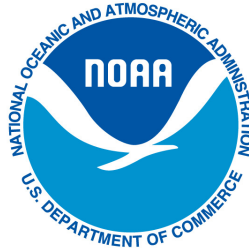


KIDS ENVIRONMENTAL LESSON PLANS

This lesson plan developed by:



Whale Jenga Food Web Game

Overview:

A fun, interactive game of Jenga that demonstrates the relationship between the trophic levels of the marine food web and the potential impact humans have on that food web.

Ocean Literacy Principles:

5. The ocean supports a great diversity of life and ecosystems
6. The ocean and humans are inextricably interconnected
7. The ocean is largely unexplored

Key Concepts:

- Small changes in food web can have dramatic impacts even though ocean seems so vast
- Tiny marine organisms are critically important to creatures higher up in the food web

Materials:

- 1 set of Jenga blocks
 - 21 colored green blocks (phytoplankton)
 - 12 colored blue blocks (zooplankton)
 - 12 red blocks (krill and small fish)
 - 1 purple block (whales)
- 1 stack of playing cards
- informational whale cards

Set-up Prior to Activity:

- Color the ends of the Jenga blocks as specified above
- Write the name of the organisms on the sides of the blocks to match

Whale Jenga Food Web (cont.)

- Print out playing cards and informational whale cards
- Print whale food web card

Duration:

20-30 minutes (or more if the students want to keep playing)

Physical Activity:

Moderate

Background:

Baleen whales feed on crustaceans such as amphipods, copepods, and krill, as well as small fish. With changes in ocean temperature, upwelling, acidification and other urban influences, whales can be impacted through the food web. This game demonstrates the relationship between the trophic levels of a food web in the ocean and the potential impact of humans on that food web. Everything is connected. If the balance on one level is disturbed too much by climate change, the other levels will be affected and potentially the food web will collapse.

Vocabulary:

- **adaptation:** the modification of characteristics of a species of organism over time to adjust to a new condition
- **baleen:** fibrous plates made from keratin that hang from the roof of baleen whales' mouths used for filtering food from the water. Baleen whales are classified as *Mystecets* as they feed with baleen not teeth
- **climate change:** a significant and persistent change in the mean state of the climate or its variability. Climate change occurs in response to changes in some aspect of Earth's environment: these include regular changes in Earth's orbit about the sun, rearrangement of continents through plate tectonic motions, or anthropogenic modification of the atmosphere
- **crustaceans:** invertebrates in the phylum Arthropoda, with jointed legs, exoskeleton, jaws, gills, and two pairs of antennae; examples: krill, amphipods, and copepods
- **endangered species:** an animal or plant at risk of becoming extinct as a result of overharvesting, habitat destruction, or other causes
- **filter-feeder:** an animal that eats small particles of food from water bypassing the water through a filtering structure
- **food web:** all the interactions of predator and prey, along with the flow of nutrients into and out of the ecosystem; how energy is converted and passed from one organism to another
- **invasive species:** introduced organisms that are not endemic to the area and are able to outcompete for resources
- **krill:** small shrimp-like belonging to the family *Euphasiidae*. Krill feed on phytoplankton and some tiny zooplankton and are important food source for whales and many other marine animals.
- **migrate:** pass periodically from one region to another for purpose of feeding or breeding

Whale Jenga Food Web (cont.)



- **plankton:** floating or weakly swimming organisms that move with the currents in all natural waters; can be photosynthetic (phytoplankton) or animals (zooplankton)
- **plankton bloom:** high concentration of phytoplankton in an area due to increased reproduction rates
- **pollution:** contamination of water, soil and/or air from the discharge of wastes, gases or chemicals
- **salinity:** the concentration of dissolved minerals, including salts, in the water
- **upwelling:** the rise of nutrient-rich waters from deeper areas of the ocean to the surface of the sea
- **urban runoff:** water containing pollutants (oil, grease from leaking cars, soaps, pesticides from gardens, animal waste, street debris) which washes into storm drains and rivers and gets carried out to the ocean

Activity:

Game Set Up

1. Place three green blocks side by side with pictures facing out. Place three more green blocks on top of the first layer crossways. Continue to stack green blocks this way until all are used up.
2. Stack blue followed by red blocks on top of the green base until all blocks are used up.
3. Place the purple block on the very top. The stacked up blocks represent the food web for Baleen whales in the ocean.
4. Shuffle the playing cards and stack them upside-down.
5. Ask the following engaging questions:
 - If the ocean is so large, why do small changes make a difference?
 - How can something as large as a whale be impacted by changes in the ocean?
6. Explain to the students that this game is a representation of how changes can impact the stability of a whole system. Prior to the game introduce vocabulary to ensure understanding of terminology used on the cards.

