

Cape Cod: A Marine Life Hotspot

Science/STEM Grade 3

This unit was designed and created as a response to the urgent need to provide young learners with an opportunity to harness and embrace the resources and living connections found within their surrounding communities. With the growing demands of 21st century learning within public education, community connections are increasingly vital to an enduring understanding of the natural world.

Progressing through the six lessons of this unit, students build a strong foundation in marine science literacy as it relates to Cape Cod. Discovering through hands on project based learning, students learn how impacts, both natural and manmade, affect many of the marine species living in this unique coastal community, By the end of the unit, students gain greater understanding of the dedication, love and stewardship efforts made by many in their towns and community.

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1. Created by Joanne Harrington, Orleans Elementary
2. What were some sources of inspiration for this unit?

- a. **Headstart Collaboration Project at Orleans Elementary School**
- b. **The National Marine Life Center and Rehabilitation Center**

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

Cape Cod, a unique landform jutting out into the Atlantic Ocean, is one of the most ecologically pristine and diverse coastal areas along the Northeast. With the rigors of educational requirements and financial constraints, students often have fewer opportunities to investigate local areas of wonder found just steps away in their own backyards. This unit, Cape Cod: A Marine Life Hotspot, fully linked to the newly adopted NGSS, furthers the need for science educators to continue to make educational connections between the natural world and the many resources found within our local communities.

4. What might students find exciting in this unit?

This unit addresses important topics and resources often overlooked in the elementary science classroom. Topics include: local strandings of sea turtles, seals, dolphins and small whales due to Cape Cod's unique shape; locally established organizations and networks such as the, National Marine Life Rehabilitation Center and IFAW's Stranding Network, which serves to insure that strandings and eventual deaths, so commonly experienced in the past of these marine animals, are given a chance at survival. Additionally, in an effort to recognize the interdisciplinary approach to the connections between human, animal and ecosystem health, important worldwide bacteria and disease research continues at organizations such as the NMLC

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

The majority of the grade 3 science standards, within this unit, are primarily in the Life Sciences. The newly adopted NGSS standards has identified eight life science standards for this grade level. When compared with other grades, this change can likely be best served when applied to a project-based unit addressing several standards together. The lessons, within this unit, can be adapted to other grade levels where appropriate.

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?

Personally, as a science/STEM educator for elementary and middle schools and residing on Cape Cod, I’ve experienced a growing need to connect local resources and field experiences with the important work being done in the area of rehabilitation. Having the privilege of living and working on Cape Cod most of my life, I have witnessed great strides in our understanding of this unique landform and the marine animals that inhabit this peninsula. As such, it is up to us to bring forth the passion and vigor required in understanding, at the same time, our stewardship responsibilities in order that others might embrace and pass this knowledge onto future generations.

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

During my residency at the National Marine Life Center and in creating my unit, Cape Cod: A Marine Life Hotspot, the greatest lesson I learned is how important it is to bring my experiences, connecting with the many faces of those who work behind the scenes to protect and care for the marine animals of Cape Cod, to my students. The torch of understanding of those who work long hours with heartfelt passion, giving all they can, sharing in the belief that what they do matters, not so much to themselves, but to the larger cause and mission of rehabilitation, science education and research, this, my students need to learn.

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

As educators, I trust you will find some value in these lessons. As this is a work in progress, I welcome any/all ideas that you might have to insure that I have delivered a rich and meaningful document. Ongoing work in progress.

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Stage 1 Desired Results

MA STE Standards

3-LS1-1

Math Standards 3.MD 3 and 4

3-LS4-3

3-LS4-4

NGSS 3-LS4-2

NGSS 3-LS4-5(MA)

NGSS 3-LS3-2

NGSS 3-LS4-4

NGSS 3-LS4-5(MA)

ESSENTIAL QUESTIONS

- Do all animals experience similar life cycles?
- What is the difference between natural and human impacts? What are mass/single strandings?
- How might the shape of Cape Cod, a coastal landform, effect survival rates of sea turtles, seals, pilot whales and dolphins?
- What role do humans play in affecting a particular species such as sea turtles, seals, dolphins and pilot whales verses natural impacts as it relates to strandings?
- Scientific discoveries lead to the development of new technologies. What technologies do you think might improve the number of stranding events on Cape Cod?
- How might sea turtle's needs (diet), characteristics (features), and habitats provide an advantage/disadvantage in assuring that it would more likely survive and produce offspring.
- What should one do when a marine animal stranding occurs? Does one report the stranding?
- How do rescue personnel know that an animal is stranded or not just acting normal?
- Are there laws that protect stranded/injured marine animals?

