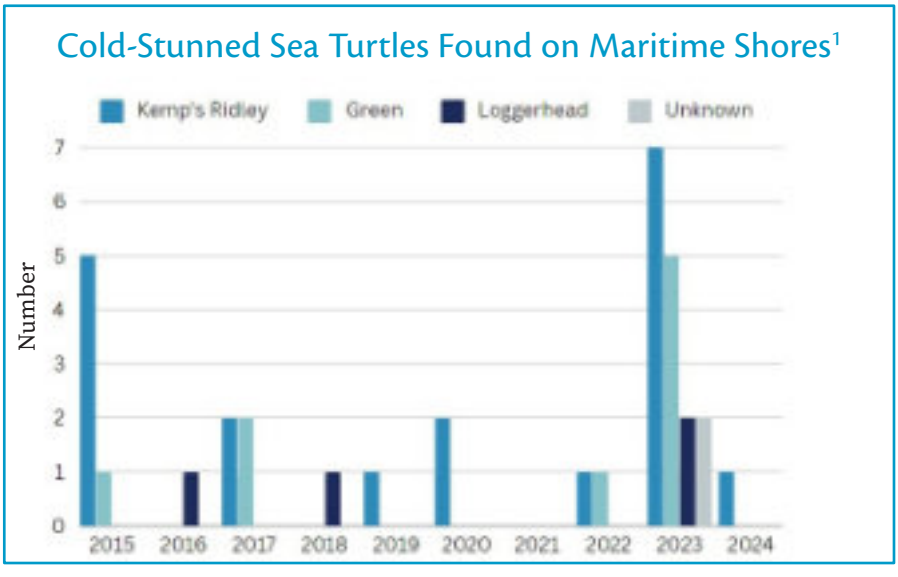
can be deadly. They become weak and susceptible to serious health issues like pneumonia. They are typically disoriented and have difficulty regulating their buoyancy, and don't have the energy required to swim against tides (let alone those in the Bay of Fundy). These little turtles can be thrown up along the shore where they are stranded, often hypothermic, and with compromised immune systems.

Turtle Rescue

The best hope a cold-stunned, stranded sea turtle has of survival is to be found quickly. The Canadian Sea Turtle Network has a Sea Turtle Beach Patrol program that runs from October through January. Volunteers walk the beaches along the coasts of the Maritimes looking for these turtles. This year we found sixteen turtles (loggerheads, greens and Kemp's) during the beach patrol season. All were dead except for one that we affectionately named Scottie, because she was found in Scots Bay by Peggy and Dale Brown. Scottie was carefully and lovingly rehabilitated by veterinarians Dr. Chris Harvey-Clark and Dr. Patricia Pryor in Nova Scotia before we sent her (with the help of a dedicated team at Air Canada) to our colleagues at the Bermuda Aquarium Museum and Zoo. She recuperated there for a few months before being released back into the wild.

Sea turtles cold stun along the eastern seaboard of the United States, and occasionally along parts of the coasts of Florida and Texas. Particular challenges to finding cold stunned turtles rapidly in the Maritimes is our vast expanse of uninhabited coastline and the proportion of coastline that is made up of boulder beaches. Finding a turtle lying stranded on a sand beach is far easier than finding one amongst boulders—many of which look a lot like turtle shells. To increase our chances of finding sea turtles alive, we are enlisting as many people as we can to walk stretches of beach as frequently as possible (a minimum of once a week).

We are also trying to determine "hot spots" for sea turtle strandings. We don't have a dataset big enough to draw firm conclusions yet, and sea turtles have washed up dead throughout the Maritimes. So far, the biggest cluster of animals over time has been found along the Fundy coast of Nova Scotia.



The Impact of Climate Warming

It is logical to expect that as the ocean warms, sea turtles will more frequently venture north in the summer. This may put them at greater risk when fall and colder temperatures hit. The Gulf of Maine is one of the fastest warming places on the planet, so we anticipate that cold stunning will become an increasing issue in the Maritimes. The chart on the previous page presents our data for cold-stunned turtles since 2015.

While the sharp increase in stranding numbers this past year is surprising, it highlights the importance of long-term surveys. It is possible that this season was an anomaly and next year we will return to just a handful of turtles appearing on our coastlines. Because we are only now collecting baseline data, it's hard to say things with certainty, however, we can look at what has happened historically with cold-stunned turtles as tracked by our colleagues working in Cape Cod Bay. The yearly average for the number of turtles found there was less than 100 in the 2000s, but more than 800 were found in 2022.[2] They expect that by 2031 they may have more than 2,300 annual cold-stunned sea turtles washing up on their shores.

> To work with sea turtles is to practice hope. Paradoxically, not having all the answers is also a source of joy.

Sea Turtles in Canadian Waters

Our study of sea turtles in Canadian waters is still relatively new. The pioneering work of Wolfville's Dr. Sherman Bleakney was first published in 1965—not quite 60 years ago. The largest body of sea turtle work in Canada, spearheaded by Dr. Mike James, began in 1998. These are early days and there is a lot we still don't know about sea turtles in our waters. This, combined with their endangered status, and layered with unprecedented, rapid environmental change, means that we have a lot to learn—and quickly.

Not having answers is stressful and frustrating. Sometimes it feels like I'm perpetually seeing through a glass darkly while a giant clock ticks away. Fifteen dead cold-stunned turtles found along our coast this year is one thing as a statistic. It's another to have handled each of them personally, cataloguing and measuring them, and then tucking them into bags for shipment to our pathologist partners at the Atlantic Veterinary College.

CSTN Beach Patrol volunteer Caleigh and her Beach Patrol pup. PHOTO: S. CLARKE.

To work with sea turtles is to practice hope. Paradoxically, not having all the answers is also a source of joy. To be uncertain means to be in a perpetual state of curiosity. To be alive to the possibility of something new. To repeatedly be reminded of the complexity of the natural world—the awe of it. What a gift.

How You Can Help

We are hoping to increase the number of Beach Patrol volunteers, particularly along the Bay of Fundy shoreline. The program runs from mid-October until the end of January. If you are interested in joining, please visit: seaturtle.ca/beach-patrol to learn more.

If you would like to help, but beach walking isn't a good fit for you, we always welcome donations to help run our programs like Beach Patrol. If you are interested in donating, please visit: seaturtle.ca. Click the "Donate" button on our home page.

Kathleen Martin is Executive Director of the Canadian Sea Turtle Network.

Notes

1. The presentation of data here does not constitute publication. This data is copyright Canadian Sea Turtle Network and may only be used with written permission (info@seaturtle.ca).

2. https://www.massaudubon.org/places-to-explore/wildlife-sanctuaries/wellfleet-bay/projects/sea-turtles

Caring for Manta Rays—Connecting Personal Passion with Global Action

Humanity can still change its destructive course; species like manta rays can play a role through inspiring wonder and connection.

BY GUY STEVENS

Manta rays are the embodiment of nature's majesty; they are a vehicle that draws people through the looking glass, opening eyes and minds. They captivate and connect people to our oceans, symbolising what is at stake if we choose not to respect and protect our natural heritage. Nova Scotia does not have manta rays swimming off the coast (the closest sighting is less than 400 km away, off Nantucket Island—only a few days swim for a manta ray), but we have a wealth of other flagship species which can connect people to the natural world. This is the story of how and why mantas captivated me. Can the Blomidon Naturalists help others find such passions?

I have always been fascinated by the natural world; it sparks my curiosity, motivating me to learn more about our planet and the animals and plants who share it with us. I was surrounded by nature growing up in the countryside of the southwest of the United Kingdom. A seemingly limitless supply of weird and wonderful creatures lay just beyond my doorstep, waiting for me to discover.

I always knew I wanted to make a career of studying animals, but it was not until I was given a tropical fish tank at the age of eleven that my passion for the underwater world began. From that moment, when people asked what I wanted to do when I grew up, I would say, "I want to study fish." True to my word, I went through my schooling with this in mind until I graduated from the University of Plymouth with a degree in Marine Biology and Coastal Ecology in 2002.

University opened my mind to the rest of the world, and I was hungry to travel and explore as much as I could. After visiting and diving in the Caribbean, Africa, and Asia, I knew I wanted to work in one of these tropical destinations. So, in 2003, when I saw a job advertisement for a marine biologist in the Republic of Maldives, I knew it was the position for me.

Above Left—Guy Stevens and an oceanic manta ray look each other in the eyes within the Mexican Revillagigedo Archipelago National Park and Marine Protected Area, 400 km off Baja California. PHOTO: THOMAS P. PESCHAK. *Above Right*—Oceanic manta rays migrate through the south of the Maldives Archipelago for just a few weeks every year. This UNESCO biosphere reserve provides sanctuary for many species. Where the manta rays spend the rest of the year remains a mystery that Guy and his colleagues are still trying to solve. PHOTO: GUY STEVENS.

