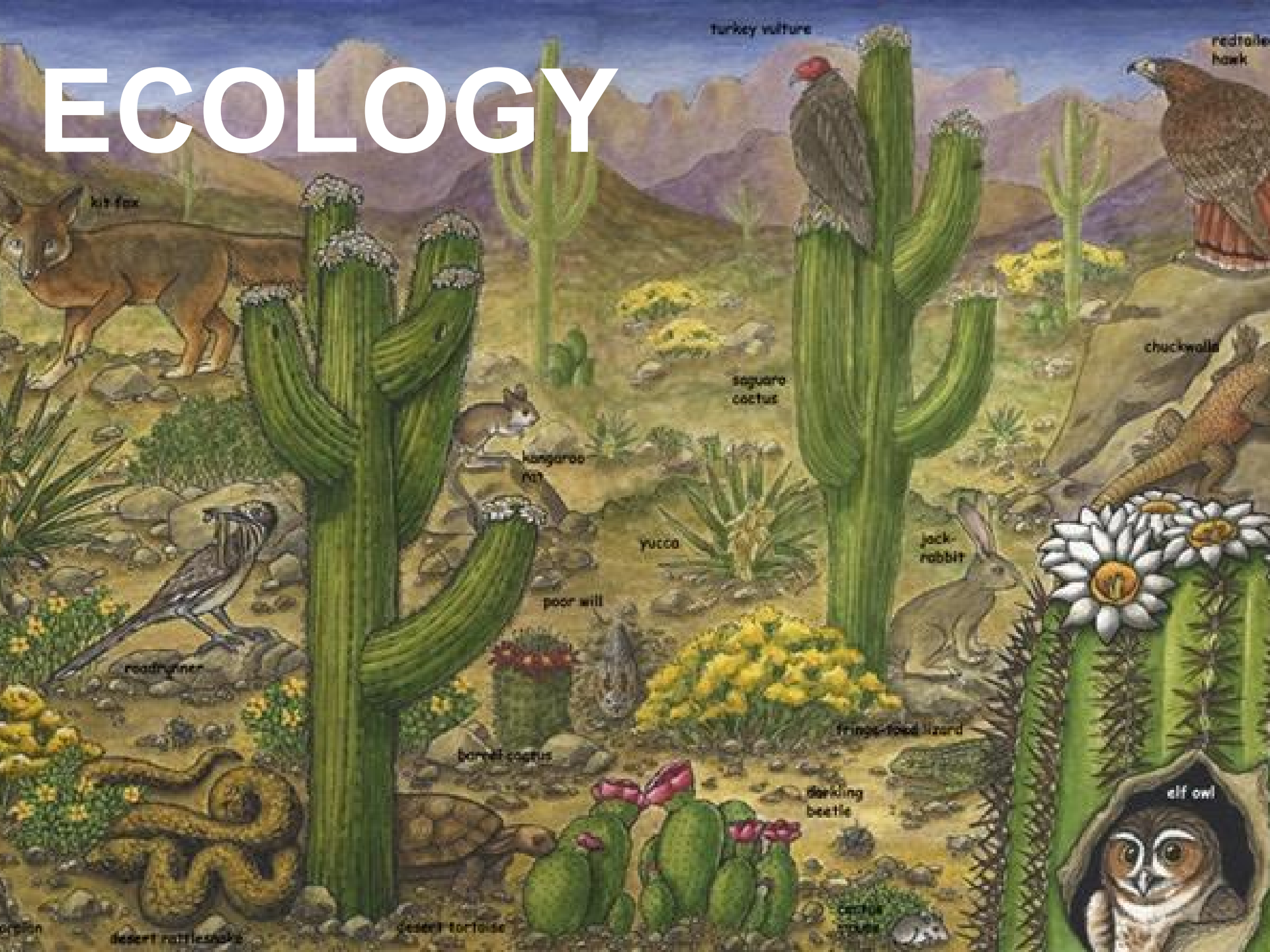


ECOLOGY



turkey vulture

red-tailed hawk

kit fox

chuckwalla

saguaro cactus

kangaroo rat

yucca

jack rabbit

poor will

roadrunner

fringed-foot lizard

barrel cactus

darkling beetle

elf owl

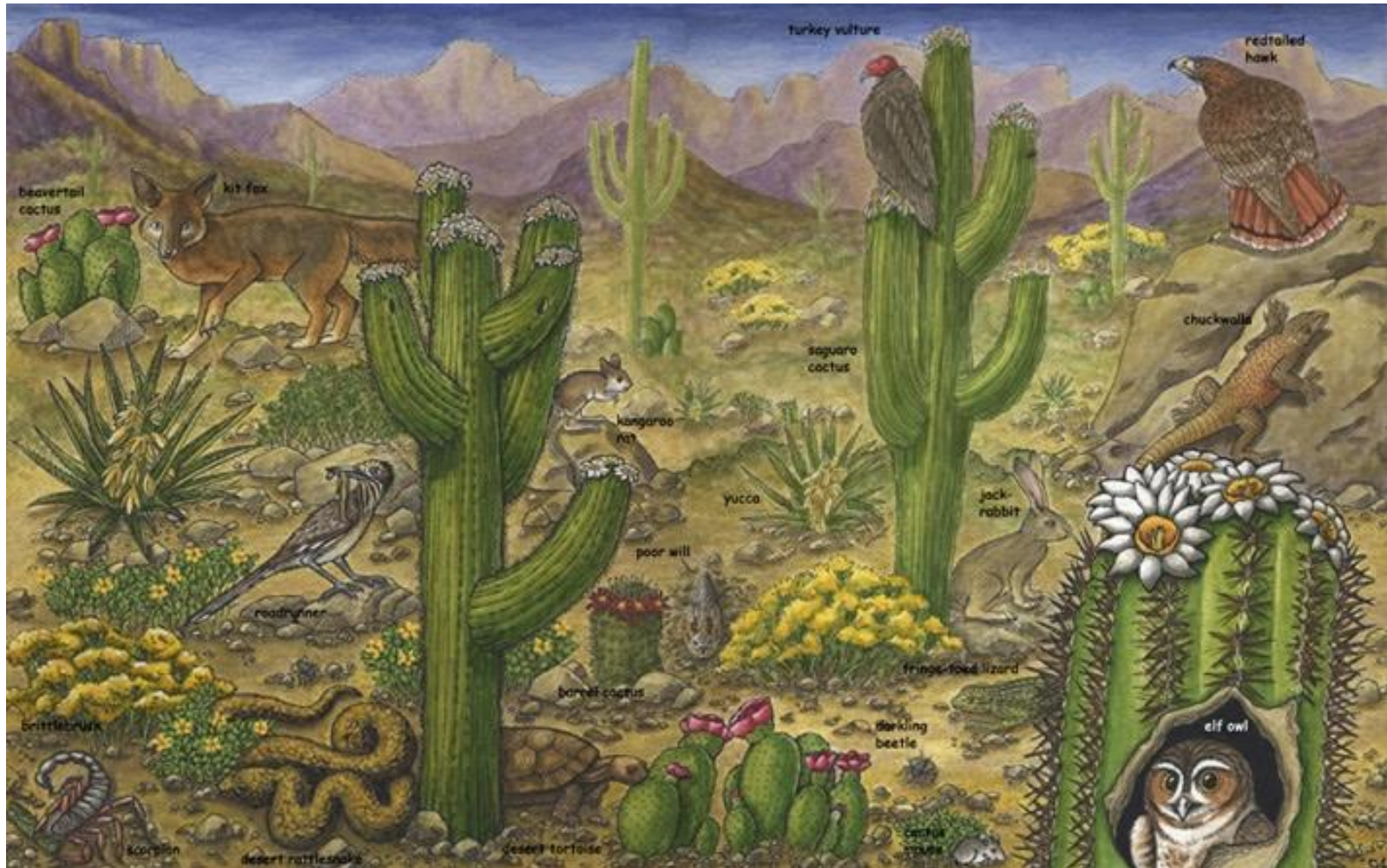
pronghorn

desert rattlesnake

desert tortoise

cottontail mouse

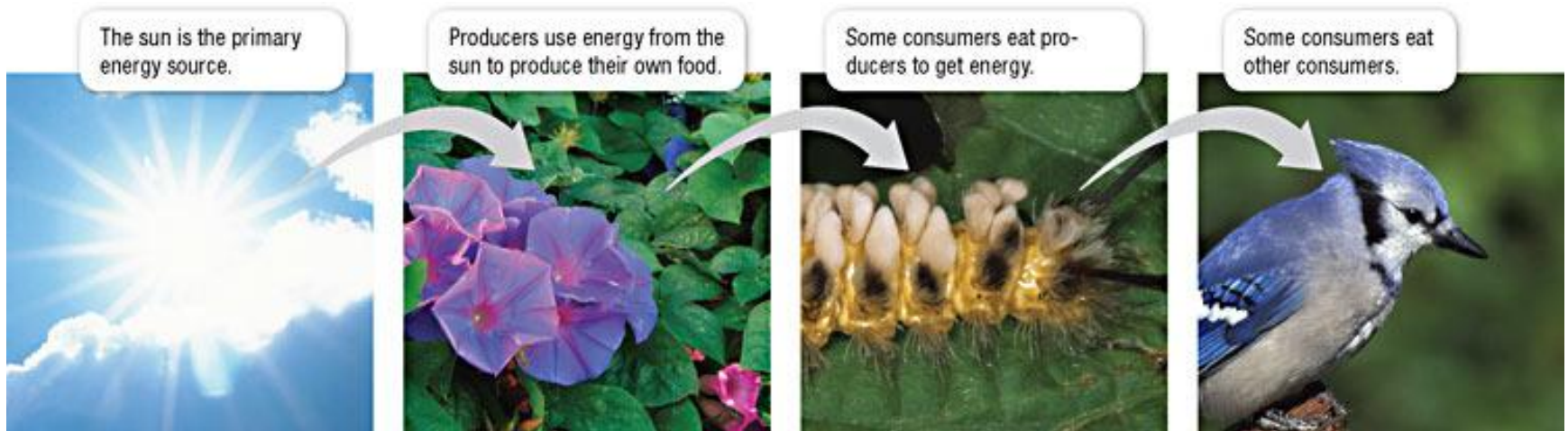
Ecology - the study of all the living and nonliving components within an ecosystem



