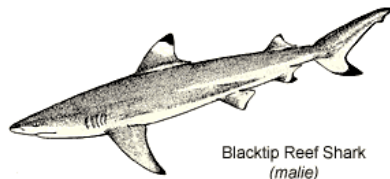
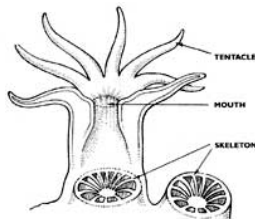


Student Worksheets

9th Grade



Blacktip Reef Shark
(male)



Name _____



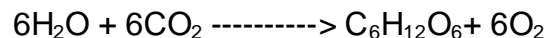


Ecosystems

Ecosystems are complex entities made up of interacting inorganic and biotic elements.

In this worksheet, we will mainly be concerned with one particular ecosystem - one that occupies a greater volume of the biosphere than any other - the marine ecosystem. [Note: you may have studied the terrestrial ecosystem, but you will find the same theories can be applied]. Before we can begin, we need to learn some vocabulary.

Photosynthesis is the process by which plants and some bacteria use the energy from sunlight to produce sugar. The sugar is converted to ATP, which is the fuel that provides energy for living things. The conversion of sunlight energy into chemical energy is made possible by the green pigment chlorophyll. Photosynthesis uses water and carbon dioxide to produce sugar and oxygen. The chemical equation for photosynthesis is:

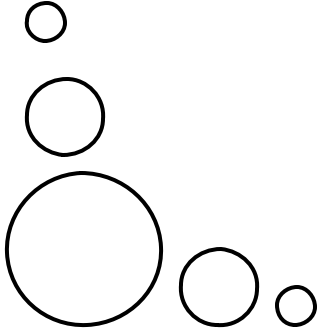


Organisms that are able to make their own food (in the form of sugars) by using the energy of the Sun are called *autotrophs*, meaning "self-feeders". Algae are an example of such beings, which may have been among the earliest forms of life on Earth. Algae self-feed by way of photosynthesis.

Heterotrophs, like fish, feed on other forms of life. This process of producing biological energy is different from that of autotrophs who produce their own food using energy from the sun.

What is the principal source of energy entering the marine ecosystem?

As many of the buildings are enclosed, how is this energy substituted at Maui Ocean Center?





Name some of the autotrophs at Maui Ocean Center.

Name some of the heterotrophs at Maui Ocean Center.

A **food web** (or chain) shows how each living thing gets its food. Some animals eat plants and some animals eat other animals. For example, a simple food chain links plants, cows (that eat plants), and humans (that eat cows). Each link in this chain is food for the next link. A food chain always starts with plant life and ends with an animal.

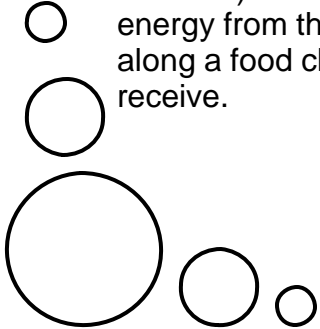
Plants are called producers (they are also autotrophs) because they are able to use light energy from the Sun to produce food (sugar) from carbon dioxide and water.

Animals cannot make their own food so they must eat plants and/or other animals. They are called consumers (they are also heterotrophs). There are three groups of consumers.

- ? Animals that eat only plants are called herbivores.
- ? Animals that eat other animals are called carnivores.
- ? Animals and people who eat both animals and plants are called omnivores.

Decomposers (bacteria and fungi) feed on decaying matter. These decomposers speed up the decaying process that releases minerals back into the food chain for absorption by plants as nutrients.

Do you know why there are more herbivores than carnivores?



In a food chain, energy is passed from one link to another. When an herbivore eats, only a fraction of the energy (that it gets from the plant food) becomes new body mass; the rest of the energy is lost as waste or used up (by the herbivore as it moves). Likewise, when a carnivore eats another animal, only a portion of the energy from the animal food is stored in its tissues. In other words, organisms along a food chain pass on much less energy (in the form of body mass) than they receive.



Draw a picture of a food web/chain using the following organisms.

Sea lettuce or limu – green alga

Sea hare or kualakai – feeds on algae

Cauliflower coral or ko'a – a hard coral with zooxanthellae

Orange cup coral – hard coral without zooxanthellae

Ornate butterflyfish or kikakapu – feeds on coral polyps

Tiger shark – feeds on fish and other animals

Yellowfin tuna or ahi – eats fish, squid and crustaceans

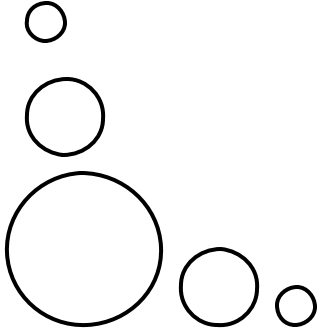
Achilles tang or paku'iku'i - eats green algae

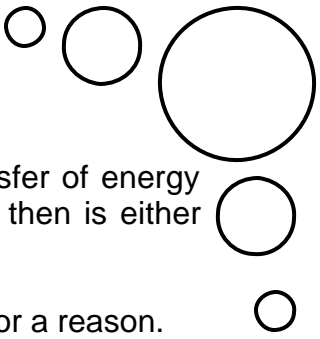
Spiny lobster or ula – crustacean, scavenger, eats anything!

