

Bay Area Scientists in Schools

Lesson Name: Food Webs/Clipfish

Grade Level: 6th Grade



Objectives:

To teach students about the study of community ecology, and how changes in one part of a community affects other parts of the community. The key concepts to understand are the use of species richness and species abundance as measures of biodiversity, and the difference between direct and indirect human impacts on ecosystems.

Lesson Concepts:

- community ecology – (a simple definition) the study of interactions between coexisting species, and how these interactions determine the distribution and abundance of these species.
- species richness and species abundance
- direct and indirect impacts
- predator/prey relationships
- direct vs indirect human impacts through overfishing
- extinction

Lesson Description

1. Explain predator/prey relationships, and food chains
2. Define species richness and species abundance. Show the differences between these 2 concepts.
3. Ask the students to think about how the predator community changes when you decrease or increase prey species
4. Play the Clipfish game – simulate the reduction of certain prey species
5. Ask students to summarize what happened during the game. Were the changes in predator richness or abundance a direct, or indirect impact of overfishing?
6. Wrap-up: connect the game to real world examples of both direct and indirect human impacts of humans on predator/prey relationships and food chains. This can include pollution, climate change, overfishing, invasive species, etc.

Pregame: Brainstorming a predator/prey system

1. Start with a charismatic aquatic predator (Killer whales! Sharks! Seals! Pelicans?)
2. Ask the student to think about what this organism eats.
3. Brainstorm what other organisms eat those same prey.
4. Would certain types of predators prefer to eat types of certain prey? Why? (energy trade-off)



CRS

COMMUNITY RESOURCES FOR SCIENCE
practical support for great science teaching

1611 San Pablo Avenue, Suite 10B
Berkeley, California 94702
(510) 527-5212 • www.crscience.org

Hands-on activity: Clipfish game

In this game, students will simulate the predation of 3 types of predators on 3 types of prey in pristine vs impacted habitats. At first, all habitats (2-3) start out pristine, with large abundance of 3 types of prey. Then 1 or 2 of the habitats are impacted by overfishing, or pollution, and 1-2 prey species die out. The remaining habitat is unaffected. The simulation continues for 1-2 seasons, and then students calculate species richness and abundance between the starting and ending seasons for each habitat.

Procedure

1. From the brainstorming, choose a set of 3 predators and 3 prey.
2. Show the students that each size of clip represents a different predator, and the 3 food items (popcorn, lima beans, marbles) represent the different prey.
3. Ask them to notice how the clips and the food items are different sized (small medium and large).
4. Explain that predators of various mouth sizes usually do just fine, but it takes more food energy to maintain the larger predator than the smaller predator.
5. Display the **Food Values in Megacalories poster**. Allow students time to apprehend that the various foods have different food values and that fish with different beaks sizes have different needs in order to survive and reproduce. Prompt them to think that different sized predators would want to eat certain types of prey to meet those needs. Pass out a **food values worksheet**.
6. Divide the class into 2 groups. Within each group, give two students large clips, two students medium clips and two students small clips. Each student/bird also gets a plastic cup to serve as its stomach.
7. Layout the 2 habitats – one to represent the normal environment, the other, the impacted environment. In each habitat, spread a plastic sheet on the ground, and empty a bag of popcorn, lima beans, and marbles on to the sheet.
8. Let the students practice eating. Tell them that in order to eat, they must use the clips in the correct clip mode (demonstrate), eat only 1 item at a time, and they must put all food that is successfully eaten into their stomachs.
9. Return all eaten food to the pile.
10. For the first season, give them 30 seconds to eat all they can. Make sure they do not scrape or shovel the food into their stomachs, as this will badly skew the results.
11. After the feeding frenzy, ask students to calculate the value of the food they ate on their worksheet. If a student doesn't eat enough to survive then he turns in his beak and sits down. If a student ate enough to survive then she continues as part of the population. Each student who ate enough to reproduce gets another bill the same size as her own and selects a student from the audience to be her offspring.
12. A teacher in each group will help calculate and record the number of predators that die, survive, and reproduce to the next season. Calculate species richness (1 = lowest, 3 = highest), and predator abundance (Abundance of predator A = # predator A/ total # predators).
13. Write this number on the **Community Structure Poster** (or on the board).

14. Now, in the impacted environment, remove both the marbles and popcorn, leaving only lima beans. If using 3 groups, remove only popcorn from one group, remove both marbles and popcorn from the second group, but leave all prey items the same in the third group.
15. Repeat directions 9-12 for one to two more seasons.
16. Have all the students turn in their clips and clean up the mess.
17. Put up the **Community Structure Poster**. Ask students to describe what happened to predator populations, and what they think caused the changes.

Wrap up Questions

How does species richness and abundance compare between the normal and impacted environments? Did any species go extinct? Was this a direct or indirect impact of pollution or harvesting? Keep the discussion going so that students can assemble their thinking that changes in prey abundance can change species richness within a community.

Food Values Worksheet

Season 1

Prey	# caught		Megacalories
Marble (Big)		x 10 =	
Lima Bean (Medium)		x 5 =	
Popcorn (Small)		x 2 =	
		Total =	

Survive? Yes/No
Reproduce? Yes/No

Season 2

Prey	# caught		Megacalories
Marble (Big)		x 10 =	
Lima Bean (Medium)		x 5 =	
Popcorn (Small)		x 2 =	
		Total =	

Survive? Yes/No
Reproduce? Yes/No

Season 3

Prey	# caught		Megacalories
Marble (Big)		x 10 =	
Lima Bean (Medium)		x 5 =	
Popcorn (Small)		x 2 =	
		Total =	

Survive? Yes/No
Reproduce? Yes/No

Table 1. Caloric Needs of Predators, in MegaCalories

Predator	MegaCal needed to survive	MegaCal needed to reproduce
Big	80	160
Medium	50	100
Small	25	50



CRS

COMMUNITY RESOURCES FOR SCIENCE
practical support for great science teaching

1611 San Pablo Avenue, Suite 10B
Berkeley, California 94702
(510) 527-5212 • www.crscience.org

Community Structure over the Seasons

	Season 1		Season 2		Season 3	
	# individuals	Abundance	# individuals	Abundance	# individuals	Abundance
Big						
Medium						
Small						
	Richness =		Richness =		Richness =	

Richness = 1 species, 2 species, or 3 species

Abundance Big = # Big / Total # Predators



CRS

COMMUNITY RESOURCES FOR SCIENCE
practical support for great science teaching

1611 San Pablo Avenue, Suite 10B
Berkeley, California 94702
(510) 527-5212 • www.crscience.org