

Note

Apparent winterkill of Painted Turtle (*Chrysemys picta*)

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Abstract

Around the margin of an artificial pond in Ottawa, Ontario, we found 25 Painted Turtles (*Chrysemys picta*) that appeared to have died over the course of two winters (17 during the first winter and eight during the second). We examined meteorological data to try to determine the cause of the mortality. Summer and fall rains were only slightly below normal in both years, suggesting water levels should have been close to normal. The winter air temperature was warmer than normal and winter snowfall was slightly above normal in both years. Unseasonable weather does not appear to be responsible for the winter mortality and the pond's maximum depth of 1.7 m should prevent freezing to the bottom. It is possible that the artificial nature of the pond creates suboptimal overwintering habitat, rendering the site an ecological trap; however, there is no direct evidence to support this theory. It is also possible that winter mortality of turtles is widespread at temperate wetlands, but that dead turtles were more detectable at this site because of the bare shoreline around the pond. Winter mass mortality events, if common, may represent an additional threat to turtle populations, which are declining from various anthropogenic threats.

Key words: Winterkill; Painted Turtle; *Chrysemys picta*; mortality

Freshwater turtles must spend the winter in a state of periodic or continuous inactivity in most temperate locations. This inactive state has been called hibernation or brumation, but, more generically, it has been termed overwintering, because the behavioural and physiological states vary among turtles (Ultsch 2006). In northern latitudes, turtles may spend half the year overwintering under water (Ultsch 1989, 2006). Overwintering can be challenging and lead to death because of prolonged anoxia or freezing (Ultsch 2006). Mortality events can result in the death of many turtles. For example, 186 turtles from five species died when a pond froze to the bottom in Iowa (Christiansen and Bickham 1989), 144 turtles from four species died from freezing in three wetlands that dried up over the winter in Missouri (Bodie and Semlitsch 2000), 86 Painted Turtles (*Chrysemys picta*) died over the winter after water levels in a lake declined dramatically in South Dakota (Platt *et al.* 2008), and 56 Painted Turtles and three Blanding's Turtles (*Emydoidea blandingii*) died over the winter in a "large shallow pond" in Ottawa (Bleakney 1966). Reports of winterkill are valuable for assessing

the frequency and magnitude of such mortality events and the factors that contribute to them.

On 28 July 2020, we found 17 dead Painted Turtles along the shoreline or in shallow water near the shore at a human-constructed pond in western Ottawa, Canada (45.43633°N, 76.02359°W). The pond did not exist before 2002, based on evidence from historical air photos (City of Ottawa 2022). The pond is not connected to any other water body; it is irregular in shape but has a total length of ~500 m, a width that varies from ~40 to 130 m, and a total area of ~3 ha. Based on measurements taken on 5 July 2021, the maximum depth of the pond is 1.7 m.

All 17 of the turtles found in 2020 had been dead for some time. In most cases, only the carapace and plastron were present, often with some scutes missing. The most intact turtles still had dried legs or a head present along with the shell. Some turtles were reduced to just fragments of the shell. In all cases, there were enough scutes still attached to the bone to identify them as Painted Turtles based on the presence of red markings on the scutes. Nine of the 17 turtles were relatively intact and were measured to the

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nearest half centimetre. The median plastron length (PL) was 12 cm (range 10.5–13 cm). One turtle was identified as an adult female (10.5 cm PL), but none of the others could be sexed confidently. Two of the turtles were found in shallow water near the shore, while the rest were found on shore, typically within 1–2 m of the water, but up to 5 m from the pond edge. The bodies of the turtles were dispersed around the pond margin, up to ~300 m apart, although five turtles were found within a few metres of each other. Given the condition of the bodies, the turtles likely died several months before they were found. The most compelling evidence that the turtles died over the winter is a photo taken of a dead male Painted Turtle in the pond on 2 April 2020 (Figure 1). Its body is clearly intact and it was not killed by a predator. It is possible that some of the dead turtles in poorer condition may have died in the previous year, given how long it can take for turtle shells to disarticulate (Dodd 1995). It is unknown how large the Painted Turtle population in the pond is, although the largest number of individuals counted on one day was 15 on 30 May 2021.

We revisited the pond in spring 2021 to determine whether winterkill recurred and also received observations of turtles from others. Three live Painted Turtles were observed on 22 March when the pond was still mainly frozen over. The turtles were in open water at the shoreline, alive but sluggish. On 25 March, one

live Painted Turtle (~10 cm PL) was found with ~90 leeches attached to the plastron and around the head. Two dead Painted Turtles were also found on this date. During 3–19 April, a total of six dead Painted Turtles were found, for a total of eight dead turtles in 2021. Five of the six were in the pond and the other was within ~1 m of the water. The sizes of the turtles, estimated from photographs, averaged approximately 10 cm PL (range 6–12 cm). One was an adult male, two were adult females, and the remainder were unsexed or juveniles. None of the turtles had any visible injuries.

