FOSS WATERWAY SEAPORT
Discover by Doing

Whale of Fun Curriculum

Museum STEAM Program

Grades: K-3rd

Advertised Description: Discover the whales, dolphins, and porpoises that call Puget Sound home! Touch real bones, talk like a whale, and see just how big whales can get.

Outline:
Four lessons/activities taught in rotations. Conclude with a large group game.

- Whale Bones
- Big & Small
- Sound in Water
- Museum Highlights
- Sound Pollution Large Group Game

Overall Learning Outcomes:

- Understand that whales are mammals and have similar anatomy to humans.
- Identify the difference between baleen and toothed whales.
- Understand what ecosystems, food chains, and food webs are
- Understand that humans are part of ecosystems and food webs.
- Increase understanding of why primary producers are important to food webs.
- Connect human actions with changes in ecosystems

Background Information:

Vocabulary:

Mammal: Animals that are warm-blooded, have hair, give birth to live young, and breathe air. Includes whales & humans.
Baleen: Hard plates of keratin in a whale's mouth that are used to filter feed.
Porpoise: A small cetacean with a blunt face and spade-shaped teeth. Generally smaller than dolphins.
Blowhole(s): Holes on the top of a whales' head that are used to breathe. Baleen whales have two, toothed whales have one.
Flippers: Two appendages on the sides of a whales' body. Homologous with human arms, have the same bone structure.
Fluke: The whales' tail. A large, powerful appendage made of cartilage that is used for propulsion/acceleration.
Dorsal fin: The fin on top of a whales' body. It may be used for balance.
Noise pollution: harmful or annoying levels of noise, such as from airplanes, boats, industry, etc.

Whale Bones Lesson Plan

Learning outcomes:

- Students will understand that whales are mammals and have similar anatomy to humans
- Students will be able to identify the difference between baleen and toothed whales

Materials needed:

- Model human arm bones
- Harbor porpoise bones
- Harbor porpoise outline
- Whalebones exhibits

Lesson Outline:
Focus on exploring, touching, answering questions...less lecture! We want to impress that whales and humans are very similar even though they look different

1. Humpback Skeleton (10 mins)
    a. Tell the story of our whale- how did she get here?
    b. Use human arm model to show homology (flipper bones)
    c. Point out baleen (in skull, on wall, and let students touch)
    d. Have vertebrae available to touch
2. Harbor Porpoise Bones (15 mins)
    a. Explain what a porpoise is (smaller than a dolphin with spade-shaped teeth instead of cone-shaped teeth, and a blunt face instead of a beak)
    b. Show them the skull and have them feel the flat teeth (how is this different than baleen?)
    c. Let them explore the different shapes of vertebrae and sort if they can. Use the humpback skeleton to help with this. Look for similar shapes!
        i. Compare porpoise vertebrae to humpback vertebrae
    d. Show flipper bones, shoulder blade, etc.
2. Fin whale skull (10 mins)
    a. Explore and talk- show foramen magnum, eye socket, etc.

Age Differentiation: Younger students may have a difficult time completing the porpoise skeleton in the time allowed. Instead, have them focus on the different shapes of the bones

Big & Small Whale Sizes Lesson Plan

Learning outcomes:

- Students will be able to identify the difference between baleen and toothed whales.
- Students will understand what ecosystems, food chains, and food webs are

Materials needed:

- Whale length ropes
- Masking or painters tape
- Stopwatch
- Pictures/drawings of whales
- Shallow plastic bin(s)
- Water
- Combs
- Oregano

Lesson Outline:

1. Examples- what kinds of whales are there? (5 mins)
    a. Are all whales big? No- some are small! See if kids can name a few big whales and a few small ones
    b. Pictures of different species (use posters, photos, other visual aids), focus on species that live in or visit Puget Sound
2. Ropes (10 mins)
    a. Each student or pair of students gets a rope- they stretch it out as far as it will go and lay it flat
    b. As the ropes get stretched out, you can see the variation in size (there are species cards that go with each rope that give an average length AND an average weight)
    c. Species- porpoise, orca, gray, humpback, fin whale
    d. Lay out the fin whale last
        i. Fin whales are called “greyhounds of the sea” because they swim very fast
        ii. Have students run the length of the rope in pairs and see if they can run faster than a fin whale can swim
        iii. Fin whales can swim the length of their body in 2 seconds (most kids run the length of the rope in about 6)
3. Eat like a whale (10 mins)
    a. Baleen whales eat tiny things (small fish & plankton)
    b. Have students “eat like a whale” using a comb as baleen to scoop out food (oregano) from a shallow flat bin
    c. If there’s time, you can also use a fine mesh strainer as another example

Age Differentiation: Younger students especially like to see the teacher’s height compared to the smallest whale

Sound in Water Lesson Plan

Learning outcomes:

- Understand that sound is made using vibrations, which are called soundwaves.
- Understand why sound moves faster and travels farther in water than in air.
- Learn how cetaceans (whales, dolphins, and porpoises) hear using their jawbones.

