Name: _____ Due Date:_____

Science

Module 4	**Matter and Energy**
Part 1	**Ecology: Food Webs, Food Chains and Energy Transfer**



Lessons & Objectives

Lesson 1: Describing Parts of the Environment and Levels of Organization in Ecology
- ❑ **I can…** characterize the parts of the environment.
- ❑ **I can…**explain how scientists organize the different biotic and abiotic parts of the environment.

Lesson 2: Introduction Activity
- ❑ **I can…** participate in an activity to **role-play** how **energy is transferred** from one organism to the next within an aquatic ecosystem, just like we discussed in our do-now.

Lesson 3: Nutrition + Energy
- ❑ **I can…** describe and compare how organisms satisfy nutritional needs using ecological vocabulary.

Lesson 4: Keystone Species
- ❑ **I can…** describe the difference between a food chain and a food web and explain the importance of a keystone species in an ecosystem.

Lesson 5: Energy Transfer
- ❑ **I can…** explain how energy is transferred from one trophic level to the next.

Packet Completion Rubric

4	3	2	1	0
Nothing in packet is missing. Responses consistently meet ALL of the criteria for high quality work. Exemplary effort is evident throughout entire packet.	Packet is 75-100% complete/accurate. Work/effort misses the criterion for high quality consistently.	Packet is 50-75% complete/accurate. Work/effort has evidence of quality but not consistently.	More than 50% of the packet is incomplete or incorrect. Work does not meet the expected level of quality.	Packet is entirely incomplete or not turned in.

Grading Breakdown: 0 - 1.9 = F 2 - 2.4 = D 2.5 - 2.9 = C 3 - 3.4 = B 3.5 - 4 = A

Lesson 1

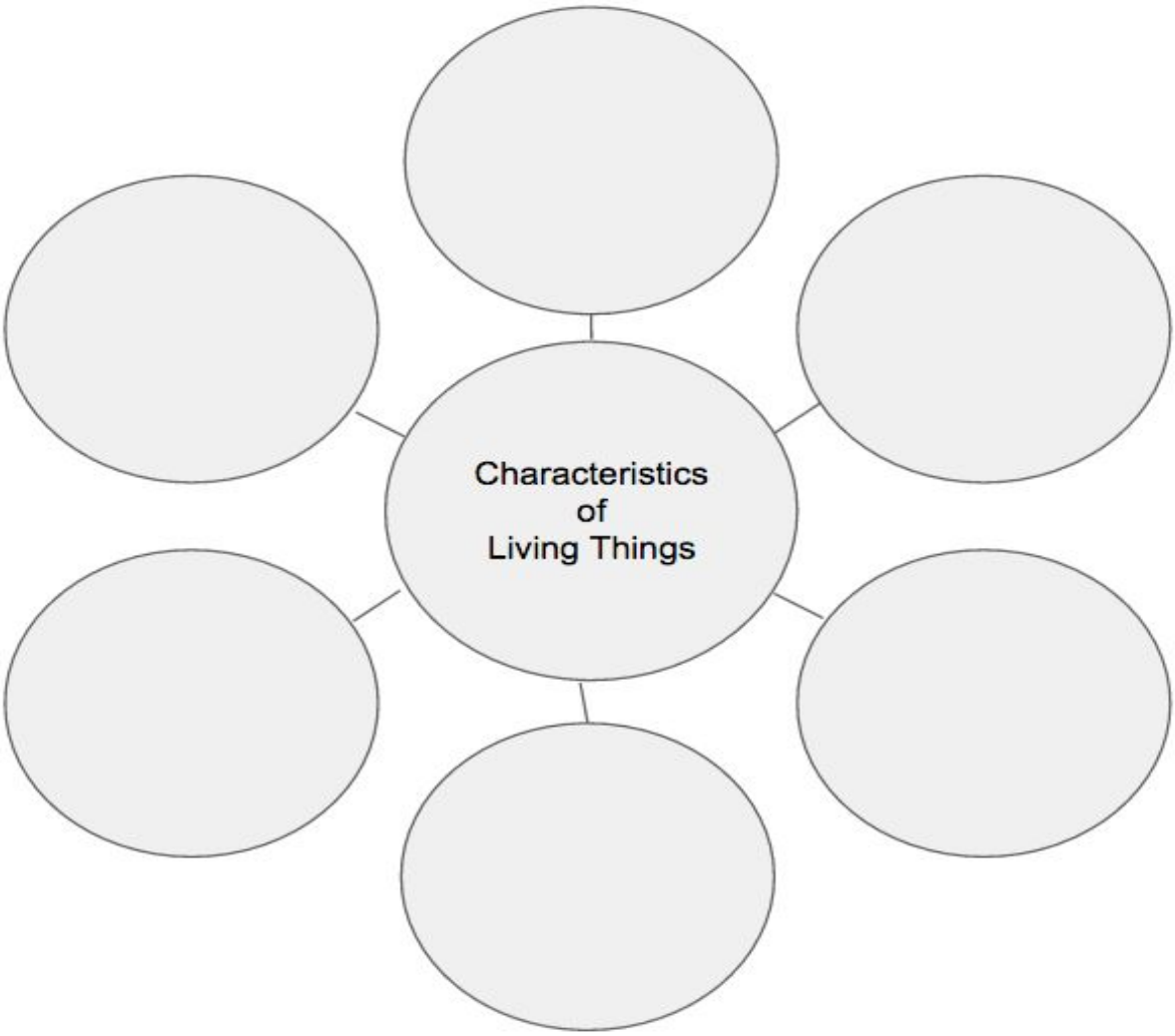
Describing the parts of the environment: Levels of Organization in Ecology

Objective 1: I can characterize the parts of the environment.
Objective 2: I can explain how scientists organize the different biotic and abiotic parts of the environment.

