### Science Lesson Plan Form

<table>
<thead>
<tr>
<th>Teacher: 4th Grade</th>
<th>Lesson: Predator/Prey</th>
<th>SPI: 2.1</th>
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</thead>
</table>

**Science Goal:** Recognize the impact of predation and competition on an ecosystem.

**What is the **big idea** of this standard?** All life is interdependent and interacts with the environment.

**What formative assessment strategy will we use to determine if they got the big idea?**

Ask students to revisit the Nomansland Deer Population formative assessment and determine if their thinking remains the same or if their ideas have now changed.

**Science background for the teacher:**

- A population consists of all members of the same species which live in the same geographical area.
- The terms predator and prey are reserved for animal to animal interactions in which one animal (the predator) hunts and kills another animal (the prey) typically for the purpose of eating.
- Primary consumers such as deer, elk, rabbits, antelope, zebra, etc. are typically prey animals.
- Predators keep prey animal populations in check.
- When whole populations of top predators (such as the wolf, mountain lion, shark, etc.) disappear from an area (usually due to humans hunting them) they are no longer able to keep the prey populations in check.
- This results in an explosion of the prey populations which causes members of the same species to begin competing for resources (food, space, etc.). When the population of a specific prey species gets too large, members start dying off due to disease and starvation.
- As well, when populations of prey species get too large it impacts the plant populations they are consuming.
- Predator/Prey relationships: Too many predators means the prey population will dwindle quickly, which in turn affects the predator population as they begin to compete for less and less food resources. If this continues indefinitely, some of the predators will begin to starve and die of hunger because as a population they have decimated their food source.
- Too few predators means the prey population will quickly explode, causing the prey to compete for food resources. If this continues indefinitely, some of the prey will begin to starve and die of hunger, because as a population they have decimated their food source.
- It is possible for members of a prey species or a predator species to move to another location in response to dwindling food sources. This however creates another problem as it puts the stress of competition for resources on another ecosystem which is already supporting its own organisms.

**What misconceptions and prior knowledge do we expect the students to have?**

**Prior Knowledge:** Students should have an understanding that plants and animals compete for resources such as food, space, water, air and shelter.

**Misconceptions:** Students may think that one species going extinct (or a population disappearing from an ecosystem) has no impact on other organisms.

**Reality:** All organisms in an ecosystem are intertwined and one population disappearing can have a domino effect on other organisms within that ecosystem.

**How will we engage them initially?**

Nomansland (attached)

Allow students private think time to answer Nomansland Deer Population formative assessment before allowing them to discuss in an ABC triad. While students are discussing, circulate, select and sequence for students who chose various answers. Then ask those students to share their thinking with the whole group.
How will we address the *science goal*?

1.) Go to the website [http://puzzling.caret.cam.ac.uk/game.php?game=foodchain](http://puzzling.caret.cam.ac.uk/game.php?game=foodchain) and work through two simulations with your students. Go through both simulations twice, first showing them the picture version and secondly, the same simulation with the graph version. For each simulation have the following discussion with them: 1.) What did you notice happening to the different organism populations? 2.) Why do you think that happened? 3.) Are there any relationships between the rise and fall of these different organism’s populations?

Simulation One: 0 Foxes, 2, 500 Rabbits, 50,000 plants – let it run for 50 years
Simulation Two: 100 Foxes, 2,500 Rabbits, 50,000 plants – let it run for 50 years

2.) Then have students work through the graphing activity called Deer: Predation or Starvation (see attached)

3.) Finally, have students go back and complete their final answer for the Nomansland formative assessment being sure to explain either further support for keeping their answer the same, or explaining what they learned during the lesson that changed their thinking to a different answer.

Use this space to plan out what information you will put on your *public record*.

Create a class graph of the Deer: Predation or Starvation data after students have completed the activity. Then discuss the questions that go with the activity while referring to the public record and its data as you go.

**Question starters** you can use within the lesson to elicit prior knowledge, misconceptions, and student understandings or to help students extend their thinking and make connections:

| How would you explain ______ to a student who doesn’t understand? | Can you explain your reasoning? |
| Do you agree or disagree with what ____ said? Justify your answer. | Compare and contrast _________. |
| Can you make a scientific model to explain that? | How does this relate to _________? |
| How do you know you are right? | Can you give an example of ________? |
| Classify and categorize ______ into groups and defend your answers. | Does that always work? Explain. |
| What were your observations and what can you conclude from them? | Is that true for all cases? Explain. |
| Create a claims and evidence from your data. | Can you think of a counter example? |
| Analyze your data. | How could you test that? |
| What other conclusions can you make? | How could you prove that? |
| What is the relationship between ______ and ______? | Why do you think that is true? |
| Critique the claim of _________ | Predict what would happen if ______. |

**Pedagogical Goals:**

**Student Interactions:**

___Listen to Understand
___Ask genuine questions
___Honor private think time
___Respect yourself and other’s right to solve problems
___Volunteer ideas
___Share my challenges
___Think about my thinking (metacognition)

