

What's For Lunch? Exploring the Role of GloFish® in Its Ecosystem, Food Chain and Energy Pyramid

Objective

The learner will define terms related to relationships and energy transfer in food chains and webs.

The learner will create a representation of a food chain and food web involving GloFish® fluorescent fish.

Introduction

Your GloFish aquarium is a small ecosystem containing a variety of organisms that impact one another. For example, bacteria in the aquarium convert the ammonia waste from the GloFish into nitrites and nitrates. These nitrogen rich compounds can supply necessary elements for aquatic plants growing in the aquarium. The living organisms make up the ecosystem's *biotic* components. All of the organisms in the aquarium are impacted by the non-living or *abiotic* components such as temperature, salinity, and the levels of nitrates and phosphates in the water.

GloFish are *omnivores* that feed on a variety of nutrient sources such as vegetable matter in flake food, blood worms, and water fleas. Algae and plants present in the aquarium are called *producers* because they synthesize carbon dioxide into usable energy through the process of photosynthesis. In this process, producers provide energy to the entire ecosystem by capturing light energy and converting it into chemical energy.

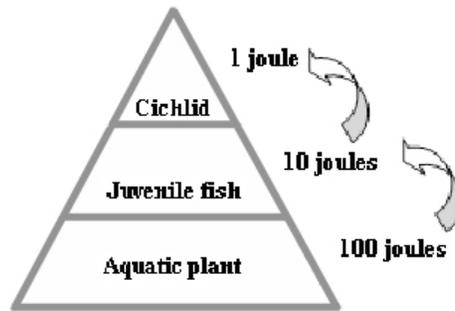
Photosynthetic organisms are also sometimes referred to as *photoautotrophs* or simply *phototrophs*. An example of an *herbivore* in this ecosystem would be a snail, since they feed only on plant material. A cichlid is a predatory fish, and is an example of a *carnivore*; if introduced into the aquarium ecosystem, it would be a threat to the GloFish. Both herbivores and carnivores are considered to be *consumers* in an ecosystem.

The relationships found within an ecosystem can be represented through schematics indicating which organisms serve as producers and which are consumers. A *food chain* is one such representation; it begins with a producer, and can have one, two or even more consumers. In the food chain shown below, the aquatic plant is a producer, the juvenile fish is a *primary consumer*, and the cichlid is a *secondary consumer*. These organisms can further be described as a producer, an herbivore and a carnivore respectively.

Aquatic plant → Juvenile fish → Cichlid

The transfer of energy through this food chain can also be represented using an *energy pyramid*. As indicated in the pyramid below, less than 10% of the energy available at one

level will be transferred to the next level. This explains why a stable ecosystem will contain fewer secondary consumers than primary consumers.



In this activity you will closely observe the members and interactions of the ecosystem housed within the GloFish® aquarium.

National Standards Addressed

Life Science C—Interdependence of organisms

Life Science C—Matter, energy and organization in living systems

Materials Per Group

One set of vocabulary matching cards

One energy pyramid manipulative

Access to internet or library resources

Microscope

Slides

Cover slip

Dropping pipette

Materials for Classroom

An established aquarium containing GloFish, plants and other fish

Safety Precautions

There are no safety issues associated with this activity.

Procedures

Part A: Learning the Terminology

1. Read the introduction section of this activity or the section of your text as identified by your teacher to become familiar with terms used in describing ecosystem components.
2. Obtain one set of ecology term matching cards from your teacher.
3. Match each term card with its corresponding definition or description card. Repeat the matching several times until you are familiar with the definitions of each of the terms.

