

# Getting to the Core

HS Biology Unit of Study

## **STUDENT RESOURCES**

### **Tidepools**



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## SAUSD Common Core High School Biology Unit – Tidepools

<b>Contents:</b>		
<b>Big Idea- Interdependent Relationships in Ecosystems:</b> There are many interdependent relationships that affect the stability of any given population.		
<i>Day</i>	<i>Contents</i>	<i>Pages</i>
<b>Lesson 1: Introduction to the Ecology of the Tidepools</b>		
<b>Day 1</b>	Student Resource 1.1 Extended Anticipatory Guide	1-2
	Student Resource 1.2 How to Paraphrase	3-5
<b>Day 2</b>	Student Resource 1.3a Organisms of the Tidepool	6
	Student Resource 1.3b How Tides are Created	7
	Student Resource 1.3c Where are Tidepools?	8
	Student Resource 1.3d Ecology of Tidepools	9
	Student Resource 1.3e Human Impact on Tidepools	10
	Student Resource 1.3f California Biodiversity	11
	Student Resource 1.4 Ecology of Tidepools Jigsaw Paraphrase	12-14
<b>Lesson 2: Photosynthesis and Cellular Respiration</b>		
<b>Day 3</b>	Student Resource 2.1 Preparing the Learner Response Sheet	15-16
	Student Resource 2.2 Photosynthesis and Cellular Respiration PowerPoint	17-18
	Student Resource 2.3 Extended Understanding	19-20
<b>Day 4</b>	Student Resource 2.4 Anticipatory Guide	21-22
	Student Resource 2.5 Photosynthesis and Cellular Respiration Lab	23-26
	Student Resource 2.6 Vocabulary Review Jigsaw Worksheet	27-28
	Student Resource 2.7 Thinking Map Planner	29-30
<b>Lesson 3: Flow of Energy in the Ecosystem: Energy Pyramids</b>		
<b>Day 6</b>	Student Resource 3.1 Ecology: Trophic Transfer of Energy in an Ecosystem article	31-32
	Student Resource 3.2 Flow of Energy in an Ecosystem	33-37
<b>Day 7</b>	Student Resource 3.3 Energy Flow in an Ecosystem: Construct an Energy Pyramid	38-42
<b>Lesson 4: Flow of Energy in the Ecosystem: Biomass</b>		
<b>Day 8</b>	Student Resource 4.1 What is Biomass?	43-44
	Student Resource 4.2 The dead sea: Global Warming Blamed for 40% Decline in the Ocean’s Phytoplankton article	45-46
	Student Resource 4.3 Biomass: The dead sea article “Save the Last Word”	47-48

<b>Day 9</b>	Student Resource 4.4 Graphing Ocean Biomass vs. Terrestrial Biomass	49-52
<b>Lesson 5: Flow of Energy in the Ecosystem: Food Webs</b>		
<b>Day 10</b>	Student Resource 5.1a Sea Otter Keystone Species article	53
	Student Resource 5.1b Prairie Dog Keystone Species article	54
	Student Resource 5.1c Grey Wolf Keystone Species article	55
	Student Resource 5.1d African Elephant Keystone Species article	56
	Student Resource 5.2 Keystone Species Jigsaw	57-58
<b>Day 11</b>	Student Resource 5.3 Tidepool Go Fish	59-62
	Student Resource 5.4a Freshwater Mussel Biodiversity and Conservation article	63
<b>Day 12</b>	Student Resource 5.4b Motorboat Turbulence Kills Zooplankton article	64
	Student Resource 5.4c Gillnets Taking Toll on Shorebirds article	65
	Student Resource 5.4d Seaweed Records Impact of Global Warming article	66
	Student Resource 5.5 Food Web Impact Jigsaw Matrix	67-68
	Student Resource 5.6 Disruption in the Food Web	69-70
<b>Lesson 6: Ecology Final Assessment</b>		
<b>Days 13-15</b>	Student Resource 1.1 Extended Anticipatory Guide (Revisit from lesson 1)	1-2
	Student Resource 6.1 Ecology Final Assessment	71-72
	Student Resource 6.2 Final Assessment Resource Notes	73-74
	Student Resource 6.3 Final Assessment Peer Presentation Notes	75-78

Name \_\_\_\_\_

## Tidepool Ecology

### Day 1/Day 13 Extended Anticipatory Guide

Statement	Day 1		Day 13		Day 13 Evidence
	Agree	Disagree	Agree	Disagree	Evidence: Explain using your own words
1. Sea stars are the true killers of the rocky tidepools.					
2. Tidepools are hostile environments that are constantly changing and are extremely susceptible to human impact.					
3. Photosynthesis occurs in organelles called chloroplasts.					
4. Cellular respiration creates oxygen for other organisms to use.					
5. Autotrophs are organisms that are able to transform chemical energy from light energy.					
6. 90% of energy is passed from one trophic level to the next in any given ecosystem.					
7. A Blue Whale can grow to over 100 feet in length yet its primary food source is no more than 2 ½ inches long.					
8. In a typical ecosystem predators account for the majority of the ecosystem's biomass.					
9. The stability of an ecosystem is dependent on the balance between producers and consumers.					
10. The biodiversity of California's kelp forest is dependent on the presence of sea otters.					
11. Tidepools are an important part of our ecosystem in Orange County.					
12. Santa Ana is not directly next to the ocean so it has no impact on the health of the costal ecosystem.					

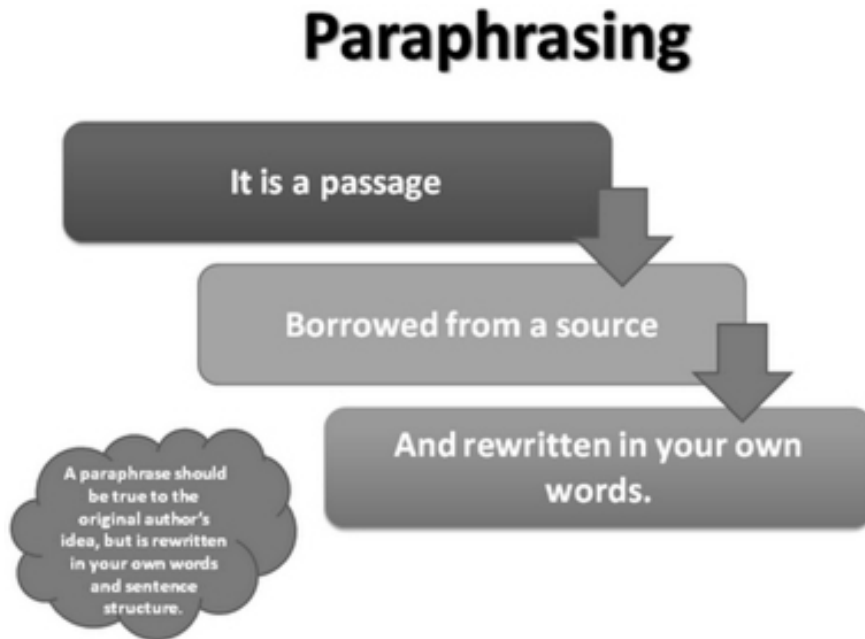
Name \_\_\_\_\_

Space for additional evidence:

Name \_\_\_\_\_

# How to Paraphrase

- Use the space surrounding the picture below to take notes on paraphrasing.
- You only need to write down the red text seen in the Power Point, but feel free to add additional information if you think it will be useful to you.



Name \_\_\_\_\_

**Examples of Paraphrasing**

**Original Sentence 1-** There is little chance that the situation will improve.

**Paraphrased:** There is little possibility that the circumstances will get better.

**Original Sentence 2-** The Great White Shark is the largest predatory fish in the world. The Great White can often be seen hunting elephant seals off of the coast of California.

**Paraphrased:** The largest predatory fish in the ocean is the Great White Shark; they are frequently seen eating elephant seals along California’s coast.

**Original Sentence 3-** Sparky the dog is really excited when her owner returns from work.

**Paraphrased:** When her own returns Sparky the dog is excited.

**Analysis:** Pick one sentence pair above and describe one similarity and one difference between the original sentence and the paraphrased sentence.

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**Practice Paraphrasing Sentences**

Directions: Paraphrase the following sentences.

1. Angel is often late to school because he stays up late watching Netflix.

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3. Mira has little time to go out with her friends because she needs to study for her Biology test in the morning.

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4. People frequently laugh at me when I tell them my dog’s name his name is Funyuns. Sometimes I feed my dog Funyuns chips and tell people he is a cannibal.

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5. Share your paraphrased sentences with a partner. Use the following student exchange sample to help you communicate your ideas clearly.

Student 1: “After reading the first sentence “Angel is often late to school because he stays up late watching Netflix,” I paraphrased that sentence as\_\_\_\_\_.”

Student 2: “After reading the first sentence I found that the author’s main idea was \_\_\_\_\_ so I made sure to include that idea in my paraphrased sentence of \_\_\_\_\_.”

Continue sharing your paraphrased sentences until you have shared all three. Change or add any information that you may be missing from your paraphrased sentences.



Name \_\_\_\_\_

**Practice Paraphrasing a Paragraph**

Directions: Read the paragraph below and paraphrase the main ideas and evidence used in the article in the space provided. Be sure to give credit to “Erik Lacitus” from the Seattle Times for his research!

**Fasting woman to end attempt to ‘live on light’ diet**

Originally published June 17, 2013 at 2:43 PM | Page modified June 17, 2013 at 9:45 PM

By Erik Lacitus at the Seattle Times

Naveena Shine, seen in her Redmond home, by Monday had lost 33 pounds after 45 days without food.

After dropping about 20 percent of her body weight, Naveena Shine, the 65-year-old Eastside woman who got worldwide publicity for trying to live on just light and no food, is calling it quits with her grand experiment.

Shine had dropped to 126 pounds from her original weight of 159 pounds on her 5-foot, 4-inch frame.

Shine says she simply wanted to know if “breatharianism,” a New Age belief that sunshine can substitute for food, was possible. She posted about her experiment on Facebook, YouTube and her Living on Light website.

“I didn’t prove it,” she admits. But, says Shine, it certainly got people talking.

Doctors have warned that it is not possible for humans to photosynthesize, and four deaths have been linked to people who apparently had tried.

Adapted by SAUSD teachers from an article in The Seattle Times

**(Begin by citing your source!)**

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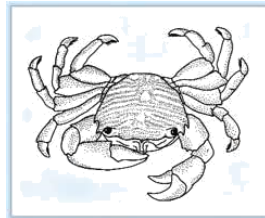


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**Don’t forget to cite where you got the information!**

Advantages to living in the tide pools

- \* There is lots of sunlight therefore there are lots of plants and algae that grow
- \* Food is abundant
- \* Lots of hiding places
- \* Constant wave action supplies the tide pool with nutrients



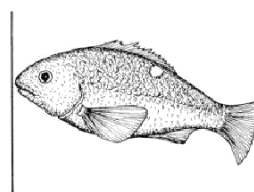
Challenges of living in the tide pools

- \* There is lots of sunlight therefore animals can dry out quickly
- \* Exposed to predators during low tides
- \* Limited space
- \* Constant wave action can carry unprotected animals

**Organisms  
of the Tide Pools**

Food Webs of the tide pools

- \* Many marine animals rely on tide pools for food and other resources.
- \* Gulls and other seabirds, as well as some mammals, forage in tide pools. Tide pools even serve as "nurseries" for some fish species.

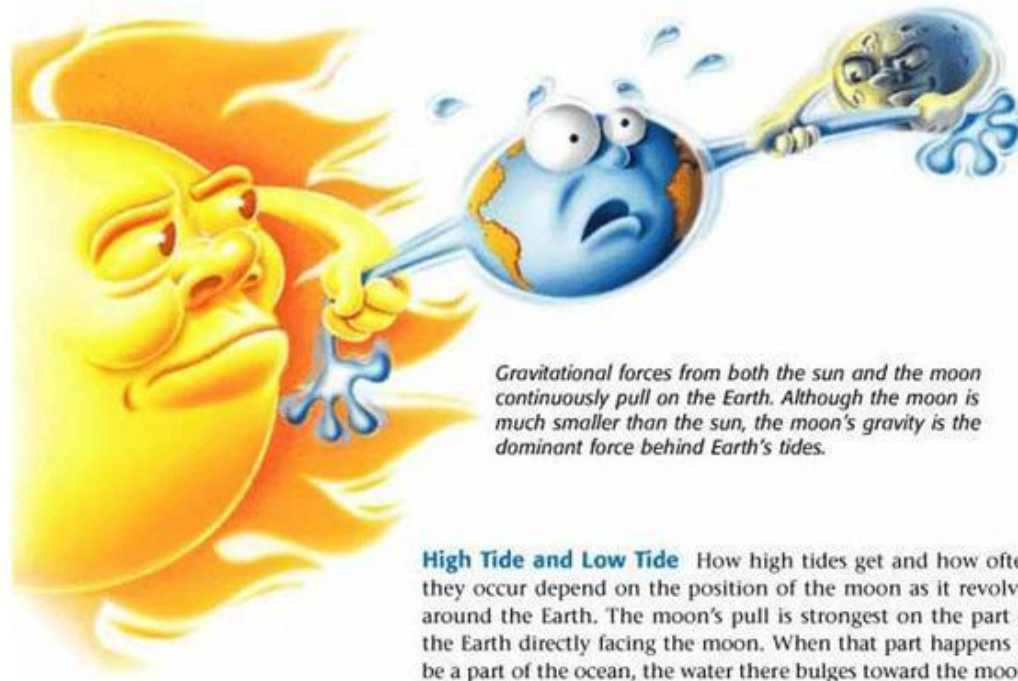


Adaptations to living in the tide pools

- \* Shells that can trap water to prevent animals from drying out
- \* Cluster together to help retain moisture
- \* High tolerance for changes in moisture and temperature

## How Tides Are Created

Have you ever heard the term high tide and low tide? Tides are periodic rises and falls of large bodies of water. The gravitational pull of the moon causes the ocean to bulge out in the direction of the moon. In other words, the moon pulls the water of the earth towards itself causing high tide. This creates a low tide on the opposite side of the earth. Because the earth is rotating there are two tidal cycles every day, two high tides and two low tides. The sun also has an effect on tides on the earth but its role in the daily tide cycle is lessened because the sun is so far away.



*Gravitational forces from both the sun and the moon continuously pull on the Earth. Although the moon is much smaller than the sun, the moon's gravity is the dominant force behind Earth's tides.*

**High Tide and Low Tide** How high tides get and how often they occur depend on the position of the moon as it revolves around the Earth. The moon's pull is strongest on the part of the Earth directly facing the moon. When that part happens to be a part of the ocean, the water there bulges toward the moon.

## Where are Tide Pools?

There are dozens of tide pools within 15 miles of Santa Ana.

The tide pools are a wonderful discovery zone, but be careful if you visit. The intertidal area is a very sensitive ecosystem. Few animals in this ecosystem can harm humans, but many animals are sensitive, and can even be killed, when handled or just touched by humans. Low tide is the best time to visit the tide pools. Low tides during convenient daylight hours are most common in the winter during full and new moons.



# Ecology of Tide Pools

## What is Ecology?

Ecology is the study of an environment, the organisms that live in the environment, and their interactions. In the study of ecology, a group of a particular species of organism living in a defined area is considered to be a population. Thus, when discussing a population, an ecologist will identify both the organism and the place.

