



Sea Turtle Energy Pyramid

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You've probably read about sea turtles in the *Conservation Tales* series already. If you have, you know that sea turtles eat fish, squid, shrimp, jellyfish and seagrass. But how much food do these sea turtles need? Based on that, we can also ask questions about how much healthy habitat a sea turtle needs. In this activity, you will make a food web for a sea turtle and estimate the amount of sea grass needed by a green sea turtle.

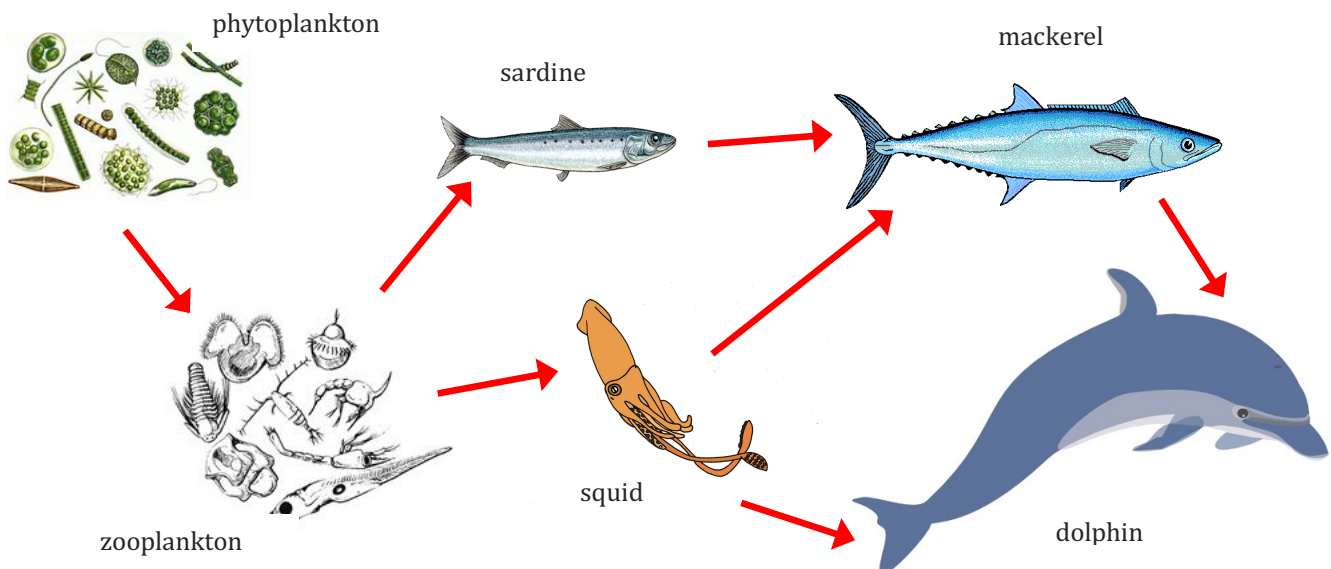
Driving Questions: *How much seagrass does a green sea turtle eat in a year? In its lifetime?*

Objectives:

- I can create a food web of a sea turtle to show how it fits in its ecosystem.
- I can estimate the amount of seagrass needed by a single sea turtle in a year.
- I can explain why we need to protect large areas of marine habitats in order to protect sea turtles.

Food Webs

A food web is a diagram that shows relationships between living things in an ecosystem based on what eats or is eaten by other organisms. The chart usually starts with "producers," organisms that use sunlight (like plants) to make food. The next living things in the food web are those that eat plants, then animals that eat plant eaters, and so on. Arrows show the flow of energy and food matter – they go from the organism that is eaten to the one that eats it. It is called a food web because sometimes more than one organism eats the same thing or is eaten by the same animal. There is a simple food web below as an example.



Green Sea Turtles

The green sea turtle has a unique diet. When they are young, they are mostly carnivorous, eating squid, small fish and jellyfish. But once they reach maturity (at about age 40), they switch diets and become completely herbivorous. For the rest of their lives, they feed only on sea grasses. No other sea turtles eat plants as adults.

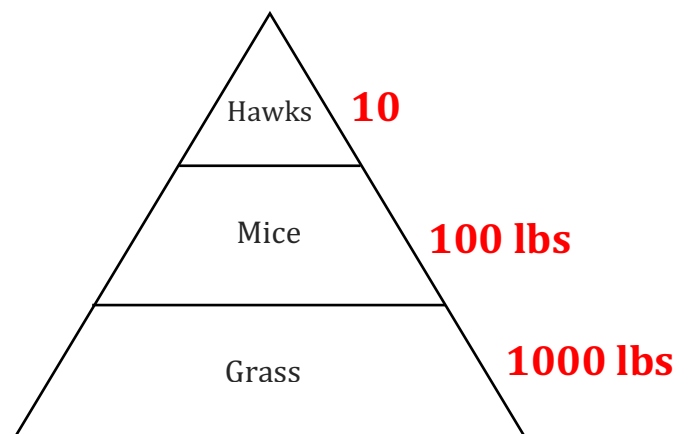


This also makes green turtles very dependent on grass beds as a habitat. Unfortunately, grass beds are shrinking or disappearing. In some places, this may be due to water pollution, but this is also related to the global warming of oceans. As the temperatures change, the types of plants that can live in many different areas is changing. Scientists are concerned that soon there may not be enough sea grass beds for green turtles and other species.

