Name _____ Period _____

Limiting Factors and Carrying Capacity Worksheet

Directions: Read each section and complete the subsequent questions. Turn in the completed worksheet at the end of the class period.

Limiting Factors

When living conditions in an area are good, a population will generally grow. But eventually some environmental factor will cause the population to stop growing. A **limiting factor** is an environmental factor that causes a population to decrease. Some limiting factors for populations are food and water, space, and weather conditions.

1. Every population has _____.

2. What is a **limiting factor**? (answer in a complete sentence by restating the question)

3. List the types of limiting factors below (use the limiting factors to label the headings of the following sections):

Limiting factors:
A.
B.
C.

4. Are the limiting factors abiotic or biotic factors? Explain why. (answer in complete sentences)

A._____

Organisms require **food and water** to survive. Since there isn't always an endless amount of food and water, they are limiting factors. Suppose a bear must eat 10 fish a day to survive. The river nearby provides about 100 fish a day without harming the fish population. Five bears could easily live in this area because they would only need 50 fish total. But if there were 15 bears they would not all survive because there would not be enough food. No matter how much shelter and water there was, the population would not get larger than 10 bears for any extended period of time.

1. How can food and water limit population growth?

2. Is food a limiting factor for plants? Why or Why not?

B._____

Space is another limiting factor for populations. Seagulls, for example, come to nest on rocky shores. But the nesting shores get very crowded. If a pair does not find room to nest, they will not be able to add any offspring to the seagull population. So nesting space on the shore is a limiting factor for seagulls. If there were more nesting space, more seagulls would be able to nest, and the population would increase.

Space is also a limiting factor for plants. The amount of space in which a plant grows determines whether the plant can get the sunlight, water, and soil nutrients it needs. For example, many small plants sprout each year in a forest. But as they grow, the roots of those that are too close together run out of space and some of the plants will die. Branches from other trees may block the sunlight the small plants need. Some of the small plants might die, limiting the size of that plant population.

1. Space can be a limiting factor because animals may not be able to _____ to have offspring, and so a population would decrease.

2. Is space a limiting factor for plant populations? *Name two ways:*

a._____

b._____

C._____

Weather conditions such as temperature and the amount of rainfall can also limit population growth. A cold front that comes in late spring can kill the offspring of many species of organisms, including plants, birds and mammals. A hurricane or flood can wash away nests and burrows. Such unusual events can have long-lasting effects on population size.

1. What is one weather condition that can limit the growth of a population?

2. How might a sudden cold front limit population growth of newborn offspring? (answer in a complete sentence by restating the question)

Review:

Limiting factors:	How can it limit a population?
A.	
B.	
C.	

Carrying Capacity

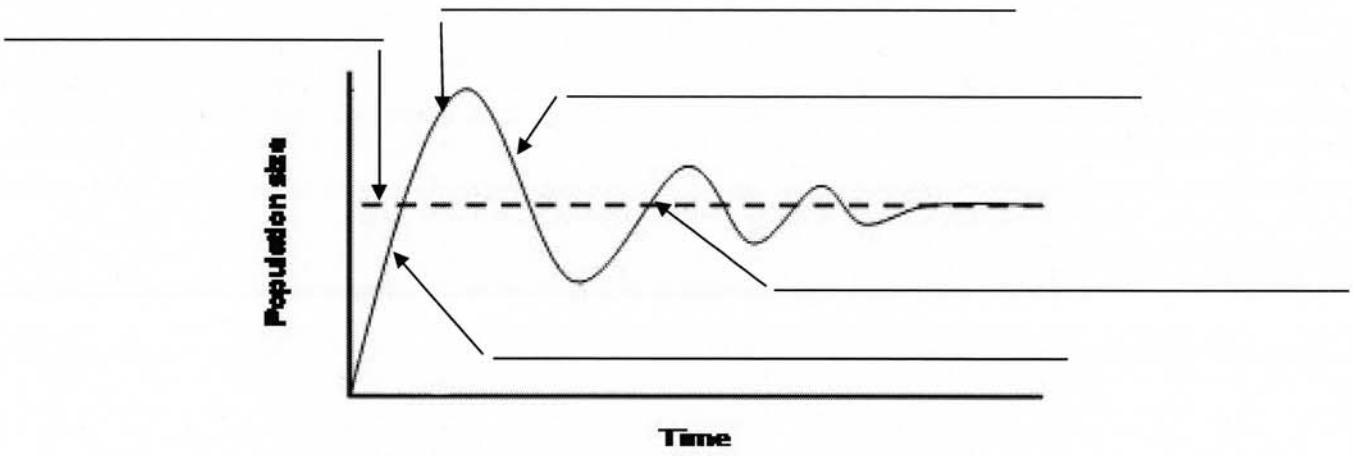
The *largest population* an area can support with its resources (i.e. food, water, land) is called its **carrying capacity** (capacity=amount). If we refer back to the limiting factor of food and water, where the bears each need 10 fish a day to survive and the nearby river can only supply 100 fish per day, the carrying capacity of the bear's habitat would be 10 bears (any more than that would require more fish than the river could provide and the bears would starve). A population usually stays near its carrying capacity because of the limiting factors of a habitat.