## Zonation of Tide Pools

The plants and animals of the intertidal zone occupy bands of distinctly different species composition. The distance above or below the mean sea level determines the vertical distributions of plants and animals.

## The Hostile Environment of Tide Pools

Desiccation (drying out) is one of the primary factors that restrict the vertical distribution of organisms. Another restricting factor is the ability to survive drastic fluctuations in temperature, salinity and oxygen levels as they are exposed to the variations in the tides. In some organisms, for example barnacles and mussels, the ability of food depends upon submergence in seawater. These organisms may be restricted by starvation problems in the high intertidal zone. Furthermore, the abundance of competitors and predators with which an organism must coexist is influenced by the tides.



## Human Impact on Tide Pools

Many intertidal animals, like the black abalone—prized for its shell and meat—are now scarce or absent in areas where they were once abundant.

Humans, historically and currently, harvest animals and plants from the intertidal environment for food, bait, and, more recently, for home aquariums.

While visiting tide pools people often crush or destroy shells and organisms.



The intertidal zone endures a variety of negative human impacts, including direct human contact and indirect contact through runoff and litter.

Coastal runoff hits the tide pools first and often in its highest concentration. This includes pesticides, car fluids from roads and driveways, and general litter.

As the world heats up, so too does the ocean. Organisms are dying in the hot tide pools or moving higher out of the water in an effort to remain cool.

# California Biodiversity



Over millions of years, geology and climate have shaped California's unique habitats and produced a rich mosaic of life. Within its 160,000 square miles, California harbors more unique flora and fauna than any other state. For example, there are over 30,000 species of insects found in California, as well as 63 different types of freshwater fish, 46 amphibian species, 96 reptile species, 563 bird species, 190 mammal species, and over 8,000 different types of plants.

Biodiversity refers to all the different kinds of living organisms within a given area. Biodiversity includes plants, animals, fungi, and other living things.

California's nearshore waters provide a rich and varied habitat for a diversity of marine life; vast numbers of algae, invertebrates, fish, seabirds, and mammals inhabit these shallow waters, which overlie a gently sloping region called the continental shelf.

Name \_\_\_\_\_

**Ecology of Tidepool Information Sheets**  
**Jigsaw Matrix**

	Paraphrase the information sheet below
<b>Organisms of the tidepool</b>	
<b>How tides are created</b>	
<b>Where are tidepools?</b>	



Name \_\_\_\_\_

<b>Ecology of tidepools</b>	
<b>Human impact on tidepool</b>	
<b>Biodiversity</b>	
<b>Use the space below to write a 2-3 sentence summary of the overarching main ideas of the information sheets:</b>	

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1. How does a plant get energy to grow and survive? Brainstorm your ideas here:



2. How does a person get energy to grow and survive? Brainstorm your ideas here:



3. Use at least one of these sentence starters to share your ideas with your partner about how people and plants get their energy.

- I am not exactly sure how this happens, but I think one way may be.....
- I know that this happens because ....



4. Do you think it is possible for people to “live on sunshine?” Why or why not?
- If you would like, use this sentence starter to write at least 1 complete sentence. “I think it is/is not possible for people to “live on sunshine” because....”
  - Or you can write your own complete sentence below.

My complete sentence for question 4 above:

- When your teacher tells you to, turn to your partner and figure out who has the longest pinkie finger.
- The partner with the longest pinkie finger reads their complete sentence to their partner, while the partner writes a summary.
- The partner with the shortest pinkie finger reads their sentence second, while the first partner writes a summary.

My partner’s complete sentence:

Name \_\_\_\_\_

<p><b>How Do Living Organisms Get Energy?</b></p>	<p>Photosynthesis</p>	<p>_____</p>
<p><b>What are the essential chemical equations?</b></p>		
<p><b>Write out the terms (labels) for the chemical symbols</b></p>	<p>Carbon Dioxide + Water+ sunlight                  → _____ + _____</p>	
<p><b>Which Type of Cell performs this reaction?</b></p>		
<p><b>Describe key organelles and their function for this reaction</b></p>		<p>Mitochondria -</p>
<p><b>When does this Occur?</b></p>		
<p><b>How Do Living Organisms Get Energy?</b></p>	<p>Photosynthesis</p>	<p>_____</p>

Name \_\_\_\_\_

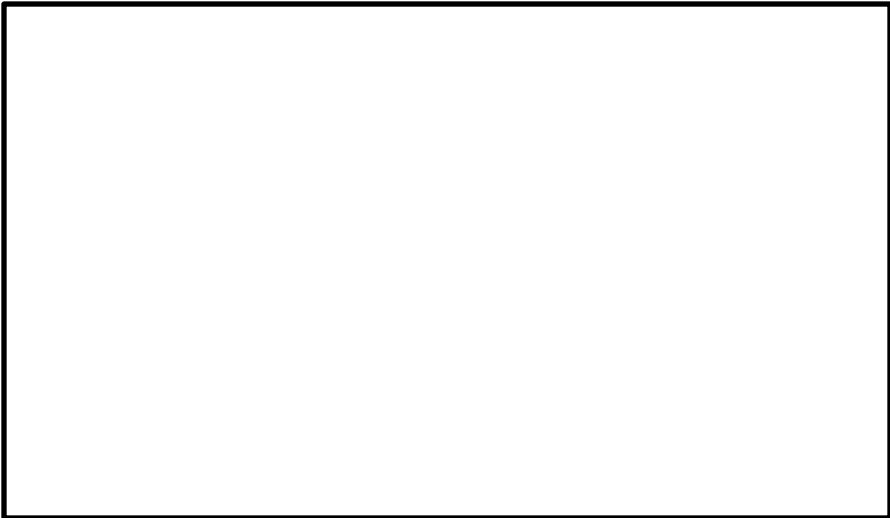
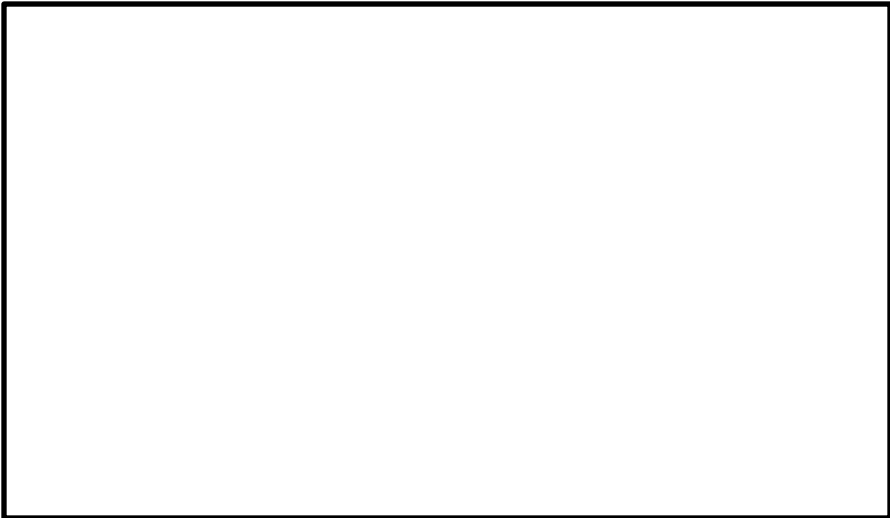
<p><b>What are the reactants in each process?</b></p>		
<p><b>What are the products in each process</b></p>		<p>ATP= chemical energy!</p>
<p><b>What type of process is this reaction? Give examples</b></p>		
<p><b>What occurs in is this reaction. Give examples.</b></p>		

- Using your notes, ask your partner one question.
- For example say, “When does photosynthesis occur?”
- Alternate who asks the question until you have each asked and answered three questions. Repeat the question for your partner if needed.
- If your partner does not remember the answer, allow them to use their notes to answer your question correctly. Check off their progress here:
- Continue until you have BOTH answered three questions correctly. Use your notes if needed.

Name \_\_\_\_\_

Use Figure 8.5 on page 222 to *draw* and *label* a Plant Cell and a Chloroplast.

Use Figure 8.11 on page 228 to *draw* and *label* an Animal Cell and a Mitochondrion.



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**Lesson 2 Anticipatory Guide**

	Before 3 Videos		After 3 Videos		
	Opinion		Findings		
	Agree	Disagree	Agree	Disagree	Evidence: Explain using your own words
1. The energy used by all living things comes from the sun.					
2. Autotrophs are organisms that cannot photosynthesize.					
3. Glucose is a needed by all organisms					
4. Chlorophyll is a green, light trapping molecule found in most plants.					
5. All animals are dependent on photosynthesis for their source of energy.					
6. Photosynthesis produces sugar and oxygen.					
7. All living organisms must have carbon dioxide in order to break the chemical bonds in glucose.					
8. One of the products of cellular respiration is energy, or ATP (Adenosine Triphosphate).					

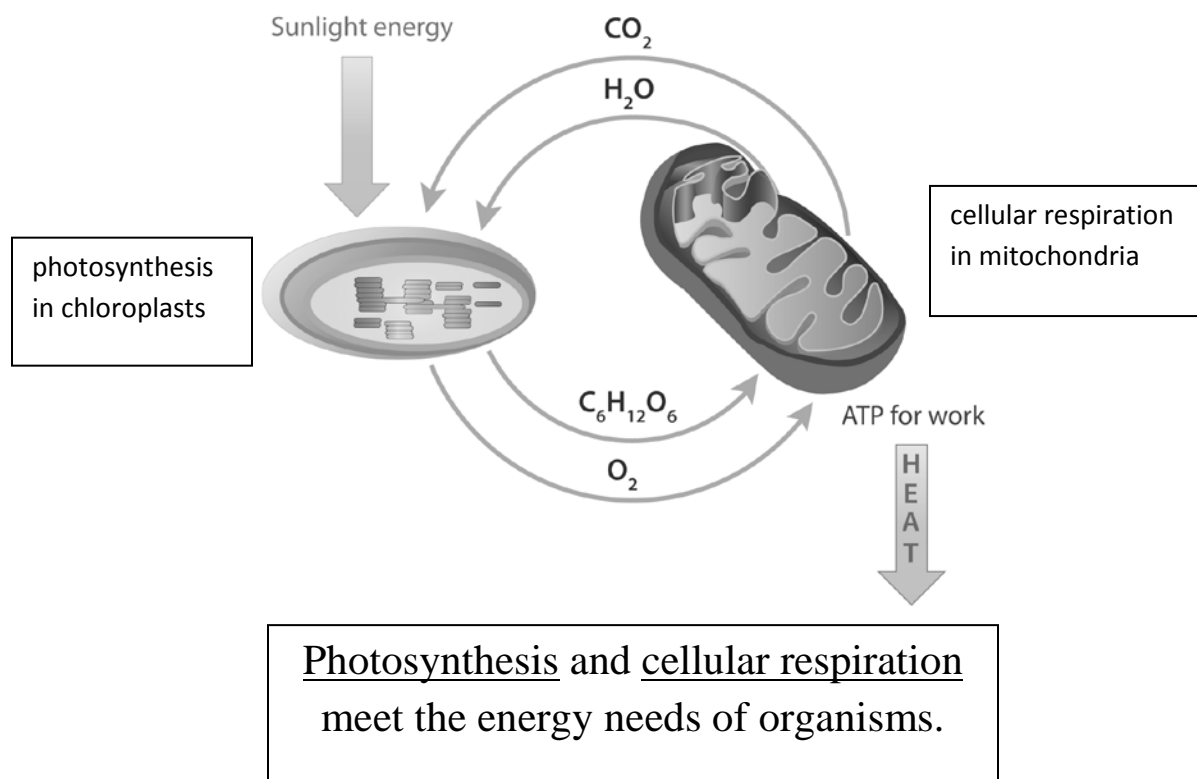
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## PHOTOSYNTHESIS AND CELLULAR RESPIRATION LAB

Every living cell needs a source of energy. Without energy, metabolism- all of the chemical reactions that occur within cells- will not occur. Two elements that are continuously cycled by organisms are carbon and oxygen. These elements sustain both organisms and ecosystems. Two fundamental cellular processes- cellular respiration and photosynthesis- provide organisms with energy and recycle carbon and oxygen in ecosystems.

Cellular respiration is the process by which cells release stored energy from such sugars as glucose. Photosynthesis is the process in which producer cells use carbon dioxide, water, and nutrients to produce glucose and oxygen. Together these two processes make the carbon cycle possible, moving essential molecules through ecosystems.

You will learn how the complex chemical reactions of photosynthesis and cellular respiration help meet the energy needs of living things. You will also examine the organelles, molecules, and chemical reactions involved in these two processes.



### Materials

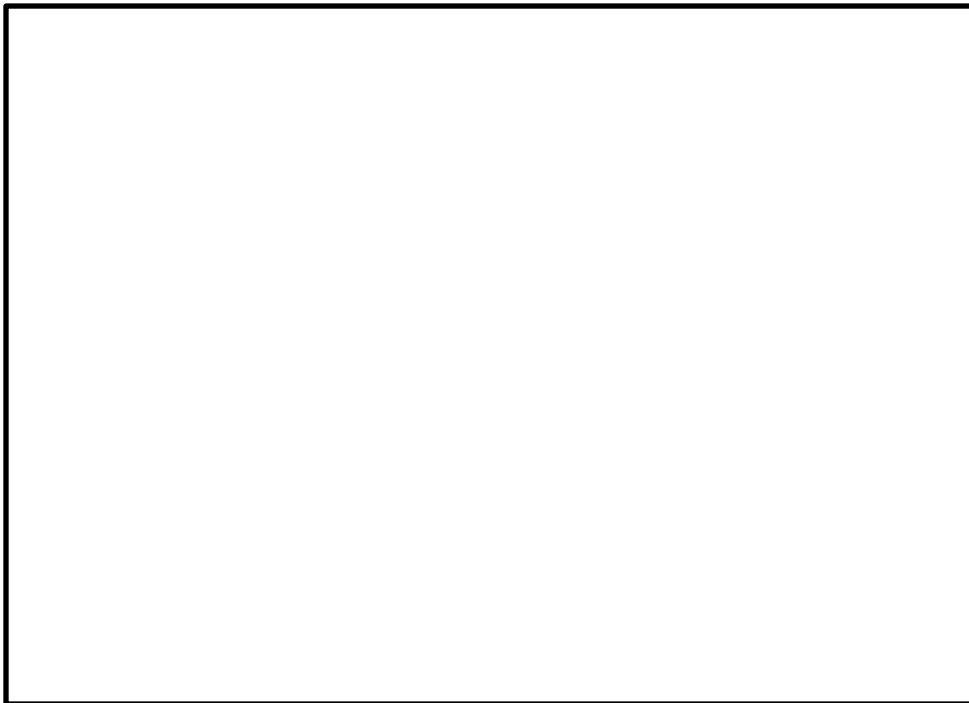
*For each group of 2 students*

- 1 set of 8 Photosynthesis & Cellular Respiration Shuffle Cards
- 1 set of 12 Photosynthesis & Cellular Respiration Shuffle Strips
- 1 set of 2 Photosynthesis & Cellular Respiration category cards

Name \_\_\_\_\_

**Procedure**

1. Spread out the 2 Category Cards, Photosynthesis and Cellular Respiration.
2. With your partner, sort the Shuffle Cards into two sets, based on what you already know about the processes of cellular respiration and photosynthesis.
3. Carefully examine the image on each Shuffle Card, and then put each card under the appropriate Category Card based on what you observe in the image.
4. When you think you have the Shuffle Cards under the appropriate Category Card, get approval from your teacher to confirm that the cards are correctly placed. If they are not placed correctly, use your text to help you make corrections. Teacher Initials for Shuffle Cards placed correctly =
5. After getting your teachers initials, obtain the Photosynthesis and Cellular Respiration Shuffle Strips from your teacher.
6. With your team, lay all of the Shuffle Strips out on the table, and read each one aloud.
7. Sort the Shuffle Strips into two stacks, one for cellular respiration and one for photosynthesis. If you are unsure about where any of the strips belong, lay them out next to where you will be working so that you can see them as you work.
8. Choose a stack to start with. Put the Shuffle Strips in the order in which you think the processes are happening.
9. Repeat Procedure Step 8 for the stack you have not ordered yet.
10. If you had any Shuffle Strips that you did not place, try to decide where they belong now that you have ordered the other strips.
11. Note: There are more Shuffle Strips than Shuffle Cards, and so more than one strip may fit with a single card.
12. Get approval from your teacher to confirm that the Shuffle Strips are correctly placed before moving on. Use your text if you need help. Teacher Initials for Shuffle Strips placed correctly =
13. Using the Shuffle Cards to help you, draw a simple picture that shows the process of Photosynthesis taking place in a pond with plants and fish.



