

Unit: Fishin' for Critters

LESSON 1

Activity Title: Counting Populations

Subject (Focus/Topic): In one phrase, state the general subject area that the lesson addresses. This lesson addresses

Grade Level: 6th grade

Average Learning Time: One 90 minute lesson

Lesson Summary (Overview/Purpose): In this lesson, students will use resources necessary to collect population data in an ecosystem.

Overall Concept (Big Idea/Essential Question): How is population data collected in the Gulf of Mexico?

Specific Concepts (Key Concepts):

- Why it is important to collect population data on the 3 types of commercial shrimp (brown, white, pink)
- Collect data about fish populations
- Graph and analyze data that has been collected

Focus Questions (Specific Questions):

- What are some critters that are found in the ocean, specifically the Gulf of Mexico?
- Why is it important to count and record data about the number of each main species in the Gulf of Mexico, particularly those that are part of our commercial fishing industry?
- How can scientists collect data about the number of each species?

Objectives/Learning Goals:

By the end of the lesson, students will be able to:

1. By conducting trawl simulations, SWBAT collect and graph data about the number of each key species, scoring a minimum of 18/24 on the graph rubric.
2. After graphing data that has been collected, SWBAT report information from their classmates' graphs

Background Information:

- Students need a general understanding about various marine ecosystems and the different marine environments certain organisms can be found in

- Talk about different methods of fishing used by NOAA (specifically trawl nets, long-lines, those used on the *Oregon II* and show pictures of the types of nets used.
- Students will need to have a general understanding how different types of graphs are used to display different kinds of information.

Common Misconceptions/Preconceptions:

1. The ocean has an abundant supply of all fish and we can take as much as we want when we fish.

Materials: List all the materials necessary to teach this lesson.

*Materials for a class of 30

- Skittles
- Worksheet for collecting data
- Graph paper OR computer with internet access (Create-a-Graph website)

Technical Requirements:

- Computers with internet access (if using Create-a-Graph website)

Teacher Preparation: Students may need instruction on using the Create-a-Graph website if it has not been used prior to this lesson.

Keywords: ecosystem, data, population, graph

Pre-assessment Strategy/Anticipatory Set:

Post a series of pictures showing the process we went through on the *Oregon II* to collect data about the fish and shrimp populations. (this information can also be accessed through my blog: <http://teacheratsea.wordpress.com/2012/06/26/andrea-schmuttermair-out-to-sea-june-24-2012/>) and (<http://teacheratsea.wordpress.com/2012/07/02/andrea-schmuttermair-collecting-data-june-30-2012/>)

Lesson Procedure:

Note: The Skittles will be representing the various species of critters found in the Gulf of Mexico:

Red: pink shrimp

Orange: brown shrimp

Yellow: white shrimp

Purple: blue crab

Green: Atlantic sharpnose shark

1. Pass out a bag of skittles inside the "ocean" (blue bag) to each team of 4-5 students.

2. Select one student from each team to be the “fisher” (will be collecting the “fish”) and one person to be the “trawl net” (will be holding a bag in which to collect the “fish”)
3. Give “fisher” 30 seconds to collect as many fish as they can using one hand. This will simulate a 30 minute trawl we do on the *Oregon II* to collect our fish.
4. Have students take their “catch” and sort it by color, counting each species they collected and recording data into their charts (Appendix A).
5. Have students repeat this 4 more times to get a total of 5 trawls.
6. Students take the data they’ve collected and choose which graph would be appropriate to display their data.
7. Have students share their graphs with the class. Take turns displaying student graphs and asking the following questions: What does the data on this graph represent? Which species had the most numbers reported? The least?

Assessment and Evaluation: Explain how students’ learning of the concept will be assessed and measured. *Note: The assessment and evaluation component should correspond to the objectives.*

The assessment will be for the students to create their graphs and score 18/24 according to the rubric. Students will also answer questions to interpret their data (see student worksheet). Answers will vary.

Standards:

☐☐National Science Education Standard(s) Addressed:

A: Science as inquiry

1. Abilities necessary to do scientific inquiry
 - c. Use appropriate tools and techniques to gather, analyze, and interpret data.
 - e. Think critically and logically to make the relationships between evidence and explanations.