The Maldives is a marine biologist's paradise, and it was there that I had my first underwater encounter with manta rays. Enthralled by these graceful and inquisitive rays, I became driven by a desire to learn as much about them as possible. As I dived deeper into their fascinating lives, I started to better understand the threats they face, which drove my desire to ensure their protection. In 2005, I founded the Maldives Manta Conservation Programme with the aim of helping to understand and conserve the Maldives population of manta rays. As I expanded my work geographically in the following years, I realised there was a need for a coordinated global approach to conserving this threatened family of rays. In 2012, I launched The Manta Trust, a charity founded to tackle the increasing threats to manta rays and their marine world. In 2016, I completed my PhD on the conservation ecology of manta rays at the University of York.

Born into a life of perpetual motion, manta rays must keep swimming to survive. Driven forward by powerful beats of their wing-like pectoral fins, they search the ocean currents for concentrated patches of the tiny planktonic food on which they feed. Giants of their kind, manta rays are among the largest species in the ocean, reaching seven metres from fin tip-to-tip. They range throughout the tropical and subtropical oceans of the world, their horn-like cephalic (head) fins giving rise to ancient mariners' tales of fearsome devilfish dragging boats into the ocean depths.

Giant remoras are common hitchhikers on manta rays. These large brown fish attach themselves to the body of the rays with modified suction cup fins and remain attached even when they dive to well over 1,000 m. PHOTO GUY STEVENS.

Reef manta rays, as their name suggests, frequent inshore coral reef habitat, often around tropical atoll destinations, like here in the Amirante Islands of the Seychelles. PHOTO: RYAN DALY.

Today, we know these gentle giants are harmless to humans, though much of their lives remain a mystery. Fundamental questions such as how long they live, their reproductive cycles, and fecundity, have yet to be answered satisfactorily. Areas of key habitat use, migration corridors, and population estimates, both nationally and internationally, must also be clearly defined if we are to make informed and educated decisions to effectively protect these animals and the world they inhabit. These questions and gaps in our knowledge are not unique to manta rays. Indeed, for many species on Earth, especially marine animals, we still have a lot to learn if we are to effectively protect them. This is why, in the face of the climate and biodiversity crises, marine protected areas (MPAs) are a key component of safeguarding the abundance and diversity of life on our planet.

Since moving to Nova Scotia four years ago, I have delighted in getting to know a whole new group of flora and fauna. It has been a joy exploring the province, including its parks and other natural spaces. Now that I have a young family, I look forward to introducing my daughter to all these wonders. I am cognizant that time is running out to protect her natural heritage. Our generation has failed in its duty to be a

good steward of planet Earth. We will leave it in a far worse state than the world into which we were born, however, there is still time to change course and I believe that species like manta rays can play a role in this sea-change through inspiring wonder and connection.

Throughout their range, manta rays, and their close relatives, the devil rays, are targeted by fishers for their meat and gill plates, or caught as bycatch. Fisheries are the biggest threat to these species globally, resulting in population declines of over 90% in some regions. PHOTO: GUY STEVENS.

Unfortunately, aside from selfish personal gains, humans will generally protect only what they can connect with and care about. As the Senegalese forestry ecologist Baba Dioum said, "In the end we will conserve only what we love. We will love only what we understand, [and] we will understand only what we are taught." Therefore, I believe that to truly conserve a species or its habitat, there must first be the desire to do so, the passion driven by empathy, which arises from care, understanding, and above all, knowledge.

> The Manta Trust and the Blomidon Naturalists Society are, at their core, about getting people to care about the natural world. If we are successful in this mission, the conservation gains will follow.

The Manta Trust and the Blomidon Naturalists Society are, at their core, about getting people to care about the natural world. If we are successful in this mission, the conservation gains will follow. Follow they must for the wellbeing of all life on Earth, including our own.

As oceans warm and currents change, many marine species must shift their distributions to survive. And to do this, they need suitable habitat which is protected and well managed. Thankfully, the global community is waking up to the threats we face. In late 2022, at the UN's Convention on Biological Diversity 15th Convention of the Parties, virtually every country in the world pledged to protect 30% of the planet's land and waters by 2030. Unfortunately, with only six years to go, we are a long way from reaching this milestone, but at least we are moving in the right direction. While there are still manta rays in the Maldives, or ospreys in Nova Scotia, and people who care about their continued survival, I remain hopeful that life on Earth can continue to flourish. We can help.

Dr. Guy Stevens is the Chief Executive and Founder of The Manta Trust, a registered charity dedicated to the conservation of manta rays and their habitat, with collaborative projects in over 30 countries. He has spent the last two decades studying manta and devil rays all over the world, and is one of the foremost experts on these species. For more information, or to offer support, visit www.mantatrust.org. Guy is a board member of the Blomidon Naturalists.

Celebrating Nova Scotia's Inland Fish Diversity Through Illustration

This project integrates science, art, and education by visualizing the diversity of our inland fish species.

BY LIZ BATEMAN

There's a certain mystery about the lives of fish that captivates so many of us. When we walk through the woods, we are immersed in the ecosystem with all the plants, birds, and other creatures right there for us to see. However, fish are concealed beneath the surface of streams, rivers, and lakes. If we happen to catch a glimpse of a trout holding in the current, or an eel lurking in the shadows, we only need to take one step too close before they've disappeared to deeper waters in the blink of an eye. In the words of Jacques Cousteau, "the best way to observe a fish is to become a fish." Since fish live in a world so different from ours, they are easy to overlook.

Nova Scotia's inland waters are home to 39 species of fish. Although this number is comparatively lower than in other provinces (New Brunswick has about 54 species), very little information about our province's fishes is readily available. The provincial angler's handbook provides limited information on select sport fish, but not on all the species in Nova Scotia. As a result, many anglers and naturalists aren't aware of what species do exist in the province, and may not know how to identify them.

Our watersheds are now in a silent crisis. Predatory invasive species, like chain pickerel and smallmouth bass, are spreading rapidly, wiping out the forage base and out-competing native species. Public observations and reports can monitor the spread of invasive species and help to find out how lesser-known native species are distributed. Thus, it is critical that people who spend time in and around our waters know which fish species occur here, and whether they are native or introduced. Without clear, accessible information about the diversity of Nova Scotia's inland fishes, we risk losing species we have barely noticed.

The first step to sharing information is through visual representation. I'm a visual learner myself, and I often skip past the abstract of a research paper to first look at the figures. Throughout my undergraduate degree, drawing and sketching was an integral part of understanding complicated biological processes and learning about anatomical structures. Scientific illustration has become more than just a study tool for me; it is now my favourite method of science communication. As an angler, fisheries biologist, and all-around fish enthusiast, I naturally tend to draw a lot of fish. A year ago, I

Liz Bateman with her poster of the minnows of Nova Scotia, the first step towards an illustrated guide to all of our native fish.

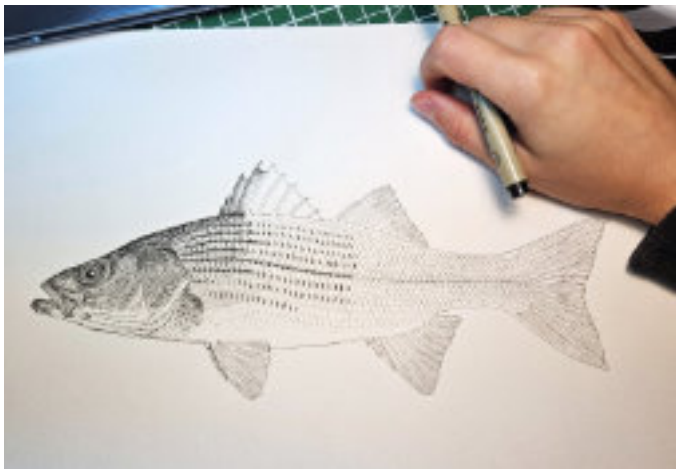
had the idea to draw every species of inland fish of Nova Scotia with the goal of creating a poster, and eventually a guidebook of the fish of the province. This way, there would finally be images for all the fish species together in one place. It's a first step to spreading awareness of and appreciation for the diversity of fish in our rivers, lakes, and streams.

I started with the most overlooked group of fish: the minnows. These cyprinids (such as dace, shiners, and chub), as well as other small-bodied minnow-like fish (like killifish and sticklebacks), make up nearly half of all our inland fish species. I couldn't even name all of them when I first began this project.

It's a first step to spreading awareness of and appreciation for the diversity of fish in our rivers, lakes, and streams.

I am now working on the more charismatic and well-known species like Atlantic salmon and striped bass, but it was important to start with the underappreciated minnows. They are the foundation of diverse aquatic ecosystems, and most at risk from invasive species. Many minnows look very similar, so it is especially important to have all of them together to highlight their minute differences and unique characteristics.

