KEYSTONE SPECIES

SUMMARY/OVERVIEW

Grades:	Prep Time:	Learning Environment:	Total Lesson Length:
1-2	1 hour	Outdoor & Indoor	3 hours

DESCRIPTION:

This booklet introduces Keystone Species; including what they are, local examples, and their respective importance and impact on their ecosystems. Activities involve outdoor exploration as well as indoor worksheets and discussion topics. The booklet includes 3 hours of activities which can be delivered separately or on the same day.

CURRICULUM EXPECTATIONS:

Questioning and predicting:

- Demonstrate curiosity and a sense of wonder about the world.
- Ask questions about familiar objects and event

Processing and analyzing data and information:

- Experience and interpret the local environment
- Compare observations with predictions through discussion

BACKGROUND:

"Keystone Species" is a designation given to animals that play a unique and crucial role in the functioning of ecosystems. They have a disproportionately large effect on their environment relative to the number of individuals that live in that same ecosystem. Because of their role in maintaining biodiversity, efforts to manage and protect keystone species can help stabilize the entire ecological community.

Source: EDI Environmental Dynamics YouTube Channel
https://www.youtube.com/watch?v=_IWw8Ruz8Uo

LESSON PLAN

TIME	ACTIVITY	LOCATION	MATERIALS
1 hour	1. Introduction to Keystone Species	Indoor/Outdoor	Printed worksheets
1 hour	2. Types of Keystone Species	Indoor	Printed worksheet
1 hour	3. Conclusion	Indoor	Printed Worksheet

TIME	ACTIVITY	LOCATION	MATERIALS
1 hour	1. Introduction to Keystone Species	Outdoor (Ex: Dolphin beach or Beachcomber Regional Park)	Worksheet printout, clipboard, pen/pencil

Introduction: What is a Keystone Species?

GOAL: Introduce the concept of **KEYSTONE SPECIES**. Explain that one organism's population has a direct effect on other populations of organisms, as well as the entire ecosystem.

PREPARATION: Print worksheets (page 5) and ID sheets, gather clipboards and pens/pencils.
NOTE: *If your class needs practice working with food webs prior to this activity, please visit https://www.mabr.ca/at-home-activities for food web specific activities (view: Terrestrial Food Webs and/or Marine Food Webs and Resiliency).*

LESSON PLAN:
Part One: Species Overview
Introduce students to keystone species (and what makes them different from other species). There are four local species (Sea stars, Sea otters, Beavers, and Salmon) highlighted with information, YouTube videos, and pictures to help students connect the concept to animals they are familiar with.

Part Two: Beach Survey
Survey an area of beach and try to identify and count as many animals, birds, plants, and marine life you and the students can see. An intertidal identification sheet is available at https://sierraclub.bc.ca/online-classroom/ under "Create an Intertidal Zone Poster".

Part One: Species Overview

Ask students if they have heard the term "Food Web" before. If so, what is it? A Food Web refers to the interdependent connection of species that feed on one another. This is how energy (from food to molecules) is carried through the trophic levels.

Keystone Species - which can be an animal, plant, or even bacteria and fungi - are the glue that hold a habitat together. Keystone Species are those species whose presence and role in an ecosystem is crucial to the point that they have an enormous or even disproportionate effect on other organisms within their habitat's system. If the Keystone Species is removed, the ecosystem falls out of balance.

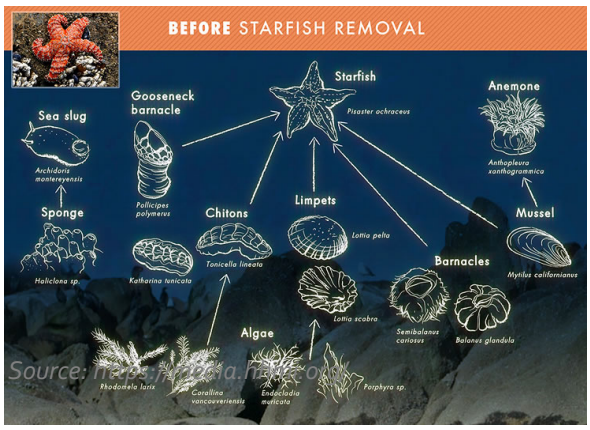
Meet the animal influencers that play an oversized – and often surprising – role in shaping our world: https://media.hhmi.org/biointeractive/click/keystone/index.html

