Changing Lifestyles

Impact on Subsistence

Middle School Guide

REACH Up

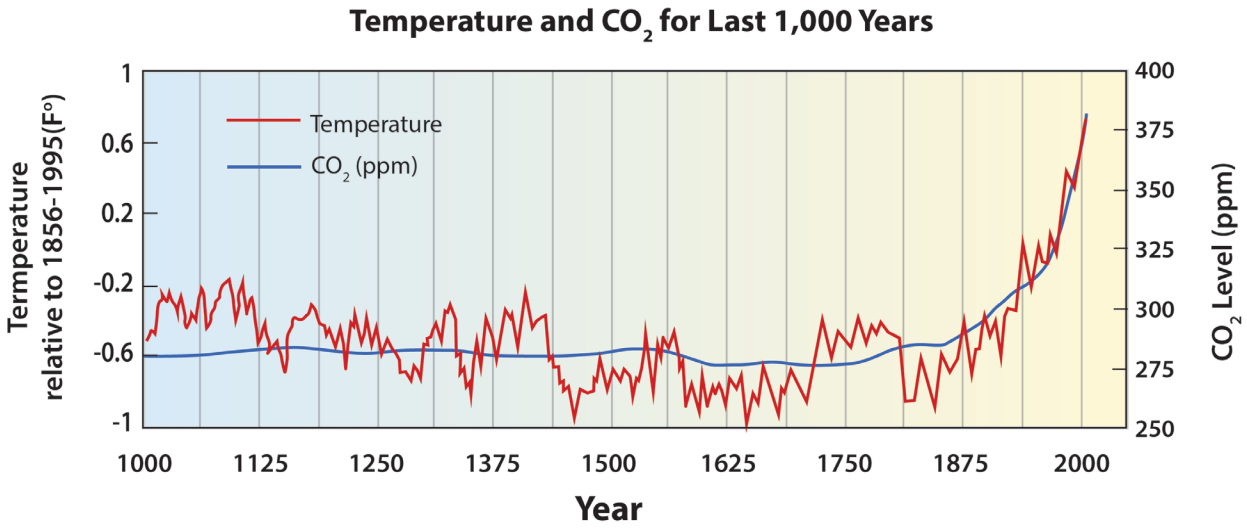
Raising Educational Achievement through Cultural Heritage Up

Changing Lifestyles

Climate Change and Carbon Dioxide

Carbon dioxide (CO_2), like water vapor and methane, is a greenhouse gas that contributes to the warming of our global climate. It is naturally produced by volcanic eruptions and forest fires, as well as by the breathing of people and animals. It is also produced by burning any type of fuel. During the last two centuries, global carbon dioxide levels have increased.

The graph below shows that carbon dioxide in the atmosphere increased significantly starting in the 1800s. This coincides with the Industrial Revolution, when people began making things in factories. The factories burned coal and wood to run their machines, and contributed carbon dioxide to the atmosphere from their smokestacks.



Graph showing increasing temperatures and CO_2 levels, modified from an article by Bill Chameides, PhD., Duke University. Data sources for CO_2: Law Dome ice core and Mauna Loa air samples. Data source for temperature: NOAA. *Source: Environmental Defense Fund, 2007.*

Today we contribute carbon dioxide in many ways. The factories that make the products we use, the airplanes that transport us and deliver our packages, the furnaces and woodstoves that heat our homes, and the vehicles we drive all produce carbon dioxide.

Changing Lifestyles

The landscapes in the northern part of the world are changing as a result of the warmer climate. People in the Bering Strait region are adapting their lifestyles to adjust to these changes. Some are also making lifestyle changes to reduce the amount of carbon dioxide and other pollution they create, so that they do not further contribute to the greenhouse effect and warming of the climate. How does the warming climate impact lifestyles in your community?

What is a Subsistence Lifestyle?

Subsistence is a lifestyle emphasizing the cultural, economic, and social practice of harvesting local wild resources for food and other uses. Many people in Alaska live a subsistence lifestyle. Climate change is causing changes to subsistence resources available in Bering Strait communities and throughout Alaska. What subsistence resources does your community rely on?

