

Appendix 3 - River Moods

Online Appendix to *The Boatman: Henry David Thoreau's River Years* (Harvard, 2014)

This appendix contains text that was originally written as segments designed to break up the historical and biographic narrative, but which were ultimately condensed into the text. In the process, a section that was 30 pages of single spaced manuscript was boiled down into a 10 page segment called "On the Water" within Chapter 7 (pages 134-145). Though the text is rougher here than in the final version, it is much broader with respect to Thoreau's specific observation.

Dates within brackets are Thoreau's journal quotes by day.

Breakup

Each year, the Concord River is reborn from the quasi-death of late winter, when it has all but disappeared. Then, one day, a dark blue artery of life can be seen flowing through the frozen whiteness, pulsating with possibilities to come. Next will come a torrent of ice floes battering the bridges, spinning in gyres, lifting masses of meadow, and grating against the banks. After that comes cold calm. But first, the river must be born from below.

As with most babies, it can't be seen until it appears. During many of Thoreau's winters, the river literally disappeared from the landscape, having been frozen over and the corridor completely buried by drifted snow, looking no different from any other snow-drifted field, aside from the identity of the brush. A few warm days, or perhaps an unusual rain, is all it takes. On the river, the carapace of snow melts, trickles downward, and re-freezes within the snow ice. On land, it is liberated to flow, seeps downward through soils, trickles to the water table, merges with the saturated aquifer, leans toward the sea, and migrates as an inexorable mass.

The pressure builds in a downstream direction. Invisibly gathered waters begin to back up at the Fordway in Billerica. The pressure builds in what will soon become a birth canal bounded on all sides by the channel bottom, the banks, and the dead weight of floating ice. The pressure builds. "Apparently when the river freezes up thus tensely, the ice compresses it." [Feb 12, 54] The rising water lifts the ice just a little. Though it flexes initially, eventually the strain becomes too great, and the ice must crack along its edges in the boundary zone between the bank, where it is frozen to the land, and the channel, where it is being uniformly lifted. When the pressure builds, "it bursts out and overflows in such places, even in very cold weather.

As with a real birth, the water breaking through it is colored by life, in this case the color of tea, of dissolved organics liberated from the meadows, marshes, swamps, and soils through which it drained. Travel through the aquifers has strained the minute solids that cause turbidity, but has left behind the honey-colored chemistry on which the river ecosystem depends.

When the lifting is strong enough, the cracks open up wider, flooding the edges of the river to produce a pair of moats below the banks and uplifted ice.

At this point, one of three things can happen, depending on the vicissitudes of the weather. A prolonged cold snap can cut halt the snowmelt, and, after a few days, relieve the upward pressure. The ice in the channel can settle downward, closing the cracks, and allowing the moats refreeze. A snowfall might then reboot the system back to where it was before, leaving a "river-channel dark and rough with fragments of old ice,--polygons of various forms,-- cemented together, not strong." [Jan 16, 55] Large cracks can open, especially along the edges, where which Thoreau sojourned by boat, pressing his luck: "We make our way with some difficulty, thorough a very narrow channel over the meadow and drawing our boat over the ice on the river, as far as foot of Fair Haven... By rocking our boat and using or paddles, we can make our way through the softened ice, six inches or more in thickness." [Apr 7, 56]

Alternatively, if the temperature stabilizes just above freezing, the uplift pressure can be kept to a minimum. The ice is eroded from below, the flowing water having added just enough heat to keep the process going. Appearing beneath the surface are slightly darker spots where the ice is thin, which become dark blue, like waves beneath the ice, a very dangerous condition for river travellers. Eventually, the ice will break up, and its floes detach from the bank, and move downstream. Though fascinating, this is far less dramatic than a rapid breakup, which Henry took great delight in as the most potent time of the year, if only because it is most like a dramatic rebirth.

A sustained stretch of unusually warm days in February or March, especially combined with a warm rain from the southwest, sends a surge of water into system, can lift the ice beyond the ability of the anchor ice along the edges to hold it in place. The result is a brittle mass up to 20 inches thick between the brush and forest of the banks. Lifting, flexing, twisting, and tipping breaks this mass up into a series of slabs called floes. "white cakes of ice gliding swiftly down the stream, --a novel sight. [Feb 27, 60] Together they batter the trees along the edge, tipping them over at times: "Examined where the white maple and the apple tree were tipped over by the ice ... It struck them seven or eight feet from the ground, that being the height of the water, rubbed off the bark, and then bent flat and broke them. They were about ten inches in diameter... They have a hard time of it when a cake half a dozen rods in diameter and nearly two feet thick is floated and blown against them. [Feb 28, 55]

They travel together like cattle in a stampede each with its own mind, yet with each acting as part of a collective. Down they go, tipping on edge, swirling in gyres, thrusting one above the other, battering bridge piers, bruising the bark of bankside trees, and

colliding with the built environment of piers, docks and boathouses, crushing and tearing them apart. One afternoon, Henry and his frequent boating companion, Nathaniel Hawthorne, climbed aboard one of these floes in the Assabet and rode it downriver, towing their boat behind for safety's sake.

Great cakes of ice are wedged against the railroad bridge there, and still threaten its existence. They are about twenty feet in diameter and some twenty inches thick, of greenish ice, more or less tilted up and commonly another, if not two more, of equal size, forced directly underneath the first by the current. They stretch quite across the river, and, being partly tilted up against the piles of the bridge, exert a tremendous power upon it. They form a dam between and over which the water falls, so that it is fully ten inches higher on the upper side of the bridge than on the lower..... One great cake, as much as a dozen rods long, is slowly whirling round just above the bridge, and from time to time and end is borne against the ice which lies against the bridge....[Feb 17, 55]

During a normal spring freshet, much of the ice action takes place above the channel because natural levees parallel to it serve as a confining guide for drifting floes. But if the freshet is unusually strong, the water rises over the top of the levees, and the ice floes have access to the full dimensions of the meadows up to a mile wide and several miles long. In these scenarios, especially if there is a strong wind, the floes are blown to leeward where they pile up crash, and wreak havoc to edge life. At bridges it was especially violent: "What a tumult at the stone bridge, where cakes of ice a rod in diameter and a foot thick are carried round and round by the eddy in circles eight or ten rods in diameter, and rarely get a chance to go down-stream, while others are seen coming up edgewise from below in the midst of the torrent!" [Jan 22, 55]

"It is very exciting to see, where there was so lately only ice [130] and snow, dark wavy lakes, dashing in furious torrents through the commonly dry channels under the causeways, to hear only the rush and roar of waters and look down on mad billows where in summer is commonly only dry pebbles." [Jan 22, 55]

After becoming calm the violence subsides, leaving "broad sheets of dark-blue water, contrasting with the white patches of snow still left. [Jan 14, 54] And when the water drains away, what's left is a "very wild and arctic scene. ...over what is usually dry land, are scattered these great cakes of ice" [Feb 28, 55] ... eight or ten feet across left two feet high or more above the banks [Feb 1, 59] Each shore is also lined with ice stuck fast to vegetation, a "continuous row attached to alders, maples swamp white oaks, etc,...They are somewhat like tables of a picnic party or a muster-field dinner. [Feb 1, 59] Some floes were decorated red with by cranberries washed up onto the ice. [Feb 27, 60]

Ice is not all that's lifted up and floated away. The meadow surface consists of upright emergent vegetation growing above organic soils that are nowhere near as heavy as soils dominated by silt and sand. Water standing on the meadows can freeze even more deeply than on the river, creating a rigid slab up three feet thick, the top of which is nearly pure ice infused with plant stems, and the bottom of which is frozen meadowland soil. When

this condition is overflowed by water, the basal layer of stem-ice and peat-ice becomes buoyant, rises upward, and drifts away as a different species of ice flow. This floe cannot melt completely because its full of plant fiber. Instead, it drifts intact until it becomes grounded somewhere, often near the channel. When it melts, a clump of meadow up to XXX rods long and almost as many wide comes to rest to produce a local hillock.

Though the disappearance of ice is inevitable, its creation, destruction, and recreation take place like toggle switches thrown on and off. A reversal of breakup provides the best skating of all, because standing water converts to ice without the interference of snow. In the meadows, the water drains away beneath the ice to produce a surface on which the skating is loud and hollow.

Physics rules during break-up. Life is in abeyance.

Stormy Lake Huron

In ancient times, the Concord Valley were filled to overflowing with a dirty-gray glacial lake averaging a hundred feet deep. A thirty-mile long ribbon of turbid water and ice floes extending between the North Billerica, and Saxonville, widening over what are now the meadows. Accumulating on its floor was a thickening mantle of muddy, silty clay that flattened the floor of the valley, and leaving a sopping-wet stratum impermeable to downward drainage. Slightly raised at the edges, this stratum hold a shallow film of water like the cement floor of a vast hockey rink.

When dried by relentless glacial winds from an ice sheet still to the north, some of the mud blew off as sandy dust, mantling the jumble of stones left throughout the valley. Downwind of shorelines blew patches of sand dunes like those of Peter's Path west of the Great Meadow. But tundra vegetation soon anchored down the gritty mud. Meanwhile, slow uplift of the bedrock outlet to the north kept the roots of plants wet during most of each years, giving rise to a variety of sedges and grasses. When fully stabilized, the result was a broad but thin fresh meadow above each former wide spot of the lake, all linked by a slow, sluggish stream.

Each strong flood within the valley re-creates this ancient lake, first as a chain of shallow lakes separated the main channel, and then as a single lake with broad bays separated by fjord-like connectors. Using Thoreau's terms, what had been a lazy river flanked by meadows became a "chain of handsome lakes," [1845, After Mar 11, p2, 124] the largest over the Sudbury Meadows becoming a "smaller Lake Huron," [Week, 2] P2, 126, 1845, After Mar 11.] Next in size was one nearly two miles long and a half-mile wide occupying submerging the Great Meadows of Concord, north of the town center. These lakes would often last for weeks a time, which was long enough to get used to them such that they surprised you by disappearing overnight.