The wonderful but challenging thing about drawing fish is that every species has a very specific set of morphological counts and measurements, called morphometrics and meristics. There's no making up details when each species has its own number of scales or fin rays. A lot of work goes into the drawings before a pen even touches the paper. This includes studying museum specimens, finding fish to take photos of

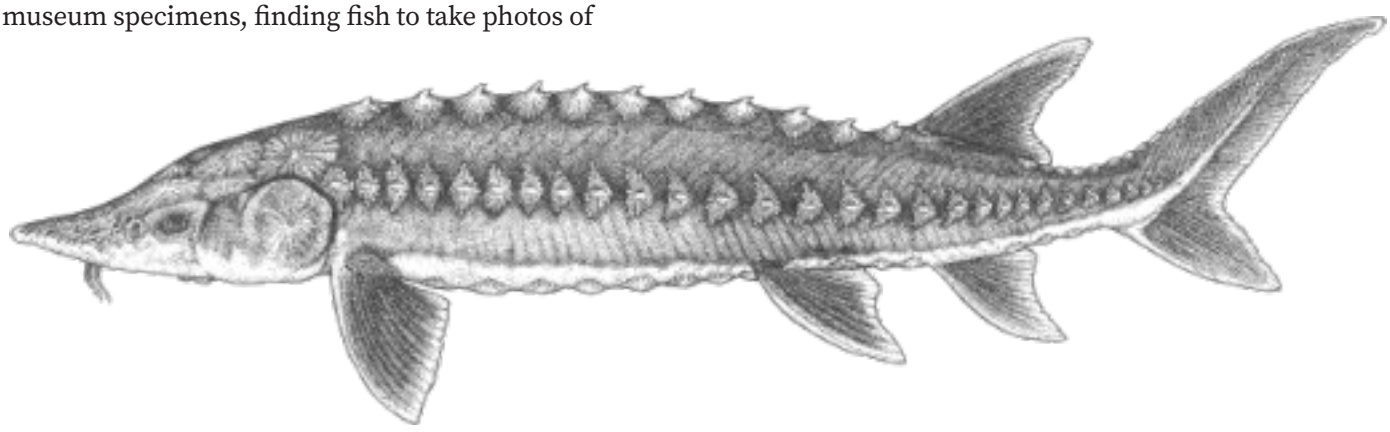


A drawing in progress.

through angling or other sampling, or even "becoming a fish" like Jacques Cousteau suggested, and grabbing a snorkel to observe fish in their habitats. At my desk, I spend hours measuring, counting, outlining, and stippling, the classic scientific illustration style of shading with dots. It's a labour of love.

This project integrates science, art, and education by celebrating the diversity of inland fish species in Nova Scotia through illustration. In my time spent drawing fish, I hope to raise awareness of the challenges they face and to better equip the public to be stewards of their provincial waters. I hope my illustrations will be of use to local naturalists, inspire future fish enthusiasts, and do justice to Nova Scotia's natural heritage.

Liz Bateman is a master's student at Acadia University in fisheries science, an avid outdoorswoman, and a self-taught scientific illustrator. If you are interested in purchasing the Minnow poster for $10, contact Liz at lizbatemanart@gmail.com.



Atlantic Sturgeon is a threatened species in the Maritimes. They have been seen infrequently in Minas Basin, and caught, tagged and released in the Annapolis River in recent years. ILLUSTRATION: LIZ BATEMAN.

Protecting a Special Place—The Chain Lakes Wilderness Area

Time is short and we need to demonstrate support for the proposal to protect the Chain Lakes Wilderness Area.

BY ALAN WARNER

"That's the biggest tree I have ever seen in Nova Scotia!" Those were the first words out of Valerie Campbell's mouth as she approached a giant yellow birch not too far from the shores of Upper Gully Lake in southwest Kings County on a sunny day in early April. The tree is one of many within the 12,000-hectare area that the Blomidon Naturalists have proposed to the Nova Scotia government for wilderness protection. A short time later, Valerie and five other Acadia community development students, their professor, and I, emerged from the deep forest into an enormous clearcut, not more than a few hundred metres away. The contrast was stark as we easily traversed the open clear cut, which was dotted with small balsam fir and patches of juvenile white birch. We were surveying the area for future field trips as part of their three-week spring project to help plan a public education campaign for protection of the proposed Chain Lakes Wilderness Area. Here is an update of why we have launched this campaign, how we hope it can make a difference, and how you can help.

Why Protect the Chain Lakes?

Alain Beliveau and James Churchill, local biologists and BNS members, spent a number of weeks over a couple of years surveying the area for biodiversity and endangered species.[1] Despite the extensive clear-cutting over time in this area of Kings County, they found areas of older growth forests, and were delighted to find lots of intriguing and rare species: Canada Warbler, olive-sided flycatchers, wisqoq (black ash), and endangered lichens, to name a few. They spotted snapping turtle nests, foraging chimneys swifts and nighthawks, and even the elusive rusty blackbird. There are pockets of old growth, forests that are older than 80 years, beautiful lakes, and

Peters Lake on an October morning, a beautiful spot to canoe or kayak. PHOTO: ALAN WARNER.

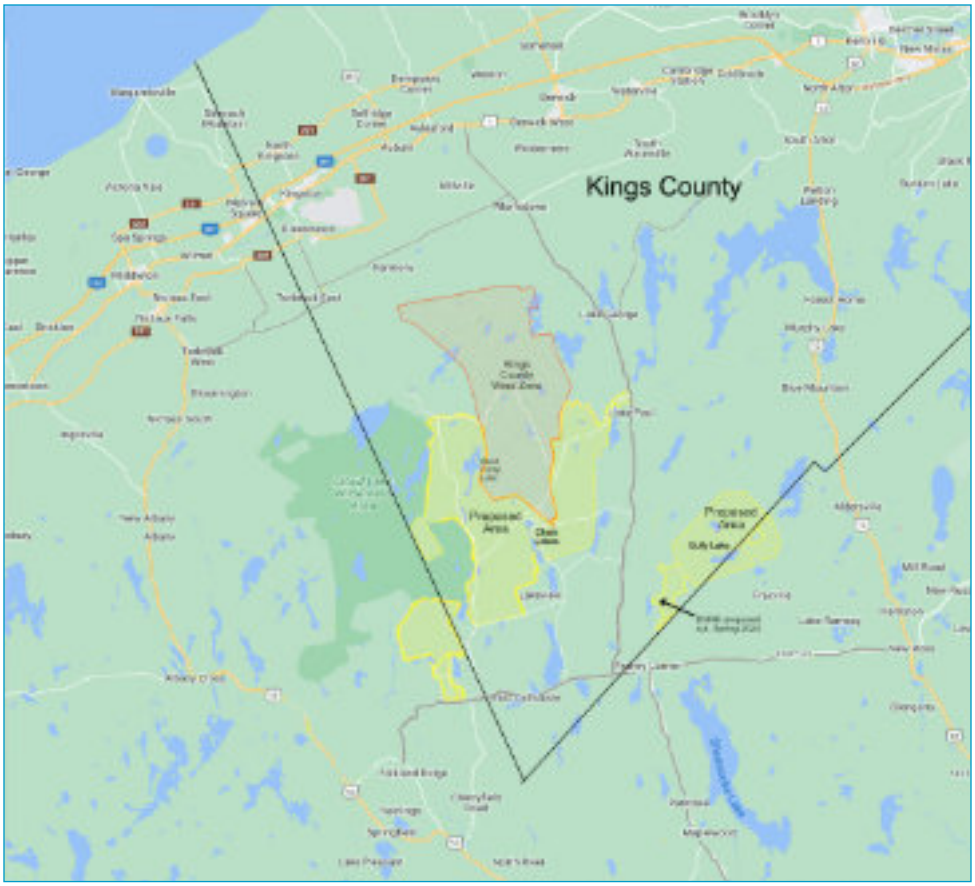
pristine still waters and wetlands. This is a key reason why the Blomidon Naturalists have proposed protecting a large part of this area.

There are many other reasons to protect this area now. First, while the province has a goal of protecting 20% of its lands by 2030, less than five percent of Kings County is protected compared to a current level of 13.5% province wide. This area is the only large block of publicly owned and undeveloped land in the County. It also offers great recreation and tourism potential for wildlife observation, hiking, canoeing, mountain biking, and is already frequently used for hunting, fishing, trapping, and by off-road vehicles. Unfortunately, the cutting over the past 20 years has devastated much of the landscape (see the map on the next page), and now Department of Natural Resources and Renewables (DNRR) is proposing new areas to cut this spring within the proposed wilderness area. DNRR states that they are shifting to "ecological forestry," but there is little indication on the ground.[2] Unless protection comes quickly, and there is a pause on cutting in the meantime, much more will be lost.

