

Bioaccumulation

Roleplay Game

KNOWLEDGE

- Students gain understanding of food chain concept and be able to classify the feeding roles of different organisms found in aquatic ecosystems
- Able to identify different organisms found in aquatic ecosystems; sensitivity of ecosystem with interconnections and understand ripple effect = continuing or spreading results of actions
- Effect humans are having on Ocean systems through litter and pollution, and how in turn may be harmful to humans as it moves up the food chain; possible solutions
- Made aware of fish consumption advisories

ACTIVE

- ☐ Concept of food chain illustrated in game

TIME	GROUP SIZE	LOCATION	GRADE LEVEL	EQUIPMENT
35 – 40 minutes	10+	Classroom or Outdoor weather dependent	Any	Poker chips Plastic cups Life cards
DEBRIEF/REFLECTIVE COMPONENT			HELPFUL TIPS	
<ul style="list-style-type: none"> • Recap game, explain stages of food chain. • Tell students that some type of phytoplankton are actually toxic; red chip=red tide • See how bioaccumulation works by using white board to break into 3 columns: organism, # of red chips, # of total poker chips 			<ul style="list-style-type: none"> • Ask students to distribute materials while lesson is presented so game is ready to play soon after lesson complete 	

- Average amount of red chips/feeding level; point out to campers that as we move up through food chain, so does amount of toxin/chemical
- What happens as we move up food chain (increase), what do we call this (bioaccumulation); discuss human relationship; conclusions of fish consumption advisories.

- Ask students to read their life cards, and if gameplay gets too rowdy, ask students how much they can eat according to life card

OCEAN LITERACY PRINCIPLES

5 – The ocean supports a great diversity of life and ecosystems.

- a. Ocean life ranges in size from the smallest living things, microbes, to the largest animal on Earth, blue whales.
- d. Ocean biology provides many unique examples of life cycles, adaptations, and important relationships among organisms (symbiosis, predator – prey dynamics, and energy transfer) that do not occur on land.
- e. The ocean provides a vast living space with diverse and unique ecosystems from the surface through the water column and down to, and below, the seafloor. Most of the living space on Earth is in the ocean.
- f. Ocean ecosystems are defined by environmental factors and the community of organisms living there. Ocean life is not evenly distributed through time or space due to differences in abiotic factors such as oxygen, salinity, temperature, pH, light, nutrients, pressure, substrate, and circulation. A few regions of the ocean support the most abundant life on Earth, while most of the ocean does not support much life.

6 – The ocean and humans are inextricably interconnected.

- e. Changes in ocean temperature and pH due to human activities can affect the survival of some organisms and impact biological diversity (coral bleaching due to increased temperature and inhibition of shell formations due to ocean acidification).
- g. Everyone is responsible for caring for the ocean. The ocean sustains life on Earth and humans must live in ways that sustain the ocean. Individual and collective actions are needed to effectively manage ocean resources for all.

Setup

1. Lesson

- a. Have students brainstorm different organisms (plants and animals) found in marine ecosystems. Write answers on board (include 2 types of plankton – zoo and phyto, decomposer and two birds, marine mammals etc.)
- b. On fishing trip off BC coast, what biotic factors or living organisms will you see?

- c. Discuss food chain terms: producer, consumer, decomposer; optional terms for older/keen students: heterotroph (consumer/decomposer), autotroph (producer).
- d. With students determine how brainstormed organisms fit into these food chain categories; determine rank with primary/secondary/tertiary consumer in triangle with apex (tertiary) at top.
- e. Define terms associated with different consumer levels: carnivore, herbivore, omnivore. As a group determine whether consumers are carnivore, omnivore or herbivore. To prompt, tell students what the organism eats and have them chorally respond with what type of consumer organism is. Discuss how some organisms can fit into more than one category (ie – fish may be herbivorous in early life stage and omnivore later in life)
- f. Save fish for last; show fish models/pictures/dead on ice here. Discuss names, what it eats and what eats it and what type of feeding relationship it has with other organisms
- g. Introduce bioaccumulation: tell students about missing biotic aspect of ecosystem – human interaction
- h. Have students brainstorm how humans negatively impact environment. Define chemical runoff and discuss vectors (residential, business). Ask students what happens to chemicals after spraying, soap from washing cars, fertilizer in fields etc., how excess chemicals can seep into groundwater and runoff/drain into water bodies like ponds, rivers that make their way to ocean environment
- i. Ask students if they think the chemicals that ran into local water body can affect organisms that live within it. Introduce bioaccumulation
- j. Explain how chemicals in runoff can have effects upon organisms that live in the water (ie – chemicals can be absorbed and get stored in fat cells; chemical/toxin can eventually move up through food chain)
- k. Define it as “the buildup of chemicals/toxins in an organism” = bioaccumulation; Write on board.
- l. Tell students they are going to play a game to show how bioaccumulation works and that they are going to become an organism from food chain example earlier

2. Game

- a. Identify play area as saltwater “ecosystem”. Point out boundaries. Tell students the boundaries represent their “home”. b. Disperse poker chips (phytoplankton blooms) in “home”.
- c. Hand out life card to each student, tell them to quietly read Life Card. Tell students each Life Card is different
- d. For marine environment example: zooplankton, fish, seal, shark; assign roles: 15 zooplankton, 9 fish, 3 seals, 1 shark
- e. Ask students which organism(s) out of the 4 eat the phytoplankton; **zooplankton!**
- f. Ask zooplankton to come to playing area, tell students they have 10-15 seconds to eat phytoplankton, **one chip at a time** by collecting in plastic cup
- g. At end of 10-15 sec., get zooplankton to stop eating and introduce fish into the game; tell zooplankton to keep eating but to be aware of their predators following instructions of Life Card
- h. Tell students to symbolize a predator “eating” their prey by tagging prey’s elbow. If tagged, camper hands food cup to predator.
- i. Involve seals, and finally shark. After game has played through gather group for reflection/debrief.