<p>NGSS 3-LS4-3 NGSS 3-LS4-4</p>	<ul style="list-style-type: none"> • What implementation of protocols are used when admitting a sea turtle species at the NMLC/local marine life rehabilitation hospital? • Are intake procedures for sick/injured marine animals similar to what happens when humans go to the hospital?
<p>NGSS 3-LS4-3 NGSS 3-LS4-4</p>	<p>UNDERSTANDINGS See Lessons</p>
	<p>TRANSFER</p> <p><i>Students will be able to independently use their learning to:</i></p>
	<p>Cross-cutting Curricular Connections</p> <p>Patterns, Systems and System Models, Stability and Change</p>

Stage 2 Evidence

Formative Assessment Ideas:

See Lessons

Summative Assessment Ideas:

See Lessons

Stage 3 Learning Plan

Summary of Key Learning Events and Instruction

- See Lessons
- See Lessons

Introductory Lesson Lesson that introduces the content. More teacher directed	Constructing Lesson Lessons that engage students in building and linking together understanding. Guided/collaborative. Student/teacher or partners/small group	Practice Lesson Lessons or activities that students can complete relatively independently	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
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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)
Life Cycles: Compare and Contrast	Introductory, Constructing, Practice, and Assessment	Compare and Contrast Life Cycles of Local Marine Animals	3-LS1-1. Math Standards 3.MD 3 and 4
Cape Cod Strandings: Human and Natural Impacts	Introductory, Constructing, Practice, and Assessment	Construct an argument with evidence that Cape Cod is a unique landform that impacts marine animals.	3-LS4-3 3-LS4-4
Adaptation of Sea Turtles found in the US Atlantic Coast	Introductory, Constructing, Practice, and Assessment	Variations in the adaptations/features/habitats of a particular species of sea turtle	3-LS4-2 3-LS4-5(MA)
Field Trip—Classroom/NMLC--Rescue and Intake	Introductory, Constructing, Practice, and Assessment	What local resources are available to aid in survival rates caused by human and natural impacts of marine animals	NGSS 3-LS3-2 NGSS 3-LS4-4
Marine Animal Medical Mystery	Introductory, Constructing, Practice, and Assessment	How do local resources function in maintaining the health and wellbeing of marine animals	NGSS 3-LS4-3 NGSS 3-LS4-4
Rescue and Satellite Tagging	Introductory, Constructing, Practice, and Assessment	Aiding in the return of injured/stranded marine animals and the engineering /technology that informs progress and research	NGSS 3-LS4-3 NGSS 3-LS4-4

Lesson 1: Life Cycles: Compare and Contrast

Overview of the Lesson:

Students will compare and contrast the unique and diverse life cycles of a variety of animal species (4): sea turtles, seals, small whales and dolphins.

Time (minutes): 50

Standard(s):

NGSS 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.

Math Standards 3.MD 3 and 4—Represent and interpret data (MA Math Standards 2011)

Essential Question(s):

- Do all animals experience similar life cycles?

Science Objectives:

- Identify and sequence general animal life cycle stages
- Plot/graph differences in life cycles (represent physical variables and their relationships)
- Data Analysis (application of quantitative relationships)

Math Objectives

- Represent patterns in real world situations using a table, graph or equation (2011 MA Math Standards)

Language Objectives and/or Targeted Academic Language:

- Classification
- Groups
- Species
- Life Cycle (birth, growth, reproduction {gestation} and death)
- Life Span

Anticipated Student Pre-conceptions/Misconceptions (optional)

- Life cycles are the same in reptiles and mammals as well as common among mammals

Instructional Materials/Resources/Tools

- Teacher species background information (see Supplemental Background Teacher Information Sea Turtles, Seals, Pilot Whales and Dolphins folder)

Assessment:

- 1.) Using the cycle template, students draw and label pictures of the life cycle of at least two different species , putting them in order on the circle chart illustrating the cyclical nature of life, i.e. birth, growth (adolescence), Adult (sexual maturity) and death.
- 2.) Student's graph (bar, plotted, etc.) to represent the contrast between the 4 life cycles: sea turtle, seal, dolphin and pilot whale

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**

Lesson Overview:

- Students will compare and contrast a variety of life cycles incorporating the topics of science and math using graphs/plot lines. Students will analyze their graphical findings to determine the differences between the four species.

