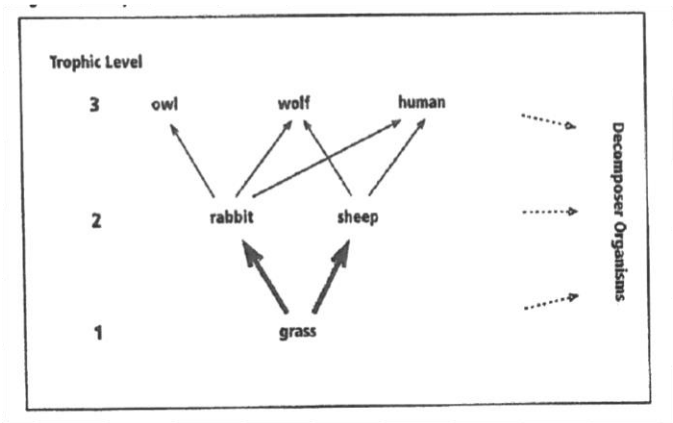
Name:_____

Lab: Producers and Consumers

Background: Energy is essential to all living things. During photosynthesis, green plants convert radiant energy from the sun into chemical energy. This chemical energy provides for plant growth and, directly or indirectly serves as the primary food source for virtually all other life forms. Plants and other organisms that are capable of photosynthesis are called producers because they produce food – any edible source of chemical energy – for other organisms. Organisms that obtain their energy by eating producers are known as primary consumers. Organisms that eat primary consumers are known as secondary consumers. Tertiary consumers are organisms that eat secondary consumers. Much of the life in the open ocean consists of tiny organisms called plankton that inhabit the top 20 meters of water. They are restricted to this narrow layer because sunlight can penetrate the water to this depth fairly easily. Some plankton are capable of photosynthesis and are called phytoplankton. Other plankton, called zooplankton, are consumers that feed on phytoplankton. Although plankton are very small, even microscopic, they are extremely numerous. They are essential to the health of the entire marine environment. Plankton are also essential to freshwater ecosystems including lakes and streams.



Every organism, dead or alive, is a potential source of food for other organisms. A food chain can be used to show how energy is transferred from producers to primary consumers, from primary to secondary consumers and so on. In nature many consumers feed on both producers and other consumers. Because of this, a food chain may not adequately describe all the pathways of energy transfer. A food web is a diagram that more completely illustrates the transfer of chemical energy within an ecosystem. Decomposer organisms, typically bacteria and fungi, feed on dead and decaying matter and are an important part of any ecosystem.

Based upon its position in the food web, each member of an ecosystem can be assigned to a tropic level. Producers (mostly plants and plankton) are in the first trophic level; primary consumers (usually herbivores) are in the second trophic level; secondary and tertiary consumers (carnivores and omnivores) are in the third and fourth trophic levels. Whenever one organism eats another, chemical energy is transferred to a higher trophic level. However, as with many energy transfers, a large portion of the energy stored in the food cannot be used by the consumer. As a result, only a small percentage of the energy available at lower trophic levels is actually available to organisms at higher trophic levels; the majority is considered “lost” to the environment. The Law of Conservation of Energy tells us that the “lost” energy does not disappear, because energy cannot be created or destroyed. But it can take forms that are not usable by consumers. Some of the energy is transformed into heat, and some remains in the portions of food not eaten or not digested by the consumer. The amount of energy stored in a food is measured in Calories.

Prelab Questions:

1. What is source of energy for phytoplankton?

2. What is the source of energy for zooplankton?

3. How does a food chain differ from a food web?

4. What would limit the number of trophic levels in an ecosystem? (Why can't there be an infinite number of trophic levels?)

Activity:

Part One: Draw two phytoplankton and two zooplankton from the samples provided. Compare and Contrast the characteristics of each.

Part Two: Draw a food web showing the pathways by which chemical energy is transferred among the organisms below. Arrows point in the direction of energy flow. Label the trophic level of each organism in the food web.

Bacteria	Phytoplankton	Zooplankton	Great Blue Heron
Mosquitofish	Largemouth Bass	Catfish	Human

Analysis:

5. Identify two similarities and two differences between phytoplankton and zooplankton.

6. You examined prepared slides of phytoplankton and zooplankton. If you had observed a sample of live plankton, what evidence of the roles they each play would you expect to have seen?

7. You observed microscopic producers and consumers. Name three macroscopic producers and three macroscopic consumers.

8. Explain how plankton might impact humans.

9. Rank the organisms in the food web from most abundant to least abundant. Explain your ranking.

10. In one square meter of open ocean, phytoplankton can generate 1,600,000 Calories of chemical "food" energy per year. Assuming that there is a 90% "loss" of usable chemical energy during transfers form one trophic level to the next, calculate the energy available at each trophic level for each of five trophic levels.

11. How many times more humans could be fed if everyone ate from the second trophic level rather than the fifth? Explain why this would be, or not be, a reasonable possibility.