As a population first begins to grow, it will typically exhibit exponential growth, and it will continue growing until the population overshoots the carrying capacity. The population will then run out of resources and decline rapidly until it can recover and stabilize around the carrying capacity. Rabbit populations exhibited this behavior when they were first introduced into Australia in the mid1800s. At first, their numbers increased rapidly because they had plenty of vegetation to eat and no predators. The rabbits quickly ate the land bare and their population crashed as they starved to death. However, over time, the vegetation recovered, and the rabbit population increased again. The population continues to increase and decrease, but less dramatically.

1. What is **carrying capacity**? (answer in a complete sentence by restating the question)

2. How are limiting factors related to carrying capacity? (answer in a complete sentence by restating the question)

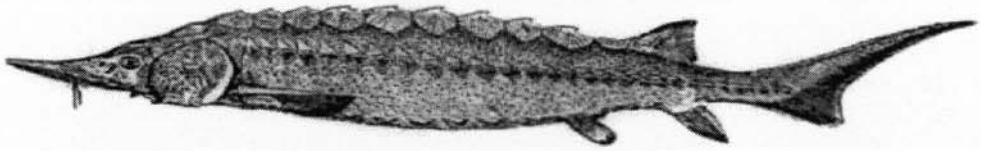
3. Label each of the blanks on the graph with the following stages of a population responding to the carrying capacity of the ecosystem with the following terms: 1) **exponential growth**; 2) **population overshoot**; 3) **population decline**; 4) **population recovery and stabilization**; and 5) **carrying capacity**.



SCUTES
Students Collaborating to Undertake Tracking Efforts for Sturgeon

Marine Biology

Sturgeon Reproduction and Population Ecology



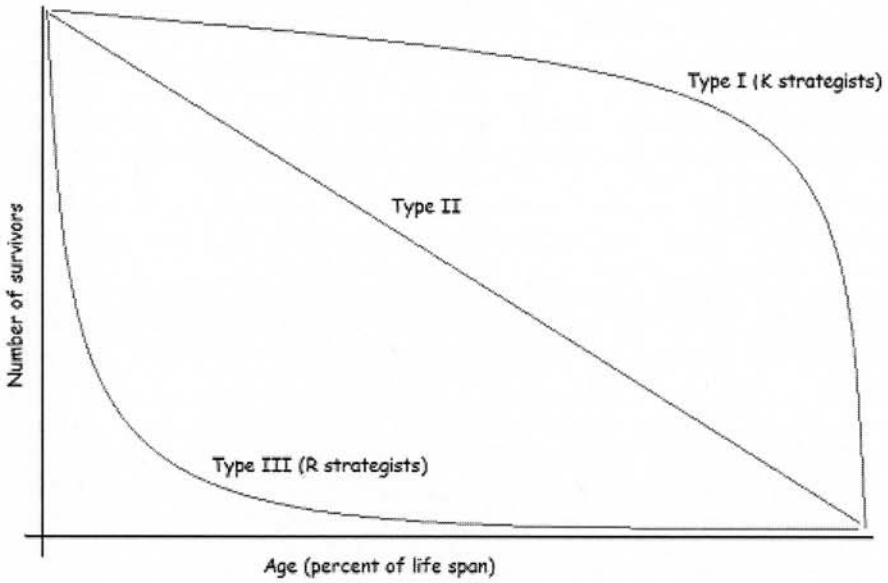
Introduction

Sturgeon are an anadromous fish species that inhabit rivers, estuaries and the ocean at various stages during their life cycle—and their lifecycle is a long one. Adults can live up to 80 years. After spending up to 3 years in their natal rivers as juveniles, they travel into the oceans until they reach sexual maturity. This may take another 8-20 years, depending on the sex of the fish (females usually take longer to reach sexual maturity) and latitude (sturgeon in the northern rivers generally take longer to reach sexual maturity).

Spawning typically occurs in the in the springtime. Both sexes swim back up their natal rivers to the spawning grounds. Females lay their eggs, which are sticky, and attach to the river's gravel bottom—larger females have been known to lay 800,000 to 3.5 million eggs. The males then fertilize the eggs with milt. The adults leave the eggs to the mercy of the river and their well chosen spawning grounds. Of that egg mass, only 10% will survive to reproduce in the natal river again. The rest die due to predation, water pollution or a menagerie of other causes.

Survivorship Curves

Below is a graph depicting the three survivorship curves and the names of two parental care strategies commonly found in nature. A survivorship curve illustrates the numbers in a population over the course of time. A strategy depicts how parents care for their offspring.



Questions:
Use the survivorship curves and the background information on sturgeon from the introduction to answer the following questions.

1. Which survivorship type do sturgeon employ? Explain your answer.

2. List three other organisms that exhibit the same strategy as sturgeon.

3. What would be two benefits of this type of parental strategy?

The next set of questions (4-6) describes the survivorship curve OPPOSITE sturgeon.

4. Which survivorship curve is opposite the sturgeons'? Explain what is happening with this survivorship type.

5. List three organisms that exhibit this parental care strategy.

6. What would be two benefits of this type of parental strategy?

The next set of questions (7-10) compares all three survivorship curves

7. Explain where the reproductive energy is focused for each type of parental care strategy.

8. Which type survives best in a crowded ecological niche? Less crowded niche? Explain your answers.

9. There is one survivorship curve that is not employed by sturgeon nor is it the direct opposite curve. Explain what is happening with organisms in this type. What organism would be an example of this type?

10. Some ecologists have dismissed the terms "R" and "K" and have replaced them with the terms "maintenance" and "dispersal." Match the new terms to the old terms and explain how they are accurately used.