Painted Turtle is one of the most anoxia-tolerant species of turtles (Ultsch 2006). In particular, the three northern subspecies can remain responsive for more than 150 days in anoxic water (Ultsch *et al.* 1985; Reese *et al.* 2004). Under hypoxic conditions, Painted Turtles may seek out colder areas of a water body to delay metabolic acidosis (Rollinson *et al.* 2008). Nonetheless, prolonged anoxia or freezing may cause mortality (Ultsch 2006), and untangling these two causes of death is often difficult because, when dead turtles are found in spring, the pond has already thawed. Monitoring turtles over the winter can confirm cause of death, as radio-tracking Painted Turtles in British Columbia resulted in finding one turtle frozen where lake ice reached the bottom in mid-winter (St. Clair and Gregory 1990).



FIGURE 1. Dead adult male Painted Turtle (*Chrysemys picta*) found in a pond in Ottawa on 2 April 2020. On this day, the air temperature reached a minimum of -1.4°C and a maximum of 10.8°C (Government of Canada 2020a). Photo: T. Hamar.

We examined meteorological data from the nearby Ottawa International Airport (~30 km southeast of the pond) to determine if weather factors could explain the observed winterkill. Precipitation from June to November 2019 and 2020 totalled 451.8 mm and 466.0 mm, respectively, which is slightly lower than the 30-year climate normal (1981–2010) of 528.3 mm (Government of Canada 2020a); however, it is likely pond water levels were near normal at the start of winter. Winterkill of Painted Turtles in South Dakota resulted after a drought when rainfall was 50% below normal (Platt *et al.* 2008).

The monthly mean minimum temperatures for December to March in both winters were on average 2.2°C (range 0.8–4.7°C) and 1.9°C (range –0.5–4.7°C) warmer, respectively, than the normal minimum temperatures (Government of Canada 2020a); thus, it seems unlikely that temperature was responsible for the mortality. A winterkill of Snapping Turtle (*Chelydra serpentina*) occurred in Ottawa when the monthly mean minimum temperature was on average 2.8°C colder than normal each month during the winter (Seburn 2015).

Lack of snow cover can substantially increase the seasonal freezing depth (Zhang 2005), but from November to February during both winters Ottawa received 169.9 cm and 164.5 cm of snow, which is slightly higher than the normal snowfall of 161.3 cm for that period (Government of Canada 2020a).

It seems unlikely that unusual weather conditions were responsible for the mortality of the turtles as conditions were close to average during both winters. It also seems unlikely that the entire pond froze to the bottom both winters, as the maximum depth is 1.7 m and Painted Turtles are known to overwinter in ponds only 1.3 m deep north of our study area (Rollinson *et al.* 2008) and often in areas of wetlands that are less than 0.5 m deep (Taylor and Nol 1989). Given that the pond is human-made, it is possible that basin characteristics create overwintering habitat that is not ideal. “Ecological traps”, habitats selected by animals that reduce their fitness, have been widely documented, but most research has been on birds (Hale and Swearer 2016). Although the pond may form some kind of ecological trap, turtles are known to make use of artificial wetlands elsewhere in Ontario and successfully overwinter there (Dupuis-Desormeaux *et al.* 2018). It remains unclear what caused the winterkill over two consecutive winters, but it is possible that winterkill occurs in many temperate locations but dead turtles are rarely found or reported. The bare shoreline of this pond may make it easier to find dead turtles compared with wetlands with abundant shoreline vegetation.

Turtles face a wide range of anthropogenic threats and currently all eight species of freshwater turtles

in Canada are listed as Species at Risk (Government of Canada 2020b). If winterkill in Canada is common and widespread, then turtle mortality rates may be higher than commonly thought. Chronic, ongoing adult mortality can have long-term effects on turtle populations. Two decades after a mass mortality event in Algonquin Provincial Park, for example, a population of Snapping Turtles has still not recovered (Keevil *et al.* 2018). Researchers are encouraged to report apparent winterkill of turtles to determine how common such events are at northern latitudes.

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Writing – Original Draft: D.C.S.; Writing – Review & Editing: D.C.S.; Investigation: D.C.S., M.B., I.A., S.C., T.F., C.H., and P.M.

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