Name \_\_\_\_\_

14. Based on what you see on the cards and on the strips, write a short paragraph describing photosynthesis. Be sure you write in your own words, and do not just copy the Shuffle Strips.  
Photosynthesis Paragraph:

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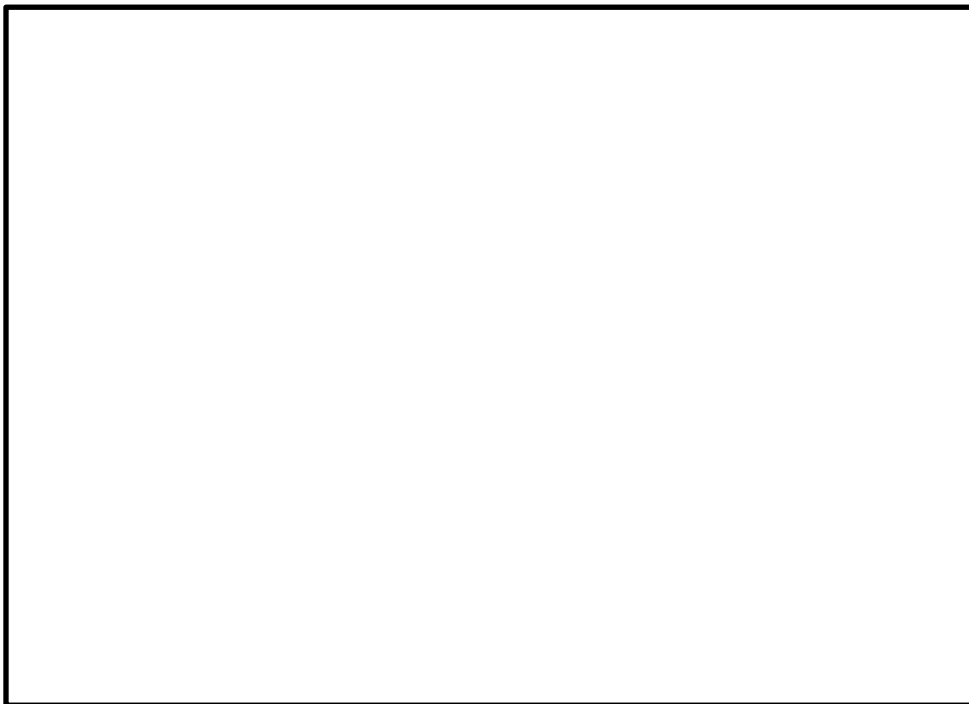
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15. Using the Shuffle Cards to help you, draw a simple picture that shows the process of Cellular Respiration taking place in a pond with plants and fish.



16. Based on what you see on the cards and on the strips, write a short paragraph describing cellular respiration. Be sure you write in your own words, and do not just copy the Shuffle Strips.

Name \_\_\_\_\_

Cellular Respiration Paragraph:

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**Analysis**

1. What does a producer need for performing photosynthesis, and what does photosynthesis produce?

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2. What does an organism need to perform cellular respiration, and what does cellular respiration produce?

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3. What roles do photosynthesis and cellular respiration have in an ecosystem?

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4. Explain whether the following statement is correct or incorrect: "Only organisms that breathe can perform cellular respiration."

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5. If the mitochondria of half the organisms in an ecosystem stopped functioning, what might change in the ecosystem? Explain.

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Adapted from LAB-AIDS© KIT #30S

Vocabulary Review Jigsaw Worksheet

- ❖ Work with your partners to complete the Vocabulary Review Jigsaw.
- ❖ Your goal is to correctly identify as many of the 15 vocabulary words as possible.
- ❖ Your group will receive points for each correct vocabulary word.

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.
- 11.
- 12.
- 13.
- 14.
- 15.

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Name \_\_\_\_\_

### Photosynthesis and Cellular Respiration Thinking Map

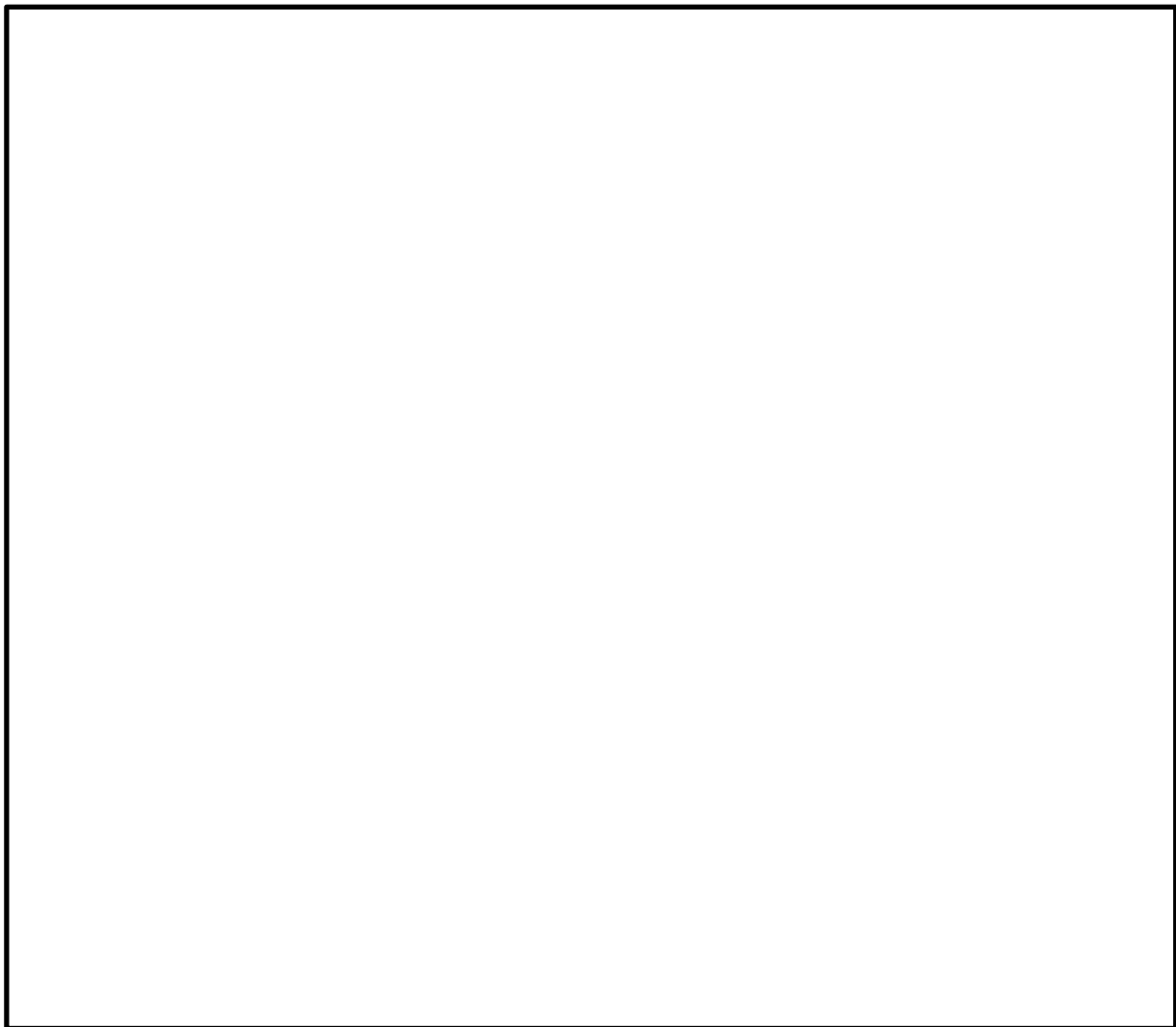
**Step 1:** Go back to Day 3 2.3 where you drew and labeled the chloroplast and the mitochondria. Use that page to brainstorm your ideas about the differences and similarities between the processes of photosynthesis and cellular respiration.




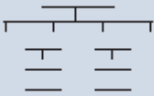
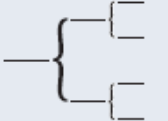

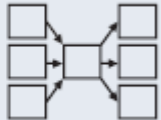

**Step 2:** Read the text on page 222 about Photosynthesis. Add to your brainstorm on the chloroplast part of the page.

**Step 3:** Read the text on page 228 about Cellular Respiration. Add to your brainstorm on the mitochondria part of the page.

**Step 4:** Use the thinking maps on the next page to help you decide what type of thinking map will best organize the information on your brainstorm page from Day 3.

**Step 5:** Draw your thinking map here: (If you need more space, you can use another piece of paper!)



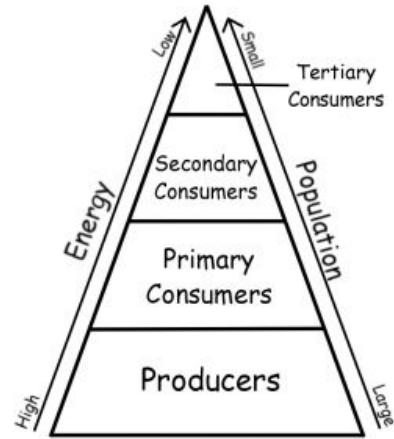
Common Core Standards & Questions	Thinking Process	Thinking Maps as Tools
<p>Understand and use general (tier 2) and domain-specific (tier 3) academic vocabulary.                      What does _____ mean? Can you define _____?</p>	<p>Brainstorming or Defining in Context</p>	<p>Circle Map </p>
<p>Use relevant descriptive details and sensory language in reading and writing.                      How would you describe _____? What are the characteristics of _____?</p>	<p>Describing</p>	<p>Bubble Map </p>
<p>Compare and contrast important points in two texts or points of view; draw comparative inferences about two populations.                      What are the similarities and differences between _____ and _____? How are _____ and _____ alike? different?</p>	<p>Comparing and Contrasting</p>	<p>Double Bubble Map </p>
<p>Determine the main idea(s) of text(s) and key supporting details in complex texts.                      What is the main idea of _____? What are the supporting details?</p>	<p>Classifying</p>	<p>Tree Map </p>
<p>Use common affixes to determine and clarify the meaning of unfamiliar terms.                      Analyze the structural parts of _____ to suggest improvements.</p>	<p>Part-to-Whole</p>	<p>Brace Map </p>
<p>Understand the steps and patterns in complex processes in order to answer questions and solve problems.                      What ordered steps would you follow to solve _____? How would you demonstrate the steps for solving _____?</p>	<p>Sequencing</p>	<p>Flow Map </p>
<p>Evaluate the argument and specific claims in a text; determine the impact the author's purpose and point of view have on a text.                      What is the impact of the author's point of view on _____? How would you evaluate the argument and claims in _____?</p>	<p>Cause and Effect</p>	<p>Multi-Flow Map </p>
<p>Analyze the relationship between a primary and secondary source; analyze patterns and relationships.                      What is the relationship between _____ and _____? How would you analyze the relationships and analogies in _____?</p>	<p>Seeing Relationships</p>	<p>Bridge Map </p>

# Ecology: Trophic Transfer of Energy in an Ecosystem

## How energy is transferred in an Ecosystem

Ecology, the study of the interactions of living organisms with one another and with their environment, is the study of ecosystems, an ecological system encompassing a community and all the physical aspects of its habitat.

A place where a certain species lives is called its habitat, and groups of different species living together are called a community. All of the physical aspects of a community are called an ecosystem.



**Figure 1: The Transfer of Energy**

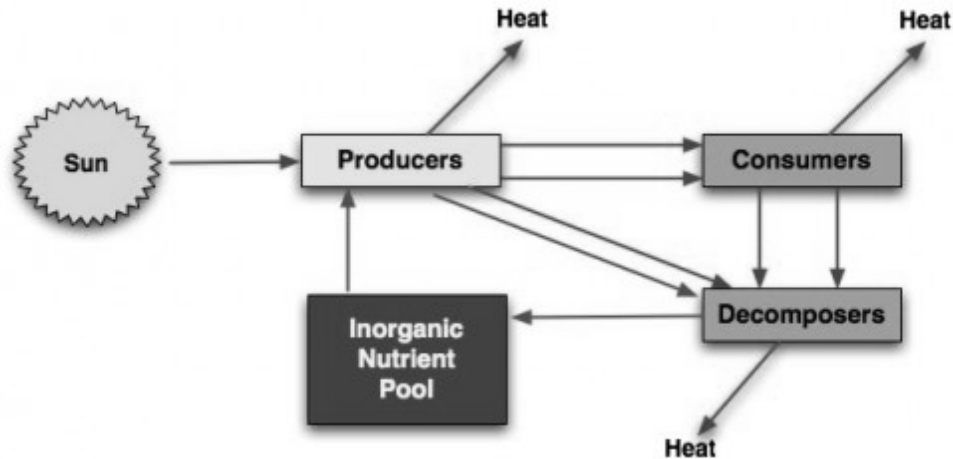
Ecosystems run on energy, which flows from the sun. Life is possible because photosynthesis captures the light energy from the sun and turns it into chemical energy of organic molecules. This is a basic principle of ecology. The organic molecule compounds are composed of what we call food, which gives us energy.

The energy budget of an ecosystem is determined by primary productivity, the amount of organic materials that the photosynthetic organisms of an ecosystem, produce.

Energy flows through food webs, a network of feeding relationships in an environment, which contain food chains, a linear pathway of energy transfer in an ecosystem. Food chains are composed of trophic levels, a group of organisms that have the same source of energy, a step in the food chain. The lowest trophic level consists of producers: plants, algae, bacteria. The 2<sup>nd</sup> level: cows, horses, caterpillars, ducks. The 3<sup>rd</sup> level: tigers, wolves, snakes. The 4<sup>th</sup> level: tertiary consumers (Top carnivores) such as a hawk eating a snake. A carnivore eating another carnivore.

Omnivores are animals that eat both plants and animals.

