Ice Out at Crystal Lake
Newton, Massachusetts

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Crystal Lake Conservancy

"The most popular sport on Crystal Lake is skating. On the clearest and crispest of winter days good ice brings out hundreds of skaters to enjoy the exhilarating and healthful exercise… Exciting games of hockey add to the zest, and sometimes an ice boat goes skimming by. In the frosty night air, the sport grows merrier and the skaters are braced up to their best efforts."

Sketch of Crystal Lake, 1911

Ice Out at Crystal Lake

By Srdjan S. Nedeljkovic
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The time at which the ice melts from northern lakes is a significant marker of passage from a long winter season to an invariably short spring and summer. Historically, the dates of freezing of lakes in New England have been memorialized since activities such as ice fishing, ice skating, and passage by snowmobile depend on a solidly frozen lake. In the spring, boating and fishing season often begins with ice out of the lakes. In some parts of Maine, logging companies kept records of lake ice, as did farmers and other locals, with continuous records available dating back to the mid 1800's. Transportation on some lakes in northern New England, such as Moosehead Lake in Maine and Lake Winnipesaukee in New Hampshire depends on the date of ice out in the spring. For New Hampshire's Lake Winnipesaukee, the actual definition of ice out is based on the ability for a ship to travel across the lake, as ice out is declared when the M/S Mount Washington cruise ship can travel safely between her ports in Center Harbor, Weirs Beach, Alton Bay, Wolfeboro and Meredith. On Lake Winnipesaukee, ice out has come as early as March 18 in 2016 and as late as May 12 in 1888. The average date of ice out is around April 20, and in 2022 ice out was declared on April 8. In 2023, "ice-in" was not declared until February 5th, which is probably the latest on record.

Dates for ice out are often variable in New England and other northern parts of the United States. The date at which lake ice thaws can depend on the size of the body of water, its depth, and other factors of geometry. There can be large differences in ice out dates of even nearby lakes due to these factors. In addition, the definition of ice out may be inconsistent. Some consider ice out to be the time when one can navigate a lake from point A to point B. Others will say that ice out occurs when the lake is 90% ice free, and yet there are some who consider ice out to be only when all of the ice has left the lake. In some parts of the country, the locals will consider ice out as occurring when an object like an old junk car falls through the ice. This was a known way to define ice out in Minnesota, especially in the earlier part of the 20th century (5). Obviously, a "car through the ice" definition of ice out will result in an earlier reported date than using the criteria of a lake being "100% ice free."

Crystal Lake and its characteristics

Newton's Crystal Lake is a 33-acre "great pond" located about 10 miles west of Boston Harbor and the Atlantic Ocean. A "great pond" in Massachusetts is defined as any pond or lake that contained more than 10 acres in its natural state. The location coordinates are 42.32 degrees north latitude and 71.20 degrees west longitude. The elevation of Crystal Lake is approximately 141 feet above sea level. In American colonial times, the name of this lake was Wiswall's Pond. In the 1800's, the lake was one of three lakes in Newton used for ice harvesting, along with Bullough's Pond and Chandler Pond. Known in the mid 1800's as Baptist Pond, the lake had another name change to make the ice of the lake

more attractive for sale for refrigeration, and the name was changed to Crystal Lake. The total volume of water in Crystal Lake is about 142 million gallons and the lake is 31 feet deep at its deepest point. It measures about 1200 feet from north to south and 1000 feet from east to west. The circumference of the lake is about one mile. The sources of water for Crystal Lake are rainwater and subterranean sources, which make the lake virtually one large spring. As for its outlet, there is a brook that passes under the railroad tracks east of the lake and then goes in a culvert on the south side of Paul Street. The brook then passes under Parker Street, Jackson Street, and Boylston Street, joining another brook at the Great South Meadow. From there, the water drains westward into the Charles in Newton Upper Falls, from which it flows to the ocean (4).

For Newton's Crystal Lake, ice out can be defined as when the Lake is free of ice such that a dinghy can travel across open water between Cronin's Cove, Levingston Cove, the Gil Champagne Bathhouse, and then back again to Cronin's Cove.