Quinn Woolven and Della Alderson hugging a giant yellow birch near upper Gully Lake in the proposed Chain Lakes Wilderness Area. PHOTO: ALAN WARNER.

Building Support for the Proposal

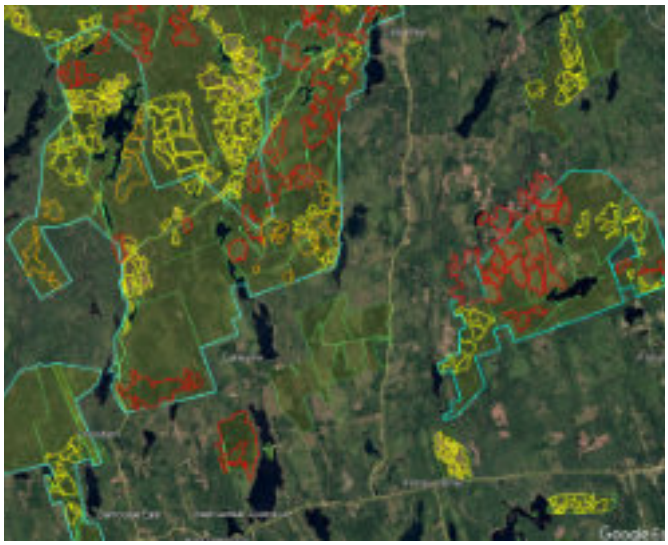
A Blomidon Naturalist committee to protect the area was formed in spring 2023 and we submitted our first proposal to the Minister of Environment last June. We heard little beyond that it would be referred to the Protected Areas branch. We updated the proposal in fall and presented it to Kings County Council, who have written a letter of support. We met with Chris Palmer, the MLA for the area, who expressed support for protected areas in general, but wants to see support from his constituents for this area. Keith Irving, another Kings MLA, supports the proposal. In February, we were finally able to meet with officials in the



Google Map image of southwest Kings County showing the proposed Chain Lakes Wilderness Area shaded in yellow. The orange area is zoned for wind power development by Kings County.

Departments of Environment and Natural Resources and Renewables. They were positive about the proposal and felt that it met the criteria for the selection process for new protected areas. They indicated this process would take time, and that public support for the proposal would be a big asset. They also noted that there was an interim target to reach 15% of land protected by 2026. Could the Chain Lakes be in the first batch of new protected areas? Time is short and we need to demonstrate support for the proposal.

Let's step back and carefully look at where it is (see map on previous page) since most people have not been there—because it is an undeveloped area that has largely been the fiefdom of large-scale forestry operations. Unfortunately, the western section of the proposed area is oddly shaped due to Kings County having zoned a significant area for wind farm development under their municipal plan. They indicate they are unable to support anything that contradicts the plan, and it would be a multi-year, complicated process to change it. The potential of suitable wind for windmills in the zone requires further study, and possibly there is room for adjusting boundaries in the future if wind development does not go ahead or is shifted one way or the other. Their support is important to making the proposal a reality. We also need support from other towns. Port Williams has supported it and we need to approach others.



Public Land areas that have been cut since 2004 in the Chain Lakes region. The blue-green border outlines the proposed protected area. The yellow outlines show cuts since 2016. The red outlines are cuts between 2004 and 2016, and the orange outlines are cuts that were only partial. This map was compiled using the Public Lands data and Harvest Plan Archives from NS DNRR. Older cuts were determined visually from satellite images on Google Earth Pro. MAP: LARRY BOGAN & CATHY VEY.

We need broad public support from diverse constituencies. This area is used by hunters, fishers, trappers, and ATV and snowmobile users, and these activities can continue in a protected area. New off road vehicle trails cannot be created, but existing trails can be grandparented in at the outset. We strongly recommend that this occur and are meeting with these groups to encourage them to engage in and support the process to assure their own continued use and the protection of the area. We have had a positive reception from multiple groups and two have written support letters to date. There are lots more groups that need to know about the proposal.

What's Next?

The Community Development students have designed the social media campaign for Facebook and Instagram to reach new demographics beyond the Blomidon Naturalists. The new Chain Lakes logo highlights the pine marten, a rare creature that needs old forests to survive, and has been spotted in the area. Please watch for the posts and share them broadly to reach folks who might not be affiliated with the BNS. A petition and post card campaign has been launched to show politicians that there is public support for the proposal. There is lots of room for volunteers to help get the message out. For example,

Quinn Woolven & Hudson Wilson pose as trees after emerging from the deep forest into a clearcut near Upper Gully Lake. The contrast with the old forest is stark. PHOTO: ALAN WARNER.

you can email Ministers Rushton (Natural Resources, mindnr@novascotia.ca) and Halman (Environment, minister.environment@novascotia.ca) to indicate your support.

We have identified three locales for area field trips, and one is a short, easy walk that most people can do on their own. Stay tuned for more information on these opportunities. There is also an iNaturalist group where people can post naturalist observations from the area. They are valuable as evidence for protection for the Nova Scotia government.

Another important aspect of the initiative has been connecting with Chris and Anna Hutchinson, who own Hutchinson Maple Syrup, a large, organic, commercial maple syrup business on leased public land, which borders on the protected area. They are very supportive of protection, and we support the expansion of their sugar bush on the edges of the protected area. Our aims are synonymous: to protect and restore old forests and the biodiversity within them. Although an organic, maple syrup operation is not allowed within a protected area, it is a sustainable use of land which provides a range of benefits for creatures and people. We are planning a field trip to learn about their sugarbush in June.

Our education work is only limited by our creativity and time. We hope you will support the efforts one way or another. There is nothing more important than restoring biodiversity while helping people to appreciate, understand and connect with local natural places. Protected areas do all these things.

Alan Warner is chair of the Protected Area Committee and editor of *Beyond the Tides*. Stay up to date on the Chain Lakes campaign through Facebook and Instagram,[3] the BNS website, the BNS e newsletter, and e mails.

Notes

[1] See the article by Alain Beliveau in the Spring 2023 issue (https://blomidonnaturalists.ca/beyond-the-tides) and videos of his two public talks on the area at blomidonnaturalists.ca/protect-the-chain-lakes-wilderness-area/

[2] See the article by Nina Newington in the Winter 2024 issue of Beyond the Tides. https://blomidonnaturalists.ca/beyond-the-tides/

[3] Facebook: www.facebook.com/groups/protectchainlakeswilderness; Instagram: (*will add addresses*), and the BNS website: blomidonnaturalists.ca/protect-the-chain-lakes-wilderness-area/

BLOMIDON NATURALISTS SOCIETY

2024 Membership Fees & Order Form

Members receive three issues of *Beyond the Tides* per year plus the monthly e-newsletter and the opportunity to participate in a range of nature programs and field trips. As a registered charity, BNS issues receipts for donations. The membership fee is not tax deductible. Annual membership fees are due Dec. 1. Visit **blomidonnaturalists.ca** to join, or use this form and send an e-transfer, or cheque or money order payable to Blomidon Naturalists Society at its address (see bottom right).

NAME: _____

ADDRESS: _____

_____

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NO.	DESCRIPTION	PRICE	TOTAL
_____	Individual/family annual membership	$30.00	$_____
_____	Student membership	$15.00	$_____
_____	Junior (under 16 years) membership	free	$_____
_____	2024 BNS Calendar	$15.00	$_____
_____	Natural History of Kings County	$10.00	$_____
_____	Within the View of Blomidon	$10.00	$_____
_____	Wildflowers of Nova Scotia	$20.00	$_____
	Postage: $4.00 (calendar), $6.00 (parcel)		$_____
	Tax-deductible donation (registration number: 118811686RR0001)		$_____
		TOTAL PAYMENT	$_____

Please send membership dues and purchases by e-transfer to **treasurer@blomidonnaturalists.ca**, or cut out this form and make out a cheque or money order payable to Blomidon Naturalists Society and mail to:

Blomidon Naturalists Society
P.O. Box 2350, Wolfville, NS B4P 2N5

Wambolt Falls: A Multi-Adventure Extravaganza

BY PETER WALLACE

Nictaux is a little-known area in the Valley, but offers one of the coolest adventures in the province. No high vistas, coastal shores, or natural spectacles; rather it is an intriguing human-built landscape. There is an amazing echo tunnel, a waterfall, and a great picnic and swim area, with lots to do in between. All ages will be amazed and amused. There are multiple access points depending on your group and your time frame. Make a day of it: visit the tunnel and falls in the morning, have lunch and a swim in the reservoir, and leave mid-afternoon. It makes for an unforgettable adventure.

A journey into darkness in the echo tunnel.