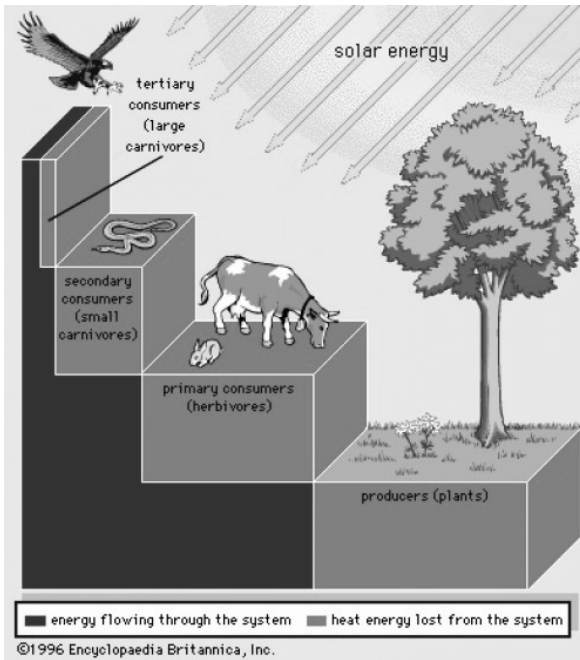
An organism acquires energy from the food it eats. Some of that energy is stored as fat, some is lost through wastes, urine, and feces. But most escapes as heat, which is produced when energy is transferred from one form to another. Only 10% of energy is incorporated into the next trophic level, so because the loss of energy from one level to the next is so great, the number of trophic levels is limited.



Transfer of energy and heat loss

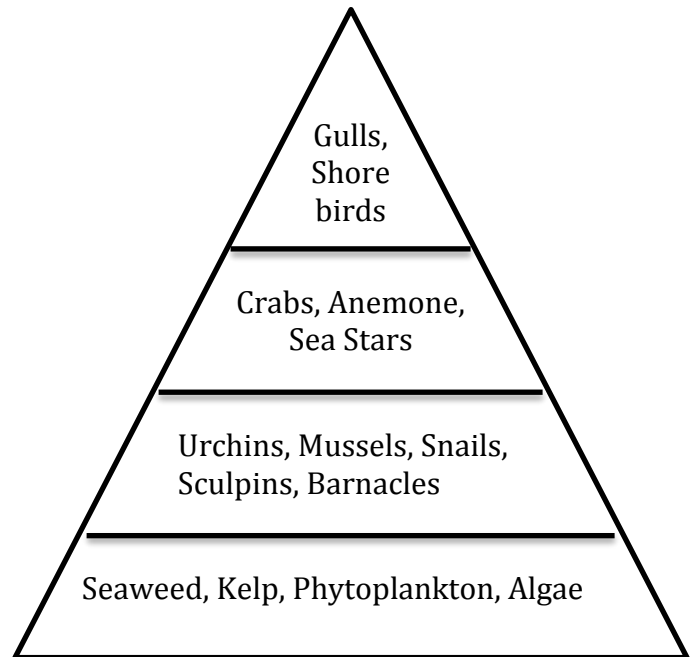
## Conclusion

To sum up, once a producer receives energy from the sun, it is eaten by a primary level consumer and gives around 10% of its energy to the primary level consumer. 90% is lost as heat. This process of ecology happens in an ecosystem all the time. The transfer of energy in an ecosystem is very inefficient, that is why consumers at the top of the food chain must constantly eat a lot of food, because less and less energy is available as we go further into the food chain.



Trophic Levels in an Ecosystem

<http://londonlady.hubpages.com/hub/The-Transfer-of-Energy-in-an-Ecosystem>



Example Tropic Level Tidepool

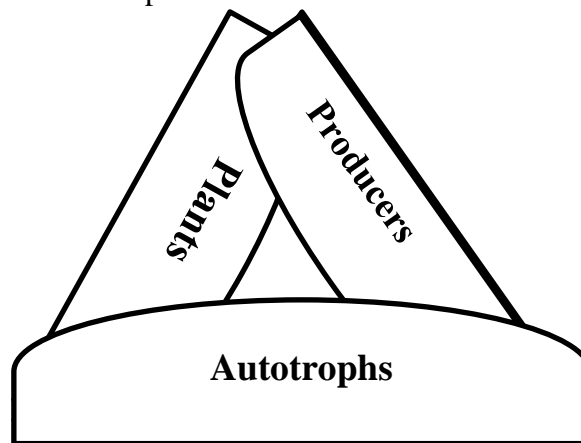
## Flow of Energy in the Ecosystem

**Objective:** Create vocabulary connections to be able to understand how energy flows through an ecosystem.

**Background:** Energy is defined, as the ability to cause change, in ecology energy is the key component of an organism being able to survive. Every ecosystem has a specific flow of energy between organisms. Autotrophs- plants, algae, and some bacteria- capture energy from the sun in special structures called chloroplasts or special pigments that capture sunlight. Autotrophs form the foundation for the flow of energy in an ecosystem and are sometimes called producers. Autotrophs in turn are eaten by heterotrophs-herbivores, and omnivores- who are able to use the energy stored in the autotroph to fuel their energy needs. Carnivores such as birds, wolves, bears, and lions then eat herbivores such as deer, insects, rabbits, and cows. All organisms that do not use the sun for their direct energy needs are classified as consumers, meaning they physically eat another organism. This chain of energy usage is called the flow of energy in an ecosystem.

### Procedures:

1. Follow the directions on the next page on how to cut out and fold each of the vocabulary circles.
2. Once all of the circles are cut out and folded, add the following information on each circle using the text to correctly place each term.
3. The three outer tabs of your circle should have the main vocabulary word and two synonyms. The first circle is done for you as an example.



4. Each circle should then have **four** key concepts that describe the main vocabulary word and how it is connected to the ecosystem as a whole.
  - A. You will need to match **two** concepts from the concept bank to each circle.
  - B. You will also need to pull **two** concepts from the text and add them to each circle.
5. Once your circles are complete tape them on the Flow of Energy in an Ecosystem page.

**Word Bank**

<u>Main Vocabulary</u>	<u>Synonyms</u>
Autotroph	Heterotroph
Primary Consumer	Plants
Secondary Consumer	Heterotroph
Tertiary Consumer	Herbivore
	Producer
	Heterotroph
	Carnivore
	Predator

**Concept Bank**

- \* Stores the most energy in every ecosystem
- \* Has the fewest number of organisms
- \* Consists of seaweed, algae, and plankton
- \* A heterotroph that eats other heterotrophs
- \* Barnacles eat plankton in rocky tidepools
- \* Able to use only 10% of energy stored in plants
- \* Able to hunt during both low tide and high tide Gulls are the top predator in the tidepools.
- \* Sea stars are carnivores that eat 1000s of mussels a year

**Conclusion Questions:**

1. Based on the text. Why are there more autotrophs in an ecosystem than top-level predators?

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2. What are the 4 basic trophic levels in an ecosystem? Give an example of an organism found in each trophic level?

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3. Describe how energy would flow through a tidepool ecosystem. Please be specific.

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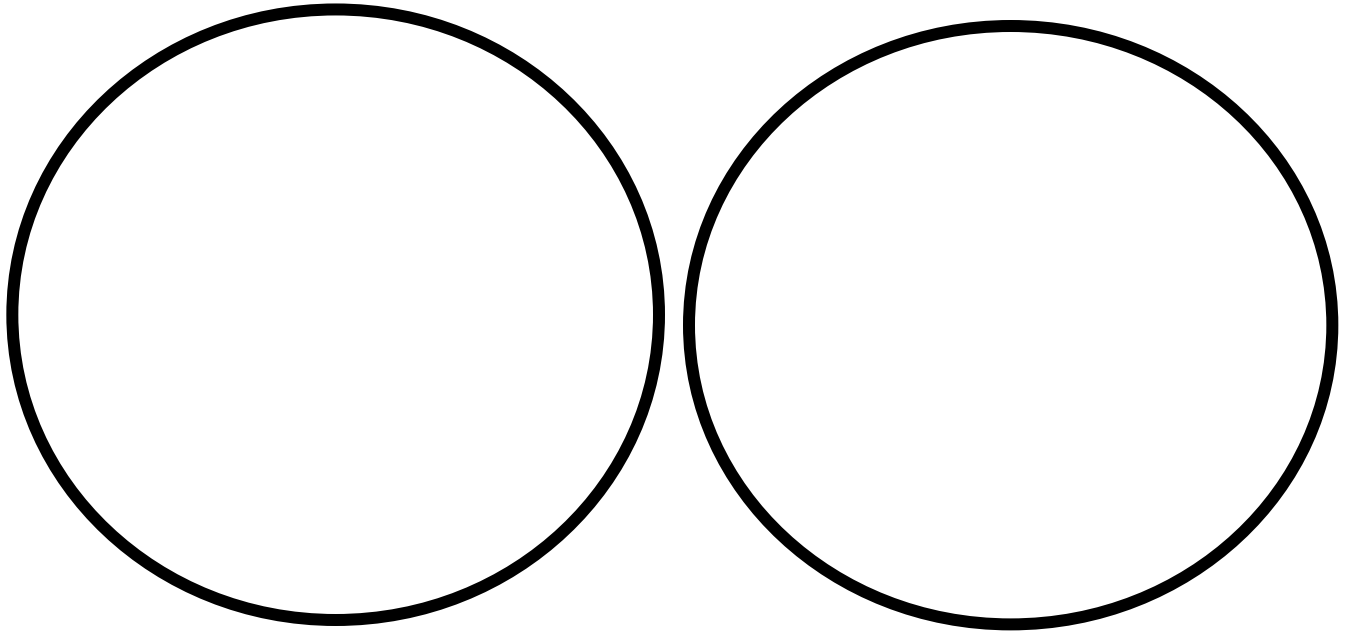
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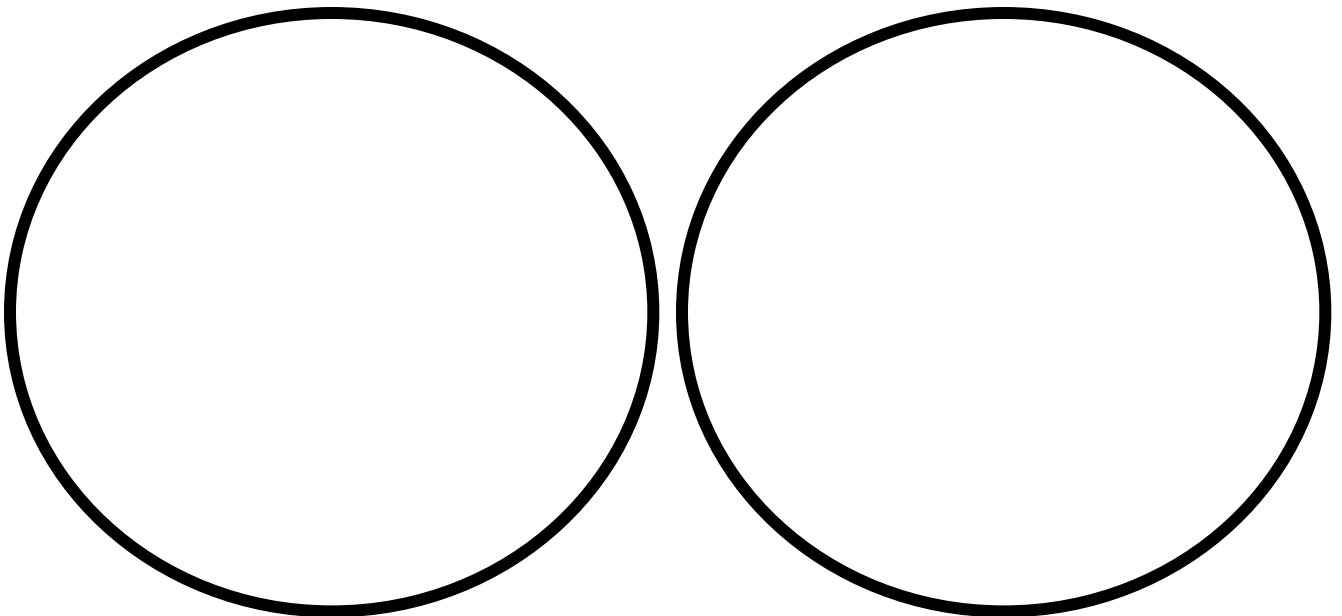
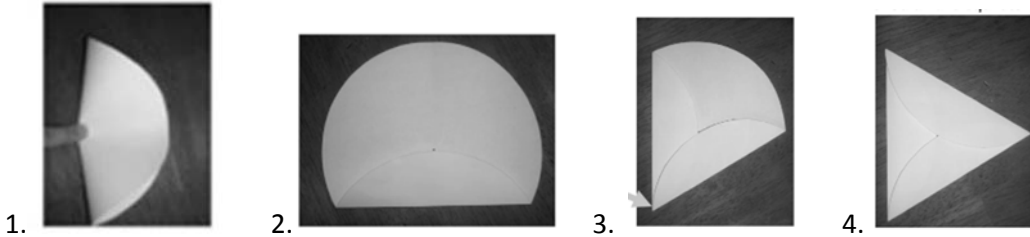
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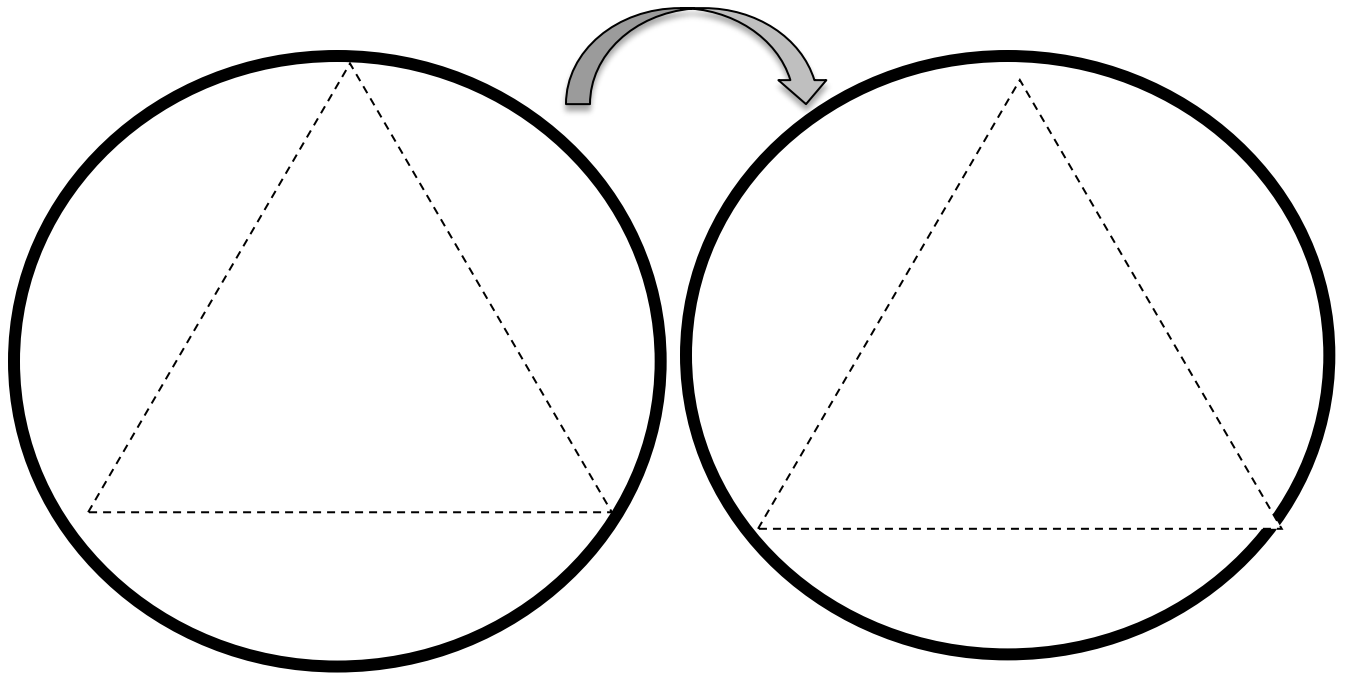
Folding Directions:

1. Cut out each of the circles.
2. Gently bend the circle in half like a taco, and then gently bend in half like a hamburger. Make a mark where the two folds intersect in the center of the circle.
3. Select a point on the outer edge of the circle and bend it towards the middle mark. Fold the circle so that you create a crease along the edge.
4. Repeat with each remaining side so that your circle now looks like an equilateral triangle.