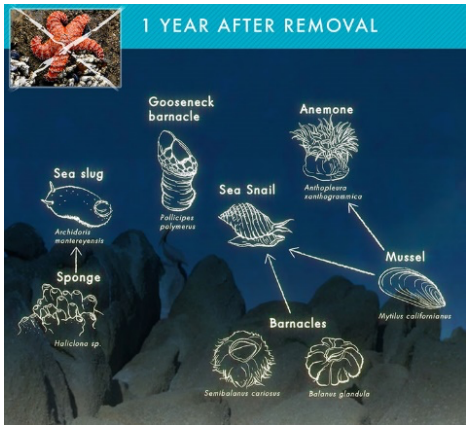
Would you consider a sea star an important predator?

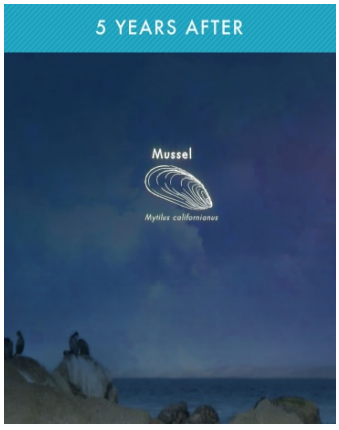
They might not look like such at a first glance, but if we are patient to watch them, we might realize they are specialized coordinated bivalve/mollusk hunters, with their favourite being blue mussels. What do you think would happen if the sea stars were to disappear from an area? The mussel population would grow very fast. Mussel habitat includes rocks (attached through their byssal threads), so in a short period of time they will "cling" to the rocks and outcompete other animals that also make rocks their home, such as snails, sea anemones, barnacles, algae, etc. Therefore, the ochre sea star (*Pisaster ochraceus*) is a Keystone Species that keeps the intertidal zone healthy and diverse.

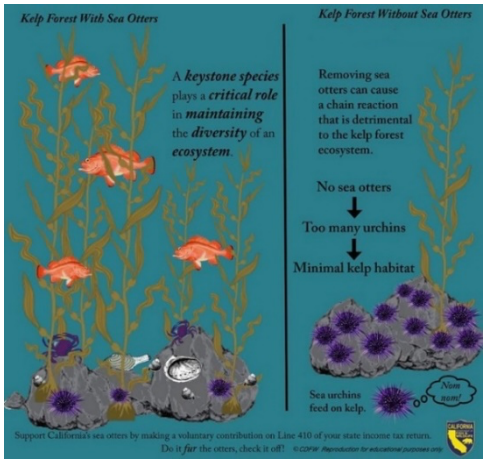
A Keystone Species is often, <u>but not always</u>, a **predator**

Watch this video to learn more about sea stars:
https://youtu.be/A6BqQ4_f7Fg









Sea Otters vs Sea Urchins:

Another example of species who can cause system imbalance are **sea urchins**. Sea urchins graze on kelp continuously, and the more sea urchins there are, the smaller the chance of there being a healthy kelp forest - leaving behind a barren and unproductive area. Why are kelp forests important anyway? They are home to dozens of other animals, serving as shelter, food, and nursery habitat, for example. What do you think happened to impact the sea urchin's population, causing them to "explode" in population? Their predator was not keeping them in check, due to the decrease in their numbers.

Humans, sea birds, sea stars and some fish eat sea urchins, but **sea otters** are their main predator. When the numbers of sea otters are too low, sea urchins will dominate the area. Here is a link to a video about sea otters: https://youtu.be/nHYUL3chc-s.

Beavers: The Original Builders

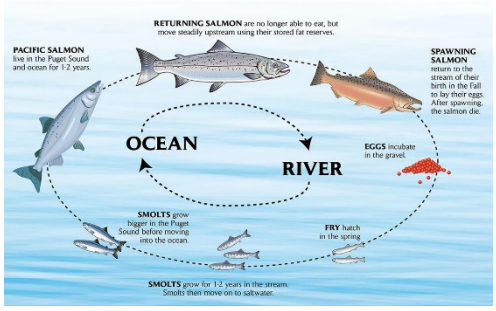
Another species that has a significant impact on its landscape and the species able to live there is the Beaver, Canada's National Animal! How does the beaver change its landscape? Beavers are busy creatures and are always building. Beavers need to build a home to live in that will keep them safe from predators and somewhere to stay warm and dry, which is why they build beaver dams. Beavers build their dams in/across moving water such as a stream or river using trees, branches, plants, and mud. This creates a barrier in the water which slows down the water flow, and often creates a new wetland behind the beaver dam as water pools and slowly flows through the beaver dam or finds a new route. A new wetland becomes home to many new species and is used by lots of animals looking for food, shelter, or somewhere to rest. This is why beavers are keystone species, because without their dams there would not be as much wetland habitat for so many other animals.