**Science and Engineering Practices:**

___Asking questions and defining problems
___Developing and using models
___Planning and carrying out investigations
___Analyzing and interpreting data
___Using math and computational thinking
___Constructing explanations and designing solutions
___Engaging in argument from evidence
___Obtaining, evaluating and communicating information

**Teaching Routines:**

___Using science notebooks authentically
___Using public records
___Using focus questions
___Using embedded formative assessment
___Using structured science talk
Nomansland island is located far out in the middle of the ocean. No humans have ever lived there. On this island there is a healthy population of the Nomansland Deer species. As well there are numerous wolves that like to eat the Nomansland Deer as their favorite meal. Several scientists have been arguing about what would happen to the Nomansland Deer if all the wolves disappeared one day. Here are their arguments:

**Scientist 1:** My hypothesis is that if all the wolves disappeared, the Nomansland Deer population would remain stable because their main predator is now gone.

**Scientist 2:** My hypothesis is that if all the wolves disappeared, the Nomansland Deer population would eventually decline because of starvation and disease.

**Scientist 3:** My hypothesis is that if all the wolves disappeared, the Nomansland Deer population would increase because their main predator is now gone.

**Initial Answer:**
I agree with scientist #_____ because ____________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

**Final Answer:**
A. If your final answer is the same as your initial answer, then provide further support for your answer from what you learned in today’s lesson.
B. If your final answer is different than your initial answer, the provide an explanation for what you learned during the lesson that changed your thinking.
I agree with scientist #_____Explanation:____________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
Deer: Predation or Starvation (Teacher Instructions)

Read the following introduction to your students:

1. Introduction: In 1970 the deer population of a small island was about 2000 animals. Although the island had excellent plant populations for feeding, the food supply had limits. Thus the forest rangers feared that overgrazing on the plants might lead to mass starvation in the deer population. Since the island was too far away for hunters to get to, the forest rangers decided to bring in natural predators to control the deer population. Their hope was that the predators would keep the deer population from becoming too large and also increase the health of the deer population as predators often kill the weaker members of the herd. So, in 1971, ten wolves were flown into the island. The population data collected from this program is provided for you in the chart below.

2. Now help them get started by explaining to them what the population change means (Population Change = the number of deer born minus the number of deer that died during that year through predation and starvation) and how to calculate it. You may have to scaffold for the positive/negative portion of the number.

3. Once students have moved through the calculations portion of the chart, have them create a line graph of the deer population and wolf population from the chart. Make sure they use a different color for each line and create a key of which color represents which animal population.

4. Finally allow them time to make some conclusions from the chart and graph and answer the questions. Be sure to require students to include data from the chart and graph to support their position in the extension question.
# Deer: Predation or Starvation

**Name:**

## Directions:
Calculate the deer population change for each year in the chart below:

\[ \text{Deer Population Change} = \text{Deer Offspring} - (\text{Predation} + \text{Starvation}) \]

<table>
<thead>
<tr>
<th>Year</th>
<th>Wolf Population</th>
<th>Deer Population</th>
<th>Deer Offspring</th>
<th>Predation</th>
<th>Starvation</th>
<th>Deer Population Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1971</td>
<td>10</td>
<td>2,000</td>
<td>800</td>
<td>400</td>
<td>100</td>
<td>+300 (800 – 500)</td>
</tr>
<tr>
<td>1972</td>
<td>12</td>
<td>2,300</td>
<td>920</td>
<td>480</td>
<td>240</td>
<td></td>
</tr>
<tr>
<td>1973</td>
<td>16</td>
<td>2,500</td>
<td>1,000</td>
<td>640</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>1974</td>
<td>22</td>
<td>2,360</td>
<td>944</td>
<td>880</td>
<td>180</td>
<td></td>
</tr>
<tr>
<td>1975</td>
<td>28</td>
<td>2,224</td>
<td>996</td>
<td>1,120</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>1976</td>
<td>24</td>
<td>2,094</td>
<td>836</td>
<td>960</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>1977</td>
<td>21</td>
<td>1,968</td>
<td>788</td>
<td>840</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>1978</td>
<td>18</td>
<td>1,916</td>
<td>766</td>
<td>720</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>1979</td>
<td>19</td>
<td>1,952</td>
<td>780</td>
<td>760</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>1980</td>
<td>19</td>
<td>1,972</td>
<td>790</td>
<td>760</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

## Graphing:
Graph the deer and wolf populations on the graph below. Use **one color** to show deer populations and **another color** to show wolf populations.
Analysis:

1. Describe what happened to the deer and wolf populations between 1971 and 1980.

2. What do you predict would have happened to the deer on the island had wolves NOT been introduced? What data from the chart and graph supports your prediction?

Extension:

3. Most biology textbooks explain that predators and prey exist in a balance that is referred to as the “balance of nature.” This hypothesis is criticized by some scientists. Think about the following questions:

   --Why is death by predators more natural or "right" then death by starvation?
   --How does one determine when an ecosystem is in "balance"?
   --Do predators really kill only the old and sick prey? What evidence is there for this statement?

Now decide, your own opinion on the “balance of nature” hypothesis. Would the deer on the island be better off, worse off, or about the same without the wolves? Defend your position with data from the chart and graph you completed earlier in this activity.