Lesson 1 Do Now	**Biotic or Abiotic?** (*Write your answer on the line below each item)* 1. EGG 2. SEED 3. FIRE 4. JELLYFISH _____ _____ _____ _____ **Is image #1 (the egg) biotic or abiotic? Support your claim with evidence and reasoning.** _____ _____ _____ _____

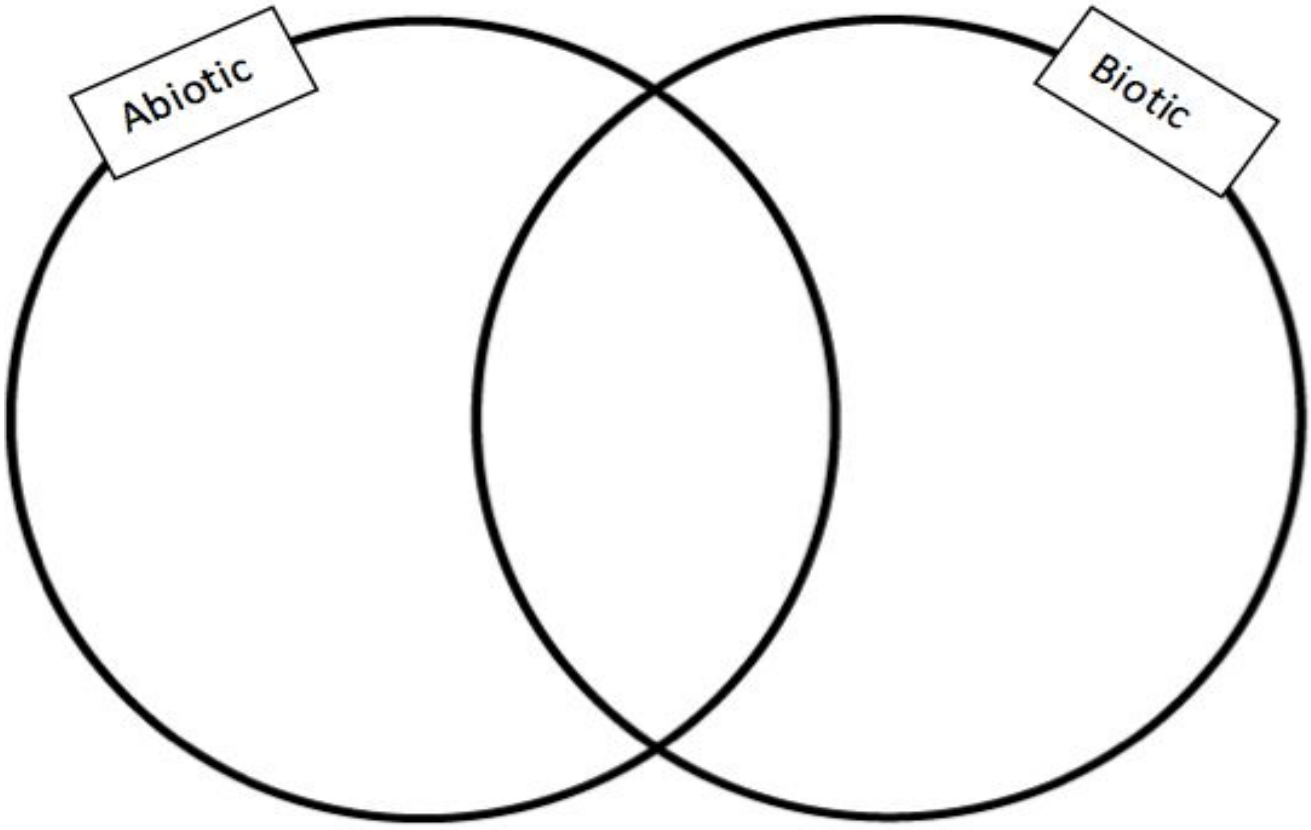
Ecology
What is Ecology? Living things rely on the various _____ & _____ of their environment to survive. **Ecology** **The study of how _____ interact with _____ and their _____.**

What characteristics are shared by **<u>all living things</u>**
(the parts of the **<u>BIOTIC</u>** environment)?