Dolphin: http://prezi.com/u66cm_u6ztny/?utm_campaign=share&utm_medium=copy&rc=ex0share

Pilot Whale: (see Life Cycle folder)

Harbor Seals: (see Life Cycle Folder)

Sea Turtles: (see Life Cycle Folder)

Opening/Engagement:

1. Where do species of turtles, seals, dolphins and pilot whales live on Cape Cod?
2. Do you think all species of mammals have the same life cycles? What's the difference between mammals and reptiles? What are the major parts of an animal life cycle? (birth, growth {adolescence}, Adult {sexual maturity} and death.
3. Make a prediction what the life spans of four species from birth to death in years, i.e., sea turtle, seal, pilot whale and dolphin would look like.

During the Lesson:

4. In rotating groups, students examine a total of 4 graphical representatives which highlights the differences in life cycles among the different species of animals.
5. Using a data worksheet, students plot a life cycle timeline for each species under the heading of birth, growth (adolescence), reproduction (sexual maturity) and death.

6. At their original tables, students analyze and compare graphs/line plots of each student's worksheet

Lesson Closing:

- Groups 1 and 3 identify the parts of the sea turtle and dolphin's life cycle. Groups 2 and 4 identify the small whale and the seal (leave out verbal cue for lesson closing expectation until end of lesson).
- Using the same grouping, have students put their grouped animals (1+3 and 2+4) in their life cycle order.

Instructional Tips/Strategies/Suggestions for Teacher:

Within the classroom, this lesson may best work and require less amounts of materials if done in a rotation format using 4 tables with up to 4 groups. Each group consists of one student from their regular table group (this allows each species to be collected by each regular table group when seated for analysis and conclusion) cycling through the different species and using their single data sheet that shows all 4 graphs on one page. This group format may help when analyzing and comparing data.

Life Cycle: Common Dolphins (short and long finned)

Reproduction: gestation 10-12 months (mating June-Sept)

Birth: calf/suckling-hours-2 years

Adolescent: 2-9 years

Adults: (sexual maturity) females-2-7 years, males- 3-12 years

Life Span: 35 years

Lesson 2: Cape Cod Strandings: Human and Natural Impacts

Overview of the Lesson:

In this lesson, students learn how the shape of Cape Cod plays a major role in the number of strandings found in this area, compared to other coastal regions. Additionally, students discover the many impacts, both human and natural, that contribute to the strandings of sea turtles, seals, dolphins and small whales, namely Pilot and Pigmy whales.

Time (minutes): 2—50 minutes blocks

Standard(s):

- 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. (Examples of evidence could include needs and characteristics of the different organisms (species) and habitats involved).
- 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.

Essential Question(s):

- What is the difference between natural and human impacts? What are mass/single strandings?
- How might the shape of Cape Cod, a coastal landform, effect survival rates of sea turtles, seals, pilot whales and dolphins?
- What role do humans play in affecting a particular species such as sea turtles, seals, dolphins and pilot whales verses natural impacts as it relates to strandings?
- Scientific discoveries lead to the development of new technologies. What technologies do you think might improve the number of stranding events on Cape Cod?

Science Objectives

- Compare and contrast similar/different coastal landform regions
- Analyze a variety of stranding events on Cape Cod of sea turtle, seal, pilot whale and dolphin
- Cause and effect: mechanism and explanation of the dynamic changes in a coastal region (impacts human/natural)
- Scale, proportion and quantity of species traveling in groups
- Patterns (time and temperature) reptiles and mammals
- Stability and Change (appear stable but over long periods of time, eventually change) stranding factors

Language Objectives and/or Targeted Academic Language

- **Bay**, salt marsh, **shoals**, shore, estuary, sound, inlet, cliff, **cape**, channel, continental shelf
- impacts
- stranding,
- rescue
- Seal
- Dolphin
- Sea turtle
- Pilot whale

Anticipated Student Pre-conceptions/Misconceptions (optional)

- Cape Cod, as a coastal landform, is like any other coastal area.
- Strandings are always a natural occurrence.
- Once a particular species strands, there is little/nothing to do.