Ice out dates for certain northern areas

In northern Minnesota, the lakes continue to have ice often into May. One of the last lakes to ice out in Minnesota is Gunflint in Cook County, which has a latest date of ice out on June 3, 1936. The earliest date of ice out at Gunflint is March 23, 2012, with a median ice out on May 6. Gunflint's average ice out date is the among the latest median ice out for all of Minnesota's significant lakes.

Maine's northern and western lakes also have fairly late ice out dates (7). Rangeley Lake in western Maine lost its ice on May 23, 1972, which was the latest ice out since records were recorded starting in 1880. First Connecticut Lake in northern Coos County, New Hampshire also recorded a late ice out in 1972, just 4 days earlier than Rangeley Lake the same year. In a typical year, such as 2008, ice out in Maine began on April 17 and ended on May 9, when Cross Lake, Square Lake, and Long Lake experienced ice out.

In Massachusetts, the latest ice out for Houghton's Pond near Blue Hills in Milton took place in 1926, when the ice left the lake on April 14. In the western part of the state, Pontoosuc Lake in the Berkshires had its latest ice out in 1940, when the lake became free of ice on April 29. Lake George in Warren County, New York reported its latest ice out date on May 2, 1971.

Dates of ice out of New England's lakes can be considered as a factor in evaluating climate change for the region, along with annual temperatures, snow cover, and changes in vegetation. An analysis by the United States Geological Survey done in 2002 found that compared to 100 years ago, ice out is occurring about 9 days earlier in the mountains of northern New England and 16 days earlier in southern New England (1). This is based on a review of ice out dates from 29 lakes in New England and comparing ice out dates between 1850 and 2000. Of the 29 lakes studied, 22 are in Maine, 4 are in New Hampshire, and 3 are in Massachusetts. One of the Massachusetts lakes is in Berkshire county (Pontoosuc Lake), and the other two are near the Blue Hills reservation just south of Boston (Houghton's Pond and Ponkapoag Pond).

Records from Lake Winnipesaukee between the 1880's and 2003 indicate that ice out occurs 4 days earlier in recent years than it did at the close of the 1800's (6). What is apparent from much of this data is that there is a high degree of variability in ice out dates from year to year. This variability is much greater than the overall trend towards an earlier ice out date in the past several decades. In the mid-1800's, Henry David Thoreau kept a diary of the dates of ice out of Walden Pond and recorded them in his book *Walden.* Between 1845 and 1854, the dates of ice out ranged from between March 23 and April 8. More contemporary records of the date of ice out at Walden Pond since 1995 note the range of dates of the lake becoming ice free occurring between February 22 (1997) and April 12 (2001). Overall, the dates of ice out at Walden Pond between 1995 and 2009 are 10-14 days earlier than they were when recorded by Thoreau.

A comprehensive data set has been published (2022) of long-term ice records for 78 lakes around the Northern Hemisphere, with some records dating back to almost 600 years. One of the oldest records of ice conditions was started in 1443 for Lake Suwa, Japan (8). In their report, the authors point out that a standard definition for ice in and ice out does not exist, as it may be based on a percentage of ice cover or the ability of a water craft to navigate a lake. Data is often lacking about ice thickness, ice quality, and freeze-thaw events that may occur during a season. Each of these factors is pertinent in the subsequent discussion about Crystal Lake in Newton, Massachusetts.

Ice out records for Crystal Lake

In the 1990's, Srdjan Nedeljkovic, a comparatively obscure but environmentally conscious physician began noting the cyclical variations in lake and river ice in eastern Massachusetts. Residing in Newton since the summer of 1992, Dr. Nedeljkovic developed a habit of riding the Green line light rail system daily past Crystal Lake, thereby having an opportunity to observe conditions on the lake on a frequent basis. This was supplemented by walks or drives around the lake from time to time. From the vantage point of a rail vehicle traveling 30-40 miles per hour, he was able to record the situation of the ice on Crystal Lake from year to year. Overall, starting with the winter of 1990-91, hundreds of notations were made by Dr. Nedeljkovic in his weather diary about lake ice in eastern Massachusetts. Initial diary notations in 1990-92 referred to various lakes outside of Newton, specifically those in Natick, Framingham, and Southborough.

