

## Science | Wildlife Health and Monitoring | Lesson Plan

Prepared for NSERC's PromoScience Program by Kutz Research Group at the University of Calgary Faculty of Veterinary Medicine



### Unit/Topic: Wildlife Health and Monitoring

Created by Susan Kutz, Juliette Di Francesco, Maltilde Tomaselli, Fabien Mavrot, Kaleigh Eichel on May 19, 2020

### Time: 3 days

[Day 1](#): 1 hour

[Day 2](#): 1 hour

[Day 3](#): 1 hour

Grade Level: 7-12 (can be adapted to younger grades)

### Local Experts:

- Hunters
- Elders
- Wildlife Officer

### PromoScience Connection:

This lesson fits into the overarching learning goals associated with wildlife health and monitoring by introducing the concepts: determinants of health, definition of health, health indicators, and zoonosis. Students will be able to appreciate how taking blood or tissue samples help researchers evaluate and monitor wildlife health to help communities make management decisions.

### Expectations: Identify overall or specific expectations from curriculum documents.

By the end of this lesson, the grades 1-6 students should be able to:

- Grade 1: Unit E: Needs of Animals and Plants
  - 1-1: Bring focus to investigative activities, based on their own questions and those of others
  - 1-4: Demonstrate positive attitudes for the study of science and for the application of science in responsible ways.
  - 1-11: Describe some common living things, and identify needs of those living things.
- Grade 2: Unit E: Small Crawling and Flying Animals
  - 2-1: Investigate, with guidance, the nature of things, demonstrating an understanding of the procedures followed.
  - 2-4: Demonstrate positive attitudes for the study of science and for the application of science in responsible ways.

- Grade 3: Unit E: Animal Life Cycles
  - 3–1 Investigate the nature of things, demonstrating purposeful action that leads to observations and inferences.
  - 3–2 Identify patterns and order in objects and events studied; and, with guidance, record observations, using pictures, words and charts; and make predictions and generalizations, based on observations.
  - 3–4 Demonstrate positive attitudes for the study of science and for the application of science in responsible ways.
- Grade 4: General Learner expectations
  - 4–1 Investigate the nature of things, demonstrating purposeful action that leads to inferences supported by observations.
  - 4–2 Identify patterns and order in objects and events studied; and record observations, using pictures, words and charts, with guidance in the construction of charts; and make predictions and generalizations, based on observations.
  - 4–4 Demonstrate positive attitudes for the study of science and for the application of science in responsible ways.
- Grade 5: General Learner Expectations
  - 5–1 Design and carry out an investigation, using procedures that provide a fair test of the question being investigated.
  - 5–2 Recognize the importance of accuracy in observation and measurement; and, with guidance, apply suitable methods to record, compile, interpret and evaluate observations and measurements.
  - 5–4 Demonstrate positive attitudes for the study of science and for the application of science in responsible ways.
- Grade 6: Diversity of Living Things
  - 6–1 Design and carry out an investigation in which variables are identified and controlled, and that provides a fair test of the question being investigated.
  - 6–2 Recognize the importance of accuracy in observation and measurement; and apply suitable methods to record, compile, interpret and evaluate observations and measurements.
  - 6–4 Demonstrate positive attitudes for the study of science and for the application of science in responsible ways.
  - “Describe microscopic living things using appropriate tools (hand lens) to assist them with their observations of pond life; and Describe ways in which microorganisms, like larger creatures meet their basic needs (water, air, energy)”

*(The NWT Grades K-6 Science and Technology Curriculum (2004))*

By the end of this lesson, the grade 7-9 students should be able to:

- “Conduct investigations into the relationships between and among observations, and gather and record qualitative and quantitative data.”
- “Analyze qualitative and quantitative data, and develop and assess possible explanations.”
- “Work collaboratively on problems; and use appropriate language and formats to communicate ideas, procedures and results.”
- Grade 7: Unit A: Interactions and Ecosystems: “analyze ecosystems to identify producers, consumers and decomposers; and describe how energy is supplied to and flows through a food web”
- Grade 8: Unit B: Cells and Systems: “Interpret the healthy function of human body systems, and illustrate ways the body reacts to internal and external stimuli”

