The Spirit of **Kettle Lakes**

Robert M. Thorson

Information does not drive the budget process for members of lake associations. Emotions do. Members don't dig into their wallets for dues or donations because they've learned something new. They do so because it "feels" like the right thing to do. Grassroots political action – or in this case, lake-roots action – comes from the heart, not from the head.

Information does not drive the budget process for state and federal agencies either. Emotions do. Professional staffs who are employed in the public trust respond only indirectly to the ecological integrity of a water body under consideration. More directly, they are obligated to respond to the emotional mood of taxpayers on whatever issue is at stake, be it water quality, ecological habitat, or development pressure. Nothing of lasting value with respect to professional lake management happens without "buy in" from below.

The individual and group emotions that stimulate right action, especially those distinct from sociology, can be subsumed under a general heading "spiritual." Though freighted with religious, cultural, and historical baggage, this word remains a good one for scientists, engineers, and managers to use, even in our largely secular and religiously pluralistic society. I use it for that part of the human-lake dialogue that isn't amenable to description and analysis.

Spiritus

"A lake is the landscape's most beautiful and expressive feature. It is earth's eye; looking into which the beholder measures the depth of his own nature."

For those who love lakes, this is the most relevant quote from *Walden,*

Pink sunrise at Lake Plantagenet in Hubbard County, Minnesota, where the author's family has a lakeside cabin.

The radial geometry of Lilypad Lake in Hubbard County, Minnesota illustrates Thoreau's metaphor of "Earth's eye."

or Life in the Woods, published in 1854 by Henry David Thoreau. Walden is more than one man's memoir of a two-year sojourn on the shores of a pond in Concord, Massachusetts. It is the literary masterpiece of American Transcendentalism, the launching pad for nature writing in the western hemisphere, and the birthplace of the modern environmental movement.

Thoreau thought of swimming or floating in the lake as a "religious exercise." When fishing, he was conscious of the "lower heaven" beneath his boat: "It seemed," he writes, "as if I might next cast my line upward into the air, as well as downward into this element which was scarcely more dense." When looking outward from the shore, he understood that "a field of water betrays the spirit that is in the air."

Within the quotes above are the words religious, heaven, and spirit. They come from a man who some of his contemporaries scorned as a "dirty little atheist." The fact that he wasn't a Christian should not matter, especially in today's society. He was clearly an intensely spiritual man. And nothing inspired him more than a clear view of the lake.

The word "spirit" translates as breath from the original Latin. Consider the third photo accompanying this article (above, this page). What our eyes see as an optical sensation, and our scientific minds see as physical phenomenon (rising pockets of condensed vapor convecting with slow turbulence in response to a strong thermal gradient under ambient conditions of calm wind and rapid diurnal warming), our emotional minds see – at least initially – as the "breath" of nature moving over the face of the waters.

Thoreau captured a similar sunrise as literature: "As the sun arose, I saw it throwing off its nightly clothing of mist, and here and there, by degrees its soft ripples or its smooth reflecting surface was revealed, while the mists, like ghosts, were stealthily withdrawing in every direction, as at the breaking up of some nocturnal conventicle."

I recall my first visit to Walden Pond more than a quarter-century ago. While pushing a double baby stroller on the trail toward Thoreau's house site, I wondered how it was possible for the potency of

Morning mist over Mansfield Hollow Lake in Mansfield, Connecticut is similar to what Thoreau described at Walden Pond.

Walden the book to have come from the ordinariness of Walden the lake. Only after my children had grown up and moved away, and only near the end of a long writing project on small lakes, did I come up with a satisfactory answer. Walden is a kettle.

Thoreau's Kettle

Kettles are geological depressions whose shapes – in their archetype state – resemble the cooking vessels from which they are named. They formed when masses of stagnant ice become detached from the glacier they originated from, were buried (or partially buried) by sediment, and then melted, leaving depressions where the ice used to be. Nature writer Robert Finch aptly dubbed them "fossil icebergs."

In New England, kettles are usually called ponds. In the upper Midwest, they are called lakes. And on the High Plains of Iowa, the Dakotas and eastern Montana, the vast majority are called potholes.

The majority of kettles are effectively sinkholes in sand and gravel. More irregular forms consist of multiple sinkholes coalesced. In the ideal, a single kettle resembles a sports stadium built at ground level and half-filled with water. More commonly, they are the size of the whole sports complex, with the adjacent parking lots being coves and bays of asphalt. Kettles are very unlike other glacial lakes: ribbon-shaped lakes (or lochs) carved out of rock by a concentrated stream of glacial ice; ragged lakes where the ice sheet quarried and scoured an irregular chaos of rocks; and expansive, mud-rimmed lakes held up by layers of clay or glacial till at shallow depth.

At 62 acres, Walden Pond is six times larger than necessary in order to qualify as a legal lake for regulatory purposes. And its salient attributes – those experienced by Thoreau in the mid-19th century and still present today – derive from its geological origin as kettle hole deep enough to intersect the groundwater table. Most important is the shape of the depression. As with a sports stadium, the attention is inward and downward to a single point of focus. Thus, kettles are places of enclosure and introspection, rather than of adventure and journey.

Though Thoreau's contemporaries speculated the lake to be bottomless, he proved them wrong by chopping holes in the ice along intersecting transects

and making bathymetric measurements with a cod line to which he tied a stone. The published result is the only original illustration in what was otherwise a heroic literary manifesto. With an average depth of 103 feet deep, Walden Pond is the deepest lake in Massachusetts, at least when the local water table is at its normal elevation.