Important Note	*Just like for **CONPTT**, to prove something is <u>living</u> **<u>(biotic)</u>**, an object* *must satisfy _____ Requirements.* *To prove something is <u>non-living (**abiotic**)</u>, you need to prove at least ____* *criteria is not satisfied.*

Practice with Biotic & Abiotic					
Determine whether each of the following terms belongs on the abiotic side or the biotic side of the Venn Diagrams. If the term contains both abiotic and biotic factors, place it in the center of the Venn Diagram.					
Bacterial Cell	Pond	Whale	Tree	Temperature	Cat
Mushroom	Fruit Fly	Sand	Ocean	Sunlight	Rainforest
Sunflower	Snail	Algae	Clouds	Stones	Carbon Dioxide
Grass	Butterfly	Fire	Mule		



Levels of Organization in Ecology	
Level 1: _____	**Definition**: A _____ living thing **Examples**:
Level 2: _____	**Definition**: A group of the _____ _____ that live in the same area. **Examples**:
Level 3: _____	**Definition**: All the living organisms (_____) in an environment **Examples**: In a pond, all the _____, _____, _____, _____, and other living things that live together.
Level 4: _____	**Definition**: All the living (_____) and nonliving (_____) factors in an environment. **Examples**:
Level 5: _____	**Definition**: The collection of all the ecosystems on the Earth. "Circle of Life" **Example**:

Levels of Organization in Ecology - Practice

Next to each phrase, identify the level of ecological organization it describes.
Organism **Population** **Community** **Ecosystem** **Biosphere**

1. The water at the lake was so clear that perch, bass, frogs, and algae could be seen.
2. A family of raccoons scavenged near the garbage cans last night.
3. A baby bird chirped happily by itself.
4. A colony of E. coli cells multiplied out of control.
5. Monarch Butterflies, finches, and bumble bees could all be seen at the park.
6. The plants in the field grew tall as a result of both nutrients from the soil and regular rainfall.
7. The lonely deer grazed on an afternoon snack.
8. Billions of species inhabit the life supporting layer of the planet and surrounding atmosphere.
9. A group of black bears wandered through the camp sight.
10. The tree was home to mosses, tree frogs, wood peckers, insects, and a raccoon.
11. The Great Barrier Reef is comprised of warm, shallow waters that receive plenty of sunlight. It is home to more than 250 bird species, 600 types of hard and soft coral, more than 1,500 fish species, and 4,000 mollusk species.
12. The groundhog poked its head of the hole for only a minute.
13. The family of groundhogs scurried across the open field.

Exploring Environmental Effects on an Ecosystem

The Re-Introduction of Wolves into Yellowstone National Park (1995)

Explain how the return of the wolves affected the environment at each level.

Individual:

_____
_____
_____

Population:

_____
_____
_____

Community:

_____
_____
_____

Ecosystem:

_____
_____
_____

Lesson 1 Exit Slip	What biotic and abiotic factors are you going to be sure to add to your new world? Be sure to state ***why*** you would include your selections. _____ _____ _____ _____ _____ _____ _____

LESSON 2

INTRODUCTION ACTIVITY

OBJECTIVE: I can participate in an activity to **role-play** how **energy is transferred** from one organism to the next within an aquatic ecosystem, just like we discussed in our do-now.

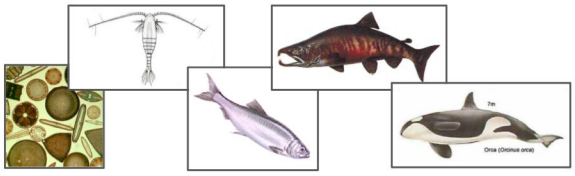
Lesson 2 Do Now	Describe, in words, what you think is happening in the image to the right. Do you know what scientific concept(s) this image is referring to? Please be as detailed and specific as possible in your response.  _____ _____ _____ _____

The Simulation:

- Each student will be assigned to play the role of **one specific organism**.
- As that organism, you need to forage for food ***without*** getting eaten by a predator. To obtain food, ***you need to tag your prey***.
- As students get tagged ("eaten") by predators, they must pass their energy (the energy squares) along to the organism that ate them.
- At the end of the activity, we will complete a **written reflection.**

The Food Chain:

Diatom ➡ Copepod ➡ Herring ➡ Salmon ➡ Killer Whale



Results:

Organism	Energy Squares Accumulated
Diatom	
Copepod	
Herring	
Salmon	
Killer Whale	

Reflection (Exit Slip)

1. What patterns/trends do you notice in where the energy squares are?

_____

_____

_____

2. Does energy move completely from one level to the next? (Ask yourself: Are there any levels with *no* energy remaining?)

_____

_____

_____

3. If you were to organize the organisms and numbers into a pyramid, what would be on the bottom? On the top?

_____

_____

_____

4. If you were to add the sun to the pyramid, where would you place it? Why?

_____

_____

_____

Lesson 3

Nutrition + Energy

Objective: I can describe and compare how organisms satisfy nutritional needs using ecological vocabulary.

Lesson 3 Do Now	**Look at the three skulls below.** Based on the characteristics of each skull's teeth, draw an inference about what type of food each organism eats and why the teeth led you to think so. #1  #2  #3  #1: _____ _____ _____ #2: _____ _____ _____ #3: _____ _____ _____

Types of Teeth:

Mammal Skulls	ARE THESE TEETH PRESENT?			Food They Eat
	Canine	Incisor	Premolars/Molars	
				
				
				

You Are What You Eat! Scientific Vocabulary

Heterotrophs: organisms that obtain their _____ from _____.