Energy Roles

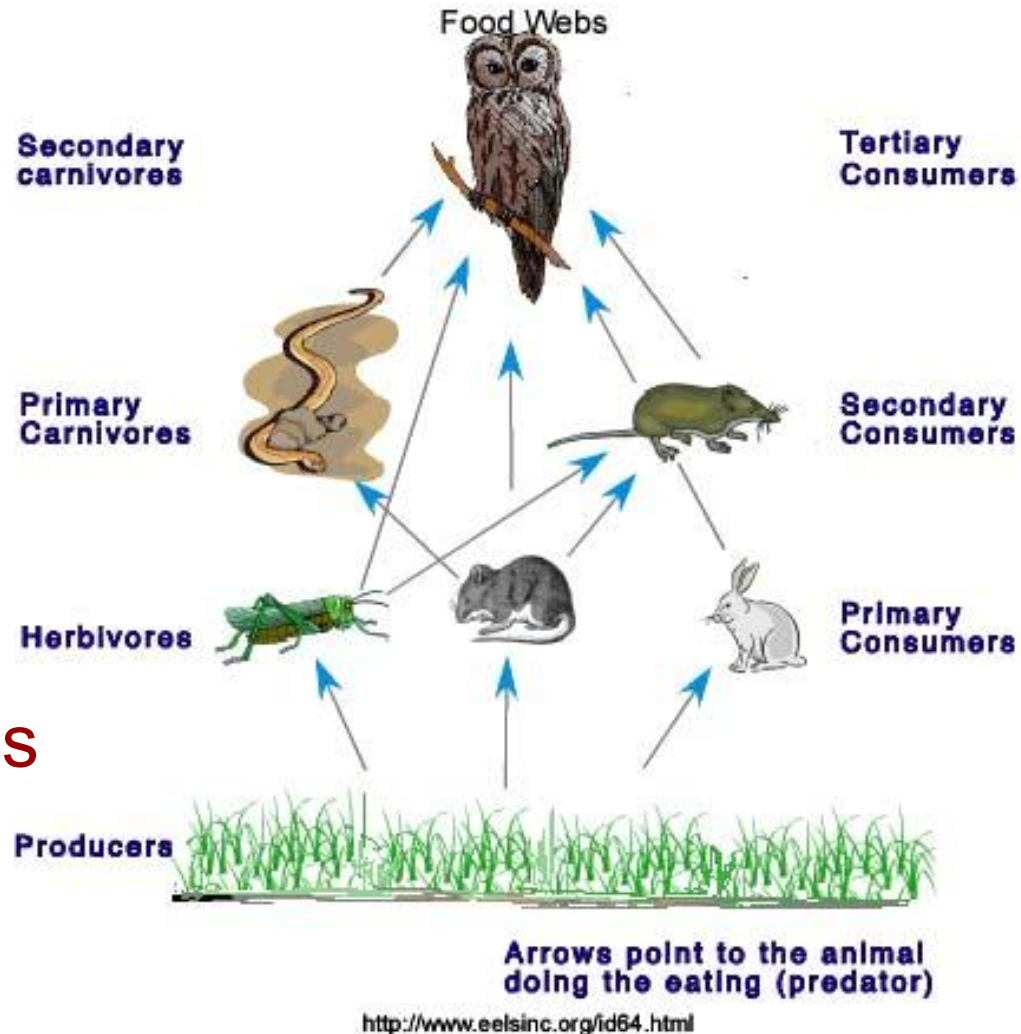
organisms fill various energy roles in an ecosystem

- An organism's energy role is determined by how it obtains energy and how it interacts with the other living things in its ecosystem.
- Organisms can be producers, consumers, or decomposers.



Trophic Levels

- **Trophic level** - the position an organism occupies in a food chain
- An organism's trophic level is measured by the number of steps it is away from a primary producer (autotroph)



It all starts with the SUN!



Producers

- energy first enters most ecosystems as sunlight
- organisms that carry out photosynthesis (make their own food) are called autotrophs or producers



Autotrophs

- organisms that are able to make their own food (in the form of sugars)
- use the Sun's energy
- autotrophs = "self-feeders"
- another word for what producers do!



Words to Know

Producer / Autotroph - organisms that carry out photosynthesis (make their own food/energy)



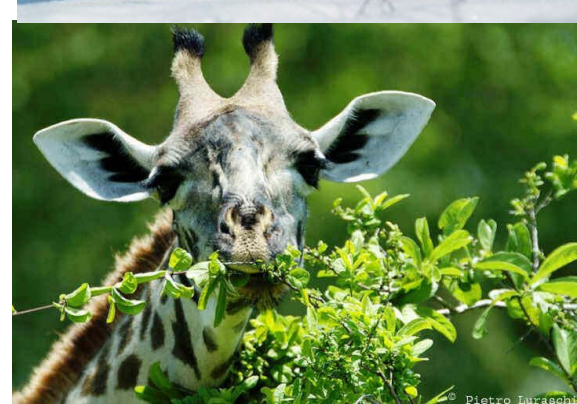
Consumers

- Organisms that cannot make their own food are called heterotrophs (they depend on the producers for food and energy)
- An organism that obtains energy by feeding on other organisms is a **consumer**. All animals are consumers.
- We classify consumers by what they eat



Heterotrophs

- Heterotrophs feed off of other forms of life
- The term heterotroph can refer to single-celled or multi-celled organisms.
- This is another word for what **consumers** do!



Words to Know

Consumer / Heterotroph - organisms that cannot make their own energy (food) so they eat other organisms



Types of Consumers

- **Herbivores** – eat only plants to obtain energy
- **Carnivores** – eat only animals to obtain energy
 - **Predators** – hunt and kill other animals
 - **Scavengers** - feed on the bodies of dead organisms
- **Omnivores** – eat both plants and animals to obtain energy



Consumers that eat producers to get energy

- are called **primary consumers**
- are called **herbivores**



HERBIVORES

These are animals that eat mainly plants.

This includes leaves, grass, flowers, seeds, roots, fruits, bark, pollen and much more.

Some herbivores are:
deer horses rabbits
cows bees sheep
grasshoppers



Consumers that eat other consumers for energy



- are called **secondary consumers** or **tertiary consumers**
- may be **carnivores**, **omnivores**, or **scavengers**

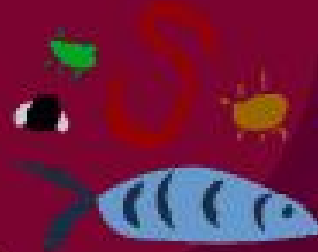


CARNIVORES

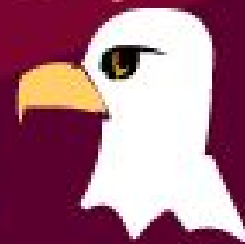


These are animals that eat mainly meat.
This includes insects and all animals.

Some carnivores are:



- felines (lions, tigers & all cats)
- birds of prey (eagles, hawks, owls etc.)
- sharks
- frogs
- spiders





OMNIVORES

These are animals able to eat plants AND animals.

Some omnivores are:

- humans
- most bears
- racoons
- most primates (apes & monkeys)
- seagulls & other birds



Decomposers

- Organisms produce waste and eventually die. If these wastes and dead organisms were not removed from the ecosystem, they would pile up until they overwhelmed the living things.
- Organisms that break down wastes and dead organisms and return the raw materials to the environment are called ***decomposers***.



DECOMPOSERS BREAK DOWN MATERIALS AND RETURN NUTRIENTS TO THE SOIL.

Words to Know

Decomposers - organisms that break down waste materials and dead organisms and return important nutrients to the environment



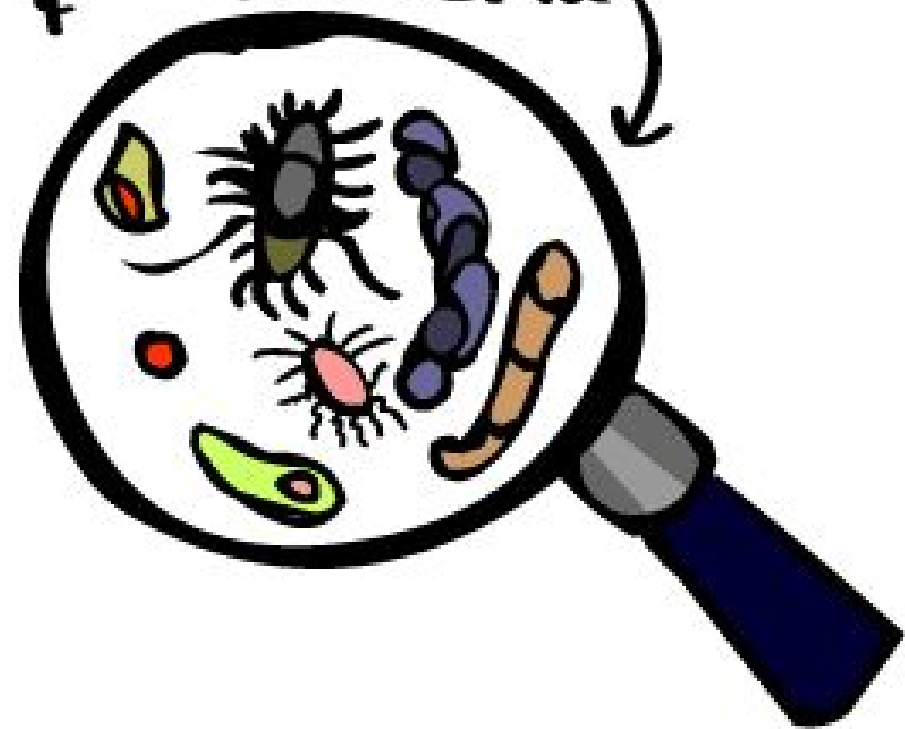
Bacteria

DECOMPOSERS

They consume (eat) dead plants & animals and decomposes them - reduces them to simpler forms of matter.

