Lesson: Habitat happening: The Buzz on Bees

Environmental Literacy Question: How have humans affected the Chesapeake Bay and its watershed?

Unit/Lesson Sequence: One of two lessons in the "Habitat happening" module

Content Standards:

- **Environmental Literacy**
  1.A.1 Identify an environmental issue.
  4.B.1.c Discuss the factors that limit population size, such as availability of food, light, space, populations of predators and prey, competitors, and disease.
  5.B.1.f Recognize and explain that activities and technology of the human species have a major impact on other species in many ways.
- **Science**
  3.D.1.b Explain that the characteristics of an organism affect its ability to survive and reproduce.

Length of Lesson: 35 minutes

Student Learning Outcome: The student will be able to explain the importance of bees to all living things and describe the positive and negative impacts of human activities on the bee population.

Knowledge of the Learner:

- Prerequisite knowledge, skills, and processes: Basic understanding that bees make honey from nectar in flowers. Students should be able to listen to instruction and follow directions.
- Student needs, interests, and previous learning: These will be identified in the pre-assessment.
- Conceptual difficulties: Relating pesticide use to the decline of bees; working with others to solve problems.
- Differentiation: Students are in fourth grade with a diversity of backgrounds and skill levels.

Knowledge of Content:

Vocabulary:

Drone	Worker	Comb	Queen	Proboscis	Brood
Hive	Nectar	Cell	Honey	Pesticides	Food web

Materials:

Observation hive	Instructional cards for bees	Smoker
Hive box	Frames	Feeder
Uncapping knife	Example of Protective clothing	Water
Plastic cups	Blue food coloring	
Buckets	Wooden Flowers	1 or 2 Pipettes

Supplements:

A: What is a Bee Keeper?
B: Members of the honey bee colony
C: Bee Issues

Lesson Setup:

- Inside the bee room: The wooden panel should be on the hive and the instructional cards 2, 5, 6, 10, and 12 ready. Bee keeper materials should be on a table.
- Outside: Set up wooden flower stands on one side of the field, each one with a cup of water. Place a drop of the blue food coloring in one of the cups (this represent pesticides sprayed on the flower). Place an empty cup with a black "fill" line on an overturned bucket on the opposite side of the field where they will deposit water. Leave a pipette next to the empty cup. ***NOTE**: For larger groups, set up two overturned buckets each with an empty cup and pipette.**

Instructional Delivery:

Pre-Assessment:

Ask students: why honey bees are important to the food web? *They pollinate flowers which help produce fruit and vegetables. They produce honey.*
What role do you think the honey bee could play in a food chain? *This is an open ended question; students could come up with a variety of correct answers. Bees could be a consumer since they eat the nectar of the flowers but they have a unique role as a pollinator which enables plants to produce food.*

Motivation/Warm-up:

1. Relay

Start at the main field to play the bee relay game. Explain that every student is a worker bee and tell them they will learn more about the types of bees when we go inside. The worker bees have to work together to collect nectar so they will have enough honey for the winter. Give instructions on how to play before beginning.

- All of the workers must collect enough nectar (water) from the flower cups to fill their team's cup to the line. Explain that they only have a limited amount of time to get as much nectar as possible.

- Line up the group. One at a time, workers collect nectar with their proboscis (pipette), an elongated sucking mouthpart found in insects that are typically tubular and flexible. They are to bring it back to the "hive" (cup) using their proboscis (pipette). On their return, pass the pipette to the next student in their line. ***NOTE**: For larger groups, line the group up into two lines, each with their own "hive" setup and have them relay at the same time. Play the game with the same rules.**
- Once all the students have had a chance to run the relay or sufficient time is up (3-5 minutes), congratulate the group on collecting their nectar.
- Discuss how much honey they made and whether or not pesticides affected their collection.
    - Did you fill up the cup to the line? Would the honey you made be enough for all of you to survive the entire winter? *It takes **35 pounds** of honey for a small hive to survive a winter.* [1] *Bees travel more than 50,000 miles and visits over 2 million flowers to make just one pound of honey!* [2] *While doing this, bees transport pollen from flower to flower when they collect nectar, and through this pollination, plants can grow fruits and vegetables.*
    - Did you notice that some of the nectar looked different as you were bringing it back to the hive? *"Pesticides" were added to the plants to keep other insects away, but it got into the hive and now bees are getting sick and dying. Pesticides are certain chemicals we use to spray our crops and other plants to keep certain insects from eating them up. However, these pesticides have a negative effect on the bees. The overall bee population has been declining in recent years as a result of pesticide use. Ask the students: 1) How could the decline of honey bees affect the food web? 2) How did humans impact the natural food web in the Relay race?*

Procedure:

1) Take group into the bee room. Ask, "Why are bees important to animals"

Honey bees pollinate plants that animals use as a food source. Honey bees also Produce honey that some animals use as a food source.