Consumers: heterotrophs that _____ (or consume) other organisms.

Carnivores: organisms that ONLY _____ _____

Herbivores: organisms that ONLY _____ _____ (producers)

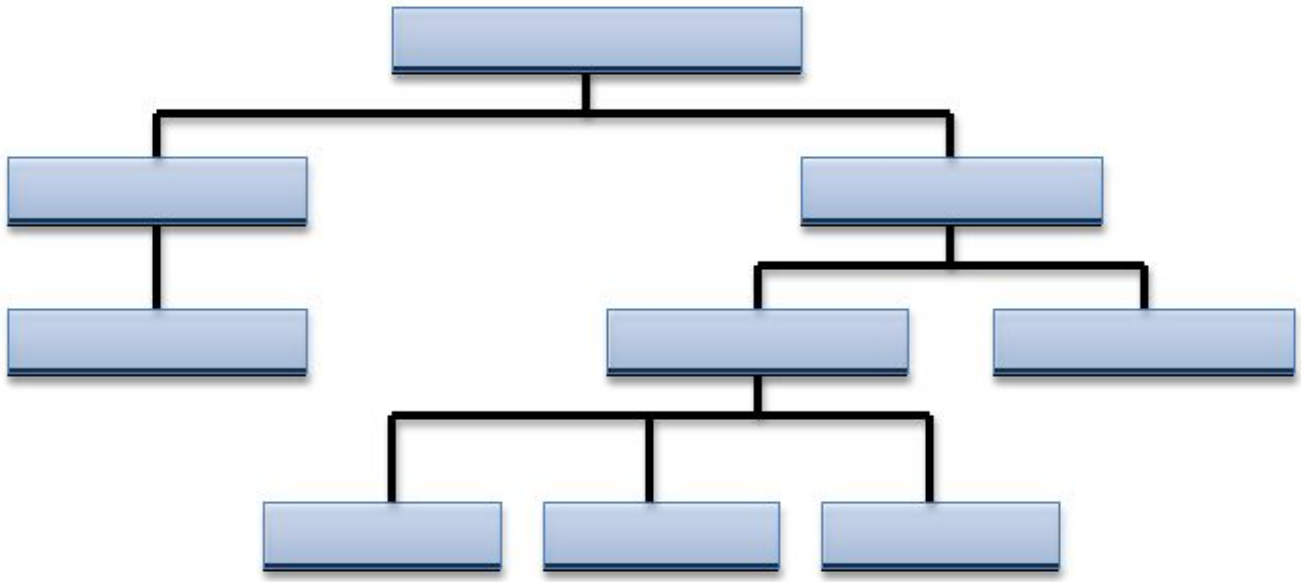
Omnivores: Organisms that _____ _____ meat/flesh AND plants

Decomposer: Heterotrophs that obtain their nutrients & energy by _____ _____ the dead remains of organisms

Autotrophs: organisms that _____ their nutrients & energy _____ _____.

The word "_____" and "_____" mean the same thing.

Types of Organisms Tree Map



Lesson 3 Exit Slip	Pretend you are the narrator (with an Australian accent) of a brand new nature documentary tracking a pride of lions through the African savanna. Describe the feeding habits of the biotic factors of the African savanna that you and your team observe. Use at least four of the following vocabulary words in your response: **heterotroph, omnivore, consumer, herbivore, carnivore, autotroph/producer** _____ _____ _____ _____ _____ _____ _____ _____ _____

Lesson 4

Energy Transfer

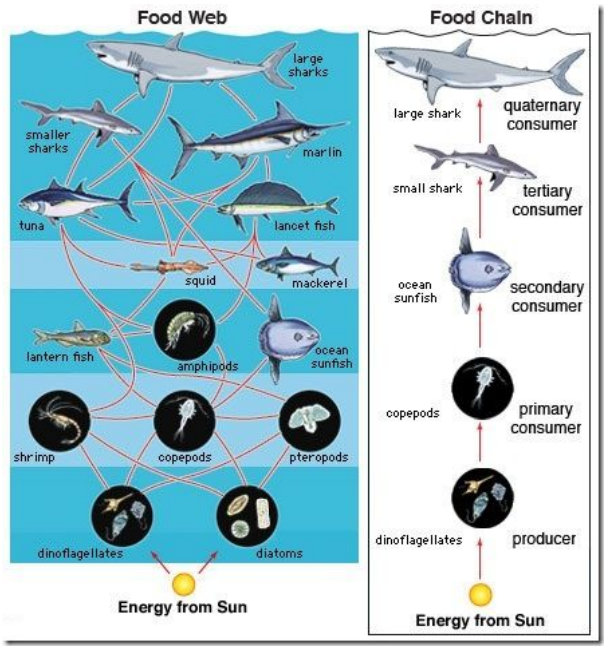
Objective: I can describe the difference between a food chain and a food web and explain the importance of a keystone species in an ecosystem.