The dates of ice-in and ice-out of Crystal Lake as recorded by Dr. Nedeljkovic are written below. It is important to note that the dates for 1991 and 1992 are general dates of ice-out for lakes in Natick, Framingham, and Southborough. It is likely that ice-out at Crystal Lake actually occurred a few days earlier than these usually colder lakes. Also, ice out information for 1999 is missing. Generally, ice in is defined as when there is at least 90% ice on the lake for at least a day, and ice out is defined as when there is complete loss of ice on the lake for at least an overnight period.

Ice Data for Crystal Lake, Newton Massachusetts

Note: December dates are from the prior year (the date Dec 24 in the row for 1993 occurred in 1992)

Year	Ice-in	Ice-out	Total days of ice
1991	January 23	March 8	43
1992	January 19	March 11	52
1993	December 24	April 4	101
1994	---	April 4	--
1995	---	March 10	--
1996	December 18	March 20	93
1997	---	February 22	--
1998	---	February 13	--
1999	December 25	---	--
2000	January 13	March 7	54
2001	December 22	March 24	92
2002	January 20	February 21	32
2003	December 3	March 28	115
2004	January 6	March 9	63
2005	January 18	April 3	75
2006	December 12	March 12	90
2007	January 24	March 19	54
2008	December 3	March 10	98
2009	January 4	March 20	75
2010	December 22	March 11	79
2011	December 16	March 21	95
2012	January 16	February 22	37
2013	January 5	March 13	67
2014	December 13	March 28	106
2015	December 31	April 9	100
2016	January 21	February 24	34
2017	December 21	February 24	65
2018	December 31	February 23	55
2019	Dec 9 – Dec 21	Jan 15 – Mar 18	74
2020	Dec 21 – Jan 11	Jan 22 – Feb 9	--
2020	February 15	February 24	48
2021	Dec 18 – Dec 25	Jan 10 – Mar 14	70
2022	January 15	March 8	52
2023	Dec 27 – Jan 1	Feb 2 – Feb 15	18 (so far)

What is striking from the data is the great variability of times that Crystal Lake has been iced over during this period. The lake has been frozen between a low of 18 days (winter 2022-2023) to a maximum of 115 days (winter of 2002-03). In recent years, the consistency of the ice has been lacking, with freezes and thaws occurring during a season.

Comparison of Crystal Lake to other nearby lakes

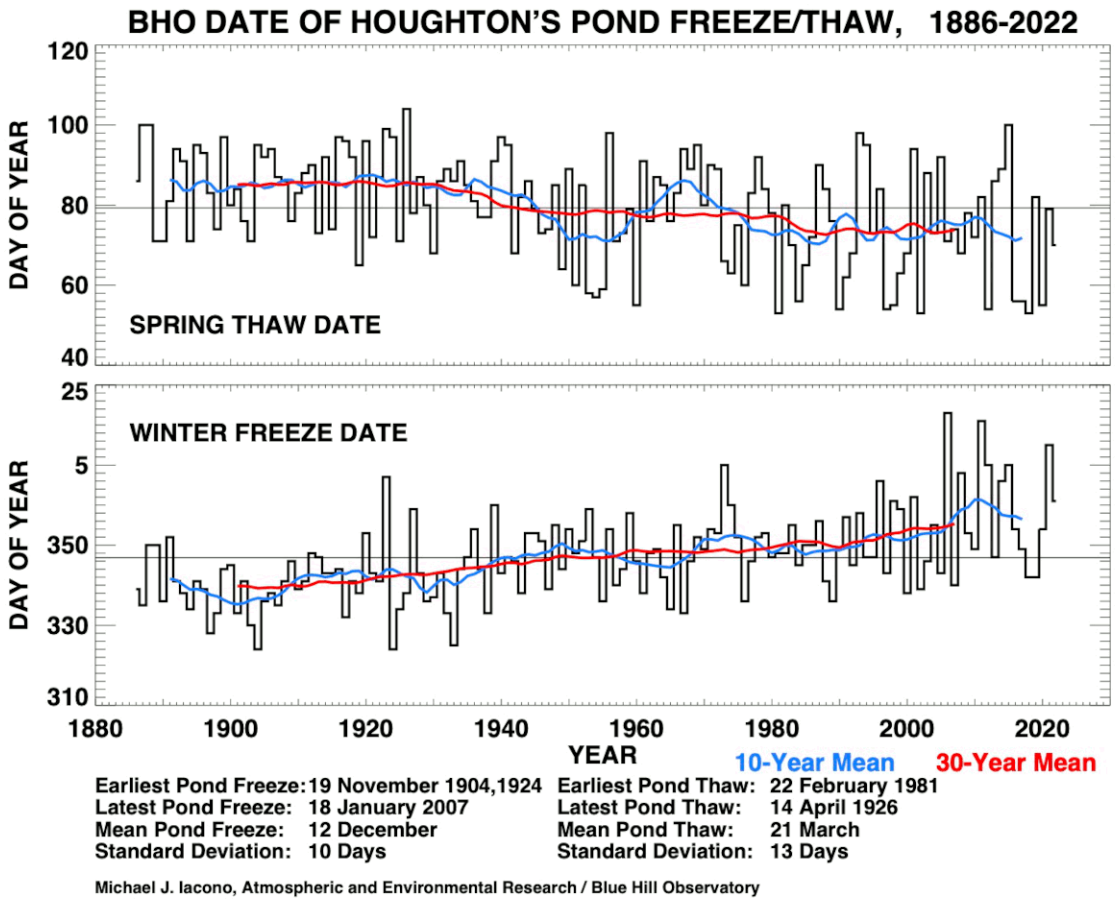
Because the above list has a number of gaps in information on the time of the freezing of Crystal Lake in the mid 1990's, data on other nearby lakes can be used as a surrogate to provide an estimate of the conditions of ice at Crystal Lake. Data for ice out times from is available for nearby lakes such as Houghton's Pond (1886 to 2021) and Ponkapoag Pond (1886 to 2008) in Massachusetts.