*(Science Grades 7-8-9 Program of Studies 2003 (Updated 2009, 2014) by Alberta Education)*

By the end of this lesson, Grade 10-12 students will:

- “Conduct investigations into relationships between and among observable variables and use a broad range of tools and techniques to gather and record data and information”
- “Work collaboratively in addressing problems and apply the skills and conventions of science in communicating information and ideas and in assessing results”
- “Formulate questions about observed relationships and plan investigations of questions, ideas, problems and issues”
- Unit A: Living Systems Respond to Their Environment:

*(Biology 20-30 Program of Studies 2007 (updated 2014) by Alberta Education)*

- Unit C: Disease Defence and Human Health: “Describe the natural mechanisms that protect the human organism from pathogens” “Analyze the relationship between human health and environmental pathogens”

*(Science 14-24 Program of Studies 2003 (updated 2014) by Alberta Education)*

**Learning Goals:** Describe what the students are expected to learn. Share goals with students.

Students will learn the basic concepts of health and determinants of health, how researchers assess wildlife health, and how wildlife populations are managed through the use of games and activities: parasite larvae isolation and analysis, sample size calculations, Health Risk card game, and population dynamics simulation. Students will learn how community members and researchers work together to understand caribou and muskox health. Students will learn how complex the topic of health is with many influencing factors through discussion, lecture, and games.

**Success Criteria:** Describe from a student's perspective what attainment of a learning goal looks like.

- Able to participate in discussion about health and express their own opinions, observations, and experiences about wildlife health
- Able to set up a sampling experiment and identify larvae under a microscope.
- Able to calculate percentage and proportion and discuss why scientists take many samples from a population.
- Able to participate in the Health Risk card game and demonstrate understanding of environmental factors that influence health and identify different pathogens that affect caribou.
- Able to identify several different ways that hunters and researchers assess animal health
- Able to discuss why it is important to monitor wildlife health

**Pre-assessment:** Describe links to prior knowledge

Previous personal experiences hunting. Personal experiences with what "health" means to humans and animals.

**Learning Environment:** Describe the setting including groupings and management strategies

**Environment:** Classroom or lab with a sink, computer, projector for PowerPoint. Whiteboard and dry erase markers.

**Equipment and Materials are available and prepared:**

- Day 1: Activity 1: Muskox lung with nodules, Dissecting tray (1 per group), Dissecting scissors, Plastic bins, PPE: Gloves, goggles, lab coats
- Day 2: Activity 2: Health Risk cards, dice, dry erase markers
- Day 3: Activity 3: Health Risk cards, dice, dry erase markers
- Day 3: Activity 4: Hunter kit and felt caribou

**Management considerations:**

**Safety:** Wear personal protective equipment (PPE) for all lab activities. Wash hands with soap at the end of each lab session.

**Accommodations:** Students will be reminded that they need to work well with the individual they choose and if their grouping is not working out, they will have to work independently (for students who would prefer to work independently, additional worksheets and clipboards will be on hand). Teacher will circulate and monitor students to ensure understanding.

- For students with processing issues and or ESL/ELL students, considering making pairs that will provide these students with a lab partner that will help them to be successful.
- For students with high levels of anxiety, particularly OCD, consider providing a copy of the lab for students to look over prior to the lesson or discuss with

the student which questions will be asked so that the student can prepare for discussions involving bacteria growth and cleanliness

- For students with ADHD, ADD or other focus issues, consider “chunking” the lessons and spreading them out so that one part occurs before a recess/ break and the second part occurs after recess/ break, with a brief recap to reinforce ideas from the first part of the lesson
- This lesson is designed for grades 7-12 with 15-30 students. The lesson can be adapted for grades 1-6 by not doing activities 1-3, focusing more time on activities 4-6, and using simpler language.