Lesson 4 Do Now	Think back to when we covered food chains in Lesson 4. What do you think would happen if Herring was **removed** from our food chain? Please be as specific and detailed as possible in your response.  _____ _____ _____ _____ _____ _____ _____ _____

Food chain vs. Food web

1. A **food chain** is a _____ sequence of organisms through which _____ and _____ pass as one organism eats another.

2. A **food web** consists of many _____ food chains and is a more _____ representation of energy transfer in ecosystems.



Organisms that share the **same function** in the food web are classified in the same _____ _____.

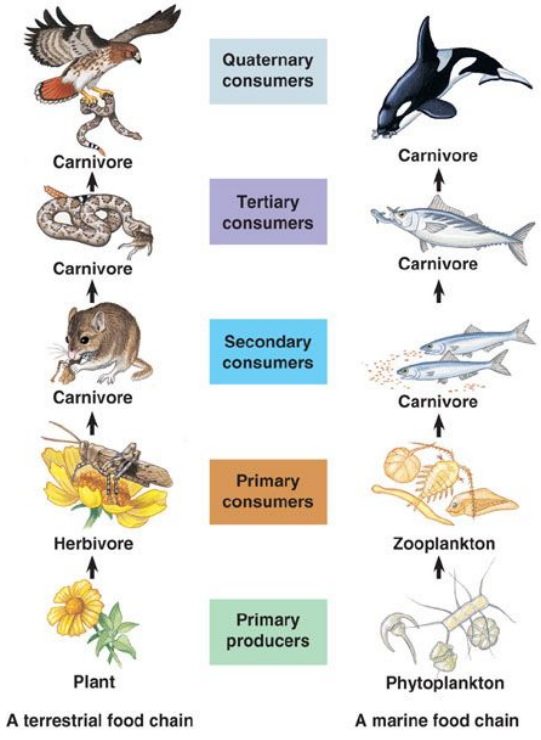
Review of terms from Lesson 3:

_____ are organisms that can produce their own food.

_____ are organisms that rely on other organisms (both plants and animals) for food.

Food web trophic levels include:

1. Primary producers
2. Primary consumers
3. Secondary consumers
4. Tertiary consumers
5. Quaternary consumers



Some species can belong to _____

depending on their diet. For example, **grizzly bears** are**:**

1. _____**consumers** when they consume berries, which are primary producers.
2. _____**consumers** when they consume elk, which are primary consumers of grass.
3. _____**consumers** when they consume salmon, which consume tiny shrimp, which consume plankton.

Observational Study

Imagine that you are a biologist at the Monterey Bay Aquarium in California. You create 4 observation plots in the adjacent kelp forest to study the health of the ecosystem over time. What do you notice about your data collected in the following tables? Record all observations.

MONTEREY BAY AQUARIUM

Observation Date: April 25th, 2015

Plot (area = 500 m²)	Kelp (% cover)	Sea Urchins (ind. #)	Sea Otters (ind. #)
1	70%	200	50
2	80%	180	60
3	85%	160	70
4	75%	175	55

Observation Date: March 20th, 2017

Plot (area = 500 m²)	Kelp (% cover)	Sea Urchins (ind. #)	Sea Otters (ind. #)
1	30%	500	10
2	25%	525	7
3	30%	490	14
4	30 %	495	13

Observations:

_____

_____

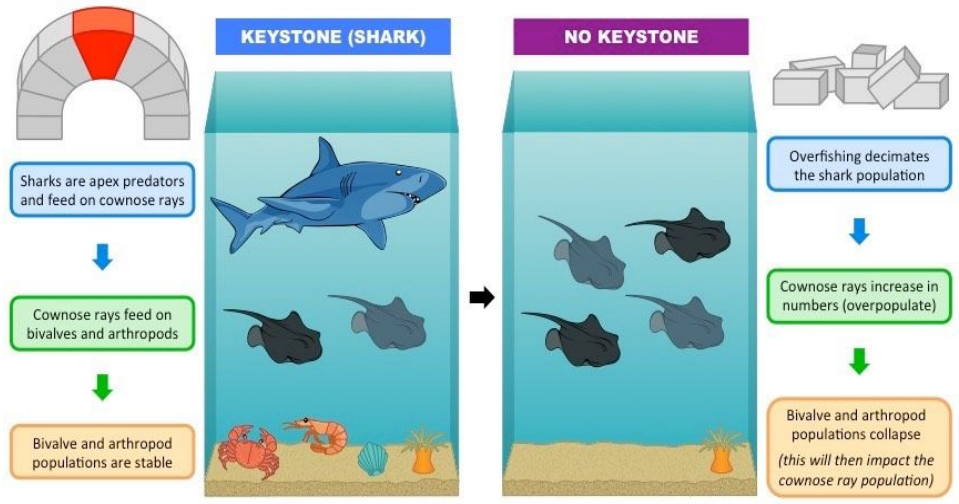
_____

_____

_____

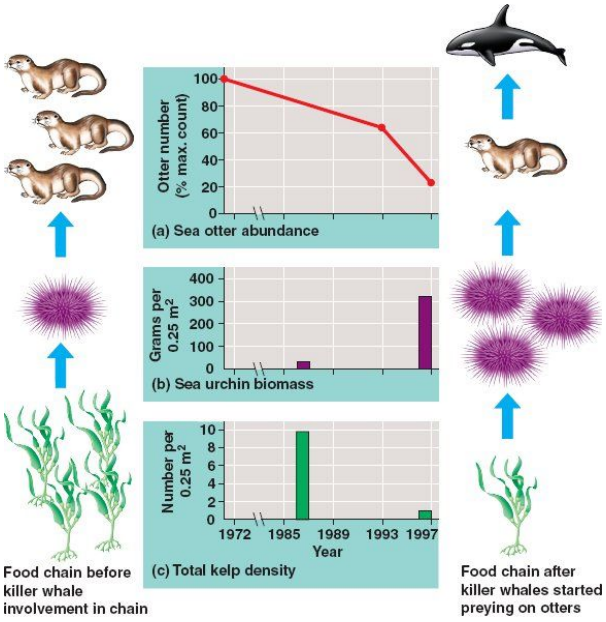
Keystone Species

Some species have more influence on a food web than others. These species are known as _____ _____.



Video Notes: The importance of keystone species

Although all species have value in a food web, some species (known as **keystone species**) hold more influence over others.



Consider the value of the sea otter in the kelp forest food web. In your own words, describe what happens when killer whales enter this specific food web.

Lesson 4 Exit Slip	Now that you have a solid understanding of what a keystone species is and the important role it plays in food web function, what are some ways that we can protect keystone species in the environment? **Please include at least two different ways and write in complete sentences with as much specifics and details as possible.** _____ _____ _____ _____ _____ _____ _____

Lesson 5

Energy transfer

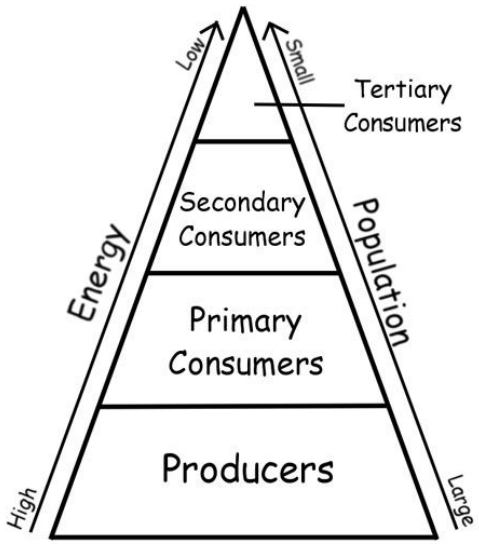
Objective: I can explain how energy is transferred from one trophic level to the next.

Lesson 5 Do Now	Explain how the event/phenomenon described above would affect each of the following levels of the aquarium ecosystem. Please be specific in your responses. Organism: _____ _____ _____ Population: _____ _____ _____ Community: _____ _____ _____ Ecosystem: _____ _____ _____

The number of organisms in a trophic level is typically_____ at the _____ of the pyramid (**producers**) compared to the top (**higher order consumers**)

Energy decreases as you travel up the pyramid. Energy is _____ (as **heat)** as you go up the energy pyramid.

This is called the _____.

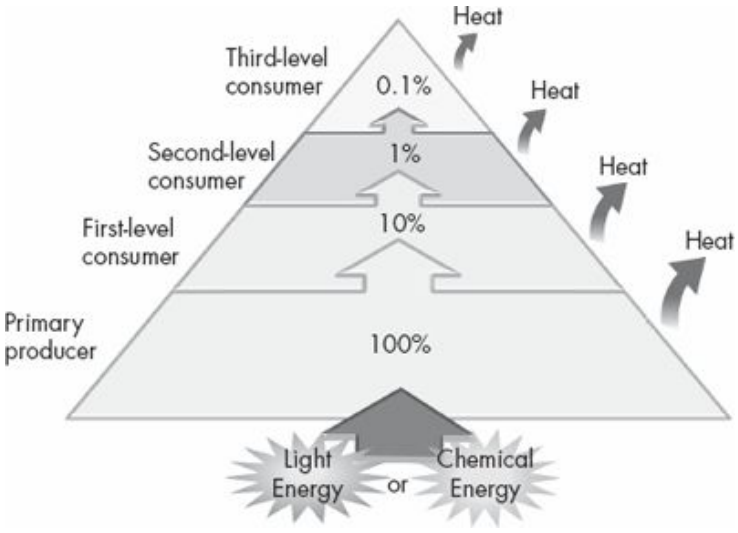


10% Rule

Only about **10%** of the energy at a given level is passed on to the next level.

That means that _____ _____ when transferred from one trophic level to the next.

That is why each level gets _____ as you approach the top of the pyramid.



Sea Otter Food Web

If killer whales only fed on sea otters, a single killer whale would require **1,825 sea otters** per year to meet its energy needs!

If as little as **four killer whales** fed solely on sea otters, the Alaskan sea otter population would collapse.

Discuss: Why do you think killer whales are now feeding on sea otters?