Instructional Materials/Resources/Tools

- Maps of Cape Cod (see stranding folder)
- Stranding Reports—newspapers, articles and webpages, stranding data (NMLC)
- Visuals of human/natural impacts of species
- Conservation laws and practices that aid species http://www.nmfs.noaa.gov/pr/pdfs/esa_factsheet.pdf
- More on Endangered Marine Animals: https://www.youtube.com/watch?v=XKXNb-TGh8o&list=PLqjRqI1v493Jm3_c4vmEbCDwXavZ0yZ_A&index=1

Assessment:

- Students analyze and interpret a variety of maps related to coastal landforms, i.e., island, peninsula, bay, beach, arch, **labeling** each term with the landform.
- Students differentiate a variety of impact cards. Using two columns titled, “Human” and “Natural”, students place the impact cards under the appropriate column.
- Students predict then graph the number of sea turtles stranding in Cape Cod bay from years 2001-2015.
- Students analyze and determine what factor(s) may have caused the standings.

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:

Enrichment: Students brainstorm engineering/technology solutions that might aid in lessening the numbers of stranding of sea turtles, seals, dolphins and small whales

Lesson Overview:

- In this lesson, students will learn how the unique land formation of Cape Cod is one of many factors that relates to the high number of standings of sea turtles, seals, dolphins and pilot whales. Students will recognize that there are both natural and human factors that play a role in the high number of standings on Cape Cod.

Opening/Engagement:

1. Students work in teams of two viewing a variety of Cape Cod strandings: sea turtles, seals, dolphins and pilot whales. Next, students write in a short *question* format, what they see. For example, what factor causes sea turtles to strand in Cape Cod bay each year? Or, why do sea turtles strand around the same time of year (Mid-November and later)? (10 minutes)
2. KWL—What’s the difference between human/natural impacts that can affect the survival of a particular species? Can you name two human and two natural impacts? (5 minutes)
3. Show mini ppt. (add discussions where needed) related to Natural/Human impact factors? (15 minutes)

During the Lesson:

4. Using a word bank, students label landforms of Cape Cod. see attached (“Cape Cod Landforms”) and (Cape Cod Landform Labels) (10 minutes)

[p://worldlandforms.com/landforms/cape/](http://worldlandforms.com/landforms/cape/)

<https://www.nationalgeographic.org/encyclopedia/cape/>

Class 2—with 50 minutes blocks)

5. Classify a variety of human and natural impact factors relating to sea turtles, seals, dolphins and pilot whales under “Human” and “Natural” titles. See attachment—**Lesson 2—Human and Natural Titles** (10 minutes)
6. Give each group of 2 students a shuffled pack of 9 Human and 9 Natural Impact cards. Have students put the cards under the appropriate titles: “Natural” and “Human.” (10 minutes)

Assessment(s):

- Formal--Students analyze and interpret a variety of maps related to coastal landforms, i.e., island, peninsula, bay, beach, arch, **labeling** each term with the landform. (see Lesson 2—map and answer map attachments)
- Informal--Students differentiate a variety of impact cards. Using two columns titled, “Human” and “Natural”, students place the impact cards under the appropriate column.
- Formal(Math)--Students predict then graph the number of sea turtles stranding in Cape Cod bay from years 2001-2015. Students analyze graph and make final predication for 2018.
- Informal/Formal--Students analyze and determine what factor(s) may have caused the strandings.

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?

- **Teacher Background on Cape Cod Strandings (see attached)**

Lesson 3: Adaptations of United States Atlantic Coast Sea Turtles Species

Overview of the Lesson:

In this lesson, students use evidence gleaned from research and graphs to construct an explanation for how variations in adaptations among the sea turtle species varies. Students determine if a particular species proves to have an advantage to a particular sea turtle's survival and reproduction when compared to other sea turtles.

Time (minutes): 2—50 minute blocks

Standard(s):

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

Essential Question(s):

- How might sea turtle's needs (diet), characteristics (features), and habitats provide an advantage/disadvantage in assuring that it would more likely survive and produce offspring.