These were high times for Henry the Navigator, who seized every opportunity to go sailing upon them. With high water and high winds came high excitement, whether

during the spring freshet in March-April, or during the late-summer or early fall season of drenching subtropical storms, or winter extra tropical cyclones called "Nor'easters." High stormy water surprised and delighted him at any time of year. The mood was one of

angry dark waves, muddy whitecaps that were actually graycaps, bubbly streaks of dirty foam, and the rise and fall of his boat. Here's one of many descriptions of Concord in its mood of stormy gray flood.

Nobody remembers when the water came into so many cellars. ... Of eight carriage roads leading into Concord, the water to my knowledge is now over six, ... All of these are impassable to foot-travellers except Wood's Bridge, where only a lady would be stopped... This may suggest how low Concord is situated. ... All this has been occasioned by the repeated storms of snow and rain for a month or six weeks past, especially the melting of the deep snow of April 13th, and, added to this, the steady rain from Sunday morning, April 18th, to this moment, 8 P.M., April 21st. The element of water is in the ascendant. From the Poplar Hill, the expanse of water looks about as large on the southwest as on the northeast. Many new islands are made,--of grassy and sometimes rocky knolls, and clumps of trees and bushes where there is no dry land.....Men are out in boats in the rain for muskrats, ducks, and geese...[Apr 21, 52]

The water has risen one and a half inches at six this morning since last night. It is now, then, eight and a half inches above the iron truss [of the railroad bridge], i.e., the horizontal part of it. There is absolutely no passing, in carriages or otherwise... Throughout this part of the country most people do not remember so great a flood, but, judging from some accounts, it was probably as high here thirty five years ago. [Apr 23, 52]

If there was enough snow that year, "dark-blue and angry waves," contrast "with the white but melting winter landscape." [Mar 8, 53] And "you cannot sail or row over this watery wilderness without sharing the excitement of this element. Our sail draws so strongly that we cut through the great waves without feeling them. And all around, half a mile or a mile distant, looking over this blue foreground, I see the bare and peculiarly neat, clean-washed, and bright russet hills reflecting the bright light... from an infinite number of dry blades of withered grass." Spring water was often muddy water, meaning they "toss upon a sea of which one half is liquid clay, the other liquid indigo...Such are the blessed and fairy isles we sail to! [Mar 16, 59]

The freshet calms, and the mud settles out, leaving an "undulating blue plain" of lively, tossing blue waves for a mile or more eastward and northward." [Mar 16, 59] "A new season has come." [Mar 16, 59] "The tumult is exciting both [to] see and [to] hear. All sorts of lumber is afloat. Rails, planks, and timber, etc., which the unthrifty neglected to secure now change hands... It blows so hard that you walk aslant against the wind. [Mar 19, 59]

Sailing usually continued for weeks. "Here, where in August the bittern booms in the grass, and mowers march enechelon [sketch] and whet their scythes and crunch the ripe wool-grass, raised now a few feet, you scud before the wind in your tight bark and listen to the surge (or sough?) of the great waves sporting around you, while you hold the steering-oar and your mast bends to the gale and you stow all your ballast to windward. The crisped sound of surging waves that rock you, that ceaseless roll and gambol, and ever and anon break into your boat. [Mar 28, 59]

Sometimes long after the snowmelt, the lakes come back again and a again. During one "violent northeast storm....The meadows are higher, more wild and angry, and the waves run higher with more white to their caps than before this year. This wind, too, keeps the water in the river" by blowing upstream from the north. [Apr 19, 52]

Henry could hardly get enough of the excitement, knowing that it was time-limited. "It is worth the while to hear the surging of the waves and their gurgling under the stern, and to feel the great billows toss us, with their foaming yellowish crests. The world is not aware what an extensive navigation is now possible on our overflowed fresh meadows. It is more interesting and fuller of life than the sea bays and permanent ponds." [Apr 22, 57]

Sailing could be just as exhilarating in May when surrounded by a verdant green landscape.

I found myself in quite a sea with a smacking wind directly aft. I felt no little exhilaration, mingled with a slight awe, as I drove before this strong wind over the black-backed waves I judged to be at least twenty inches or two feet high, cutting through them, and heard their surging and felt them toss me. I was even obliged to head across them and not get into their troughs, for then I could [247] hardly keep my legs. They were crested with a dirty white foam and were ten or twelve feet from crest to crest. They were so black,--as no sea I have seen,--large and powerful, and made such a roaring around me, that I could not but regard them as gambolling monsters of the deep. [MAY 8, 54] [see also May 6, 54]

Waves came in colors. "The water a dull slate-color and waves running high,-- a dirty yellow where they break, --and long streaks of white foam, six or eight feet apart, stretching north and south between Concord and Bedford,--without end. [May 30, 53]

In July, this stormy river mood included the economic devastation of a ruined hay crop. "I see much hay floating, and two or three cocks, quite black, carried round and round in a great eddy by the side of the stream, which will ere long be released and continue their voyage down-stream." [AUG 22, 56] A surprise October storm brought this scene: "A half-dozen boats at the landing were full, and the waves beating over them. It was hard work getting at and hauling up and emptying mine. It was a rod and a half from the water's edge," submerged by the rapid rise. Now was the time to "look out for your rails and other fencing-stuff and loose lumber, lest it be floated off. [Oct 27, 57]

October flood were expected, but caused no harm to the town, "The reign of water now begins, and how it gambols and revels! ...How they [the waves] run and leap in great droves, deriving new excitement from each other! Schools of porpoises and blackfish are only more animated waves and have acquired the gait and game of the sea itself. The high wind and the dashing waves are very inspiring. ... When I turn about, it requires all my strength and skill to push the boat back again. [Oct 27, 57]

In late fall, "we rowed against a very powerful wind, sometimes scarcely making any headway. It was with difficulty often that we moved our paddles through the air for a new stroke. ... We had to turn our oars edgewise to it.... There was quite a sea running on the lee shore,--broad black waves with white crests, which made our boat toss very pleasantly," with a wave height between trough and crest of "fifteen inches." [Nov 11, 53] During night sailing, they could move "rapidly but mysteriously over the black waves, black as ink and dotted with round foam-spots with a long moonlight sheen on one side." [Nov 14, 53]

Early winter waves had ice to work with again: "Dark waves are chasing each other across the river from northwest to southeast and breaking the edge of the snow ice," breaking it up into "what arctic voyagers call "brash," which "carry forward the undulation." [Dec 4, 56]

Aquatic Spring

The boundary between river breakup and river spring flutters back and forth. Black ice forms at night and persists during cold snaps. It then goes away during the day and during warm spells. On and off. True spring on the river is ice free, perhaps with remnant floes still melting in shaded places. True spring is less a mood in itself than a rapid succession of mini-moods between the clear, cold, bright sparkling waters of melted snows to the sluggish, weedy, oily, dusty, iridescent water surface of summer.

A sure sign of spring is when dark water of the middle flows between the sun-reflecting "clear, placid, silvery water" of the sides, flowing between the brown, gray, and russet tones of banks that are not yet leafed out. [Mar 10, 59] "These earth colors, methinks, are never so fair as in the spring... The earth lies out now like a leopard, drying her lichen and moss spotted skin in the sun, her sleek and variegated hide. ...Brown is the color for me, the color of our coats and our daily lives." [MAR 28, 59]

It is a time of falling water, between the peak stage of the annual spring freshet, and the low stage of the spring-fed river in summer, when the level remains fairly constant, a buffered balance of ins and outs. "The river is almost down to summer level there now," Henry wrote on May 1, 1855, "It has fallen about eight feet since February 17. [May 1, 55] Falling water leaves a brown-gray residue of "spray-like foam" where the waves dashed, and "a line of rubbish," wherever transiently rising water reversed direction. Such lines of flotsam "remain throughout the summer to remind the walker how high the water had once been." [Feb 12, 51] Falling water exposes fresh mud to preserve the

tracks of mink, birds, and squirrels which, given enough time, will "make tracks for the geologists." [Apr 29, 59]

It is a time of high wind speeds driven by regional air masses. -- On April 10, 1859, he remarked: "This makes 22 days of windy weather in all reckoning only from the last still days Of these, 11 days have been of very strong & cold NW wind the last, or yesterday, more northerly-- --except the first when the wind was S. W.-- 7 of strong wind & generally NW--& 4 only of moderate wind--[APR 10, 59] The easterly or southerly winds came with rain, northerly and westerly with clearing, cold, and dryness. [Apr 10, 59] The wind can take a variety of forms. On May 1, 1859 to watched "a remarkable whirlwind on a small scale--which carried up the oak leaves from that {Island} copse ...no doubt 5 or 600 feet high at least" [May 1, 59, PJ 64] On March 2, 1860 he watched "strong puffs...spread and diffuse itself in dark fan-shaped figures over the surface of the water. ...drop and spread on all sides at once, and dash off, sweeping the surface of the water for forty rods in [a] few seconds, as if so many invisible spirits were playing tag there.... [MAR 2, 60].

