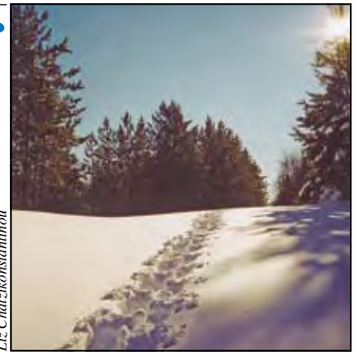
proteins that serve to control and confine the formation of ice crystals to the spaces outside their body cells and they accordingly lose their ability to withstand freezing. But by then, of course, it doesn't matter. For the rest of their lives they will hibernate in the water below the ice — at balmy, above freezing temperatures of, say 35° to 40°F (2° to 5°C). Under those conditions they don't have to worry about freezing to death and, as we have already seen, all they will have to do is hold their breaths and go without oxygen for six months!

By now we think you will agree with us that words like simple and unsophisticated are a little misplaced when it comes to describing hibernation. Certainly for the Painted Turtles we see these days soaking up the last September sunshine along the Mizzy Lake Trail and a thousand other places in Algonquin, they will soon be doing a lot more than merely settling in for a long winter snooze.

Wouldn't it be fairer to say that they are about to settle in for a long winter miracle?

Going for a hike?

Your safety is ultimately YOUR responsibility. Be prepared!



Liz Chatzikonstantinou

- **Know your limitations!** Check the length, difficulty, and time required to walk the trail before you start out.
- **Allow enough time** to be off trails and back at your vehicle before dusk. In winter, do not start out on any trail after 3 p.m.
- Wear **footwear and clothing** appropriate for the trail and weather conditions.
- **Do not rely on your cell phone.** Service may be "limited" to "none."
- **Overnight parking** at interpretive walking trail parking lots is **prohibited.**
- **Use *caution* when walking trails.** You could encounter wet areas, downed branches/trees, snow, and icy conditions. Regular maintenance on all interpretive trails begins in May and continues to the end of October. Blue markers identify trail routes.
- **Guide booklets are removed** from trailhead dispensers from late October to early May. Booklets are available year-round during business hours at the East and West Gates and the Visitor Centre, or online.
- Carry a well-equipped **Emergency Kit** when travelling away from your vehicle.

Looking for Internet access?

The Visitor Centre now offers free WiFi internet access… and while there, don't forget to check out The Friends of Algonquin Park bookstore, or enjoy a light snack or meal at the Sunday Creek Café. *Check Algonquin's Information Guide (tabloid) for the Visitor Centre winter operating schedule.*

Finding Algonquin Specialties

Many birdwatchers are interested in finding the four northern Algonquin specialities — Black-backed Woodpecker, Boreal Chickadee, Gray Jay, and Spruce Grouse — during their winter visit. One tip is to drop in at the Algonquin Visitor Centre on weekends to review recent sightings of these species (and, of course, check the feeders!).

Here are some specific tips and locations from the *Checklist and Seasonal Status of the Birds of Algonquin Provincial Park* to assist you:

- **Black-backed Woodpecker:** Watch for dead spruce trees with freshly debarked trunks where this woodpecker has knocked off flakes of bark in search of wood-boring beetles underneath.

Locations: Western Uplands Backpacking Trail entrance, utility poles along Hwy 60 near Km 8, Wolf Howl Pond and West Rose Lake on Mizzy Lake Trail, Bat Lake Trail, out on the point in Mew Lake Campground, and Opeongo Road.

- **Boreal Chickadee:** The most productive way to locate this chickadee is by listening for its nasal vocalizations in bog and mature spruce habitat. They often accompany Black-capped Chickadees in mixed species foraging flocks during winter, but rarely visit feeders.

Locations: Western Uplands Backpacking Trail entrance, Wolf Howl Pond and West Rose Lake on Mizzy Lake Trail, Bat Lake Trail, Spruce Bog Boardwalk, and areas of Black Spruce along the upper part of Opeongo Road.

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- **Gray Jay:** In the Highway 60 Corridor, these birds are attracted to people since they get fed regularly. Most Gray Jays along the Corridor are colour-banded as part of a long-term research project and may come to hand for food.

Locations: Mew Lake Campground, Spruce Bog Boardwalk, Opeongo Road, Algonquin Logging Museum, and the Algonquin Visitor Centre.

- **Spruce Grouse:** Watch for grouse getting grit on roads or trails, especially early in the morning, and systematically search the coniferous and treed bog habitat by walking slowly and stopping frequently, which may cause the grouse to move when they sense detection.

Locations: Wolf Howl Pond and West Rose Lake on Mizzy Lake Trail, Spruce Bog Boardwalk, and Opeongo Road.

For more information on Algonquin in winter, pick up a copy of our leaflet, available at the East and West Gates, and the Visitor Centre.

