Name_____

DATA Nugget

Candid camera: Capturing the secret lives of carnivores

Featured scientist: Erik Olson from Northland College. Written by: Melissa Kjelvik

Research Background:

Carnivores, animals that eat meat, captivate people's interest for many reasons – they are charismatic, stealthy, and can be dangerous. Not only are they fascinating, they're also ecologically important. Carnivores help keep prey populations in balance. They often target old, sick, or weak individuals. This results in more resources for healthier prey. Carnivores also impact prey's behavior and population sizes, which can have further effects down the food web. For example, if there are too many herbivores, such as deer, the plants in an ecosystem may be eaten to a point where they can't survive. In this way, carnivores help the plant community by either reducing the number of herbivores in an ecosystem, or changing how or where prey forage for food.

Erik demonstrating how to place a camera trap on a tree on Stockton Island.

Despite their importance and our interest in carnivores, they are very hard to monitor. Not only do they have naturally low population sizes because they are at the top of the food chain, they also have a natural ability to hide and blend into their environment. Erik is a wildlife biologist who is interested in taking on this challenge. He wants to learn more about carnivores and what factors affect where they live. Learning more about where carnivores are found can help scientists with conservation efforts.

Erik lives on the southern shore of Lake Superior, the largest lake (by area) in the world. This area is home to the Apostle Islands National Lakeshore – including 21 islands and a 12-mile stretch of the mainland in northern Wisconsin. The Apostle Islands vary in many ways – size, distance from the mainland, highest elevation, historical and current human use, plant communities, and even small differences in climate. The islands are so remote that scientists really didn't know which carnivores lived on the islands. There is evidence from historical reports that red fox and coyotes lived on some of the islands. More recently, black bears have been observed by visitors as they are hiking or

camping. Erik wanted to know which species of carnivores are on each island. As he began to explore methods to document wildlife on the islands, Erik and his collaborators were shocked to discover that American martens, Wisconsin's only state endangered species, live on some of the islands.

Sand beach on Stockton Island, Apostle Islands National Lakeshore

Erik thought a promising step in learning more about what drives carnivores to live on different islands in the archipelago would be to apply what has been learned from islands in the ocean. He referred to a fundamental theory in ecology called the **theory of island biogeography**. This theory predicts that island size and its distance to the mainland affects the **biodiversity**, or number of species, found on that island. Specifically, larger islands will have higher carnivore biodiversity because there are more resources and space to support more species than smaller areas. In contrast, islands farther away from the mainland will have lower carnivore biodiversity because more isolated islands are harder for wildlife to reach.

Erik wanted to test whether the theory of island biogeography also applied to the Apostle Islands. Just like the classic research on island biogeography, some islands are closer to the mainland and they range in size. To inventory where each carnivore is found, Erik and his collaborators and students set up 164 wildlife cameras on 19 of the islands. They made their way out to the remote islands by boat and then bushwhacked their way to the sites, which are not along trails. Often this means they have to push through thick brush and climb over fallen trees, but it's important to put the cameras in all habitat types, not just those that are enjoyable to walk through. When the research team arrived at a site, they mounted a camera on a tree at waist height. Whenever an animal came into the frame of a camera, a photo was taken and stored on a memory card. The cameras were left on the islands year-round from 2014-2019. Every 6 months Erik and his collaborators would traverse through the thick woods to swap out memory cards and batteries. During this time, they noticed that four of the cameras had not worked properly, so they used the pictures from 160 of the cameras.

Back at the college, the research team spent countless hours identifying which animals triggered the cameras. The cameras had taken over 200,000 photos over three years including 7,000 wildlife visits. Of these visits, 1,970 were from carnivores! They found 10 different kinds of carnivores, including: American marten, black bear, bobcat, coyote, fisher, gray fox, gray wolf, raccoon, red fox and weasels. After the pictures were processed, Erik used this information to map out which islands the animals were found. For this study, he used **species richness**, or the number of different species observed on each island, to answer his question.