It is a time of great contrasts, especially in heat. March 24, 1853 was " one of those days divided against itself, when there is a cool wind but a warm sun, when there is little or no coolness proper to this locality, but it is wafted to us probably from the snow-clad northwest, and hence in sheltered places it is very warm. [Mar 29, 53] Given the strong thermal contrasts, "The wind has regularly gone down with the sun, & risen again with it. It has been so strong as to interfere with all outdoor occupations." [Apr 10, 59] Some days are quite hot. And others, as late as May 21, was cold enough to " Sit by fires, and sometimes wear a greatcoat and expect frosts." May 21, 55]

It is a time of desiccation, the "drying up the superabundant moisture" of mud season, when the water, trapped above the "hard-pan" of frozen ground makes "a batter of the surface soil." [Mar 31, 59] Once the frost is out of the ground, however, the persistence of cold, breezy, generally northerly and westerly air, is warmed by the strengthening sun, lowering its relative humidity, and becoming a desiccating wind. Dust at this time of year blows from farmers fields from February to April. If early enough, it can ruin the skating by making the ice gritty. [Feb 25, 55]

Gradually overwhelming these physical phenomenon is the resurgence of life. Each year, Thoreau's journal reflects this shift. About mid March, he emerges from his lyrical philosophical winter phase and his chronicle of breakup into a steady rush of botanical and zoological inventories, the first sightings of this or that. The entry from April 7, 1860, in this case motivated by the chorus of spring peepers, is typical:

This is the *Rana halecina* day, --awakening of the meadows...Fishes now lie up abundantly in shallow water in the sun, --pickerel, and I see several bream. What was lately motionless and lifeless ice is a transparent liquid in which the stately pickerel moves along.... he still brown river-bottom, where scarcely a weed has started. Water is yet only melted ice, or like that of November, which is ready to become ice. [Apr 7, 60]

To this list, he adds all manner of arrivals on the river bank, the skunk cabbage blooming, tortoises moving about, alder catkins unfolding, white maple blossoming, and the earliest birds peeping [Mar 3, 51] Cruising along in his boat, "Hundreds of tortoises, painted and wood, are heard hurrying through the dry leaves on the bank, and seen tumbling into the water as my boat approaches. [May 7, 53]] Salamanders, which he called "lizards" could be seen swimming quickly beneath the clear water [Mar 11, 54] with "tortoises on the bottom, a sternotherus among them [May 4, 56] "It is evident that the date of the first general revival of the turtles, excepting such as are generally seen in ditches, i.e. the yellow-spotted, depends on the state of the river, whether it is high or low in the spring. [Apr 1, 58]

The frogs hold their annual orgy, proclaimed by peeping: "It is a singularly emphatic and ear-piercing proclamation of animal life, when with a very few and slight exceptions vegetation is yet dormant. [Mar 31, 57] These peepers, or hylas, could be heard "on two keys or notes...The little croakers, too, are very lively there...great commotion and half hopping, half swimming about...in pursuit of each other," during this mating frenzy. [Apr 3, 53] Watching them gather, he witnessed "a mass of them, five or six inches in diameter, where there are at least a dozen of fifteen clinging to one another and making a queer croaking...The water is alive with them...." [Apr 4, 58] Following sunset on May 6, 1858, he "heard air full of the ring of the toad, the peep of the hylodes, and the low growling croak or sterorati of the *Rana palustris*. ...[403] Each shore of the river now for its whole length is all alive with this stertorous purring. It is such a sound as I make in my throat when I imitate the growling of wild animals....I think that the different epochs in the revolution of the seasons [404] may perhaps be best marked by the notes of reptiles [amphibians]. They express, as it were, the very feelings of the earth or nature. They are perfect thermometers, hygrometers, and barometers. [May 6, 58]

Below the bank is the muskrat, or musquash, " sitting in the sun on the edge of the ice, eating a clam, ...Ever and anon he drops into the liquid mirror, and soon reappears with another clam [?May 7, 53?] In the air are the sound of honey bees drawn to the smell of skunk cabbages in April, [Apr 6, 53] and the sweet fragrance of bass trees in early May. By mid-may, the crickets are background noise. [May 12, 55] .

The river banks were the richest places for bird life, the "general quire of spring." [Mar 12, 54] On April 5, 1855, he noted that "Inland, the groves are almost completely silent as yet." ...[Apr 5, 55] Indeed, birdsong "was the handle by which my thoughts took firmly hold on spring." [Mar 5, 59] The "peep of a robin" is ...so often heard in cheerless or else rainy weather, so often heard first borne on the cutting march wind or through sleet or rain, as if its coming were premature. [Feb 27, 57] Bluebirds and larks. [Mar 13, 51]. Blackbirds [Mar 29, 53] Song sparrows, blackbirds, robins, bluebirds, woodpeckers, and chickadee's adding to the concert." [Mar 22, 55] All their "warbling" best heard in the ' still, sunny hour after sunrise, as rivers twinkle." [Mar 12, 54] With them come the marsh hawks, an aerial case of predator migrating with their prey. [Mar 27, 54]

The water itself becomes "full of fishes, suckers, pouts, eels, trouts,--endeavoring to get up" streams of all sizes . [May 7, 56] This is, in fact, a collision between "The water running down meets the fishes running up." [Mar 20, 58] Taking advantage of high water, gravid fish and fish fry "are dispensing themselves through the fields and woods, imparting new life into them. They are taking their places under the shelving banks and in the dark swamps." [May 7, 56] Each spring, the eel's build their stone heaps, the nests in which their young are protected from predators [May 7, 53] Each year, the sunfish, or bream, build their nests on the sandy bottoms and stand guard above them.

The dead sucker, often a mutilated one, is one of the surest signs of river spring: "I can remember now some thirty years-- after a fashion-- of life in Concord, and every spring there are many dead suckers floating belly upward on the meadows. This phenomenon of dead suckers is as constant as the phenomenon of living ones; nay, as a phenomenon it is far more apparent. [Mar 26, 57] Indeed, the annual migration draws gulls up from the shore, and fishermen with spears coming out from their homes. [Apr 4, 53]

The waterfowl migrations are especially prominent. Flock after flock of Canadian geese, and different species of ducks pass through, resting and feeding on wet meadows *en route*. Other birds use the river corridor as well, if only because it parallels the coast: On Mar 2, 60, he saw "thirty or more crows come flying in the usual irregular zigzag manner in the strong wind, ...going northeast,--the first migration of them, --without cawing. [MAR 2, 60]

The spring mood of the river is incredibly clear and bright because it is leafless. Ever so gradually " Shade is being born; the summer is pitching its tent; concealment will soon be afforded to the birds in which to build their nests." [May 12, 53] Along with the shade comes a dusting of pollen and a coating of airborne seeds, particularly the down of the black willow, which resembles the impossibility of snow accumulating above liquid water. [May 25, 53]

Aquatic plants begin their show, generally before those of the land. Those of the cress family are among the earliest arrivals, often appearing even before the ice is gone. [Mar 2, 59] By mid-March, a "radical greenness" in the water begins "to correspond with that on the land." [Mar 19, 55] May is the time for river plants to remake the look of the river. Yellow lily pads reach the surface in early May [May 7, 53], followed by the white lily. By mid May, the more leafy aquatic plants rooted in the muck begin growing toward the surface, for example: "a myriad of polygonums, potamogetons, and pontederias are pushing up from the bottom, but have not yet reached the surface." [May 14, 53]

Beyond the bank, the meadows have their own sequence. Initially, there is only that "strong, fresh marsh scent wafted from the meadows, much like the salt marshes. [May 1, 55] Then rapid plant growth, with "the greenest and rankest grass" always being next to the river, beginning with the "pipes" or horsetails. [May XX, 53] " When the early grass of the broad meadows takes off with growth they " remind me of flame, as if it were a kind off green flame allied to fire, as it is the product of the sun." [Apr 15, 52]

Summer

The moods of breakup and spring are followed by the summer mood. Its beginning was somewhat arbitrary, depending on the question being asked. Had the last flock of migrating birds gone by? If so, then "summer has suddenly come upon us." [May 8, 57] Or "does not the summer regime of the river begin say about July 1st, when the black willow is handsome and the beds of front-rank polygonum are formed above water?" [Jul 2, 60] Or, "now that season begins when you see the river to be so regularly divided longitudinally into [lily] pads, smooth water, and sparkling ripples between, in a clear day." [Jun 30, 60] Or when "the water begins to feel as warm or warmer than the air when cool. "May 5, 56]

In its summer moon, the river invited boys everywhere to dive into its waters for a good swim, what they called bathing. Water that was sun-warmed at the surface, yet still cool at depth. "Thus we are baptized into nature." [May 27, 57] Henry was one of the few adults who never quit the childhood joy of full-body immersion into the living waters, whether by wading in from the shore, or jumping off a bridge into the deep scour pool. And then, after bathing, to lay down on clean sands and bask, *au naturale*, like a tortoise.

Henry had a variety of swimming places. One was the perfect combination of shade and breeze " under the oak at Tarbell's first shore. It is about as cool a place as you can find, where you get the southwest breeze from over the broad meadow, for it draws through the valley behind." [Jul 11, 56]

Swimming was a daily occurrence of mid-summer and early fall, when the water temperatures were at or above "bracing." Cattle responded to the same schedule, beginning to stand in the water in late May [May 24, 1860]. Henry usually waited until after he'd seen the boys take the lead, which was usually just before the middle of May, [May 8, 57] [May 13, 55]

By July, "bathing is an undescribed luxury. To feel the wind blow on your body, the water flow on you, and lave you, is a rare physical enjoyment this hot day." [Jul 9, 52] "What a luxury to bathe now! It is gloriously hot, -- the first of this weather. [383] I cannot get wet enough. I must let the water soak into me. When you come out, it is rapidly dried on you or absorbed into your body, and you want to go in again. I begin to inhabit the planet, and see how I may be naturalized at last." [Jul 3, 54] Naturalized as an amphibious creature of the river. Like the frog.