Directions

Start anywhere along the Middleton–New Germany rail trail if you are biking, but beware of the long climb out of Nictaux. The rail trail joins up with the reservoir at the end of the climb (see map). Alternatively, you can park where the Nictaux Canal crosses Highway 10 at Neily and Varner Mountain Roads. The parking area at the canal is small, but there is plenty of space on the two side roads within 200 m of the canal. From here, you can bike or hike along the flat trail that follows the canal for about 3 km to the reservoir. Alternatively, you can launch a kayak or canoe here and paddle the canal to the reservoir. Another option, the shortest route (800 m), is the NS Power entrance road and parking area, which is three kilometres further south on Highway 10, but do not park beyond or in front of the gate. From here, it's best to just walk to the reservoir. The best picnic and swimming area is one kilometre south from the dam along the rail trail, which follows the reservoir shore.

Trail Description

The bike trail up from Nictaux is a typical rail trail, but has been "repaired" using large round cobbles, so road bikes are not advisable. The trail that follows the canal from Neily Road is flat and easily biked or hiked. The canal has no barriers past this point to the reservoir, and the current is minimal, so paddling is easy. The NS Power road is an easy walk downhill to the reservoir from Highway 10, but it is rough in places.

The fun starts at the reservoir. You might begin by walking along the top of the dam to see how high it is above the original river valley and go along to the

The canal and accompanying trail (left) and the opening to the tunnel (right).

spillway to see how much water is going over it. To get to the echo tunnel, go down the gravel trail directly opposite the NS Power road where it crosses the canal road. You are going down the outside slope of the dam, and at the bottom it makes a tight J-curve to the left. From there you can see the tunnel entrance ahead. The tunnel is about two metres high and wide, and gently curves back into the darkness nearly 150 m—scary to those of such a mind. The echo from the start is amazing—hoot and whistle, stamp your feet. The returning echo seems louder than the original noise! The tunnel is quite dry and easily traveled, but you do need a light to see the end—not your cell phone, it's a large light -absorbing place. An unsubstantiated rumour is that the tunnel was built and used for the river flow while building the dam. Once the dam was finished, the tunnel was sealed on the up-stream end, allowing the reservoir to fill, but the down-stream end was left open in case it is needed in the future.

The falls is reached by a trail that starts where the canal and rail trail diverge. This is an old logging trail

Wambolt Falls

contouring around the hill. After less than fifty metres, the trail goes to the right, leaving the logging trail, and curves down the slope in a series of switchbacks to the river's edge. It is quite steep, and along the way a few well-placed trees can help you get down. The trail ends at the river's edge where you can see the falls. To get closer to the falls, you must travel the riverbed, which is full of very large moss-covered boulders, and you need to dodge puddles and running water. This is not recommended for children or wobbly adults.

The best picnic area is one kilometre south on the rail trail in a little clearing by the reservoir, with a few trees and a small beach. If you are going for a swim, beware of hazards, especially broken glass.

This is a disturbed area with burdock, wild lettuce, mullein, knap weed, hawkweed, and brambles in the open areas. Most trees are spruce and fir, no more than 50 years old, with even younger groupings of hardwood saplings. On a recent trip we observed a little brown bat at the end of the echo tunnel. If you spot one, take care not to disturb it, and report your sighting. We've also seen garter snakes sunning themselves on the rocky beach and frogs in the water.

This area provides a great adventure, is kid-friendly, and shows that human constructed landscapes can be as enjoyable as natural ones. Please tread lightly, take only photos and recordings, and carry out your waste.

Peter Wallace is a retired geologist and leads a weekly hiking group of retirees to areas of natural beauty and interest in the region. Peter contributed the photos and map specifications.

What's Happening with the Birds?

Here are the 2022 and 2023 West Hants Christmas Bird Counts. Similar numbers of species each year, lots more black ducks, herring gulls and starlings in 2023.

BY PATRICK KELLY

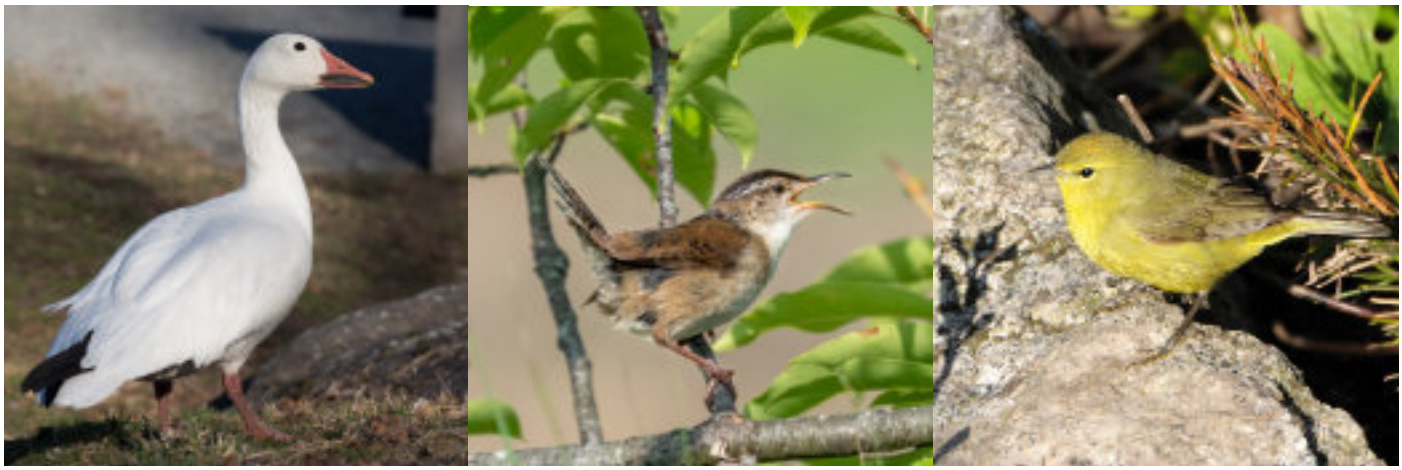
Something different for this count: I am reporting on two years at once to show the variations that often occur from one year to the next. The last two West Hants counts are very interesting.

The 2022 count was held on Tuesday, January 3, 2023, while the 2023 count was held on Saturday, December 30. In 2022, temperatures ranged between –1 C and 5 C, with a mix of sun and cloud; in 2023, the temperature was 1 C and overcast. Given how variable the weather can be here at that time of the year, these two days were remark similar!

The data from the last two counts are in the table. The total number of species we saw is not that different, but many species showed up in just one of the two years, often in very small numbers. This is part of what makes bird counts so much fun: You never know what you are going to find. Even more exciting is that in the last two years, five species (snow goose, Cooper's hawk, marsh wren, orange-crowned warbler, and yellow-breasted chat) have been seen on this count for the first time—and the count started back in 1987! The one oddball is the Bohemian waxwing. These birds form large flocks and move around a lot in the winter. You tend to have lots, or very few.

The next obvious difference is the total number of individual birds we saw in 2023 almost doubled to just under 21,000. A new record! This is mainly due to three species: American black duck, herring gull, and European starling. Thousands of herring gulls and starlings literally carpeted large areas of ground at the working face of the West Hants landfill on the Walton Woods Road, along with many bald eagles, crows, and ravens. I do wonder if there are that many there on a Sunday when no new "food" is delivered.

We set all-time, record highs for number of birds counted for 15 species in 2022 or 2023! The species name and record number are italicised in the count table on the next page. As well, we tied the old record highs for several species. Interestingly, the starling numbers, though highest of any species, were still over 1,000 short of the record!