☐☐Ocean Literacy Principles Addressed:

5. The ocean supports a great diversity of life and ecosystems.

- d. Ocean biology provides many unique examples of life cycles, adaptations and important relationships among organisms (symbiosis, predator-prey dynamics and energy transfer) that do not occur on land.
- f. Ocean habitats are defined by environmental factors. Due to interactions of abiotic factors such as salinity, temperature, oxygen, pH, light, nutrients, pressure, substrate and circulation, ocean life is not evenly distributed temporally or spatially, i.e., it is “patchy”. Some regions of the ocean support more diverse and abundant life than anywhere on Earth, while much of the ocean is considered a desert

☐☐State Science Standard(s) Addressed:

Earth Science 3a. Research and evaluate data and information to learn about the types and availability of various natural resources, and use this knowledge to make evidence-based decisions

Additional Resources: List any books, articles, Web sites, videos, etc. that may enhance this lesson for students, teachers, parents/guardians or others.

1. [A Good Catch](#) by Taylor Morrison
2. Andrea Schmuttermair's Teacher at Sea blog:
<http://teacheratsea.wordpress.com/category/andrea-schmuttermair/>

Author: Andrea Schmuttermair

The Academy Charter School

Adams 12 School District

11800 Lowell Blvd.

Westminster, CO 80031

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Appendix A

Use the chart below to collect your data.

	Total Fish in Catch	Total brown shrimp	Total pink shrimp	Total white shrimp	Total blue crab	Total Atlantic sharpnose sharks	
Trawl 1							
Trawl 2							
Trawl 3							
Trawl 4							
Trawl 5							

Now, take your data and create a graph to display your data on a separate sheet of graph paper or on the website, Create-a-Graph.

Using your data, answer the questions below.

1. According to the sample you collected, what species has the largest population?
2. According to the data you collected, what species has the smallest population?
3. How can you explain the differences in the each trawl sample that you collected?
4. How can you explain the difference between the amount of brown shrimp, pink shrimp, white shrimp, blue crab and Atlantic sharpnose sharks?

LESSON 2:

Activity Title: Overfishing and Sustainability

Subject (Focus/Topic): In one phrase, state the general subject area that the lesson addresses. This lesson discusses the importance of maintaining sustainable fish populations and the impacts overfishing can have on an ecosystem.

Grade Level: 6th grade

Average Learning Time: One 60 minute lesson

Lesson Summary (Overview/Purpose): In this lesson, students will learn about the impacts overfishing can have on an ecosystem and how can we help maintain sustainable fisheries.

Overall Concept (Big Idea/Essential Question): What impact can overfishing have on an ecosystem?

Specific Concepts (Key Concepts):

- Students will understand the impact overfishing can have on an ecosystem
- Students will understand why catch limits for certain species are set
- Students will learn how to make ocean-friendly seafood choices

Focus Questions (Specific Questions):

- What is overfishing and how can it impact an ecosystem?
- What is sustainability and what are the steps we can take to maintain a sustainable population?
- What are ocean-friendly seafood choices and how can we be more aware of where our seafood comes from?

Objectives/Learning Goals:

By the end of the lesson, students will be able to:

1. Explain how overfishing affects a population by removing too many “fish” from the “ocean”
2. Explain what could happen to an ecosystem if too many predators at the top of the food chain are removed
3. Determine whether local supermarkets are selling “ocean-friendly” seafood according to Monterey Bay Aquarium’s Seafood Watch Guide

Background Information:

- Students need a general understanding about overfishing
- Students need to know what makes a population sustainable

Common Misconceptions/Preconceptions:

The ocean has an abundant supply of all fish and we can take as much as we want when we fish.

Materials: List all the materials necessary to teach this lesson.

*Materials for a class of 30

- Graphs from Lesson 1
- Seafood Watch Pocket Guides or access to the internet for the online guide (http://www.montereybayaquarium.org/cr/cr_seafoodwatch/download.aspx)
- Science journals

Technical Requirements:

- Computers with internet access (if using Seafood Watch online guide)
- Projector to play film

Teacher Preparation: State the necessary preparations the teacher will need to make in order to teach this lesson most effectively.

