



Animals of the Sea Curriculum

Museum STEAM Program

Grades: K-5

Advertised Description:

Dive into Puget Sound through live animals, a plankton tow, and a game about food webs.

Outline:

Four lessons/activities taught in rotations

- Microscope Plankton Viewing
- Food Web Jenga
- Seastars & Friends
- Museum Highlights

Overall Learning Outcomes:

- Identify three invertebrate structures and their purpose
- Identify one phylum of invertebrates
- Explain one adaptation of tidal animals that helps survival in the extreme environment
- Identify one invasive intertidal species and countermeasures
- Increase understanding of the importance of biodiversity. Increase understanding of keystone species

Background Information: Plankton are drifters in the water that are too small or too weak to fight against a current. They are split into two types: phytoplankton and zooplankton. Both types form the base of the Puget Sound food web as primary producers and primary consumers.

Vocabulary:

Ecosystem: a biological community of interacting organisms AND their physical environment

Food Chain: a hierarchical series of organisms each dependent on the next as a source of food

Food Web: a system of interlocking and interdependent food chains

Echinoderm: “spiny skin”, includes stars, urchins, cucumbers, and sand dollars

Tube feet: flexible appendages used for movement and feeding

Madreporite: an opening that lets in water to the water vascular system

Eyespot: a pigmented spot with light-sensitive cells

Microscope Plankton Viewing Lesson Plan

Learning Outcomes:

- Students will be able to identify distinguishing characteristics of phytoplankton and zooplankton
- Students will understand there is diversity in plankton structures
- Students will be able to use a microscope to see plankton

Materials needed:

- 3 - 4 tables
- Plankton sample from docks
- Brine shrimp
- Plankton matching cards
- Pipettes
- Petri dishes
- Zoomscope/Video scope
- Dissecting scopes, 1 per student
- Plankton Observation Worksheets
- Paper towels
- Pencils
- Colored Pencils
- Plankton ID pages
- Chalk/chalkboard

Lesson Outline:

1. Preparation
 - a. Set up and pre-focus scopes
 - b. Set up each petri dish, one per quadrant with:
 - i. Brine shrimp
 - ii. Phytoplankton
 - iii. Zooplankton
 - iv. Random Sample
 - c. Draw a diagram on the chalkboard matching the pattern of the plankton in the petri dishes
2. Introduction to microscopes
 - a. Students will be introduced to relevant microscope parts
 - b. Students will practice focusing microscopes
3. Observing plankton
 - a. Guided by the teacher, students will observe each quadrant of their petri dish, focusing on the different structures visible, starting with brine shrimp because everyone's will look basically the same
 - b. Students will sketch each quadrant of their petri dish in one of the circles on the Plankton Observations Worksheet
 - c. Characteristics of phytoplankton vs zooplankton
 - i. Phytoplankton
 1. Only move with motion of the water
 2. Geometric shaped structure: circles, rectangles, etc
 3. Oil droplets
 - ii. Zooplankton
 1. Can move themselves

2. Structures that resemble animal body parts: legs, head, antennae, etc

Age Differentiation: Have older students make detailed drawings, labeling structures. Younger students can make fewer or less detailed drawings and simply identify either phyto- or zoo-plankton

Food Web Jenga Lesson Plan

Learning outcomes:

- Understand what ecosystems, food chains, and food webs are
- Understand the difference between a food chain and a food web
- Understand that humans are part of ecosystems and food webs
- Understand why primary producers are important to food webs
- Connect their actions in the game (destabilizing the tower by removing pieces) with changes in ecosystems – some due to human actions

Materials needed:

- Custom Food Web Jenga Pieces
- Whiteboard
- Dry Erase Markers
- Food Chain Pictures
- Food Web Pictures

Lesson Outline:

1. Ecosystems
 - a. Start the students off by asking them what an ecosystem is. Write the word “ecosystem” on the whiteboard. After they’ve given some answers, give them the definition, either in your own words or from the written definition above.
 - b. Ask them to give examples of what makes up the Puget Sound ecosystem. If they don’t list humans, ask them if they think humans are part of the ecosystem.
 - c. Remind them that it includes non-living things (physical environment). Ask them to think about non-living parts of an ecosystem such as rocks, sand, etc.
 - d. What are other ecosystems? (deserts, forests, rivers, etc.)
 - e. OPTIONAL EXTENSION- What type of ecosystem is Puget Sound?
 - i. Estuary- where fresh and saltwater meet

Instructor tip: A great way to talk about ecosystems and integrate art is to have students draw their own ecosystems on a whiteboard or piece of paper. Alternatively, have students “ad-lib” by passing around a board or piece of paper, with each student adding a new component to the ecosystem. For example, one student adds an animal, one adds a plant, one adds a non-living object, etc.

2. Food Chain

- a. Ask if animals eat the same thing all the time. Do we eat the same thing every day? Do all humans eat exactly the same thing? Ask each student what they last had to eat.
- b. Show a graphic of a food chain (linear trophic/feeding interactions). Ask them if they think that is “real” – is this how animals REALLY eat? Does every animal ONLY eat one thing?
- c. Either go back to the list of things that live in Puget Sound or generate a new list. Select each organism one-by-one and ask “What do you think THIS eats?” and then “WHO do you think EATS this?”
 - i. This will make for a VERY messy diagram!! That is the point to introduce Food Webs.

Instructor tip: Depending on the ages of the students, it is fun to have cards or papers with different animals on them and have the students MAKE their food chain and then their food web. Involves visual and kinesthetic learners.

3. Food Webs

- a. Introduce the food web graphic (note: you can use any graphic that works best for you). Explain the trophic levels (primary producers, primary consumers, etc.) and describe example species briefly.
- b. Food webs allow for more complex interactions between animals and the things they eat. It’s more useful than using a food chain, which is generally simpler.

4. Jenga Game

- a. Introduce the Jenga blocks and explain that the colors relate to each of the trophic levels that they just learned about:
 - i. GREEN – producers
 - ii. GOLD – primary consumers
 - iii. BLUE – secondary consumers
 - iv. RED – tertiary consumers
 - v. BLACK (or plain) – quaternary consumers or Apex Predators
- b. Ask the students to sort the blocks by color and either stack them up (2 blocks wide, as high as they go) or line them up by color
 - i. They will create a visual “graph” of the relative amounts of organisms in each trophic level
 - ii. This is a great discussion of why there are so many of the producers and primary consumers and so few of the higher levels – this can lead to a discussion of if you are going to CHOOSE to eat from a particular level, what is/are the most sustainable level(s)

- c. Introduce the game and explain that you are going to pretend your Jenga tower is a food web in the ocean. Explain the rules if needed (most kids know how to play Jenga). They will go one at a time and remove a block.
 - i. In this version of Jenga, the blocks are NOT stacked on top, they are removed completely and set aside. This can be explained as depletion of various stocks of organisms.

Instructor tip: You can also ask the kids to think of reasons that might cause an organism of that type to disappear from the ecosystem – natural disaster, overfishing, oil spill, etc. This can bring up a conversation around human impacts.

- d. After the tower falls, discuss why and how it relates to actual food webs in the ocean, i.e. what would happen if all the plant plankton disappeared?

Note: Feel free to add more information you find relevant or interesting, or to use different examples. This works for any ecosystem with a few modifications! Also, feel free to expand on the critters that make up the Puget Sound food web if students aren't familiar with them.

