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Science Unit: *Pacific Salmon and their Environment*

Lesson 15: *Predators and Prey Mystery Box*

Summary: This activity is a fun and dramatic way for students to **visualize** the **relative sizes** of a variety of **marine predators and prey**. Students each take a turn pulling a length of string from a pre-prepared “mystery box” (the length of the string pulled from the box between labels represents the actual length of an animal, e.g., a harbor seal is 1.5 metres long). During the activity, each animal’s role in **marine food webs** is discussed.

School Year: 2014/2015

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Grade level: Presented to grade K-2; appropriate for grades 1-4

Duration of lesson: 1 hour and 20 minutes

Notes: A large room is useful for the first part of this unit.

Objectives

1. Students will learn the size of marine predators and their prey.
2. Students will learn how to describe a simple marine food web and the importance of each organism within it to the others (feeding relationships).

Background Information

Organisms in a community are linked through what they eat and what eats them. A food chain is a single pathway connecting a producer with several levels of consumers. The feeding relationships in an ecosystem consist of many food chains interconnected into a network called a food web. The ocean is such a vast place that it has a very complex food web. Each level is dependent on the organisms below as their food sources. Sometimes when issues such as oil spills or overfishing occur, it can destroy entire populations of fish or other species. In this way, the predators of those creatures are directly affected, since they now have less food to eat. With less food, the predators can go hungry and fall ill or die. On the other hand, the prey of those same creatures may flourish since they are not being eaten, and then start overpopulating. Even this is actually a bad thing, since overpopulation can cause several other problems.

An example of one simple marine food chain can be divided into levels. Large Predators, the most powerful and strongest creatures exist at the top-most level of the ocean’s food chain. These include killer whales and sharks. They often feed upon large prey like salmon or squid. The next level usually has creatures that mostly feed on small fish, like large fish (salmon) and large squid and octopus. Thus a fish like salmon is both a predator and prey. Then come the small fish like herring and sardine that themselves consume zooplankton. At the very base of the food chain are a collection of plants and very tiny organisms called phytoplankton. They may seem quite insignificant, but their purpose is quite the opposite. The entire food chain depends on these plants and phytoplankton. They help to transform the sun’s light into food for zooplankton and other small herbivorous fish. Large whales like the blue whale are part of a simpler food chain. They mainly eat large shrimp-like animal plankton (zooplankton) called krill that swarm in vast numbers in productive oceans.



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Vocabulary

Predator: An animal that naturally hunts and eats other animals

Prey: An animal that is hunted and killed by another for food

Food chain: One set of linkages in an ecosystem, in which each link feeds on the one before it and is fed on by the one after it.

Food web: A whole system of organisms related by a network of predator-prey links (who eats who) – i.e., a network of many food chains.

Marine mammal: Mammal species that depend on the sea include whales, dolphins and porpoise (cetaceans), as well as seals, sea lions, fur seals and walrus (pinnipeds). Sea otters, polar bears, manatees are also considered marine mammals.

Plankton: Plankton are microscopic organisms that float freely with oceanic currents and in other bodies of water. Plankton is made up of microscopic plants (called phytoplankton) and very small animals (called zooplankton).

Materials

- Shoe box
- Roll of string (50m)
- Labels and pen
- Wooden spoon
- Scissors
- Computer/speaker

In the Classroom

Introductory Discussion

1. Short description of 'hook' to capture student's attention.

Bring out the decorated 'Marine mammal mystery box'. Ask who knows what the largest animal is? How long is it and what does it eat (let students call out answers). How big is a killer whale? What does it eat? How big is a giant squid? What does it eat? Who eats it?

Explain today the class is going to find out how big different ocean creatures grow to be - using the 'Marine mammal mystery box'. Then explain the class will learn how different marine predators find and eat their prey – who eats who – and how they are all linked together in a marine food web.

2. Remind students what a predator is and what prey is.

3. Briefly describe the processes of science that the students will focus on:

Students will observe the size of marine animals from krill to blue whale using the 'Marine mammal mystery box'

Students will learn about marine predators and how they find (using senses, sounds and skills) and eat (using specialized dentition) their prey - using slide images, descriptions and sound clips (presented using a computer and the white board).

Students will as a group highlight their understanding of predator-prey linkages by creating a simple marine food web. Students will broaden their understanding of the food web created by predicting what would happen if certain parts of the food web disappeared.



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Science Activity

Activity Title: Marine Mammal Mystery Box – Predators and their Prey

Purpose of Activity:

To learn the size of marine animals from krill to blue whale, learn how marine predators find and eat their prey and as a class create then discuss a simple marine food web.

Set-up prior to experiment:

Prepare the 'Marine mammal mystery box' and presentation of computer material (images and sounds), using speakers and white board.