- If using the Seafood Watch pocket guides, order these ahead of time

Keywords: ecosystem, overfishing, population, sustainable fisheries

Pre-assessment Strategy/Anticipatory Set (Optional):

Show students video: Andy Sharpless: 5 Things You Need to Know About Our Oceans (<http://youtu.be/s3u2ZxKhPoA>)

Lesson Procedure:

1. Review the food chain with students. Have students give examples of a food chain. Then, using the Gulf animals provided, have students put the animals in the correct places in a food chain.
2. Have students spread out skittles from Lesson #1. Have students remove all the green skittles (which represent the Atlantic sharpnose shark). Ask: Now that we've removed the top predator in this food chain, what will happen to the shrimp and blue crab populations? Have students show this by adding in more red, yellow, orange and purple skittles
3. Next, have students fish most of the shrimp out of their oceans. Ask: Now, what would happen to our blue crab and Atlantic sharpnose populations with the removal of so many shrimp? Again, have students model this with skittles.

4. Ask: What will the effects be if we remove too much of any one species from the ocean? Create the effect side (for now) of a multi-flow thinking map with the students to describe what will happen if we remove too many of any one species from our oceans.
5. Now, discuss with students the concept of overfishing. Explain that this is one of the causes (for the cause and effect map) of the removal of too much of any one species in our oceans. Ask students what other causes might be and add them to the cause and effect map.

Part II:

1. Introduce the concept of sustainable fisheries (see resources for websites and books)
2. Show students Seafood Watch pocket guides and explain how Monterey Bay Aquarium is helping to raise consumer awareness about their seafood choices.
3. Distribute Seafood Watch pocket guides to each student and allow them to look through it, noting if there are any fish they eat in there on a regular basis.
4. Ask students to name some of the local grocery stores they shop at. Do you know how they get their seafood?
5. Explain the assessment portion of this lesson.

Assessment and Evaluation: Explain how students' learning of the concept will be assessed and measured. *Note: The assessment and evaluation component should correspond to the objectives.*

Here are a couple of options for the final portion of this assignment:

1. Students can take a trip to a local grocery store and talk to a manager in the fish department about where they obtain their fish from. Some questions to ask might be: Are you familiar with the concept of sustainable fisheries? Have you heard of Monterey Bay Aquarium's Seafood Watch pocket guide? Where do you get your seafood from? Is it frozen or fresh, and how often is it delivered? Do you post where your seafood comes from and how it is caught?
2. Write a persuasive essay to convince your family members to buy ocean-friendly seafood. Cite evidence from what you have learned about sustainable fisheries to help convince them and explain why it is important.

??National Science Education Standard(s) Addressed:

A: Science as inquiry

2e. Think critically and logically to make the relationships between evidence and explanations.

Life Science 4d. The number of organisms an ecosystem can support depends on the resources available and abiotic factors, such as quantity of light and composition

F2a. When an area becomes overpopulated, the environment will become degraded due to the increased use of resources.

??Ocean Literacy Principles Addressed:

5. The ocean supports a great diversity of life and ecosystems.

d Ocean biology provides many unique examples of life cycles, adaptations and important relationships among organisms (symbiosis, predator-prey dynamics and energy transfer) that do not occur on land.

6. The oceans and humans are inextricably interconnected.

e. Humans affect the ocean in a variety of ways. Laws, regulations and resource management affect what is taken out and put into the ocean. Human development and activity leads to pollution (point source, non-point source, and noise pollution) and physical modifications (changes to beaches, shores and rivers). In addition, humans have removed most of the large vertebrates from the ocean.

g. Everyone is responsible for caring for the ocean. The ocean sustains life on Earth and humans must live in ways that sustain the ocean. Individual and collective actions are needed to effectively manage ocean resources for all.

??State Science Standard(s) Addressed:

Life Science 1: Changes in environmental conditions can affect the survival of individual organisms, populations and individual species

- a. Interpret and analyze data about changes in environmental conditions – such as climate change – and populations that support a claim describing why a specific population might be increasing or decreasing

??Other National or State Standards Addressed (Optional)

Additional Resources: List any books, articles, Web sites, videos, etc. that may enhance this lesson for students, teachers, parents/guardians or others.