Houghton's Pond, at an elevation of about 160 feet, is located in the Blue Hills Reservation in Milton, Massachusetts, just north of Route 128 and about 10 miles southeast of Crystal Lake. It is considered a "spring-fed kettle hole" formed by receding glaciers of about 24 acres in size and has a maximum depth of 42 feet up to 80 feet. Ice out records for Houghton's Pond are available from 1886. Since the winter of 1993, ice out at Houghton's Pond has generally been 1 to 5 days later than at Crystal Lake. The later ice out date may be due to Houghton's Pond having a greater depth than Crystal Lake. If data for Houghton's Pond is used to supplement the dates of ice out for Crystal Lake for the missing years of 1990, 1991, 1992, and 1999, the average ice out date at Crystal Lake in the 1990's would be March 9. Note that the latest recorded ice out at Houghton's Pond occurred on April 14, 1926, and the second latest recorded ice out at Houghton's Pond occurred on April 10, 2015 after especially cold weather that occurred in February and March of that year, when record snowfall of 141.1 inches also occurred at the nearby Blue Hills Observatory.

Ponkapoag Pond, at an elevation of about 150 feet, is only about one mile south of Houghton's Pond, straddling the line between Canton and Randolph just south of Route 128 and also about 10 miles southeast of Crystal Lake. It was also formed from glaciers and is thought to be formed by a "shallow, rock rimmed scouring" as the glaciers receded. It is about 200 acres in size and has a maximum depth of only 6 to 8 feet. The configuration of the pond was changed in the 1920's, when a dam was built on its southwest corner. Ice records for Ponkapoag Pond also date from 1886. Since the winter of 1993, ice out at Ponkapoag Pond has generally been 1 to 3 days earlier than at Crystal Lake. Again, the date of ice out may be influenced by the depth of the body of water. Since Ponkapoag Pond is shallower than Crystal Lake, it may experience ice out a few days earlier. If data for Ponkapoag Pond is used to supplement the dates of ice out for Crystal Lake for the missing years of 1990, 1991, 1992, and 1999, the average ice out date at Crystal Lake in the 1990's would be March 3 (including the anomalously early date of ice out of Ponkapoag Pond in 1999, February 5) or March 6 (not including 1999 data). The latest date of ice out at Ponkapoag Pond since 1886 occurred on April 11, 2015.