2) Review card 12 and the bee-keeping equipment (see supplement A).
    - Pass all tools around for students to hold
    - Use the demonstration hive box to demonstrate how a bee keeper would open the hive
    - Use the hive tool to open the lid of the hive
    - Use the smoker to "smoke the hive"
    - Use the hive tool again to take out a frame
    - Brush "bees" off with the bee brush

3) Review the types of bees that will be found in the observation hive using the numbered bee instructional cards. Tell the students we will be looking for:
    a. Worker bees (card 2)

   b. Drone bees (card 10)
   c. Queen bees (card 5)
   d. Brood and Honey (card 6)
4) Open the observation hive and look at the bees. Have the students notice:
   a. What type of bees are the majority? *Most of the bees are workers.*
   b. What are the workers bringing to the hive? *Nectar and pollen*
   c. Why are some of the bees "dancing"? - *This is a way of communicating the location of a nectar source.*
   d. Can you find any nectar? Brood? Honey?
   e. Can you find any drones and drone cells?
   f. Can you find the queen bee?
5) Review what a bee keepers does (Supplement A). Go over all the tools that a bee keeper uses.
6) Optional: Go out the back door and look at the hives **from a distance** making sure not to go past the barrier.
7) Give each student a piece of organic fruit or vegetable that is local and in season (watermelon, apple, peach, pear, etc.), and a taste of local honey.

Assessment:

Ask the students the three questions and once they get the correct answer give the group the wood cookie with the corresponding letter indicated on the answer card.

1. Question: What do we call an animal that moves pollen from one flower to another?
   Answer: POLLINATO**R**
2. Question: There are three members of the honey bee family. The queen, the workers, and the…?
   Answer: DRO**N**ES
3. Question: Humans can help the honeybee population by reducing our use of harmful…?
   Answer: P**E**STICIDES

Student Reflection and Closure:

What do you think we could do to help the bees stay healthy? *Plant bee friendly flowers and gardens, buy local, and buy organic, raise bees and leave weeds such as dandelions for bees to use, opt for natural solutions over pesticides.*

Electronic sources

1- Goldenblossomhoney.com
2- York County Bee Keepers Association YCKB.org

Supplement A: What is a Beekeeper?

Bees and Man – Card 12	• Bee keepers raise honey bees to produce honey and to pollinate crops. • Bee keepers use man made boxes to raise the colonies and they transport these hive boxes to different farms to pollinate crops. • Bee keepers extract excess honey from the hives leaving enough for the honey bees to use as a food source in the winter.
Man-made hive	• A man made hive is made with hive boxes that can be stacked on top of each other.
Smoker	• A fire is lit inside the smoker, and then the lid is closed, putting out the flames. By squeezing the accordion portion, smoke blows out of the spout. • Smoke helps calm the bees because they go deeper into the hive to eat honey (which relaxes them).
Hive tool	• A special tool that helps a beekeeper open the hive boxes and take out the frames. • Things will stick together because bees try to seal any open spaces and holes with a substance called **PROPOLIS**.
Frames	• Inside the hive boxes, these trays are where the bees build the **COMB** with **BEESWAX** for eggs to be laid and honey to be stored. • The frames are removable so that beekeepers can inspect the hive and collect honey.
Bee brush	• A soft brush used to gently remove bees from a frame during inspection or collection.
Extractor	• A type of machine that spins the comb to remove the honey.

Supplement B: Members of the honey bee colony

Worker bees – Card 2	• Workers are all females and make up most of the bees in the colony. • The first job they have when they are born is to clean the cells in the hive and maintain the hive. • After about 24 days of life, they move on to either guard the hive or collect pollen/nectar for the hive. • The orange on the legs is pollen. • Workers live about 48 days.
Drone Bees – Card 10	• Drones are all males. • They live a little longer than workers - about 60 days • Their only job is to fertilize the queen bee's eggs. • In the winter, they are all kicked out of the hive to preserve resources.
Queen Bees – Card 5	• The Queen's job is to lay eggs. • She is larger than the other bees. • There is only one queen in each colony. • The hive senses her through pheromones, and when they sense that she will not live much longer they start making a new queen. • A queen can live 1-2 years.
Brood Card 6	• A queen bee lays about 1,200 eggs per day, but she can lay as much as 2,000 per day. • She stops laying in the winter to keep the colony small. • The workers feed the queen.

Supplement C: Bee Issues

- Pesticides
    - There are different kinds, but many are toxic to bees either killing them directly or harming young bees when brought back to the hive.
- Diseases
    - There are a few different diseases bees can contract such as bacterial, fungal, viral diseases, and dysentery.
- Pests, Parasites, and Predators
    - Pests include: bee lice, wax moths, ants, and mice.
    - Parasites include: Varroa mites (which can also cause parasitic mite syndrome – a viral complex) and tracheal mites.
    - Predators include: small hive beetle, Giant European Wasps, skunks, and bears.
- Colony Collapse Disorder
    - A mass disappearance of worker bees in the hive, resulting in the collapse of the hive due to not having enough workers to support honey and comb production or care of brood.
    - The exact cause of CCD is unknown, but it is possible that it is a result of the hive dealing with a combination of issues at once.