Science Objectives: Crosscutting Concepts

- Compare and contrast: similar/different sea turtle species
- Analyze: a variety of sea turtle species found in the Atlantic, Northeast
- Cause and effect: mechanism and explanation of adaptations among the different species

- Structure and Function: sea turtle specie adaptations
- Scale, proportion and quantity of species: weight, length and population size
- Stability and Change: sea turtle population growth/decline over time
- Patterns—analysis of similarities and differences
- Stability and Change—factors affecting survival rate

Language Objectives and/or Targeted Academic Language

- Adaptation
- Habitat
- Species
- Group
- Leatherback
- Green
- Hawksbill
- Loggerhead
- Kemp’s Ridley
- Costal scutes
- Reptiles
- Endangered species
- Protected—US Endangered Species Act

Anticipated Student Pre-conceptions/Misconceptions (optional)

- Animals of the same species have the same characteristics/features.

- Animals from the same species encounter the same advantages/disadvantages.
- Animals of a particular species, such as sea turtles, have the same needs, habitats and reproduction rates.

Instructional Materials/Resources/Tools

Endangered Species Information for Teachers:

- <http://www.nmfs.noaa.gov/pr/species/mammals/>
- https://www.greateratlantic.fisheries.noaa.gov/protected/esd/docs/es_day_art_contest_invitation.pdf
- <https://www.greateratlantic.fisheries.noaa.gov/protected/esd/docs/coloringbook.pdf>
- <https://www.greateratlantic.fisheries.noaa.gov/protected/esd/docs/garfoespecietable.pdf>

Species Information for Students:

- <https://www.afsc.noaa.gov/nmml/education/marinemammals.php>

Assessment:

Formal--Research--Turtle Research worksheets

Formal--Math--Turtle Graphs

Formal—Turtle Species Analysis Conclusion in a paragraph

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:

- In this lesson, students investigate a variety of adaptations and features related to five species of sea turtles living in the US Atlantic Coast. In doing so, students gain knowledge and understanding of how variations in characteristics/features, among the same species, sea turtles, may provide advantages; one organism is more likely to survive and therefore more likely to reproduce.

Opening/Engagement:

1. What are some challenges organisms face in a marine environment? What are some ways organisms handle those challenges?
2. What adaptations are the same in all the species of sea turtles? What adaptations are different in each of the sea turtles?
3. What major habitat does each of the five species of sea turtles live?
4. Predict which species you think has the highest population. Predict which species of sea turtle has the lowest population.

During the Lesson:

1. Research handout--Sea Turtles of United States Atlantic Coast research
2. Research worksheet (See Sea Turtle's Research worksheet)
3. Math--Research Graphing-- shell size, weight and population size in estimates(See Sea Turtle Graphing)

Lesson Closing:

4. In groups of two, analyze research, graphing, and knowledge gained on the topic of adaptations in determining which particular species of sea turtles has the highest survival rate.
5. Conclusions—Have students conclude their findings with a short paragraph (4-5 sentences) outlining which sea turtle species they think has a better chance of surviving and reproducing.
6. End the lesson with a “Sowing Seeds” question. “How might an endangered sea turtle species have a better chance of increasing its population and survival rate when assisted in a particular habitat such as, Cape Cod’s coastline.”

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: Field Trip—Classroom/NMLC—Assessment and Rescue

Overview of the Lesson:

1. Marine animal stranding response begins with a phone call from a member of the public who finds an animal on the beach to an organization authorized by the U.S. government to respond to stranded animals. By gathering information during this initial phone conversation, the responding organization is able to determine whether additional action is necessary and plan the next steps of response.

Time (minutes): 50 minute block

Standard(s):

- **3-LS3-2. Distinguish between inherited characteristics and those characteristics that result from direct interaction with the environment. Give examples of characteristics of living organisms that are influenced by both inheritance and environment.**
- **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 Question(s):

- What should one do when a marine animal stranding occurs? Does one report the stranding?
- How do rescue personnel know that an animal is stranded or not just acting normal?
- Are there laws that protect stranded/injured marine animals?

Science Objectives

- Compare and contrast: stranded/injured marine animals
- Analyze: share conclusions of possible injury and reason for stranding
- Cause and effect: As a team decide what might be the cause and the effect it had on the animal
- Structure and Function: what adaptations/feature of the animal may be injured
- Scale, proportion and quantity of species: weight, length and population of stranding
- Stability and Change: Is this event an anomaly or common
- Patterns—analysis of similarities and differences

Language Objectives and/or Targeted Academic Language

- Stranding
- Rescue
- Dispatch
- Seal
- Dolphin
- Sea Turtle

Anticipated Student Pre-conceptions/Misconceptions (optional)

- Marine animals that have been hurt by human/natural impacts are left to fend for themselves, often perishing.
- Anyone can rescue a distressed marine animal and take them home, especially if they already work in the field of medicine.