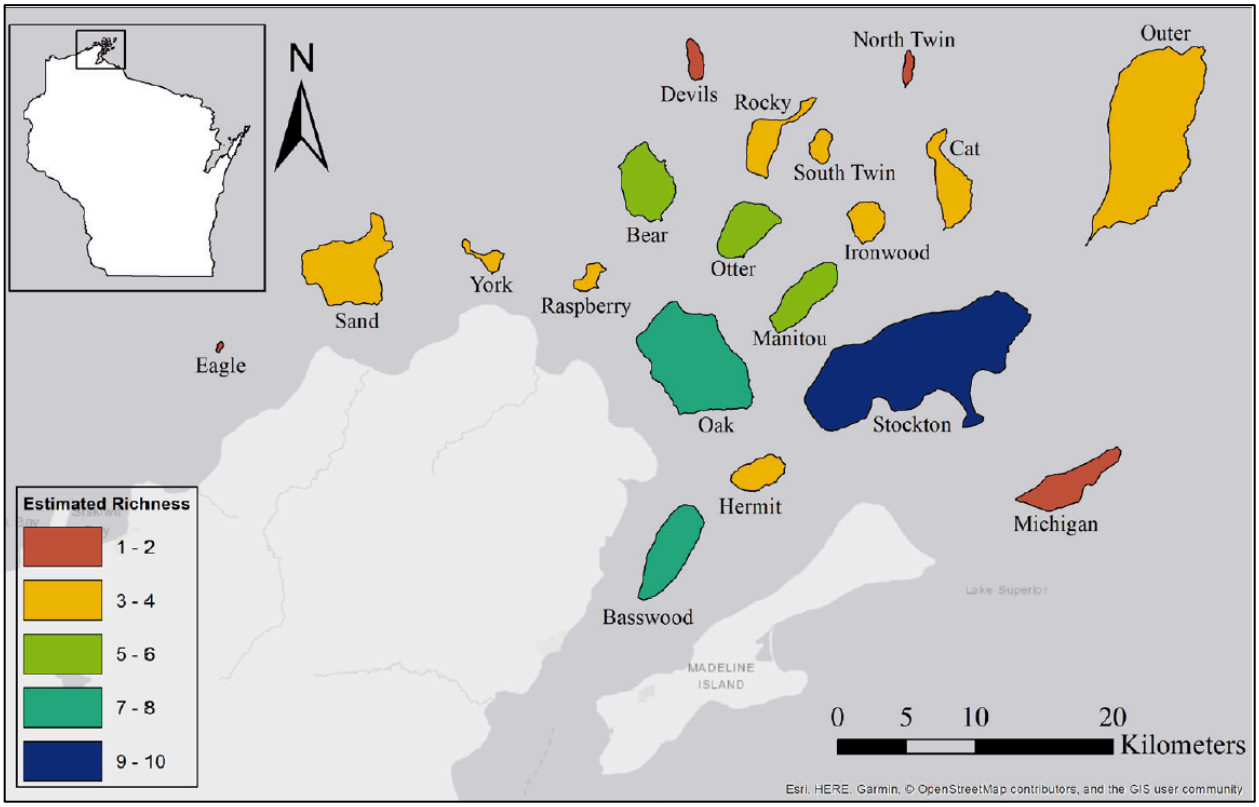
Name_____

Scientific Question: How does island size and/or the distance to the mainland affect carnivore richness in the Apostle Islands?

What is the hypothesis? Find the hypothesis in the Research Background and underline it. A hypothesis is a proposed explanation for an observation, which can then be tested with experimentation or other types of studies.

Scientific Data:

Use the map below, and the data on the following page, to answer the scientific question:



Map of the Apostle Islands with the richness, or number of different carnivore species, detected on each island.

Name_____

Island Name	Island Size (km^2)	Distance to mainland (km)	Carnivore richness
Basswood	7.7	1.9	5
Bear	7.3	7.2	4
Cat	5.4	18.0	3
Devils	1.3	14.3	1
Eagle	0.8	3.5	0
Hermit	3.2	3.7	3
Ironwood	2.7	14.4	1
Manitou	5.4	8.4	4
Michigan	6.2	17.9	0
North Twin	0.7	20.8	0
Oak	20.3	2.1	7
Otter	5.4	8.4	4
Outer	21.8	23.8	3
Raspberry	1.2	2.7	2
Rocky	4.2	12.4	3
Sand	11.6	2.0	3
South Twin	1.4	15.1	1
Stockton	40.0	7.8	10
York	1.1	1.5	0