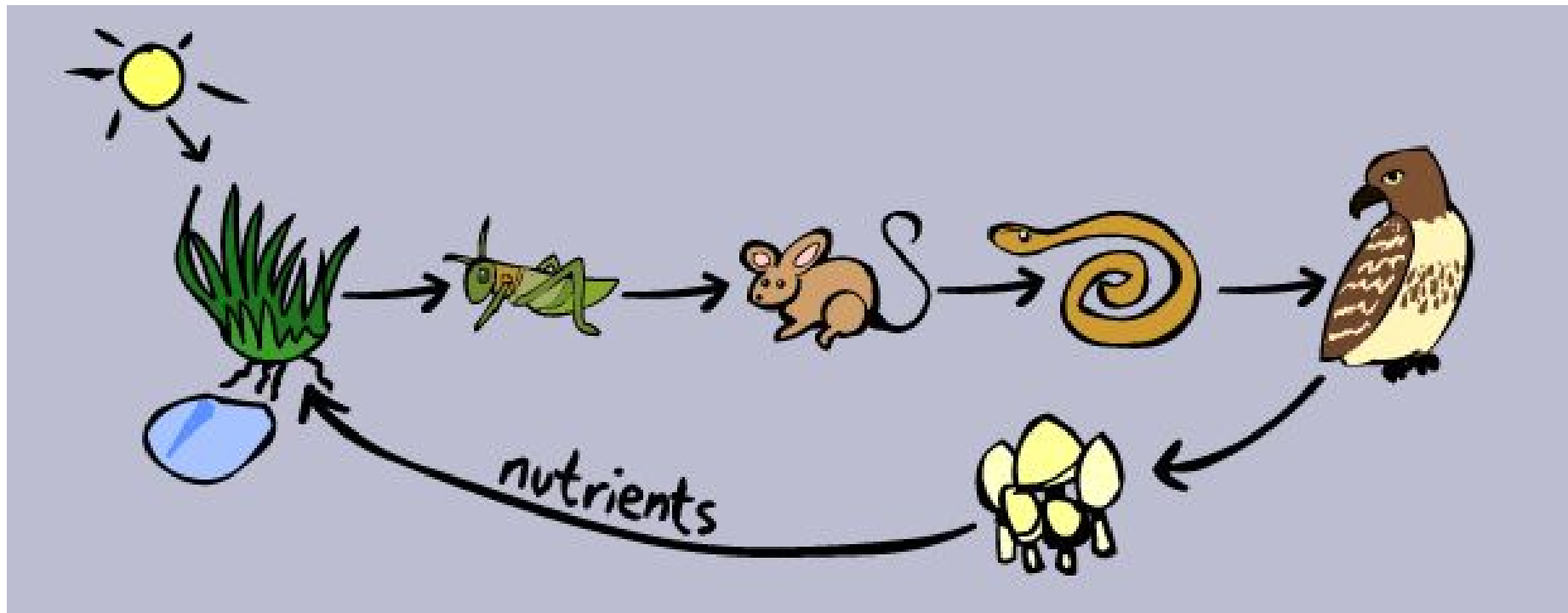
PRIMARY DECOMPOSERS

Fungi & Bacteria

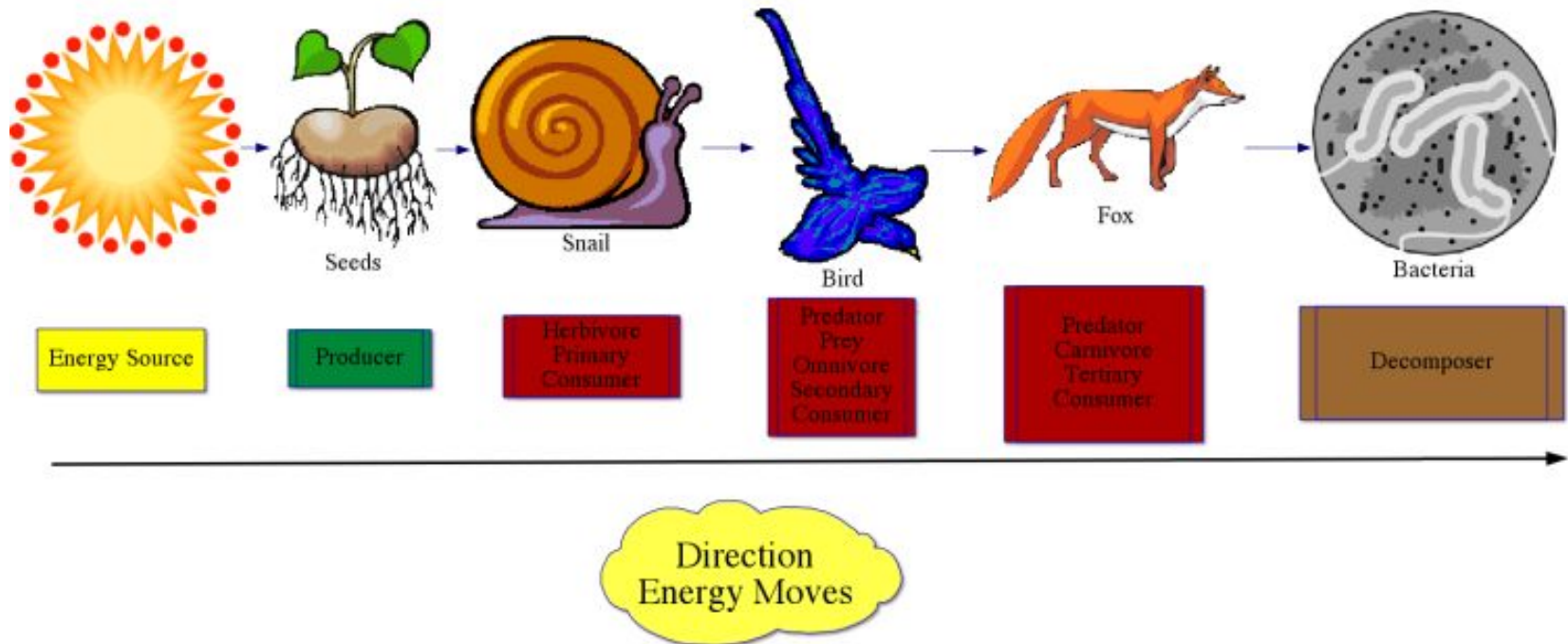


Food Chains

The transfer of energy from sun to producer to primary consumer to secondary consumer to tertiary consumer can be shown in a **food chain**.

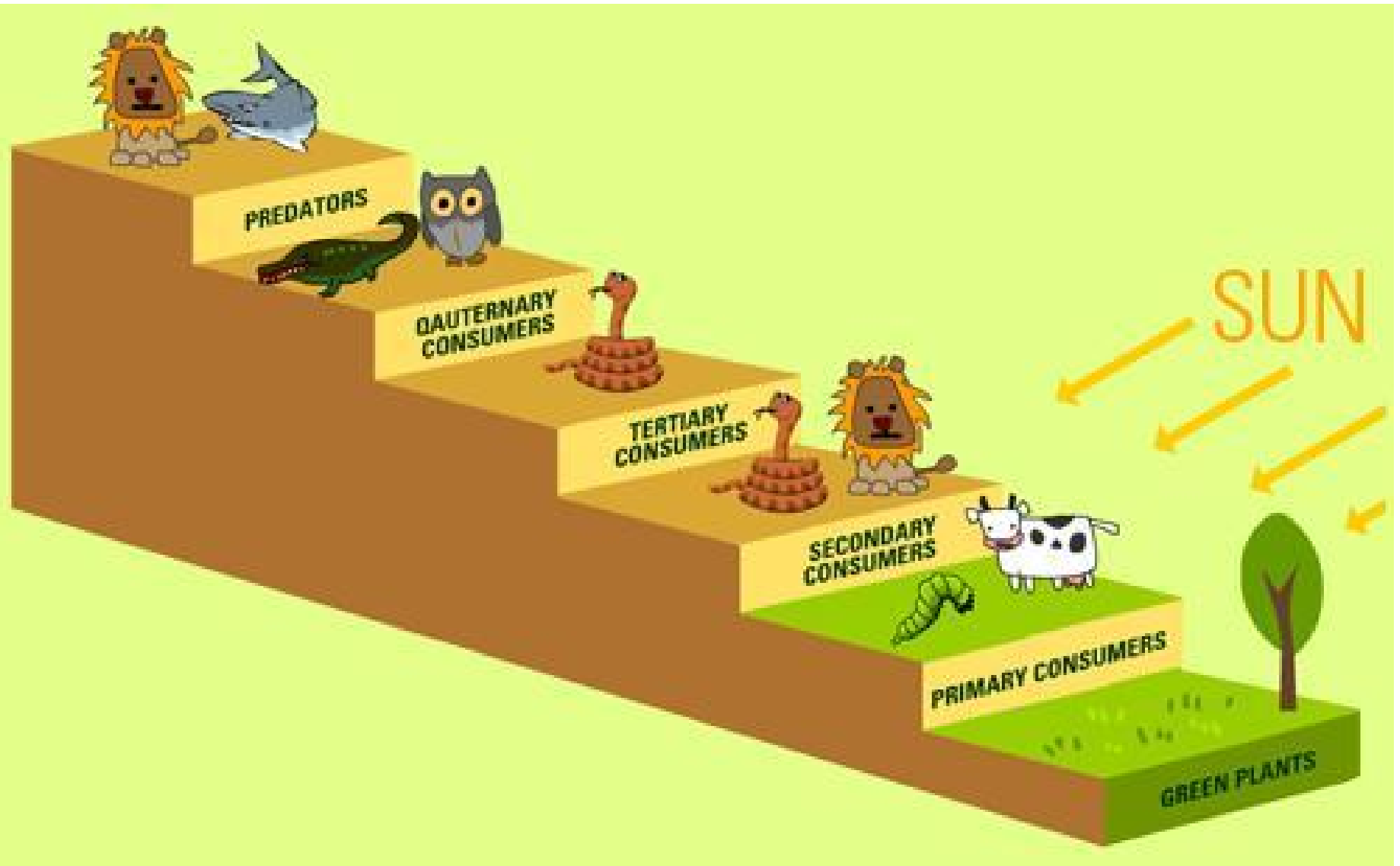


Energy Flow in a Food Chain



Most food chains have no more than four or five links.

There cannot be too many organisms in a single food chain because the animals at the end of the chain would not get enough food / energy to stay alive.





Carnivore



Carnivore



Carnivore



Herbivore



Plant

Quaternary consumers

Tertiary consumers

Secondary consumers

Primary consumers

Primary producers



Carnivore



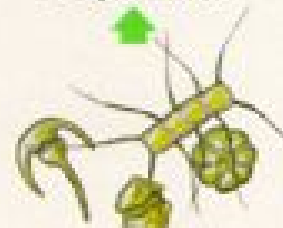
Carnivore



Carnivore



Zooplankton



Phytoplankton

Think of examples of organisms from each trophic level as you watch the following video

[Krill Video from NatGeoKids](#)

- What is the ultimate source of energy in this ecosystem?
the sun; photosynthesis

- What is the primary producer in the video?
phytoplankton and other algae

- What is the primary consumer in the video? Is it an herbivore or carnivore?
krill; herbivore