In summary, it appears that ice out at Crystal Lake occurs a few days after ice out at the shallower but larger Ponkapoag Pond and a few days earlier than the deeper but smaller Houghton's Pond, both of which are located about 10 miles away. Based on historical records of those two lakes dating back to 1886, it may be accurate to estimate the dates of ice out at Crystal Lake over the past >130 years (see appendix).

Houghton's Pond Freeze/Thaw Data (from Blue Hill Observatory)
https://bluehill.org/graphs-of-annual-blue-hill-observatory-climate-data/
Accessed February 21, 2023



Facts and Trends about ice out at Crystal Lake

A number of interesting facts emerge from the recent ice out data for Crystal Lake, at least looking at the available data since 1993 and until the spring of 2022.

- Crystal Lake "ice in" has occurred as early as December 3 and late as January 24.

- Crystal Lake "ice out" has occurred as early as February 13 and as late as April 9.

The variability of ice in and ice out is almost equal, being 52 days from first to last ice in date and 55 days from first to last ice out date. However, during the past few years, there has been an inconsistent freeze-thaw cycle in that the lake freezes in December, then thaws in January, and then refreezes again in February. In those years, the date for the initial ice-in and the latest date for ice-out are considered as the official dates for these two events.

The most reliable time for ice on Crystal Lake falls between January 24 and February 13. However, in 2020 the lake was unfrozen from February 9 to February 15. And in 2023, the lake did not freeze the entire month of January. That leaves February 2 to February 9 as the only week that the lake has been frozen year-after-year over the past 3 decades.

Freezing of Crystal Lake during the 1990's and until the 2020's was not observed prior to December 3 or after April 9 in any years.

- In the 10 years between 2000 and 2009, Crystal Lake froze over 5 years in December and 5 years in January. Ice out took place once in February, 8 times in March, and once in April.

- In the 10 years between 2010 and 2019, Crystal Lake froze over 7 years in December and 3 years in January. Ice out took place 4 times in February, 5 times in March, and once in April.

- In the 4 years between 2020 and 2023, Crystal Lake initially froze over 3 years in December and 1 year in January. Ice out took place twice in February and twice in March.

When considering the average date of ice out, in the 1990's (6 years of records available) this date was March 13.

However, if the data were supplemented with 4 years of ice out records for Houghton's Pond, with ice out that averages several days later than Crystal Lake, the average ice out date in the 1990's would be March 9. If data were used from Ponkapoag Pond during that same period of time, the average ice out date in the 1990's would be March 3.

Using the data from the 1990s that includes these two ponds, once can summarize that for Crystal Lake:

- The average date for ice out in the 1990's was approximately March 6.

- The average date of ice out in the 2000's was March 16.

- The average date of ice out in the 2010's was March 11.

- The average date of ice out in the 2020's (4 years) is March 1

As the graph from the data from Houghton's Pond shows, ice out is occurring earlier in recent years for lakes in eastern Massachusetts. The average date for ice out for the first 4 years of the 2020's is about 5 days earlier than in the 1990s and about 2 weeks earlier than it was in the decade of the 2000's. Also, the consistency of the freeze-thaw cycle has resulted in ice-free periods on the Lake even in the months of January and February, which is when the lake has historically been most reliably frozen.

The Science of Ice Out

The date at which ice out occurs is influenced by factors such as air temperature, the angle of incidence of sunlight, the depth and thickness of the snow and ice, and the physical characteristics of water as a liquid and a solid. Interestingly, only about half of the variability in the dates of ice out can be explained by air temperatures in March and April (1). It is believed that the southern lakes in New England are more susceptible to the effects of temperature for ice out compared to the northern lakes, perhaps due to higher snowfall amounts in the spring in the north. Lakes that are shallower will tend to lose ice earlier than lakes that are larger and deeper. In Massachusetts, the deeper Houghton's Pond (42-80 feet deep) usually ices out several days later than the shallower Ponkapoag Pond (only 6-8 feet deep). Some years, the difference in ice out dates between these adjacent lakes can be close to one month, most likely due primarily to differences in depth between the two.

