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**When ‘Temporary’
Becomes
‘Permanent’**



Raccoon and deer tracks traverse a desiccating film of duckweed that coats the muddy remains of our vernal pond.

As little as fifteen years ago in the month of September a statement like this would hardly have been worth mentioning: *Our vernal ponds have gone dry.*

Hardly worth mentioning because, for anyone who knows the seasonal dynamics of a vernal pond, a late-summer dry-down is *normal*. In fact, it is this temporary existence that sets it apart in so many ways from all forms of permanent water (i.e., lakes, deeper ponds, rivers, streams, canals) that punctuate our landscape. Thanks to increasingly extreme weather events brought about by fossil fuel-driven climate change though, “normal” appears to have morphed into “the exception” in barely more than a decade.

I’ve written columns in several past newsletters about the life and times of these two, adjacent low areas that encompass almost two of our 6.3 acres, especially in relation to the declining reproductive success of the amphibian species that utilize them. I’ve also cited the cliché that frogs are considered indicators of the health of the environment, then posed the question, *If they are indicating something is wrong, who among us is paying attention?*

First, some quick background about vernal ponds...

- 1) These same waters also go by the monikers, *vernal pool, ephemeral pond* or *pool, temporary pond*.
- 2) While occupied and utilized by a diversity of plant and animal life that may also occupy permanent wetlands, the fleeting nature of the water supports species that otherwise cannot effectively survive or function over generations in a permanent-water habitat, i.e., fairy shrimp, breeding wood frogs. It also dictates that members of one particular vertebrate class will *not* be present – fish. Despite (and partially because of) their absence, however...
- 3) Vernal ponds harbor more biological abundance and diversity per unit of area than any other natural community in temperate climates.
- 4) The majority of Michigan amphibians rely heavily on vernal wetlands for reproduction. Fish devour small amphibians as well as their eggs and larvae, so their absence in these waters is critical for amphibian reproductive success.

5) Tens of thousands of vernal wetlands once freckled the state’s landscape. Over 75 percent have been drained or otherwise destroyed or significantly degraded mostly due to agriculture, urbanization and infrastructure projects.

The “Normal” Years

When we moved to this country locale north of Williamston at the onset of 1989, the approach of our first spring was steeped with anticipation as to what frog and salamander species would be found breeding on the vernal ponds out back.



A Western Chorus Frog vocalizes in early spring.

From late March into the summer we marveled at the breeding cacophony of a total of seven species of native frogs, the breeding window of each opening and closing according to its species-specific schedule. Spring Peepers, Western Chorus Frogs and Wood Frogs started their breeding activity around late March. Wading after dark through the frigid waters with flashlights also yielded views of silently-breeding Eastern Tiger and Blue-spotted Salamanders. These earliest breeders were followed in close succession by Northern Leopard Frogs, then Eastern American Toads by the middle of April. At the onset of May it was the Eastern Gray Tree Frogs’ and Green Frogs’ time to breed.

Breeding Windows & Green Frogs

Each species vocalizes and calls within its evolutionarily-set breeding window of time. The duration of the windows of most are typically in the neighborhood of six weeks or so. However, at a mere two weeks the Wood Frog, by far, exhibits the shortest breeding window. On the other end of the spectrum, the ubiquitous Green Frog’s breeding window stretches over three months into August, giving it the distinction of having the longest breeding window, by far, of any Michigan frog. In a sense, we’ve found that functionally, the Green Frog’s exceptionally long breeding window has the effect of *two* breeding opportunities per year to just one for everybody else. Here’s how.

After the window in which eggs are deposited, tadpoles of the other species grow, metamorphose into froglets and disperse from the pond between June and early August. Let’s call this the “metamorph window,” and, just like the breeding window, it opens and closes for each of these species only once a year.

By contrast, Green Frog tadpoles that hatched in May and June metamorphose into froglets by late August and September. Additionally, then, tadpoles hatched from eggs laid later in the summer only partially grow before the cold months set in and trigger a pause in their feeding activity and growth. Upon the following spring’s warm-up, these tadpoles resume eating and growing in time to emerge as metamorphs around the end of May, resulting in a second metamorph window within a year’s span.



Green Frog tadpole.

Photo © Steve Sage.