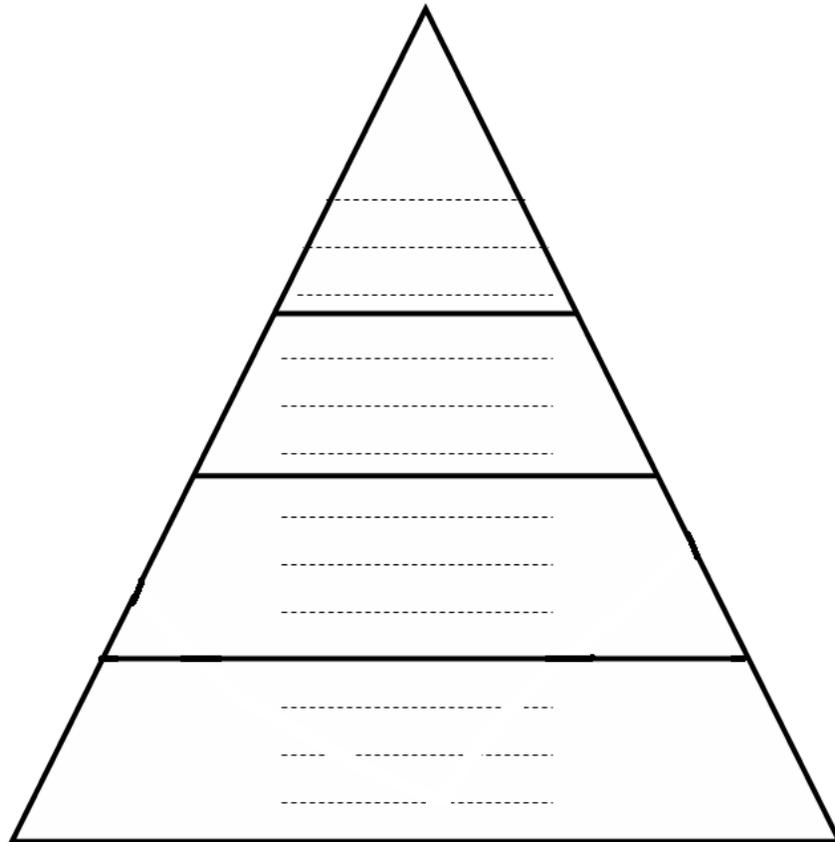
Lesson plan for GloFish® fluorescent fish; Starfire Red®, Sunburst Orange®, and Electric Green®. For additional **FREE** lesson plans, please visit the **GloFish.com** Classroom page at <http://www.glofish.com/classroom.asp>.

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4. Formulate a definition using your own words as much as possible for each term listed in Table 22.1.

Part B: Construct an Energy Pyramid

1. Label the portion of the pyramid below that represents each of the following: primary consumer, secondary consumer, tertiary consumer, and producer.



2. Write the following energy amounts in the appropriate level of the pyramid: 1215 Joules, 1.3 Joules, 11.6 Joules, 120 Joules.
3. Label each level in the pyramid using the following food chain members: algae, GloFish®, paramecium, and water flea.

Part C: Members of the GloFish® Ecosystem

1. Carefully observe the aquarium in which the GloFish swim.
2. List all of the macroscopic living organisms you observe. Be sure to include all plants and animals. Record your list in Table 22.2.
3. To observe microscopic organisms, use an eye dropper to collect a sample of water from the filtration system of the tank.

4. Place a drop of the aquarium water on a slide. Cover the drop with a cover slip.
5. Using a microscope, observe the slide under high-power magnification.
6. Describe any living organisms observed on the slide in Table 22.2.
7. If algal growth is present in the tank, removed a small sample using a sterile swab.
8. Wipe the swab across the surface of a new glass slide and observe using the microscope.
9. Describe any living organisms observed on the slide in the space provided in Table 22.2.
10. Answer the discussion questions.

Data

Part A: Table 22.1 - Ecology Terms

Term	Definition/Description
Energy Pyramid	
Food Chain	
Producer	
Primary Consumer	
Secondary Consumer	
Herbivore	
Omnivore	
Carnivore	
Biotic	
Abiotic	

Part C: Table 22.2 - Organisms in the GloFish® Ecosystem

Macroscopic Organisms

Microscopic Organisms

Discussion Questions:

1. Describe the role of producers in an ecosystem.

2. Would a balanced ecosystem contain more producers or primary consumers?
Explain your answer.

3. Name two biotic and two abiotic components found in the GloFish® aquarium ecosystem.

Biotic _____, _____

Abiotic _____, _____

4. Identify an example of each of the following using the macroscopic/microscopic organisms list you developed in Part C.