The process of how ice melts has been described by Ed Swain, of the Minnesota Pollution Control Agency and is adapted as follows (3):

1. In the late fall, a lake loses heat to the atmosphere, and then on a day or night when the wind is not blowing, ice forms. The ice gets thicker as long as the lake can continue to lose heat.

2. In most Januaries and Februaries, snow both reflects sunlight and insulates the lake. With a thick snow layer, the lake neither gains nor loses heat. The bottom sediment is actually heating the lake water slightly over the winter, from stored summer heat.

3. Around March, as the air warms and the sun gets more intense, the snow melts, allowing light to penetrate the ice. Because the ice acts like the glass in a greenhouse, the water beneath it begins to warm, and the ice begins to melt from the bottom.

4. When the ice thickness erodes to between 4 and 12 inches, it transforms into long vertical crystals called "candles." These conduct light even better, so the ice starts to look black, because it is not reflecting much sunlight.

5. Warming continues because the light energy is being transferred to the water below the ice. Meltwater fills in between the crystals, which begin breaking apart. The surface appears grayish as the ice reflects a bit more light than before.

6. The wind comes up, and breaks the surface apart. The candles will often be blown to one side of the lake, making a tinkling sound as they knock against one another, and piling up on the shore. In hours, a lake can go from a sheet of ice to a sparkling blue lake once again!

The density of water as a liquid plays an important role in this process. When water cools in the autumn, it becomes more dense and sinks to the bottom of the lake. Since water is densest and heaviest at 39 degrees F, when water cools under that temperature, it rises to

the surface and freezes when its temperature reaches 32 degrees F. The result is that a sheet of ice forms on top of a lake, while the heaviest 39-degree water stays at the bottom. Shallow lakes tend to freeze first, as do the shallow edges of larger lakes.

In the spring, the process reverses with shallow shorelines melting first. The ice functions almost like a greenhouse, warming the water underneath. As ice is weakened by the strengthening heat and rays of the sun, it starts to buckle and may even emit a groaning sound. The vertical crystals may make a tinkling sound when water hits the rapidly melting ice sheet. Any object in or near the ice will absorb heat and cause further melting, with sticks, leaves, and rocks causing open water around them. Rain will melt the ice from above as will the warm winds of spring. The ice becomes soft, flexible, and black as it no longer can reflect sunlight. Some have called the ice at this stage "rotten." As the ice warms and water melts on top of the ice, it reaches a temperature of 39 degrees and reaches its most dense and heaviest form. The water then tries to sink down to the bottom. The circulation of dense, cold water to the bottom of the lake helps promote a process of "turnover," which allows bottom sediments to rise to the top. These elements are nutritious to the lake. The mixing also brings oxygen to the bottom of the lake, which is important to sustain fish, which begin to swim to the top of the lake (2). Therefore, lake ice out dates may influence the food chain in a lake and also the rate of change of oxygen levels (1).

Summary

Every winter, Crystal Lake in Newton, Massachusetts freezes over. There is, however, a great variability in the date of this occurrence as the time of the lake freezing over ranges from early December to mid January. Similarly, there is substantial variability in the time of ice out, ranging from mid February to early April each year.

Using comparative historical records from nearby lakes in eastern Massachusetts, it is possible to create a table of dates estimating the time of ice out on Crystal Lake since 1886. In doing so, it is important to consider factors such as lake depth and overall late winter and early spring temperatures as influencing the actual time of ice out.

Recent records over the past 30 years indicate that ice out of Crystal Lake may have occurred somewhat later in the first decade of the 2000's compared to the previous decade of the 1990's and compared to the present decade of the 2020's thus far. It will be interesting to observe whether this trend for less ice and more inconsistency in the freezing of the lake is maintained in upcoming years.

Appendix A:

Estimated ice out dates at Crystal Lake based on historical ice out dates at Houghton's Pond and Ponkapoag Pond (* actual ice out at Crystal Lake) (1886-2022). Adapted from (1).

