Controlling the Lionfish Population Graphing Lab (Invasive Species)

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Target Grade: 9-12 Ecology

Time Required: 60 minutes

Standards:

- CCSS.ELA-Literacy.SL.9-10.4 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.
- CCSS.ELA-LITERACY.RST.9-10.3
  Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
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- CCSS.ELA-LITERACY.SL.9-10.1
  Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9-10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.
- CCSS.ELA-Literacy.RST.9-10.8
  Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.
- CCSS.ELA-LITERACY.RST.9-10.9
  Compare and contrast findings present in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.

Living Environment NYS Core Curriculum Standards:

- Key Idea 3: Performance Indicator 3.1: Use various methods of representing and organizing observations (e.g., diagrams, tables, charts, graphs, equations, matrices) and insightfully interpret the organized data.
- Key Idea 3: Performance Indicator 3.1a: Interpretation of data leads to development of additional hypotheses, the formulation of generalizations, or explanations of natural phenomena.
- 6.1g: Relationships between organisms may be negative, neutral, or positive. Some organisms may interact with one another in several ways. They may be in a

producer/consumer, predator/prey, or parasite/host relationship; or one organism may cause disease in, scavenge, or decompose another.

- 6.3a: The interrelationships and interdependencies of organisms affect the development of stable ecosystems.
- 6.3c: A stable ecosystem can be altered, either rapidly or slowly, through the activities of organisms (including humans), or through climatic changes or natural disasters. The altered ecosystem can usually recover through gradual changes back to a point of long-term stability.

Lesson Objectives:

Students will:

- Analyze, construct, and graph data based on real world lionfish population changes over time after culling methods have been put into place.
- Connect their understanding of invasive species in an ecosystem in order to explain how invasive species populations can change over time.
- Create a graph to represent data of changes to the lionfish population after culling methods have been enforced.
- Compare the effect of culling on lionfish populations based on the numbers in the control and experimental sites in order to assess the effectiveness of this control method.
- Cite evidence from the graph in order to synthesize the effects of culling control methods on the population of lionfish.
- Apply concepts learned from the lab to the aim and success criteria where students self-assess the success criteria and their understanding of the lesson by ranking 2 success criteria statements and explaining their ratings and providing supporting evidence.
- Be able to fully explain one method scientists have been using to control the lionfish population.
- Be able to assess the effectiveness of this method and fully explain my reasoning for this based on the graph created in this lab.

Central Focus:

This lab will allow students to hypothesize and make inferences regarding how the population of a specific invasive species may change once culling takes place and whether or not this method has been an effective method of population control. Students will analyze and explain the impact and effectiveness of the culling control methods specifically towards the lionfish species using evidence from web resources, student-created graphs, and completion of lab questions.

Background Information:

- Students will need to have working knowledge of the following vocabulary: Population, population change, limiting factors, finite resources, predator, prey, Invasive species, native species, competition, lionfish, generalist, R-strategist, specialist, K-strategist
- Prior research should be conducted on various methods of controlling other invasive species such as, the snakehead fish, brown tree snake, cane toad, and Asian carp.
- There should be prerequisite assignments/activities specifically regarding the lionfish species, specifically in the Atlantic.
- Students should be familiar with converting data into bar graphs.

Materials:

- Lab binder (or equivalent)
- Laptop
- Promethean ActivPanel
- (Teacher Preference if included) Electronic survey tool (e.g., Google Forms, Poll Everywhere, or similar)
- Pencils
- Websites (Listed in preferred order of use)
    - Lab introduction information: http://oceanservice.noaa.gov/education/stories/lionfish/lion05_stop.html
    - Central Caribbean Marine Institute Lionfish Data of Control and Experimental sites for Graphing show at end of lab: https://nas.er.usgs.gov/taxgroup/fish/Lionfishanimation.gif
    - Additional Resources (if time permits):
        - http://video.nationalgeographic.com/video/news/150723-invasive-lionfish-vin
        - http://video.nationalgeographic.com/video/news/160606-eating-lionfish-vin?source=relatedvideo
        - http://www.pbs.org/newshour/updates/robot-lionfish-invasive-species-rise-nekton/
- Controlling the Lionfish Population Graphing Lab Sheets *(See Attached)*
    - Information sheet
    - Graphing/Data sheet
    - Analysis questions sheet
    - Lab Summary sheet

Instruction:

Lesson Introduction and Aim: (approximately 3 minutes)

To what extent has culling been effective in controlling lionfish populations?