New birds seen in the recent West Hants Bird Counts... the snow goose, marsh wren, orange-crowned warbler, and cooper's hawk (above). PHOTO: WIKIMEDIA.ORG[2]

Birds Counts by Species for 2022 & 2023

	2022	2023
Waterfowl		
Snow Goose	–	1
Canada Goose	1,114	*2,449*
Gadwall	–	1
Eurasian Wigeon	2	1
American Wigeon	37	9
American Black Duck	1,414	*2,796*
Mallard	307	404
Northern Shoveler	–	9
Northern Pintail	16	*45*
Green-winged Teal	10	1
Ring-necked Duck	–	2
Greater Scaup	*2*	–
Lesser Scaup	–	*3*
Bufflehead	1	–
Common Goldeneye	–	2
Hooded Merganser	1	*4*
Common Merganser	1	–
Game Birds		
Ring-necked Pheasant	81	53
Ruffed Grouse	7	–
Raptors and Owls		
Bald Eagle	*63*	54
Northern Harrier	3	4
Sharp-shinned Hawk	3	1
Cooper's Hawk	–	3
Red-tailed Hawk	28	34
Merlin	2	–
Barred Owl	2	–
Gulls		
Ring-billed Gull	22	8
Herring Gull	270	*3,486*
Iceland Gull	1	*6*
Great Black-backed Gull	74	105
Doves		
Rock Pigeon	285	172
Mourning Dove	383	719
Woodpeckers		
Red-bellied Woodpecker	1	–
Downy Woodpecker	24	26
Hairy Woodpecker	18	32
Northern Flicker	19	12
Pileated Woodpecker	7	12
Corvids		
Canada Jay	–	1
Blue Jay	436	*686*
American Crow	372	557
Common Raven	106	76

	2022	2023
Waxwings		
Bohemian Waxwing	1,307	1
Cedar Waxwing	32	–
Warblers		
Orange-crowned Warbler	1	–
Common Yellowthroat	–	1
Yellow-breasted Chat	1	–
Sparrows (incl. Old World)		
American Tree Sparrow	41	31
Chipping Sparrow	–	1
Savannah Sparrow	1	–
Song Sparrow	84	119
Swamp Sparrow	7	*8*
White-throated Sparrow	23	*106*
Dark-eyed Junco	119	201
House Sparrow	33	47
Blackbirds		
Red-winged Blackbird	2	46
Finches		
Pine Grosbeak	22	–
Purple Finch	82	9
White-winged Crossbill	–	1
Common Redpoll	1	
American Goldfinch	588	435
Evening Grosbeak	127	106
Nuthatches		
Red-breasted Nuthatch	8	12
White-breasted Nuthatch	32	*38*
Kinglets		
Golden-crowned Kinglet	27	82
Ruby-crowned Kinglet	–	1
Miscellaneous		
Belted Kingfisher	1	–
Eastern Phoebe	–	1
Horned Lark	6	–
Black-capped Chickadee	399	432
Brown Creeper	2	6
Marsh Wren	–	1
American Robin	182	70
Grey Catbird	–	1
Northern Mockingbird	–	1
European Starling	2,981	7,119
American Pipit	–	1
Lapland Longspur	–	1
Snow Bunting	111	52
Northern Cardinal	46	*99*

Of course, there needs to be a way to compare the amount of effort that goes into looking for birds. That is why party-hours and distance travelled are recorded by each group. A party-hour is when one group spends one hour birding together. Similarly, the distance that people cover, and their methods are tracked. While one does need to drive to cover the assigned area, a lot of the scarcer (and smaller) birds are usually found on foot while "whacking in the weeds." This seems part of the reason the species numbers for the last three years have been high compared to the recent past. The number of hours spent walking are actually higher than the number of hours spent in cars.

Birds are also counted at feeders. In this case, one counts the maximum number of each species seen at the same time. The reason for this is to treat all species the same. If you see a male cardinal, and later see a female cardinal, you know they are two different birds, but you would only count that as one! Now imagine you see one blue jay. If you later see another blue jay, you can't tell if it is a different sex than the first one you saw. Thus, you treat the cardinals the same way as the blue jays. You also keep track of how much time you spend watching your feeding area.

Bird Count Totals

	2022	2023
Species Seen	61	63
Total Birds*	11,380	20,844
Party-hours (car)	27:39	25:15
Party-hours (foot)	34:49	32:20
Party-hours (total)	63:28	57:35
Party-km (car)	400.7	320.4
Party-km (foot)	68.2	59.2
Party-km (total)	468.9	379.6
Feeder Watching	4:00	3:25

Lastly, there are "count week" birds. While not counted in the totals for the count, any species seen three days on either side of the count date can be reported. This is a lot easier to track if you subscribe to the eBird rare bird alerts for your area. In 2022, there were no count week birds. In 2023, there were four: great horned owl, Barrow's goldeneye, fox sparrow, and Lincoln's sparrow. With a bit of luck, the species count for 2023 could have been even higher.

Guess who were most common? PHOTO: WIKIMEDIA.ORG.[2]

Thank you to everyone who participated in these counts.[1] The count would not be possible without your efforts. On a sad note, since the 2021 count, two couples have retired (George and Margaret Alliston; Susan and Andrew Harvie), and three long-time participants have died: Jim Wolford, John Robertson and Tony Duke. They are all greatly missed. Jim would be well known to many BNS members as a long-standing field trip leader. He always covered the town of Windsor, a lot of it on foot, and visited the Windsor sewage lagoons several times, as rare gulls, ducks, and shorebirds often turn up there. What Jim was to Windsor, John Robertson was to Hantsport, again, doing most of it on foot.

Who knows what the 2024 count will bring?

Patrick Kelly is the compiler for the West Hants Bird Count.

Notes

[1] Thank you to all helped in the field or as feeder watchers: George Alliston, Margaret Alliston, John Belbin, Charlene Bishop, Sherman Boates, Sarah Boudreau, Lyall Bouchard, Robert Burns, Timothy Burns, Louis Coutinho, Joanne Cook, Sandy Cook, Tony Duke, Jocelyn Durstan, Alison Fortune, Larry Hughes, Arianne Janes, Patrick Kelly, Peggy Kochanoff, Logan Lalonde, Virginia Mackenzie, Kevin Moore, Richard McKay, Barry Sabean, Janet Sabean, Elizabeth Stern, Richard Stern, Guy Stevens, Phil Taylor, and Jake Walker.

[2] The individual photos can be found on wikimedia.org with a search for the bird. The photographers are: snow goose & marsh wren—Rhododendrites; orange-crowned warbler—Greg7 on Flickr; Coopers hawk—Cephas; European starling—Frank Shulenburg.

Fall/Winter Weather 2023 - 2024

BY LARRY BOGAN

Warm and wet is a good phrase to describe this past fall and winter seasons. Overall the weather was 2.2° C warmer than normal, and wetter by 21%. Although solar data is no longer collected, I would guess it was cloudier than usual.

Temperatures: For comparison, the mean daily temperatures for the fall-winter for Kentville have been plotted below along with the historic mean daily temperatures (solid line). If you guessed that almost every month had above average temperatures, you would be correct. Only November was below normal, and by -1.7° C. March was the champion month by being 4° C warmer than average. Note that only two days of that month were below normal in mean temperature. December was the runner-up for high temperatures at 3.4° C above average, mainly because of a really warm series of days in the middle of the month. Two days hit 12° C and 15° C above normal. The coldest period occurred at the end of February, which is why the snow persisted through the month.

Precipitation: September and March provided the greatest rainfall with 180 and 210 mm respectively. This represented 53% of the total rainfall for the seven month period. All of the other months had relatively normal rainfall except November, which only had 61% of its expected precipitation. Interestingly, there were eight days of the season with over 25 mm of rain; they contributed 355 mm, or 40% of the total.

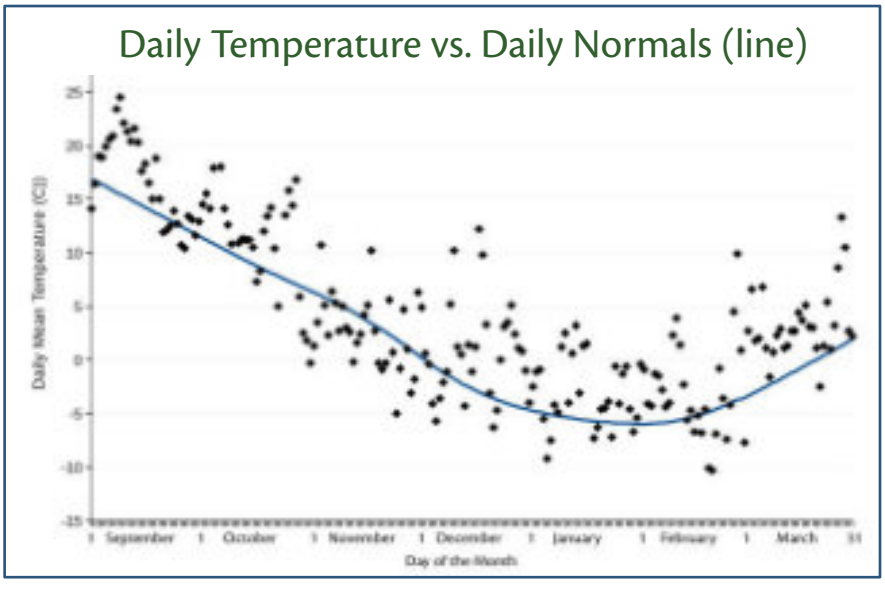
We were shy of snow this year, with none until we received 10 cm in early December that did not stay. There was only a few centimetres in January. February had most of the snow for the longest period, reaching a maximum depth of 28 cm, which was great for snowshoeing and skiing until the rain ruined it. When that snow melted in March, it combined with the sizeable rainfall to cause significant flooding of rivers and streams.

Monthly Temperature & Precipitation
Kentville, N. S.

