Biology
Ms. Ye

Name _____
Date _____ Block _____

Carrying Capacity: How big can a population get?

In this activity, you will study the effects of environmental stresses (loss of habitation, predation, etc) on a size of a Musky (a type of fish) population in Box Lake.

Rules to Box Lake:

1. Musky eat smaller fish like perch. There is enough perch in each square of box lake to keep one Musky alive. Therefore, **only one Musky**  **can occupy a square** within Box Lake at a time.

2. For every two Musky, one new offspring will survive predators (birds, fisherman, etc.) each generation or season. **Add a new Musky each generatio**n.

3. If all of the squares are filled in box Lake with Musky during a generation, there will not be enough perch to eat and no additional Musky will survive.

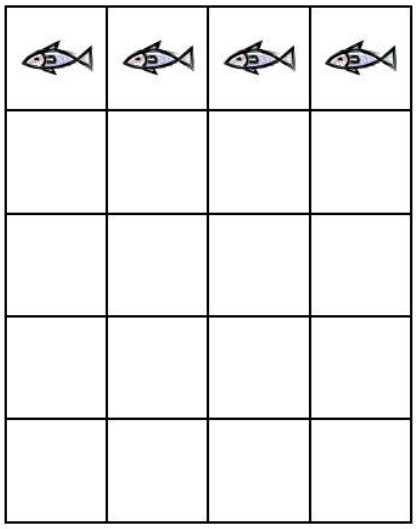
4. If all of the squares are filled with Musky at the ***start*** of the generation or season, the perch population will start to decline. Two Musky will starve and need to be removed from Box Lake. No additional offspring will survive.

Follow the rules outlined above for the following 3 scenarios.

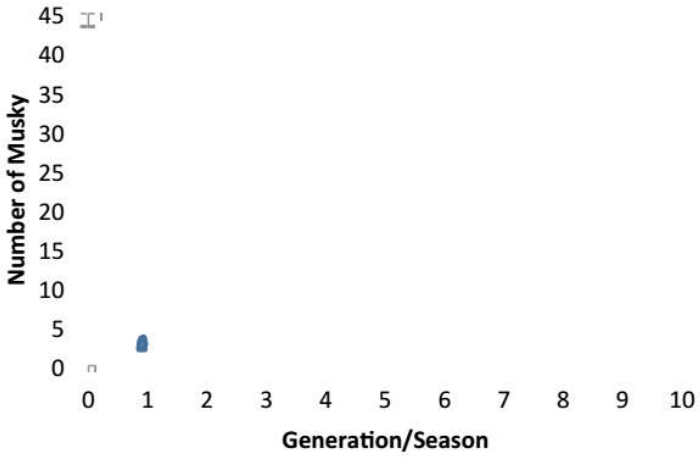
Scenario 1: Normal Conditions

Generation 1 in this scenario has 4 Musky in it. Follow the rules to Box Lake as outlined above. For each generation, draw additional Musky on the Box Lake Map. For example, since there are 4 Musky, 2 offspring would be added, and the total number of Musky will not equal 6. To show this on the Musky Population Graph, record 6 Musky for Generation 2. Continue this process for 10 generations.

Box Lake Map



Musky Population Graph



Questions:

1. Does the Musky population continue to increase overtime? Why or why not?

2. The maximum number of organisms that an environment can support without ruining the environment is called the **carrying capacity**.
   a. The carrying capacity for Musky in Box Lake is about 19 Musky. Draw a line across your graph at 19 Musky and label it “carrying capacity”.

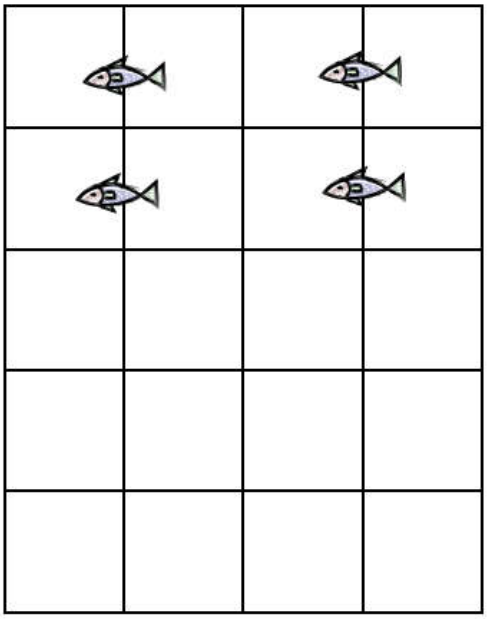
   b. Describe how you can determine the carrying capacity of an organism by just looking at a Population vs. Time graph.