Abby Takak of Shaktoolik and Bobbi Andrews of St. Michael each demonstrate their methods of fish cutting. *Photo: Yuri Bult-Ito, REACH Up.*

Blueberries in a zip-top bag. *Photo: Joe Miller, K-12 Outreach Office.*

Salmon drying under a covered fishrack in Unalakleet. *Photo: Putt Clark, REACH Up.*

Drying seal skin on a rack in Shishmaref. *Photo: Putt Clark, REACH Up.*

How is Climate Change Impacting Subsistence Resources in the Bering Strait Region?

Elders, hunters, and scientists have observed changes in the plant, animal, bird, and fish populations in the Bering Strait region. Warmer average temperatures, reduced sea ice, winter rain events, increased wildfire risk, salt water inundation from storm events, and other climate changes are impacting the wildlife in this area. Less sea ice means walrus must find new places to rest and seals must travel further to find ice stable enough to birth their pups. Moose are moving into new territory as warmer weather and longer summers bring the willows that are their food source into new areas. Milder winters mean caribou expend less energy keeping warm, but can also bring rain events that create a layer of ice in the snow above the lichen, making it hard for these animals to break through and access food.

Furry catkins appear in the spring on willows and alder bushes. These spring alders are part of an increasing number appearing in Kotzebue. *Photo: Putt Clark, REACH Up*.

Ask an Expert

1. Watch the video *Impact on Subsistence* available at www.k12reach.org/videos.php. You may also want to watch the videos *Subsistence: Marine Mammals* and *Subsistence: Birds*.

2. Discuss local subsistence with an elder or other community member. Some questions you may want to ask:
   - What subsistence resources does our community rely on?
   - How are the plant and animal resources we rely on specially adapted to our climate or environment?
   - How is climate change affecting subsistence resources?
   - Have you or others you know of had to adapt their subsistence practices because of climate change? If so, how?

3. If the person you interview speaks an Alaska Native language, ask them what language and dialect they are familiar with. Ask them to please translate the following words:
   - bird
   - blubber
   - egg
   - goose
   - migration
   - nest
   - seal
   - walrus
   - whale

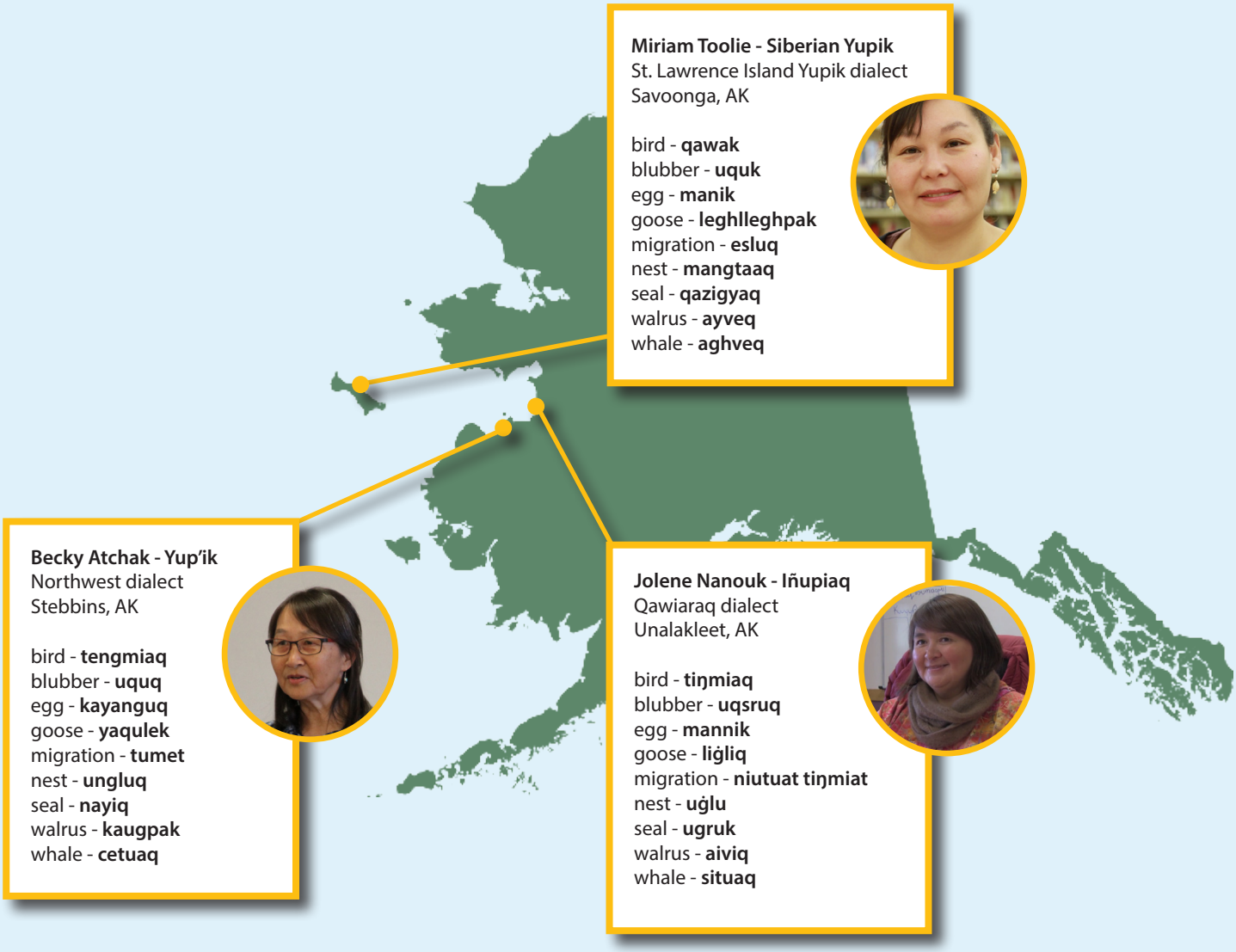
   Compare your words with the translations on the Subsistence Vocabulary page of this student guide. Are any of the terms the same or similar?