Of course, in order for the Green Frog’s extra metamorph window to run its course the breeding waters have to be permanent; that is, remain deep enough through the coldest months to avoid “winter-killing” tadpoles along with other occupants under the ice layer. A normally-functioning vernal pond does not

allow these late tadpoles to survive. It either evaporates completely by summer's end, or draws down to such shallow depth that the remaining life within it freezes solid over the winter.

What happens when unusually abundant late summer precipitation increases the depth of a vernal pond at a time when it should normally be drying? The Green Frog tadpoles survive the winter, which means the amphibians that enter the pond to breed the following spring will have company - hungry company. Our observations over more than thirty years confirms that Green Frog tadpoles by the thousands in an early spring vernal pond function like fish in their ability to devour a high percentage of amphibian eggs.



Wood Frogs deposit copious amounts of eggs. Their tadpoles soon teem through the vernal pond.

Over the first twenty consecutive winters of our presence here, winter 1988-89 to winter 2008-09, the vernal ponds receded to the point that there was never Green Frog tadpole survival. Each spring, all other breeding amphibians enjoyed abundant reproductive success. Whether wading through the pond on a sunny day or at night with the view illuminated by flashlight dozens of tiny tadpoles would swim out of the way with every step. Then, in late June, when the raisin-sized metamorphs of Wood

Frogs and Spring Peepers emerged from the pond and dispersed, the living, ambulant carpet of tiny hoppers made us reluctant to mow the lawn. Metamorphs of Leopard Frogs, American Toads and Gray Tree Frogs also flooded the yard in their due time. This was the natural order, year in and year out, of what we came to know as normal.

When *Temporary* Goes *Permanent*

Unknown to us, the first taste of what was to quickly become an unsettling trend occurred in late summer of 2009. That August most certainly had to be the wettest on local record. Rain fell nearly every day. The vernal ponds filled with run-off from the surrounding higher ground. By month's end their depth had risen beyond waist-deep. This soggy stretch had just set the stage for the first winter since we lived here in which the Green Frog tadpoles would survive.

The following spring among the usual sights and sounds of breeding Wood Frogs, Peepers, and Chorus Frogs it took some getting used to. As we waded about, dozens of large Green Frog tadpoles evaded us at every turn.

Weeks later, we waded through the ponds well after the eggs of these species would have hatched. Of course, the abundant, huge Green Frog tadpoles persisted, and by then had developed hind legs, but where were the smaller tadpoles of the other species? We found ourselves wading for minutes on end between sightings of a solitary individual Wood Frog or Peeper tadpole. Later, we would confirm our suspicion. The Green Frog tadpoles, mimicking the devastating effect fish have on the breeding success of many amphibians on permanent waters, had devoured nearly all their eggs.

Starting with that first winter of Green Frog tadpole survival on our vernal ponds, the table here shows their fate over the ensuing winters. It includes our assessment for this coming winter (since the ponds have already dried and the tadpoles perished). Keep in mind, were this table to begin in 1988-89 when we first moved here and began our observations, the first *twenty* consecutive winters would be listed as 'No' in the Green Frog Tadpole Survival column.

Winter	Tadpole Survival
2009-10	Yes
2010-11	Yes
2011-12	No*
2012-13	No
2013-14	No
2014-15	Yes
2015-16	Yes
2016-17	Yes
2017-18	Yes
2018-19	Yes
2019-20	Yes
2020-21	Yes
2021-22	Yes
2022-23	No

Green Frog tadpole survival over 14 winters on our vernal ponds.

It bears mentioning that for anyone giving a cursory glance at the table without absorbing the content of this column it would appear that the winters marked “Yes” for tadpole survival would be assumed to be a good thing, when, in fact, the opposite is true in terms of the reproductive success of eight other amphibian species breeding here. Interpret every ‘Yes’ year as one in which these other species’ ability to procreate the following spring was severely hampered by the Green Frog tadpole presence.

However, note the asterisk after the ‘No’ for the winter of 2011-12. In this case, the Green Frog tadpoles did not survive the winter, but the ensuing spring and summer delivered record-shattering heat: 80s in mid-March and many days of 100-plus by summer. The vernal ponds were cooked dry by the end of June. It is the only year over, now, 34 years of observation in which we witnessed complete reproductive failure of all amphibians present, including Green Frogs.

Spring 2023 will snap an eight-year run in which Green Frog tadpoles have cohabitated with the early-breeding frog species and, correspondingly, severely hindered their reproductive efforts.