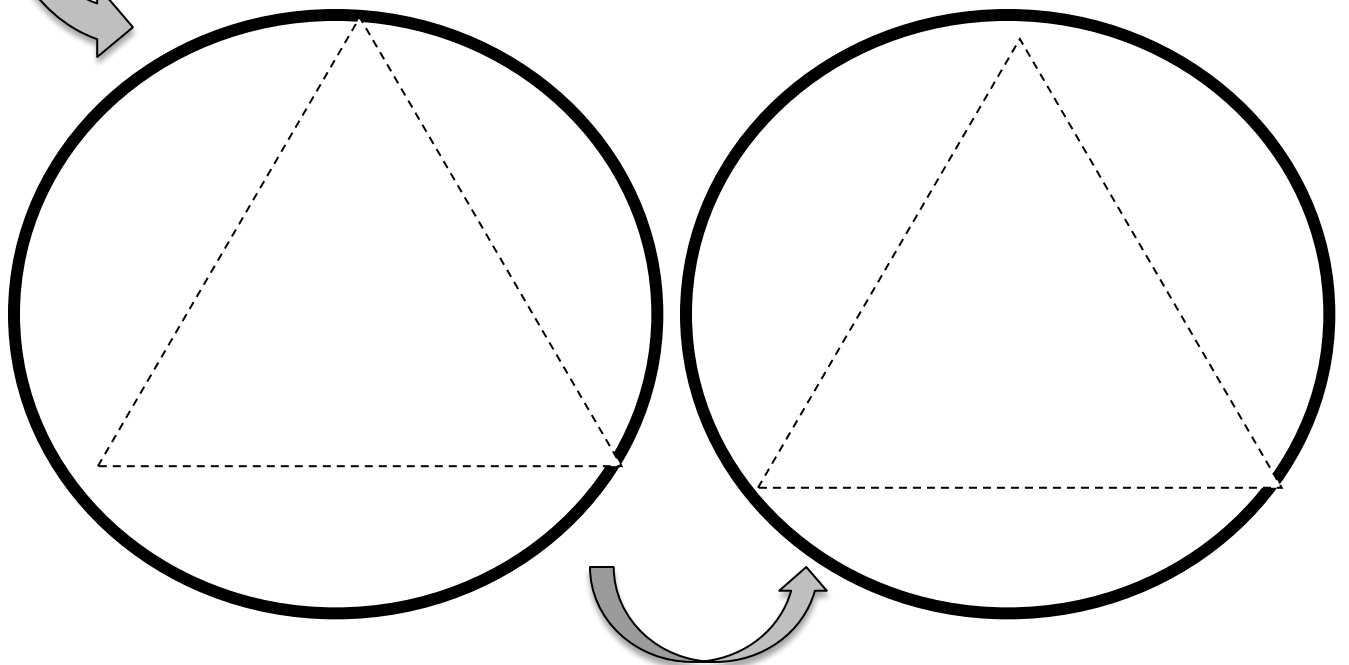
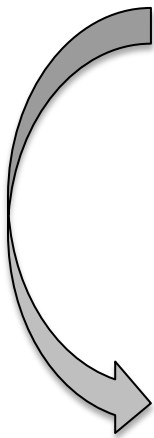


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**Flow of Energy in an Ecosystem**



## **Energy Flow in an Ecosystem: Energy Pyramid**

Ecological pyramids are models that ecologists use to show how energy flows through ecosystems. There are three main types of ecological pyramids: pyramid of energy, pyramid of biomass, and pyramid of numbers. In this activity you will create a pyramid that shows the information found in each of these ecological pyramids.

### **Pyramid of Biomass**

In a pyramid of biomass, each level represents the amount of biomass (the total mass of living matter at each trophic level) consumed by the level above it.

Follow the directions to make a Pyramid of Biomass

**EACH LEVEL SHOULD DECREASE IN WIDTH JUST LIKE A PYRAMID.**

1. Cut out the primary producers and glue them along the bottom of the triangle
2. Cut out the primary consumers and glue them above the primary consumers
3. Cut out the secondary consumers and glue them above the primary consumers
4. Cut out the tertiary consumer and glue it above the secondary consumers
5. Label each of the trophic levels using the main vocabulary from yesterday's lesson.

### **Pyramid of Energy**

In a pyramid of energy, each level represents the amount of energy that is available to that trophic level. With each step up there is a energy loss of 90%.

Follow the directions to make a Pyramid of Energy.

1. To the right of your pyramid: Label each level with the correct energy % available
  - o Primary consumers start at 100%)
  - o REMEMBER YOU LOSE 90% (for each trophic level multiple the number by 10% example:  $100 \times .1 = 10\%$ )
2. Draw an arrow up the pyramid and label the arrow "Available Energy decreases due to loss of energy in the form of heat".
3. Across the bottom write: Parasites and decomposers feed at each level

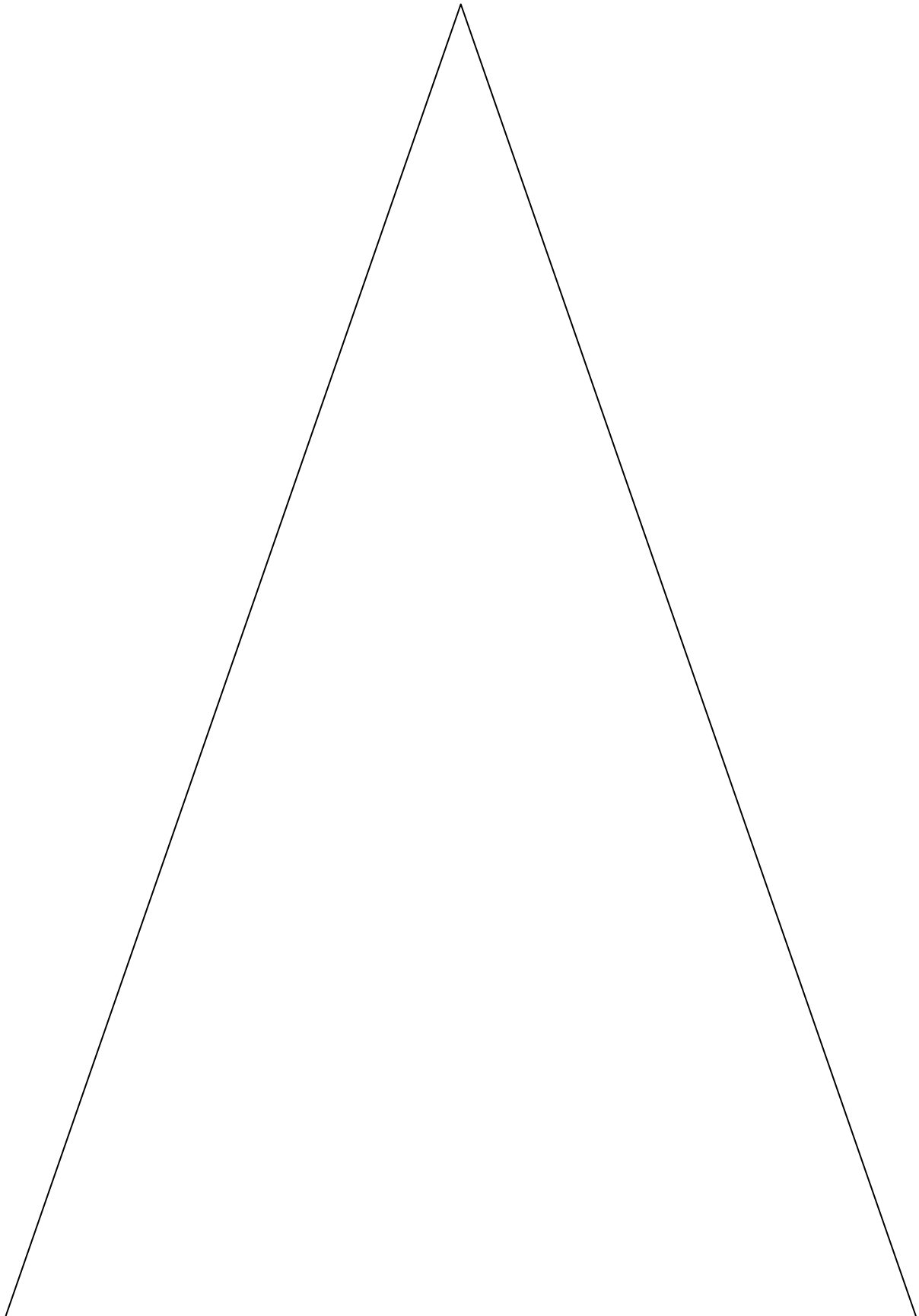
### **Pyramid of Numbers**

In a pyramid of numbers, each level represents the number of individual organisms consumed by the level above it. Each trophic level needs more individual animals to support it.

Follow the directions to make a Pyramid of Numbers.

1. On the left side draw an arrow up the pyramid and label the arrow "Population Size decreases".
2. As you go up your pyramid you lose animals label the pyramid from bottom to top with the following numbers:
  - 10,000 pounds of phytoplankton
  - 1,000 pounds crab larvae, zooplankton
  - 100 pounds mussels
  - 10 pounds sea star

Name \_\_\_\_\_



Name \_\_\_\_\_

**Analysis Questions:**

1. Describe the flow of energy through a simple food chain that ends with a lion as the final consumer.

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2. Predict what might happen to the pyramid of biomass if the Sun began to produce less energy and then finally burned out?

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3. Determine approximately how much total energy is lost from a three-step food chain if 1000 calories enter at the autotroph level.

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4. Apply what you know about how energy is transferred between trophic levels to explain why there can be only one Great White shark in your pyramid of biomass?

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5. In the food web to the right which part of the food web would contain the greatest biomass? WHY?

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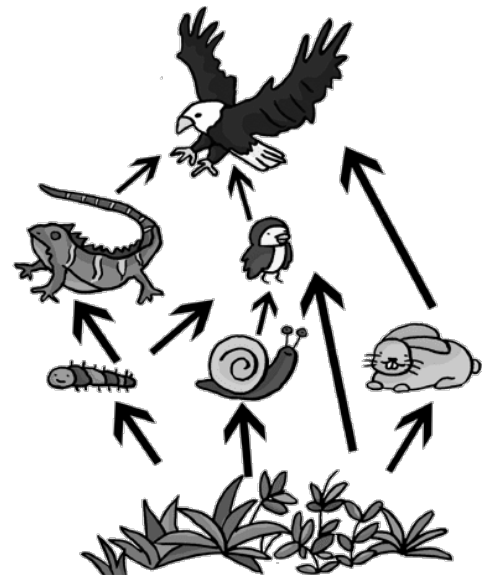
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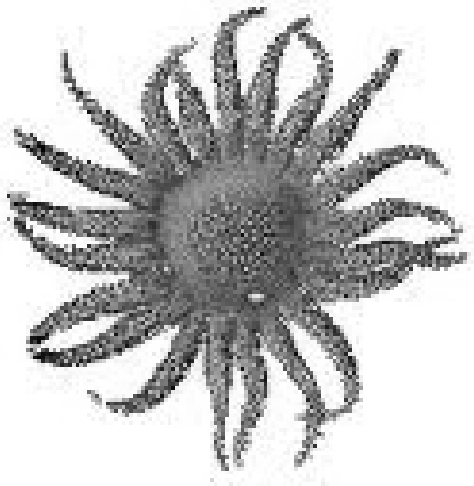
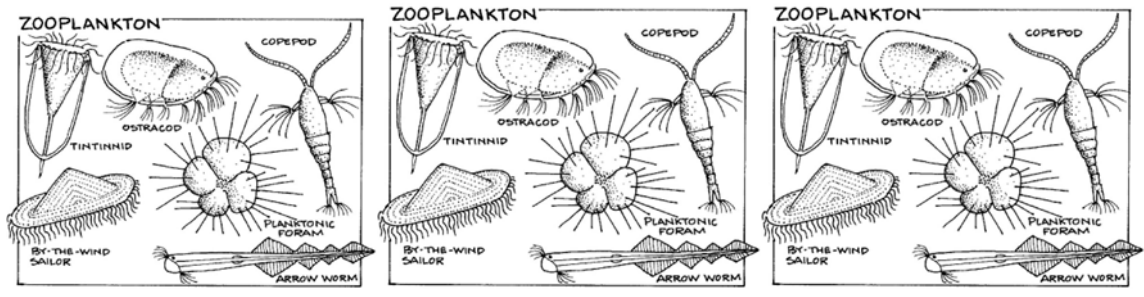
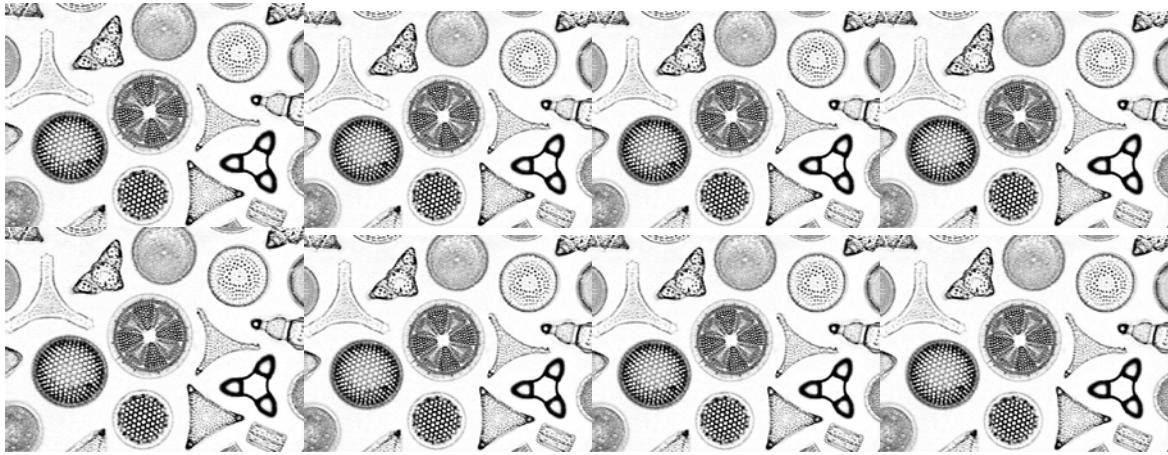
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Name \_\_\_\_\_

Animal cut outs for the pyramid of biomass in a tidepool.

