

Appendix A

Lake Superior Historical Maximum Ice Coverage

(Rounded to nearest 5%)

Year	1973	1974	1975	1976	1977	1978
% Ice Coverage	70	75	65	50	95	90

Year	1979	1980	1981	1982	1983	1984
% Ice Coverage	95	80	85	85	20	90

Year	1985	1986	1987	1988	1989	1990
% Ice Coverage	80	90	15	65	80	80

Year	1991	1992	1993	1994	1995	1996
% Ice Coverage	90	70	75	95	30	100

Year	1997	1998	1999	2000	2001	2002
% Ice Coverage	90	10	20	35	50	10

Year	2003	2004	2005	2006	2007	2008
% Ice	95	50	55	20	55	60

Coverage						
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Year	2009	2010	2011	2012	2013	2014
% Ice Coverage	95	30	35	10	40	95

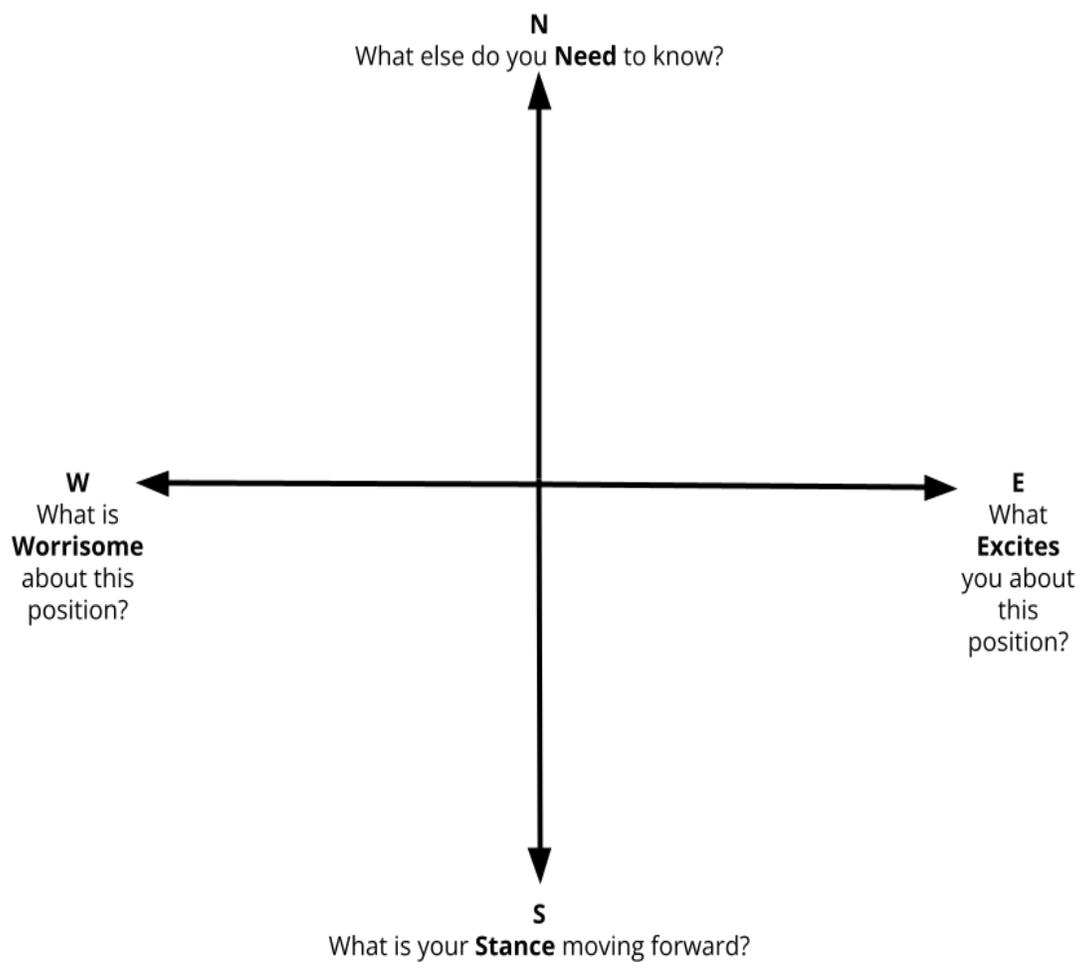
Year	2015	2016	2017	2018	2019	2020
% Ice Coverage	95	20	20	80	95	20

[Ice Bridges](#)

