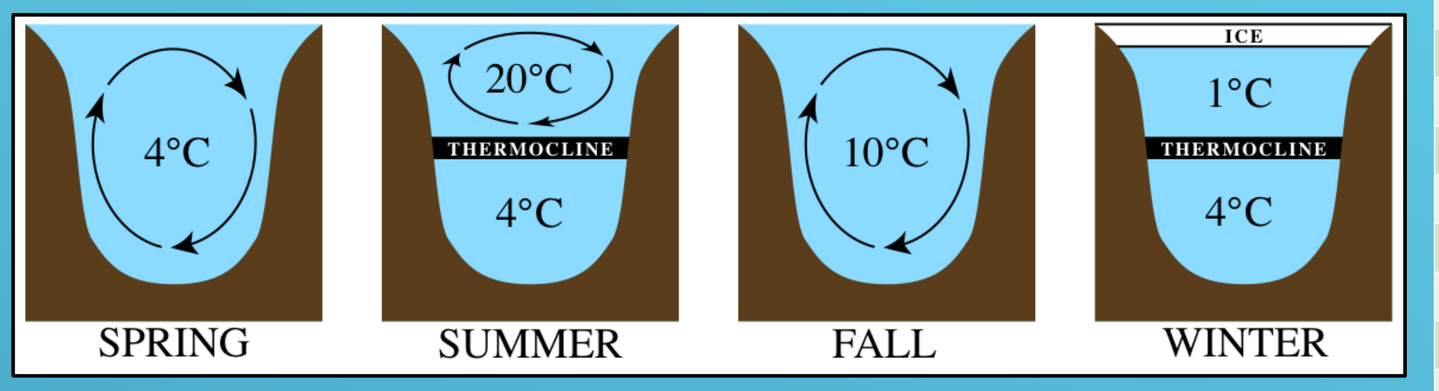
# How often does Quabbin Reservoir freeze in winter?

Quabbin Reservoir is the largest body of water in Massachusetts, spanning 18 miles from north to south. When at capacity, it holds 412 billion gallons of water and has an average depth of around 45 feet. The reservoir surface itself covers 25,000 acres.

It is a well-known fact that water freezes at 32 °F. However, this doesn't mean that when the air temperature reaches 32 °F that a lake will quickly freeze over. Water is a great insulator and good at holding heat, this is why a lake's water temperature doesn't fluctuate much day to day like the air does. Therefore, below freezing temperatures are needed for a week or more to form ice on Quabbin.

Before a lake can freeze over, its entire water column from top to bottom, must reach a temperature of 39.2 ºF (4 ºC). This natural cooling process is called *fall overturn*. It is a gradual process as the surface water slowly cools down and a larger and larger layer of water can be mixed by the wind.




After the entire body of water reaches the magic temperature of 39.2 ºF, the water on top can finally get cold enough to freeze. Small ponds tend to ice over earlier in the winter than deep lakes, because there is less water to cool. Some very deep lakes never freeze or do so infrequently.

| Quabbin Ice Milestones (1970 - Today) | |
|---|---|
| Earliest ice over | 12/25/1988 |
| Latest ice out | 4/21/2001 |
| Longest ice over | 94 days (1/13/1982 – 4/17/1982) |