Never was the river more inviting than when the terrestrial realm was over-baked. "Furnace-like" is the way he described it on July 7, 1852, when " the railroad men cannot work in the Deep Cut, but have come out on to the causeway, where there is a circulation of air. [Jul 7, 52] "Melting weather," is the term he used in mid-August, 1853, when "hundreds sunstruck in New York. Sultry, mosquito nights." [Aug 15, 53] Locally so

hot that "the pig pants and melts in his pen, and water must be cast on him." [Jul 26, 56] And with air so "still and sultry" that, as late as "6 P.M. even. I cannot even sit down in the pasture for want of air, but must keep up and moving, else I should suffocate." Thermometer ninety-seven and ninety-eight today. [Jul 26, 56] "Almost impossible to pursue any work out-of-doors." The "hottest night" of the year." [Jul 22, 54]

For a few years at least, Henry figured out a way to sojourn and swim simultaneously, taking what he called a "fluvial," or a "water "walk." [Jul 10, 52] He stripped off all his clothes except for his hat, and then walked the center of the Assabet channel, feeling with his toes the squishy mud in one place, a ledge of iron hardpan in another, and rippled sand in between. " Here is a road where no dust was ever known. ...Now your feet expand on a smooth sandy bottom, now contract timidly on pebbles, now slump in genial fatty mud --greasy, saponaceous -- amid the pads...." Jul 12, 52] Keeping company with the shiners and the curious bream. " I wonder if any Roman emperor ever indulged in such luxury as this," he bragged in his journal, "of walking up and down a river in torrid weather with only a hat to shade the head. "[Jul 10, 52]. Walking along, "now in water a foot or two deep, now suddenly descending through valleys up to my neck, but all alike agreeable."[Jul 10, 52]

This could be done only a few days each year: "That the luxury of walking in the river may be perfect it must be very warm, such as are few days even in July, so that the breeze on those parts of the body that have just been immersed may not produce the least chilliness." [Jul 27, 52]

River walking marked the culmination of a process that combined sojourning, fording, and swimming. "I forded the river and, for the experiment, tried swimming with one hand while I held up all my clothes with the other, for a short distance." [Aug 9, 53] Logically, the best alternative was to strip down, leave your clothes on the bank, and do your walking in the river itself. Swimming was also done when boating, when it became too hot to paddle. Intermittent dunkings cooled Channing and Henry down enough to keep the day pleasant.

Summer is a mood of moderately low and smooth and quiet water "confined to the river for the most part." [May 5, 56] And when low enough that forward movement is best done with a pole, rather than a paddle [Jun 26, 56] A time when sailing was chancy, with light but variable winds, caused by local heating. Often, the "water sparkles" only at morning and evenings, "as in the fall and spring." [Jul 1, 54]. Mid-day and mid-night are quiet because the locally generated thermal unrest is at rest. With such stillness, "the air over the river meadows is saturated with sweetness." [Jun 6, 54]

I sail up the stream, but the wind is hardly powerful enough to overcome the current, and sometimes I am almost at a standstill where the stream is most contracted and swiftest, and there I sit carelessly waiting for the struggle between wind and current to decide itself. Then comes a stronger puff, and I see by the shore that I am advancing to where the stream is broader and runs less swiftly and

where lighter breezes can draw me. In contracted and swift-running places, the wind and current are almost evenly matched. [May 17, 54]

Sometimes "my sail so idle that I count ten devil's-needles [dragonflies] resting along it at once." [Jun 13, 54] Sometimes the speed is steady and brisk, announced when "Whole schools of fishes leap out of water at once with a loud plashing, even many rods distant, scared by my sail." [May 28, 54] But "Tumultuous water,--waves running with whitecaps" is unusual, because the gusty winds of thunderstorms seldom last long enough to set the waves running. [Jun 16, 54]

Away from the water, summer is announced by "a tender green on the meadows and just leafing trees." [May 14, 58]. On the bank, "Does not the summer regime of the river begin say about July 1st, when the black willow is handsome...? [Jul 2, 60] Or when the "white maple keys falling and covering the river" from its edge [May 30, 53]

Alternatively, summer in the river is announced by growth from the bottom up: a "new era in the vegetation of the river, the commencement of its summer stage," being signaled when the potamogetons "have just reached the surface of the river and begun to spread out there." [May 28, 60] This dominant aquatic plant and others have been growing up from the "muddy river bottom" not with the rigidity of wooden stems, but with the buoyant tissue of air-filled leaves: "rising toward the surface, first, the coarse multified leaves of the *Ranunculus Purshii*...second, perhaps, in coarseness, the *ceratophyllum*, standing upright; third, perhaps, the *Bidens Beckii*, ...then the *Utricularia* [417] *vulgaris*, with its black or green bladders, and the two lesser *utricularias* in many places. [Jul 18, 56]

Alternatively, we could define the onset from the surface of the water: "Now that season begins when you see the river to be so regularly divided longitudinally into pads, smooth water, and sparkling ripples between, in a clear day. [Jun 30, 60] Looking shoreward from open water, "beyond the pads are the smaller-leaved *polygonum* beds, not yet in bloom; then the *pontederia*, or, perchance (in some places), the marsh cinquefoil; then the meadow-grass, or piles, or sweet flag, or button-bushes, with their lower limbs and stems covered." [Jul 7, 52] Row after row of plants, each adapted to its proper zone. River life is but a series of parallel green lines.

At last, the "season I had waited for is arrived" Jun 16, 54] with the "scent the white water-lily [Jun 16, 54] "How satisfactory is the fragrance of this flower! [Aug 5, 58] ... It is the emblem of purity, and its scent suggests it. Growing in stagnant and muddy [water], it bursts up so pure and fair to the eye and so sweet to the scent, as if to show us what purity and sweetness reside in, and can be extracted from, the slime and muck of earth. [Jun 16, 54] the unalloyed sweetness of the earth and the water [Aug 5, 58]

"The river is now in all its glory, adorned with water-lilies on both sides... [Jul 7, 52] "These pads are to the smooth water between like a calyx to its flower. The river at such an hour... perfectly smooth and lighter than the sky, reflecting the clouds, is a paradisaical scene. ...Are not the Musketaquid and the Assabet rivers of Concord, fairer than the rivers

of the plain? [Jun 22, 53] "A tender place in Nature, an exposed vein....So floats the Musketaquid over its segment of the sphere.," [Jul 4, 52] the floating lilies. "Methinks there is not even a lily, white or yellow, in Walden," the river's counterpoint with its harder, stonier and steeper shore. [Jul 4, 52]

"The *Nymphaea odorata*, water nymph, sweet water-lily, pond-lily, in bloom. A superb flower, our lotus, queen of the waters. Now is the solstice in still waters. How pure its white petals, though its root is in the mud!" [Jun 26, 52] "We now have roses on the land and lilies on the water, --both land and water have done their best,--now just after the longest day. Nature says, "You behold the utmost I can do." [Jun 26, 52]

"The river and shores, with their pads and weeds, are now in their midsummer and hot-weather condition, now when the pontederias have just begun to bloom. The seething river is confined within two burnished borders of pads, gleaming in the sun for a mile, and a sharp snap is heard from them from time to time." [Jul 3, 54] In search of their schedule, Henry took some very early excursions. "I could perceive that the lilies began to open about fifteen minutes after the sun from over the opposite banks fell on them, which was perhaps three quarters of an hour after sunrise (which is about 4.30), and one was fully expanded about twenty minutes later...At 12.30 P.M., I perceive that the lilies in the river have begun to shut up." [Jul 4 52]

"In shallow places the river is for long distances filled, quite bridged over, with the leaves of the *Potamogeton natans*, the direction of whose stems, at least, may show which way the sluggish water is inclined." [Jul 1, 52] "The weeds are now so thick in the river -- *potamogetons*, heart-leaf, *Ranunculus Purshii*, eel-grass, etc., etc. -- as almost to conceal the stream and seriously to obstruct the passage of my boat. " [JUL 4, 53] Even when "the river was high, we pushed through many beds of *potamogeton*, long leafy masses, slanting down-ward and waving steadily in the stream, ten feet or more in length by a foot wide. In some places it looked as if the new *sparganium* would fairly choke up the stream." [Aug 5, 58] They catch my oars and retard the boat." [Jul 12, 54] "These cover the stream so densely in some places that a web-footed bird can almost walk across on them. " [Aug 6, 58] "The *potamogetons* are so thick some places in the main stream that a frog might hop quite across the river on them without getting in over his head. Aug 8, 59 PJ 228.

Specific places have their own habits: "At the clamshell curve, great masses of a kind of fresh-water eel-grass have lodged against the *potamogeton* [300] in mid-channel, as against a shore, half a foot deep and stretch across the river, long, green, narrow, ribbon-like... As storms at sea tear up and cast ashore the seaweeds from the rocks. These are our seaweeds cast ashore in storms." ...[JUN 24, 53] "At Hubbard's bend....three [324] rails have been lodged in different places in mid-channel and have not advanced for a week or more. [Jul 21, 53] "At the Rock, I am surprised to see flags and pads, laying the foundation of an islet in the middle, where I had thought it deep before. Apparently a hummock lifted by the ice sunk there in the spring, and this may be the way in which many an island has formed in the river. [Jul 3, 56] "At Rice's Bend the river [423] is for a long distance clogged with weeds, where I think my boat would lodge in midstream if I

did not more than guide it. The potamogeton leaves almost bridge it over, and the bur-reed blades rise a foot or more above the surface. The water weeps, or is strained, through." [AUG 5, 54]

Mythologically, this is a "river of wailing" or "lamentation" flowing into the Archeron, comparable to the river Styx, and Lethe. "This might be called the Potamogeton River.. [Jul 7, 52] "where you caught a crab at every stroke of the oar, and farmers drove their hay-carts across [AUG 12, 56] One with "weeds which drape and trail form my oars," such that "I am now on foot -- (the potamogeton), as if it were Charon's boat, and this a funeral procession down the Cocytus. [JUL 20, 53]

Even the bottom is paved with fleshy green: "I believe it is the radical [basal] leaves of the heart-leaf, -- large, waved, transparent,-- which in many places cover the bottom of the river where five or six feet deep, as with green paving stones." Jul 13, 53]

The summer mood is

One of early morning fogs, the "summer's vapor bath... a great crescent over the course of the river from southwest to northeast. Already, 5.30 A.M., some parts of the river are bare. It goes off in a body down the river, before this air, and does not rise into the heavens." [Jul 22, 51] Rowing in it was a dream. "I go to the river in a fog through which I cannot see more than a dozen rods, ... As I row down the stream, the dark, dim outlines of the trees on the banks appear, coming in to meet me out of the mist on the one hand, while they retreat and are soon concealed in it on the other. My strokes soon bury them behind me. [Jun 2, 53]

