The End of Winter As We’ve Known It?

Changes in Lake Superior Ice Cover at Bayfield, Wisconsin

By Neil Howk
Winter in Bayfield means Ice
Earliest Ice Record  Alexander Henry - 1765
Earliest Ice Record - 1765

Freeze-up: December 15, 1765

Breakup: April 20, 1766

Ice Season: 126 Days
What’s Happening to the Ice?
The Start of a Science Project

- Bayfield Science teacher
  Rick Erickson

- Junior Science and Humanities Symposium

- Intel International Science and Engineering Fair
Selecting a Topic

• Neil suggests investigating evidence of climate change close to home.
Presenting Results

• National Junior Science and Humanities Symposium.

• Intel International Science and Engineering Fair
Changes in Lake Superior Ice Cover at Bayfield Wisconsin

Forrest Howk
Bayfield High School
September 17, 2007
Lake Superior and the Apostle Islands

Lake Superior
Ice Cover
March, 2003
Hypothesis

Null Hypothesis: The ice cover on Lake Superior has not changed since the town of Bayfield was founded in 1856.

Active Hypothesis: The ice cover on Lake Superior near Bayfield has decreased in the past 150 years.
Procedure

1. My first source of data was from the Madeline Island Ferry Line.

2. The Ferry Line then directed me to the Island Gazette for data dating to 1964.
3. Data from 1857-1964 was collected by looking back through issues of the Bayfield County Press.
Andrew Tate, one of Bayfield’s first settlers, noted the opening and closing dates of navigation from 1857 to 1888.

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(See “E.K.” page 3, column 2)
Why was Ice Data Noteworthy?

In 1859, Andrew Tate kept records of boat arrivals and departures as deputy director for the port.

Druggist, Lawyer, District Attorney, Town Official, etc.
Andrew Tate Was. It Seems.
One of the Community's Most Versatile Individuals.
By ELEANOR KNIGHT

Andrew Tate was Bayfield's pioneer druggist. He built and lived in the house now owned by Mrs. E. R. Mitchell, and his drug store was close by — right where the Odd Fellows building now stands. To say merely that Andrew Tate was a druggist is doing him an injustice, because for many years he was lawyer, doctor and general adviser to the whole village.

He came to Bayfield in 1857 and, like most of our pioneer men, undertook many civic jobs and did them well. Through his efforts the first school was organized. For many years his services as legal and medical adviser were in demand and were given to all, usually without price. He was county judge, district attorney, county treasurer, member of the town board, president of the water company, and held other minor offices, all with honor to himself and profit to the community.

One of his jobs in 1859 was Deputy Collector for the Port of Bayfield. He kept the record of boat arrivals and departures, and when the Steamer "Lady Elgin" which left Bayfield on June 6
Open water was important for shipping.

Why was Ice Data Noteworthy?
Three Men Meet Tragic Death In Icy Waters

Three Men Meet Tragic Death In Icy Waters

In what is undoubtedly the most tragic accidents occurring on Chetumegon Bay in many years was the drowning Monday afternoon of three well known Madeline Island residents, Charles Russell, Chauncey Wright and Nels Telen. The sudden deaths and miraculous escape from a like fate by the two survivors of the accident, Capt. Angus and W. S. Johnson, cast a gloom upon the city and their home village LaPointe, which is indeed diffic-

having been attracted by signal fire built on the island beach and by the sounding of a fog siren. Latest reports are that Johnson has about fully recovered.

All three of the drowned men had families, Mr. Wright his wife, mother and sister, Mr. Tiegen his wife and two sons and Mr. Russell his wife and six sons. To each of these the greatest sympathy the Press and the entire community extended.

A pathetic feature of the tragedy lies in the fact that Mrs. Russell had recently undergone a serious operation in an Ashland hospital and is now convalescent. The mere fact

Pictu Picture Serial Story "Starting in This Issue"

Every week. See the pictures at the Princess Theatre every Thursday evening.