Decade	Years
1970	1970, 1971, 1972, 1974, 1977, 1979
1980	1982, 1985, 1988
1990	1991, 1994, 1996, 1997
2000	2008
2010	2014, 2015, 2018

Appendix B

Compass Points



Appendix C

Actions Considered

<p>Alternative A: No Action</p>	<p><i>Under the no-action alternative, wolves would not be introduced to the park.</i></p> <p>Pro: Least impact to wilderness.</p> <p>Cons: Island Ecosystem: broad changes to forest composition and structure could be further influenced by climate change and increased plant consumption.</p> <p>Moose: Without wolves, moose population would likely increase and could deplete their food source. A large-scale starvation event could possibly occur.</p> <p>Wolves: Original population would likely disappear from the island. Presence of wolves on the island would depend on natural immigration, which is unlikely due to reduction of ice bridge formation because of global climate change. Wolf reproduction would be unlikely because of low genetic diversity and inbreeding.</p>
<p>Alternative B: Immediate, limited introduction of new wolves</p>	<p><i>Under alternative B, the park would introduce wolves over a 3-year time period. After the third year, if an unforeseen event occurred (disease or mass deaths), wolves may be supplemented for an additional 2 years. No wolves would be introduced after 5 years from the first introduction.</i></p> <p>Pros: Island Ecosystem: Restore an apex predator and the process of predation to the island. Retain forest components.</p> <p>Wilderness: Restore an ecological function (predation) on the island and benefit the natural quality.</p> <p>Moose: Reintroducing predation to the ecosystem would reduce the fluctuations of the moose population.</p> <p>Wolves: Island wolf abundance and distribution would increase. Genetic variation would increase with the aim to delay any potential future inbreeding problems</p> <p>Cons:</p>

	<p>Wilderness: The wilderness character of the island would be impacted. This alternative includes the use of radio collars and mechanized transport that impact the untouched and undeveloped qualities of wilderness.</p>
<p>Alternative C: Immediate introduction of new wolves, with potential addition of more wolves in the next 20 years</p>	<p><i>Under alternative C, wolves would be immediately introduced with the possibility of more introductions over a 20-year period.</i></p> <p>Pros: Island Ecosystem: Restore an apex predator and the process of predation to the island. Retain forest components.</p> <p>Wilderness: Restore an ecological function (predation) on the island and benefit the natural quality.</p> <p>Moose: Reintroducing predation to the ecosystem would reduce the fluctuations of the moose population. A smaller number of wolves would be introduced, allowing some predation. Future introductions of wolves would be allowed to manage the moose population as needed.</p> <p>Wolves: Relocating a lower number of wolves would best reflect a natural migration event. This would result in a lower genetic diversity in the short term. The NPS would have the ability to relocate wolves and increase diversity as needed.</p> <p>Cons: Wilderness: The wilderness character of the island would be impacted. This alternative includes the use of radio collars and mechanized transport that impact the untouched and undeveloped qualities of wilderness. Additional impacts to wilderness could occur depending on the number of introduction events.</p>
<p>Alternative D: No immediate action, with allowance for possible future addition of wolves</p>	<p><i>Under alternative D, the park would continue to monitor conditions and take no immediate action but allow for future introductions of wolves to Isle Royale.</i></p> <p>Pros: All pros are depending on if future action occurs. Pros would be similar to alternatives B and C.</p> <p>Wilderness: If action did not occur, nature would be allowed to take its course without human influence.</p> <p>Cons: All cons depend on if future action occurs.</p>

Wolves: A delayed response could lead to the original wolf population disappearing and new wolf relocations would possibly establish a new, genetically different, population.

Moose: A delayed response could lead to the moose population continuing to increase until a possible moose population collapse due to starvation or winter moose ticks causing illness.

Wilderness: If action occurred, the wilderness character of the island would be impacted. This alternative includes the use of radio collars and mechanized transport that impact the untouched and undeveloped qualities of wilderness. Additional impacts to wilderness could occur depending on the number of introduction events.

Appendix D

Claim, Evidence, Reasoning Statement

Claim: The National Park Service's decision to bring new wolves to Isle Royale in 2019 was _____ because:

Scientific principles:

- ☒ Climate change from human activities has resulted in changes to the physical and biological parts of the ecosystem.
- ☒ Changes to abiotic or biotic parts of an ecosystem affect its populations.
- ☒ An ecosystem's biodiversity is often used as a measure of its health.

Evidence: (List the important facts about climate change and Isle Royale populations that you recorded above.)

Reasoning: Use your evidence AND the scientific principles above to explain why your claim is correct.



Claim, Evidence, Reasoning Statement