Thoreau described Walden as a "deep green well." Indeed, its hydrology is like that of an old-fashioned well "dug" far below a relatively flat water table beneath a plain of sand and gravel, and made much wider than necessary to throw a bucket into. One of Thoreau's early admirers, John Muir, wrote that Walden waters "ooze through beds of drift," a 19th century term used to describe meltwater sediments of glacial origin. As with many kettles, there are no inlets or outlets. They are natural "wells."

The purity results from many other factors set up by the "fossil iceberg" origin. The narrow littoral fringe minimizes weed growth, encouraging stonewort algae (*Nitella*, sp.), which uptake nutrients. Another is the cool average water temperature relative to the air in summer, caused not only by its great average depth, but also from being set "low in the woods," where cool air settles. Walden has a well-defined hypolimnion, and is historically dimictic, which promotes mixing of cold bottom water.

The great mass of water concentrated in such a small spot contributes to strong diurnal contrasts during the shoulder seasons of fall and spring. This intensifies and prolongs local breezes and ripples on the surface. And as with maritime conditions near the sea, local summer lasts longer and local spring comes later. Temperature inversions under clear-sky conditions are common; giving rise to optical affects that so delighted Thoreau. The trapping of winter air within this kettle helped promote the crystallization of clean ice that caught and held Thoreau's attention.

The steep, high banks rising to a flat plateau above the water made Walden Pond an elliptical acoustic reflector, helping to keep the so-called "hermit of Concord" company: "When . . . I had none to commune with, I used to raise the echoes by striking with a paddle on the side of my boat, filling the surrounding woods with circling and dilating sound, stirring them up as the keeper of a menagerie his wild beasts, until I elicited a growl from every wooded vale and hillside."

Steep bank, boulder shore, and fall colors at Walden Pond in Concord, Massachusetts.

Ripples and morning mist at Walden Pond in Concord, Massachusetts.

The isolation of the pond away from "civilization" also has a geological explanation. Kettles, especially in early New England, were randomly sprinkled over the landscape, lacked sufficient stream flow for mill-hydropower, and were located on bumpy terrain with excessively drained sand- and gravel-soils. Hence, they were of little value beyond the cutting of scrub oak and pine. It is for this reason that when Thoreau went to live there in 1845, Walden was still a forest refuge, despite being surrounded by a network of farms and pastures, even more than two centuries after the founding of Concord, one mile to the north.

Kettles for the Rest of Us

Walden is special for its historic and literary associations, and for residents of greater Boston who use it as a local swimming hole and an aesthetic backdrop.

But as a lake, its completely ordinary, possibly less interesting than most of the 50,000 (or more) lakes of the same age and origin sprinkled across the northern United States in a broad, irregular arc bounded by Machais, Maine and Nantucket, Massachusetts on the east, and by Des Moines, Iowa and Great Falls, Montana on the west.

I refer to this arc as the "glaciated fringe," a geologically unified region where the outer edge of the Laurentide Ice Sheet oscillated between about 22,000 and 12,000 years ago. This is where the meltwater rivers draining beneath and beyond that great sediment-producing machine deposited astonishing quantities of sand and gravel against and above masses of ice stranded during northward retreat of the ice margin. To the north – along the hard-rock southern edge of the Canadian Shield, the Adirondacks, and the northern Appalachians – the lakes are mostly carved out of rock, with kettles sprinkled among them. To the south, beyond the glacial limit, natural lakes are practically non-existent.

Earth's Eye

> "A lake is the landscape's most beautiful and expressive feature. It is Earth's eye; looking into which the beholder measures the depth of his own nature."

Thoreau's metaphor was very detailed. The pupil of Walden's eye was the deep, dark blue of the profundal zone. Its "iris" was the blend of ambient blue above the yellow sand of the littoral zone. Its "slender lashes" were the "fluviatile trees next to the shore," the ideal riparian habitat for temperature lakes. Its "overhanging brows" were the "wooded hills and cliffs" around it, the ideal place for a lakeside cabin, camp, or cottage. As with the human eye, the spherical geometry of Walden involves an infinite number of rays moving outward in all directions from a common point of origin. Each ray crosses a minimum of four perimeters of color, texture, and material: profundal, littoral, riparian, and forest.

The metaphor of the eye could not have been written about New York's Finger Lakes, whose regular elongate pattern was created by a single lobe spreading out above flat-lying strata: They draw the viewer's attention either up or down the lake. It could not have been used for the mountain lakes of northern New England and the Adirondacks, which were gouged out individually by the opposing forces of irregular ice flow and differential rock resistance: Their edges are too irregular and hard to be compared to an eye. It could not have been used for the Great Lakes, inland freshwater seas that are more than an order of magnitude too large.

The metaphor of the eye should be reserved for kettle lakes and ponds: small, drop-shaped, soft-sided lakes set low in the landscape. If the human eye is a window into the soul, then each kettle lake, pond, or pothole can be thought of as a portal into that part of nature where color, light, water, descent, and focus combine to draw us inward to our spiritual selves.

My hope is that, those of us who care greatly about lakes can tap into that force for ecological and social good.

Notes

Quotes are from *Walden, A Fully Annotated Edition*, by Henry David Thoreau, edited by Jeffrey S. Cramer, New Haven, Yale University Press, (2004).

More information about the origin and natural history of glacial lakes in the northern United States – and their relationship to limnology, history and literature – can be found in *Beyond Walden: The Hidden History of America's Kettle Lakes and Ponds*, by Robert M. Thorson, New York, Walker & Company (2009). ISBN 0-8027-1645-8. Link to http://thor.uconn.edu/walden.html for a Website devoted to the book.

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