Also, beavers cut down a lot of trees to make their dam using their teeth! This changes the types of trees and vegetation surrounding the pond where the beavers are living, which is another way beavers modify their habitat. Check out this video on beavers: https://youtu.be/Ic3x8OVYe8o.

The picture on the left is an area without beavers, and the picture on the right is what happened once beavers were re-introduced to the area

Salmon: How the Ocean Connects to the Forest

Salmon are an iconic type of fish in BC, especially in coastal communities where they are a part of the community's lifestyle. What makes salmon a keystone species? Salmon hatch and start their lives in freshwater streams, and eventually move out to the ocean where they continue to grow and mature. When it is their time to breed and reproduce, salmon come back to the stream they hatched in and start the whole cycle over again. On top of coming back to make the next generation of salmon, the fish also bring back loads of nutrients from the ocean to the freshwater ecosystem and surrounding forest. From other animals eating them, decomposers breaking down their bodies, and trees using these nutrients, salmon have a huge impact on their ecosystem and all of these components rely on the salmon migrating back from the ocean to replenish their nutrient systems.



Part Two: Beach Survey

At a local beach, try and count as many different animals, birds, plants and marine life that you can! Try your best to write down the name of what you find.

SURVEY INFORMATION:

Date: _____ Time: _____ Location:_____

Name: _____ School: _____

I saw these animals/birds/plants/marine life at the beach today:

_____ _____

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Total number of species:

TIME	ACTIVITY	LOCATION	MATERIALS
1 hour	2. Types of Keystone Species	Indoor	Printed worksheet

Types of Keystone Species

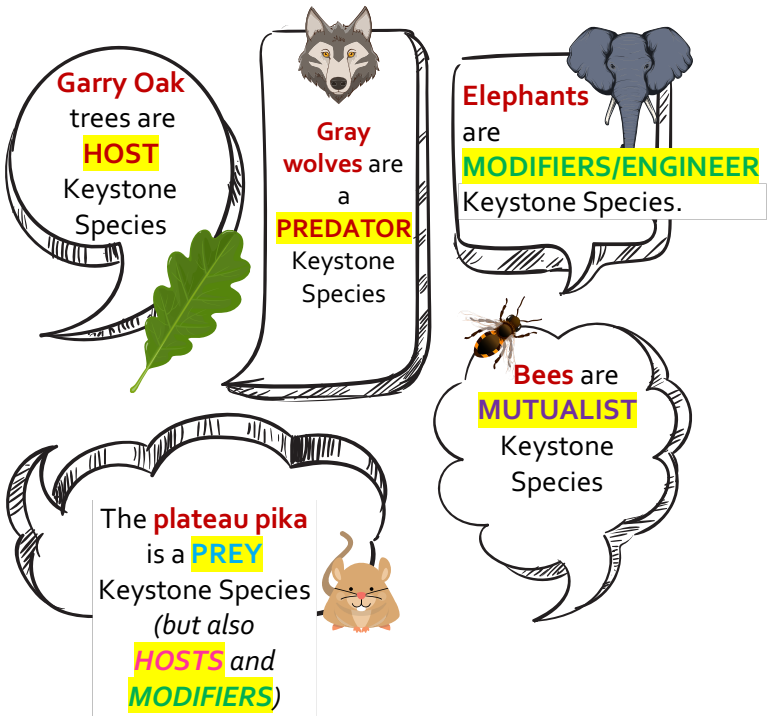
GOAL: Discuss how Keystone Species differ from each other. Different species will have different effects on their ecosystem and are classified as such.

PREPARATION: Print worksheet (page 7 and 8).

LESSON PLAN: Ask students to match the description of the animal with the type of Keystone Species it is.