Instruction	
<b>Day 1</b>	
<b>Time</b> 15 minutes	Follow the PowerPoint <b>“Minds on”</b> : What is health? Draw a mind map on the board as students contribute answers. What is the difference between absolute health, relative health, and disease? Go back to the mind map and add answers. What determines health? Add answers to the mind map. Introduce the 3 determinants of health: genetics, lifestyle/lifestage, environment Introduce the 5 environmental drivers of health: Pathogens, habitat, disturbances, contaminants, climate. Explain what a Pathogen is.
5 minutes	<b>Research connection</b> : Explain how your research looks at a pathogen or one of the environmental drivers of health. Can give Muskox Lungworms as an example.
35 minutes	<b>“Action Piece”</b> : Use Muskox Lungworms as an example to go into <a href="#">Activity 1</a> : Cutting open Muskox lungworm nodules
5 minutes	<b>“Consolidate”</b> : Follow PowerPoint: Summarize what was talked about today and set expectations for tomorrow. <b>EXIT TICKET</b> : What is one thing you found interesting today?
<b>Day 2</b>	
<b>Time</b> 20 minutes	Follow the PowerPoint <b>“Minds on”</b> : How pathogens affect animals: Energetic cost, Reproductive cost, Death
30 minutes	<b>“Action Piece”</b> : <a href="#">Activity 2</a> : Health Risk
10 minutes	<b>“Consolidate” and EXIT TICKET</b> : Discuss when your caribou in the Health Risk game was in absolute health, relative health, disease, and dead. What factors determined its health in the game. How is it more complicated in real life? How is health a continuum?

## Wildlife Health and Monitoring

Day 3	
<b>Time</b> 15 minutes	<p><b>“Minds on”:</b> Follow PowerPoint: Group discussion: Yesterday, we talked about how pathogens affect health. Today, we will be looking at the bigger picture. Why does it matter to monitor health in wildlife?</p> <p>Monitoring wildlife health can tell us how a population is doing based on herd size and the number of calves each year; health can be an indicator of climate change; wildlife health can have an impact on human health through zoonotic diseases.</p>
20 minutes	<p><b>“Action Piece”:</b> <a href="#">Activity 3</a>: Health Risk modified: only play with the health risk cards: lungworm, winter storm, good season calf, and good season adult. Include extra good season cards.</p>
5 minutes	<p><b>“Minds on”:</b> Follow the PowerPoint: Discuss the game on a population level: When we played the game, over time, many of you got worse and worse lungworm infections, but some of you recovered or only had a little bit of infection and were relatively healthy. The greater your infection, the more likely you were to die! How does this relate to the concept that health is a continuum? How do environmental factors interact? What happened when a winter storm came? You may have been able to survive with the lung worm infection, but if a winter storm came, you were less likely to survive!</p>
15 minutes	<p><b>“Community Connection”:</b> Wildlife officer or hunter: Discuss what samples they take to monitor health. What indicators of health have they seen?</p> <p><b>“Action Piece”:</b> <a href="#">Activity 4</a>: Hunter Kits: Use a clean hunter kit to explain how to collect samples from the felt caribou.</p>
5 minutes	<p><b>“Consolidate”:</b> Summary in PowerPoint: Health is influenced by many factors and is a continuum. Most animals are healthy with a few pathogens, but additional stress can lead to increased numbers of sick or dead animals. We can use different measurements to assess the health of wildlife. Monitoring wildlife health can inform wildlife management and public health and serve as an indicator of environmental changes.</p> <p><b>EXIT TICKET:</b> How would you apply what you learned about animal health to human health or your own health?</p>

### Assessment (data collection)/Evaluation (interpretation of data)

This is an introductory module and students are encouraged to participate in all activities.

### Additional Resources:

<https://www.ucalgary.ca/caribou/index.html>

[https://www.caff.is/images/\\_Organized/CARMA/Resources/Field\\_Protocols/RangiferHealthBodyConditionManualforwebe42d.pdf](https://www.caff.is/images/_Organized/CARMA/Resources/Field_Protocols/RangiferHealthBodyConditionManualforwebe42d.pdf)

[https://www.enr.gov.nt.ca/sites/enr/files/rev\\_bluenose\\_caribou\\_herds\\_draft\\_management\\_plan\\_v10\\_final\\_signed\\_-\\_nov\\_4\\_2014\\_0.pdf](https://www.enr.gov.nt.ca/sites/enr/files/rev_bluenose_caribou_herds_draft_management_plan_v10_final_signed_-_nov_4_2014_0.pdf)