Clarence "Junie" Towarak of Unalakleet discusses changes to subsistence resources in his community. *Photo: Qian Li, REACH Up.*

Subsistence Vocabulary

Would you like to know Alaska Native language terms related to subsistence?

Work with your classmates to practice subsistence vocabulary words in English and the indigenous language of your community. Your teacher will give you vocabulary cards with the English word and an illustration on one side. Write the corresponding indigenous term on the blank line on the back of each card. Use the words that you learned from a local elder or cultural knowledge bearer, or choose the translation below that is closest to your community.



Miriam Toolie - Siberian Yupik
St. Lawrence Island Yupik dialect
Savoonga, AK

bird - **qawak**
blubber - **uquk**
egg - **manik**
goose - **leghlleghpak**
migration - **esluq**
nest - **mangtaaq**
seal - **qazigyaq**
walrus - **ayveq**
whale - **aghveq**

Becky Atchak - Yup'ik
Northwest dialect
Stebbins, AK

bird - **tengmiaq**
blubber - **uquq**
egg - **kayanguq**
goose - **yaqulek**
migration - **tumet**
nest - **ungluq**
seal - **nayiq**
walrus - **kaugpak**
whale - **cetuaq**

Jolene Nanouk - Iñupiaq
Qawiaraq dialect
Unalakleet, AK

bird - **tiŋmiaq**
blubber - **uqsruq**
egg - **mannik**
goose - **liġliq**
migration - **niutuat tiŋmiat**
nest - **uġlu**
seal - **ugruk**
walrus - **aiviq**
whale - **situaq**

How are Local Plants and Wildlife Adapted to the Climate and Ecosystems of the Bering Strait Region?

The local plants and wildlife that people in the Bering Strait region depend on for subsistence are adapted to the local climate and ecosystem. These organisms use physical and behavioral adaptations to help them thrive in the Far North. Physical adaptations are features of an organism's body that help it survive, such as thick fur for keeping warm. Behavioral adaptations are things organisms do to survive, such as burrowing beneath the snow to stay warm in winter.

Climate is changing quickly in this region and the rapid changes lead to new challenges that organisms may or may not be able to adapt to. What adaptations have you observed among the local plants and wildlife in your area?

Seals haul out on sea ice, where they rest and give birth to pups. This is a behavioral adaptation. Waterproof underfur helps seals stay warm in and out of the water. This is a physical adaptation. *Photo: Jooa Hooli, Wikimedia Commons.*

The Alaska Blackfish is a northern pond-dwelling fish that can withstand freezing temperatures and can also survive water-deficient environments by breathing air through a modified esophagus. *Photo: Alan Crouch, Wikimedia Commons.*

What Physical Adaptations Help Local Plants and Wildlife Thrive in a Cold Climate?