Instructional Materials/Resources/Tools:

- Photos of stranded/injured sea turtles, seals, dolphins, seals, and small whales
- 911 Worksheet
- Journals

Assessment:

1. How effective were their questions in soliciting information?
2. How effective were their answers in describing the situation?
3. How well did they present their cases in class?
4. How appropriate were their conclusions?

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:**

- Living in a coastal region such as Cape Cod, one is more apt to visit the long expanses of beaches it may not seem too surprising to come upon a sick/injured marine animal. In an effort to understand more about these incidences and what procedures are in place to insure safe and responsible stewardship practices are met, students will simulate a stranding response protocol (not all stranding protocols are necessarily identical).

Opening/Engagement:

Discussion: Marine animal strandings are common on Cape Cod. A number of organizations work to help stranded sea turtles, seals, dolphins, and whales. (Show the following brief videos)

1. Video of National Marine Life Center and New England Aquarium releasing sea turtles.

<http://www.youtube.com/watch?v=kfJO0-hoROA&list=UUnF9g1c06Ci47AMIZxtIIVg&feature=share&index=44>

Video of National Marine Life Center releasing a seal.

<http://www.youtube.com/watch?v=WZRYb6R-wEE&feature=share&list=UUnF9g1c06Ci47AMIZxtIIVg&index=1>

Video of the International Fund for Animal Welfare releasing four dolphins.

http://www.youtube.com/watch?v=8o4mZm3yd6k&list=UUxo3ZrchhY_9sTkZQ_LfXug&feature=share&index=2

During the Lesson:

The teacher can introduce homework in class, then give the students #2-3 as homework.

- 1) Introduction: Marine animal stranding response begins with a phone call from a member of the public who finds an animal on the beach to an organization authorized by the U.S. government to respond to stranded animals. By gathering information during this initial phone conversation, the responding organization is able to determine whether additional action is necessary and plan the next steps of response.
- 2) Step One: Imagine you are the Animal Rescuer taking the call from the public. What questions would you ask that would allow you to gather enough information to make an informed decision and plan your next steps? Make a list of 8-12 questions.
- 3) Step Two: Choose four or five of your questions. Choose two photos of animals. Answer the questions about each photo.

Lesson Closing

1. In class, students will work in pairs to present their work to the rest of the class. Pairs will present one animal from one student, then a second animal from the other student. For each animal presented, one student will ask the questions s/he developed and the other student will read the answers the first student wrote.
2. After all teams have presented, the teacher will facilitate a discussion among students about the effectiveness of their questions and answers. Discussion may include the following questions for consideration.
 - What information was helpful/Not helpful? What additional information might be useful?
 - What do you think will happen next?

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 5: Marine Animal Medical Mystery (In Process)

Overview of the Lesson:

In this lesson, students play the role of a Marine Rehabilitation Intern/Technician. Using prior knowledge of initial rescue intake, students take the next step in treating marine animals as hospital patients.. At the National Marine Life Center, Veterinarians/Interns/Volunteers are responsible for the care and wellbeing of a variety of species such as sea turtles, seals, dolphins and small whales. Hospital protocols are rigorously followed in order to abide to licensing regulations set forth by the State.

Time (minutes): 50 minute block

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

- **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. (Examples of evidence could include needs and characteristics of the different organisms (species) and habitats involved).**
- **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.**

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

- What protocols are implemented when admitting a sea turtle species at the NMLC/local marine life rehabilitation hospital?
- Are intake procedures for sick/injured marine animals similar to what happens when humans go to the hospital?

Science Objectives

- Compare and contrast: similar/different injuries of sea turtles

- Analyze: a variety of sea turtle species found in the Atlantic, Northeast condition
- Cause and effect: mechanism and explanation of abnormalities and external observations
- Structure and Function: external observations
- Scale, proportion and quantity of species: weight, length, salinity levels, heart rates
- Stability and Change: sea turtle growth/decline over time
- Patterns—analysis of human/natural impacts
- Stability and Change—factors affecting survival rate

Language Objectives and/or Targeted Academic Language

- Admission
- Intake
- Carapace
- Plastron
- Water quality
- Hatchling
- Subadult (adolescent)
- Species

Anticipated Student Pre-conceptions/Misconceptions (optional)

- Marine animals do not have any place to go when injured, especially larger marine animals.
- Marine animals are likely easier to care for than humans.