Seastars & Friends Lesson Plan

Learning outcomes:

- Identify three invertebrate structures and their purpose
- Identify one phylum of invertebrates (echinoderms)

Materials needed:

- | | |
|--|--|
| <ul style="list-style-type: none"> ● Variety of dried stars ● Dried sand dollars ● Visual aids ● Finger bowls ● Live urchin | <ul style="list-style-type: none"> ● 2-3 live stars, different species ● Paper towels ● Optional- copies of Whelks to Whales ● Optional- live sea cucumber |
|--|--|

Lesson Outline:

1. Sea Star Features
 - a. Put out several dried stars of different species, sizes, and number of rays
 - b. Have kids hold, touch, and look for different parts of the star
 - c. Features/behaviors that should be mentioned and/or pointed out include...
 - i. Tube feet
 - ii. Madreporite
 - iii. Rays
 - iv. Mouth
 - v. Second stomach & feeding
 - vi. Eyespots
 - vii. Regeneration

- d. Show visuals of different species to show diversity (color, size, # of rays, texture, mid-regeneration, etc.)
2. Sea Star Cousins
 - a. Have kids touch and hold a sand dollar test and show a visual of a live sand dollar; discuss similarities to stars
 - i. *Stewardship component- always leave live sand dollars on the beach so they can do their job in nature. Take litter instead!*
 - b. Pull out a green or purple urchin in a finger bowl and let kids touch with one finger; discuss similarities
 - i. Echinoderm = spiny skin
 - c. Optional- Pull out a cucumber and repeat
3. Stars
 - a. Bring out at least 2 to 3 stars in finger bowls for kids to touch
 - i. Choosing stars that are very different is a good teaching tool (i.e. leather and rose star; six-arm and vermillion)
 - b. Look for features on the live stars that you saw on the dried stars
4. Tank Exploration
 - a. Unfocused time at the touch tank seeing other species of stars, urchins, and other tank animals
 - i. Gentle one finger touch
 - ii. Keep voices at an indoor level
 - iii. Respect animals as living things
 - b. Answer questions as needed and take advantage of “teachable moments”
 - c. Wrap up, have kids dry hands and help wipe down tank windows and tops if extra time

Extension-

5. Field Guide (3rd grade & up, minimum 35 min rotations)
 - a. Introduce kids to a naturalist field guide (Whelks to Whales) and show them how it's organized, what kinds of information they can find, etc.
 - b. Assign pairs or 3s to a tank
 - c. Ask them to use the guide to find at least one echinoderm from their tank
 - d. Have them report back to the group about what they found

Museum Highlights Lesson Plan

Learning outcomes:

- Students will understand the amount of effort in wooden boat making
- Students will connect one thing they see in the museum to the program material or personal experience

Instructor Preparation: Prior to student arrival on the day of the program, check-in with the Boat Shop volunteers to verify they have the materials needed for the number of students

coming and to give them a copy of the schedule, noting the specific times the students will be in the Boat Shop

Materials needed:

- Student sailboat hulls
- Student sailboat masts (dowels)
- Student sailboat sails (paper cut into triangles with two holes punched for mast)
- Student sailboat lines (cut lengths of string)
- Sandpaper scraps
- Colored markers

Lesson Outline:

1. Boat Shop
 - a. ~15 min
 - b. Boat Shop safety rules
 - c. Guided by the Education instructor, students assemble a toy wooden sailboat
 - i. During sanding, introduce wooden boat construction
 - ii. During sail assembly, introduce sailboat movement
 - d. Boat Shop Walk-Thru
 - i. Opportunity for students to ask questions of Boat Shop staff about boats or boat building equipment
 - e. “Dock” finished boats in the “marina”
2. Other Exhibits
 - a. ~20 min
 - b. Students are taken to one or more exhibits to round out this rotation. Exhibits can be relevant to the program or a fun exploration
 - c. Exhibit examples include:
 - i. Faith Fishing Boat
 - ii. TYC Sailboat
 - iii. Lego Boat Building
 - iv. K’NEX Truss Building
 - v. Puyallup Exhibit

Age Differentiation: For younger students, the boats may be pre-assembled and the students may focus on just sanding the hull and decorating with markers instead. Any amount of pre-assembly can be used as appropriate for student age and rotation time. The amount of detail given during Boat Shop explanations should be age-appropriate