

Explore and Discover:

Horseshoe Crabs

Science Grade 3

This unit focuses on horseshoe crabs, *Limulus polyphemus*. Students will understand how unique our local Cape Cod horseshoe crabs (HSCs) are. The lessons compare horseshoe crabs to other local organisms. At the end of the unit, students will create a public service announcement explaining to other Cape Codders the importance of our local horseshoe crabs.

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those author(s) and do not necessarily reflect the views of the National Science Foundation.

Please provide us some background information on the unit development. In order to help others who are interested in this topic understand a bit more about what you created, we will write a short introduction to each unit and provide some images, in addition to posting the completed units on the Cape Cod Regional STEM Network website (www.capecodstemnetwork.org). Please help us by answering the questions below after you have completed your unit.

1. Who helped to create this unit?

Deirdre Detjens	Hyannis West Elementary School
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2. What were some sources of inspiration for this unit?

While exploring Cape Cod Museum of Natural History (CCMNH), I noticed many organisms had similarly named body parts, but with different designs. CCMNH's Horseshoe Crab Crawl showed me how easily visitors could engage with exhibits throughout the museum, using a central theme. I did look at the lesson designed by earlier TiRs. The *Fossils and Extinction* and *Ecosystems: Interactions and Dynamics* were especially helpful.

3. In your own words, what are you hoping students learn—big picture—through this unit?

I hope students understand that Cape Cod is home to an incredible variety of living organisms. These organisms may have a tail or a set of eyes, but each animal's body part is unique. I also hope students will be inspired to go outside, find some horseshoe crabs and try to help save our population.

4. What might students find exciting in this unit?

This unit compares local organisms in a unique way. There are times to write, times to draw, times to discover and explore.

5. What science standards or real-world content did you strive to emphasize?

I tried to connect horseshoe crabs with other local animals the students may know.

6. How would you say that this unit "matters" to the STEM community? Or to our community on Cape Cod? Or to the larger community?

This unit ties the standards to our local Cape Cod environment. It gives the CCMNH visitor an additional way to interact with the existing exhibits.

7. What's the most important lesson you learned as you created this?

Research materials were not as easily accessible as I had assumed.

8. Anything else you would like fellow teachers or others to know about this unit?

Start collecting horseshoe crab molts as soon as you can. The more molts of varying sizes you can collect, the better. Also, preserve the molts so they last longer.

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Stage 1 Desired Results

MA STE Standards

3-LS1-1. Use simple graphical representations to show that different types of organisms have unique and diverse life cycles. Describe that all organisms have birth, growth, reproduction, and death in common but there are a variety of ways in which these happen.

3-LS3-1. Provide evidence, including through the analysis of data, that plants and animals have traits inherited from parents and that variation of these traits exist in a group of similar organisms.

3-LS4-2. Use evidence to construct an explanation for how the variations in characteristics among individuals within the same species may provide advantages to these individuals in their survival and reproduction.

3-LS4-3. Construct an argument with evidence that in a particular environment some organisms can survive well, some survive less well, and some cannot survive.

3-LS4-4. Analyze and interpret given data about changes in a habitat and describe how the changes may affect the ability of organisms that live in that habitat to survive and reproduce.

3-LS4-5(MA). Provide evidence to support a claim that the survival of a population is dependent upon reproduction.

ESSENTIAL QUESTIONS

- Have horseshoe crabs evolved differently from other local organisms?
- Do similar body parts work the same way?
- Why should we try to save horseshoe crabs on Cape Cod?

UNDERSTANDINGS

- Students will understand that horseshoe crabs are ancient animals. These animals have evolved with very unique and specific body parts.
- Students will understand that observing, comparing evidence, and documenting observations in their science journals is essential to all types of scientists.
- Students will understand that each organism has evolved with specially designed body parts to meet its own needs.