Materials needed:

- Table
- Pan of water about 2 inches deep, with or without food coloring
- Tuning forks
- Laptop, HDMI cord, TV
- Voices of the Sea website

Lesson Outline:

1. Intro
    a. Have them put their hand on their throat and say a short phrase. What do they feel? They should feel vibrations in their neck. These are vocal cords being used to produce sound.
    b. Sound travels in waves
    c. Have them make a really low sound and a really high sound with their hands on their throats. Which sound made more vibrations?
        i. Low sounds have long wavelengths and slower vibrations, high sounds have short wavelengths and faster vibrations
2. Sound in Air vs. Sound in Water
    a. Have kids line up all facing the same way, far enough apart that they can hold their arms out straight and just touch the shoulders of the person in front of them.
        i. They are all air molecules- air is a gas, gas molecules are far apart from each other and don't touch.
        ii. You act as a sound/soundwave- bump the first kid into the next kid, repeating until you get to the end.
        iii. This takes a lot of time and a lot of energy because the molecules are far apart.
    b. Have kids line up facing the same way again, this time almost touching each other but not quite.
        i. Now they are water molecules- water is a liquid, water molecules are close together and slide around each other.
        ii. Act as a sound wave and bump the first kid. They should all bump into each other on their own now that they're closer.
        iii. The "sound" moving in "water" took less time and less energy because the molecules are closer together
3. Seeing Sound in Water
    a. Use tuning forks to show kids how they vibrate. Hold tuning fork up to kids' ears for them to hear the sound.
    b. What will happen if we hit the tuning fork and then stick it in water? Have them hypothesize.
    c. Do this (the middle C tuning fork works best). The water jumps out of the pan or makes ripples. This is because the vibration of the sound waves pushes water molecules away quickly.
4. Bone Conductance Experiment
    a. Whales hear differently than us; they rely on bones in their head to carry sound to their ears
    b. Tell the kids they can hear like a whale too (always ask if everyone wants to do this, including chaperones)
        i. Student plugs their ears, you ring the tuning fork, and place the end on the middle of the forehead for a few seconds, then on the chin
        ii. Ask the kids where they heard the sound
        iii. It generally sounds clearer on the chin than on the forehead- this is because the jawbones connect back to the ears. Whales hear primarily through their jawbones (mandibles)
5. Whale Sounds

a. Humpback- known for singing (males). They also use sounds for bubble net feeding.
b. Orca- play resident and transient calls. Residents eat fish (mostly salmon), transients eat mammals.
c. Blue- this recording is sped up so that we can hear it. A normal blue whale call is so low frequency that our ears can't pick it up.
d. If extra time, pick a few extra whale species to listen to

Museum Highlights Lesson Plan

Learning outcomes:

- Students will appreciate the diversity of life in Puget Sound
- 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. Touch Tanks
    a. ~10 min
    b. Students spend about 10 minutes visiting and touching the animals in the tanks, asking questions, and sometimes observing feeding time if the aquarist is in.
    c. Encourage students to look for hidden animals, not just the easy to touch ones, but this time should mainly be student-led exploration
    d. If the Touch Tanks are otherwise part of the program, substitute other museum exhibits
2. 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”
3. Other Exhibits
    a. As time allows
    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

Sound Pollution Group Game

Learning outcomes:

- Understand what noise pollution is and how we can reduce it.

Materials needed:

- Whale species cards
- Clickers
- Large open area to play

Lesson Outline:

1. Introduce the Game
    a. Students spread out in a playing field
    b. Each student gets a “secret identity” card with a whale species on it. They can’t show or tell the people around them what kind of whale they are.
    c. They will try to find the other members of their “pod” using their voices only. For example, if their card has “humpback” written on it, they walk around the ocean saying “humpback” over and over until they find another member of their pod.
    d. Once they find a member of their pod, they link arms and continue looking. Once they find all members, they stop and sit down.
2. Round 1
    a. Give students about 1 min to play the first round. Once it looks like almost everyone has found their pod, stop the game, and debrief.
    b. Another instructor will gather cards and shuffle them. They will hand out clickers to the adult chaperones and/or other Seaport instructors.

    c. Have the kids stand back up and spread back out. Have them sit again while cards are redistributed.
    d. They will be playing the game again, and give them a hint that whales are not the only things in the ocean that make noise.
3. Round 2
    a. This time, while the students are playing, chaperones and instructors with clickers will be walking around making as much noise as possible
    b. Stop the game even if it looks like not many students have found their pod- this is part of the point.
    c. When the game has stopped, have the students gather and sit and gather up their cards.
4. Debrief
    a. What was different this time?
        i. There were other noises in the ocean- this made it hard to hear where members of the pods were.
        ii. What are things that might make extra noise in the ocean?
        iii. Extra noise from things like boats, machines, or factories is called noise pollution
        iv. Expand on this as you see fit and answer any questions.
        v. Can play an extra round if time allows

Age Differentiation: Younger students will likely need adult help to read their species cards