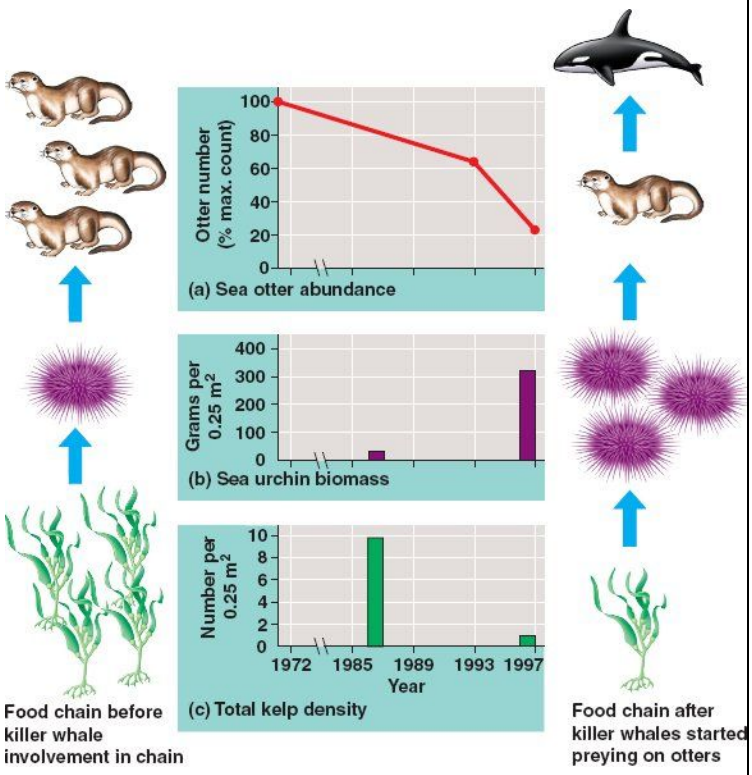
_____

_____

_____

_____

_____

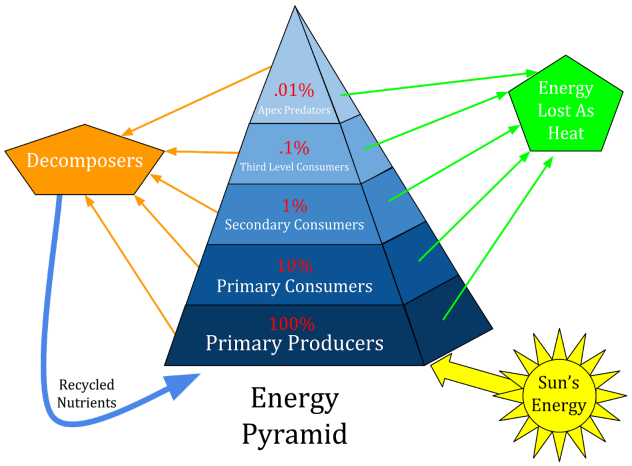


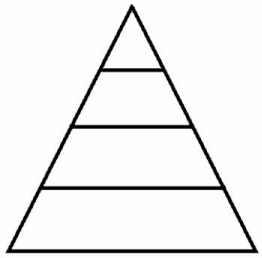
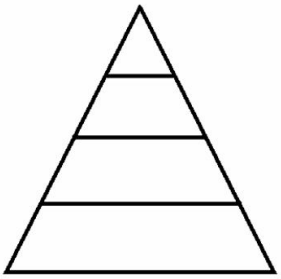
Decomposers

_____ break down dead plants and animals and recycle nutrients back into the food web.

Examples of decomposers include fungi, worms, insects and their larvae.

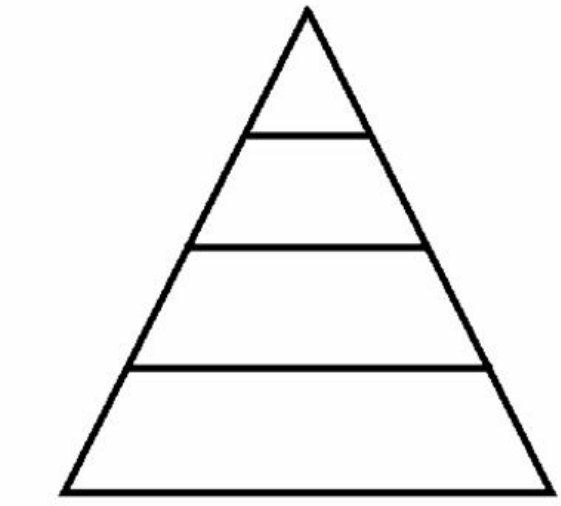
Decomposers can break down organismal matter from _____.



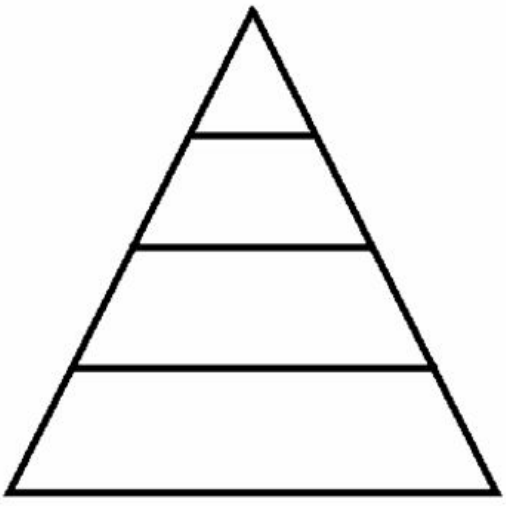
Lesson 5 Exit Slip	In the space provided, complete the energy pyramids by placing the species in the appropriate trophic levels. **Group 1:** Squirrel, Acorn, Coyote, Crow  **Group 2:** Shark, Phytoplankton, Shrimp, Snapper 

Energy Pyramid Activity

1. Work in groups or with a partner to determine which species (on the next page) are primary producers, primary consumers, secondary consumers, tertiary consumers and decomposers.
2. Create your own energy pyramids in the space provided by selecting organisms from each category.
3. You may find that organisms can fit into more than one category!



