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DATA Nugget

The end of winter as we've known it?

Featured scientist: Forrest Howk, Bayfield High School. Written by: Richard Erickson, Bayfield High School and Hannah Erickson, Boston Public Schools

Research Background:

Forrest in front of the ferry that takes residents from the mainland town of Bayfield, and LaPointe, located on Madeline Island.

As a boy growing up in Bayfield, Wisconsin, Forrest was familiar with the seasonal rhythms of Lake Superior and the nearby Apostle Islands. Forrest watched each year as ice formed in the Bayfield Harbor, stopping the boat traffic each winter. Eventually, as the ice thickened even more, an ice road would open between Bayfield and LaPointe. The small town of LaPointe is located on Madeline Island just over two miles from the shore of Bayfield. When the ice road opens, it frees the island residents from working around the ferry schedule and they can drive on the ice to get to the mainland.

As a senior at Bayfield High School, Forrest became interested in conducting a scientific study related to the ice season on Lake Superior. He knew that Lake Superior plays a vital role in the lives of people who live and work on its shores and therefore all sorts of data are recorded to help understand and take care of it. Based on his own observations and comments of other area residents, Forrest thought that winters were getting shorter. He wanted to know whether the length of the ice season was changing over time. Forrest turned to historical data to answer his question.

Forrest's first stop on his quest to find data was the Madeline Island Ferry Line, a company that operates the ferries between Bayfield and LaPointe. Since 1970, the ferry line has kept yearly records of the date on which the last ferry traveled between Bayfield and LaPointe before the water was too frozen for travel. They also recorded the date on which the first ferry traveled the channel when ice melted in the spring. That gave Forrest a start, but he wanted data that would date farther back than 1970.

Luckily, Forrest's father, Neil, was an interpretive ranger for the Apostle Islands National Lakeshore. Neil showed Forrest local newspaper archives that were stored in the basement of their headquarters building. News about shipping and fishing have been

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important to the people in the community throughout history, so it was common to find articles referencing the first and last boat of each year. Looking back through newspaper records, Forrest and Neil were able to collect data for almost every year dating back to 1857!

Forrest standing in front of the ice road that forms between Bayfield and LaPointe each winter, preventing ferry traffic but allowing cars to travel between the mainland and island.

Armed with these data, Forrest began his analyses. He chose to define the **length of the ice season** as the time between the last boat each winter and the first boat each spring. This also represents the time during which there was no boat navigation due to ice cover. Forrest's next step was to choose how to quantify the dates. He decided to use **Julian dates,** which start with January 1 as Day 1 and continue to count up by 1 for each day. This means that January 31 would be Day 31, February 1 would be Day 32, and March 1 would be Day 61. After assigning Julian dates to each historical data point, Forrest subtracted the day of the last boat from the day of the first boat to find the number of days without boat traffic each year. This number serves as a consistent way to estimate the length of the ice season each year. Winter begins in one calendar year but ends in the next, so Forrest identified the year based on the calendar year that the winter began.

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Scientific Question: Is the length of the Bayfield harbor ice season changing over time?

Scientific Data:

Use the data below to answer the scientific question:

Years	Average days without boat traffic	Average Julian day of last boat	Average Julian day of first boat
1857-1859	97	-2	95.0
1860-1864	115	-8.6	106.4
1865-1869	116	-6.2	110.2
1870-1874	134	-14.2	119.8
1875-1879	108	-3.8	104.6
1880-1884	125	-11	114.4
1885-1889	112	1.2	113.2
1890-1894	112	-1	110.8
1895-1899	111	-4	106.8
1900-1904	113	-6	107.4
1905-1909	92	9	101.4
1910-1914	101	6	104.6
1915-1919	113	-2	107.6
1920-1924	104	-4	100.2
1925-1929	114	-11	107.2
1930-1934	109	-5	103.8
1935-1939	108	-2	106.6
1940-1944	86	5	91.4
1945-1949	101	0	100.6
1950-1954	94	7	101.0
1955-1959	99	-1	98.0
1960-1964	104	-3	102.2
1965-1969	87	3	90.4
1970-1974	95	2	96.8
1975-1979	93	2	95.0
1980-1984	82	6	87.8
1985-1989	88	2	90.2
1990-1994	79	11	90.0
1995-1999	63	10	89.0
2000-2004	58	31	89.2
2005-2009	54	30	82.2
2010-2014	61	14	89.5
2015-2018	42	15	98.0

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What data would you graph to answer the question?