One of dog days and blue haze. "This is a perfect dog-day," he wrote on July 30, 1856. "The atmosphere thick, mildewy, cloudy. It is difficult to dry anything. The sun is obscured, yet we expect no rain. Bad hay weather." Alternatively, he describes the air as "sultry, i.e., hot and cloudy, the air full of mist and here and there misty clouds; and you find yourself perspiring much before you are aware of it." [Jul 30, 56] The river becomes especially inviting at such times: "quite cool, and it is more bracing and invigorating to bathe, though less luxuriously. [Aug 6, 52] During sunrises and sunsets, the "sun's disk is seen round and red for a long distance above the horizon, through the thick but cloudless atmosphere, threatening heat,--hot, dry weather. [Jul 26, 56] Looking westward through the woods, "I see, sleeping and gleaming through the stagnant, misty, glaucous dog-day air, i.e. blue mist, the smooth silvery surface of Fair Haven Pond. There is a singular charm about it in this setting. The surface has a dull, gleaming polish on it, though draped in this glaucous mist." [Jul 31, 56] The soils seem parched, even as the air seems close to dripping wet. "The sky has become a mere fungus. ...Moisture reigns. You cannot dry a napkin at the window, nor press flowers without their mildewing. You imbibe so much moisture from the atmosphere that you are not so thirsty, nor is bathing so grateful as a week ago. [Aug 1, 56] "It is sticky weather, and the air is filled with the scent of decaying fungi." [Aug 17, 58] "This blue haze is not dissipated much by the

night, but is seen still with the earliest light. " [Aug 25, 54] Haze that is cleared by each successive thunderstorm [Jul 1, 54]

One of great thunderstorms that inaugurate summer. " I hear the low rumbling of the first thunder, and now the summer is baptized and inaugurated in due form. Is not the first lightning the forerunner or warranty of summer heat?" [Apr 13, 58] Yes, one that comes up with fury on the water, catching boaters by surprise: " It suddenly began to rain with great violence, and we in haste drew up our boat on the Clamshell shore, upset it, and got under, sitting on the paddles, and so were quite dry while our friends thought we were being wet to our skins.... It was pleasant to lie half an hour close to the edge of the water and see and hear the great drops patter on the river, each making a great bubble; the rain seemed much heavier for it." [Jun 14, 55]

The water surface also changed its clothes in summer. Toward the banks, it is darkening with "shade from the trees on its banks." There, in a leafy wind-shadow it is "smooth to a cobweb, with green shores." [Jun 13, 52] In the center it may be "dark blue or slate," rippled by the wind, and with "whitish water" on the sides, where light has a scattered reflection "on the pads." [Jun 12, 52]

Stagnant water "appears covered with an almost imperceptible blue film," a smooth, almost " unctuous surface," [Jun 3, 54] a " bluish scum ... somewhat stagnant-looking," ... "smooth and full of reflections here and there, as if there had been oil in those rains, which smoothed it." [Jul; 17, 54] [also Jul 20, 54] "Methinks that about this time the waters begin to be more glassy, dark and smooth." [JUL 17, 54]. In early August of 1860, he described one surface as "purplish scum," and another as a " brown scum, somewhat gossamer-like as it lies, and browner still on your finger when you take it up." "What is it?" he asks. "The pollen of some plant? [Aug 2, 60], even as he likely knows what it really is, a thin oxidation precipitate on ultra-stagnant surface water.

"Our river is so sluggish and smooth that sometimes I can trace a boat that has passed half an hour before, by the bubbles on its surface, which have not burst. A swift stream soon blots out such traces." [AUG 3, 56] These bubbles tend to persist at this time of year, likely due to a change in aqueous organic chemistry, [Jun 3, 54] which Thoreau called "viscosity." [Jun 7, 57]

Some days, however, it is covered with "a kind of lint, looking like dust at a little distance [Jun 4, 54], and which undulates on the ripples without breaking," perhaps from "the young leaves and bud-scales." [Jun 6, 55] In the "great eddy" of the Assabet, it gives the swirl the "appearance of having been dusted over. [Jun 4, 57] On June 29, '57, he identified this as " down of the black willow." [Jun 29, 57] Mingled with the dust was "a minute plant abundantly spring from its midst and greening itlike grass growing in cotton in a tumbler. [Jun 29, 57]

After the onrush of spring, animals take a backseat to flowering plants of all sizes. By May 1, 1858, Henry had noticed how the sound of the spring peepers, the hyla, was now missing "what became of the thousands with which the meadows swarmed a month ago?"

[May 1, 1858] Now they were replaced by a chorus of toads so loud that Henry had to shut his garret window in order to sleep. [May 29, 53] My mid-June, even these were gone, and river now "resounds with the trump of the bull-frog" to such an extent the thought that "Bullfrog River," rather than Potomageton River, might make a better name. "As we have 'frog ponds'" why should we not have Bullfrog Rivers, given that Musketaquid is but "one long frog pond." Or why not "Lily River?" Lilies and bullfrogs are salients here, in a way they could not be in faster rivers like the Nashua. [JUN 18, 53]

Toward the end of May and early June, the "shad-flies" came out in such numbers as to darken the evening skies. In 1854, on June 2, "When we returned to our boat at 7 P.M., I noticed first, to my surprise, that the river was all alive with leaping fish... Looking up I found that the whole atmosphere over the river was full of shad-flies. It was a great flight of ephemerae. It was not so when I landed an hour and a half before. They extended as high as I could see. It was like a dense snow-storm, and all (with very few exceptions) flying as with one sense [check previous word] up the stream." [Jun 2, 54] In 1856, it was on June 9, when he saw "many of them coupled, even tripled" and the fishes leap as before." [Jun 9, 56]. IN 1857, it was June 5 that they came out in such numbers as to blacken "every cobweb," and "all freshly painted surfaces are covered with them." [Jun 5, 57]

This was the season when "the mosquitoes encircle my head and torment me." [Jun 9, 54] Thankfully, the bats and birds depend on them for food. A "flock of bank swallows consisting of "over a hundred birds" flew out of a bank on some river bend: "They continually circling about over the meadow and river in front, often in pairs, one pursuing the other, and filling the air with their twittering." [May 23, 54]

"Abundant small dragon-flies of different colors," were creatures of summer, "bright-blue and lighter, looped along the floating vallisneria [eel grass], make a very lively and gay appearance. I fancy these bright loops adorn or set forth the river like triumphal arches for my procession, stretching from side to side." [AUG 3, 56]

June is the month of fireflies. [Jun 7, 58] "The meadows full of lightning-bugs to-night; first seen on the 14th." [Jun 16 60] By midsummer, we have the "creak of crickets," "that fine serene undertone or earthsong ... imparting its own serenity. It is time now to bring our philosophy out of doors. Our thoughts pillow themselves unconsciously in the troughs of this serene, rippling sea of sound.... These rills that ripple from every hillside become at length a universal sea of sound, nourishing our ears when we are most unconscious. [Jun 4, 57] By late summer, the "fine Zing of locusts" becomes "inspiring,"

As the sand hills warm up, the tortoises were out on every sandbank, leaving their double-dotted line of their trackways *en route* to depositing their eggs, the skunks following behind to gobble up as many as they could. [Jun 14, 53] Before learning their official names, he developed his own typology for these tortoises "rough...scented... vermillion (rainbow, rail?), yellow box, black box, and yellow-spotted. [Sep 10, 55]

Floating by like a submarine with its periscope up might be a "great snap-turtle...reconnoitering us" in our boat [Jul 11, 56] Flying by might be a "green bittern.... with a heavy flapping flight, its legs dangling, ... deep slate-blue above, yellow legs, whitish streak along throat and breast, and slowly plows the air with its prominent breast-bone, like the stake-driver. [Jul 30, 56]

By June 21, the water had calmed and clarified enough so that Henry could watch the fish at depth, in once case a bream "poised over her nest," [Jun 21, 60] and in another, two old pouts tending their countless young close to the shore...[story].....there must be a thousand of them at least--is incessantly moving, pushing forward and stretching out. [Jun 21, 54]

Hatched young were everywhere. " Now is the time for young birds," on the river bank. "You cannot go near any thicket but the old will scold at you." [JUN 22, 53]. On the bars, the clams are so thick that you can lift up many with your feet when bathing [Jul 3, 54]. When boating, "young pickerel two or three inches long "flee before me" in shallow and weedy places. Young screech owls sit in their nest, watching my every move. [Jul 10, 56]. Bitterns [Aug 31, 55]

Drought

Dust. Withered grass. Drooping leaves. Parched springs. Crops arrested. Factories shut down for lack of power. These were signs of drought on the terrestrial landscape. The fifth of ten river moods, breakup, stormy seas, spring, and summer in sequence.

Henry spelled it "droughth." A particularly bad one took place in September 1859, just before the water commissioner's returned to Concord for the hearings.

The 7th 8th & 9th--the State muster is held here. The only observation I have to make is that is fuller of dust & more uninhabitable than I ever knew it to be before. Not only the walls fences & houses are thickly covered with dust-- & bushes --but the fields & meadows^{\.} & the pads in the river for half a mile from the village are white with it. From a mile or 2 distant you see a cloud of dust over the town & extending thence to the muster field.... The surface of the roads for [Sep 8, 59, Prince]

In the river droughts translate as deficits in the water economy of the river. Times when the inputs to the channel from rainfall and groundwater drainage fall short of the outputs over the outlet as streamflow and back into the sky as evaporation from the surface, its banks and meadows. Henry described the village scene in September, 1851.