Types of Keystone Species: **Keystone Mutualist, Keystone Modifier/Engineer, Keystone Host, Keystone Prey.**

ANSWER KEY:



CONTENT: We have learned that Keystone Species have a huge effect on their ecosystem - much bigger than the effects of other species. There are different types of "effects" that Keystone Species may exert. Compare one example of a Keystone Species with the other and ask students if they both work the same way. Example: Gray wolves are categorized as apex PREDATORS that play a crucial role as Keystone Species. Other types of Keystone Species are:

MUTUALISTS
Hummingbirds are referred to as Keystone Mutualists because they influence the success of several plant species through pollination, resulting in **mutually beneficial** interactions.

PREY
Keystone prey are species that can maintain their numbers despite being **preyed upon**, therefore controlling the density of a predator.

MODIFIERS/ENGINEERS
Keystone Modifiers, such as the North American beaver, determine the prevalence and activities of many other species by **dramatically altering the environment**.

HOSTS
Species like the Saguaro cactus in desert environments and palm and fig trees in tropical forests are called Keystone Hosts because they **provide habitat** for a variety of other species.

Source: ww.nrdc.org

Matching Game!

Complete the matching game below by filling in the blank with the type of Keystone Species based on the description (or draw a line connecting the description to the related animal). Does it describe a PREDATOR, MUTUALIST, MODIFIER/ENGINEER, HOST or PREY Keystone Species?
Each matching pair is on the same page

Gray wolves' presence has a ripple effect on the rest of its ecosystem. Studies show that wolves keep elk populations in check, preventing them from over-browsing on willow and aspen, which maintains healthy trees in the landscape.

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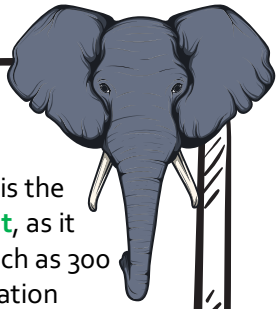

A Keystone Species in the African savanna is the **African Elephant**, as it consumes as much as 300 pounds of vegetation per day, preserving sunny, open spaces where grasses can thrive.

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MODIFIERS/ENGINEERS
Keystone Modifiers, such as the **African Elephant**, determine the prevalence and activities of many other species by **dramatically altering the environment**.

PREDATOR
Gray wolves are categorized as apex **PREDATORS** that play crucial role as Keystone Species as they keep Elk populations controlled so the Elk don't overgraze.

MODIFIERS/ENGINEERS
Keystone Modifiers, such as the **Beaver**, determine the prevalence and activities of many other species by **dramatically altering the environment**.

Beavers are busy creatures and are always building. When they build their dams across moving water, it creates a barrier for the water which slows down the water and creates new wetlands behind the beaver dam. A new wetland becomes home to many new species and is used by lots of animals looking for food, shelter, or somewhere to rest.

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Did you know?

Otters used to be EXTIRPATED from Vancouver Island due to the fur trade. They have since been successfully reintroduced.

Source: www.dfo-mpo.gc.ca

Matching Game!

Complete the chart below with the type of Keystone Species type based on the description. Does it describe a PREDATOR, MUTUALIST, MODIFIER/ENGINEER, HOST or PREY Keystone Species?

Ecosystems containing many **Garry Oak** trees are considered "biodiversity hotspots", as they provide habitat to many organisms that do not thrive anywhere else.

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Bees support the reproduction of as much as 90% of the world's flowering plants. Not only do they pollinate fruits, vegetables, and other crops that provide humans with everything from food to clothing to fuel, but they also help produce the seeds, nuts, berries, and fruit that countless other species need in ecosystems around the world.

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MUTUALISTS

Bees are referred to as Keystone Mutualists because they influence the success of several plant species through pollination, resulting in **mutually beneficial** interactions.

HOSTS

Species like the **Garry Oak tree** are called Keystone Hosts because they **provide habitat** for a variety of other species.

PREY

Keystone prey are species that can maintain their numbers despite being **preyed upon**, therefore controlling the density of a predator, such as the **plateau pika**.

The **plateau pika** plays important roles in their ecosystem in Tibet. Not only do they make burrows that are the primary homes to a wide variety of small birds and lizards, but this rodent also serves as the principal food source for nearly all of the plateau's predator species.

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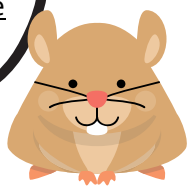

Did you know?

Due to the successful reintroduction of sea otters, the kelp forests along the coast of B.C. are thriving again and are home to many other species!