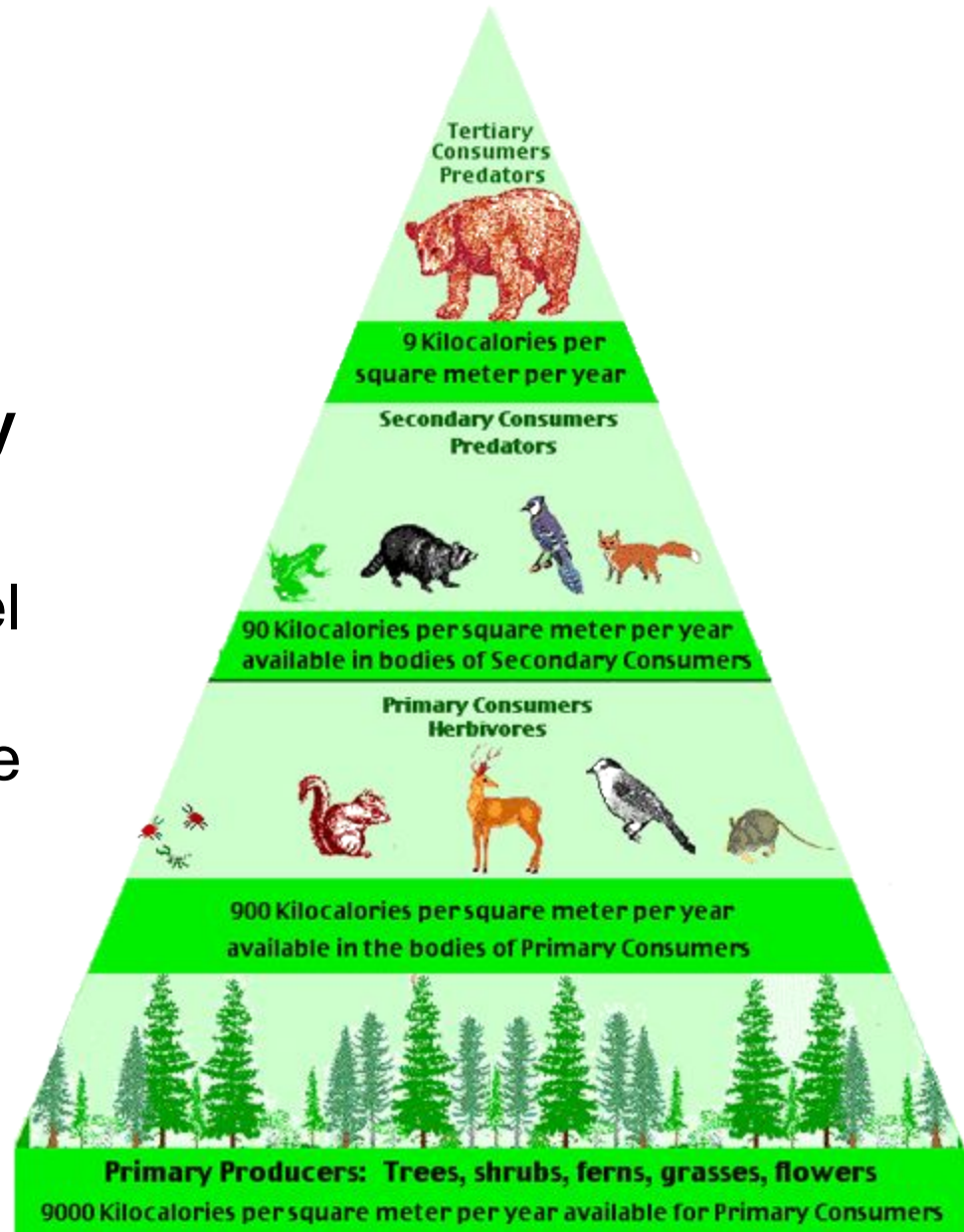
- What secondary and tertiary consumers are shown in the video? Are they herbivores or carnivores?

(anchovies, sardines, birds, salmon, tuna, humpback and blue whales; carnivores)

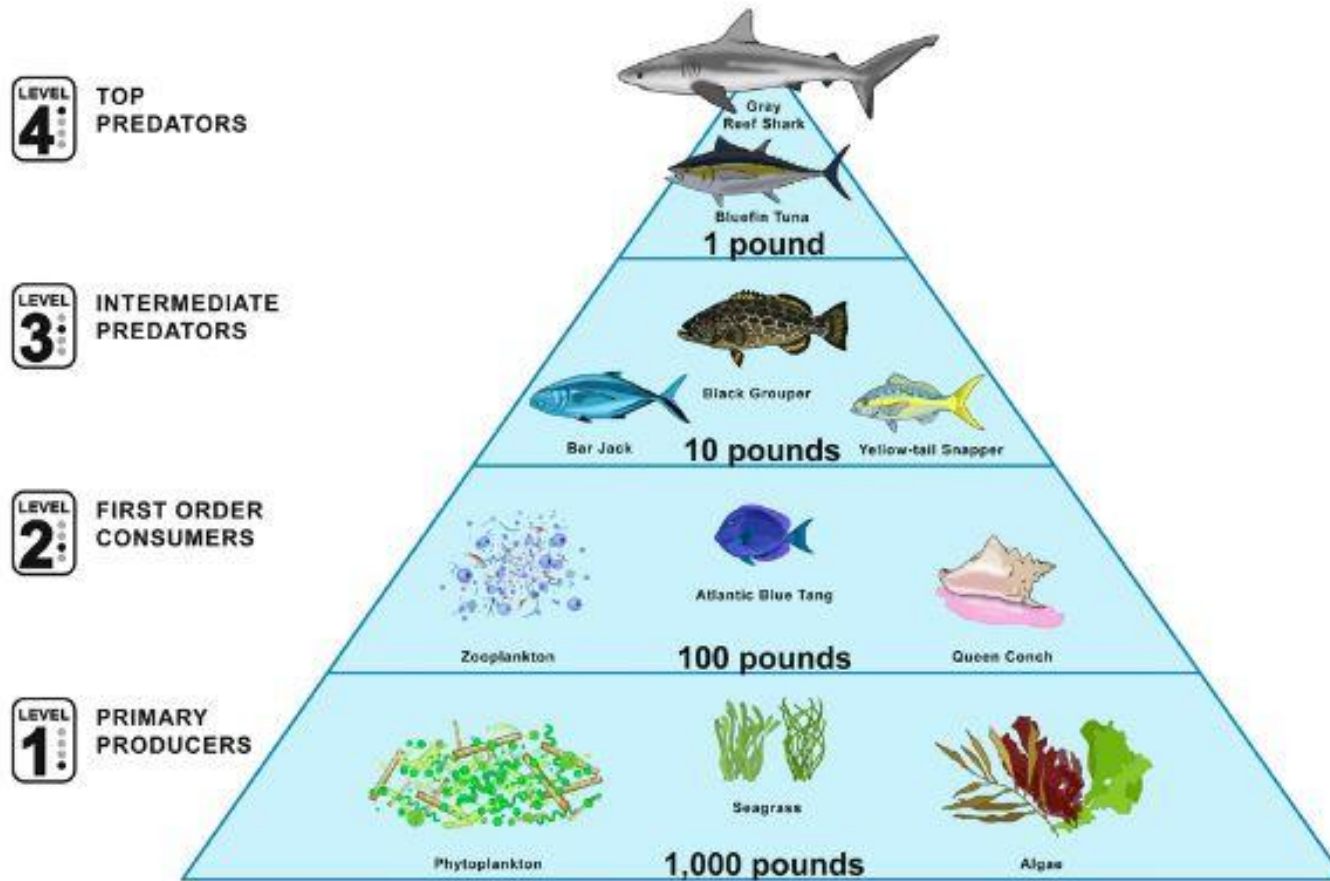
Energy Pyramid

Another way of showing the transfer of energy in an ecosystem is with an **energy pyramid**.

- Energy Pyramids model the decreasing amount of food/energy available to organisms in a food chain.