It is remarkably dry weather. The neighbor's wells are failing. The watering places for cattle in pastures, though they have been freshly scooped out, are dry. People have to go far for water to drink, and then drink it warm. The river is so

low that rocks which are rarely seen show other black heads in mid-channel. [SEP 21, 51]

"Silent are the watercourses," where "tinkling is normally heard." [Aug 31, 54]. Brooks flowing one day would find themselves dry the next, as local water tables continued to fall. Even the outlets of ponds go dry, most notably that Flint's Pond, which trickles all year for all but the rarest years. [Aug 31, 54] "Millers have not water enough to grind their grists. [Oct 15, 57] Factories have to shut down. On Nut Meadow Brook, "Sam Barrett tells me on the 19th that he has so little water that he has raised his gate only 3 or 4 times for a fortnight." Ditto for the factories of "Damon & Warner's" on the more powerful Assabet, "whose gates affect the river most here." [Aug 14, 59, Prince]

During droughts, the parching hot days are often windless. Sailing was pointless, even on wide reaches. Elsewhere, on shallow reaches, rowing became nearly impossible because the threads of flow narrowed, and the water shrunk to less than the depth of an oar. Pushing the boat with a pole was now preferred, provided you stay away "snags and water-logged trunks" and rocks in the bottom of the channel previously unseen. [Oct 11, 57] Sometimes, even in the main stem of the river, there was no choice but to get out and walk, pulling your boat behind you, whether over a mass of weeds, or sharp-edged clams.

Being cupped in a bedrock basin however, the deeper reaches of the Musketaquid never went dry. Rather its local surface fell asymptotically to the bedrock bottom of the outlet at the Fordway. Flow might diminish to a trickle, but could never stop until the last drop was drained from the deepest aquifer.

On the meadows, the water deficit meant liberation and death. Liberation for the sojourner who could now walk where a boat was needed before, to "walk where in ordinary times I cannot go." [Aug 22, 54] In fact, "we can walk across the Great Meadows now in any direction. They are quite dry. Even the pitcher-plant leaves are empty." [Aug 18, 54] Along the way, however, one noticed the thousands of pools being dried up in places where overflow ice had later been drowned and floated upward, taking with it a patch of the meadow. In such pools, the frogs could burrow downward, and the insects estivate. But the fish had nowhere to go. "In one little muddy basin where there was hardly a quart of water, caught half a dozen little breams and pickerel, only an inch long.... Hundreds, if not thousands of fishes have here perished on account of the drought." [Aug 22, 54]

They became easy pickings for the carnivorous waterfowl such as the herons, bittern's and stakedrivers who could stand still and eat their fill of wriggling fish. Gulls flew up from the ocean. Crows came down from the woods. "Saw a blue heron... Here was a rare chance for the herons to transfix the imprisoned fish. It is a wonder that any have escaped." [Aug 22, 54] With continued lowering the last fish gasp for death and begin to rot, adding the smell of aquatic carrion to that of the sulfurous, rotten-egg smell of hydrogen sulfide being released when the bacterial respiration switches to anaerobic. Sediment at the bottoms of countless small pools desiccate, becoming "cracked into a sort

of regular crystals." [Aug 28, 54] When loosened, the featherweight brown dust spreads widely throughout the valley.

With progressive drought, the entire surface of the meadow --not just the pools-- can become firm and hard enough for a "regimental muster," provided the grass was scythed low. Soon the meadows would break up in vast polygons of vertical fissures, resembling in pattern those on the alkaline dry lakes of the hyper-arid west, or the ice-wedge polygons of permafrost regions, all from the same ultimate cause: horizontal shrinkage on a vast scale. At greater depth the fissures would reach the ancient lakebed on which the marshes were created. The basal peat would lift up and curl. Then the strata of clay. Meanwhile, organic dust was everywhere.

When dry enough, the dust from the meadows and fields and roads blew over the river, coating the pads. In early September, 1859, the State regimental muster was held in Concord. With all that trampling, it was "fuller of dust & more uninhabitable than I ever knew it to be before," and the "pads in the river for half a mile from the village are white with it. [Sep 8, 59, Prince]

Smoke was added to that dust, when farmers burned their meadows, which they did to "burn out the moss" or the shrubs, hoping that grass would come back in its place. [SEP 19, 51] Once started, these fires would often burn out of control, turning the peat to ash, lowering the surface, and thereby increasing the local wetness. In Thoreau's witness: "Saw a meadow said do be still on fire after three weeks; fire had burned holes one and a half feet deep; was burning along slowly at a considerable depth." [Aug 31, 54]

Below the meadows, the water kept falling in the main channel. Miles of lily pads bordering both sides of the rivers found their tethers loosened. After leaning downstream or downwind, when the river dropped below the bars and banks, they fell in a twisted heap to either rot or dry in place. There was a fall as well, not of leaves, but of whole plants. Mud on the exposed bars would then crinkle and crack into miniature polygons like their counterparts in the meadow pools. Filamentous green algae growing on the banks became pasted against them: "muddy shores are covered here and there with a sort of dark-brown paper, the dried filaments of confervae which filled the water. Now is their fall."

Sunfish nests, normally on the bottom, are left "high and dry," [Jul 29, 59] the snails that crawled into them dying inside. [Jun 21, 53] The life that remains migrate inward and downward to deeper water. most notably the clams. [May 2, 60].

Blue Chain of Lakes

"I think our overflowing river far handsomer and more abounding in soft and beautiful contrasts than a merely broad river would be. A succession of bays it is, a chain of lakes, an endlessly scalloped shore, rounding wood and field." [Apr 16, 52] A chain that

comes in two moods, one stormy and gray; the other blue and tranquil. Either may happen at any time of the year. In spring or late fall they reflect russet hills. In summer lush green. In winter, snow white.

What's bad for the cool-weather teamster is good for the navigator when the roads are submerged. What's worse for the mower is even better for the navigator when the flowers are covered.

"There is the magic of lakes that come and go. The lake or bay is not an institution, but a phenomenon. You plainly see that it is so much water poured into the hollows of the earth." [Mar 16, 59] These bodies of water last up to a month's duration, long enough to forget what it's like when they aren't there. Seen now from the same side with the westering sun, it looks like a dark-blue liquid like indigo poured in amid the hills, with great bays making up between them, flooding the causeways and over the channel of each tributary brook." [May 6, 54] "This dark-blue water is the more interesting because it is not a permanent feature in the landscape." [May 6, 54]

Under normal circumstances, "we are stiff and set in our geography because the level of water is comparatively, or within short periods, unchangeable." Then "we look only in the sea for islands and continents and their varieties." But here in Concord, we can look forward to "more subtle and invisible and fluctuating floods which *island* this or that part of the earth whose geography has never been mapped." Mar 17, 59]. "A new feature is being added to the landscape, and that is expanses and reaches of blue water. [Mar 12, 54].

In April or November, the meadows become "reservoirs of dark indigo amid the general russet and reddish-brown and gray. [Nov 14, 53] [Apr 9, 59] Between May and August, flooding creates a sea of many colors with islands of "green hills rising out of it" one that may be "dark-blue, clay, slate, and light-blue, as you stand with regard to the sun. With the sun high on one side it is a dirty or clayey slate; directly in front, covered with silvery sparkles far to the right or north, dark-blue; farther to the southwest, [242] light-blue. My eyes are attracted to the level line where the water meets the hills now, in time of flood, converting that place into a virgin, or temporary shore." [May 7, 54] Especially when that shore is reddened by the flotsam of a cranberry crop, raked but not picked. [Oct 31, 53]

Let the wind die down, the froth bubbles burst, the brown sediment settle, and the yellow river tea clarify, and the stormy inland seas of the spring freshet transform itself into a placid and brilliantly reflective chain of sky blue lakes far more suitable for paddling (rowing) than for sailing. So still and so deep is the water at such times that red cranberries and blooming flowers decorate a bottom being cruised by pickerel. Five miles of open water can be seen in a single reflection of the Carlisle reach when seen from the right angle.

On April 24, 1852, a popular river-side prominence named "Ball's Hill and the rest are deep sunk in the flood. The level water-line appears to best advantage when it appears

thus to cut the trees and hills. It looks as if the water were just poured into its basin and simply stood so high. No permanent shore give you this pleasure. [Apr 24, 52] "There is no strand, -- nothing worn; ... It does not beat, but simply laves the hills. [May 7, 54] In places the strand is ""so reddened with cranberries that I perceive them fifteen rods off, tingeing it. [Nov 20, 53] Like a meniscus, it "kisses" the shore with a tremulous surface, creating a shore that is an "inexpressibly soft curving line." [Mar 23, 59] "a shore where there are no shore marks," but instead one that is "abrupt and surprising." [Mar 17, 59]]

Another pleasant oddity is glass-bottom-boat view. One might look down to see pickerels waiting in ambush next to daffodils. Or "fields of potatoes and rye beneath still waters." [Mar 16, 59] In Miles's swamp, they could "paddle right over ... cow-slips in full bloom ; their lustre dimmed, they look up with tearful faces." [May 7, 54] Looking at the blue lakes from through the forest, it becomes "a thousand little vistas," an ... "intimate mingling of wood and water." Using "our imagination," we "may navigate" those parts of the waters that are "concealed." [Nov 6, 53]

Under the deep blue flood, "the Great Meadows are covered... expanded to a large lake, the shore-line being ... the sides of the hills reflected in it. It was a scene worth many such voyages to see." [Apr 15, 55] When flooded, the valleys of tributaries entering each lake of the chain become "deep and narrow 'fjords'" [Mar 16, 59]

And of course, the waters a "smooth and full of reflections, [Apr 15, 55], and colored "with a far deeper and more exciting blue than the heavens." [Apr 9, 56] Fair Haven Pond becomes "Fair Haven Lake, undistinguishable from fallen sky." [Jun 11, 51] In such a mood, "The great phenomenon these days is the sparkling blue water, --a richer blue than the sky ever is. The flooded meadows are ripple lakes on a large scale. ...[a]... copious living and sparkling blue water of various shades. It is more dashing, rippling, sparkling, living, this windy but clear day; never smooth, but ever varying in its degree of motion and depth of blue as the wind is [173] more or less strong, rising and falling. [Mar 2, 60]