[https://www.enr.gov.nt.ca/sites/enr/files/field\\_guide\\_wildlife\\_diseases.pdf](https://www.enr.gov.nt.ca/sites/enr/files/field_guide_wildlife_diseases.pdf)

[https://www.gov.nu.ca/sites/default/files/muskox\\_health\\_survey\\_-\\_final\\_report\\_may\\_2011.pdf](https://www.gov.nu.ca/sites/default/files/muskox_health_survey_-_final_report_may_2011.pdf)

i Some resources may not be authorized but are provided to identify potentially useful ideas for teaching and learning. The responsibility to evaluate these resources rests with the user.

ii All website addresses listed were confirmed as accurate at the time of publication but are subject to change.

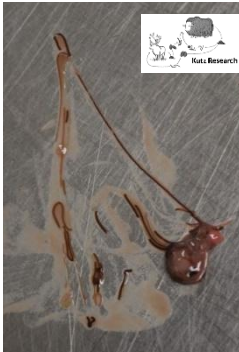
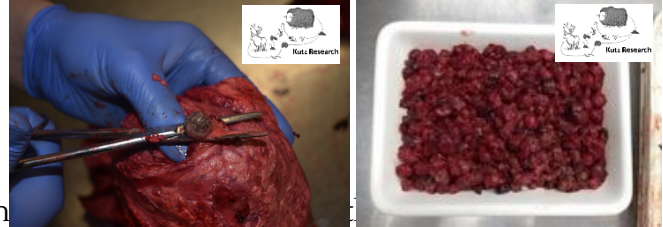
## Activity 1: What's in a lung nodule?

### Materials:

- Muskox lung with nodules
- Dissecting tray (1 per group)
- Dissecting scissors
- Plastic bins
- Glove, goggles, lab coat

### Instructions:

- Wash hands, put on PPE.
- As a class, cut down the **trachea** and in  
These airways end in **alveoli**, where gas exchange occurs with millions of tiny capillaries. Notice that the lung tissue also contains **nodules**.
- Cut open several nodules. What is inside? Look at these under the microscope.
- Clean up, wash hands.





## Activity 2 and 3: Health Risk Card Game

This activity was designed for about 30 students. Adjust the number of cards accordingly if you have fewer students. Adding more “Good Season” cards will make the game last longer.

For Activity 3, use only the lungworm cards, the winter storm cards, and the good season cards (along with the 3 years of game play and the caribou score cards). Use more of the “Good Season” cards with activity 3.



### Materials:

- Playing Deck (best if you can laminate the decks)
- Dice (1 die per student)
- Pencils or dry-erase markers if laminated (be able to erase cross outs for summer)

### Instructions:


- Prepare the deck before the game starts by printing on cardstock and cutting out. You will have 3 decks: Green: Muskox Score Cards, Green and Blue: Game Play Cards, and Red/Green: Health Risks (predators and diseases and good season) cards. Ideally, laminate the deck.
- Deal every student 1 muskox score card and 1 dice (students can share dice if needed)
- Use the Game Play Cards to guide the game:
  - o Year 1: Summer: Roll the dice. There is 100% chance of survival or 6/6.
  - o Year 1: Winter: Cross off 1 die on the muskox score card. There is now a 5/6 chance of surviving winter or 83%. If the student rolls the crossed out die, the muskox dies and is eliminated from the game.
  - o Year 2: Summer: Erase the 1 cross out line from winter because we have entered summer. Then shuffle and draw a health risk card.
    - Optional: Players can trade cards before crossing out dice on their muskox score card. It is up to the discretion of the players whether a trade is good or not. A player may refuse to trade.
    - Once trading is complete, cross out the number of dice indicated on the muskox score card.
    - Roll the dice. If the student rolls one of the crossed out dice, the muskox dies and is eliminated from the game.
  - o Year 2: Winter: Cross off 1 additional die on the muskox score card depending on Health Risk cards. Keep all other crossed out dice from the health risk cards. Roll the dice. If the student rolls one of the crossed out dice, the muskox dies and is eliminated from the game.
  - o Year 3: Summer: Erase the 1 cross out line from winter because we have entered summer. Then shuffle and draw a health risk card, trade (optional), and cross out the number of dice indicated on the muskox score card. The game is cumulative, so add up all the reductions. Roll the dice. If the student