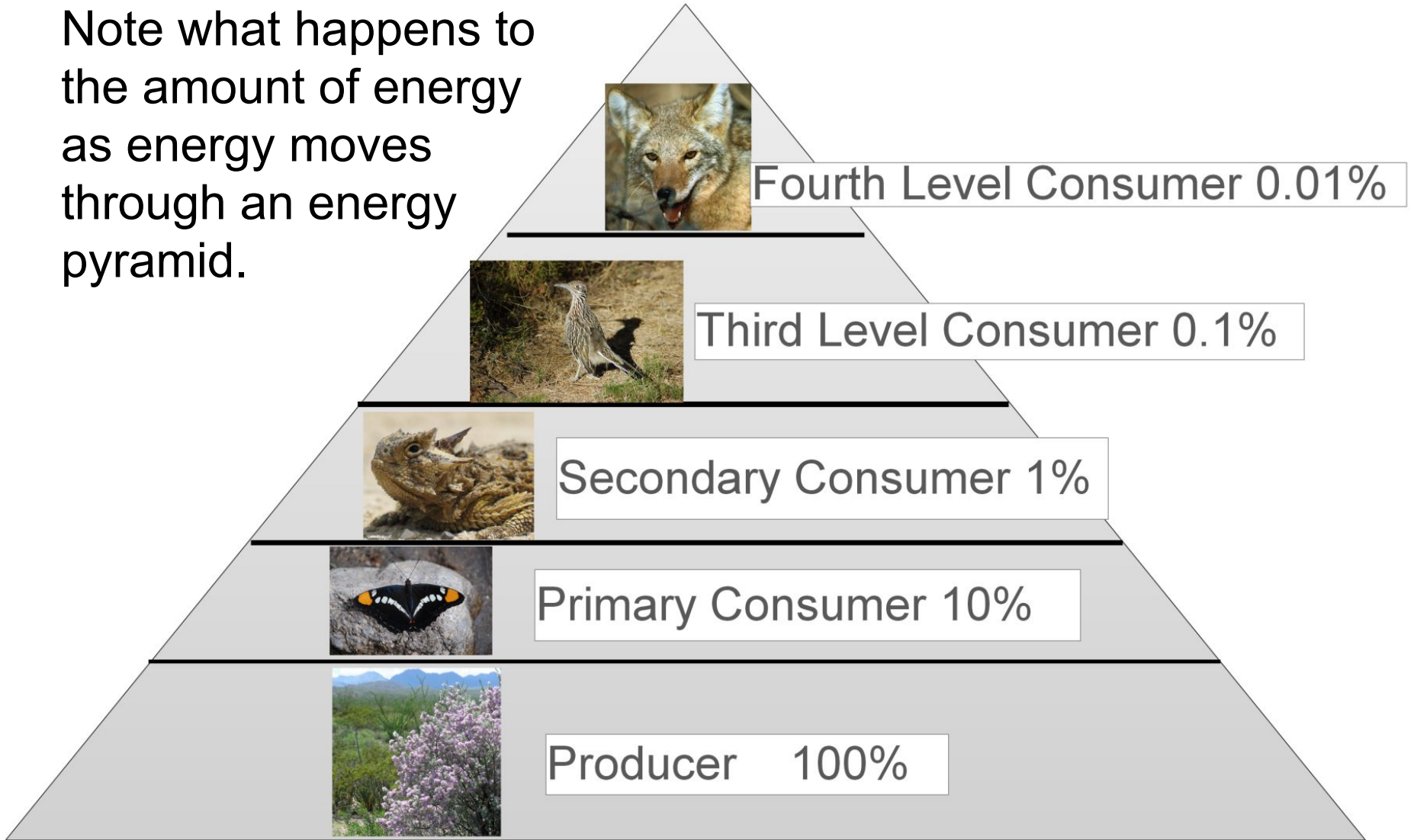


Energy Pyramid

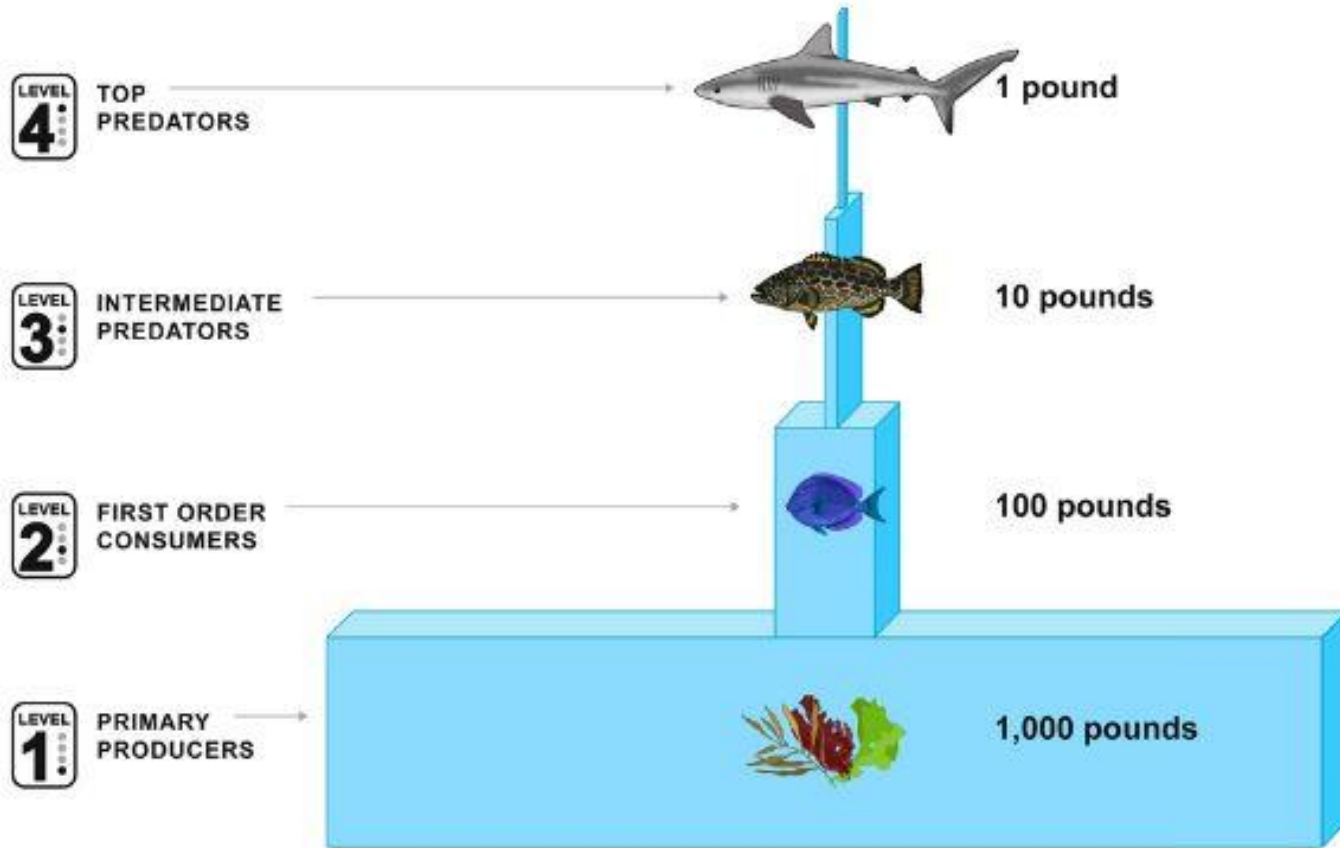


Based on this food pyramid, do you think there are more top predators (gray reef sharks, bluefin tuna) than producers (phytoplankton, seagrass, algae)? Why or why not?

Note what happens to the amount of energy as energy moves through an energy pyramid.



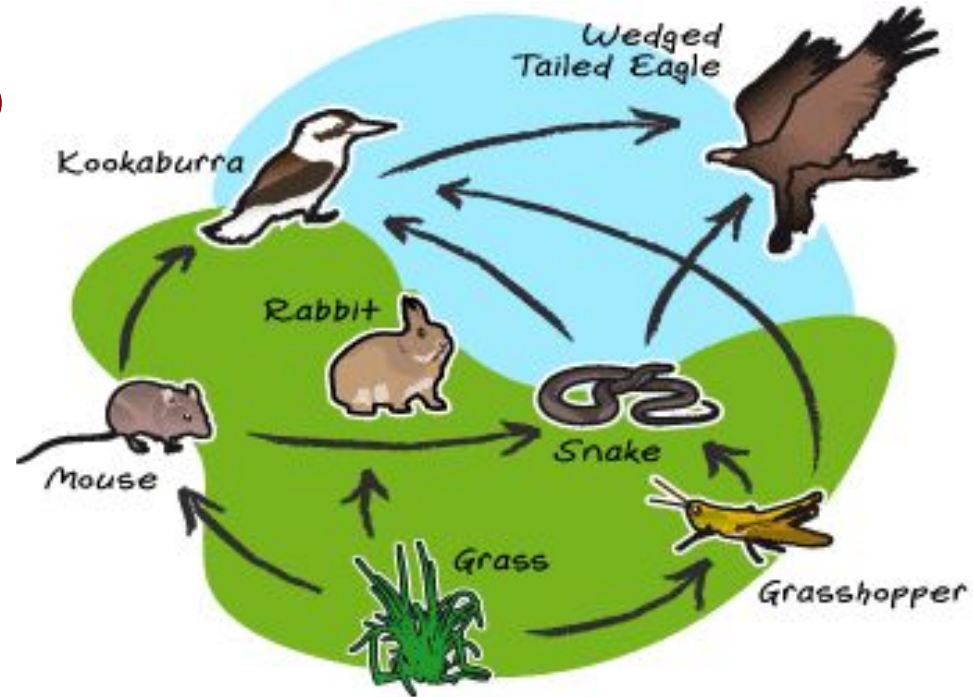
Biomass Pyramid



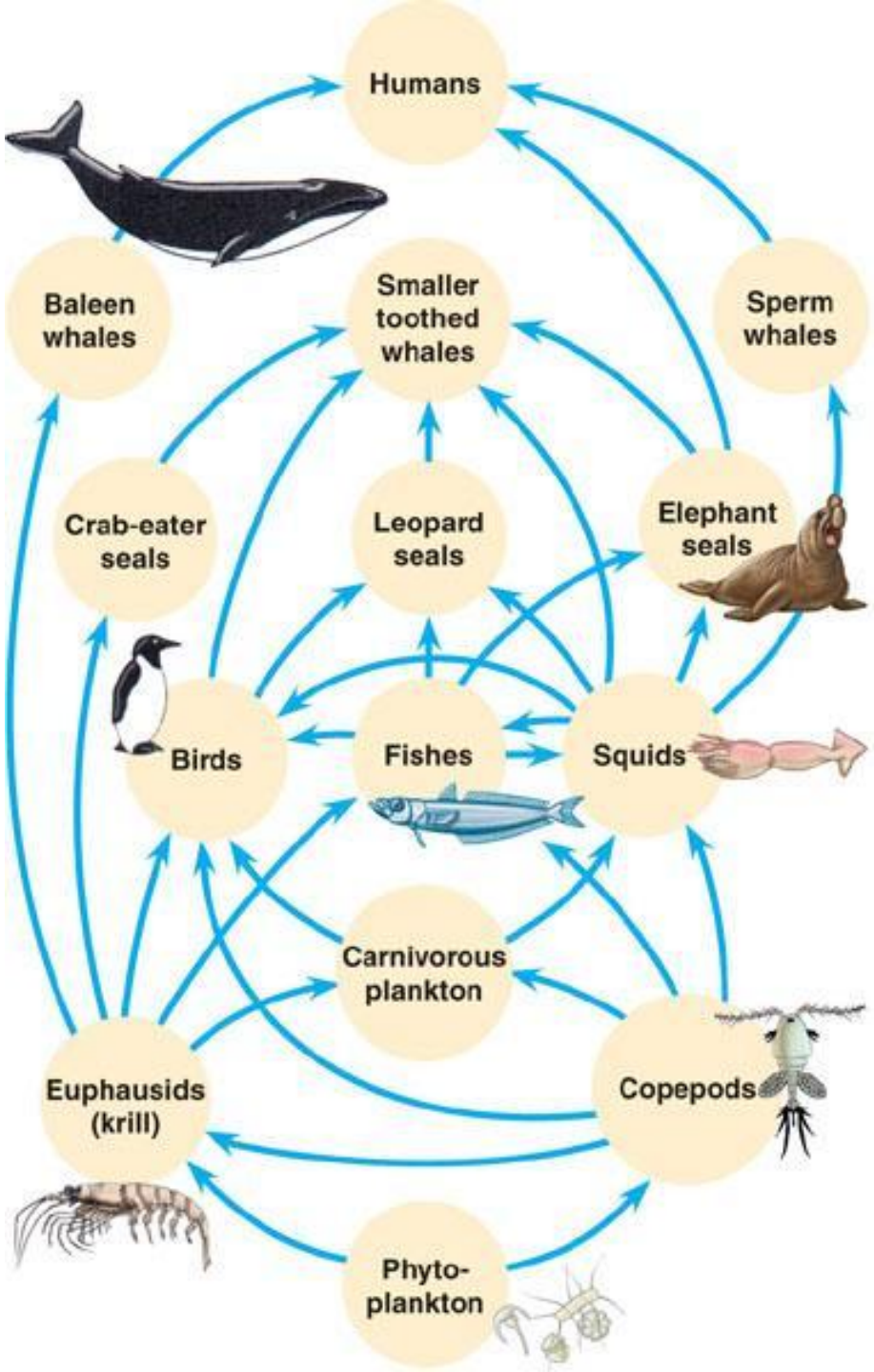
Based on this biomass pyramid, do you think there are more top predators (gray reef sharks, bluefin tuna) than producers (phytoplankton, seagrass, algae)? Why or why not?