Each high water leaves a mark, flotsam of whatever was floating. When the farmer is haying, it's hay cut loose, lifted, up, and floated to shore. In spring, it's the residue of winter: "an endless meandering light-brown line, further from or nearer to the river.... I love to see it even in midsummer, ... reminding me of the floods and the windy days of the fall and spring, of ducks and geese and gulls, of the raw and gusty days which I have spent on the then wilderness of water, of the origin of things, as it were, when water was a prevailing element." [Nov 7, 53]

"Methinks this rise of the waters must affect every thought and deed in the town. ... I trust there will appear in this Journal some flow, some gradual filling of the springs and raising of the streams, that the accumulating grists may be ground. A story is a new, and in some respects more active, life in Nature. ... [Oct 26, 57]

Autumn Aquatic

On September 24, 1854 Henry went "graping" to harvest the bowers of luscious grapes hanging over the water, fermenting on the vine. To harvest them, he needed only to paddle his boat beneath them and snip away until he literally have a boatload of purple food. This was one of the surest signs of the aquatic autumn, which preceded the autumn on land by as much as a month, "I should say that the vegetation of the river was a month further advanced in its decay than of the land generally. [Sep 17, 52]

The Aquatic autumn begins during the dog-days of the terrestrial summer, during which there is scorching heat, violent thunderstorms, and dust. Almost magically,

the water is suddenly clear, as if clarified by the white of an egg or lime. I think it is because the light is reflected downward from the overarching dog-day sky... All the secrets of the river bottom are revealed. I look down into sunny depths which before were dark. The wonderful clearness of the water, enabling you to explore the river bottom and many of its secrets now, exactly as if the water had been clarified. This is our compensation for a heaven concealed. [Jul 30, 56]

The river becomes "so clear & sunny" that it's "better than any aquarium." Traveling by boat, either "standing up & pushing gently up the stream or floating yet more quietly down it-- I can in some places, see the secrets of 1/2 the river & its inhabitants---familiar bream with the dusty light reflected from its fins--the vigorous-looking perch--(tiger like among fishes)--....motionless pickerel--with reticulated back & sides--as it were the seed vessel of a water plant --eyes set far back--enchanters wand.... The weeds are as indispensable to the fishes--as woods & shrubbery to us... The Potamogeton...growing in dense beds under water...like a bed of brown & muddy ostrich feathers--alternating with darker beds of *Bidens Beckii*....the potamogetons are so thick some places in the main stream that a frog might hop quite across the river on them without getting in over his head. Aug 8, 59 PJ 228

The season has now arrived when I begin to see further into the water--see the bottom--the weeds--& fishes--more // than before-- I can see the bottom when it is 5 1/2 feet deep even--see the fishes esp. the perch, scuttling [142] in & out amid the weeds-- Has this clarity anything to do with the greater sluggishness of the water when low? Perhaps you can see furthest into the most sluggish water." [Jul 28, 59] This could indeed be the case, if the water is stagnant to the point where its nutrients are all sopped up by the larger plants, stunting algal growth. Or "perchance the increased stagnancy of the river at this season makes the water more transparent--it being easier to look into stagnant [148] water--than when the particles are in rapid motion." [Jul 30, 59]

And then begins an autumn where the leaves don't flame with pigment, as on the land, but rot in place until they become so soft they disintegrate to mush and flow downstream, rather than harden to crisps and flutter downward to the ground. "Inbrowned" was the word he used.

"First, the two varieties of yellow lily pads begin to decay and blacken.... Second, the first fall rains come after dog-days and raise and cool the river, and winds wash the decaying" weeds "to the shores and clear the channel more or less [Sep 24, 54] Alternatively, the "river weeds" begin to rot and become loosened when "the water rises, the winds come, and they are drifted to the shore, and the water is cleared. [Sep 5, 54] By mid-September, "the weeds in midstream have generally disappeared, washed away or drowned. [Sep 14, 54]

With cooler temperatures, the fall rains come, evapotranspiration slows, and more water finds its way into brooks and streams. "Mill-wheels that have rested for want of water begin to revolve again. " [Aug 26, 59] The surface of the water is changed as well, becoming less unctuous, and bubbles do not "readily form on the water, and soon burst, probably on account of the late rains, which have changed its quality. There is probably less stagnation and scum. It is less adhesive." [Sep 4, 54]

The wind regime changes. With cooler surface water and warmer banks, the wind now rises " in the middle of the day, blowing [448] hardest at noon, -- quite hard, -- but went down toward night." [Aug 16, 54]

By later September, there is a chill in the air, especially above the water, especially during mid-day, and "the river is getting to be too cold for bathing." [Sep 26, 51] Sensing this, the clams are "now moving into deep water [Sep 27, 55] The water temperature drops, even when there is no rain, or perhaps because of this, because there is proportionately more flow from deeper groundwater. [Aug 14, 54]

Freeze-up

With the autumn leaves flamed out, fallen, and either floated away or sunk, the mood of the river mood became one of anticipation. Of waiting for that first freeze, which always took place on the stillest water, always to Henry's surprise.

Freeze-up strikes with black crystalline beauty. Within thin sheets of "black ice are the most beautiful crystals." A "remarkably coarse crystallization [Dec 9, 56]. In one place "single-crystal spears up to six feet long, narrow and sharp. " In another "gossamer threads...beyond conception" [Jan 2, 53]. In yet another, a "surface being starred with great raised rays as thick as you thumb and several feet long, as it were the beginning of a bony [174] system...[Dec 9, 56] Crystals "oftenest that of low, flattish, three-sided pyramids," within which were small and perfect pyramids, the largest with bases equal to two or three inches." [Dec 9, 56]

These were "shooting crystals," because they shoot inwards from the edges toward the centers, so thin that they can be seen only under certain light conditions. Once solid, they give "the appearance of broad fern leaves, or ostrich-plumes, or flat fir trees with

branches bent down." [Dec 9, 56] Rosettes. Sometimes the crystals formed tessellated mosaics like that of a tile floor. When skating with the sun low, Henry saw them "reflected from the surface of the ice, flakes of rainbow somewhat [120] like cobwebs, where the great slopes of the crystallization fall at the right angle, six inches or a foot across, but at so small an angle with the horizon that they had seemed absolutely flat and level before." [Feb 12. 54]

A mood of clean cold beauty! Diametric to the suffocating, panting heat of the dog days of summer when the world was humid hazy green.

This is "virgin ice" [Dec 13, 57] When coating the river a "transparent" "black ice," a superficial "glaze." When laden with suspended sediment, the color is a translucent gray brown. When bubbly, it's white. When "snow ice," it's gray.

Sometimes a watery slush of crystals floated by, "looking like dark ripples in the twilight and grating against the edges of the firm ice" [Dec 8, 53] before coming to rest and freezing in place. Sometimes this slush had crystallized within the water as frazil ice. Elsewhere it was slush composed of snow, perhaps floated off by rising water. Or snow falling on super-cooled water with too little heat to melt it. "When I crossed the river on the roughish white ice," in early December, "there were coarse ripple-marks two or three feet apart and convex to the south or up-stream [drawing]" presumably blown that direction by the wind" before the stiff slush froze in place. [Dec 6, 1856]

Freeze-up is a mood of back and forth. With ice freezing, and then melting, by day and night, as with frost. Or week by week, as one weather system replaced another. In streams it commences with small patches of "ice by the side of brooks" [Nov 23, 50] clinging to the edges, a delicate fringe of shelf ice, marbled by bubbles. "On the meadow" where the water "stands virtually still," it freezes "to a whitish light, like a sliver plating." Or, when stained by the organic tea of river sediment, frozen overflows create "a discolored yellowish and soft ice." [Dec 17, 56] Thick pure ice when "settled of all its sediment, and drained of all its life, freezes a deep indigo blue." [Nov 25, 53]

Wide spots first, where the current is slackest. "These expansions of the river skim over before the river itself takes on its icy fetters." (Nov 25, 1850). "There is a thin ice for half a rod in width along the shore," he wrote in late November, "which shivers and breaks in the undulations of my boat." "A black river with a fringe of black ice." [Nov 25, 59]

From the edge, the freezing front moves outward like an advancing glacier, attempting to close the channel. It becomes contest for the middle, a tug 'o war between atmospheric cold pulling one way and aqueous heat pulling the other "Each day at present, the wriggling river nibbles off the edges of the trap which have advanced in the night. It is a close contest between day and night, heat and cold." [Dec 4, 1856]

The Assabet, flowing more quickly, freezes long after the Sudbury to become "a beautifully smooth mirror within an icy frame." [Dec 14, 54] Looking inward from the

shore, " your eye slides first over a plane surface of smooth ice of one color to a water surface of silvery smoothness like a gem set in ice...." [Dec 14, 54]

Continued freeze-up takes place in a series of parallel lines, sometimes so clear they resemble tree rings [Feb 15, 60] The snow ice of the edge, the yellowish ice of the overflow, the "new dark smooth ice" of the middle, and over the widest spots in the lake-like reaches, "a thick fine gray ice, marbled." [Dec 19, 54] Sometimes the river freezes as foam, creating a "rough, flowing, scaly mass.... frozen into a kind of batter, like mortar, or bread that has spewed out in the river," typically "where water has oozed out at the sides." [Jan 4, 57]

Near the end of freeze-up however, some patches remain open year after year. Why? In places it's where the flow is accelerated by a bridge, or "where a brook comes in," Others defy explanation. It is heat from below? Shade from above? An unseen current? Access to the wind? Or all of the above.

Thin sheets, once formed, flex with the waves, producing fascinating undulations. If they break the ice, the undulations can be heard as the "sound of the undulations" [Dec 3, 53] before they freeze into a mosaic of beauty, [Nov 11, 53] or to a hash of fragments piled once against the other. Even if unbroken, thin sheets are rapidly cracked, and covered with hoar. The glaze doesn't last. Heating and cooling, cracks the ice. Sleet might make the ice "hobbly like a coat of mail or thickly bossed shield." [Dec 8, 54], ruining the skating.