Extreme weather events, mostly in the form of torrential rain episodes (labeled ‘hundred-year floods’ in the media) are rapidly tending toward ‘annual’ in occurrence. More intense precipitation spells deep vernal ponds by fall and all but ensures Green Frog tadpole survival over the winter.

Is this trend something specific only to our vernal ponds in relation to amphibian reproduction? With the same weather conditions affecting the whole area, why would it be? We suspect that this scenario is playing out on vernal wetlands over our entire area, and probably beyond.



Frog populations are monitored aurally in the spring by surveyors who recognize their presence and relative abundance by their species-specific vocalizations. We’ve found an additional means of monitoring area frog species - by sightings on country side-roads during warm, rainy nights when frogs are on the move. The frogs are illuminated by the headlights of our car as we creep along these roads. We stop, jump out and walk ahead of the vehicle to get a sense of the species and numbers present.

In the spring, most of the species emerge from underground then head across land and across roads toward neighborhood breeding ponds. On warmish wet nights in late summer and fall, frogs of many species take advantage of these conditions to disperse into habitats beyond the breeding ponds. A high percentage are young-of-the-year, notably smaller than a typical adult of the species.

Not surprisingly, and completely in-line with breeding observations on our ponds, every frog species other than the Green Frog is far less common on rainy-night roads than what we observed fifteen years ago. Green Frogs seem to show no discernable decline.

The Amphibian Crash

In general terms, compared to what we observed prior to 2010, the populations of the rest of the local amphibian species are mere ghosts of what they used to be. Despite the absence of hard data to back it up, Carol and I agree that populations of nearly every species have declined 80 percent or more to the present day. Cases in point...



On some rainy nights Green Frogs seem to outnumber all other frogs combined on rural roads.

In years of late, come late June we no longer need to consider refraining from mowing because of the density of newly-emerged metamorphs of Peepers and Wood Frogs covering the lawn. They're no longer there. The sight of even a single individual hopping out of the mower's path has become a less-than-common occurrence.

Northern Leopard Frogs have taken the biggest hit. Once incredibly abundant breeders through April and early May, the ponds are now completely silent of their signature descending snores. In mid-summer abundant, spotty metamorphs used to leap from the overgrowth on to the lawn and mowed trails. We haven't seen one in over ten years and now consider the species extinct on our property. Once abundant on local rainy-night roads it is now possible to drive the same roads for hours on a good night and never see one.

The Eastern Tiger Salamander, even when common, is difficult to detect. Indeed, we call this species the "moliest" member of the mole salamander family. Outside of its early-spring night time jaunt to and from the breeding pond it rarely surfaces from underground. We used to find an individual or two in the early spring ponds after dark or hiding under a stump or other object in the yard. We have gone several years now with no sightings.



The Eastern Tiger Salamander seems to be sharing the same fate as the frogs on our property.

The Eastern Gray Tree Frog seems to be less-dramatically affected by this chain of events than the other frogs. Individuals are typically depositing eggs in the pond from early May to mid-June; later than all the rest of the amphibians except the Green Frog. The Green Frog tadpoles that overwintered metamorphose into froglets by late May. As they change form, they become no longer anatomically-equipped to devour other frogs' eggs. Thus, whereas some tree frog eggs may be consumed at the onset of the breeding window, the threat diminishes to nil as the tree frog breeding window progresses into June.

After a relatively dry and "normal" summer, we're thrilled that the Green Frog tadpole menace will be absent from our vernal ponds next spring. It is going to be interesting to observe how effectively amphibian reproduction will be able to rebound, if at all in only a single year. However, we're also realistic about the accelerating and intensifying impacts of our steadily warming atmosphere: increasingly frequent and voluminous precipitation events that trigger yet more flooding of communities, agricultural fields and, yes, vernal ponds.

Recent history makes a strong case that we should more likely than not expect Green Frog tadpoles to be swimming again in our vernal ponds in spring of 2024, as well as in many more years beyond. At what point will these 'temporary' waters become 'permanent' *permanently*?

All the more reason to not take the continued existence of frogs and salamanders for granted.

All the more reason to choose to break free from our confined, human-centric obsessions and to acknowledge and engage with the myriad and wonderful diversity that surrounds us.