1. Marine Bio: Overfishing: <http://marinebio.org/oceans/conservation/sustainable-fisheries.asp>
2. BBC: Global Fish Consumption Hits Record High: <http://www.bbc.co.uk/news/science-environment-12334859>
3. Texas Parks and Wildlife catch limits: http://www.tpwd.state.tx.us/regulations/fish_hunt/fish/saltwater_limits.phtml
4. Article- Fish stocks recover as conservation measures take effect, analysis shows: <http://www.guardian.co.uk/environment/2009/jul/30/fishing-stocks-recover>
5. A Good Catch: Managing fisheries to meet the nation's demand for seafood by Taylor Morrison

Author: Andrea Schmuttermair

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LESSON 3:

Activity Title: Introduction of an Invasive Species: Lionfish in the Gulf

Subject (Focus/Topic): Invasive Species in the Gulf of Mexico

Grade Level: 6th grade

Average Learning Time: One 90 minute lesson

Lesson Summary (Overview/Purpose): In this lesson, students will learn how an invasive species, the lionfish, has impacted the Gulf ecosystem.

Overall Concept (Big Idea/Essential Question): What is an invasive species and how does it affect an ecosystem?

Specific Concepts (Key Concepts):

- Lionfish are not native to the Gulf of Mexico
- Non-native species can impact an ecosystem in different ways

Focus Questions (Specific Questions):

- What are some predators in the Gulf of Mexico?
- What is an invasive species?
- How is the lionfish impacting the Gulf's ecosystem?

Objectives/Learning Goals:

By the end of the lesson, students will be able to:

1. Explain how the lionfish has affected the Gulf ecosystem by reading the student guide
2. List potential threats the lionfish has to the Gulf ecosystem

Background Information:

- Students need a general understanding about various marine ecosystems and the different marine environments certain organisms can be found in
- Students need to understand what an invasive species is (information can be found in the student guide located in the resources portion of this lesson. Teachers should read this beforehand to have an understanding of the concepts being taught)

Common Misconceptions/Preconceptions:

Students may be unfamiliar with the lionfish, and unfamiliar with the fact that it is not native to the Atlantic ocean and the Gulf area.

Materials:

Materials for a class of 30

- The Lionfish Invasion! PDF document (see resources)
- The Lionfish Invasion! Student quiz (optional)

Technical Requirements:

- Computers with internet access (for initial video clip)

Keywords: ecosystem, invasive species, lionfish

Anticipatory Set:

1. Show video clip of lionfish (choose from list found at: <http://ccfhr.noaa.gov/stressors/lionfish.aspx>) invasions to get students interested in the topic

Lesson Procedure:

1. Discuss the concepts of native species and invasive species. Ask: What are species native to the Gulf of Mexico? (students should list examples from previous lessons in this unit, in addition to species they are familiar with) What is an invasive species?
2. Have students create a cause and effect thinking map, focusing on just the causes at this point. Ask: How does a species come to invade an ecosystem? Write some of the causes for a species to invade an ecosystem.
3. Have students read “The Lionfish Invasion!” student guide (http://oceanservice.noaa.gov/education/stories/lionfish/downloads/chapters_glossary.pdf)
4. Optional: Give students quiz (see attached quiz) to check students’ understanding of the student guide.
5. Students will now play “Blob Tag”, a version of tag in which the person who is “it” tags other students. Once a student is tagged, they too become “it”. When finished playing the game, relate the game to how an invasive species can often “take over” an ecosystem.
6. Have students now fill out the effects side of their cause/effect map. What effects has the introduction of the lionfish had on the Gulf ecosystem? What are other potential effects it could have in the future?
7. Interview with scientist: watch NOAA biologist Alex Fogg discuss his research on how lionfish interact with other species in the Gulf: <http://teacheratsea.wordpress.com/2012/07/26/steven-frantz-a-days-delay-july-26-2012/>
8. Students will develop a list of questions they have for scientists about the lionfish invasion. What are they still wondering about? (If possible, contact a NOAA biologist to answer some of the students’ questions)

Assessment and Evaluation:

Students will write an essay explaining the impacts the introduction of the lionfish has had and could potentially still have to the Gulf ecosystem since its discovery in the Atlantic ocean.

Standards:**??National Science Education Standard(s) Addressed:**

1. **Populations and Ecosystems**
 - b. Populations of organisms can be categorized by the function they serve in an ecosystem...Food webs identify the relationships among producers, consumers, and decomposers in an ecosystem.

??Ocean Literacy Principles Addressed:**5. The ocean supports a great diversity of life and ecosystems.**

d Ocean biology provides many unique examples of life cycles, adaptations and important relationships among organisms (symbiosis, predator-prey dynamics and energy transfer) that do not occur on land.