One of the tasks of protecting green turtles is to determine the size of their habitat needed to support the sea turtle population.

Energy Pyramids

Another idea you need to consider is what biologists call the “energy pyramid.” This is a way to show how much plant life animals need in order to survive. This usually is shown in a pyramid shape. The bottom layer of the pyramid includes all the plants. The next row up includes herbivores – the animals that eat plants. The third layer is for carnivores, animals that eat herbivores. If a fourth level is included, those animals eat the animals that eat herbivores.



This model can be used to understand how big each layer needs to be in order to support the living things higher up in the food web. This model follows the “10% Rule.” Each layer can only be 10% ($1/10^{\text{th}}$) of the weight of the organisms in the layer below it.

In this model shown here, we see grass (plants) eaten by mice (herbivore). The mice are eaten by hawks (carnivore.) You can see that in order to support 10 pounds of hawks, they need to be 100 pounds of mice. To support 100 pounds of mice, there needs to be 1000 pounds of grass. This same pattern is seen in all food webs and energy pyramids.

Green Turtle Food Webs

Now it is your turn to draw two food webs – one for an immature green turtle that eats a carnivorous diet, and another for a mature green turtle that eats seagrass.

For each of these food webs, write the names of the green turtle, the organisms in the animals diet described on page 2. Include the animals eaten by the ones sea turtles eat, too. Draw the arrows to show the flow of energy and food matter.

Make sure to complete both food webs.

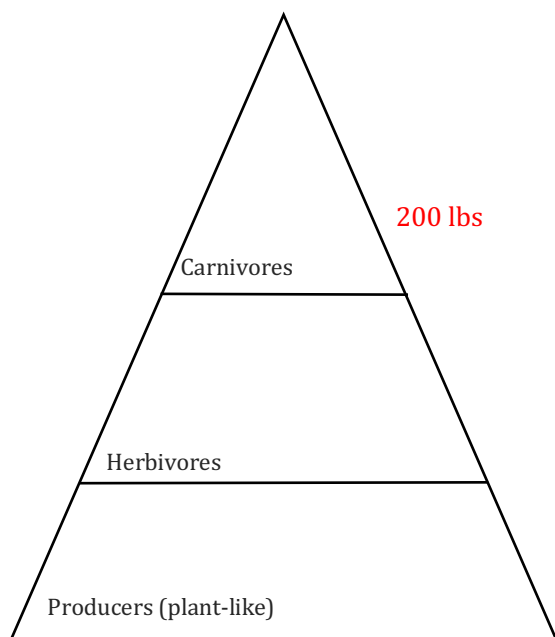
Food Web for Immature Sea Turtle

Food Web for Mature Sea Turtles

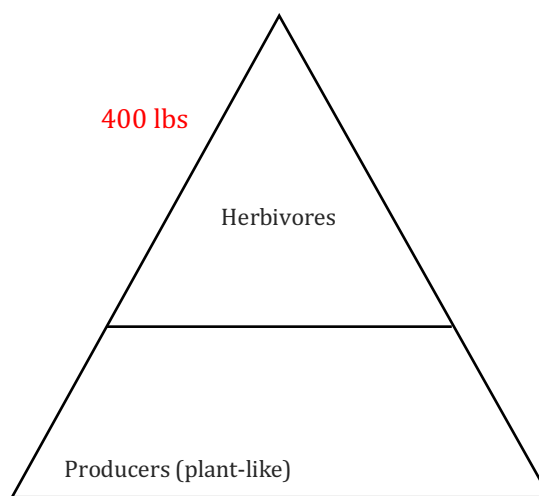
Green Turtle Energy Pyramid

Now use the two food webs you created on page three and fill in the two energy pyramids below. For both, calculate the weight of the plants (or plant-like phytoplankton) needed to support a single sea turtle. (Note: An adult sea turtle weighs about 400 pounds. Use a weight of 200 lbs for the immature sea turtle.) Remember, each level down the pyramid will be 10x larger than the one above it.

*Energy Pyramid for
Immature Green Turtle*



*Energy Pyramid for
Mature Green Turtle*



Noticing Patterns and Making Inferences

1. Seagrasses have a mass of about 20 lbs for every square meter of space. Based on this amount, how many square meters would a sea turtle need to feed on to survive as an adult?
2. Which green turtle, immature or mature, probably needs to travel the farthest each year to find enough food?
3. Seagrass beds are disappearing at an increasing rate. What impact is this likely to have on green turtles?

Thinking Deeper

- a. Seagrasses are declining because of damage from boat traffic, pollution from oils and fertilizers, and warming ocean temperatures.

Do some research on things you can do that would help protect seagrass habitats. You can use the Conservation Tales: Sea Turtles book or search the internet for information.

Then write some suggestions for things you can do at home that might help seagrass habitats.

- b. Do some research to find out what other species feed on or live in seagrasses. How do you think those species are being impacted by the decline of seagrasses?

And how will the actions you wrote about in the answer above help those species?