And all the more reason to care genuinely and deeply about the quality and diversity of life - human and otherwise - with which we share our neighborhoods and planet; so deeply, in fact, that we conscientiously devote ourselves, without consternation or complaint, to curbing every aspect of our personal and societal carbon footprints. The quality of *all* life can endure if we motivate a will to align our priorities with more holistic intent.

-Jim McGrath



Visit Us at Crane Fest, Saturday or Sunday, October 8-9

Visit Nature Discovery's interactive exhibit of live Michigan-native reptiles and amphibians at Crane Fest, Saturday or Sunday October 8 & 9. Also crane-viewing, guided walks, nature artists, vendors and more. The event takes place each day from 12-7pm at the Kiwanis Youth Conservation Area near Bellevue. Parking fee is \$7/vehicle. For more information visit

<https://www.michiganaudubon.org/calendar/community-cranefest-xxvii-2022/2022-10-09/>

Williamstown Twp Harvest Festival Sunday, October 16



Nature Discovery will have an interactive exhibit featuring our Michigan reptiles & amphibians on display at Williamstown Township's Harvest Festival on Sunday, October 16 at the township park. This is just one of a slew of concurrent activities planned throughout the day for visitors of all ages. Click this link for details: <https://williamstownmi.gov/harvest-festival-oct-16th/>



A heartfelt thank you to our many supporters, including these donors over the past month.

*JT Brown
Betsy Jabs
Aidan O'Brien
Gene Wasserman*

This yearling Blue Racer is a recent addition to our educational menagerie. Racers are serpentine motion detectors. They react to movement around them more acutely than other snakes, like this one toward the rise of the camera.

Nature Discovery

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Visit Our Nature Center by Appointment

**Suggested Minimum
Donation: \$5/person/hr**



The sky's the limit for natural science learning here – with a Michigan twist! Adults, couples and families are welcome to schedule a safe, intimate outdoor or indoor visit to what we call “The Biggest Little Nature Center in Michigan,” and “Home to the Largest Zoo of Michigan-native Reptiles and Amphibians.” Weather-permitting, we will bring snakes, turtles, frogs and salamanders outdoors to interact with visitors.



Identify and feed “the grand slam of Michigan turtles” - all ten species native to our state! Meet, pet and feed “Milberta”, our always hungry Red-footed tortoise.

Handle any or all of Michigan’s three species of garter snakes while learning how to tell them apart, then watch them gobble up worms and live frogs. Hold or “wear” a gentle 6-foot Black Rat Snake – the largest in the state!

Many more snakes, turtles, frogs and salamanders to identify and feed. Take a guided walk on our trails to identify birds, bugs, trees, vines, and invasive plants as we encounter them.

Ask us about...

- ... field trip to our center for academic classes, pre-K thru college.
- ... weekly or biweekly drop-off visits with experiential activities for your elementary thru high school student(s).
- ... volunteer opportunities for middle-high school students and adults.
- ... a guided interpretive experience at a local natural area of your or our choosing for your small group of students, adults or families.

Profit, Greed an Unrelenting Threat to Wetlands

This article from the National Parks Conservation Association is an apt supplement to my opening column in this newsletter issue.

<https://www.npca.org/articles/3292-the-supreme-court-case-that-threatens-our-waters>

Wetlands and the laws that protect them constantly stand in the way of more profit for corporations and well-monied citizens who, frankly, can never have “enough,” and who will wield influence to get what they want. The column argues for the conservation of smaller wetlands, the ones I describe in the opening column as the most biologically-rich and most critical to sustaining amphibian populations, but the article barely articulates such details. These pockets of quality habitat would be at the forefront of the regulatory chopping block if the Supreme Court were to rule that way. Assuming every SCOTUS justice must surely be many times wealthier than the average American, I suspect most of them are far more focused on the performance of their investment portfolios than on what is and isn’t environmentally ethical.

Please join us in speaking up for all wetland protection.

-JM

The next generation would be justified in looking back at us and asking, “What were you thinking? Couldn’t you hear what the scientists were saying? Couldn’t you hear what Mother Nature was screaming at you?” -Al Gore

I don’t want you to be hopeful. I want you to panic. I want you to feel the fear I feel every day. I want you to act. I want you to act like you would in a crisis. I want you to act like your house is on fire, because it is. - Greta Thunberg

Scientific findings should never be distorted or influenced by political considerations.

- from President Biden’s Memorandum on Restoring Trust in Government through Scientific Integrity and Evidence-Based Policymaking.



Less Beef = Less CO₂
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