3. Populations tend to fluctuate naturally around the carrying capacity. Why do you think populations fluctuate?

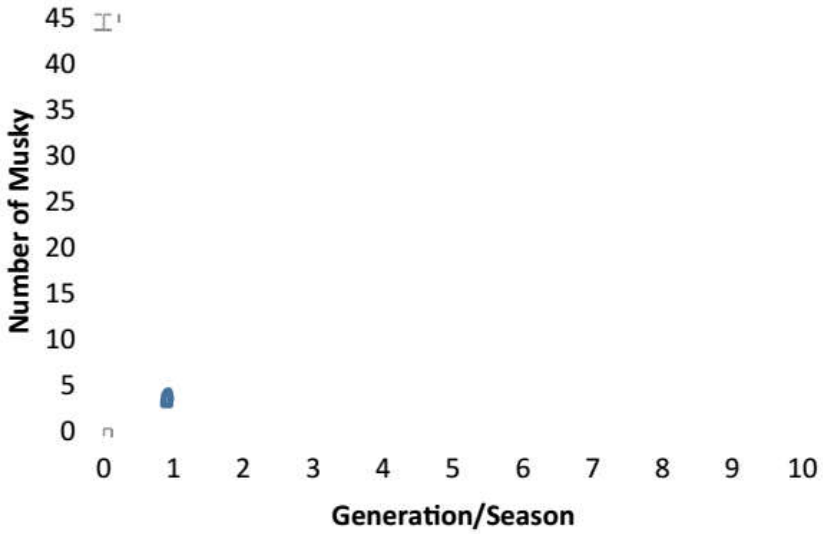
Scenario 2: Invasive Species

Rainbow smelt, an invasive (non-native) fish species, has been introduced into Box Lake. Rainbow smelt and trout compete to eat enough zooplankton to survive this competition over resources leads to a decrease in zooplankton and trout populations. Follow the rules to Box Lake to complete the Map and the Graph, **but this time, <u>there can only be one Musky for every two squares</u> due to the decrease in trout**. Complete for 10 generations.

Box Lake Map



Musky Population Graph



Questions:

4. What is the new carrying capacity for Musky after Rainbow smelt have been introduced? Support your answer using evidence from your population graph.

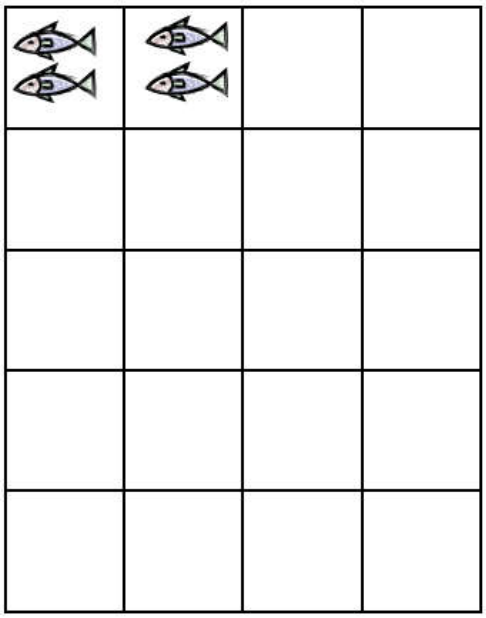
5. Why was the carrying capacity of Musky lower in this scenario compared to scenario 1?

6. Come up with two other scenarios or changes to the Box Lake environment that would also lower the carrying capacity of Musky.

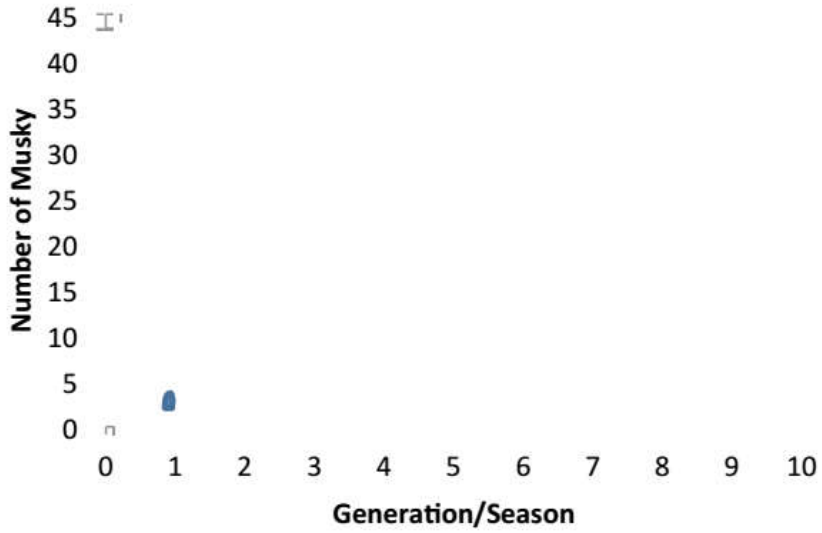
Scenario 3: Fishing Regulation Change

The minimum length needed to keep a trout caught through fishing has increased to 13" at Box Lake. This means more trout survive from generation to generation, providing more food for Musky. Follow the rules to Box Lake to complete the Map and Graph, **only this time, <u>two Musky can fit in a square</u> due to the increase in trout population**. Complete for 10 generations.

Box Lake Map



Musky Population Graph



Questions:

7. What is the new carrying capacity after the fishing regulation change? Support your answer using evidence from your population graph.

8. Why was the carrying capacity of Musky higher in this scenario than in scenario 1?

9. Come up with two other scenarios or changes to the Box Lake environment that would also increase the carrying capacity of Musky.