1. Marine mammal mystery box preparation:
 - a. Attach labels onto spool of string, rewind and place in shoebox using a wooden spoon as a spindle.
 - b. Two holes are cut in side to allow spindle to rotate and one to allow labels to exit from the front of the box.
 - c. 20 sticky labels are added to the correct length of string as follows (the number of labels can be increased depending on class size (i.e., enough for each student)):
Plant plankton (0.1cm), Krill (5cm), herring (25cm), pink salmon (50cm), sockeye salmon (58cm), chinook salmon (100cm or 1m), Harbour seal (1.5m), Porpoise (1.6m) Dr. Dom (1.8m, name and the height of the scientist), California sea lion (2.4m), Dolphin (2.5m) Steller sea lion (3m), Giant octopus (5m), Elephant seals (6m) White shark (6.5m), Killer whale (8m male), whale shark (12m), Giant squid (13m max), Humpback whale (14m), blue whale (31m), HALF a giant redwood (50m).
2. Computer material (images and sounds) preparation: Pictures of the following ideally in a powerpoint format. Slide 1 (plankton - phytoplankton and zooplankton), Slide 2 (shoal of herring and adult salmon) Slide 3 (head/teeth of dolphins, killer whales and sperm whales), Slide 4 (head/teeth and whiskers of seals), Slide 5 (beak and suckers of giant squid), Slide 6 (head and baleen of large whale), Slide 7 (teeth of different sharks and whale shark with mouth open feeding), Slide 8 (blank simple food web – see below), Slide 9 (Humpback whale bubble net feeding).
3. Pictures are easily found on the web or on request to this unit's program scientist via SRP program contact.
4. Sound clips of marine mammals and vessels from NOAA or Discovery of Sounds in the Sea web sites which both have sound clips available to download
<http://www.nefsc.noaa.gov/psb/acoustics/sounds.html> or
<http://www.dosits.org/audio/agsummary/>

Methods and Instructions:

1. Before the Activity:

A large room is ideal for the first part of the activity. Set up Marine mammal mystery box and computer/speakers and white board ready to play material in class. Ask students to line up against left hand wall. Explain that students will come up to the box one at a time and each pull out the string till they reach a label.



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2. Mystery Box Activity:

- a. Remind the students we are going to learn about the size of different marine creatures. (Remind class 100cm in 1 m.)
- b. Hold the marine mammal mystery box (box with 50m of string) and stand in middle of room, left side to the line of students. Have the first student come up to pull the string out and read out first label (name of animal and it's length), they then stand on your right (you repeat and introduce relevant information about the animal provided in brackets below). The next student comes up, pulls out the next label and reads the label. The first student has to move up to let the next one stand next to them. They continue to hold the string and label.
- c. Repeat sequentially, until the line of students reaches the right wall and circles around the side of the room in front of you. Remember that it will end up being 50m in length and go around the room and more.

Brief discussion about each as follows:

- Plant plankton (0cm, use the sun's energy to make food, eaten by zooplankton)
- Krill (5cm, a type of zooplankton eaten by whales and fish)
- Herring (25cm, a fish that eats zooplankton)
- Pink salmon (50cm, adults eat young herring, so salmon both a predator and prey then)
- Sockeye salmon (58cm)
- Chinook salmon (100cm or 1m)
- Harbour seal (1.5m, predator eats herring, small squid and octopus and salmon, uses whiskers and eyes to find food, predator)
- Porpoise (1.6m, eats herring and salmon, uses clicks sounds like bats to find prey and find its way)
- Dr. Dom (the height of the scientist 1.8m, predator eats herring and salmon)
- California sea lion (2.4m, predator eats herring, small squid and octopus and salmon)
- Dolphin (2.5m, predator eats herring, small squid and octopus and salmon, also uses clicks to find prey)
- Steller sea lion (3m, large male, predator eats herring, small squid and octopus and salmon)
- Giant octopus (5m max, predator eats herring and salmon)
- Elephant seals (6m, large male, largest seal in the world, predator eats squid and fish)
- White shark (6.5m, predator eats squid, fish and marine mammals, uses sense of smell and detecting electrical signals from prey to find prey)
- Killer whale (8m male max, females smaller, eats fish and marine mammals and sharks)
- Whale shark (12m, largest fish in the world but eats only plankton)
- Giant squid (13m max, eats fish)
- Humpback whale (14m, eats small fish and krill)
- Sperm whale (16m, largest predator – eats giant squid)
- Blue whale (31m, largest animal on planet; eats mainly krill, some small fish, uses sounds to communicate 100s even 1000s of km)
- HALF a giant redwood (they get to be 110m tall, so twice as big as this string and more. They are one of the largest living things in the world – but a large underground fungus found in the USA which covers multiple city blocks is now thought to be the largest!).