Walrus have tusks to pull their large bodies onto sea ice, where they rest between feedings. *Photo: NOAA staff, Wikimedia Commons.*

Moose and caribou have split hooves that spread as they walk, distributing the animal's weight to avoid sinking into snow or tundra. Caribou hooves harden during winter, when they use their hooves to dig down to lichen buried beneath the snow.

Tundra plants have shallow root systems that allow them to grow above the permafrost, and small leaves so that less moisture escapes from the plant in this dry environment. *Photo: Joe Miller, K-12 Outreach.*

Beavers produce an oil that is water-repellent. They use a claw to comb the oil into their fur to keep their skin warm and dry underwater and during winter months. *Photo: Marcin Klapczynski, Wikimedia Commons.*

Physical Adaptations: Blubber!

Why is blubber important?

Sea mammals such as walrus, whales, and seals have a thick layer of fat beneath their skin. This fat is known as blubber. People who rely on these sea mammals for subsistence use the blubber in a variety of ways. Some families render the blubber to make a tasty oil for dipping. Others whip the fat and mix it with frozen berries and sugar to make a dessert. Historically, the oil rendered from the blubber of these animals was also burned for light and heat. How do people in your community use blubber?

Have you ever thought about why sea mammals have blubber? Blubber is a physical adaptation. Work with a group of classmates to model blubber and discover how it helps animals survive in cold ocean water.

Predict!

Which will stay warmer in cold water: a hand encased in blubber and skin, or a hand with only skin? Why?

Model It

Create models of skin with blubber beneath, skin without blubber, and icy ocean water.

Materials

- 4 quart-size zipper seal plastic bags
- Shortening (approximately 2 cups)
- Tape
- Spoon
- Ice water
- Water basin
- 2 Thermometers
- Timer

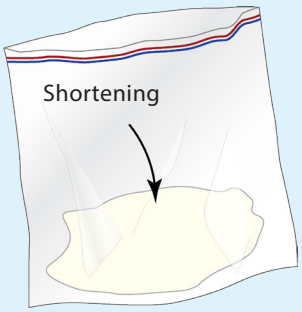
Activity

1. Make a "blubber mitten" by following the steps in the illustration below. The shortening will represent blubber in your model, and the outer plastic bag will represent skin.

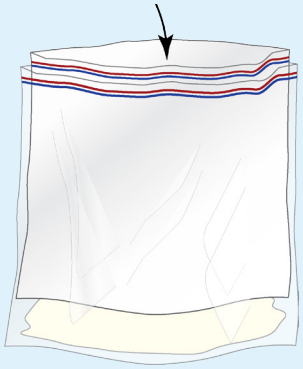
Resealable bags (2)

Put shortening in one bag

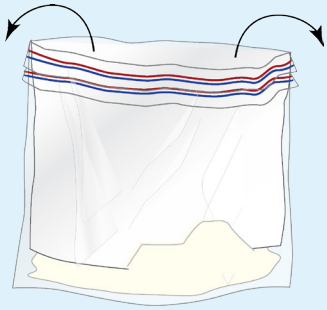
Shortening



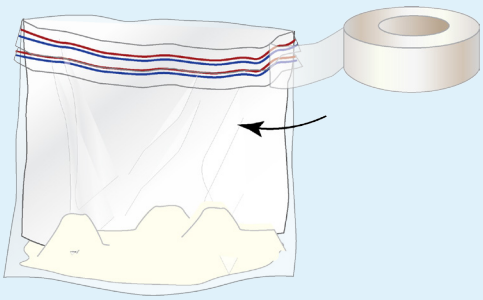
Insert the second bag inside the first.



Fold the top edges over



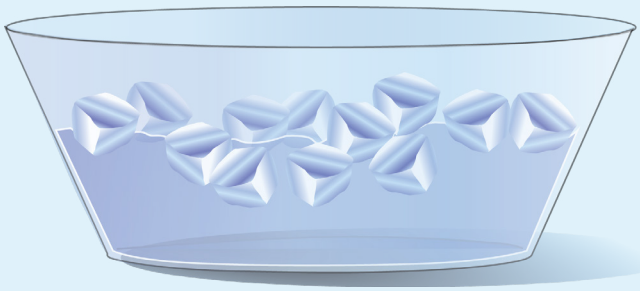
Tape the outside of the first bag to the second bag so the edges are sealed.



Put your hand inside the "blubber mitten" and squish the shortening around to create an even layer of shortening between the bags. Be sure the layer is equal on both sides of your hand.