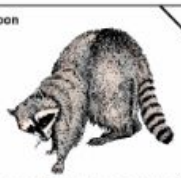
Species in Energy Pyramid:



Species in Energy Pyramid:

Sort the following organisms as into their respective categories and then create two energy pyramids (located on the previous page). Color in the top corners to sort your organisms with the respective color key ->

Raccoon

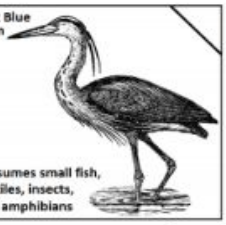


Consumes plants, worms, gastropods, fish, bivalves, amphibians, & crayfish

Zooplankton (Microscopic animals)

Consumes phytoplankton, detritus, and other zooplankton.

Great Blue Heron

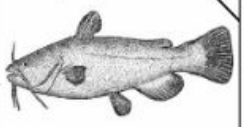


Consumes small fish, reptiles, insects, and amphibians

Detritus (Nonliving organic material)

The remains of dead organisms, feces, fallen leaves, and wood.

Bullhead (Catfish)



Consumes aquatic plants, algae, insects, worms, fish eggs, and small fish

Snapping Turtle

Consumes invertebrates, fish, reptiles, birds, mammals, and plants

Aquatic worms (Nematodes, tubifex, oligochaetes, & bloodworms)

Consumes detritus and bacteria

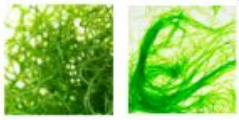
Largemouth Bass

Young -- Consumes zooplankton and insects
Adult -- Consumes Fish, crayfish, and frogs

Mallard

Consumes seeds & plants; may also eat insects, mollusks, crustaceans

Filamentous Algae



Converts energy from sunlight into food energy

Sun

Ultimate source of energy for life

Gastropods (Snails and slugs)

Consumes phytoplankton, detritus, and aquatic plants

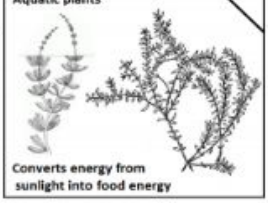
Color Key

- Producers
- Primary Consumers
- Secondary Consumers
- Tertiary Consumers

Bivalves (Clams and mussels)

Consumes phytoplankton, bacteria, and detritus

Aquatic plants



Converts energy from sunlight into food energy

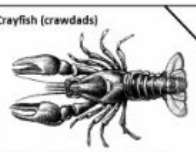
Pond Frog

Young – Consumes algae and detritus
Adult – Consumes Insects, spiders, small fish, and worms

Newts and Salamanders

Consumes worms, snails, tadpoles, insects, and other salamanders

Crayfish (crawdads)



Young -- Consumes zooplankton
Adult -- Consumes fish, plants, worms, insects, snails, & plankton.

Flagfish

Consumes algae and phytoplankton

Grass shrimp

Consumes aquatic plants, algae, phytoplankton, detritus

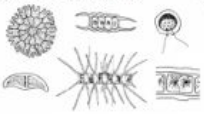
Beaver

Tree bark, twigs, shoots & leaves

Bluegill

Young -- Consumes zooplankton
Adult -- Consumes insect larvae, crayfish, leeches, snails, small fish

Phytoplankton (Microscopic photosynthetic organisms)



Converts energy from sunlight into food energy

Trees, shrubs, & grass

Converts energy from sunlight into food energy

Marsh rabbit

Consumes plants

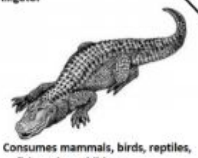
Bacteria

Decomposes detritus, dead organisms

Aquatic insect larvae (Mayfly, stonefly, mosquito, caddisfly, riffle beetle)

Consumes algae, plankton, and bacteria

Alligator



Consumes mammals, birds, reptiles, fish, and amphibians.

Dead animals

Are consumed by bacteria, insects, fungi.

Grass Carp

Consumes aquatic plants, algae.

Rotting log

Are consumed by bacteria, insects, fungi.

Duckweed

Converts energy from sunlight into food energy

Aquatic worms (Leeches, planaria)

Consumes insect larvae, snails, and worms

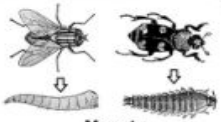
Vulture

Consumes dead animals.

Toadstool fungus

Decomposes organic matter

Insects and their larvae



Maggots

Decomposes dead organisms