	<p>TRANSFER <i>Students will be able to independently use their learning to...</i> -create a public service announcement. It will contain the students' knowledge of HSCs. The product will be a tri-fold brochure, a poster, a set of slides, etc. Its purpose is to persuade others to help save our dwindling population of HSCs.</p>
	<p>Cross-Curricular Connections</p>
<p>Stage 2 Evidence</p>	
<p>Formative Assessment Ideas: -Each lesson involves writing and/or drawing in their science notebooks. -Small group and whole class discussions.</p>	
<p>Summative Assessment Ideas: -Students will create Public Service Announcement to share with CCMNH, other students, staff, and families utilizing their new knowledge. This can be created on paper, a poster, tri-fold brochure, or digitally, through Microsoft PowerPoint, Google Slide, or Apple Keynote, for example. Students may also translate their project into another language, Portuguese or Spanish, for example.</p>	
<p>Stage 3 Learning Plan</p>	
<p>Summary of Key Learning Events and Instruction</p> <ul style="list-style-type: none"> • Introduction to horseshoe crabs, <i>Limulus polyphemus</i>. • Field trip to Cape Cod Museum Of Natural History, Brewster, MA. • Public Service Announcement 	

<p>Introductory Lesson Lesson that introduces the content. More teacher directed</p>	<p>Constructing Lesson Lessons that engage students in building and linking together understanding. Guided/collaborative. Student/teacher or partners/small group</p>	<p>Practice Lesson Lessons or activities that students can complete relatively independently</p>	<p>Assessment Lesson Formative: Check-ins along the way to see if students “get it” Summative: Students showing what they know, when you feel they are ready</p>
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Stage 3 Learning Plan

Summary of Key Learning Events and Instruction

Lesson Name	Type (Introductory, Constructing, Practice, and Assessment)	Content Addressed	Standards Included (by number)
1. What is a horseshoe crab?	I and A	Students learn what a horseshoe crab is.	3-LS1-1; 3-LS3-1; 3-LS4-2; 3-LS4-3
2. How do my eyes see?	C, P and A	Students explore the different types of animal eyes and how they work.	3-LS4-3
3. Hoes does my tail work?	C, P and A	Students understand that different tails have different functions.	3-LS3-1; 3-LS4-3
4. How old am I?	C, P and A	Students learn how to figure out the age of an organism.	3-LS1-1; 3-LS4-3; 3-LS4-4
5. Field trip to CCMNH	P and A	Students go to CCMNH for a field trip, exploring inside and outside.	3-LS1-1; 3-LS3-2; 3-LS4-2; 3-LS4-3; 3-LS4-4; 3-LS4-5(MA) 3-LS4-5(MA)

6. Why do horseshoe crabs matter?	C and A	Student teams will design a Public Service Announcement, trying to convince Cape Codders to save our HSCs.	3-LS4-2; 3-LS4-3; 3-LS4-5(MA)
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Lesson 1: What is a Horseshoe Crab (HSC)?

Overview of the Lesson: What will students be doing?

Students will learn all about horseshoe crabs: how long they have been on Earth, basic body part names and purposes.

Time (minutes): 45 minutes

Standard(s): What standards (s) will be the focus of the lesson?

- 3-LS1-1
- 3-LS3-1
- 3-LS4-2
- 3-LS4-3

Essential Question(s): What essential questions will be addressed in this lesson?

- What is a Horseshoe crab?

Science Objectives

- analyze and interpret information.

Language Objectives and/or Targeted Academic Language

- horseshoe crab (HSC), *Limulus polyphemus*
- marine environment
- prosoma, opithosoma, telson

Anticipated Student Pre-conceptions/Misconceptions (optional)

- telson (tails) are poisonous or weapons.

Instructional Materials/Resources/Tools

- HSC model and/or molt
- Green Eggs and Sand curriculum
- Crab Moon book
- HSC hat activity
- colored pencils
- scissors
- hole punch
- 3 fasteners per student
- science journal
- Any vocabulary words translated for ELL students

Assessment: How will you know that the students got it?

- The students will draw and label a HSC in their science journals.
- Their HSC hat looks like a HSC.

Science and Engineering Practices included (put the included ones in bold):

1. Asking questions (for science) and defining problems (for engineering)
2. **Developing and using models**
3. Planning and carrying out investigations
4. **Analyzing and interpreting data**
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

Notes about Science and Engineering Practices included:

Lesson Overview:

- Students will learn about *Limulus polyphemus*, our local horseshoe crab.

Opening/Engagement:

1. On the board, write: What are Horseshoe Crabs(HSC)? Where do they live? Have you seen a Horseshoe Crab? (If need to, translate.)
2. Think/pair/share, first in small groups, then with entire class.
3. Show photographs and drawings of HSCs. Include images of the fossil HSC, as well as our local one. Then show a true crab, through photographs, molts or models. Compare the 2 animals. Explain how crabs molt backwards, HSCs forward.
4. Help students draw a Venn diagram comparing HSCs and true crabs. Molting direction, both molt, # of legs, # of eyes, live in marine environment.
5. Have students draw a horseshoe crab in their science journal. Label the 3 body parts. Point out where the 10 eyes are.