2. Make a "skin mitten" using the same procedure as above, but without the shortening.
3. Model the ocean during winter by pouring ice and water into the water basin. Fill the basin about 2/3 of the way to the top.

Test your Prediction



Work with a group to test your prediction. Each person in the group should perform the following test:

1. Put the blubber mitten on one hand, and the skin mitten on the other hand.
2. Slide a thermometer into each mitten so that it is resting against your hand. Place both mitted hands into the ice water at the same time. Ask another person in your group to set the timer for 30 seconds. Make sure that no water gets inside the mittens.
3. After 30 seconds has elapsed (OR if either of your hands becomes uncomfortable at any point) remove both hands from the water and immediately read the temperatures recorded on each thermometer.
4. Make a chart like the one below and record your findings.
5. Repeat this process for each person in your group.

Name	Blubber Mitten Temperature	Skin Mitten Temperature
Lucy		
Tyler		
Bessi		
Marlene		

Conclusions

- Which mitten kept your hands the warmest? Why?
- What role do you think that blubber plays in helping sea mammals survive in your climate? How might more or less blubber affect survival?

What Behavioral Adaptations Help Local Plants and Wildlife Thrive in a Cold Climate?

Salmon hide their eggs in the gravel of clear-flowing streambeds each summer. This behavioral adaptation protects the eggs from predators while also providing enough oxygen for development. *Photo: Kelsey Skonberg, REACH Up.*

Migration is a behavioral adaptation that enables many species of geese and other birds to spend winters in warmer climates and summers in the Bering Strait region. *Photo: Julo, Wikimedia Commons.*

To make the most of the short growing season, fruiting plants in the Far North tend to flower quickly at the beginning of the summer. This plant is locally known as a salmon berry. It is also called a cloudberry and its scientific name is *Rubus chamaemorus*.
Photo: Jörg Hempel, Wikimedia Commons.

Beavers build dams in rivers, streams, ponds, and lakes to provide protection against predators, and for easier access to food during the winter. *Photo: Yuri Bult-Ito, REACH Up.*

Goose Gamble

What is migration?

Migration is the seasonal movement of animals from one region to another. It is a behavioral adaptation. Many of the birds, fish, and animals within the Bering Strait region migrate, which is why they are present part of the year and absent part of the year. During the last summer of their life, salmon migrate from the ocean back to the streams where they were hatched to spawn. This rush of salmon in the rivers each summer is an essential subsistence resource for people in the region, who catch, dry, smoke, and store the fish to eat year-round. Birds such as geese and ducks that fly thousands of miles from their winter resting places to their summer nesting grounds in Alaska are also a valued food source. What other animals in your region migrate?

How might climate change and other factors impact the survival of birds that migrate to Western Alaska to nest? Play Goose Gamble with a group of classmates to discover how climate changes might impact migratory geese.

Materials

- Game board (on following pages)
- Playing pawns (one per player)
- Game counters to represent birds (approximately 100 per group)
- 1 four-sided die

How to Play

This game is for 2-4 players.

1. Each player selects a playing pawn and places it on the word "Start" on the game board.
2. Each player takes 6 game counters (geese) and places them on the part of the game board labeled "Flock." All players' geese are part of the same flock and it does not matter which geese each player contributed.
3. Choose a player to go first. Play proceeds clockwise.
4. On your turn, roll the die and move your pawn ahead that number of spaces. For the space you land on, read the instructions aloud to your teammates and then follow the instructions. When you reach a stop sign, you must stop and follow the directions beneath the sign before you can proceed.
5. This is a team game. Your flock is trying to survive migrating north, nesting, raising young, and migrating south again. Good luck!

Discuss

- How many geese were in your flock when you started? How many did you end with?
- What are some of the ways climate impacted your flock? Were these impacts helpful or harmful? What other factors impacted your flock?

START

The field where your flock always stops to rest and eat on the way north is now a parking lot for a new shopping mall. There is no food available and you must continue on. Two of the weaker birds in your flock don't make it.

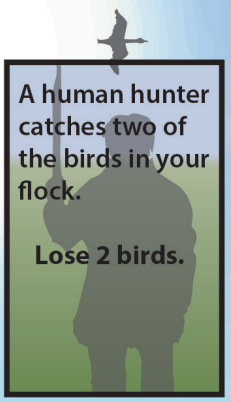
Lose 2 birds.