Year	Houghton's	Ponkapoag	Crystal Lake
2022	March 11	March 6	March 8 *
2021	March 20	March 13	March 14 *
2020	February 24	February 24	February 24 *
2019	March 22	March 19	March 18 *
2018	February 22	February 20	February 23 *
2017	February 25	February 25	February 24 *
2016	February 25	February 25	February 24 *
2015	April 10	April 11	April 9 *
2014	March 30	Missing	March 28 *
2013	March 27	Missing	March 13 *
2012	February 23	Missing	February 22 *
2011	March 23	Missing	March 21 *
2010	March 13	Missing	March 11 *
2009	March 19	Missing	March 20 *
2008	March 9	March 9	March 10 *
2007	March 15	March 14	March 19 *
2006	March 12	March 10	March 12 *
2005	April 2	April 2	April 3 *
2004	March 14	March 7	March 9 *
2003	March 29	March 26	March 28 *
2002	February 22	February 19	February 21 *
2001	April 4	March 25	March 24 *
2000	March 9	March 4	March 7 *
1999	March 4	February 5	---
1998	February 24	February 12	February 13 *
1997	February 23	February 20	February 22 *
1996	March 24	February 26	March 20 *
1995	March 14	March 9	March 10 *
1994	April 5	April 3	April 4 *
1993	April 8	April 4	April 4 *
1992	March 8	February 27	March 11 (F/N/S)
1991	March 3	February 21	March 8 (F/N/S)
1990	February 23	February 10	February 10-23 (est)
1989	March 17	February 23	February 23-March 17 (est)
1988	March 24	March 10	March 10-24 (est)

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Estimated ice out dates at Crystal Lake based on historical ice out dates at Houghton's Pond and Ponkapoag Pond (* actual ice out at Crystal Lake) (1886-2022). Adapted from (1).

Year	Houghton's	Ponkapoag	Crystal Lake
1987	March 31	March 30	March 30-31 (est)
1986	March 13	March 7	March 7-March 13 (est)
1985	March 6	February 28	February 28-March 6 (est)
1984	February 25	February 21	February 21-25 (est)
1983	March 11	March 8	March 8-11 (est)
1982	March 21	March 15	March 15-21 (est)
1981	February 22	February 21	February 21-22 (est)
1980	March 18	March 11	March 11-18 (est)
1979	March 25	March 23	March 23-25 (est)
1978	April 2	April 2	April 2 (est)
1977	March 24	March 16	March 16-24 (est)
1976	February 29	February 29	February 29 (est)
1975	March 16	March 16	March 16 (est)
1974	March 4	March 4	March 4 (est)
1973	March 7	March 7	March 7 (est)
1972	March 29	March 23	March 23-29 (est)
1971	March 31	March 28	March 28-31 (est)
1970	March 21	March 17	March 17-21 (est)
1969	April 5	April 3	April 3-5 (est)
1968	March 29	March 26	March 26-29 (est)
1967	April 4	April 4	April 4 (est)
1966	March 24	March 21	March 21-24 (est)
1965	March 17	March 13	March 13-17 (est)
1964	March 25	March 17	March 17-25 (est)
1963	March 28	March 27	March 27-28 (est)
1962	March 27	March 25	March 25-27 (est)
1961	April 1	March 29	March 29-April 1 (est)
1960	February 24	February 23	February 23-24 (est)
1959	March 20	February 19	February 19-March 20 (est)
1958	March 14	March 10	March 10-14 (est)
1957	March 12	February 27	February 27-March 12 (est)
1956	April 7	March 12	March 12-April 7 (est)
1955	February 28	February 26	February 26-28 (est)
1954	February 26	February 22	February 22-26 (est)
1953	February 27	February 1	February 1-27 (est)
1952	March 25	March 25	March 25 (est)

Appendix A (page 3)

Estimated ice out dates at Crystal Lake based on historical ice out dates at Houghton's Pond and Ponkapoag Pond (* actual ice out at Crystal Lake) (1886-2022). Adapted from (1).