??State Science Standard(s) Addressed:

Life Science 1 c. Model equilibrium in an ecosystem, including basic inputs and outputs, to predict how a change to that ecosystem such as climate change might impact the organisms, populations, and species within it such as the removal of a top predator or introduction of a new species.

Additional Resources

1. **The Lionfish Invasion!:**
http://oceanservice.noaa.gov/education/stories/lionfish/downloads/chapters_glossary.pdf
2. **Teacher at Sea blog:** <http://teacheratsea.wordpress.com/2012/07/26/steven-frantz-a-days-delay-july-26-2012/>
3. **Lionfish:** <http://ccfhr.noaa.gov/stressors/lionfish.aspx>

Author: Andrea Schmuttermair

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The Lionfish Invasion! Quiz

Lionfish, fire ants, zebra mussels, and kudzu—are all examples of invasive species or “alien invaders” They are everywhere—in your state, in your neighborhood and even in your backyard! Take this interactive quiz to test your knowledge of invasive species and the arrival of lionfish in the Atlantic Ocean. Good luck!

1. A species that occurs in an environment naturally is called a(n):
 - A. exotic species
 - B. natural species
 - C. native species
 - D. non-indigenous species
 - E. alien species

2. When an exotic species overwhelms a native species, it becomes:
 - A. a native species
 - B. an invasive species
 - C. an indigenous species
 - D. an indigent species

3. Some introduced species become problems in their new homes. In what way(s) do exotic species harm native species?
 - A. Directly compete for resources like food, water or space
 - B. Alter ecosystem services and functions
 - C. Bring diseases with them from their native homes
 - D. Both A and B are correct
 - E. All of the above (A, B, and C are correct)

4. What is the most likely vector for the invasion of the lionfish in U.S. Atlantic waters?
 - A. ship ballast water
 - B. the aquarium trade
 - C. aquaculture
 - D. sushi restaurants
 - E. live bait

5. Lionfish are native to:
 - A. the South Pacific and Indian Oceans, including the Red Sea
 - B. the Atlantic Ocean
 - C. the Atlantic Ocean, including the Caribbean Sea
 - D. the Caspian and Black Seas
 - E. none of the above

6. Where in the food web of their native habitats would lionfish most often be placed?
 - A. They are herbivores.
 - B. They are omnivores.
 - C. They are detritivores.
 - D. They are predators.
 - E. They are top predators.

7. Considering both their native and non-native ranges, in which of these habitat types would lionfish **NOT** be found?
 - A. hard-bottom habitats
 - B. coral reefs
 - C. artificial substrates like sunken ships
 - D. mangroves

8. Where are the **venom glands** of a lionfish located?
 - A. On the tips of the dorsal, anal and pelvic fins
 - B. In a groove along the length of the spines on its dorsal, anal and pelvic fins
 - C. At the base of the spines on the dorsal, anal and pelvic fins
 - D. At the tips of the fleshy tentacles above the eyes and below the mouth

9. Currently, nobody is quite sure how far lionfish will spread in Atlantic waters, but scientists have made a hypothesis. Which statement below reflects that hypothesis?
 - A. Eventually, lionfish will invade the waters off the entire East Coast of the United States from Florida to Maine.
 - B. Lionfish will establish populations in the warm, subtropical waters off the coast of Florida only.
 - C. Lionfish will establish populations from the warm waters of Florida north to about Cape May in New Jersey, where juvenile lionfish have been found.
 - D. Lionfish will invade not only the warm waters of the Atlantic Ocean, but they will also invade the Gulf of Mexico.
 - E. Lionfish will establish populations from the warm waters of Florida north to about Cape Hatteras in North Carolina, where coastal waters are warmed by the Gulf Stream.

10. Lionfish are related to the much more poisonous and dangerous:
 - A. scorpionfish and stonefish

- B. string rays
- C. mosquitofish and squirrelfish
- D. sand tiger sharks
- E. none of the above

The End!

Quiz courtesy of:

<http://oceanservice.noaa.gov/education/stories/lionfish/teachers.html#printable>

Assessment:

Answer the first to questions in QIA (question in answer):

1. What is an invasive species?
2. Why is the lionfish considered an invasive species?

Answer the final question using the ACE constructed response format:

A= answer the question

C= cite evidence from the text

E= explain or elaborate on your answer

3. How has the lionfish affected the Gulf ecosystem and what are other possible threats it poses? Include evidence from your student guide, “The Lionfish Invasion”, to answer your question.
