

# LIFE IN THE FOOD WEB

*Background Information for Educators:*

## SPOTLIGHT ON KEYSTONE SPECIES

A keystone is the stone at the top of an arch that supports the other stones and keeps the whole arch from falling. A keystone species is a species on which the persistence of a large number of other species in the ecosystem depends.

If a keystone species is extirpated (The complete removal of a particular type of organism from an area, usually a specified geographic area.) from a system, the species it supported also will disappear, as will the other dependent species.

Keystone species may be top carnivores that keep prey in check, large herbivores that shape the habitat in which other species live, important plants that support particular insect species that are prey for birds, bats that disperse the seeds of plants, and many other types of organisms.

An example of a keystone predator is the sea otter, which is a keystone in the kelp forest ecosystem. Kelp forests are marine forests of seaweed that provide food and shelter for large numbers of species of fish and shellfish. They also protect coastlines from damaging wave action. Sea otters prey on sea urchins and keep their numbers in check.

If the sea otters are extirpated, large numbers of sea urchins feed heavily on the kelp forests, causing severe declines in the kelp forests and their associated species. Wherever otters have been reintroduced, kelp communities have returned. Ironically, many fishers resent sea otters because they view them as competitors for valuable commercial fish and shellfish, such as abalone. They do not realize that without the otters, the abalone would not have kelp forest habitat.

Keystone species may occur at any level of the ecosystem, from plants and herbivores (plant eaters), to carnivores (meat eaters), and detritivores (waste eaters).

*(excerpt from: <http://www.bagheera.com>. Bagheera is a website focused on endangered species around the world.)*

**Background Information for Educators:**

## Nassau Grouper

Now lets take  
a look at the  
Nassau Grouper

*and its role as a keystone  
species in the Caribbean  
coral reefs.*



# What are Nassau Grouper?



Photo by Stephanie Archer

Normally solitary and territorial, during the winter full moons grouper travel, sometimes over great distances, and “group” together to spawn. About fifty of these spawning aggregations sites have been recorded in different places throughout the Caribbean. Historically, once discovered, grouper aggregation sites have become synonymous with fisherman aggregation sites. Due to the timing and site fidelity of the spawning aggregations and the ease with which these relative loners can be caught while congregating by the hundreds and thousands to spawn, one-third to one-half of the known Caribbean aggregation sites are now inactive. The Cayman Islands used to be home to five Nassau grouper (*Epinephelus striatus*) spawning sites. Today, four of these sites are dormant or depleted. But one site, on the west end of Little Cayman Island, is home to one of the last great reproductive populations of this endangered species.

## Nassau Grouper (*Epinephelus striatus*)

**The Nassau grouper is classified as follows:**

**Kingdom Animal** – all multicellular organisms that ingest their food

**Phylum Chordata** (Vertebrates) – animals with backbones

**Class Actinopterygii** – fish with fins that consist of a web of skin supported by bony spines

**Order Perciformes** – dorsal fins divided into two parts – they are spiny in the front and soft in the back

**Family Serranidae** – all groupers and seabasses

**Genus Epinephelus** – large sized groupers

**Species striatus** – striped body coloration

# How does the Nassau Grouper function as a keystone species?

It is ecologically important as a **predator** on the reef helping to keep the population of reef fish in check. The health of the reef is dependent on the delicate balance between herbivores, which feed on algae, and organisms that feed on coral and carnivorous predators.

## Diet

**Juvenile Nassau grouper:** Amphipods, isopods, small fish

**Adult Nassau grouper:** Shrimp, crabs, octopus, a variety of reef fish

*(Excerpts pulled from [www.REEF.org](http://www.REEF.org) and [www.BREEF.org](http://www.BREEF.org))*

## FOOD WEB GAMES

According to Wikipedia: A food web (or food cycle) depicts feeding connections (what eats what) in an **ecological community**. Scientists can organize these different living things into categories called “trophic levels.” Trophic levels are the feeding positions in a food chain such as primary producers, herbivore, primary carnivore, etc. Green plants form the first trophic level, the producers. Herbivores form the second trophic level, while carnivores form the third and the fourth trophic levels.

(<http://www.bcb.uwc.ac.za/>)

**FOOD WEB CARDS:** We have created cards for many different coral reef animals. Each card will show their particular trophic level and the role they play in the food web:

**Tertiary Consumer:** Top-level carnivores, eaters of other carnivores

**Secondary Consumers:** Carnivores-eaters of herbivores

**Primary Consumers:** Herbivores, eaters of primary producers

**Primary Producers:** Photosynthesizers, plankton, algae, etc.



# FOOD CHAINS

**STEP 1:** Pass out a card to each student in random order. Explain, “Each of you will now get a card with a coral reef animal on it. Read it over so you understand where you exist in the food web. Figure out “Who eats you?” and “Who you eat?”.