Humans – eats a varied diet of fish, meat and vegetables

Phytoplankton – microscopic green algae

Zooplankton – feeds on phytoplankton





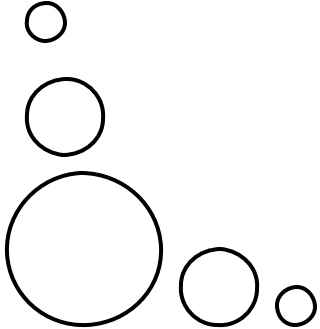
Autotrophs and heterotrophs perform an important role in the transfer of energy through the ecosystem. The energy is trapped at each level and then is either transferred, lost as heat or decomposed.

At Maui Ocean Center, one of the trophic levels is greatly reduced, for a reason. Algae can cause problems in an aquarium, limiting the growth of display species, such as corals and covering windows making viewing difficult. Without autotrophs however, certain chemicals may build up in the aquaria – which major two nutrients do you think these may be and what process are they a product of?

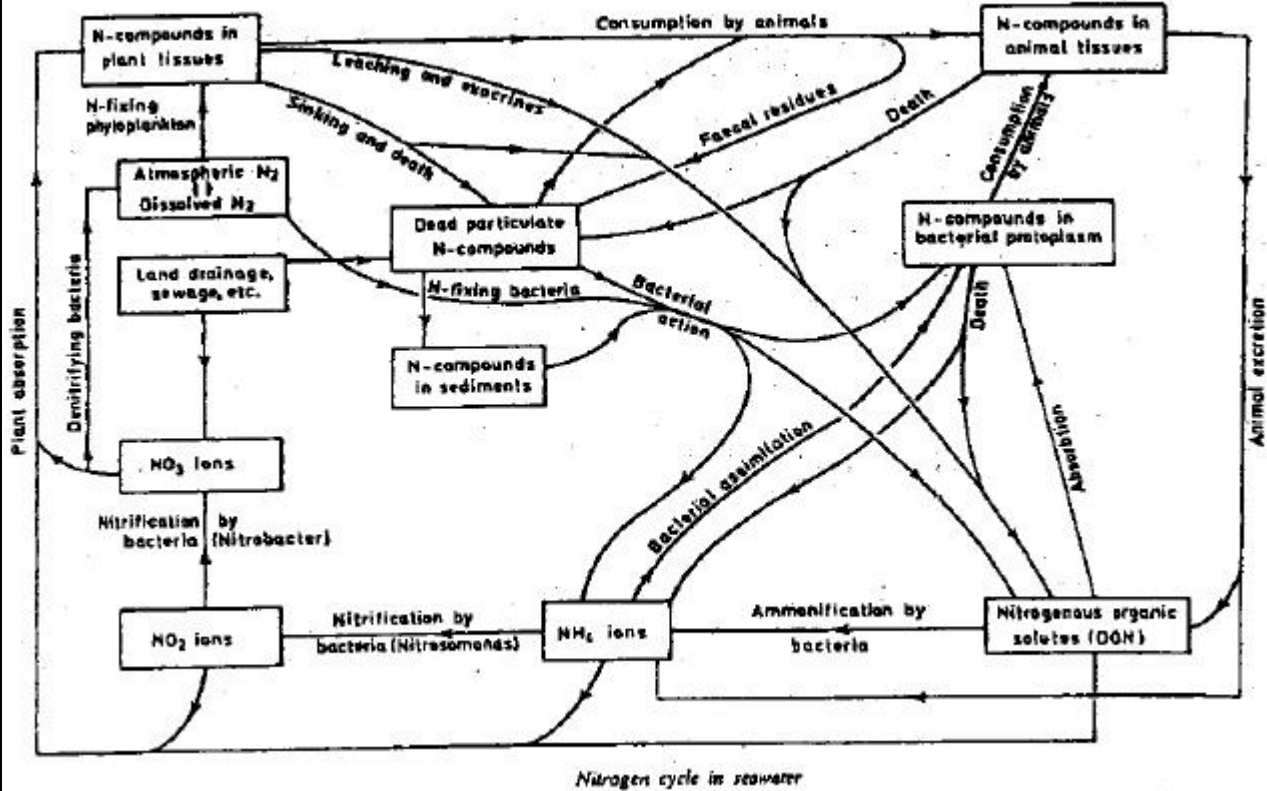
Give two reasons why you think there are limited numbers of autotrophs at Maui Ocean Center.

To substitute for algae, complex biological filtration systems must be maintained. Water from the tank is trickled over **bioballs**. Each bioball has a surface area of 0.27 square feet and is inhabited by bacteria. These bacteria help break down the potentially harmful nutrients.

Visit “Behind the Scenes” at Maui Ocean Center and describe how water is treated at Maui Ocean Center. Is the process simple, or complex? Draw a diagram of the seawater system at Maui Ocean Center.



Use the diagram below to identify the part of the nitrogen cycle for which the animals on your list are responsible.



- Sea lettuce
- Sea hare
- Cauliflower coral
- Orange cup coral
- Ornate butterflyfish
- Tiger shark
- Yellowfin tuna
- Achilles tang
- Spiny lobster
- Humans
- Phytoplankton
- Zooplankton