During the Lesson:

5. Hold up the (already made) HSC Hat. Explain they will each make their own.
6. Give directions including the materials: 2 pieces of paper, scissors, hole punch, fasteners.
7. Pass out the materials. Let students create their own HSC, including adding the eyes.
8. Have students clean up their spaces.

Lesson Closing

9. Ask students, 1: did creating the hat help them understand HSCs any better? 2: any comments about animal or project?
10. Ask students if HSCs are related to true crabs. Hopefully, they will respond “No”.
11. If time, read Crab Moon.

Instructional Tips/Strategies/Suggestions for Teacher: What other ideas would you like to highlight? What grouping strategies are important? What are adjustments for struggling learners, enrichment, or for students who are English Learners?



Lesson 2: How do my eyes see?

Overview of the Lesson: What will students be doing?

The students will learn about different types of eyes. They will see illustrations in books. They will draw pictures of the different eyes. The students will be able to look through a model of compound eyes.

Time (minutes): 45 min

Standard(s): What standards (s) will be the focus of the lesson?

- 3-LS4-3

Essential Question(s): What essential questions will be addressed in this lesson?

- Do different types of eyes work the same way?

Science Objectives

- Evaluating Information

Language Objectives and/or Targeted Academic Language

- compound eyes

Anticipated Student Pre-conceptions/Misconceptions (optional)

Instructional Materials/Resources/Tools

- Science Journals
- Eye by David Macaulay
- Animal Eyes by Steve Jenkins
- Horseshoe crab hats
- scallop shells
- HSC molt
- paper towel/toilet paper tubes
- wide tape to hold tubes together as compound eyes
- Ultraviolet detecting beads
- a UV light source (you can make one, buy one, use a window sill or go outside)
- technology with Atlantic White Shark Conservancy's and Shark Saver's websites up. Both have sections on shark eyes.
- technology with scallop eyes or print out photographs of their blue eyes.

Assessment: How will you know that the students got it?
Students will know that different eyes work differently.

Science and Engineering Practices included (put the included ones in bold):

1. **Asking questions** (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. **Analyzing and interpreting data**
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

Notes about Science and Engineering Practices included:

Lesson Overview:

- Animals do not all see the same.

Opening/Engagement:

1. With books and supplies already set out, ask students what they remember about HSC eyes: the number of eyes and the types of eyes. Have them refer to their science journals and the HSC hats they made.
2. Do all animals, including humans, see like HSCs? Write down students' ideas on board. How do our eyes work? Show diagram of human eye in David Macaulay's Eye.
3. Read parts of Steve Jenkins' Eye to Eye.

During the Lesson:

5. Students, with their science journals, will rotate through stations: 1. UV beads 2. compound eyes, both HSC & insect (have a tube compound already made on table. If possible, have 'fly eye' goggles or kaleidoscope compound eye models to look through) 3. scallop eyes (have shells, technology and illustrations set out) 4. cat-eyed dogfish (have technology, photos of dogfish eyes vs white shark eyes and information)
6. Students will experiment with UV beads. Remind them that the HSC telson can detect UV light. How does that help HSCs survive?
7. Students will draw and write about the different types of eyes at the other stations.
- 8.

Lesson Closing

9. Help students make a Venn diagram in their science journals. Have HSCs be one of the animals. Let them pick other animal to compare with. Have them Think/Pair/Share with their tablemates. Does anyone want to share with entire class?
10. If time allows, show the short DE Sea Grant videos on HSC eyes and scallop eyes.
11. If time allows, ask students how they could use UV beads to help themselves? If they had their own UV beads, they would know when to wear sunscreen, even on cloudy days.
- 12.

Instructional Tips/Strategies/Suggestions for Teacher: What other ideas would you like to highlight? What grouping strategies are important? What are adjustments for struggling learners, enrichment, or for students who are English Learners?

Lesson 3: How does my tail work?

Overview of the Lesson: What will students be doing?

Students will discover that animal tails have different purposes, so work differently.

Time (minutes): 45 minutes

Standard(s): What standards (s) will be the focus of the lesson?

- 3-LS3-1
- 3-LS4-3

Essential Question(s): What essential questions will be addressed in this lesson?

- What does an animal's tail tell us about the animal?

