Ecology Activity: Energy Transfer in a Model Ecosystem
Integrated Science 1-2 *Name:* *Per:*

Introduction

One of the most important factors in any ecosystem is the flow of energy through the ecosystem. Plant tissues form energy–containing compounds, using the energy absorbed from the Sun. Animals that eat the plants obtain this energy. Food is the means by which energy is transferred from one organism to the next organism in the food chain. This lab will allow you to study, quantitatively, how energy moves through a model food web in the San Francisco Bay/Estuary.

Focus Questions

- What is the source of energy for San Francisco Bay's food web?
- How much energy is transferred from one organism to another in the food web?
- What happens to the energy which is not transferred in the food web?

Procedure

1. You will receive a role card and a cup with some beans in it. The role card will tell you the type of organism you represent. Your role card will also tell you what plants or animals your organism eats and what animals can eat your organism. The number of beans you start out with will be different from the number held by other students.
2. You will approach another student and reveal the identity of your organism to that student. You will exchange beans with the student based on the summary below. Every meeting with another organism will affect your energy supply (the beans).
3. At the front of the classroom there is a large "SUPPLY" container of beans and a large empty "LOSSES" container.
4. The **bean exchange summary** below provides specific instructions for each encounter.

Situation	How beans are exchanged
One organism eats another	1. *Eating* organism takes **five** beans from *eaten* organism 2. *Eating* organism puts **two** in the "LOSSES" container.
Neither organism can eat the other	1. Each student places **one** bean in the "LOSSES" container.
Phytoplankton and Algae	1. Remove **ten** beans from "SUPPLY" after each encounter 2. Put **one** in the "LOSSES" container after each encounter
An organism loses all beans	Withdraw from the game

5. Play the game until the teacher calls time. Count the number of beans which you have remaining and enter this number on **Your Data**.
6. Enter your data on the **Class Data Overhead**, at the front of the room. Copy the completed and totaled version of the **Class Data** so you may refer to it later.
7. Use the information from the class data to complete the **Trophic Level Totals** table.
8. Use the data tables along with information from your readings and class discussion, to answer the conclusion questions.

Data

Your Data

Organism name	# beans-- start	# beans-- finish

Class Data

Organism	trophic level	number of organisms	# beans PER ORGANISM	TOTAL beans start	TOTAL beans End
Algae			30		
Phytoplankton			30		
Shrimp			15		
Zooplankton			15		
Anchovy			15		
Duck			10		
Striped Bass			10		
Sea Lion			10		
Heron			5		
Shark			5		

Trophic Levels Totals

	TOTAL beans at start	TOTAL beans at end
Producers		
Primary Consumers		
Secondary Consumers		
Top Consumers		

Discussion/Conclusion:

1. Which organism finished with the most beans?_____

Which finished with the least?_____

Why do you think this happened?_____

2. What does the "SUPPLY" represent in a real ecosystem?_____

Why were the phytoplankton and algae the only organism allowed to withdraw beans from the container? _____

3. What do you think would have happened to the shark or heron if they could have taken beans from the producers?

4. Anchovies eat producers, while the striped bass does not. Do you think the anchovy has an "advantage" in the simulation over the striped bass? Why or why not?_____

5. You may have realized that there were many more phytoplankton and algae in the simulation than there were sharks or heron. Why do you think the simulation was set up that way?_____

_____

_____

6. Why were all the organisms in the simulation required to place beans in the "LOSSES" box after every encounter where you were able to feed?_____

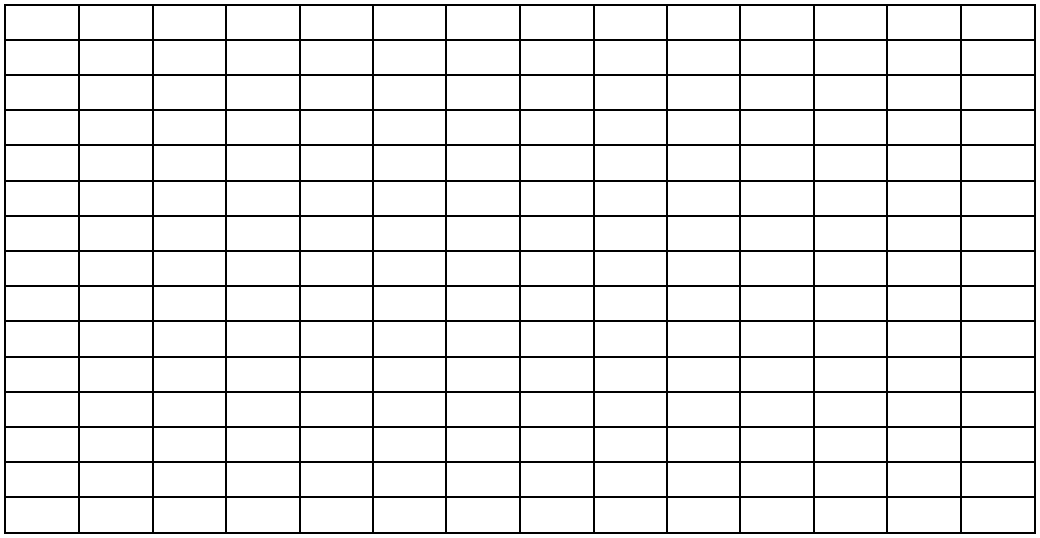
_____

7. Why were you required to place a bean in the "LOSSES" box even after encountering an organism that you could eat and that could not eat you?_____

_____

8. Complete the graph below to show total energy per trophic level (as represented by the total number of beans) at ***start and end*** of activity. Remember your rules of graphing.

Total Number of Beans



Trophic Level

9. Which trophic levels ended up with the most beans at the end of the simulation?_____

_____

10. Explain why the top consumers do not end up with many beans._____

_____

_____

11.What does this graph say about the relative number of producers and consumers that need to co-exist in an ecosystem?_____

_____

_____