	Max °C Temp	*Min °C Temp*	*Mean °C Temp*	*Precip. mm*
September	*21.8*	*12*	*16.9*	*180.7*
30 year avg.	19.5	9.5	14.5	84.4
October	*16.1*	*7.2*	*11.7*	*119.4*
30 year avg.	13.7	4.9	9.4	89
November	*6.5*	*-1.6*	*2.4*	*74.6*
30 year avg.	7.8	0.3	4.1	121.5
December	*4.8*	*-2.6*	*1.1*	*116.3*
30 year avg.	1.5	-6.1	-2.3	122
January	*0.5*	*-6.8*	*-3.1*	*106.8*
30 year avg.	-1.3	-9.8	-5.6	116.1
February	*1.4*	*-7*	*-2.8*	*90.4*
30 year avg.	-0.5	-9.2	-4.9	101.3
March	*6.8*	*-0.9*	*3*	*210.5*
30 year avg.	3.4	-5.3	-1	109.8
Fall-Winter	*8.3*	*0.1*	*4.2*	*898.7*
30 year avg.	6.3	-2.2	2.0	744.1

Overall, the trends this past fall and winter are in line with the predicted climate changes for our region as the planet warms. Spring may be early this year.

Larry Bogan is a long term member and contributor to the Blomidon Naturalists.



Sticks and Stones: Facilitating Risky Play

Risk-taking is a critical part of children's development; here are a few tips and tricks for facilitating and engaging in risky play.

BY DELLA ALDERSON & JUDY LIPP

You're starting out on a nice family hike—how lovely it is to be back outside with the kids in the crisp spring air! With no need to bundle everyone up, you're more relaxed than usual. That is, you were relaxed, until one of the kids hops too close to a cold stream with their sneakers on, and promptly begins to howl! So... what do you do?

Risk-taking is a critical part of children's development, which until recently, has not received the necessary recognition. While childhood once conjured up images of cycling with reckless abandon, climbing trees, and wild neighbourhood street games, childhood today increasingly happens in front of a screen. According to the Children & Nature Network, kids today spend an average of 44 hours per week in front of a screen, and less than 10 minutes a day playing outdoors: a very sedentary, risk-free lifestyle, at least in the short term.[1] A recent CBC article noted that risky play can improve "self-confidence, resilience, executive functioning abilities... risk-management skills, and... reduce the risk of injury, too."[2]

Many of us have been raised in extremely risk adverse environments, and this shows up in how we care for children. A typical reaction of a risk-averse parent to the child in the stream is to begin chastising and lecturing. Our fears of risk are acquired through our own experiences, and are passed on to others if left unchecked. One way to address this risk aversion is by being deliberate about offering risky play opportunities for children and questioning our own discomforts. What's the big deal with wet feet in springtime?

We believe it is important to provide opportunities for free, unstructured play in an environment that encourages and includes risk-taking. Flying Squirrel Adventures provides regular risky play opportunities for kids in our programs, including during our recent March Break camps. We spend much of our time outdoors, with conditions ranging from warm and sunny, to cold and snowy, to drizzly, perhaps all on the same day! During our March break camp at Hennigar's Farm, we explored a beautiful ravine trail along an alluring, babbling brook. Kids tested the waters, both literally and metaphorically, as they used sticks to measure depth, build rock bridges, and balance and splash about. Wet boots and snowsuits followed, but they adapted and learned to build more bridges to keep their feet (relatively) dry, and asked for help

Getting high on nature at March Break Camp. PHOTO: FSA.

when needed. The kids took risks and learned through natural consequences.

Climbing and balancing is another area where children are determined to explore their personal comforts and physical limits. If we squash this natural tendency, we reduce the opportunities for them to develop fine motor skills and hand-eye coordination, build confidence, overcome fears, and problem-solve. So, we embrace these moments and engage the children in dialogue about potential risks, personal comfort, and group safety. This approach expands the children's perspectives, builds trust, and encourages kids to think for themselves. These are all traits that will serve them well as they grow older.

Depending on parents' and caregivers' exposure to healthy risk in their own lives, offering these opportunities to young people can feel challenging, but this is a learning edge we need to embrace. As self-proclaimed risky play advocates, here are a few tips and tricks for facilitating and engaging in risky play:

• Understand the difference between a hazard and a risk. A risk is walking across a slippery log over a gentle stream, which requires learning to balance. A hazard, by contrast, would be traversing that same log over a rushing river where falling could lead to serious injury or drowning.

Challenge your own assumptions and behaviours. Consider why you are reacting or proactively shutting down risky behaviour.

• Offer alternatives to reduce potentially dangerous behaviour. Judge the risk according to your perceived abilities of the kids. Suggest other challenges that would be more appropriate if an area or activity presents too many hazards to manage. An example might be to avoid a water source that could swamp the kid's boots if the temperature is below freezing, and instead find puddles for jumping or ice for sliding.

• Use language that supports good decision-making. Our language can have a tremendous impact on kids' experiences and perceptions. For example, instead of saying, "Put down that stick," how about trying, "How

Taking risks builds a range of skills. PHOTO: FSA.

are you going to handle that stick so that it doesn't accidentally hurt someone?" Or, if a child is determined to take a big risk, rather than shutting down the activity, you can ask, "What is your plan for getting down once you've climbed up?" A relationship is key in these conversations—a child needs to believe you truly have their best interest at heart, and that you're not just trying to control their behaviour.

• Challenge your own assumptions and behaviours. Consider why you are reacting, or proactively shutting down risky behaviour. Consider whether your aversion is due to a real hazard, such as extremely slippery conditions leading to falls and injuries, or just a perceived risk like their clothing or hands might get dirty. What impact could your attitudes have on kids?

During the muddiest of seasons, we encourage you to embrace the beauty and challenges of the natural world. Perhaps join your littles in some risky play—a little stick-fighting or stream-hopping anyone?

Della Alderson did a placement with Flying Squirrel Adventures (FSA) while wrapping up her Bachelor of Community Development at Acadia. Judy Lipp is the FSA Program Director. Both love facilitating nature play programs for children and are mastering the art of embracing risky play.

Notes

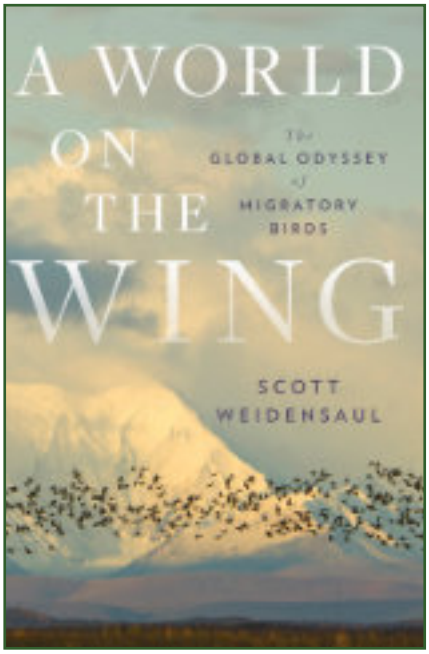
[1] https://www.childrenandnature.org/#

[2] Toole, B. (2024). *Risky play for children: Why we should let kids go outside and then get out of the way*. CBC news. https://www.cbc.ca/natureofthings/features/risky-play-for-children-why-we-should-let-kids-go-outside-and-then-get-out#

A World on the Wing:

The Global Odyssey of Migratory Birds

REVIEW BY JOHN BURKA



Migration has long intrigued me: snow geese crossing the St. Lawrence River via a narrow corridor at Ste. Anne-de-Beaupre, Quebec; thousands of trumpeter swans darkening the sky as they approach Beaver Hills Lake, Alberta. Scott Weidensaul has written an outstanding book describing many examples of migratory patterns. Some cover many thousands of kilometres; others rise through rarified air to cross mountain ranges.

Weidensaul describes how ornithologists around the world discern the migratory patterns, using new technologies in addition to conventional banding. The Motus Wildlife Tracking System, developed by Birds Canada in 2012, is now integral to bird tracking everywhere. It uses tiny radio transmitters called nanotags and automated receivers. Combined with conventional banding, Motus provides massive amounts of data and shows that specific subpopulations of bird species use distinct migratory routes.

I particularly enjoyed reading about the migrations connected to the Bay of Fundy. Of course, there is reference to our familiar semipalmated sandpipers that rely on feeding in the Minas Basin mudflats before flying 4,000 km to South America. However, I didn't realize that birds from both the western Arctic and northern Europe also migrate through this region. For example, whimbrels, which nest in the Mackenzie Basin in the Northwest Territories, migrate over Nova Scotia and across the western Atlantic to winter in the Lesser Antilles and South America. Who knew?