Science Objectives

- Analyze and interpret information

Language Objectives and/or Targeted Academic Language

- telson

Anticipated Student Pre-conceptions/Misconceptions (optional)

Instructional Materials/Resources/Tools

- science journals
- animal models and photographs of different tails
- bird tail feathers
- What do you do with a Tail like this? Steve Jenkins & Robin Page
- Feathers: Not Just for Flying by Melissa Stewart
- A Closer Look at Whales and Dolphins by Elizabeth Strachan
- Eyewitness Whale by Vassili Papastravrou
- Winter's Tail: How One Little Dolphin Learned to Swim Again by Juliana, Isabella & Craig Hatkoff

Assessment: How will you know that the students got it?
Through student questions and science journal entries.

Science and Engineering Practices included (put the included ones in bold):

1. Asking questions (for science) and defining problems (for engineering)
2. **Developing and using models**
3. Planning and carrying out investigations
4. **Analyzing and interpreting data**
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

Notes about Science and Engineering Practices included:

Lesson Overview:

Opening/Engagement:

1. Ask students if all tails work the same way. Which animals have tails? Think/pair/share.
2. Ask students to imagine what kind of tail they would want and why, if they could grow one. Think/pair/share.
3. Have students draw their 'ultimate' tail in their science journals. Let them know that later, there will be more time to finish their creation.

During the Lesson:

5. Show students the animal models: whale/dolphin; shark; HSC (or molt); sea horse; bird.
6. Explain that there are 5 stations they will move around: HSC; whale/dolphin; shark/fish; bird tail feathers; sea horse.
7. Each station's books, models, molts, feathers and examples will give students the time to explore different tails. If possible, use technology with the sea horse videos.
8. Students will draw and/or describe the tails in their science journals.

Lesson Closing

9. Ask students if anything about animal tails surprised them.

10. On the board, help students do a Venn diagram with HSC and another animal. Have them copy it into their science journals.

11. If time, show some of the Winter the dolphin, Clearwater Marine Aquarium, videos.

Instructional Tips/Strategies/Suggestions for Teacher: What other ideas would you like to highlight? What grouping strategies are important? What are adjustments for struggling learners, enrichment, or for students who are English Learners?



Lesson 4: How old am I?

Overview of the Lesson: What will students be doing?

The students will learn how to tell the age of an organism using their observational skills. They will understand that organisms will grow at different rates.

Time (minutes): 45 minutes

Standard(s): What standards (s) will be the focus of the lesson?

- 3-LS1-1
- 3-LS4-3
- 3-LS4-4

Essential Question(s): What essential questions will be addressed in this lesson?

- How can we tell the age of organisms through visual observations?

Science Objectives

- Analyze and interpret data

Language Objectives and/or Targeted Academic Language

Anticipated Student Pre-conceptions/Misconceptions (optional)

- Organisms grow at the same rate.

Instructional Materials/Resources/Tools

- HSC molts of varying sizes
- HSC hand puppet already constructed
- tree ‘cookies’ (slices) from different aged trees
- quahog and oyster shells of varying sizes
- student science journals
- rulers with cm/mm (or conversion from inches)
- monarch butterfly life cycle chart & models

Assessment: How will you know that the students got it?

Listening and observing students as they interact in small groups. Correct aging of HSC molts. Science journal activity.

Science and Engineering Practices included (put the included ones in bold):

1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. **Analyzing and interpreting data**
5. **Using mathematics and computational thinking**
6. Constructing explanations (for science) and designing solutions (for engineering)
7. **Engaging in argument from evidence**
8. **Obtaining, evaluating, and communicating information**

Notes about Science and Engineering Practices included:

Lesson Overview:

- Students will learn how to tell the age of an organism and distinguish between different rates of growth.

Opening/Engagement:

1. How old am I, your teacher? young (up to 30), middle aged (31-64), older (65+)? I want you to answer after observing the differences between me and you. Compare our feet size, hands, hair color, any baby teeth left?
2. Please write your answer in your science journal. Turn/pair/share why you chose young, middle aged or older.
3. Ask entire class: how else can one tell the age of an organism? Ask a human, does organism move smoothly or with stiff joints, how tall is the tree, are there tomatoes on the plant? etc
- 4.