Playing the game:

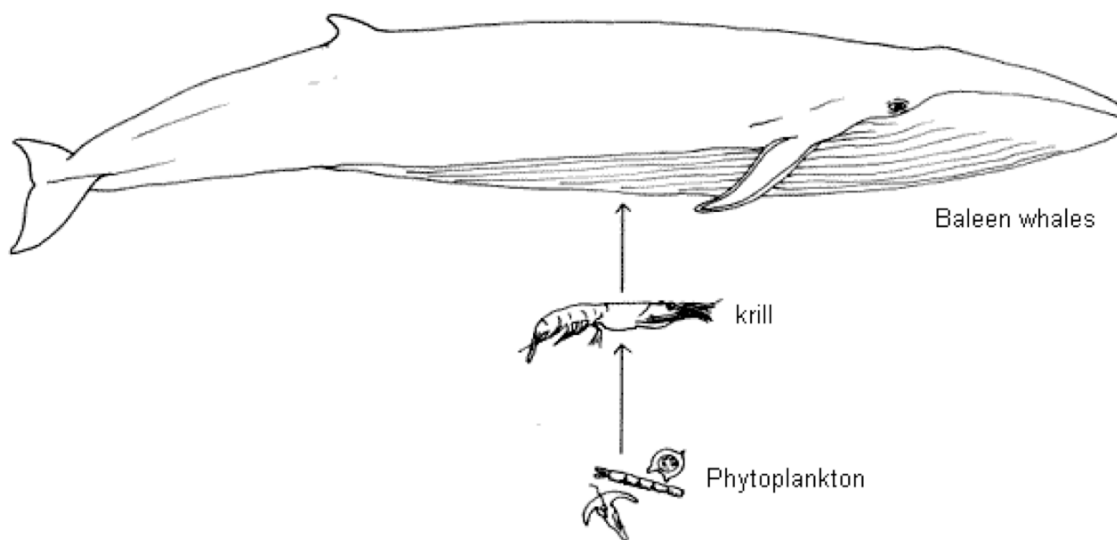
1. The first player picks a card, reads it aloud and follows the instructions written on the card. Only the block being removed or returned may be touched. (You are not allowed to hold the rest of the stack together while removing the blocks.)
2. Put the used cards into a discard pile.
3. Place removed wood blocks into a discard pile off to the side.
4. Continue to take turns until the tower falls and the food web collapses or all cards are used up.
5. Reset to play again using the directions above.

Discussion:

1. What surprised you in playing this game?
2. What did you discover about human influences on the environment?
3. What questions would you like to investigate further?

Extension:

1. Create additional cards for the game
2. Look for local impacts on the ocean that could influence this food web and find solutions you can facilitate
3. Create another food web and cards



The secret of the success of the baleen whales is this simple food chain - keep the chain short and transfer as much energy as possible as efficiently as possible. (From coolantartica.com)

Plankton: organisms that live in the top layers of water whether sea, lake, river, stream etc. Plankton are at the mercy of the currents and movement of the water. Some plankton dwellers can move about within the water column, up and down, but generally drift where the tides and currents take them.

Phytoplankton: *Phyto* - plant, *Plankton* - see above. These are the tiny plants that capture the energy of the sun and turn it into food, these are the *Producers* of the Antarctic food web.

Zooplankton; *Zoo* - animal, *Plankton* - see above. These are the tiny (and not so tiny) animals that feed directly on the phytoplankton

Whale Jenga Food Web (cont.)



<p>Explosion in population of invasive filter feeding invertebrates consume too much zooplankton.</p> <p>Remove 1 blue block.</p>	<p>Harmful algal blooms creates toxin.</p> <p>Remove 1 blue and 1 red block.</p>
<p>Bacteria decomposing algae following a bloom pull oxygen from ocean water.</p> <p>Remove 1 blue and 1 red block.</p>	<p>Changes in ocean currents, disperses phytoplankton.</p> <p>Remove 2 green blocks.</p>
<p>Increase in atmospheric carbon dioxide (CO₂) leads to increased ocean acidification.</p> <p>Remove 2 red blocks.</p>	<p>Successful beach clean-up reduces near shore blooms.</p> <p>Put back 1 blue block.</p>
<p>Sunlight reaching ocean increases.</p> <p>Put back 1 green block.</p>	<p>Pollution through storm drains increased with storms.</p> <p>Remove 1 green and 1 blue block.</p>



Whale Jenga Food Web (cont.)

<p>Chemical spill in watershed.</p> <p>Remove 1 green, 1 blue and 1 red block.</p>	<p>Layer of smog reduces sun reaching ocean.</p> <p>Remove 1 green block.</p>
<p>Oil spill in harbor.</p> <p>Remove 1 green, 1 blue and 1 red block.</p>	<p>Increase in ocean temperature leads to smaller phytoplankton, unsuitable as food for zooplankton.</p> <p>Remove 1 blue and 1 red block.</p>
<p>Whales leave the area.</p> <p>Put back 1 red block.</p>	<p>Blue whales remain in area longer than usual.</p> <p>Remove 1 red block.</p>
<p>Changes in ocean currents decrease upwelling.</p> <p>Remove 1 blue block.</p>	<p>Rise in ocean temperature.</p> <p>Remove 1 green, 1 blue and 1 red block.</p>



Whale Jenga Food Web (cont.)

<p>Rainwater influx into ocean reduces the concentration of phytoplankton.</p> <p>Remove 2 green blocks.</p>	<p>Introduction of invasive zooplankton reduces the number of phytoplankton.</p> <p>Remove 1 green block and put back 1 blue block.</p>
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