Access to mail/danger for La Pointe residents.
Why was Ice Data Noteworthy?
Fishing, supplies, emergencies.

HEADLINE OF THE WEEK
CG Cutter Woodrush Called to Open Channel Between the Bayfield and La Pointe Docks

Gar-How II Proved Inadequate for Job of Cutting Ice Bridge from La Pointe to Mainland.

The ice bridge between Madeline Island and the Bayfield mainland has been cut and navigation was opened this afternoon about 3:00 o'clock, with the Nithyeo arriving at 3:30 and Gar-How II some 10 minutes later.

But it was not as simple as it sounds. Gar-How II attempted on Sunday afternoon to cut the ice planking but gave up after several hours of work, reaching the point off O'Brien's landing. Another assault was made Monday, the boat reaching a point about one-half way to Bayfield.

Continued cold weather, with below freezing each night, made impractical further efforts by the ferry boat.
## Opening and Closing Dates of Navigation in Bayfield Harbor

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Opening and Closing Dates of Navigation for Bayfield Harbor

Day of year: Dec 31 = 0

Opening day:
y = 0.1621x - 311.62
R² = 0.2115

Closing day:
y = -0.1737x + 436.46
R² = 0.2902
Duration of Closed Navigation for Bayfield Harbor

5-year running mean

\[ y = -0.3382x + 752.58 \]

\[ R^2 = 0.3296 \]
Opening and Closing of Navigation of Bayfield Harbor since 1975

\[ y = -0.3028x + 691.37 \]

\[ y = 1.1741x - 2323.8 \]

R\(^2\) = 0.3282
Summary

• The data indicates that there has been a significant decrease in Lake Superior ice cover at Bayfield Wisconsin.

• Although the data shows an overall trend of change in the past 150 years, the most dramatic changes have occurred since 1975.

• Since 1975 the ice season has begun an average of 11.7 days later and ended 3 days earlier every decade.
Why are these changes happening?

• Technological advances in the local vessel’s design and materials might account for some of the change in the length of the ice season.
Global Climate Change?

The most likely reason for a lack of ice is the rise in local air and water temperatures.
Bayfield Air Temperatures ... Fairly Steady?

Data from Midwest Regional Climate Center
Lake Superior is Warming

- Water temperatures are rising at twice the rate of air temperatures since 1980
- This correlates with decreasing ice cover over the same period
- Research is by Jay Austin and Steve Colman of the Univ. of Minnesota Large Lakes Observatory (Duluth)

Lake Superior’s Decreasing Ice Cover

Historical satellite data were used to measure ice cover in the Great Lakes from 1973 to 2010. There was a significant downward trend in ice coverage for all of the lakes. The total loss for overall Great Lakes ice coverage is 71%, while Lake Superior showed a 79% decrease in ice cover from 1973 to 2010.

- (Wang et. al., 15 Feb., 2012, Journal of Climate)
AMIC - Annual Maximum Ice Cover on Lake Superior
(Data from Assel, Cronk, & Norton, 2003)
Bayfield - % of Ice Season with Ice Cover

$y = -0.0039x + 8.4678$
$R^2 = 0.0264$

$y = -0.0077x + 16.011$
$R^2 = 0.1677$
Changes around the Northern Hemisphere

(36-37 of the 39 time series are in the direction of warming)

Source: IPCC 3rd Assessment 2001 Modified from Magnuson et al. 2000
The April 15 Ice Out Line is Moving North

Jenson, Benson, Magnuson et al. In press
If the 30 year trend continues...

Opening and Closing of Navigation of Bayfield Harbor since 1975
What will winter in Bayfield mean?

• Less ice road?
• More wind sled?
• Longer navigation season?
What will winter in Bayfield mean?

1765 - 126 days of ice

2006 - 54 days of ice

2036 - 0 days?
The End of Winter
As We’ve Known It ?