Food Webs

- Healthy, well-balanced ecosystems are made up of multiple, interacting food chains
 - Organisms may play more than one role in an ecosystem
 - [Coral Reef Food Web](#)
 - [BBC Food Chains](#)



Marine Food Web



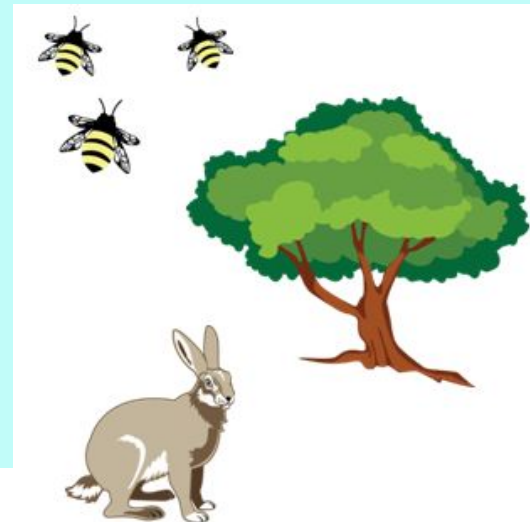
Abiotic Factor

- the **non-living** components of the environment
- **examples:** sunlight, temperature, moisture, wind or water currents, soil type, and nutrient availability



Biotic Factor

- the **living** components of the environment
- **examples:** plants, animals, fungi, algae, and bacteria



Ecosystems

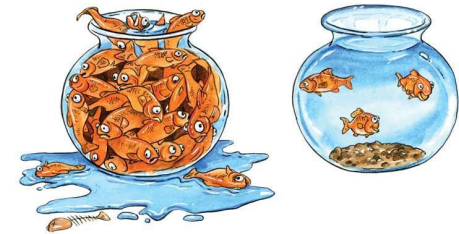
An ecosystem is all the living (biotic) and nonliving (abiotic) things that interact in an area.



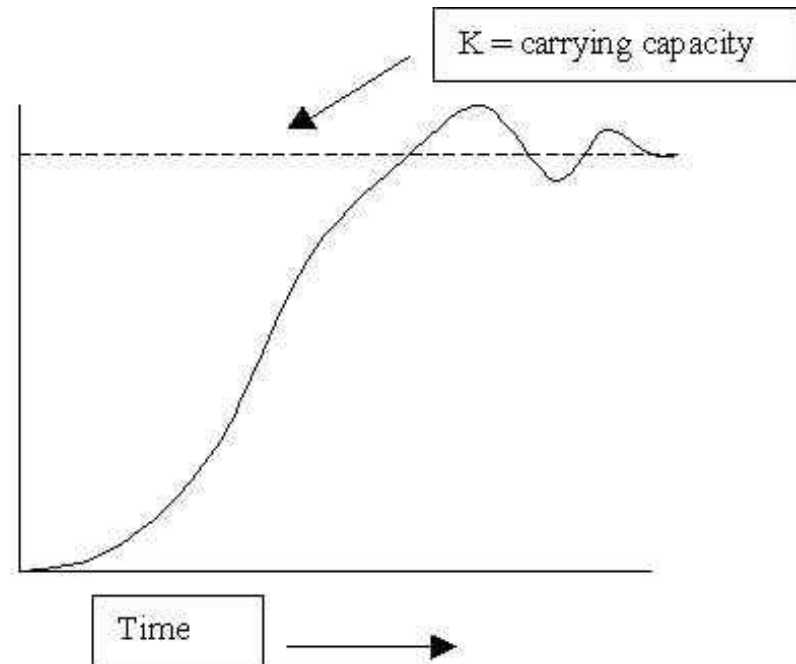
Carrying Capacity

The number of individuals that can obtain food, shelter, and water from the environment in a given period of time is the **carrying capacity**.

- This applies to plants and animals



Population
Size
(N)



Limiting Factors

Limiting Factors are things that prevent a population from growing any larger

examples: food, water, light, living space, temperature, competition, disease, etc.



Disease/Parasites



Accidents



Natural Factors
(fires, floods, etc...)



Starvation



Hunting
(minimal effect
on game animals)



Predation



Other



Interactions In Ecosystems

There are three major types of interactions among organisms in ecosystems:

- ✓ **Competition**
- ✓ **Predation**
- ✓ **Symbiosis**



Competition

- **Competition** occurs between organisms when they try to make use of the same limited resources
- Competition can occur between:
 - members of the same species
 - among species with similar niches



Words to Know

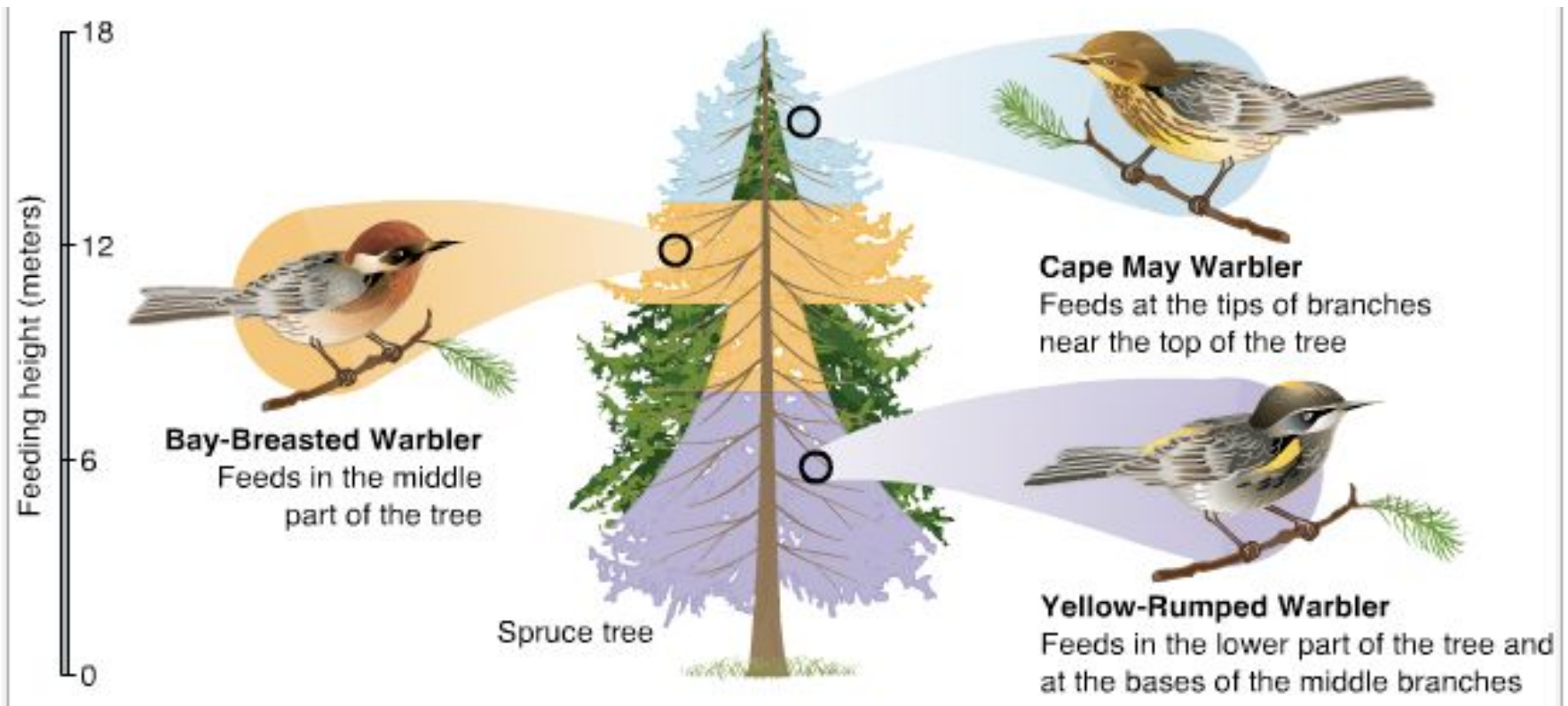
Niche - an organism's particular role, or how it fits into an ecosystem



How many different species of plants and animals would you estimate are living on this branch?

Words to Know

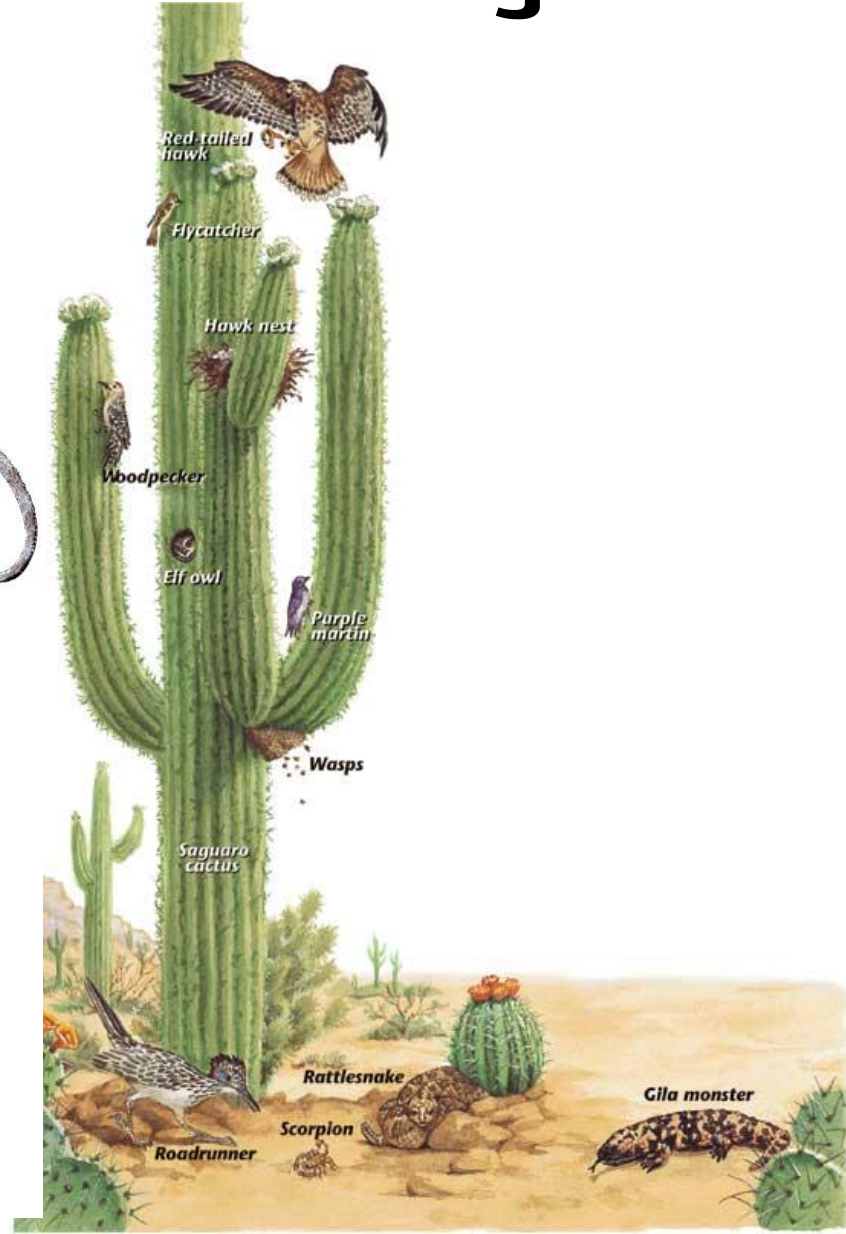
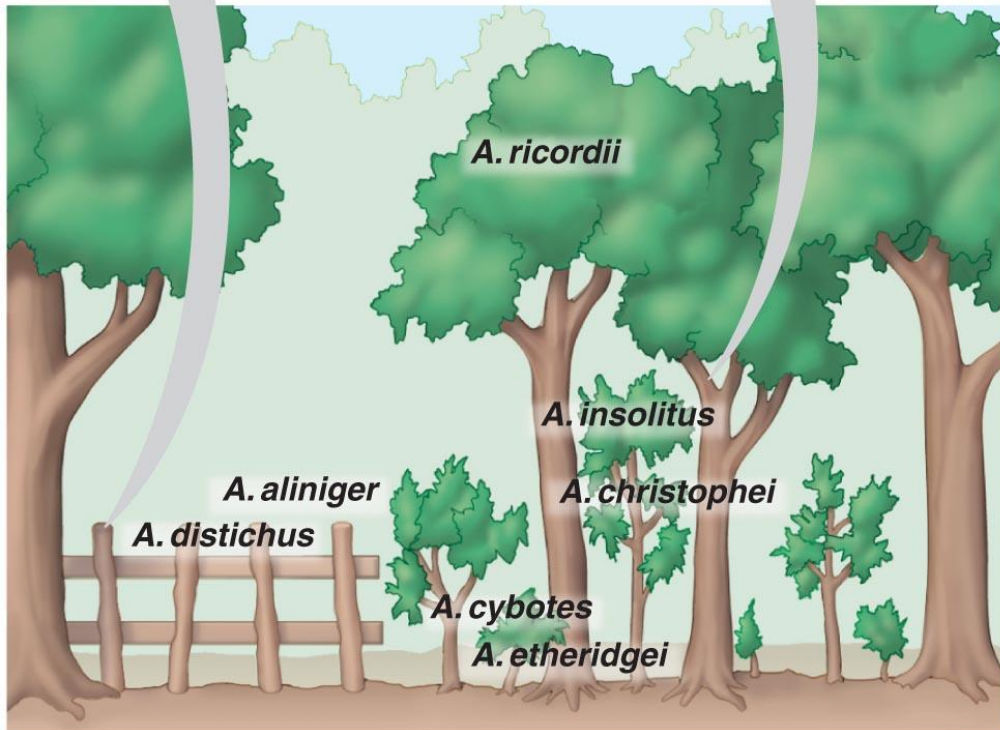
Resource partitioning - helps competing species share a resource and develop a niche for themselves in an ecosystem. To partition, they may feed at different times of day or at different levels of the same tree.



