WICKED LOCAL WELLFLEET

Number-one issue at ponds is climate change, not pee

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Some people refuse to swim at the public beach at Wellfleet's Long Pond after Aug. 1. They say the problem is a buildup of urine and bacteria from heavy use throughout the summer.

But Cape Cod National Seashore ecologist Stephen Smith says that the amount of urine in the Outer Cape's kettle ponds is "absolutely insignificant." Urine is far too diluted to have any notable effect on the ponds. Still, Smith says, it's a good idea, when you have to go, to wait until you've located a toilet on dry ground.

Wellfleet beach administrator Suzanne Grout Thomas says that the town tests the kettle ponds each week for total chloroform, bacteria derived from fecal matter, and E. coli. The water has been clean this year and for the past several summers, she says, with only one positive test for bacteria this season at Long Pond after a heavy rain.

The ponds are being altered, however, by a more insidious culprit: climate change.

Smith has been analyzing a meteorological data set that goes back two decades or more, collected from ponds in Wellfleet and Truro. The kettle ponds are uniquely situated to record changes in climate.

"Because the kettle ponds are very small, with no riverine inputs that would act as buffers, they're very sensitive to meteorological changes," Smith says. He and his colleagues have already found evidence of global warming's effects on the ponds.

One of their findings is a change in water temperature patterns. Surface temperatures in the ponds have increased by 2 to 3 degrees Celsius over the past few decades. At the same time, water is circulating less, which creates a larger temperature gradient between the surface water and the water at the bottom of the ponds. In other words, the ponds are more stratified. Smith thinks the increasing stratification is due to a decrease in wind, a result of climate change.

"Ponds usually have a period of stratification, but then they get well mixed by big winds or the change in seasons," Smith says. "But the visible separation of warm and cold water is becoming stronger during the summer and happening over a longer period of time."

Stratified water alters pond ecosystems, since the nutrient-rich water near the bottom of the ponds, where bacteria break down organic matter, does not circulate as readily to the top, where phytoplankton live in the sunlit euphotic zone. With less nutrients, there are fewer phytoplankton, which are the base of the food web in ponds. That means fewer zooplankton, frogs and fish, and less prey for predators, like birds.

Smith and his colleagues have also found that the water level at the ponds is increasing, even taking into account inter-annual variability of precipitation.

“Part of the effect of sea level rise on Cape Cod will not only be salt water levels rising along the coast and salt water intrusion, but interior flooding with the groundwater aquifer,” Smith says. “Sea level rise will end up pushing the ground water table upwards. It ultimately might fill up tri-kettle ponds,” like Gull, Higgins and Williams in Wellfleet, “or make seasonal ponds more permanent.”

Smith and his team have also conducted land use analysis to address concerns about wastewater pollution.

“There’s been hardly any development in the Seashore,” he says, explaining that the changes observed in the ponds are not a result of runoff or pollution. Unlike at other ponds in Massachusetts, “the changes we’re seeing are probably due to much broader atmospheric conditions. Those affect our ponds much, much more than any wastewater inputs from humans.” Still, swimmers are advised to refrain from walking outside the designated beach zones, since trampling shoreline vegetation might lead to more runoff entering the ponds.

Water clarity has also decreased in recent decades, but that’s not a bad thing.

“Every time water clarity diminishes, even if it’s a natural process, people tend to view it in a negative light,” Smith says. Ponds have become less clear since the Clean Air Act of 1972 because acid rain has decreased substantially, making pond acidity drop and allowing more plant life to grow there. With more stratification, however, it’s likely that fewer plants will be able to grow in surface waters, increasing clarity in the future.

Each of the kettle ponds Smith and his team studied is unique. “The ponds are highly dependent on their physical dimensions — shallow ponds behave very different than deep ponds,” Smith says. The freshwater mussels in Gull Pond filter and clean the water, while shallower ponds have more light and therefore more vegetation. Higgins, Gull and Williams are part of the herring run, which has a significant impact on the tri-ponds’ ecosystem.

Despite their diversity, the kettle ponds in Wellfleet and Truro are all experiencing the effects of climate change outlined above.

Smith and his team are currently expanding their research to analyze how the physical changes that they have observed affect biology and ecology. Smith is interested in how temperature changes might affect what types of plants, phytoplankton and bacteria grow in the ponds.

Smith says that climate change may actually result in better conditions for recreational uses of the ponds. With less algae growing in the nutrient-poor surface waters, clarity will likely increase, and warmer waters may extend the swimming season.

The Cape's kettle ponds were formed around 18,000 years ago, at the end of the last ice age, by melting chunks of ice from the retreating glacier. The ponds "harbor a unique assemblage of fauna and flora, as well as abundant recreational opportunities," Smith says. Their beautiful and peaceful atmosphere makes them perfect for families escaping the summer heat. With recent shark activity, Smith thinks that the kettle ponds were even more crowded this season than usual.

Because climate change is less tangible than urination, however, Smith's findings present a challenge in galvanizing pond users to be thoughtful environmental stewards. He encourages people enjoying the ponds to be aware on multiple levels, both big and small. When using the ponds, he says, be careful to protect shoreline vegetation and not apply bug spray before swimming.

"But we also stress what people can do on a personal level, like thinking about their carbon footprint," Smith says. "If a lot of people reduce their impact, we can have a collective positive impact on the climate."