Independent variable(s): _____

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Dependent variable(s): _____

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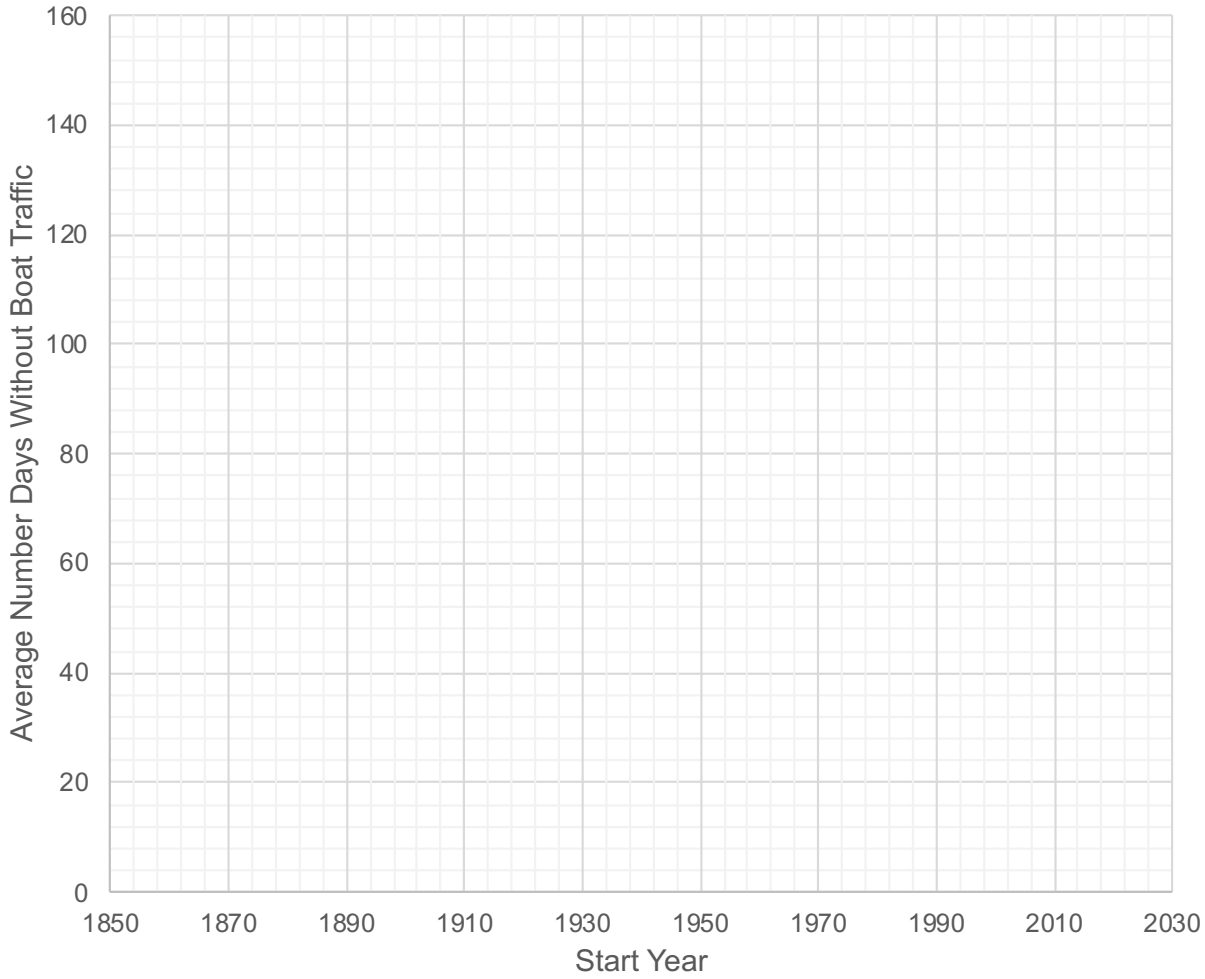
Draw your graph below: Identify any changes, trends, or differences you see in your graph. Draw arrows pointing out what you see, and write one sentence describing what you see next to each arrow.



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Interpret the data:

Make a claim that answers the scientific question.

What evidence was used to write your claim? Reference specific parts of the tables or graph.

Explain your reasoning and why the evidence supports your claim. Connect the data back to the relationship between boating traffic in Bayfield Harbor and ice cover.

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Your next steps as a scientist: Science is an ongoing process. What new questions do you think should be investigated? What future data should be collected to answer your question?