The Raven is available online [www.algonquinpark.on.ca] and a limited number of complete sets of the previous year's Raven are available at the Visitor Centre and the main gates along Highway 60.

A Natural and Cultural History Digest
Algonquin Provincial Park

The Raven

ONTARIO PARKS

Vol. 51, No. 6 **November 1, 2010**

Winter Issue

Why the new look?

Peter Mills

How do Painted Turtles survive the Algonquin winter? See page 2.

You have probably noticed that *The Raven*, the official newsletter for Algonquin Provincial Park, looks different this year. Why the new look?

2010 represents a new era for *The Raven*. For the first 50 years, *The Raven* had only two authors…Russ Rutter from 1960 to 1973 and Dan Strickland from 1974 to 2009. When Dan announced recently that he was going to end his run as the author, the Park thought that we should also retire *The Raven*…but we heard from you and you wanted us to keep the newsletter.

After much deliberation, we decided *The Raven* would continue, but with some changes. The new principal author will be Michael Runtz, a well-known Ontario naturalist, photographer and writer — with a strong connection to Algonquin Park. But we will also introduce guest writers and continue to reprint some of the old *Raven* articles.

The Raven will now have six issues a year (two in the spring, two in the summer, one in the fall, and one in the winter). *The Raven* was weekly in the summer but that format goes back 50 years when the newsletter was the only Park publication and represented the Park Information Guide, *This Week in Algonquin,* as well as the natural history essay. This new schedule will allow us to update our visitors with timely seasonal information and safety messages.

We hope you enjoy the new version of *The Raven* and welcome your comments. We know it is not the same but we hope that, after 50 years, you will allow us some flexibility to change!

The Park thanks The Friends of Algonquin Park for its generous contribution to the production, printing and distribution of The Raven for the past 12 years.
THANKS! Friends, for your support.

Settling in for a Cosy Winter Snooze?

by Dan Strickland

Originally printed in The Raven, *Vol. 36, No. 12, September 7, 1995.*

Now that Labour Day is behind us and another busy Algonquin camping season is winding down, we don't have to look far to see signs of bigger changes to come. The nights are nippy and many maples have already started to turn colour. Chipmunks scurry through dead leaves on the forest floor, laying in their winter larders, and basking turtles are soaking up the sun's last bit of warmth around a thousand beaver ponds.

It is obvious that the plants and animals of Algonquin Park must prepare for the winter that lies ahead and everyone knows that there aren't a lot of choices. Some creatures escape altogether by migrating south to warmer climates, some grow thicker coats and fatten up, and still others retreat to some sheltered hiding place to hibernate through the bitter Algonquin winter.

Of these limited possibilities, the last is the one that usually appeals to us the most. We all have the simple and unsophisticated, albeit very pleasing, picture of curling up in a nice warm den somewhere for a long and cosy winter snooze. And yet, as attractive as this image may be, it really misses the mark. Overwintering animals may indeed do some serious snoozing but, if we knew even half the truth about hibernation, we would find words other than simple or cosy to describe it.

One of the best examples of what we mean is given by our common Painted Turtles, the ones we see basking in the sun these days out on logs in places such as Wolf Howl Pond on the Mizzy Lake Trail or along the Madawaska River on the Track and Tower Trail. Soon, when the weather gets really cold, these turtles will disappear from view down to the bottom of their local water body. There, they will hibernate through to next spring, under the ice.

Now, we suspect that most people take this fact more or less for granted, having learned it in childhood. We seldom stop to reflect, however, just what an extraordinary thing it is. After all, here is an air-breathing animal, like us, that one day just goes down to the bottom of its pond and doesn't take another breath for the next six months! To be sure, hibernating Painted Turtles may be capable of absorbing some oxygen from the surrounding water through their skin. Some frogs can definitely do this and there is some evidence that Painted Turtles can hold out longer and with less stress when they are immersed in oxygen-rich water. Still, the fact remains that Painted Turtles often hibernate right down in the bottom mud where there is no oxygen at all. Also, even when they spend the winter resting actually on (rather than under) the bottom surface, the oxygen under the ice in many ponds often runs out before the end of winter. And, lest there be any remaining doubt on the subject, Painted Turtles in the laboratory have been proven capable of surviving for as long as 150 days while continually submerged in water that contained no dissolved oxygen at all.

Such an amazing feat is obviously far beyond what we can reasonably call "simple" and seriously challenges our ability to explain it. True, we did omit the important detail that the Painted Turtles which survived the five months without oxygen did so in water that was only 37°F (3°C). This provides at least a partial answer because turtles are "cold-blooded," meaning that their body processes are slower at colder temperatures and that they therefore have less need for oxygen under those conditions. But there is much more to the ability of hibernating Painted Turtles to get along without oxygen than that. In addition, submerged turtles can somehow slow down their metabolic processes even further, perhaps with special hormones, down to a mere 10 per cent of what their rate would be in an animal at the same temperature but with access to air.