Year	Houghton's	Ponkapoag	Crystal Lake
1951	March 1	February 23	February 23-March 1 (est)
1950	March 30	March 24	March 24-30 (est)
1949	March 5	February 28	February 28-March 5 (est)
1948	March 25	March 24	March 24-25 (est)
1947	March 15	March 14	March 14-15 (est)
1946	March 14	March 9	March 9-14 (est)
1945	March 20	March 20	March 20 (est)
1944	March 26	March 26	March 26 (est)
1943	March 23	March 21	March 21-23 (est)
1942	March 9	March 9	March 9 (est)
1941	April 5	April 2	April 2-5 (est)
1940	April 6	April 6	April 6 (est)
1939	April 1	March 29	March 29-April 1 (est)
1938	March 18	March 18	March 18 (est)
1937	March 18	March 18	March 18 (est)
1936	March 21	March 20	March 20-21 (est)
1935	March 26	March 24	March 24-26 (est)
1934	April 1	March 29	March 29-April 1 (est)
1933	March 27	March 23	March 23-27 (est)
1932	March 29	March 29	March 29 (est)
1931	March 27	March 25	March 25-27 (est)
1930	March 9	March 8	March 8-9 (est)
1929	March 21	March 20	March 20-21 (est)
1928	March 27	March 25	March 25-27 (est)
1927	March 18	March 17	March 17-18 (est)
1926	April 14	April 10	April 10-14 (est)
1925	March 12	March 10	March 10-12 (est)
1924	April 6	April 5	April 5-6 (est)
1923	April 9	April 8	April 8-9 (est)
1922	March 28	March 26	March 26-28 (est)
1921	March 13	March 10	March 10-13 (est)
1920	April 5	April 3	April 3-5 (est)
1919	March 6	March 6	March 6 (est)
1918	April 2	April 1	April 1-2 (est)
1917	April 6	April 2	April 2-6 (est)
1916	April 6	April 5	April 5-6 (est)

Appendix A (page 4)

Estimated ice out dates at Crystal Lake based on historical ice out dates at Houghton's Pond and Ponkapoag Pond (* actual ice out at Crystal Lake) (1886-2022). Adapted from (1).

Year	Houghton's	Ponkapoag	Crystal Lake
1915	March 15	March 12	March 12-15 (est)
1914	April 2	March 31	March 31-April 2 (est)
1913	March 14	March 14	March 14 (est)
1912	March 30	March 22	March 22-30 (est)
1911	March 29	March 28	March 28-29 (est)
1910	March 24	March 22	March 22-24 (est)
1909	March 17	March 17	March 17 (est)
1908	March 26	March 17	March 17-26 (est)
1907	March 28	March 27	March 27-28 (est)
1906	April 4	March 31	March 31-April 4 (est)
1905	April 2	March 31	March 31-April 2 (est)
1904	April 4	April 3	April 3-4 (est)
1903	March 12	March 11	March 11-12 (est)
1902	March 17	March 14	March 14-17 (est)
1901	March 25	March 23	March 23-25 (est)
1900	March 20	March 19	March 19-20 (est)
1899	April 7	March 31	March 31-April 7 (est)
1898	March 15	March 14	March 14-15 (est)
1897	March 24	March 23	March 23-24 (est)
1896	April 2	April 2	April 2 (est)
1895	April 5	March 27	March 27-April 5 (est)
1894	March 12	March 12	March 12 (est)
1893	April 1	April 1	April 1 (est)
1892	April 3	April 2	April 2 (est)
1891	March 22	March 13	March 13-22 (est)
1890	March 12	March 12	March 12 (est)
1889	March 12	March 12	March 12 (est)
1888	April 9	March 29	March 29-April 9 (est)
1887	April 10	March 24	March 24-April 10 (est)
1886	March 27	March 27	March 27 (est)

Appendix B: Safety and Ice Thickness – adapted from the Old Farmer's Almanac

Accessed March 24, 2009 at: http://www.almanac.com/outdoors/safeice.php

There are no completely certain guidelines for when ice thickness is safe. Ice safety is only partly related to its thickness, since its age, the temperature of the air and water, the depth of water underneath, currents, and the distribution of load on the ice can all influence the strength and safety of lake ice.

The Old Farmer's Almanac has published the following related to ice thickness.

Thickness	Permissible Load
3"	Single person on foot
4"	Group in single file
7.5"	Passenger car (2 tons gross weight)
8"	Light truck (2.5 tons gross weight)
10"	Medium truck (3.5 tons gross weight)
12"	Heavy truck (8 tons gross weight)

These figures apply to solid clear blue/black lake ice. River ice has 15% less strength. Slushy ice has only half the strength of blue ice.

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