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2. Clear up the box material and move back to the class to present the computer material.
 - a. Show the students pictures of phytoplankton and zooplankton, including krill. Remind the students of the importance of sun and phytoplankton in starting every marine food chain. Discuss what eats plankton.
 - b. Show a shoal of herring (herring eat zooplankton and shoaling is used to confuse predators) and adult salmon (predators of herring and prey to dolphins and seals). Discuss what eats small and large fish.
 - c. Show teeth of dolphins (remind students that these species are predators on smaller fish and squid), killer whales (top predators eating either fish or marine mammals, including porpoise, seals, sharks and even young whales) and sperm whales (deep divers for giant squid).
 - d. Show teeth and whiskers of seals (predators that use mainly whiskers and eyes to find prey). Discuss what seals eat and what eats them (killer whales and sharks).
 - e. Show the beak and suckers of a giant squid and how they are used to capture and eat prey.
 - f. Show teeth of different predatory sharks and explain the largest shark - whale shark – eat only plankton and are harmless. Remind the students how few shark attacks there are each year on humans – we are not their natural prey. Discuss what their natural prey is (fish and marine mammals).
 - g. Show the students pictures of whale baleen and discuss how baleen is used - like a comb - to filter out krill. Whales need to find special places where the krill is found in large swarms.
 - h. Display the blank simple marine food web - that has at the bottom of the page plant plankton and animal plankton (krill), in the middle small fish and large fish, to one side squid and blue whale and seal on the other. Have killer whale at the top (see the figure below). Starting with phytoplankton ask students what animals eat them (zooplankton, also very small fish). Use the white board to draw an arrow from phytoplankton to zooplankton and phytoplankton to small fish. Then move to zooplankton and ask again what eats them. Draw the arrows to small fish and blue whales. Then move to large fish, then to the other predators, letting the students draw in the right arrows. Repeat the process for all the other animals. Explain that the network of arrows they have created is called a food web and explain one or two examples of a food chain (e.g., dolphin eat salmon which eat herring which eat zooplankton which eat phytoplankton).
 - i. Discuss how all the animals are linked together. Cover up or rub out the large fish and ask what would happen if we fished so much there were no more large fish (top predators would starve, small fish numbers would increase). Cover up phytoplankton and ask the same question (no food for anything!).
 - j. Brainstorm what the students think marine mammals use to find and capture their prey. Write down the suggestions and help as necessary (sounds, whiskers, eyes, baleen, teeth, ramming them with their heads, hitting them with their fins). Explain many dolphins and killer whales use sound in a special way to aid them in finding and capturing food.



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They do this by producing sounds that are reflected back when they strike an object. This is called echolocation. Echolocation is important to marine mammals because it allows them to navigate and feed in the dark at night and in deep or murky water where it is not easy to see. Bats are the only other mammals known to use echolocation for feeding. Play echolocation sounds from killer whales.

- k. Explain sound is also used for communication, to maintain contact between mother and offspring, for the groups of animals to hunt well together, to defend territory, to find a mate and for protection from predators. Play sounds of Fin whales communicating, male Humpback whales attracting a mate, as well as Harp seals and Weddell seals. Play the noise of a container vessel and ask students whether they think it would be harder to hunt and communicate if vessel noise was continuous. Highlight that scientists are very concerned about how noise from boats as well as noise used to find oil disturbs marine mammals.
- l. End the unit by describing one of the most incredible forms of whale feeding behavior – known as bubble net feeding – a technique to capture prey that uses brains and sounds. Explain Humpback whales have developed a feeding technique called bubble net feeding. Bubble net feeding involves one or a few whales blowing air from their blowhole while underwater. This produces sound as the bubbles form a cloud, curtain, or column that rises toward the surface. A bubble net is formed when the bubbles emitted by a circling whales form a ring and concentrate prey like herring inside. The bubbles trap the prey and when the fish are close to the surface, multiple whales, sometimes 5-6 at once, and capture the fish by opening their mouths wide and coming out of the water in the area surrounded by the bubble net – whole shoals of herring get gulped up in one big mouthful!

Closure Discussion

- Discuss how everything in the ocean is interlinked and in balance.
- Remind the students how we need to keep healthy populations of both prey and predators. Remind them how important fish is to much of the world's population, including Canada.
- Remind them things like pollution and global warming can effect that balance, as well as overfishing or killing too many top predators like sharks.

References

This is the Sea that Feeds Us. Robert Baldwin and Don Dyen. Barnes and Noble.

Extension of Lesson Plan

Draw a humpback whale using a bubble net to catch fish.
Complete an 'I learnt in class today' worksheet.



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SIMPLE FOOD WEB

KILLER WHALE

SQUID

SEAL

BIG FISH

BLUE WHALE

SMALL FISH

KRILL – ANIMAL PLANKTON

PLANT PLANKTON