Peter Mills

And even this isn't the whole story. Perhaps the most important thing of all is that Painted Turtles store food energy, not in the form of fat the way we mammals do, but as carbohydrates called "glycogen." Glycogen can be broken down (thus liberating energy for use by the turtle elsewhere) without consuming oxygen, in a process known as "glycolysis."

This is the same process that occurs in human muscle cells when we are running fast or otherwise using up energy more quickly than we can bring oxygen to those cells. In both humans and turtles the process results in a build-up of lactic acid, a substance that is poisonous to animal cells. With us, a lactic acid build-up causes extreme pain in our muscles and forces us to stop and pant so as to bring in more oxygen that will clear out the accumulated acid. Hibernating turtles have a much more elegant way around the same problem. They use calcium and magnesium to neutralize their acid build-ups. And where might they get the life-saving calcium and magnesium? You guessed it — from their shells! In other words, a Painted Turtle can hibernate for months without oxygen in part because it carries not just its house, but also its pharmacy, around on its back.

As impressive as the hibernating abilities of adult Painted Turtles may be, however, they are almost nothing compared to those of their babies. Female Painted Turtles lay their eggs in June, after first excavating suitable chambers in gravelly soil (often on south-facing slopes). When all the eggs (normally 5 to 8) have been deposited, the females cover over the chamber and leave, letting the sun's warmth incubate the eggs over the Algonquin summer. They usually hatch right about now, in September, but then something peculiar happens. Rather than digging their way out and joining older turtles in the nearby water, the hatchling Painted Turtles just stay put. Though hatched, they spend all winter underground and emerge only the following spring. Such behaviour has a few advantages (particularly that of lessening their exposure to predators) but having a nice warm place to spend the winter is not one of them. Two nests whose temperatures were measured one winter here in the Park, for example, ranged between 18° and 28°F (-10° and -2°C) through January and February — in spite of all the insulation provided by the ground itself and a thick layer of snow. All thirteen of the baby turtles in these two nests nevertheless survived, even though it was hard to see how they could have avoided freezing solid.

Later experiments were carried out in a lab to see what really might have happened to the baby turtles. When hatchlings were put in a special incubator and the temperature slowly lowered, they went well past the supposed freezing point of turtle blood (31°F or -0.5°C). It was beginning to look as if living Painted Turtle hatchlings might have some non-understood ability to defy the normal laws of physics. But then, when their temperatures reached 26.5°F (-4°C) they suddenly froze. Ice quickly formed on their outer skin and over the next several hours the ice grew inwards, first cutting off blood circulation to the surface areas of the turtle and eventually shutting it down completely. The hatchlings ended up to all appearances frozen solid, with no muscle movement, no heartbeat, no blood flow, no breathing, and only the barest remnant of brain activity. And yet, incredible as it may seem, when the baby turtles were thawed out a day later, they all "came back to life" as if nothing had happened.

This was a truly astonishing result because, as any gardener knows (not to mention anyone who has ever lost a toe or finger to frostbite), the freezing of living tissue is normally a devastating experience. What does the real damage is the formation of ice crystals inside cells. The little slivers of ice pierce delicate membranes, and irreparably disrupt the finely-tuned structures and organization essential for a cell to function and live. How then, can hibernating hatchling Painted Turtles freeze solid and then, even weeks later, almost literally "rise from the dead"?

It turns out that baby Painted Turtles have two very special mechanisms that save them from what would otherwise be certain (and very painful) death. As its body temperature drops, a hatchling's liver starts to manufacture special proteins that are then distributed to all the bodily fluids that lie outside cells. These fluids include blood plasma, abdominal fluid and urine. When the turtle's body temperature reaches the freezing point of these fluids, the special proteins, by now all in place, actually serve as starting points for the formation of ice crystals. This sounds disastrous but what is happening is that the crystals are all forming in a controlled manner outside the turtle's cells. In particular they form in such a way that each one of them remains very small (rather than growing into a large and potentially very damaging ice dagger). Also, as more and more of the fluids outside the cells freeze, much of the water inside nearby cells tends to be drawn outside and be added to the growing mass of crystals that is forming safely outside the delicate cells. At the same time, the cells have set in motion the production of what amounts to antifreeze — sugar compounds like glycerol and glucose that lower the freezing point of the water still inside the cell walls. The final result is that "only" 53 per cent of a hatchling's body water is actually frozen and all of that amount is outside the cells and in the form of very tiny ice crystals that can't do very much damage.

This is how hatchling Painted Turtles, hibernating through their first winter while still inside their nest chamber, escape death even though they are "frozen solid." After that first winter, baby Painted Turtles no longer have the ability to make the special