**STEP 2. Species Introduction.** Go around the room and have each student introduce their particular species to the group, explaining: what species they are, what they eat, and who eat them.

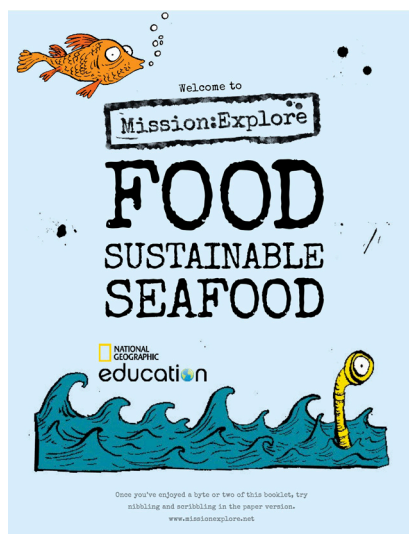
**STEP 3. Food Chains.** Next, have students walk around the room (I usually do this activity in a contained area, like our Meeting Rug) and look for other species that they are connected to through the food chain. Students need to put themselves into groups of three or four, representing each level of the food chain. They must do this without speaking, simply by going from person to person and reading each other’s cards. I give the students about 5 minutes to complete this task. Once they are done, each group introduces the 3-4 organisms in their food chain and how they are connected. Once you have done this, you can have them rearrange themselves into new food chains, illustrating the many connections that exist among the different marine species.

Collect the cards and have a quick discussion about the food chain activity. What did they notice? How many people or marine organisms did they find that they were connected to? Finish by asking if anyone can describe the difference between a food chain and a food web?

A food web consists of all the food chains in a single ecosystem. Each living thing in an ecosystem is part of multiple food chains. Each food chain is one possible path that energy and nutrients may take as they move through the ecosystem. All of the interconnected and overlapping food chains in an ecosystem make up a food web. ([www.education.nationalgeographic.com](http://www.education.nationalgeographic.com))

**Extension Activity:** The National Geographic’s education website has a wonderful slide show illustrating the difference between a food chain and a food web. It also covers many of the vocabulary introduced in this activity. See the following link:

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



# FOOD WEB GAME

**MATERIALS:** Marine Organism Cards, ball of yarn

**STEP 1:** Stand in a circle facing each other. The teacher will stand in the middle with a ball of yarn.

**STEP 2:** Begin the activity by handing the end of the ball of yarn to the asking for someone who is at the bottom of the food chain. “What organism can receive the sun’s energy...who is a Primary Producer or a plant?”

**STEP 3:** The teacher then selects a person and carries the ball of yarn to the plant person and have them hold the yarn very tight, showing the transfer of sun’s energy.

Ask them to keep ahold of their part of the string with one hand or a couple of fingers, but not with both hands or they will dampen the effects of the tugging later on in the game.

**STEP 4:** The teacher then asks: “who could eat the plant?” The herbivores around the circle will raise their hands yarn to that student. Don’t go around in a circle with the string. Let anyone yell out an answer and the more times you go across the middle with the string the better! The teacher will help with passing the yarn back and forth to each person. You will probably need to explain that if a participant is already holding onto the string, they don’t need to call out an animal/plant since they are already one. Ask them to remember which one they were! Once you have selected all the top predators the food web is complete.

## Giving the Message:

Once you have the web completed, the teacher will climb your way out of the middle. Ask everyone to make sure there is no slack in their sections of yarn. Pick one animal that was mentioned (hopefully they will remember which one they were) and pose a question like: “What would happen if one of these organisms disappeared? Well, let’s see!” Ask the example animal participant to tug on their piece of string (sometimes a hard tug is necessary, but not too hard!). Then ask that whoever felt the tug to raise their hands. Ask those with raised hands what animals they were. Ask them if they ever imagined if Animal A and Animal B were so closely linked. You can go around the circle and pick some other animals/plants and ask them to tug, too. Then pick one final animal, the Nassau Grouper, and say it went extinct! Ask that person to drop the string and ask someone to describe what happened to the food web (It collapsed!).

## To Conclude:

Ask everyone to drop their piece of string and take one step back. As you are balling up and untangling the web, start a brief discussion on why food webs are important and how each species has its own place in the web.

**Extension Activity:** As a class you can create a coral reef mural on a wall in the classroom. Students can become experts on their particular food web card organism. Each student can create an illustration of their organism that includes a few interesting facts. The illustrations can be placed on the mural with lines or yarn connecting them all, representing the food web.