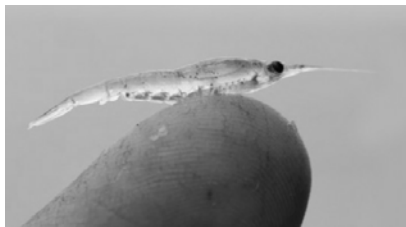
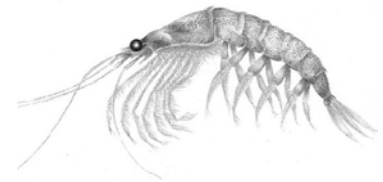
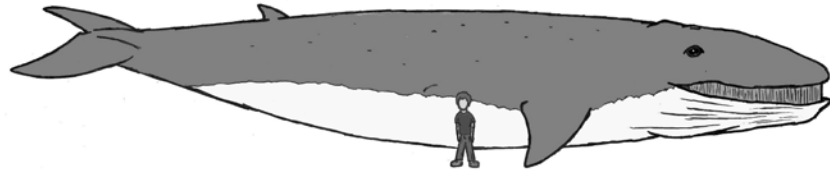


Name \_\_\_\_\_

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# What is Biomass?

1. Write the information in RED from the PowerPoint.



2. Record your ideas about how the Blue Whale, who primarily eats tiny krill, is still the largest animal the Earth has ever known.
3. Calculate the total biomass of the Blue Whale population. (number of individuals x mass of individual whale)
4. In 2-3 complete sentences compare the worldwide biomass of the Blue Whale population to that of the Antarctic Krill population.

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## The dead sea: Global warming blamed for 40 percent decline in the ocean's phytoplankton

**Microscopic life crucial to the marine food chain is dying out. The consequences could be catastrophic** By Steve Connor , Science Editor

1 The microscopic plants that support all life in the oceans are dying off at a dramatic rate, according to a study that has documented for the first time a disturbing and unprecedented change at the base of the marine food web.

2 Scientists have discovered that the phytoplankton of the oceans has declined by about 40 per cent over the past century, with much of the loss occurring since the 1950s. They believe the change is linked with rising sea temperatures and global warming.

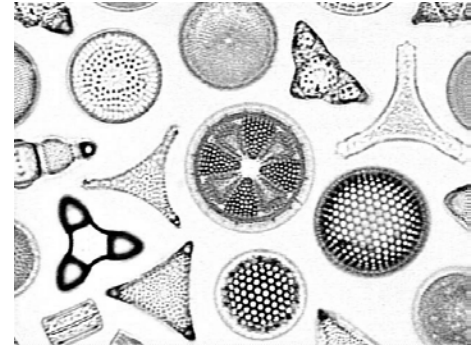
3 If the findings are confirmed by further studies it will represent the single biggest change to the global biosphere in modern times, even bigger than the destruction of the tropical rainforests and coral reefs, the scientists said yesterday.

4 Phytoplankton are microscopic marine organisms capable of photosynthesis, just like terrestrial plants. They float in the upper layers of the oceans, provide much of the oxygen we breathe and account for about half of the total organic matter on Earth. A 40 per cent decline would represent a massive change to the global biosphere.

5 "If this holds up, something really serious is underway and has been underway for decades. I've been trying to think of a biological change that's bigger than this and I can't think of one," said marine biologist Boris Worm of Canada's Dalhousie University in Halifax, Nova Scotia. He said: "If real, it means that the marine ecosystem today looks very different to what it was a few decades ago and a lot of this change is happening way out in the open, blue ocean where we cannot see it. I'm concerned about this finding."

6 The researchers studied phytoplankton records going back to 1899 when the measure of how much of the green chlorophyll pigment of phytoplankton was present in the upper ocean was monitored regularly. The scientists analyzed about half a million measurements taken over the past century in 10 ocean regions, as well as measurements recorded by satellite.

7 They found that phytoplankton had declined significantly in all but two of the ocean regions at an average global rate of about 1 per cent per year, most of which since the mid 20th Century. They found that this decline correlated with a corresponding rise in



sea-surface temperatures – although they cannot prove that warmer oceans caused the decline.

8 The study, published in the journal *Nature*, is the first analysis of its kind and deliberately used data gathered over such a long period of time to eliminate the sort of natural fluctuations in phytoplankton that are known to occur from one decade to the next due to normal oscillations in ocean temperatures, Dr. Worm said. "Phytoplankton are a critical part of our planetary life support system. They produce half of the oxygen we breathe, draw down surface CO<sub>2</sub> and ultimately support all of our fishes." he said.

9 But some scientists have warned that the Dalhousie University study may not present a realistic picture of the true state of marine plant life given that phytoplankton is subject to wide, natural fluctuations.

10 "It's an important observation and it's consistent with other observations, but the overall trend can be over interpreted because of the masking effect of natural variations," said Manuel Barange of the Plymouth Marine Laboratory and a phytoplankton expert.

11 However, the Dalhousie scientists behind the three-year study said they have taken the natural oscillations of ocean temperatures into account and the overall conclusion of a 40 per cent decline in phytoplankton over the past century still holds true.

12 "Phytoplankton are the basis of life in the oceans and are essential in maintaining the health of the oceans so we should be concerned about its decline.

13 "It's a very robust finding and we're very confident of it," said Daniel Boyce, the lead author of the study.

14 "Phytoplankton is the fuel on which marine ecosystems run. A decline of phytoplankton affects everything up the food chain, including humans," Dr Boyce said.

15 Phytoplankton is affected by the amount of nutrients the well up from the bottom of the oceans. In the North Atlantic phytoplankton "blooms" naturally in spring and autumn when ocean storms bring nutrients to the surface.

16 One effect of rising sea temperatures has been to make the water column of some regions nearer the equator more stratified, with warmer water sitting on colder layers of water, making it more difficult for nutrients to reach the phytoplankton at the sea surface.

17 Warmer seas in tropical regions are also known to have a direct effect on limiting the growth of phytoplankton.

Adapted by SAUSD teachers from:

<http://www.independent.co.uk/environment/climate-change/the-dead-sea-global-warming-blamed-for-40-per-cent-decline-in-the-oceans-phytoplankton-2038074.html>



Image Courtesy of NOAA

**Biomass: The dead sea article  
“Save the Last Word”**

Group Member	¶ Number	Circle the adjective that best fits your underlined sentence	Sentence from Article	Group’s Comments/Response/Discussion Notes
1		Surprising Interesting Confusing Difficult		
2		Surprising Interesting Confusing Difficult		
3		Surprising Interesting Confusing Difficult		
4		Surprising Interesting Confusing Difficult		



## Graphing Ocean Biomass vs. Terrestrial Biomass

**Objective:** Using comparative graphs explain the potential difference of biomass pyramids between an ocean ecosystem and a terrestrial ecosystem

**Background:** Biomass, in ecology, is the mass of living biological organisms in a given area or ecosystem at a given time. Biomass can refer to species biomass, which is the mass of one or more species, or to community biomass, which is the mass of all species in the community. It can include microorganisms, plants or animals.

The mass can be expressed as the average mass per unit area, or as the total mass in the community. Most of this biomass is found on land, with only 5 to 10 billion tonnes C found in the oceans.

On land there is about 1,000 times more plant biomass (phytomass) than animal biomass (zoomass). About 18% of this plant biomass is eaten by the land animals. However, in the ocean the animal biomass is nearly 30 times larger than the plant biomass. Ocean animals eat most of the existing ocean plant biomass, which is quickly replaced before affecting the stability the animal populations.

Ocean environments can have inverted biomass pyramids. In particular, the biomass of consumers (copepods, krill, shrimp, forage fish) is larger than the biomass of primary producers. This happens because the ocean's primary producers are tiny phytoplankton that grow and reproduce rapidly, so a small mass can have a fast rate of primary production. In contrast, terrestrial primary producers grow and reproduce slowly.


**Procedure:**

- Using the data provided create two graphs that show the varying biomasses found at each trophic level in an ocean ecosystem and a terrestrial ecosystem.

**Biomass Data**

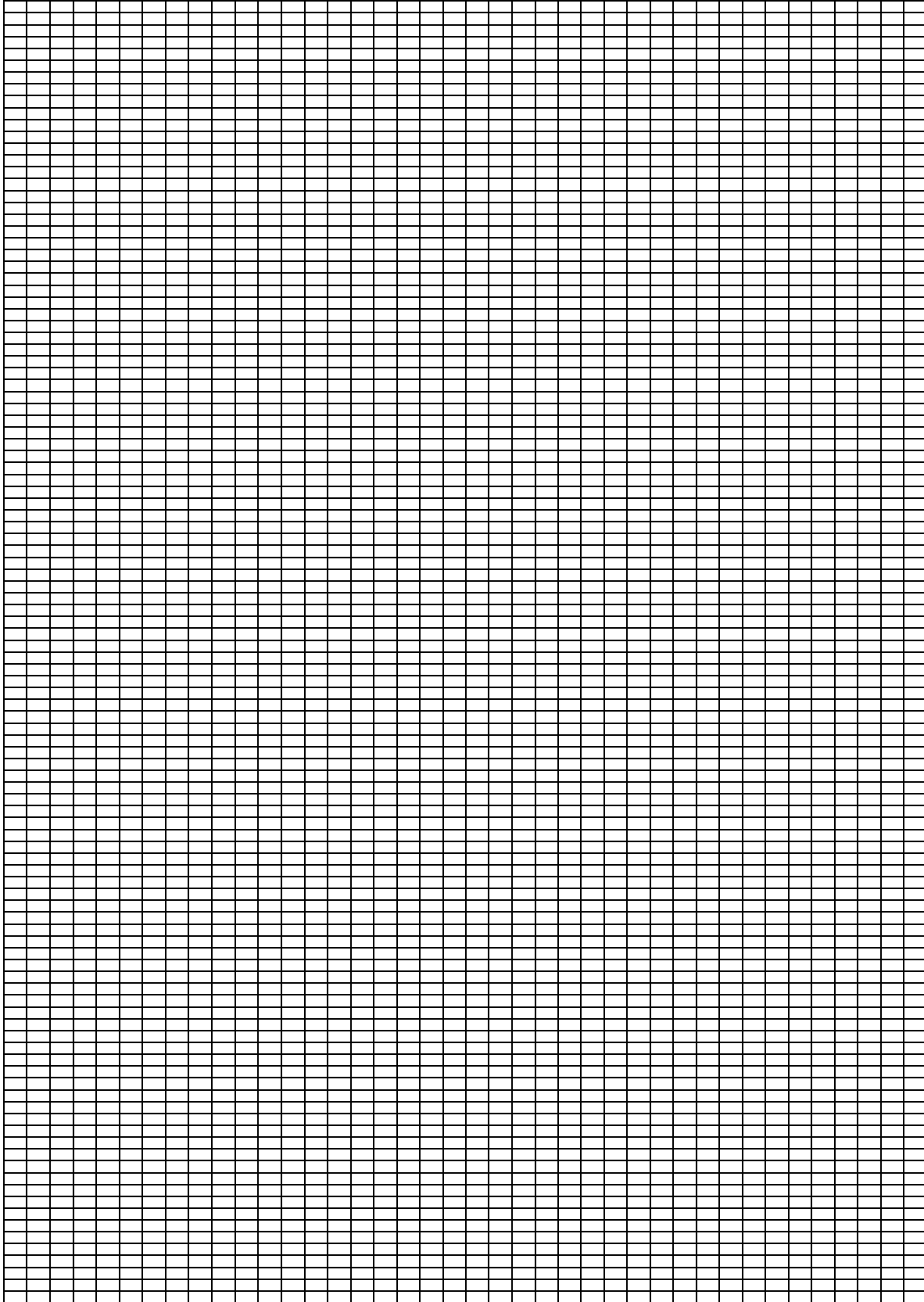
	Organism	Global wet biomass in million tons		Organism	Global wet biomass in million tons
<b>Ocean</b>	Cyanobacteria (picoplankton)	1,000	<b>Terrestrial</b>	Domesticated Crops (wheat, corn, grain)	2,000
	Antarctic Krill	500		Insects	1,050
	Marine Fish	1,300		Domesticated animals (chicken, goats, sheep cattle)	700
	Blue Whales	0.5		Humans	350

Your graph should be constructed as follows:

- 1 square = 1 million tons
- Color the appropriate number of squares to demonstrate biomass
- 3 tons of biomass = 
- Label each level of your biomass graph with the correct trophic level and the name of the organism.
- Label each level with the biomass

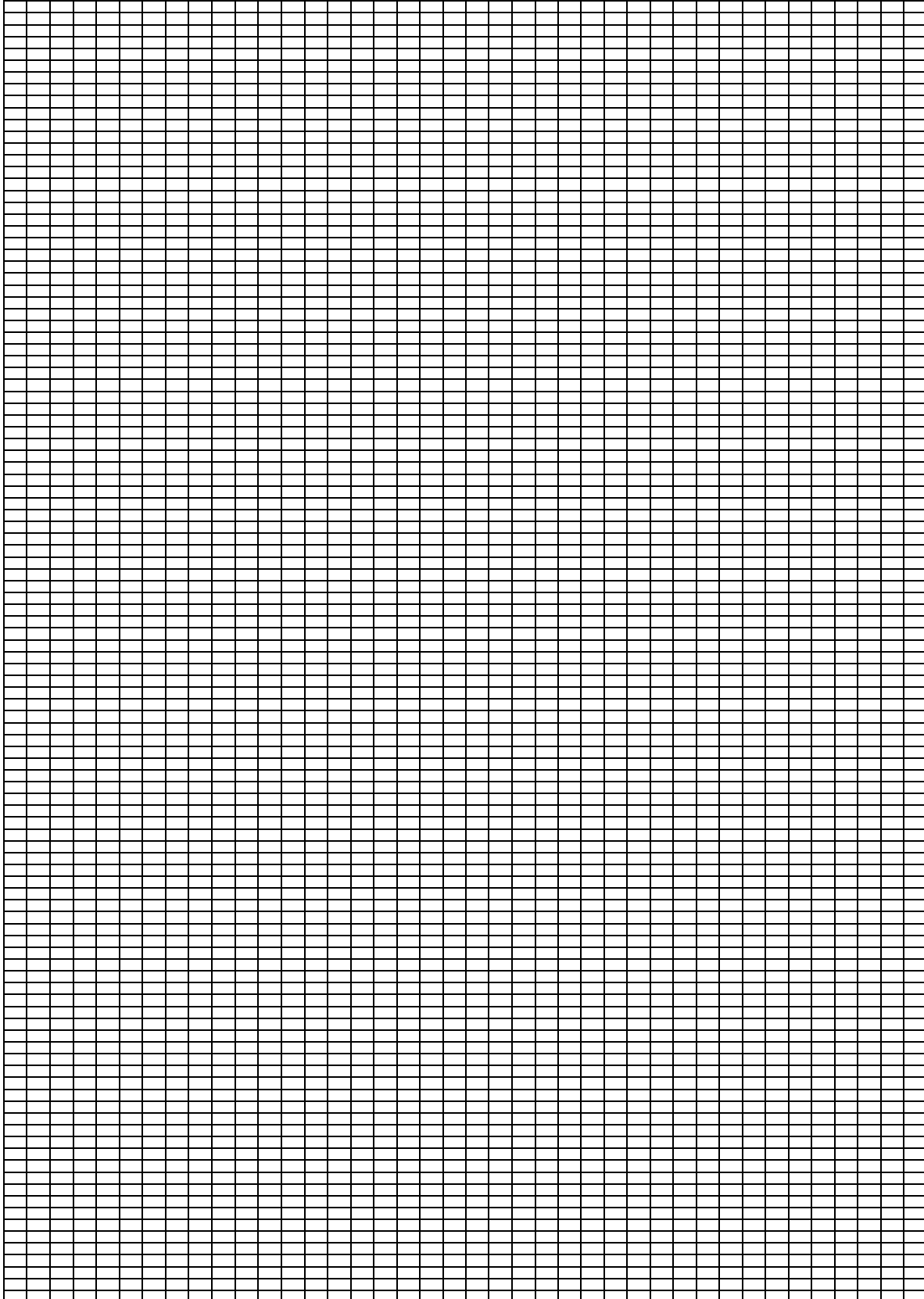
Name \_\_\_\_\_

### Ocean Biomass Pyramid Graph



Name \_\_\_\_\_

### Terrestrial Biomass Pyramid Graph







### Keystone Species: Sea otter

The sea otter is an example of a keystone species in the Pacific Northwest. These mammals feed on sea urchins, controlling their population. If the otters didn't eat the urchins, the urchins would eat up the habitat's kelp. Kelp, or giant seaweed, is a major source of food and shelter for the ecosystem. Some species of crabs, snails, and geese depend on kelp for food. Many types of fish use the huge kelp forests to hide from predators. Without sea otters to control the urchin population, the entire ecosystem would collapse.