Weidensaul describes destructive human interventions and climate changes that are impacting bird migration and threatening biodiversity, while also noting restoration efforts. For example, industry near Shanghai was destroying major mudflats and wetlands in the Yellow Sea. Birds that nest in the Siberian and Alaskan Arctic stop there to feed on crustaceans on their flight to Australia and New Zealand. Populations of these birds were declining due to habitat loss, but conservationists were able to convince the Chinese government to protect the feeding grounds. Hopefully, recovery will follow.

It bothered me to read that deliberate human interference still includes trapping and hunting songbirds throughout Asia, the Mediterranean, and even northern Europe. Authorities in Cyprus tried to curtail it by tying a ban on hunting songbirds to membership in the European Union. Unfortunately, poaching is still rampant there and elsewhere. Weidensaul takes us to Nagaland in the Himalayas where migratory birds, particularly Amur falcons, are trapped and hunted for badly needed cash. Populations have suffered devastating losses. Finally, the Government of India, in collaboration with naturalist groups, banned the killing of these falcons, and developed a tourism industry around watching the migrations. This innovative conservation tactic provided a new source of local income.

Despite the barriers humans put in the way of the birds, migrations continue. Weidensaul expresses reverence for the birds. I concur. A greater appreciation and understanding of bird behaviour can only help us protect the birds, as well as biodiversity. This book was full of interesting information and I highly recommend it.

John is a retired professor of pharmacology with a passion for nature.

The End of Eden:

Wild Nature in the Age of Climate Breakdown

REVIEW BY WAYNE WOODMAN

This book provides an eye-opening exploration of climate change from the perspective of wild species and natural ecosystems—a homage to the miraculous, vibrant entity that is life on Earth. *The End of Eden* depressed and invigorated me, and is an extremely well written and deeply researched exploration of wild species reacting to climate breakdown, a term the author prefers over climate change. He explains that "change" implies reversibility, and something we can "fix." "Climate breakdown" helps us better understand that climate is a definable pattern that is breaking apart and not easily reassembled.

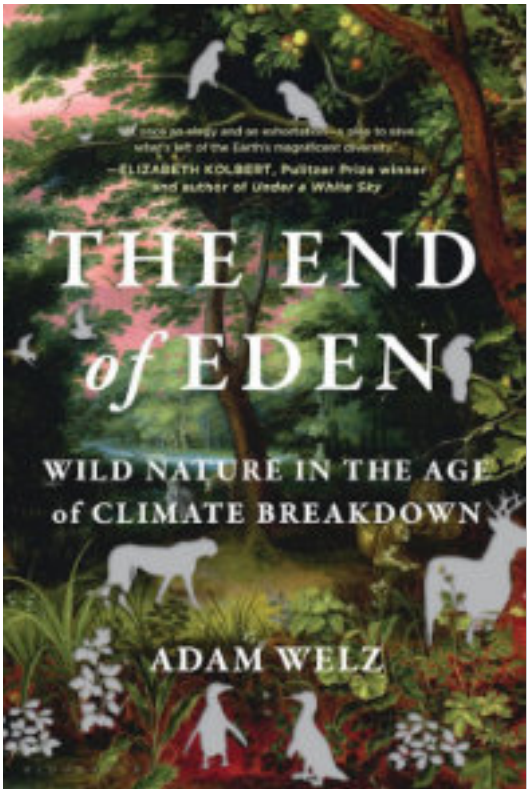
The reader is able to roam the globe with the author and observe the changes to a myriad of wild species and natural ecosystems. Combining natural history, firsthand reporting, and insights from cutting-edge research, Adam Welz introduces us to diverse creatures as they struggle to survive, including moose in northern Maine, parrots in Puerto Rico, cheetahs in Namibia, and rare fish in Australia. The stories are intimate, yet expansive, and always dramatic.

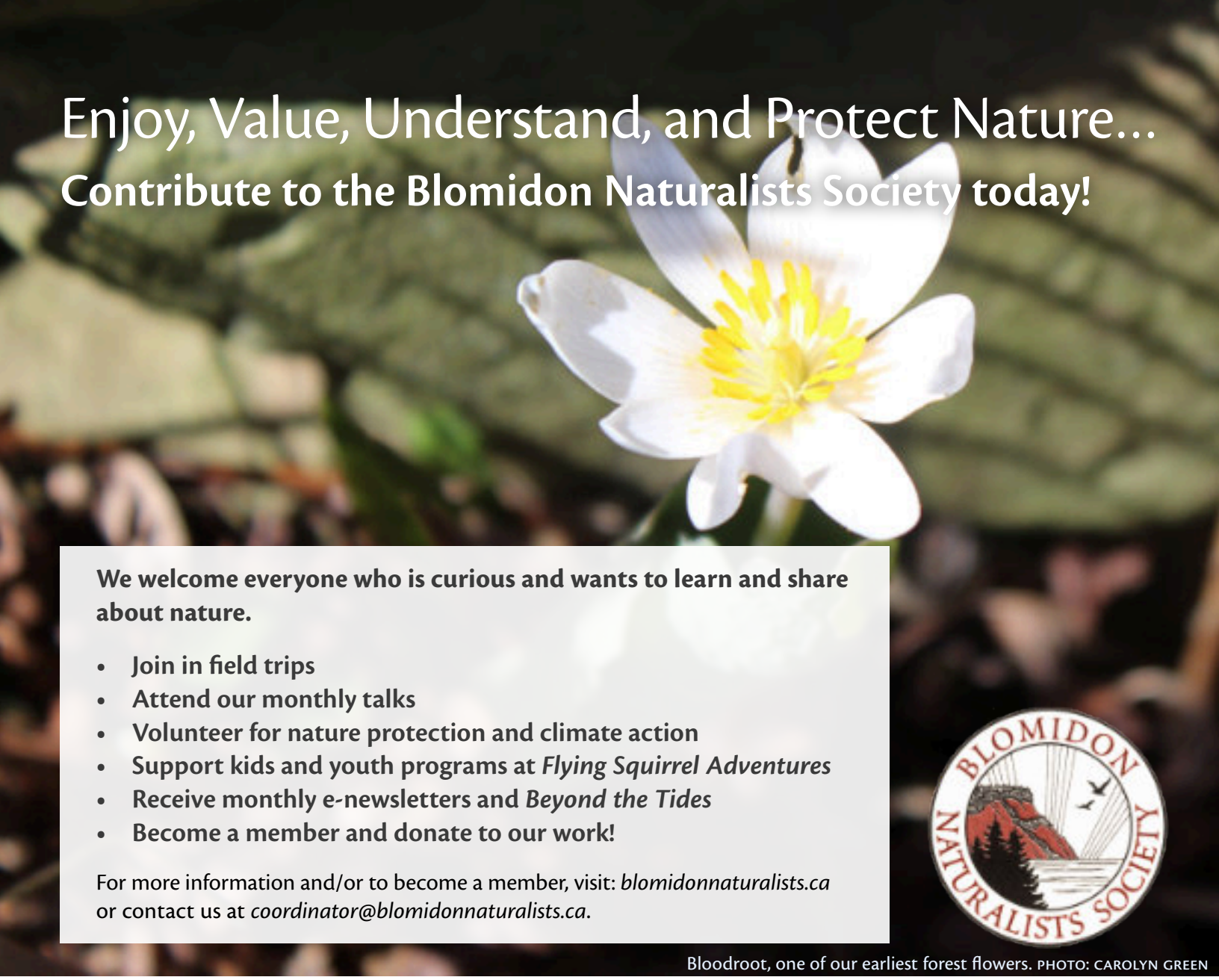
I contend that many of us know about climate change in an abstract, high-level way. What was so interesting (and sad) about this book was how the author illuminates the specific details and the small changes. He demonstrates how a change in one part of the world has a knock-on effect on species in an entirely different part of the planet. For example, the warming of the southeastern United States enabled the pine beetle to advance northward and decimate the otherwise untouched forests of Maine and eastern Canada. No one is shielded from climate change, because everything is connected. A bird species that you particularly love in your garden might quietly dwindle and disappear. You won't know why, and your life will be poorer for it.

I have long maintained that Nature will adapt and renew itself in spite of the ravages we have inflicted on this tiny planet. The author demonstrates the resilience of natural systems as they change in unexpected ways to meet new realities. Watch a vacant lot in the midst of a city transform itself in one short summer! Or view David Attenborough's documentaries where he returns to the devastated city of Chernobyl 30 years later to see what nature has done to rehabilitate the area.

I believe our intelligence has been outstripped by our greed, and that will be the catalyst for our demise here in our Eden. But there is always hope when authors like Adam Welz shine a light on our follies.

Wayne Woodman grew up in a small outport in Newfoundland where he developed his love of the outdoors and a career in hunting and fishing tourism. He is now happily retired in Wolfville and a member of the Blomidon Naturalists.





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Bloodroot, one of our earliest forest flowers. PHOTO: CAROLYN GREEN

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