During the Lesson:

5. Have specimens set out for students to look at, ideally each organism type will have its own table. Ask students to look at the different organisms, from their seats first. HSC molts with rulers growth charts, oyster and quahog shells, tree cookies and a diagram explaining rem rings, monarch life cycle models and/or diagrams of complete life cycle with time for each stage.
6. Ask students if they recognize the different organisms.
7. Explain each station to the students and model how they will rotate through them. They will need their science journals to record their answers and observations.

Lesson Closing

9. After all students have made the station circuit, have them return to their seats.
10. Ask the class to share what they observed. What was the oldest organism? The youngest?
11. Ask if any one would show their HSC sizing method? Can use the HSC hand puppet, already constructed.
12. Ask them how one could tell the age of a living tree by looking at it. Does anyone know what information tree rings can tell us besides the age of the tree?
13. Was anything the same age, but a different size? (If time, have students organize themselves by age in a line. Hopefully, some taller and shorter students will be out of height line).
14. If time, help students with a Venn diagram using tree rings and bi-valve rings.

Instructional Tips/Strategies/Suggestions for Teacher: What other ideas would you like to highlight? What grouping strategies are important? What are adjustments for struggling learners, enrichment, or for students who are English Learners?

Fish scales also have annual rings. Scales are so small, that a microscope is best to count them. An overhead projector, an Elmo could work, too.





Lesson 5: Cape Cod Museum of Natural History

Overview of the Lesson: What will students be doing?

Students will be exploring CCMNH, both inside and outside.

Time (minutes): 5 hours

Standard(s): What standards (s) will be the focus of the lesson?

- 3-LS1-1
- 3-LS3-2
- 3-LS4-2
- 3-LS4-3
- 3-LS4-4
- 3-LS4-5(MA)

Essential Question(s): What essential questions will be addressed in this lesson?

- What are some similar traits HSCs share with other animals?
- What types of habitats exist at CCMNH?

Science Objectives

- To see some living animals that the students studied.
- To walk in nature, using multiple observational senses.

Language Objectives and/or Targeted Academic Language

Anticipated Student Pre-conceptions/Misconceptions (optional)



Instructional Materials/Resources/Tools

- CCMNH's Explore and Discover worksheets: Eyes, Tails, Age.
- Horseshoe Crab Crawl

Assessment: How will you know that the students got it?

Students will have completed at least one of the self-guided worksheets in the Museum. They will be able to share some of the animals they saw and learned about.

Science and Engineering Practices included (put the included ones in bold):

1. **Asking questions** (for science) and defining problems (for engineering)
2. Developing and using models
3. **Planning and carrying out investigations**
4. **Analyzing and interpreting data**
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. **Engaging in argument from evidence**
8. **Obtaining, evaluating, and communicating information**

Notes about Science and Engineering Practices included:

Lesson Overview:

- Students will be on a guided tour of the trails at CCMNH.
- Students will explore the exhibits and aquarium inside.

Opening/Engagement:

1. Review with students behavior expectations while on bus, on CCMNH's trails, and especially while in CCMNH.
2. Remind students to explore and learn about different things.
- 3.

During the Lesson:

5. Students will go on a guided tour through CCMNH's trails. Hopefully, it will be low tide and horseshoe crabs can be found.
6. Students will complete different *Explore & Discover* worksheets, as well as the *Horseshoe Crab Crawl*.
7. Students will look for the animals they have learned about.
- 8.

Lesson Closing

9. Students thank CCMNH's staff.
10. Students load up on the buses and return to school.
11. If time, have share 3 things they learned. These should be added to their science journals.

Instructional Tips/Strategies/Suggestions for Teacher: What other ideas would you like to highlight? What grouping strategies are important? What are adjustments for struggling learners, enrichment, or for students who are English Learners?



Lesson 6: Why do Horseshoe Crabs matter?

Overview of the Lesson: What will students be doing?

Students will create a Public Service announcement. In small groups, students will create a poster, a tri-fold brochure, a slide show or something similar. They will use arguments and facts to convince Cape Codders that we need HSCs in our environment, we need to save them. They will be able to use their science journals and other resources they have seen during these lessons. If they make the project out of paper, it could be given to CCMNH, hung up at their Town Hall, in the lobby of their school.

Time (minutes): 1-3 hours, depending on depth of research, could take multiple days.

Standard(s): What standards (s) will be the focus of the lesson?

- 3-LS4-3
- 3-LS4-5 (MA)
- 3-LS4-2

Essential Question(s): What essential questions will be addressed in this lesson?

- Why should Cape Codders try to save our HSC population?