- rolls one of the crossed out dice, the muskox dies and is eliminated from the game.
- Year 3: Winter: Cross off 1 additional die on the muskox score card. Keep all other crossed out dice from the health challenge cards. Roll the dice. If the student rolls one of the crossed out dice, the muskox dies and is eliminated from the game.
- Repeat year 3 until the deck is depleted or end the game after year 3.
- **Who survived? Why did the game get harder every season?**
- Note any special cases as the season changes or if you are holding other cards as well that may decrease the chances of survival further.
  - For example, if it is summer and you are holding both a lungworm card and a wolf card, your survival decreases by -3 total (-1 from the lungworm card and -2 from the wolf card). When it becomes winter, if you are holding both a lungworm card and a wolf card, your survival decreases by -4 total (-1 from the lungworm card, -2 from the wolf card, and -1 from the winter card).
  - You can acquire the same disease many times, which increases the amount of infection. For example, if you draw 2 Orf viruses, the infection is cumulative and you will have -4 impact on survival.
  - Lungworm card: If you drew lungworm the first time, there is no survival impact. If you drew lungworm on the second round, you will have -1. If you drew a lungworm on the third round, you will have -2 and so on. If you drew a lungworm on the first round, there is no impact on survival. If you drew Orf virus on the second round, you will have -3 impact on survival (-1 from the lungworm, -2 from the orf virus).
  - Orf virus and Erysipelas cards: These pathogens affect younger animals more severely than older animals so there is a larger reduction in survival if you get these cards earlier in the game.
  - Wolf card: During the summer, wolf predation is higher and the impact on survival is -2. In the winter, the impact on survival is -1. There is an additional -1 impact on survival if the muskox has at least 1 infection from another disease (orf virus, erysipelas, or lungworm). If the muskox has many other diseases, the impact from the wolf is still -1 (though the disease cards are cumulative).
  - Winter storm card: Will only occur during the winter season of the year. Return to the draw pile at the end of the winter season if you survive the winter storm. If you die, it does not return to the draw pile.
  - Good Season calf card: You can remove 1 Disease or Predator card of your choice and erase the cross-outs on the dice on your muskox score card. Return this card and the discard card to the draw pile at the end of the season.
  - Good Season adult card: No additional diseases or predators are added for that year. Return this card to the draw pile at the end of the season.

# Wildlife Health and Monitoring

Print 4 sheets on cardstock and cut out. Each student gets 1 muskox score card.

Photo: The Bannock, US Fish and Wildlife Service/Peter Dinkley. Photo courtesy of the author and permission of the University of Calgary.



You start off as a healthy muskox living in your ideal environment. Your health score starts at 6.

With each disease you get, bad weather, or predator, your chances of survival decrease.

Cross off the health score as you encounter obstacles to health.

Then roll the dice. If you land on one of the crossed off numbers, you do not survive that season.

Each season, you will draw a new health challenge.







Photo: The Bannock, US Fish and Wildlife Service/Peter Dinkley. Photo courtesy of the author and permission of the University of Calgary.



You start off as a healthy muskox living in your ideal environment. Your health score starts at 6.

With each disease you get, bad weather, or predator, your chances of survival decrease.

Cross off the health score as you encounter obstacles to health.

Then roll the dice. If you land on one of the crossed off numbers, you do not survive that season.

Each season, you will draw a new health challenge.







Photo: The Bannock, US Fish and Wildlife Service/Peter Dinkley. Photo courtesy of the author and permission of the University of Calgary.



You start off as a healthy muskox living in your ideal environment. Your health score starts at 6.

With each disease you get, bad weather, or predator, your chances of survival decrease.

Cross off the health score as you encounter obstacles to health.

Then roll the dice. If you land on one of the crossed off numbers, you do not survive that season.

Each season, you will draw a new health challenge.

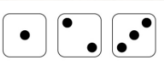





Photo: The Bannock, US Fish and Wildlife Service/Peter Dinkley. Photo courtesy of the author and permission of the University of Calgary.