In the 1700-1800s, on the coast of California, the sea otter was hunted for its sleek, beautiful fur. It was also killed by fishermen who thought they were eating too many of the fish they wanted to catch. The sea otters were hunted almost to extinction. Without the sea otter, fishermen began to see changes in the ecosystem. Sea otters are one of the few animals that can eat sea urchins. When the otters disappeared, the sea urchin population grew very quickly. Soon there were more sea urchins on the California coast than ever before.

Sea urchins eat kelp. With so many more sea urchins, they ate up all the kelp beds. The kelp beds are very important to many fish as a place to have their young. This set off a chain reaction. With the otters gone and the sea urchins numbers growing quickly, the kelp beds began to disappear. Then the fish, with no safe place to spawn, began to disappear. In just a few years, the fishermen noticed that the fish were suddenly gone. Killing off the sea otter had the opposite effect they had hoped. They didn't know the sea otter actually helped protect the fish populations by eating sea urchins. The sea otter is a keystone species for its ecosystem.

In 1911, a treaty was passed to protect the sea otters from hunting. This was called the International Fur Seal Treaty. In some areas the sea otters came back. The sea urchins in those areas were brought back into control. Their kelp beds recovered and the fish population came back too. This is an example of how a keystone species is interconnected with a whole ecosystem.



[www.fws.gov](http://www.fws.gov)

Adapted by SAUSD Teachers from [http://education.nationalgeographic.com/education/encyclopedia/keystone-species/?ar\\_a=1](http://education.nationalgeographic.com/education/encyclopedia/keystone-species/?ar_a=1)

And from <http://www.exploringnature.org/db/detail.php?dbID=7&detID>



[www.geog.ucsb.edu](http://www.geog.ucsb.edu)

### Keystone Species: Prairie dog

Conservation of prairie dogs is of great importance to the prairie ecosystem. These animals were largely exterminated by farmers who worried their cattle would break legs by stepping in the burrows. In reality, however, there are no known cases of any cattle ever being injured by a prairie dog burrow. Hunting prairie dogs for sport and for pest-control has persisted right up to modern times. If such hunting continues, the populations will continue to drop disastrous consequences will ensue for the ecosystem of the Great Plains.

Prairie dogs are considered a “keystone species” for the prairies. This means that they are a species whose existence adds to a diversity of life. If this keystone species becomes extinct, it would mean the extinction of many other forms of life as well. Over 200 other species have been observed living on or near prairie dog colonies. These colonies contribute to the ecosystem by providing burrows for other animals such as burrowing owls, black-footed ferrets, and snakes; providing a food source for such species as badgers, black-footed ferrets, coyotes, and many birds of prey; and their burrowing churns the soil to enable the earth to better sustain plant life. Without prairie dogs present, many aspects of the prairie life would change or disappear.

The prairie dog is one of the most important species in the American prairie. Its numbers used to be so great that Lewis and Clark on their journey up the Missouri River noted that the animal "appears in infinite numbers". Now due to the intrusion of man, this wonderful creature's populations have been dramatically reduced. We must save this animal not only because we are responsible for its demise, but also because western ecosystems depend on the prairie dog.



Kathy Milani/The HSUS.

Adapted by SAUSD teachers from [http://www.conservenature.org/learn\\_about\\_wildlife/prairie/prairie\\_dog.htm](http://www.conservenature.org/learn_about_wildlife/prairie/prairie_dog.htm)

### Keystone Species: Grey Wolf

Once the world's most widely distributed land mammal, the gray wolf, or timber wolf, was systematically eradicated from the continental United States in the 20th century and was added to the endangered species list in 1973. Gray wolves are considered a "keystone" species — one with a dramatic effect on its environment. For example, the recent reintroduction of gray wolves to Yellowstone National Park has led to the recovery of the entire ecosystem, from vegetation to beavers to hawks and eagles. The animal is the direct descendent of the ancestor to dogs.

Following is an excerpt from Smithsonian Magazine of how this occurred: The reintroduced wolves appear to be doing the job they were recruited to do—put more teeth in the natural order that had been out of whack since the wolves disappeared in the early 20th century. By 2005, they (wolves) were killing around 3,000 elk every year in Yellowstone, where oversized herds had been denuding the park's vegetation. Much of the elk predation took place in the Lamar Valley in the northeast quarter of the park, a stretch of open space that has been compared to East Africa's Serengeti Plain. For all its magnificence, it has been something of an unbalanced ecosystem, the absence of trees due in no small part to an overabundance of browsing elk.

With wolves back on the prowl, the elk became more restive. And as the elk spent less time foraging along stream banks, scientists have reported that willows and other plants that had been eaten to the nubs began to flourish again. So did some of the animals that depend on the trees, like beavers, which use willow branches to build lodges. Since the wolves were reintroduced, beaver colonies have increased eightfold. So there are more beaver ponds—habitat for insects, fish, amphibians, reptiles, birds and mammals, even moose, Smith says. Especially in winter, wolf kills have provided food for other park dwellers, including ravens, magpies and bald and golden eagles. For human visitors to the park, one of the highlights of wildlife viewing in recent years has been watching the combat between wolves and grizzly bears, alternately fierce and comical, for control of elk carcasses.



Adapted by SAUSD teachers from the following sources:

<http://www.pbs.org/wnet/nature/animal-guides/animal-guide-gray-wolf/476/>

[http://keystoneconservation.us/keystone\\_conservation/wolves.html](http://keystoneconservation.us/keystone_conservation/wolves.html)

<http://www.smithsonianmag.com/science-nature/Howling-Success.html#ixzz2WnBhHVx9>

### Keystone Species: African Elephants

There once was a time that the African elephant roamed most all of the African Continent. It was estimated that around 7-10 million elephants existed in the 1930's. Today that number is a shocking 300,000 individuals and still declining at a rapid pace. Demand for ivory, combined with habitat loss from human settlement, has led to a dramatic decline in elephant populations.

In African savannas such as the Serengeti plains in Tanzania, elephants are a keystone species. Elephants eat small trees, such as acacia, that grow on the savanna. Even if an acacia tree grows to a height of several feet, elephants are able to knock over the tree and uproot it. This feeding behavior keeps the savanna a grassland and not a forest or woodland. With elephants to control the tree population, grasses thrive and sustain grazing animals such as antelopes, wildebeests, and zebras. Smaller animals such as mice and shrews are able to burrow in the warm, dry soil of a savanna. Predators such as lions and hyenas depend on the savanna for prey. Elephants are the keystone species that maintain the entire savanna ecosystem.

They dig waterholes in dry riverbeds that other animals can use as a water source, and their footprints create deep holes that water can collect in. They create trails that act as fire breakers and water run offs. Other animals, including humans, depend on the openings elephants create in the forest and brush and in the waterholes they dig. Elephant dung (droppings) is important to the environment as well. Baboons and birds pick through dung for undigested seeds and nuts, and dung beetles reproduce in these deposits. The nutrient-rich manure replenishes depleted soils so that humans can have a nutrient rich soil to plant crops in. Elephant droppings are also a vehicle for seed dispersal. Some seeds will not germinate unless they have passed through an elephant's digestive system.

Elephants need a large amount of habitat to live in. Habitat destruction is not the only threat to the African Elephant. Poaching is the illegal taking of wild plants and animals or parts of the plants or animals. It is estimated that 30,000 to 38,000 elephants are poached every year for their Ivory. With statistics like this the African elephant is doomed or extinction in 15-20 years, unless we can put a stop to these illegal activities thru education and alternative recourses for income in communities that assist in the ivory trade.



Adapted by SAUSD teachers from the following sources:  
<http://www.elephanttag.org/>  
[http://www.soselephants.org/about\\_elephants.html](http://www.soselephants.org/about_elephants.html)

## Keystone Species

**A keystone species is a plant or animal that plays a unique and crucial role in the way an ecosystem functions.** Without keystone species, the ecosystem would be dramatically different or cease to exist altogether. All species in an ecosystem, or habitat, rely on each other. The contributions of a keystone species are large compared to the species prevalence in the habitat. A small number of keystone species can have a huge impact on the environment.

Adapted by SAUSD teachers from:

[http://education.nationalgeographic.com/education/encyclopedia/keystone-species/?ar\\_a=1](http://education.nationalgeographic.com/education/encyclopedia/keystone-species/?ar_a=1)

Paraphrase the paragraph above to explain a **keystone species**.

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## Keystone Species Articles

### Directions:

- There are 4 examples of keystone species.
- Complete the matrix on the next page using the following guidelines
  - Each person in your group should read one of the passages and draw a food web that emphasizes the position of the species in the ecosystem. If drawing is not your strength then use names of plants and organisms and show species interaction with arrows.
  - Use bullet points to find the main ideas or points of interest from the paragraphs
  - Share the key points with the group while everyone takes notes to create a food web for all four of the keystone species.

Name \_\_\_\_\_

Prairie Dog	African Elephant
Sea Otter	Grey Wolf

## Tidepool Go Fish



**Objective:** Construct multiple tidepool food chains

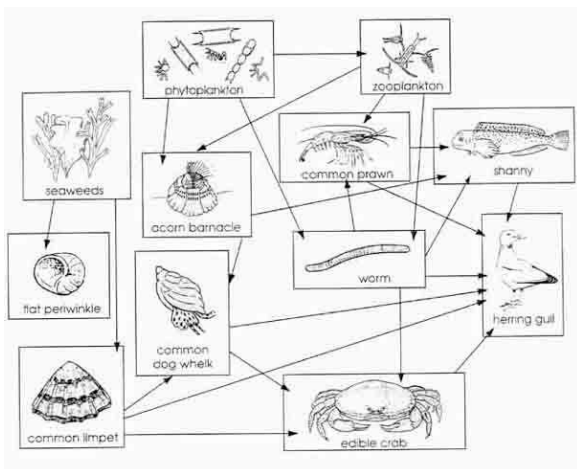
**Background:** Ecosystems maintain themselves by cycling energy and nutrients obtained from external sources. At the first trophic level, primary producers (plants, algae, and some bacteria) use solar energy to produce organic plant material through photosynthesis. Herbivores—animals that feed solely on plants—make up the second trophic level. Predators that eat herbivores comprise the third trophic level; if larger, more aggressive predators are present, they represent an even higher trophic level. Organisms that feed at several trophic levels (for example, grizzly bears that eat berries and salmon) are classified at the highest of the trophic levels at which they feed. Decomposers, which include bacteria, fungi, molds, worms, and insects, break down wastes and dead organisms and return nutrients to the soil.

**Procedure:**

1. In groups of three to six students, each player is dealt five cards.
2. All remaining cards are placed face down in a draw pile.

**GAMEPLAY**

3. Choose a player to go first.
4. On your turn, ask a player for a specific animal or plant that you need to build a food chain. For example: "Joe, do you have any phytoplankton?" You must already hold at least one card of the food chain you are trying to build.
5. If the player you ask has the card you requested, they must give you the card that you asked for. In the example, Joe would give you one of his phytoplankton cards.
6. If you get a card from the player you ask, you get another turn. You may ask any player for any plant or animal you need, including the same one you just asked for.
7. If the person you ask doesn't have the specific card you asked for, they say, "Go fish." You then draw the top card from the draw pile.
8. If you happen to draw the card you asked for, show it to the other players and you get another turn. However, if you draw a card that's not the card you asked for, it becomes the next player's turn. You keep the drawn card, whatever card it is.
9. NOTE: The "next player" is the one who said, "Go fish."



10. When you collect a set of cards that form a three or four card food chain, immediately show the set to the other players and place the food chain face up in front of yourself.

**WINNING**

11. Go Fish continues until either someone has no cards left in their hand or the draw pile runs out. The winner is the player who then has the most sets of food chains. A three-card food chain is worth five points. A four-card food chain is worth ten points.





Name \_\_\_\_\_

2. What is detritus? Why do you think it is important to have detritivores (organisms that eat detritus) in an ecosystem?

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3. What would happen if all of the predators were removed from a certain habitat?

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4. In general, are there more tertiary consumers or producers in a healthy habitat? Why?

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5. Create a food web using the cards that you saw in the game. Your food web should have at least seven organisms and show the interactions between each of these organisms, be sure to label the trophic levels.

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## Sustaining America's Aquatic Biodiversity - Freshwater Mussel Biodiversity and Conservation

420-523

*Louis A. Helfrich, Department of Fisheries and Wildlife Sciences; Richard J. Neves, Department of Fisheries and Wildlife Sciences; Virginia Tech; and Hilary Chapman, U.S. Fish and Wildlife Service*

### Water pollution

The contamination of rivers and streams with toxic chemicals is a serious and growing problem for adult and young mussels and their host fish. Deadly chemicals, including heavy metals (e.g., copper and mercury), coal-mine acids, pesticides, chlorine, gasoline, and oil, flushed daily into tributary streams of the Ohio River system, threaten mussels and other aquatic animals.

Although adult mussels have the ability to "clam up" for a limited time and avoid poisonous chemicals that flow downstream, young mussels are often killed immediately. Multiple spills or the long-term, chronic leaching of toxins into streams will eventually kill the entire population. Water pollution is "double trouble" for mussels. It can either kill mussels directly or kill the fish hosts on which they depend for successful reproduction, ultimately eliminating the mussels



Adapted by SAUSD teachers from <http://www.pubs.ext.vt.edu/420/420-523/420-523.html>

## Motor boat turbulence kills zooplankton in estuaries

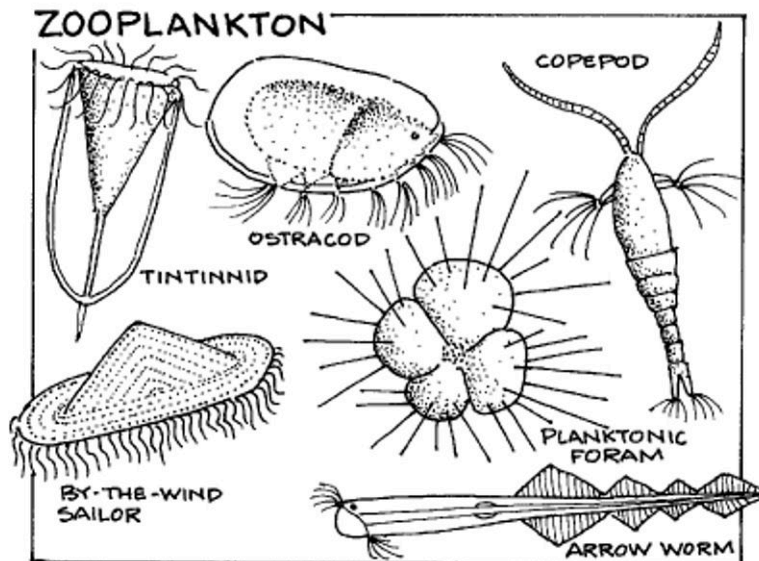
By Matt Walker  
Editor, Earth News

Turbulence generated by speeding motor boats kills significant numbers of zooplankton, a study has revealed for the first time. Experiments on copepods, tiny crustaceans that live and float in water, show that a third die in waters frequented by propeller-driven boats. That is significantly more than in bodies of water not used by boats.