Your flock stops at a wildlife refuge where humans have scattered seed for you to feed on. Food is abundant and your flock resumes their journey well fed and well prepared.

Roll again

An eagle attacks a bird at the edge of your flock while the flock is resting.

Lose 1 bird



A human hunter catches two of the birds in your flock.

Lose 2 birds.

Your flock stops during the night at a freshly seeded field and gobbles up all the tasty seed to fuel your continued journey north. The farmer chases you off, but not before you have enjoyed a hearty meal.

Roll again.

STOP

You have reached your nesting grounds! Roll the die and move to the nesting grounds with the matching number.

FLOCK

You are injured while defending your hatchlings from a coyote.

Miss your next turn.

Your flock does not fly as far south as usual. Due to warmer temperatures, you do not need to travel as far south to find a good place to winter over. A shorter trip means fewer perils and your flock arrives intact.

Advance to Finish!

Migration has begun

Roll again.

A human hunter catches two members of your flock as you are migrating south.

Lose 2 birds.

In flight.

Roll again.

FINISH

The water supply at one of your usual rest stops on your journey south has been polluted. Several of the birds in your flock become sick. Two birds do not recover.

Lose 2 birds.

1: The lake you nest on each year is gone! The permafrost beneath it thawed and all the water drained away. The plants (your food source) that once thrived around the lake are now dead. You must look for a new place to build your nest. Lose one bird to starvation as you search for a new nesting area.

Lose 1 bird.

2: The lake you nest on each year has grown! The ice wedges that separated it from other lakes on the polygonal ground have thawed due to climate change, allowing the lakes to merge into one. Food is abundant and your flock is content.

Roll again.

3: The marsh you nest on each year has been inundated by saltwater from increased storms in the area. The plants you typically feed on here are freshwater plants, and they are struggling in the newly salty soil. The saltwater plants you also enjoy have not yet taken over. There is not enough food to go around. One bird starves.

Lose 1 bird.

4: Your nesting area is a welcome sight. Your flock eats their fill of the aquatic plants, seeds, and grasses in the area, along with a few insects. The females begin building nests in which to lay eggs.

Roll again.

One of the birds in your flock is injured by a coyote. The flock is more at risk while the injured bird heals.

Miss your next turn.

More mother birds than usual are sitting on nests because a warmer climate has caused better breeding conditions. They must remain on the ground and are vulnerable to predators. They rely on camouflage and the males in your flock to protect them. Unfortunately, a fox has found your flock. Some of the mother birds in your flock are eaten despite the best efforts of the males.

Lose 2 birds.

Earlier spring and warmer weather in your nesting region means plants are thriving. Food is plentiful and you do not have to range far from the nest to eat.

Roll again.

The winter in your nesting region was unusually warm. This killed off many of the lemmings in the area, which rely on a stable winter snowpack to thrive. The arctic foxes, which prey on lemmings are looking for other food and have been attacking birds in your flock.

Lose 1 bird.

It is time for the eggs to hatch! Roll the die and move to the nest with the matching number.

STOP

1: This was an uneventful nesting season for you and you hatched the usual number of eggs.

Add 6 birds to the flock.

2: A human harvested the eggs from your nest. Fortunately you were not quite done laying eggs yet so two eggs survived.

Add 2 birds to the flock.

3: A raven discovered your nest while the mother bird was away feeding. Only three of your eggs survived this year.

Add 3 birds to the flock.

4: Climate change is causing warmer conditions that are more favorable for breeding than in summers past. You hatched more eggs than usual.

Add 10 birds to the flock.

A seagull swoops in and gobbles up one of your new hatchlings.

Lose 1 bird.

You delay your southward migration because your flock has more offspring than usual and they are not quite ready to fly. This means you are staying in the north as food becomes scarce and temperatures drop. Lose two birds to starvation and cold.

Lose 2 birds.

An eagle snatches one of your hatchlings

Lose 1 bird

Spring came early at the nesting grounds this year, but your flock did not arrive early. This means that the plants your hatchlings need to eat passed their peak by the time your goslings hatched. Now food is scarce.

Lose 2 birds.

The plants you feed on are abundant this season. Your hatchlings are thriving.

Move an extra space on your next roll.

One hatchling is born with a deformed beak. It cannot eat properly and dies of starvation.

Lose 1 bird.

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