You start off as a healthy muskox living in your ideal environment. Your health score starts at 6.

With each disease you get, bad weather, or predator, your chances of survival decrease.

Cross off the health score as you encounter obstacles to health.

Then roll the dice. If you land on one of the crossed off numbers, you do not survive that season.

Each season, you will draw a new health challenge.







Photo: The Bannock, US Fish and Wildlife Service/Peter Dinkley. Photo courtesy of the author and permission of the University of Calgary.



You start off as a healthy muskox living in your ideal environment. Your health score starts at 6.

With each disease you get, bad weather, or predator, your chances of survival decrease.

Cross off the health score as you encounter obstacles to health.

Then roll the dice. If you land on one of the crossed off numbers, you do not survive that season.

Each season, you will draw a new health challenge.

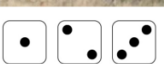





Photo: The Bannock, US Fish and Wildlife Service/Peter Dinkley. Photo courtesy of the author and permission of the University of Calgary.



You start off as a healthy muskox living in your ideal environment. Your health score starts at 6.

With each disease you get, bad weather, or predator, your chances of survival decrease.

Cross off the health score as you encounter obstacles to health.

Then roll the dice. If you land on one of the crossed off numbers, you do not survive that season.

Each season, you will draw a new health challenge.







Photo: The Bannock, US Fish and Wildlife Service/Peter Dinkley. Photo courtesy of the author and permission of the University of Calgary.



You start off as a healthy muskox living in your ideal environment. Your health score starts at 6.

With each disease you get, bad weather, or predator, your chances of survival decrease.

Cross off the health score as you encounter obstacles to health.

Then roll the dice. If you land on one of the crossed off numbers, you do not survive that season.

Each season, you will draw a new health challenge.







Photo: The Bannock, US Fish and Wildlife Service/Peter Dinkley. Photo courtesy of the author and permission of the University of Calgary.





You start off as a healthy muskox living in your ideal environment. Your health score starts at 6.

With each disease you get, bad weather, or predator, your chances of survival decrease.

Cross off the health score as you encounter obstacles to health.

Then roll the dice. If you land on one of the crossed off numbers, you do not survive that season.

Each season, you will draw a new health challenge.

# Wildlife Health and Monitoring

Print 1 sheet on card stock and cut out, keep in order.



**Year 1: Summer**

- Lots of food to eat
- Good weather
- No diseases
- No predators

To survive summer: Roll 1, 2, 3, 4, 5, 6





**Year 1: Winter**

- Extreme Cold
- Less food to eat
- No disease
- No predators

Your chances of survival decreases -1. Cross off 1 dice on your muskox card.

To survive winter: Roll 2, 3, 4, 5, 6





**Year 2: Summer**

- Lots of food to eat
- Good weather
- Erase 1 crossed out dice
- Draw a health challenge card and cross off dice on your muskox card if required.

Roll! Did you survive the summer of year 2?





**Year 2: Winter**

- Extreme Cold
- Less food to eat
- Cross off 1 dice on your muskox card

Roll! Did you survive the winter of year 2?





**Year 3: Summer**

- Lots of food to eat
- Good weather
- Erase 1 crossed out dice
- Draw a health challenge card and cross off dice on your muskox card if required.

Roll! Did you survive the summer of year 3?





**Year 3: Winter**

- Extreme Cold
- Less food to eat
- Cross off 1 dice on your muskox card

Roll! Did you survive the winter of year 3?




# Wildlife Health and Monitoring

Print 8 sheets on cardstock and cut out. Shuffle in with other disease and predator cards.