Black ice is dangerous because there's no way to determine its thickness, and therefore its strength. Fortunately, it is quickly cracked, allowing the walker or skater to judge its thickness. Three inches will confidently support the walker, even over the deepest water. When barely strong enough to bear weight, it flexes up and down as one walks, a rubbery feeling.

The first ice supports snow, which instantly covers black ice with a crystalline white powder. Walking over this "dust of diamonds" [Feb 13, 59] creates great rays the color of rainbows separated by an angle of about sixty degrees. Walking elsewhere on black ice, one might see "richly marked...large whitish figures suggesting rosettes of ostrich-features or coral...a sheaf of feathered arrows five or six feet long...a black floor divided into polygonal segments..." [Dec 13, 59] Dazzling display of crystals while walking.

Now the contest is not from edge inward, but for the vertical dimension. Each snowfall adds weight, which pushes the ice down, which saturates the snow, which freezes to produce "snow ice." A subsequent rise of the river might flood that snow ice and freeze in place as a clear pane over translucent snow ice. River ice becomes complexly layered, frozen upward as snow ice sandwiches, and downward into the channel.

Winter Fade to White

"It is surprising how much room there is in nature," Henry famously wrote, "if a man will follow his proper path. ... I enjoy the retirement and solitude of an early settler.... and yet there may be a lyceum in the evening, and there is a book-shop and library in the village, and five times a day I can be whirled to Boston within an hour." This was a quote from a river sojourn in mid-winter, all of the landscape was buried together under a blanket of drifted snow. [Jan 26, 53]

Indeed, "not till winter do we take possession of the whole of our territory. I have three great highways raying out from one centre, which is near my door. I may walk down the main river or up either of its two branches. Could any avenues be contrived more convenient? [Feb 13, 59]

It's also a world without the need for bridges, [Feb 9, 51], so one may take a bee-line to wherever one wants to go. Once solidly frozen, it's as safe as dry land, and one is "not compelled to walk in the tracks of horses." [Feb 13, 59] [Jan 5, 56]

The river is thus an advantage as a highway, not only in summer and when the ice is bare in the winter, but even when the snow lies very deep in the fields. It is invaluable to the walker, being now not only the most interesting, but excepting the narrow and unpleasant track in the highways, the only practicable route. The snow never lies so deep over it as elsewhere, and, if deep, it sinks the ice and is soon converted into snow ice to a great extent. ...Neither is it drifted here...Here, where you cannot walk at all in the summer, is better walking than elsewhere in the [122] winter. [JAN 20]

Meadows that were lush green and scythed for sweet-smelling fodder, now present "a very wild and arctic scene...a sea of white waves of nearly uniform shape and size," ...oval hollows" with a "regular reticulation," resembling those of the sea, but standing cold and still. [Feb 2, 60] The Great Meadows have become "a broad level plain, roughened only by snowy waves, about two miles long and nearly half as wide. Looking back over it made me think of what I have read of Arctic explorers traveling over snow-covered ice. [Feb 7, 54] "It is such a scene as Boothia Felix" in the Canadian arctic archipelago, "may present." "How glorious is the perfect stillness and peace of the winter landscape!" [Dec 31, 54]

Where liquid water once rippled, solid water ruptures with belches and booms. [Dec 20, 54] Like the crust of the earth, it moves over a softer center.

On December 27, 1853, Henry sojourned to "Fair Haven Pond up meadows and river. The snow blows like spray, fifteen feet high, across the fields, while the wind roars in the trees as in the rigging of a vessel. It is altogether like the ocean in a storm....drifting it

builds out eaves to the bank of razor sharpness. [Dec 27, 53] All three combine to form "one great wintry-looking field, whose surface consists of great wave-like drifts. [Feb 6, 54] "The river is now so concealed that a common eye would not suspect its existence." [Jan 21, 57] Indeed, the river is no more., if one cannot tell when one is on it. [Feb 9, 55]

The analogy, of course, is that a life is no more, if one cannot hear its heart beat.

Wading through the snow in a downriver direction, "in the face of the cutting northwest wind and driving snow-steam. Our tracks are obliterated before we come back. How different this from sailing or paddling up the stream here in July, or poling amid the rocks! Yet still, in one square rod, where they have got out ice and a thin transparent ice has formed, I can see the pebbly bottom the same as in summer." [Feb 3, 56]

This was a window to a different world, on the other side of liquid life.

The snow is not all white. Depending on the light, reflections and absorptions give rise to a "pink light" here, and a "dark indigo blue" there. [Jan 2, 55] Ice isn't all clear either. It may be black when transparent on water, white when bubbly, yellow when overflowed, and a "vitreous green, as if seen through a junk bottle," when the ice is pure and the sun low on the horizon, [Jan 31, 59] [Dec 30, 55] becoming "greenest when the sun is twenty or thirty minutes above the horizon [Dec 29, 59]

Indeed, the ice forms thickly when the temperature plummets. On the night of February 6, 1855, the mercury in the Thoreau thermometer plunged into the bulb, and the neighbor Smith's thermometer fell to twenty-six below zero on the Fahrenheit scale. That night there were seismic shocks as "the ground cracked in the night as if a powder-mill had blown up, and the timbers of the house also. ...Must leave many buttons unbuttoned, owing to numb fingers. Iron was like fire in the hands. ... The cold has stopped the clock. Every bearded man in the street is a gray-beard. Bread, meat, milk, cheese, etc., etc., all frozen." [Feb 7, 55]

In the next year, January 25 was "the hardest day to bear," with "a strong northeast wind. ...No man could stand it to travel far toward this wind. It stiffens the whole face, and you feel a tingling sensation in your forehead...[Jan 25, 56] Precisely on year later, Smith's thermometer fell even lower, to -30 degrees Fahrenheit." [Jan 24, 57]

At times like these, the Concord River literally turns into dry land, albeit composed entirely of the mineral ice. "What a solid winter we have had! No thaw of any consequence; no bare ground since December 25th." [Mar 18, 56]] "Frozen solidly for seven weeks." [Feb 27, 56] "Elijah Wood, Senior, about seventy, tells me he does not remember that the river was ever frozen so long, nor that so much snow lay on the ground so long. [Mar 27, 56] This solid ice-land responds to physical stress very much the same way our silicate crust does: seismically. "The ice cracks suddenly with a shivering jar like crockery....And I notice, as I sit here at this open edge, that each time the ice cracks, though it may be a good distance off toward the middle, the water here is very much agitated. [Dec 28, 58] Those agitations result from seismic waves traveling through the

ice to its edge, or to pressure waves traveling through the water from the site of rupture. Both are likely.

"Who would have suspected that so large and cold and thick-skinned a thick to be so sensitive?" This famous line from *Walden*, leads us to believe that this observations was made there. No. The source, was Fair Haven Pond, where the seismic waves, felt or unfelt, can travel through many miles of continuous ice upstream or downstream. [Feb 12, 54] Indeed, there's always a stream below.

In some years, however, winter never seemed to come, for example 1852-53. "The ground has been bare almost all the time, and the river has been open about as much. I got but one chance to take a turn on skates over half an acre...I doubt if there has been one day when it was decidedly better sleighing than wheeling. [Mar 24, 53]

"We do not commonly distinguish more than one kind of water in the river, but what various kinds of ice there are! [Jan 31, 59] Indeed, river ice is not one thing but many. The ice stratigraphy on February 8, 1856 was "seven inches of snow, nine inches of snow ice and eight of water ice....The water rises to within half an inch of the top of the ice." [Feb 8, 1856] Snow needs no definition. Snow ice is snow saturated with water and then frozen. Water ice is that which thickens from the bottom downward. What he called "graphic ice" is a mosaic of crystal faces and fractures. [Jan 26, 59] Marble ice is snow, saturated from above by rain, floated slightly away, and then refrozen with a capping glaze [Jan 31, 59] At Barrett's Pond, Henry identified ten different downward freezings from cold nights in about fifteen inches of ice. [Jan 10, 59]

After a deep freeze, the river can rise and fall. On the way up, the ice is lifted above the channel, but not where it is anchored to the bank, creating a flat ridge, rifting it along the edges, and allowing some of the yellow water to bleed out and re-freeze. On the way down, the flat ridge can become a low valley as the ice sags deeper into the channel than where it started, making the bank appear higher than normal. And to the bank is attached "a shelf of ice -- what arctic voyagers call the ice-belt or ice-foot ... adhering to the walls and banks at various heights, ...It is often two or three feet wide and now six inches thick" as of January 1, 1857. [Jan 1, 57]

Even in the coldest winter, there are ice openings. Perhaps "a black artery here and there concealed under a pellicle of ice." [Dec 8, 54] Certainly near the piers of bridges, or immediately downstream where the flow is fastest. [Dec 19, 54] [Perchance "where perchance warmer springs come in" [Dec 14, 1851] Or perhaps where the flow, being shallow, is too swift to freeze. [Jan 24, 56] Or perhaps where the flow, turning a corner and rising up from the bottom in a helix, eats away at the ice from below [Dec 28, 59] In late December of the river survey, Henry identified persistent openings as part of his investigation. [Dec 28, 59]

The full winter mood is not the kiss of death for animal life, but the time of hibernation. "I do not this moment hear an insect hum, nor see a bird, nor a flower." he wrote near the end of January in 1856. The Great Meadow, "That museum of animal and vegetable

life...is now reduced to a uniform level of white snow, with only half a dozen kinds of shrubs and weds rising here and there above it. [Jan 20, 56] There is life beneath the ice, but it's a tenuous life spent waiting for the oxygen supply to diminish. Winter kills take fish that float up each spring.

In mid winter, one can build a fire on the ice with "fat pine" right in the middle of the channel, the snow melting and sizzling on the way down.