| Year | Ice-over date | Ice-out date | Duration (days) |
|---|---|---|---|
| 1970 | 1/2/1970 | No data | - |
| 1971 | 1/13/1971 | No data | - |
| 1972 | 1/17/1972 | 4/19/1972 | 93 |
| 1973 | 1/10/1973 | 3/21/1973 | 70 |
| 1974 | 2/6/1974 | 3/6/1974 | 28 |
| 1975 | 2/8/1975 | 3/26/1975 | 46 |
| 1976 | 2/7/1976 | 2/20/1976 | 13 |
| 1977 | 1/3/1977 | 4/1/1977 | 88 |
| 1978 | 1/22/1978 | 4/2/1978 | 70 |
| 1979 | 2/10/1979 | 4/4/1979 | 53 |
| 1980 | No ice-over | | - |
| 1981 | 1/5/1981 | 2/25/1981 | 51 |
| 1982 | 1/13/1982 | 4/17/1982 | 94 |
| 1983 | 2/13/1983 | 3/14/1983 | 29 |
| 1984 | 1/16/1984 | 2/28/1984 | 43 |
| 1985 | 1/27/1985 | 3/16/1985 | 48 |
| 1986 | 1/15/1986 | 3/27/1986 | 71 |
| 1987 | 1/28/1987 | 3/31/1987 | 62 |
| 1988 | 1/14/1988 | 3/31/1988 | 77 |
| 1989 | 12/25/1988 | 3/16/1989 | 81 |
| 1990 | No ice-over | | - |
| 1991 | 1/29/1991 | No data | No ice out date |
| 1992 | 1/31/1992 | 3/9/1992 | 38 |
| 1993 | 2/18/1993 | 4/18/1993 | 59 |
| 1994 | 1/12/1994 | 4/14/1994 | 92 |
| 1995 | 2/9/1995 | 3/15/1995 | 34 |
| 1996 | 2/5/1996 | 4/2/1996 | 57 |
| 1997 | No ice-over | | - |
| 1998 | No ice-over | | - |
| 1999 | No ice-over | | - |
| 2000 | No ice-over | | - |
| 2001 | 1/23/2001 | 4/21/2001 | 88 |
| 2002 | No ice-over | | - |
| 2003 | 1/19/2003 | 4/15/2003 | 86 |
| 2004 | 1/22/2004 | 4/11/2004 | 80 |
| 2005 | 1/29/2005 | 4/10/2005 | 71 |
| 2006 | No ice-over | | - |
| 2007 | No ice-over | | - |
| 2008 | No ice-over | | - |
| 2009 | 1/20/2009 | 4/3/2009 | 73 |
| 2010 | No ice-over | | - |
| 2011 | 1/22/2011 | 4/12/2011 | 80 |
| 2012 | No ice-over | | - |
| 2013 | No ice-over | | - |
| 2014 | 2/5/2014 | 4/13/2014 | 67 |
| 2015 | 2/5/2015 | 4/17/2015 | 71 |
| 2016 | No ice-over | | - |
| 2017 | No ice-over | | - |
| 2018 | 2/9/2018 | No data | No ice out date |
| 2019 | No ice-over | | - |
| 2020 | No ice-over | | - |
| 2021 | No ice-over | | - |
| 2022 | No ice-over | | - |
| 2023 | No ice-over | | - |

Water freezes from the perimeter of a lake to the center. It happens this way because the water is shallower at the lake's edge, so it cools off faster. Water is most dense at 39 ºF. When it gets colder than that, the cold, lighter water floats to the top of the lake. This top layer of water interfaces with the cold air, which cools the top of the lake even further until it freezes. Windy days cool the lake surface off faster because the cold air moving over the water cools the lake faster.

View from the Quabbin Administration Building as the reservoir is icing out – 4/9/2014

As climate change pushes annual average temperatures to continue to rise, the number of days with ice over lakes is projected to fall. What this means for Quabbin Reservoir is that we're going to see a narrowing of that winter window, for ice. There will be later freezes and earlier thaws, which is what we've been starting to see over the past 25 years already. This trend of seeing a continued reduction in frozen days could lead to a variety of effects (not just at Quabbin) on ecosystems, drought, wildfire risk, agriculture, natural resources, and the economy.

View from the Quabbin Administration Building one week after completely icing over – 2/13/2014

From the years 1970 - 1996 the reservoir surface completely froze over almost every winter (25 out of 27 years (92.5%)). During this time, the surface tended to ice-over in January-February and melted during March-April. From 1997-2023, the data is much different. During these more recent times the reservoir surface completely froze only 9 out of 27 years (33.3%).

Aerial photo of Quabbin completely frozen over - 2009

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