 <p><b>Lungworm</b> Lungworm makes it difficult for muskox to breath and reduces muskox survival by: If you hold no other cards, there is no additional impact on survival -1 for each additional disease or predator card (including another lungworm)</p> 	 <p><b>Lungworm</b> Lungworm makes it difficult for muskox to breath and reduces muskox survival by: If you hold no other cards, there is no additional impact on survival -1 for each additional disease or predator card (including another lungworm)</p> 
 <p><b>Lungworm</b> Lungworm makes it difficult for muskox to breath and reduces muskox survival by: If you hold no other cards, there is no additional impact on survival -1 for each additional disease or predator card (including another lungworm)</p> 	 <p><b>Lungworm</b> Lungworm makes it difficult for muskox to breath and reduces muskox survival by: If you hold no other cards, there is no additional impact on survival -1 for each additional disease or predator card (including another lungworm)</p> 
 <p><b>Lungworm</b> Lungworm makes it difficult for muskox to breath and reduces muskox survival by: If you hold no other cards, there is no additional impact on survival -1 for each additional disease or predator card (including another lungworm)</p> 	 <p><b>Lungworm</b> Lungworm makes it difficult for muskox to breath and reduces muskox survival by: If you hold no other cards, there is no additional impact on survival -1 for each additional disease or predator card (including another lungworm)</p> 
 <p><b>Lungworm</b> Lungworm makes it difficult for muskox to breath and reduces muskox survival by: If you hold no other cards, there is no additional impact on survival -1 for each additional disease or predator card (including another lungworm)</p> 	 <p><b>Lungworm</b> Lungworm makes it difficult for muskox to breath and reduces muskox survival by: If you hold no other cards, there is no additional impact on survival -1 for each additional disease or predator card (including another lungworm)</p> 

# Wildlife Health and Monitoring

Print 2 sheets on cardstock and cut out. Shuffle with other disease and predator cards.

 <p><b>Wolf</b> The wolf pack can hunt muskox and reduce muskox survival by:</p> <p>-2 in the summer    -1 in the winter    -1 if the muskox is sick</p> 	 <p><b>Wolf</b> The wolf pack can hunt muskox and reduce muskox survival by:</p> <p>-2 in the summer    -1 in the winter    -1 if the muskox is sick</p> 
 <p><b>Wolf</b> The wolf pack can hunt muskox and reduce muskox survival by:</p> <p>-2 in the summer    -1 in the winter    -1 if the muskox is sick</p> 	 <p><b>Wolf</b> The wolf pack can hunt muskox and reduce muskox survival by:</p> <p>-2 in the summer    -1 in the winter    -1 if the muskox is sick</p> 
 <p><b>Wolf</b> The wolf pack can hunt muskox and reduce muskox survival by:</p> <p>-2 in the summer    -1 in the winter    -1 if the muskox is sick</p> 	 <p><b>Wolf</b> The wolf pack can hunt muskox and reduce muskox survival by:</p> <p>-2 in the summer    -1 in the winter    -1 if the muskox is sick</p> 
 <p><b>Winter Storm</b> There is a terrible storm and the muskox have a hard time staying together. The chance of survival is reduced by: -3</p>  <p>Return this card to the draw deck at the end of the season.</p>	 <p><b>Good Season</b> You don't get any additional infections this season!</p>  <p>Keep all of your existing infections and return this card to the draw deck at the end of the season.</p>