Science Objectives

- Ask questions
- Analyze and Interpret data
- Construct explanations

Language Objectives and/or Targeted Academic Language

Anticipated Student Pre-conceptions/Misconceptions (optional)

Instructional Materials/Resources/Tools

- Previously viewed resources: books and videos
- Student science journals
- Animal models and specimens
- materials needed for project: markers, paper, technology
- Public Service Announcements: the crying Native American from the 1970s, Smoky the Bear, etc
- Create a rubric for students' project. (www.rubric-maker.com)

Assessment: How will you know that the students got it?

Their finished projects should illustrate what they've learned by convincing others to think about the importance of horseshoe crabs in our environment.

Science and Engineering Practices included (put the included ones in bold):

1. **Asking questions** (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. **Analyzing and interpreting data**
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. **Engaging in argument from evidence**
8. **Obtaining, evaluating, and communicating information**

Notes about Science and Engineering Practices included:

Lesson Overview:

- Students will work in small groups to create a project to convince Cape Codders that HSCs need to be saved.

Opening/Engagement:

1. Review the field trip. Each person shares 1 like, 1 dislike, 1 new thing they learned.
2. Explain that teams will create a Public Service Announcement, to convince Cape Codders to save the Horseshoe Crab before it becomes officially endangered in Massachusetts.
3. Show some example of Public Service Announcements, both in print and in video.
4. Explain the rubric to students.

During the Lesson:

5. In small groups, students will decide which media to use for their project. Have them write down the team's members' names, the media type, and any supplies they will need.
6. Students will collaborate to create a persuasive argument.
- 7.
- 8.

Lesson Closing

9. Students will present each of their projects to the class.
10. Students will fill out a self-grading rubric individually, not as the project team.
- 11.
- 12.

Instructional Tips/Strategies/Suggestions for Teacher: What other ideas would you like to highlight? What grouping strategies are important? What are adjustments for struggling learners, enrichment, or for students who are English Learners?



Information to Support Teaching Learning

What additional resources can support teachers in developing background understanding of content or ideas in this unit?

- CCMNH has resources to access before your visit. Contact Barbara Knoss, Director: Education & Volunteers, bkness@ccmnh.org or (508) 896-3867 x119. www.ccmnh.org
- The Ecological Research & Development Group (ERDG)'s website is a great resource: <https://horseshoecrab.org>
- Delaware Sea Grant <https://www.deseagrant.org> has great helpful information, both on its website and through its 15 Second Science video series on YouTube.
 - Check out these episodes:
 - for Horseshoe Crabs: # 25, 221, 222, 223, 224, 225, 226.
 - for Scallops: # 178, 185, 188, 191.
 - for Oysters: # 32, 136, 160.
- Green Eggs & Sand curriculum http://www.tydb.org/greeneggs_sand The lesson on aging a HSC molt is from this curriculum.
- This document covers HSC anatomy, how to preserve molts with glycerin, and includes the HSC molt lab from Green Eggs & Sand.
 - <https://horseshoecrab.org/teacher-toolbox/wp-content/uploads/2015/06/Exploring-external-anatomical-features-of-the-American-Horseshoe-Crab-through-observation-of-molt-specimens.pdf>
- MD Dept of Natural Resources: <https://dnr.maryland.gov/ccs/Pages/horseshoecrab-anatomy.aspx>
- Squidtoons: <https://squidtoons.com/>
- National Science Teaching Association has a variety of resources: www.nsta.org

List of Unit Resources (in lesson sequence)

What additional resources can support the teaching and learning of this unit? What resources can support the teacher in implementing the unit?

Lesson 1: What are Horseshoe Crabs?



- Green Eggs & Sand curriculum
- Crab Moon book
- Acorn Naturalist catalog for animal models: <https://www.acornnaturalists.com/>
- Chesapeake Bay Environmental Center:
 - <https://www.bayrestoration.org/wp-content/uploads/2018/07/HSC-LP-Grades-1-2-for-CBEC-11-10-17.pdf>
- For links to other sources: try Beach Chair Scientist: <http://beachchairscientist.com/limulus-love/>

- PBS' Nature Crash: A Tale of Two Species:
 - <https://www.pbs.org/wnet/nature/crash-a-tale-of-two-species-horseshoe-crab-anatomy/593/>
 - <https://www.pbs.org/wnet/nature/crash-a-tale-of-two-species-additional-web-and-print-resources/598/>

Lesson 2: How do I see?