Instructional Materials/Resources/Tools

- Sea Turtle Admission Data Sheet

- 6-8 sea turtle models with a variety of injuries
- Teacher packet: Marine Animal Medical Mystery Outline-Turtles

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

Formal—Sea Turtle Admission Data Sheet

Informal—student check-ins

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:

In this lesson, students are provided an opportunity to engage in a role play activity as an Intern/Rehabilitation Technician admitted to the NMLC. The procedures for hospital admission requires knowledge in a variety of areas such as habitat, type of sea turtle species, common human impacts

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Opening/Engagement:

Review natural and human impacts of sea turtles, seals, dolphins and small whales

- Natural
 - Cold-stunning
 - Disease
 - Parasites
 - Injury
 - Geography

- Storms
- Malnutrition
- Old age
- Pneumonia
- Human related
 - Harassment
 - Entanglement in or ingestion of marine debris
 - Entanglement in fishing gear
 - Ship strikes
 - Pollution
 - Oil spills
 - Toxin

During the Lesson:

- 2.
- 3.
- 4.
- 5.

Lesson Closing

- 6.
- 7.
- 8.
- 9.

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: Sea Turtle Satellite Tracking and Mapping

Overview of the Lesson: What will students be doing?

Students will have an opportunity to track two turtles released following rehabilitation at the National Marine Life Center. Using data from the satellite tagging technology and attached to the released sea turtle, the location and time data is obtained and recorded. Students review findings to predict the locations that the turtles might be found, long after their release.

Time (minutes): (2) 50 minute blocks

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

- 3.3-5-ETS1-1
- 3.3-5-ETS1-2
- 3.3-5-ETS1-4(MA)
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Essential Question(s): What essential questions will be addressed in this lesson?

- **What problem does satellite tracking technology solve?**
- **What would you change about the current technology?**

Science Objectives

All sea turtles are threatened or endangered. Post release monitoring allows rehabilitation specialists and scientists to evaluate the success of the rehabilitation treatments, see where the animals are going and what kind of habitat they are using.

Language Objectives and/or Targeted Academic Language

- Tag Data
- Satellite

- Engineering
- Technology
- Solution
- Design
- Latitude
- Longitude
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Anticipated Student Pre-conceptions/Misconceptions (optional)

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Instructional Materials/Resources/Tools

- Tag data
- Map of the North Atlantic with a measurement scale
- Case studies

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

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:

Biologists use satellite tracking for many different reasons. At the National Marine Life Center, we use satellite tracking as a way to find out how a rehabilitated animal does post release and what habitat the animals are using. The tag data supplied are real data from two of our rehabilitated animals. These data may be used for educational purposes with proper credit given to the National Marine Life Center. NMLC uses www.seaturtle.org to publish our tag data.

Opening/Engagement:

1. Give the students one or both of the case studies.
2. Have the students plot points on the map over a certain amount of tag time.
3. Have the students figure out how far their animal has moved in a week, 2 weeks, a month, and over the entire life of the tag.

During the Lesson:

4. Plot the points on a mapping program such as Google Earth.
5. Have your students adopt a sea turtle from www.seaturtle.org and track the animal throughout the school year.
6. Have students research the habitat where their animal is located.
- 7.
- 8.
- 9.
- 10.

Lesson Closing

- 11.
- 12.
- 13.
- 14.

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?

The National Marine Life Center has been most helpful in providing their resources such as power points, Discovery Center worksheets, data and background information. I have no doubt that if an educator wanted/needed more information, the center would be amenable to assisting.

- *National Marine Life Center resources* <http://nmlc.org/>
- *GraphingSite:* <https://nces.ed.gov/nceskids/createagraph/default.aspx?ID=6c8d0d95e93a4b1aaeb0c9cf14fc7aa5>
- *Maps of Cape Cod:* <https://earthobservatory.nasa.gov/IOTD/view.php?id=83749>
- *Audubon, Wellfleet Bay Wildlife Sanctuary* <http://www.massaudubon.org/get-outdoors/wildlife-sanctuaries/wellfleet-bay>