Source: www.dfo-mpo.gc.ca

TIME	ACTIVITY	LOCATION	MATERIALS
1 hour	3. Conclusion	Indoor	Printed worksheet

Conclusion

GOAL: Help students visualize the Keystone Species they learned about earlier through a drawing activity.

PREPARATION: Print off a selection of dot-to-dot colouring sheets that are included in the following pages (pages 10-13).

LESSON PLAN: Have students pick which dot-to-dot colouring worksheets they would like to complete. They can colour the animals after completing connecting the dots.

CONTENT:
A few follow up questions during the activity:

- What was one thing you learned today that surprised you, or that you didn't expect?
- What is your favourite animal that you learned about today?
- Is there another animal that you know about that might be a keystone species?
- What information did you already know, or had heard of before today's class?


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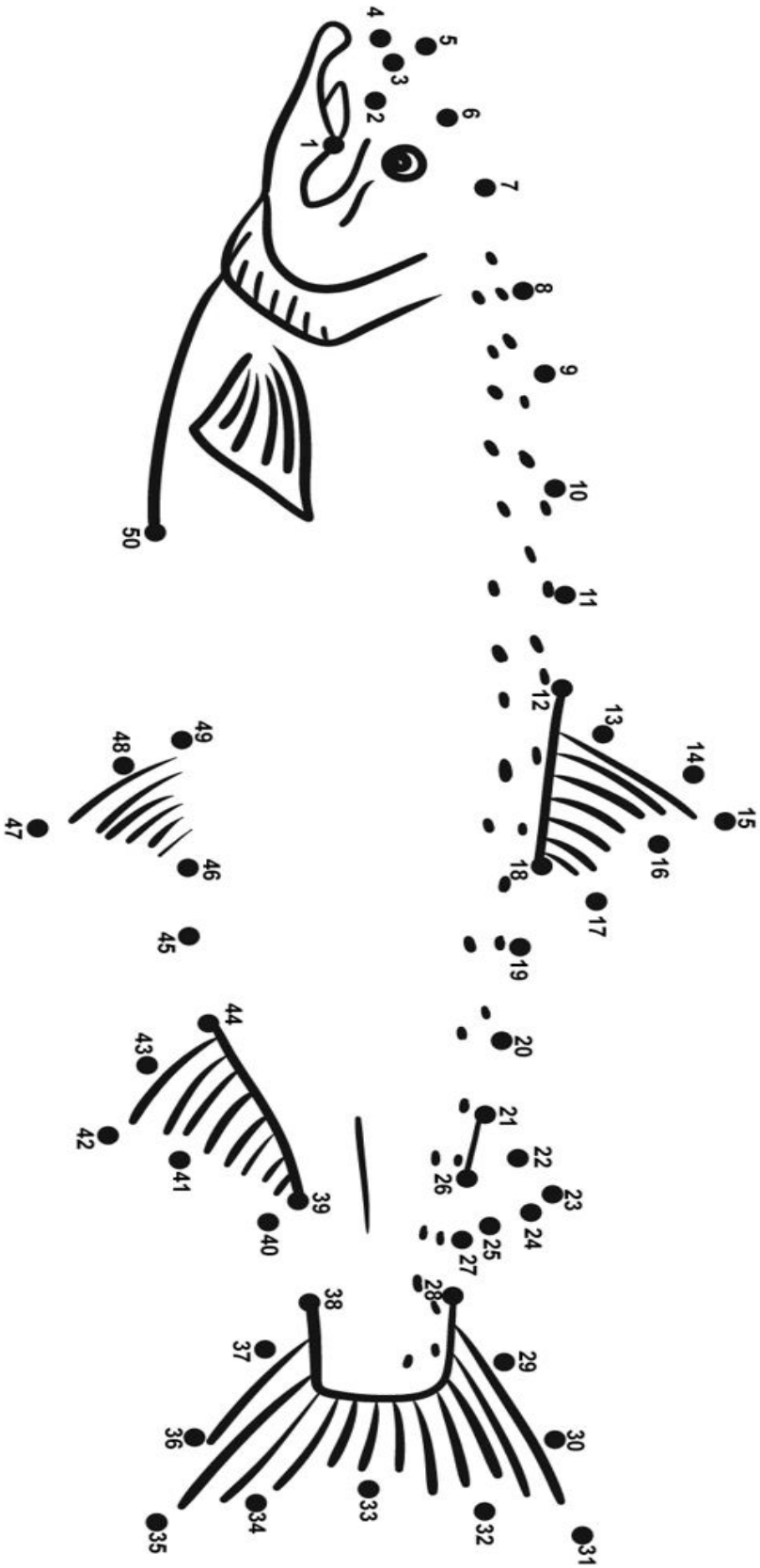
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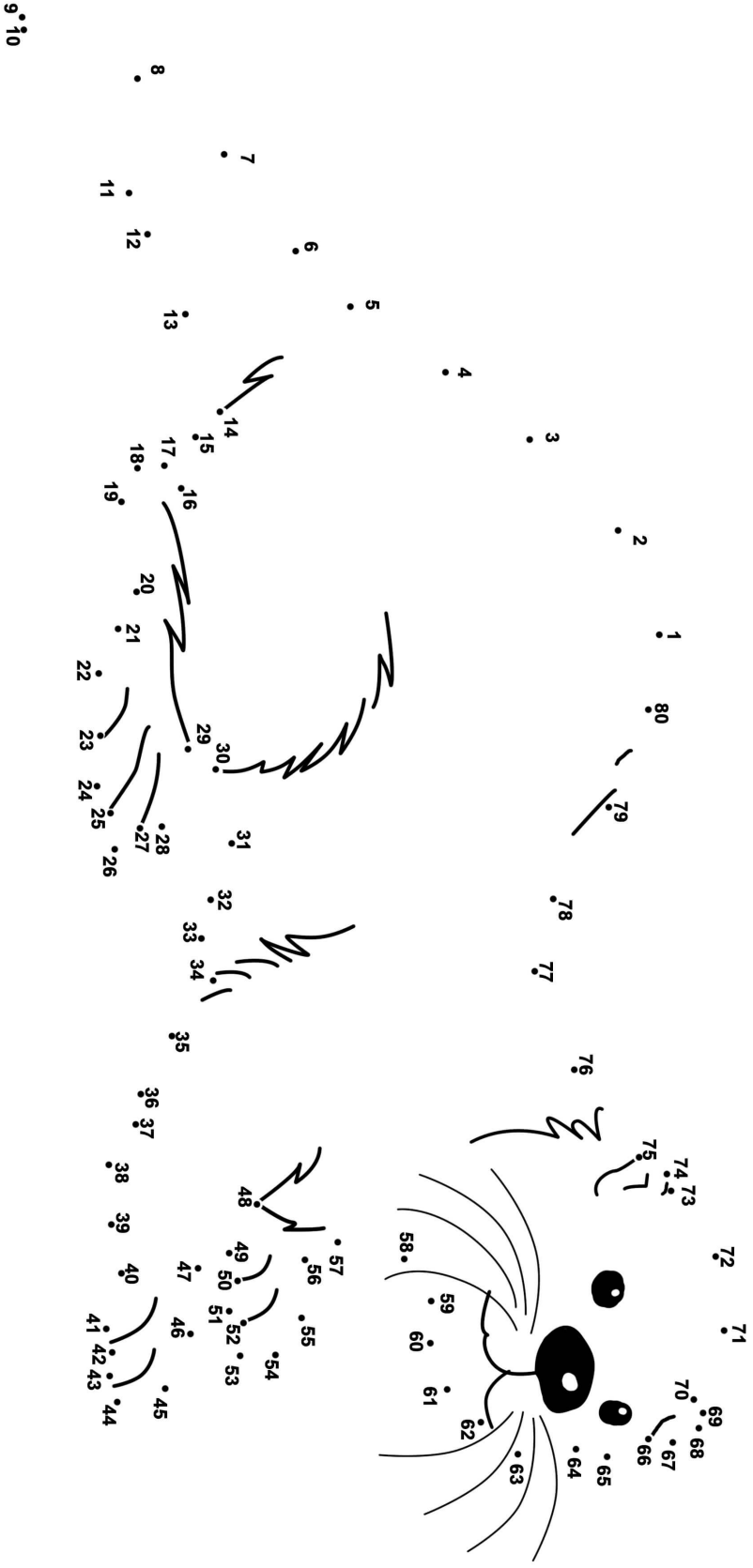

Show us your results! Snap a picture and share it with us on social media, or email it to the MABR Coordinator at **mandy.hobkirk@viu.ca**

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