- Eye to Eye: How Animals See the World by Steve Jenkins
- Eye: How It Works by David Macaulay
- What if You had Animal Eyes? by Sandra Markle
- Horseshoe crab eyes:
 - <https://www.youtube.com/watch?v=do77Jj9vh2M>
- Insect compound eyes:
 - eyes found at 2min 10 sec: <https://www.youtube.com/watch?v=rKQfJFAHW8Q>
 - https://www.youtube.com/watch?v=cvN0_2ztaVc
- Dogfish and their eyes video:
 - <https://www.adventuresportsnetwork.com/random/spiny-dogfish-produce-unique-lightshow-with-eyes/>
 - <https://animals.howstuffworks.com/fish/sharks/shark-senses3.htm>
- Beads:
 - <https://www.teachersource.com/product/ultraviolet-detecting-beads/light-ultraviolet>
 - <http://www.incrediblescience.com/uv-solar-energy-beads.html>
- Fly Eye glasses <http://www.incrediblescience.com/fly-eyes-glasses.html>
- kaleidoscopes as compound eyes: (transparent prisms)
 - https://www.rinovelty.com/ProductDetail/cakalpr_175-prisms-----6015

Lesson 3: How do I use my tail?

- Green Eggs & Sand telson information
- CCMNH's Osprey Cam video- watch for tail feathers
- What Do You Do with a Tail Like This? Steve Jenkins & Robin Page
- Feathers: Not Just for Flying by Melissa Stewart



- A Closer Look at Whales and Dolphins by Elizabeth Strachan
- Eyewitness Whale by Vassili Papastavrou
- Science with Kids YouTube channel: Facts about Seahorses <https://www.youtube.com/watch?v=QdXGSsKKAiQ>
- SciNews YouTube channel: Why the seahorse tail is square <https://www.youtube.com/watch?v=pEcVPQDI5ql>
- Bird tails from Bird Protection Quebec: <https://pqspb.org/bpqpoq/a-tale-of-form-and-function-10-facts-about-bird-tails/>
- Winter's Tail: How One Little Dolphin Learned to Swim Again by Juliana, Isabella & Craig Hatkoff
- Clearwater Marine Aquarium's videos on Winter the dolphin, her rescue, prosthesis tail development, etc
- From NSTA: <http://static.nsta.org/connections/elementaryschool/201811HowAnimalsMove.pdf>
- Engineering is Elementary Curriculum, Museum of Science, Boston:
 - <http://eie.org/engineering-everywhere/curriculum-units/go-fish-0>

Lesson 4: How old am I?

- A Butterfly's Life by Nancy Dickmann
- The Monarch's are Missing: A Butterfly Mystery by Rebecca E. Hirsch
- When Fish Got Feet, Sharks Got Teeth, and Bugs Began to Swarm: A cartoon PreHistory of Life Long Before Dinosaurs by Hannah Bonner
- Oyster aging: <https://learn.weatherstem.com/modules/learn/lessons/124/13.html>
- Green Eggs & Sand aging with molts lesson
- <https://www.education.com/worksheet/article/tree-rings/>

Lesson 5: Field trip to Cape Cod Museum of Natural History

- Field trip information given by CCMNH
- Activities for students to Explore & Discover at CCMNH:
 - Horseshoe Crab Crawl
 - Explore & Discover Eyes!
 - Explore & Discover Tails!
 - Explore & Discover My Age!

Lesson 6: Why do Horseshoe Crabs matter?

- Public Service Announcements in print and video
 - <https://www.govtech.com/education/news/How-to-Create-the-Perfect-Public-Service-Announcement.html>
 - <https://www.youtube.com/watch?v=epCKjaStFu0>
 - <https://smokeybear.com/education/smokey-activity.pdf>
 - the stick puppet project has some great illustrations of animal tails.
 - <https://youtu.be/SHNL5M6q-bg>
 - https://youtu.be/5wSz_D7iOZ4