Producer –

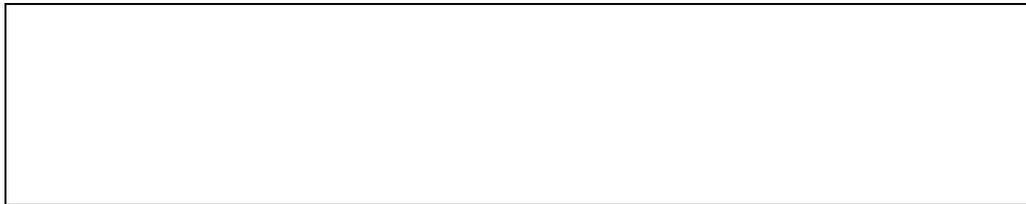
Primary Consumer –

Secondary Consumer –

Omnivore –

Herbivore –

5. In the space below, draw a food chain using organisms found in the GloFish® aquarium ecosystem.



6. How much energy would be available at the secondary consumer level if the producer level contained 34,780 joules of energy? Show your calculations.

Elaborations and Extensions

Students could observe additional ecosystems such as a segment of the school property, their home lawn, or a small pond.

What's for Lunch?

Exploring the Role of GloFish® in Its Ecosystem, Food Chain and Energy Pyramid

Answer Sheet

Intended Grade Level

9th, 10th, 11th

Teacher Information

Students need access to a well established aquarium containing GloFish® along with several species of producers and consumers.

The ecology term matching cards (please see last two pages of this document) can be run on card stock to make them more durable.

Discussion Questions and Possible Answers

1. Describe the role of producers in an ecosystem.

Producers provide energy to the ecosystem by capturing and converting light energy into chemical energy.

2. Would a balanced ecosystem contain more producers or primary consumers? Explain your answer.

In order to be balanced, the ecosystem would contain more producers than primary consumers due to the 10% energy transfer rule.

3. Name two biotic and two abiotic components found in the GloFish aquarium ecosystem.

Biotic GloFish, second species of fish

Abiotic pH of water, temperature of water

4. Identify an example of each of the following using the macroscopic/microscopic organisms list you developed in Part C.

Producer – *photosynthetic organisms such as aquatic plants and alga*

Primary Consumer – *any organism that consumes plants or algae (Examples include herbivorous fish, snails, algae eaters, and protozoa.)*

Secondary Consumer – *Carnivorous fish or snail-eating fish*

Omnivore – *GloFish*

Herbivore – *any organism that consumes plants or algae (Examples include herbivorous fish, snails, algae eaters, and protozoa.)*

5. In the space below, draw a food chain using organisms found in the GloFish® aquarium ecosystem.

Food chain components will be determined by the organisms available in the aquarium.

6. How much energy would be available at the secondary consumer level if the producer level contained 34,780 joules of energy? Show your work.

34,780 joules at producer level X 10% = 3,478 joules

3,478 joules at primary consumer level X 10% = 347 joules

347 joules at secondary consumer level X 10% = 34.7 joules

34.7 joules at tertiary consumer level

(The ecology term matching cards are available on the following two pages.)

Abiotic	Non-living components of an ecosystem
Biotic	Living components of an ecosystem
Carnivore	Organisms that feed on other consumers
Energy Pyramid	A schematic representation of the flow of energy in a food chain
Food Chain	A representation of one set of feeding relationships in an ecosystem

Herbivore	Organisms that consume producers such as plants and algae
Omnivore	Organisms that feed on producers and consumers
Primary Consumer	Organisms that feed on producers, also known as herbivores
Producer	Photosynthetic organisms, also known as phototrophs
Secondary Consumer	Organisms that feed on primary consumers