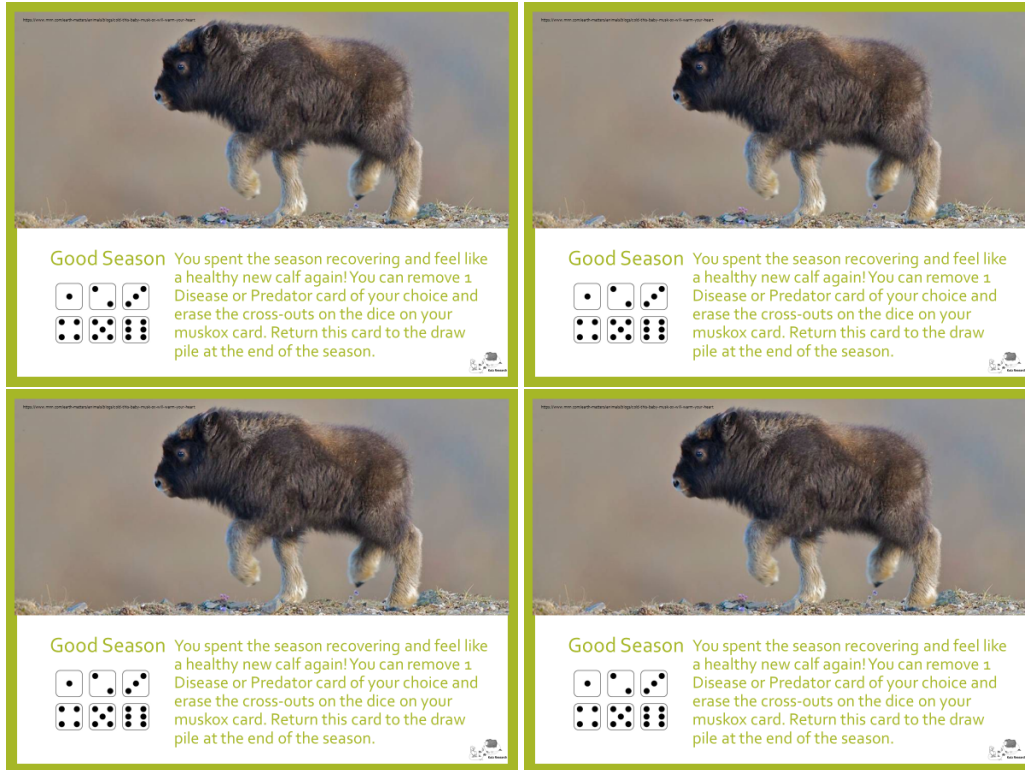
# Wildlife Health and Monitoring

Print 1 sheet on cardstock, cut out, and shuffle in with other disease and predator cards.

 <p><b>Orf Virus</b> Orf virus causes painful sores around the mouth, reduces pregnancy rates, and can cause death in calves. It reduced muskox survival by:</p> <p>-2 in Year 2, -1 in all years after</p> 	 <p><b>Orf Virus</b> Orf virus causes painful sores around the mouth, reduces pregnancy rates, and can cause death in calves. It reduced muskox survival by:</p> <p>-2 in Year 2, -1 in all years after</p> 
 <p><b>Orf Virus</b> Orf virus causes painful sores around the mouth, reduces pregnancy rates, and can cause death in calves. It reduced muskox survival by:</p> <p>-2 in Year 2, -1 in all years after</p> 	 <p><b>Orf Virus</b> Orf virus causes painful sores around the mouth, reduces pregnancy rates, and can cause death in calves. It reduced muskox survival by:</p> <p>-2 in Year 2, -1 in all years after</p> 
 <p><b>Erysipelas</b> Erysipelas is a bacteria that can cause sudden death in muskox and reduces muskox survival by:</p> <p>-3 in Year 2, -2 in all years after</p> 	 <p><b>Erysipelas</b> Erysipelas is a bacteria that can cause sudden death in muskox and reduces muskox survival by:</p> <p>-3 in Year 2, -2 in all years after</p> 
 <p><b>Winter Storm</b> There is a terrible storm and the muskox have a hard time staying together. The chance of survival is reduced by: -3</p> <p>Return this card to the draw deck at the end of the season.</p> 	 <p><b>Winter Storm</b> There is a terrible storm and the muskox have a hard time staying together. The chance of survival is reduced by: -3</p> <p>Return this card to the draw deck at the end of the season.</p> 

# Wildlife Health and Monitoring

Print 4 sheets on cardstock, cut out, and shuffle in with other disease and predator cards  
For normal game play, use only 3 sheets (12 calf good season cards and 14 adult good season cards total) and shuffle in with other disease and predator cards. For Lungworm simulation, use all 4 sheets (16 good season calf cards and 18 good season adult cards).



Each card features a photograph of a muskox calf in profile, facing left, standing on a patch of ground. Below the photo is the text: "Good Season You spent the season recovering and feel like a healthy new calf again! You can remove 1 Disease or Predator card of your choice and erase the cross-outs on the dice on your muskox card. Return this card to the draw pile at the end of the season." To the left of the text are six dice icons arranged in two rows of three. The top row shows 1, 2, and 3 dots. The bottom row shows 4, 5, and 6 dots. A small logo is visible in the bottom right corner of each card.



# Wildlife Health and Monitoring

Print 4 sheets on cardstock, cut out, and shuffle in with other disease and predator cards.

