National Marine Mammal Foundation
Food Web Activity

Focus: What are the roles played by plants, animals, and other organisms in marine food webs off the west coast?

Key Words:
FOOD CHAIN - transfer of energy in sequence, for example, from green plants, to animals that eat plants, to animals that eat other animals.
FOOD WEB – a network of food chains that are interconnected within a particular **COMMUNITY** - shows how energy moves throughout an ecosystem, more complicated than a food chain.
PRIMARY PRODUCERS – make their own food (i.e. phytoplankton, diatoms, plants)
PRIMARY CONSUMERS – eat the primary producers (cannot make food for themselves). These are typically herbivores (i.e. crabs, copepods, krill, urchins)
SECONDARY CONSUMERS - Organism that feeds on primary consumers (herbivores) to obtain energy and occupies the third trophic level of the food chain.
TERTIARY CONSUMERS- A carnivore or omnivore that occupies the fourth trophic level of the food chain, feeding primarily on primary and secondary consumers.

Key Words to Consider for Older Groups:
BOTTOM-UP CONTROL –when changes in an ecosystem spread from the primary consumers upward (more plankton = more fish)
TOP-DOWN CONTROL – when changes in an ecosystem occur at the top and move downward (less whales = more fish = less phytoplankton, small fish.
WASP-WAIT ECOSYSTEM - In wasp-waist ecosystems, there are a large number of species of primary producers and carnivores, but only a few species of secondary consumers. The important secondary consumers in this ecosystem are small fishes, such as sardine and anchovy. Since there are few other secondary consumers, changes in the abundance of sardine and anchovy can have a large effect on both the organisms that they eat and their predators.

Instructions:

1.Presentation

- Introduce students to new vocabulary words related to the different roles that species play in food webs.
    i. To help students learn this vocabulary, images of plants, animals, and fungi that play different roles in **terrestrial** food webs are included in the presentation. These terrestrial organisms will likely be more familiar to students than sea creatures. ***Remember, the key is tofocusonthevocabulary,notwhatorganismseat what***
- Once students have mastered the new vocabulary, the teacher should provide a brief overview of food webs and how they differ from food chains.

2. Students line up to select their species card from a pile.
   In this Southern Resident killer whale example, there will be the following organisms in our web:

   -Plankton (plankton eat diatoms & phytoplankton, which make energy from the sun)
   -Herring
   -Salmon
   -Killer Whale

   After choosing their species cards, students stand in a circle where they read off the name of their species and tell the class what their species eats.

3. The ball of string starts at the bottom of the food chain and works its way up. The string is cut and another chain is started until everyone is holding a string.

4. The leader describes several scenarios where one organism increases or decreases in abundance. If an organism increases in abundance, the student playing this organism raises their hand. A decrease in abundance is symbolized by a student sitting down. If an organism increases in abundance, its prey will become less abundant, which is indicated by the students who play prey species sitting down. Predators of the more abundant species will also increase in abundance. Students playing predators should raise their hand. This chain of reactions will then affect the prey's prey and the predator's predators. At the end of each scenario, the majority of students will be either raising their hands or sitting down to indicate how their abundance has changed.

***Here is a partial list of scenarios that the group should try acting out. Start with some basics but then, especially for older students, try to make them think a bit..**

- ○Whathappens if there is a big rainstorm and a bunch of agricultural chemicals from runoff get washed into the waterways? (Answer: all animals affected in different ways. Talk about biomagnification)
- ○ What happens if fishermen catch almost all of the salmon? (Answer: the salmon disappear and there is a break in the web)
- ○ What happens if ocean temperatures become too cold for herring causing them to decrease in abundance? (Answer: the herring disappear, the salmon will eventually disappear and so will the whales)
- ○ What happens if a dam is built, blocking salmon hatchery routes? (Salmon need specific conditions to lay their eggs - if they cannot get to nesting grounds, numbers will decrease).
- ○ What happens if there is an influx in diatoms/plankton due to a rainstorm that brings fertilizer into the ocean? - diatoms/plankton increase and draw out the oxygen from the water (making it **anoxic**)
- ○ What happens if salmon decrease in abundance, while herring increases in abundance? (Wasp-wait system: there are a large number of species of primary producers and carnivores, but only a few species of secondary consumers. The important secondary consumers in this ecosystem are small fishes, such as sardine and anchovy. Since there are few other secondary consumers, changes in the abundance of sardine and anchovy can have a large effect on both the organisms that they eat and their predators.)
- ○ What would happen if the whales disappeared? (Top-Down Control: when changes in an ecosystem occur at the top and move downward (less whales = more fish = less phytoplankton, small fish).

5. If there is time:
   - ○ Describe what role your organism played in the marine food web.
   - ○ Why are humans important to include in the marine food web?
   - ○ An example. In the 1930s, the largest fishery in California was for sardine. However, during the following decades, sardine became much rarer due to changes in ocean temperature and because too many sardine were caught by fishermen. At the same time that sardine became less abundant, anchovy, another species of small fish, increased in abundance. Based on the activity that you did today, how do you think

these changes in sardine and anchovy will affect other organisms in the ocean food web?