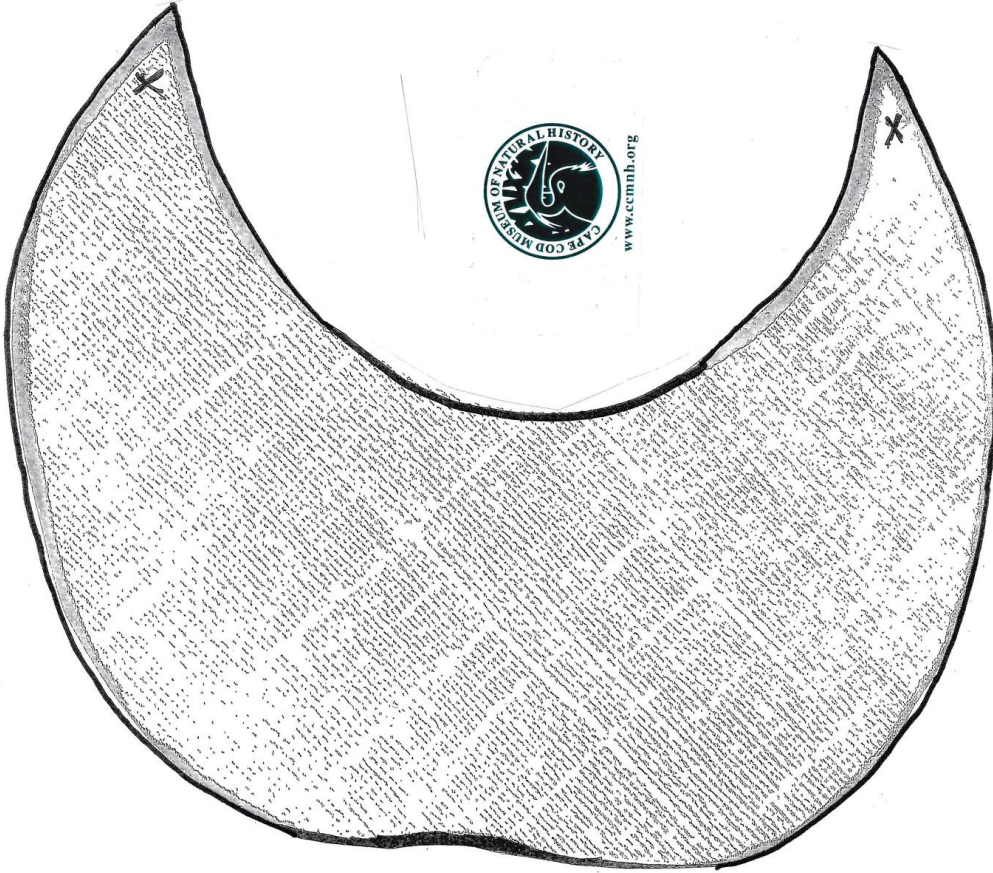


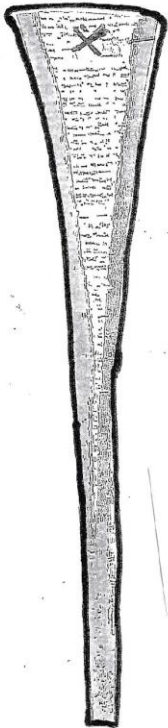
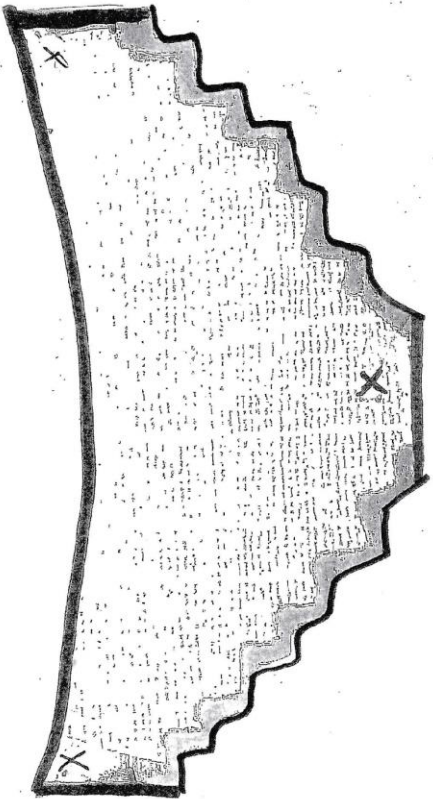
- <https://www.youtube.com/watch?v=eywBa0xfQFw>

Curriculum Embedded Performance Assessment (CEPA; if applicable)

Detail the performance assessment and include any rubrics or resources

HORSESHOE CRAB HAT





1. Color
2. Cut out on solid black lines
3. Punch holes on X's
4. Use fasteners to attach at 3 points
5. Use black markers to add the 10 eyes in the appropriate locations
6. Put on your hat!!!