Zooplankton play a crucial role in water ecology and their death may have hitherto unknown impacts. These prior studies had showed that even a small amount of turbulence can affect a copepod's ability to feed and grow. So "it seemed intuitive that the sudden and intense turbulence created by a boat could harm or even kill copepods".

For example, 34% of copepods were dead in a channel while only 5-6% were dead in a marina and along a shoreline. More copepod carcasses were found inside boat wakes (14%) than outside boat wakes (7%) and the fraction of dead copepods increased with increasing turbulence intensity. "This suggests that turbulence generated by boats can be an important source of mortality among copepods," Ms Bickel said. "This could have a number of important impacts within aquatic systems."

Zooplankton are a critical link between phytoplankton and fish in aquatic food webs. High mortality in copepods could reduce the ability of a zooplankton population to graze down phytoplankton blooms and reduce the amount of food available to smaller fish that eat zooplankton, says Ms Bickel. Also, if copepod carcasses are not consumed, they could transport high quality organic materials to the sediments or be decomposed by bacteria within the water column, she adds. "So the zooplankton biomass that would normally go towards feeding fish would be diverted to feed bacteria instead."



Adapted by SAUSD teachers from  
[http://news.bbc.co.uk/earth/hi/earth\\_news/newsid\\_9449000/9449070.stm](http://news.bbc.co.uk/earth/hi/earth_news/newsid_9449000/9449070.stm)

## Gillnets taking a toll on seabirds

By MICHAEL WINES *The New York Times*

Published: Thursday, June 13, 2013 at 1:00 a.m.

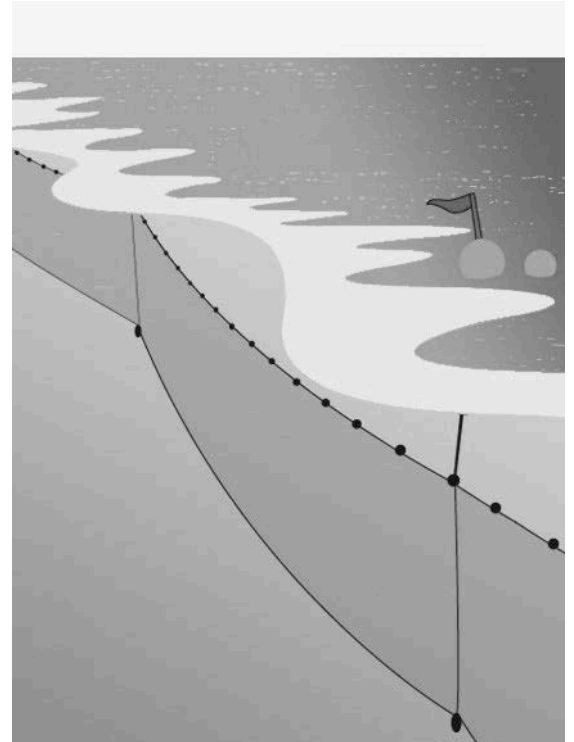
Fishing vessels that deploy gillnets snare and drown at least 400,000 seabirds every year, and the actual figure could be considerably higher, according to research published in the June edition of an academic journal devoted to conservation.

The study, in the journal *Biological Conservation*, uncovered reports of 81 species killed by gillnets, including penguins, ducks and some critically endangered birds like the waved albatross. One of its three authors, Cleo Small, called the estimated toll a bare minimum.

"It's quite startling," said Small, who heads the global seabird program at the British conservation group BirdLife International, which sponsored the study.

Gillnets, mesh nets that are much smaller, are used both by commercial and small local fishermen. Anchored in the water by weights and buoys, they are designed to snare fish by their gills.

Nearly half of the seabirds killed by gillnets were in a section of ocean stretching from the northern tip of Africa to north of Greenland and Scandinavia.



Adapted by SAUSD teachers from <http://www.heraldtribune.com/article/20130613/ARCHIVES/306131023/-1/TODAYSPAPER?template=printpicart>

## **Kelp! Kelp! It's warming!**

Posted on October 27, 2011 by Anthony Watts

### **Seaweed records show impact of ocean warming**

As the planet continues to warm, it appears that seaweeds may be in especially hot water. New findings reported online on October 27 in *Current Biology*, a Cell Press publication, based on herbarium records collected in Australia since the 1940s suggest that up to 25 percent of temperate seaweed species living there could be headed to extinction. The study helps to fill an important gap in understanding about the impact that global warming is having on the oceans, the researchers say.

The changes observed in the seaweed community could have cascading effects across marine ecosystems, Wernberg said, as seaweeds are the “trees of the ocean,” providing food, shelter, and habitat to a diversity of other species.

“I hope people will appreciate that the threats of climate change to marine environments are not just about exotic tropical coral reefs but also are likely to affect the diversity of life across a much broader spectrum of marine ecosystems,” Wernberg said.



Adapted by SAUSD teachers from <http://wattsupwiththat.com/2011/10/27/kelp-kelp-its-warming/>

Name \_\_\_\_\_

## Food Web Impact Jigsaw Matrix

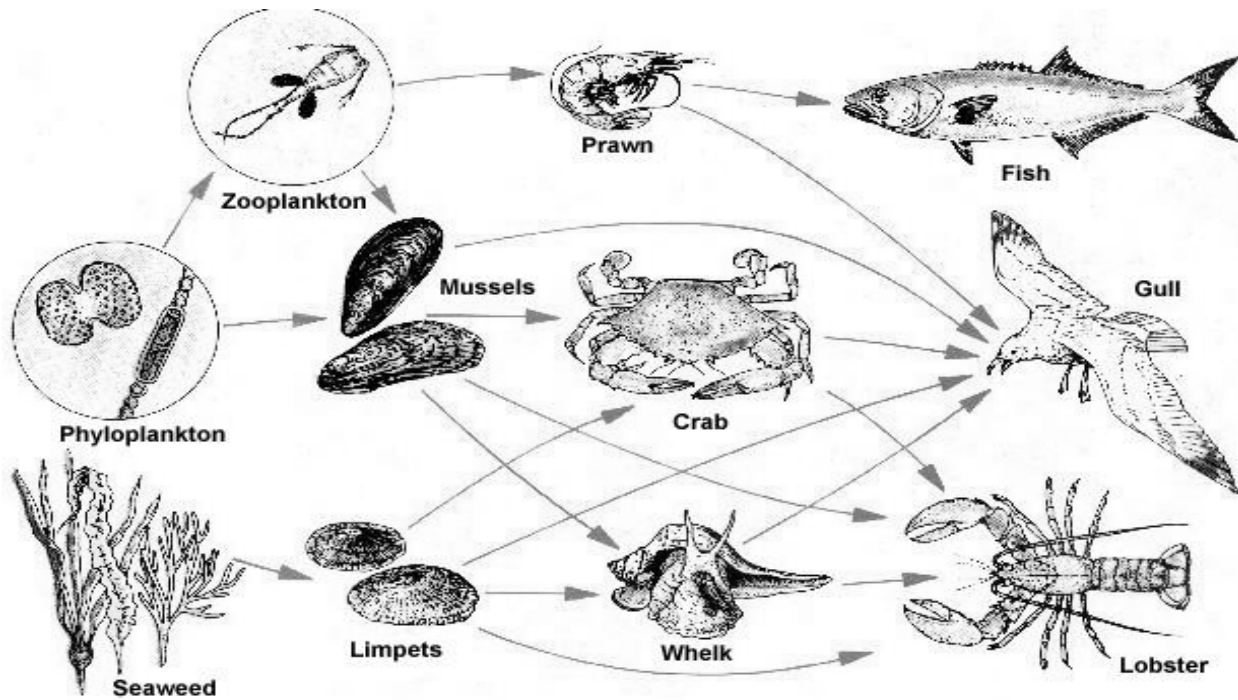
Freshwater Mussel Biodiversity	Motor Boat Turbulence	Gillnets taking a toll on seabirds	Seaweed records impact of global warming

Symbol	Comment/Question/ Response	Sample Language Support
<b>*</b>	<ul style="list-style-type: none"> <li>• Author’s main point</li> <li>• Key ideas expressed</li> <li>• Significant ideas</li> </ul>	<ul style="list-style-type: none"> <li>• One significant idea in this text is...</li> <li>• The author is trying to convey...</li> <li>• One argument the author makes is that...</li> </ul>
<b>!</b>	<ul style="list-style-type: none"> <li>• Shocking statements or parts</li> <li>• Emotional response</li> <li>• Surprising details/claims</li> </ul>	<ul style="list-style-type: none"> <li>• I was shocked to read that...</li> <li>• How can anyone claim that...</li> <li>• That part about ____ made me feel...</li> </ul>
<b>O</b>	<ul style="list-style-type: none"> <li>• Ideas/sections you connect with</li> <li>• What this reminds you of</li> </ul>	<ul style="list-style-type: none"> <li>• This section reminds me of...</li> <li>• I can connect with what the author said because...</li> <li>• This experience connects with my own experience in that...</li> </ul>

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# Disruption in the Food Web



**Directions:** Provide a short answer to the questions below while watching the Prezi Presentation .

- 1) What populations are directly affected by the reduction of mussels? How are each of these populations affected?

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- 2) The reduction of zooplankton has a direct effect on which populations? What is the effect on the secondary populations? List them and describe the effect.

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- 3) Explain how the reduction of the seabird/gull population affects phytoplankton.



## **Ecology Final Assessment**

Our planet is over 70% salt-water ocean and there is more than 370,000 miles of coastline. Of the estimated 7 billion people living on our planet more than 2.5 billion live within 60 miles of the ocean. Not only do oceans produce more than half of the oxygen in the atmosphere, and absorb the most carbon from it but, the water you drink, the food you eat, the products that keep you warm, safe, informed, and entertained — all can come from or be transported by the ocean. Ocean-based businesses contribute more than \$500 billion to the world's economy.



The sheer number of people who use and depend on the ocean, and the sometimes unwise practices we adopt, have created problems such as overharvest of resources, reduction in biodiversity, and degradation of marine habitats and species, among others. We risk the very ecosystems on which our survival depends.

Over the past 3 weeks we have explored the ecology of the rocky tidepools in California. The tidepools are a small portion of the global marine environment. In this project you will be asked to apply your knowledge of the interactions of species and the flow of energy in an ecosystem not only to the tidepools but also to the coastal marine environment as a whole.

In groups of 4 you will be asked to research two specific ways that humans have had an impact on the coastal oceans and relate those impacts to changes in the stability and overall health of the ocean ecosystem.

### **Guidelines:**

1. Divide your group of 4 into pairs. Each pair will select and research one method in which humans have impacted the coastal ecosystem. You may choose from the list provided or research a topic that you are interested in.

### **Human Impact List (cause)**

Each idea is divided into pathways that you may explore; you do not need to research all topics you will only need to pick one pathway. For example if you are interested in coastal runoff after storms then you will only need to research stormwater runoff.

- Coastal runoff: stormwater runoff, effects of fertilizer, litter, industrial pollution
- Global warming: temperature increase of ocean, sea level rising
- Pacific Garbage Patch
- High Visitation of tidepools
- Overfishing: abalone, tuna, sardines, shrimp
- Oil Spills: Exxon Valdez 1989, Deepwater Horizon 2010, BP oil spill Huntington Beach, CA 1990
- Marine Mammal Hunting: Sea otter hunting, whaling- blue whales, grey whales

Name \_\_\_\_\_

2. Once you have decided which of the two ways that humans impact the ocean to research you will need to use the following list to guide your research. Again you do not necessarily need to find the answers for all of these effects listed but you should choose one or two that you will thoroughly explore.

You should be able to:

**Ecological Implications list (effect)**

How did the event that you choose change ...

- The overall stability of the ecosystem?
- The food web of the ecosystem?
- The flow of energy in the ecosystem?
- The biodiversity of the ecosystem?
- The numbers and distribution of the ecosystem's biomass?



Picture courtesy of NOAA

3. Ideas of where you can gather information include: general websites, news articles, government sites such as NOAA or EPA, research papers, journal articles, and conservation websites.

4. Once you have a firm grasp on the event, including the history of the event and why it happens or happened, and you have identified the ecological implications of the event, you will need to create a visual representation to present to the class.

**Ideas for presentations**

- |                      |                        |
|----------------------|------------------------|
| ➤ Tri-fold brochure  | ➤ 3-dimensional Models |
| ➤ PowerPoint         | ➤ Create a video       |
| ➤ Prezi Presentation | ➤ Research paper       |
| ➤ Poster             | ➤ Skit or song         |

5. Presenting information in front of your peers can be stressful. Here are some tips and things to think about to make sure your presentation is of the highest quality.

**Tips and Things to think about**

- Your presentation addresses all 5 of the guidelines.
- Your presentation is completed by the due date and that each team member has all necessary materials and or visuals prepared.
- All 4 members of your group speak during the presentation and your group is aware of the order in which they will speak.
- You know the material before you present so you are not simply reading it to the class.
- Your presentation is designed to capture your classmates' attention and interest. Make sure that it can be read, heard, and seen from all corners of the classroom.
- Time your presentation beforehand to make sure that it is at least 3 minutes long but no more than 5 minutes in length.





Name \_\_\_\_\_

**Final Assessment Peer Presentation Notes**

Directions: During the transitions between groups you will need to paraphrase each group's presentation. Your paraphrase must touch on the main ideas that the group presented and be written in complete sentences.

Title of Presentation: \_\_\_\_\_

Ocean Ecosystem Affected: \_\_\_\_\_

Paraphrase of main ideas:

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Title of Presentation: \_\_\_\_\_

Ocean Ecosystem Affected: \_\_\_\_\_

Paraphrase of main ideas:

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Title of Presentation: \_\_\_\_\_

Ocean Ecosystem Affected: \_\_\_\_\_

Paraphrase of main ideas:

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Name \_\_\_\_\_

Title of Presentation: \_\_\_\_\_

Ocean Ecosystem Affected: \_\_\_\_\_

Paraphrase of main ideas:

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Title of Presentation: \_\_\_\_\_

Ocean Ecosystem Affected: \_\_\_\_\_

Paraphrase of main ideas:

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Title of Presentation: \_\_\_\_\_

Ocean Ecosystem Affected: \_\_\_\_\_

Paraphrase of main ideas:

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Name \_\_\_\_\_

Title of Presentation: \_\_\_\_\_

Ocean Ecosystem Affected: \_\_\_\_\_

Paraphrase of main ideas:

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Title of Presentation: \_\_\_\_\_

Ocean Ecosystem Affected: \_\_\_\_\_

Paraphrase of main ideas:

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Title of Presentation: \_\_\_\_\_

Ocean Ecosystem Affected: \_\_\_\_\_

Paraphrase of main ideas:

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