Examples of Resource Partitioning

A. distichus perches on fence posts and other sunny surfaces.

A. insolitus usually perches on shady branches.



Predation

Predation is an interaction in which one organism hunts and kills another organism for food.

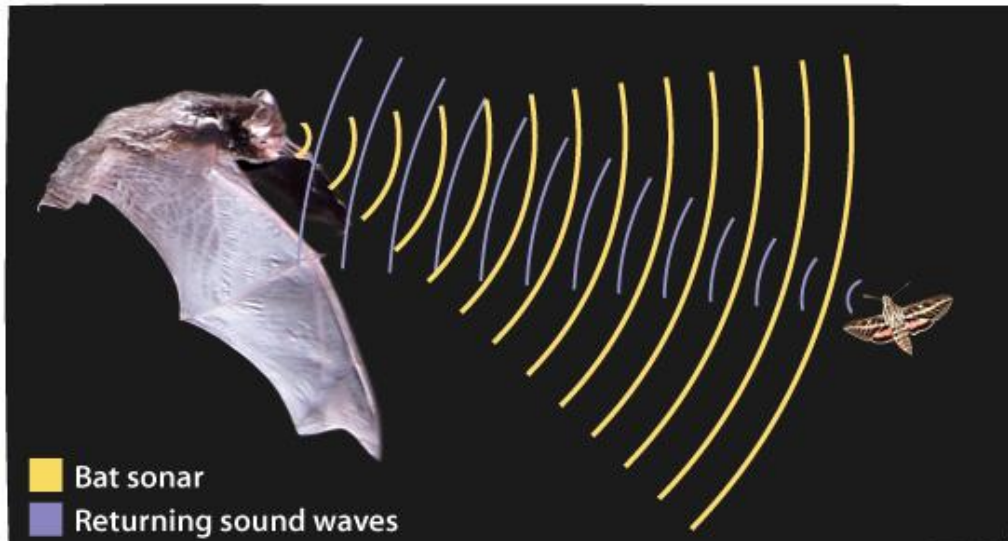
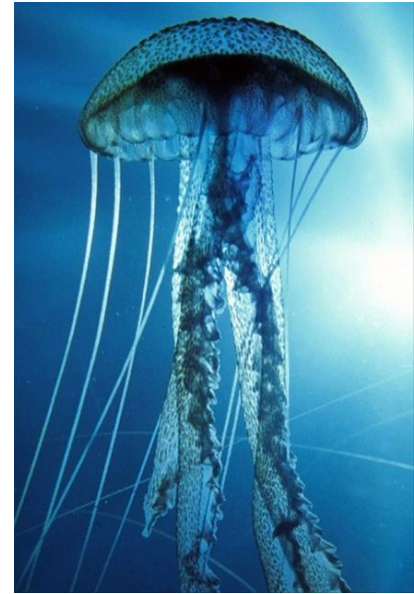
- organism that does the killing is the **predator**
- organism that is hunted is the **prey**



Predator Adaptations

Predators have adaptations that help them catch and kill their prey.

- ✓ Cheetahs can run very fast to catch prey
- ✓ Jellyfish have poisonous tentacles to paralyze prey
- ✓ Owls have big eyes to see at night
- ✓ Bats use echolocation to find insects



Prey Adaptations

Prey have adaptations to help them avoid being caught.

- camouflage
- protective coverings
- warning coloring
- mimicry
- false coloring

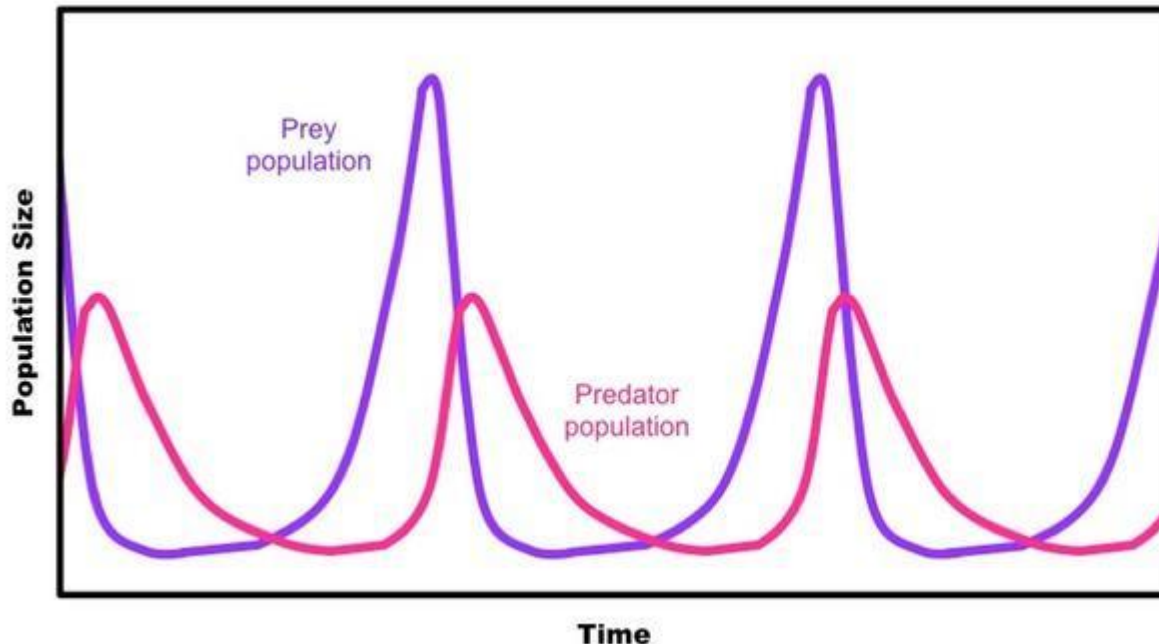


Effects on Predation on Population Size

Predation can have a major effect on population size

- If predators are very effective, the result is a decrease in the prey population
- In turn, a decrease in the prey population will result in a decrease in the predator population

Note how each population responds to the other (ex. what happens to prey population when predator population rises? vice versa?)