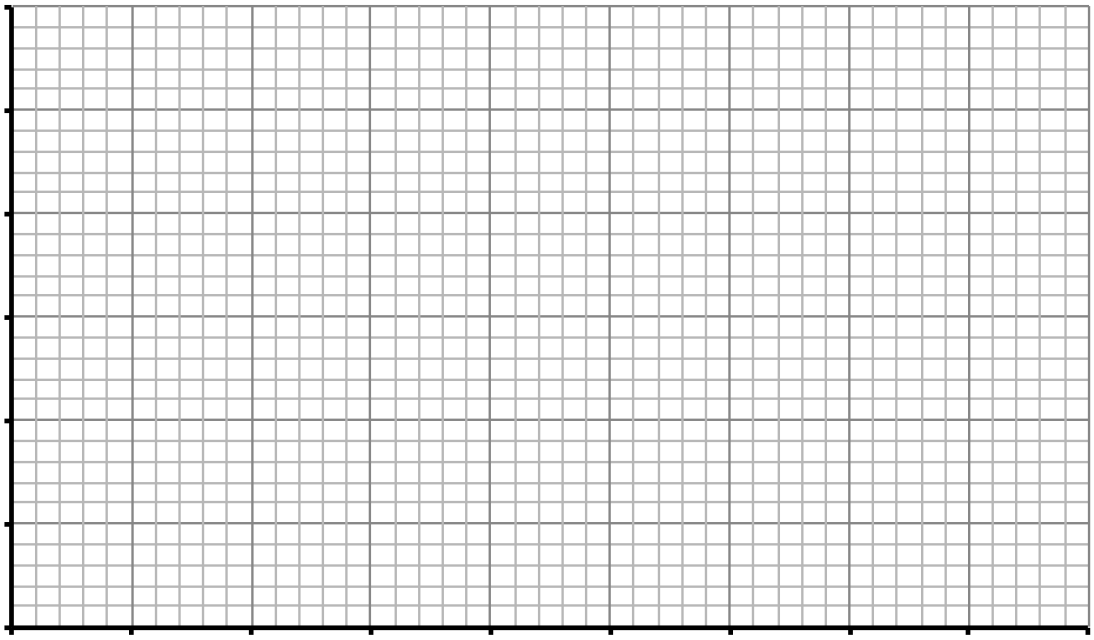
What data will you graph to answer the question?

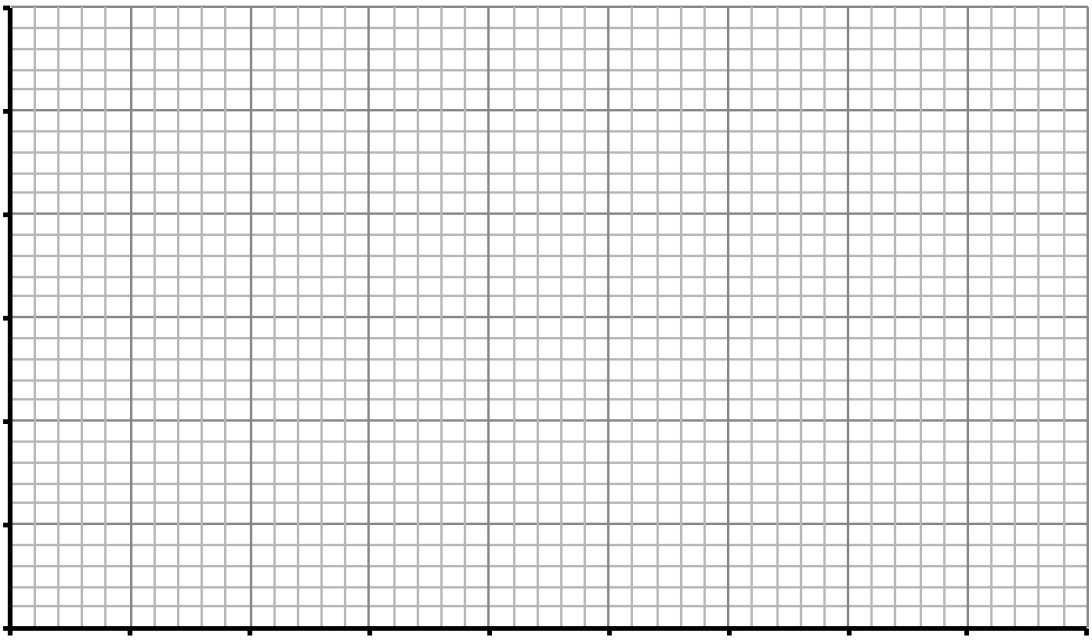
Independent variable(s): _____

Dependent variable(s): _____

Name_____

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





Name_____

Interpret the data:

Make a claim that answers the scientific question.

What evidence was used to write your claim? Reference specific parts of the map, table, or graph(s).

Explain your reasoning and why the evidence supports your claim. Connect the data back to what you learned about the theory of island biogeography.

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Did the data support Erik's hypothesis? Use evidence to explain why or why not. If you feel the data was inconclusive, explain why.

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