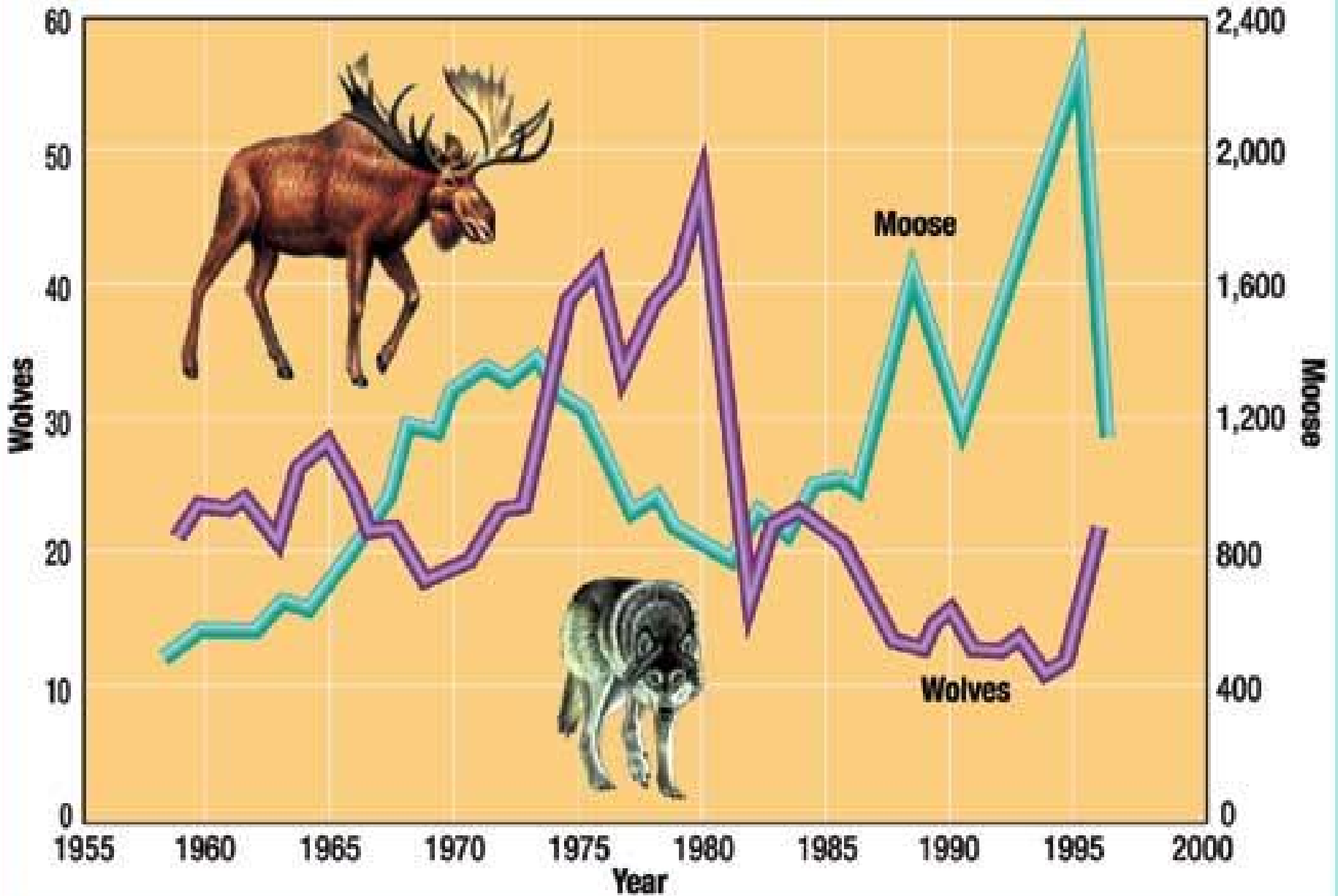


Arctic Hare



Canadian Lynx

Moose and Wolf Populations on Isle Royale



Symbiosis

Symbiosis is a close relationship between two different species in which at least one species benefits.

There are three types of symbiotic relationships:

- ✓ **Mutualism**
- ✓ **Commensalism**
- ✓ **Parasitism**









Benefits of Symbiosis

- ✓ Food
- ✓ Transportation
- ✓ Cleaning
- ✓ Protection/Shelter
- ✓ Reproduction



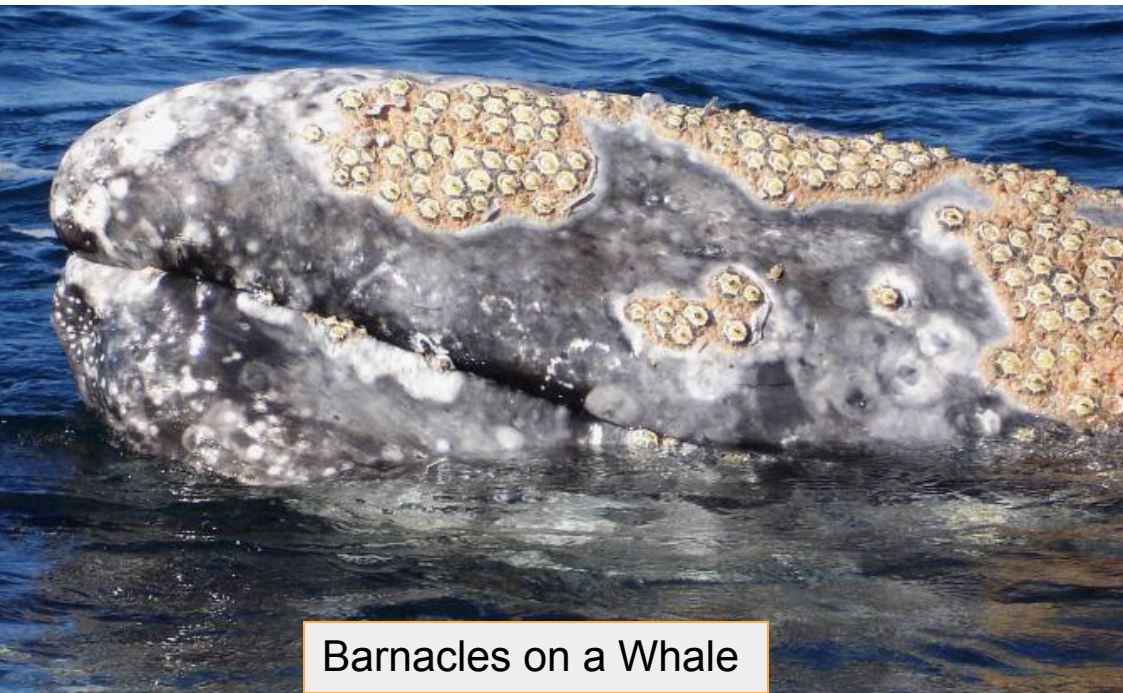
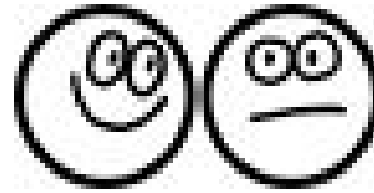
Symbiotic Relationships

In symbiosis, at least one member of the pair benefits from the relationship.

Commensalism	Mutualism	Parasitism
One benefits 	One benefits 	One benefits 
One is unaffected 	Also benefits 	One is harmed 

Commensalism

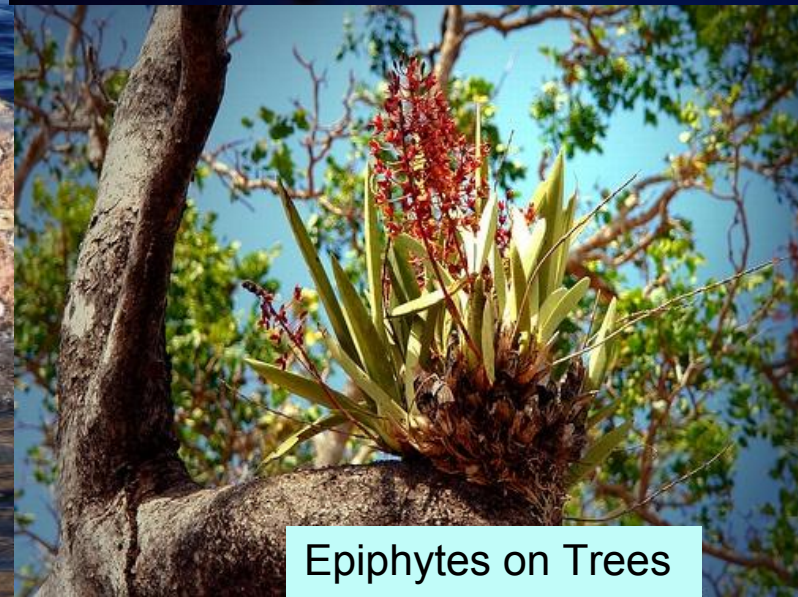
- One species benefits (+) and the other is unaffected (0)
- Commensalism means “at the table together”



Barnacles on a Whale



Remora on a Shark



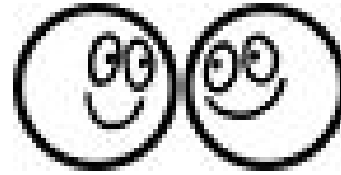
Epiphytes on Trees

Commensalism

Triggerfish 😐 create feeding opportunities for smaller fish 😊 by moving large rocks too big for them to shift themselves



Mutualism



- Both species benefit 😊 😊
- Giraffes and Oxpeckers



Honey Guide Bird and Honey Badger



Bee and Flower



Oxpecker and Deer



Clownfish and Sea Anemone



Cleaner Shrimp and Eel

Mutualism

[Honey Guide Bird and Honey Badger](#)

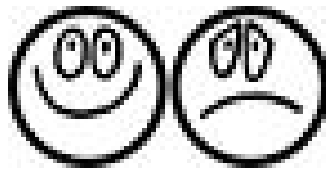


Mutualism

Acacia Tree and Acacia Ants

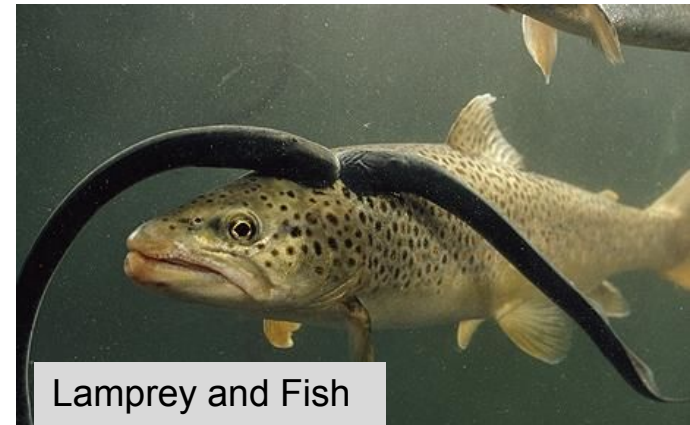


Parasitism



- One organism benefits (+) at the expense of another organism (-) which is harmed
 - **Host** – the organism that the parasite lives on or in (it will be harmed)
 - **Parasite** – the organism that benefits

Tongue-eating Louse and Fish



Lamprey and Fish

Tick and Mammals



Cowbird and Nesting Birds



Wasps and Tomato Hornworm

Parasitism

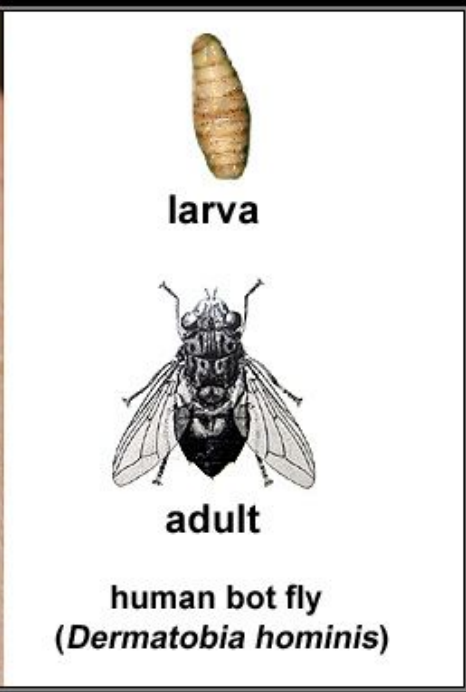
<https://youtu.be/327-bwMQI-Y>



https://youtu.be/XBMK7C_HwI4

Parasitism

Botfly and Mammals



Parasitism

<https://youtu.be/tZpjKemWalk>



Parasitism

Lampreys and Fish



Parasitism

Cuckoos and Brown-headed Cowbird Parasitism

https://youtu.be/SO1WccH2_YM?t=17s