Warm-up Activity: (approximately 5 min)

1. Obtain lab binders and fill in Table of Contents (Lab #____- Controlling the Lionfish Population Graphing Lab)
2. Write/Pair/Share:
    a. WRITE: Students use research from previous research opportunities (i.e., homework, in-class activities, etc., which is referenced in **Background Information** section of lesson plan), and answer the following question in written form: What method did you think would be the most effective for controlling the lionfish population in the Atlantic? Explain your reasoning. (*Students who may not have completed previous research due to absences, lack of participation or homework completion, may synthesize a possible solution they think may be effective for controlling the lionfish population based on prior knowledge.)*
    b. PAIR: Students will work with their shoulder partner to discuss their individual answers to the stem question.
    c. SHARE: Students will share the responses of their shoulder partner with the table group members.

Main Lesson (Pre-Lab): (approximately 10 minutes)

1. Teacher will employ a whole-group formative assessment to gauge the class' understanding and readiness to continue beyond the warm-up activity (e.g., thumbs up/thumbs down, clickers, Poll-Everywhere, etc.)
2. Using the information from the Write/Pair/Share activity, the teacher will guide students through a class discussion regarding the various methods of population control for lionfish populations. Students will relate the methods discussed in their groups and as a class to the prior learning to determine if culling is the best solution to controlling the population of lionfish and record their determination in their notes as the discussion progresses. (Teacher will record key words, ideas, points made, etc. on the ActivPanel or whiteboard to model for IEP students and students needing additional help)
3. Following the class discussion and note-taking period, the teacher will show the following videos: (Teacher will continue to record key ideas, etc. for visual reference)
    a. http://video.nationalgeographic.com/video/news/150723-invasive-lionfish-vin
    b. http://video.nationalgeographic.com/video/news/160606-eating-lionfish-vin?source=relatedvideo
    c. http://www.pbs.org/newshour/updates/robot-lionfish-invasive-species-rise-nekton?

4. During the discussion and videos, the teacher should actively monitor students' note taking to monitor student progress and identify key points of difficulty, giving additional prompts, and re-focusing and re-directing when necessary.
5. Following the videos, students will compare their notes with their table partners to ensure a complete set of notes was taken.

Lab Introduction and Directions: (approximately 3 minutes)

1. The teacher will go over the lab directions and explain what the students will be doing with each lab sheet(attached).
2. Teacher will use a quick formative assessment to ensure understanding of directions.
3. Students will work independently to complete the lab sheets.

Population Data Bar Graphing & Data Interpretation: (approximately 45 minutes)

1. Students will evaluate the data in the chart on the **Graphing Skills** lab sheet
2. Using the data table, students should title the graph and label each axis of the graph. (Students who need additional academic supports may need to have the graph pre-labeled or work with a partner to label their graph.)
3. Following the set-up of the graph, students will begin to complete the bar graph that accurately represents the given data set.
4. Once the graph is completed, the students will share their graph with a table partner for peer review and feedback.
5. Teacher should circulate the room helping students, clarifying, offering feedback, and formatively assessing student work.
6. Students will make any additional changes and corrections as identified by peers.
7. Once students complete the bar graph, they will move on to the **Analysis Questions** lab sheet and complete independently based on their bar graph information. (Students should write in complete sentences, depending on modifications needed for students' ability level)
8. To complete the **Analysis Questions** sheet, students may also use notes from the Pre-lab lesson
9. Teacher will continue to circulate to help with needs of students, ask extension-type questions, and continue assessment of learning.
    a. Possible extending questions:
        i. Can you provide an example/evidence to explain your response?
        ii. What information do you have?
        iii. What do you need to do to find out the answer?
        iv. What other resources do you know of or have that may help you?
        v. What are you assuming in your argument?
        vi. How does this relate to...?
        vii. What do you mean by...?
        viii. Is there someone in your group who may agree/disagree with you?

10. Once students complete the **Analysis Questions**, they will begin the **Lab Summary Sheet** (again writing in complete sentences, if capable)
11. At the end of the **Lab Summary**, students will self-rate their individual understanding of the lesson.
12. Following the rating portion, the students will take turns discussing their understanding/ranking with their shoulder partners from the Pair activity earlier.
13. Once sharing their understanding and discussions are complete, students will turn the lab sheets packet in to be graded.
14. Once every student has turned in their packet, the students should complete the following closing activity:
    a. Using a Google form, Poll Everywhere, or similar survey-type program, the teacher will have the students reflect using these stems:
        i. What is one thing that you learned from today's lesson?
        ii. Summarize the information portrayed in your lionfish population graph.
        iii. Differentiate between an invasive species and a native species.
        iv. How did you use evidence from your graph to draw conclusions in this lab?
        v. How can you apply the concepts you learned from the graphing lab to your future learning?

Differentiation:

- Strategic seating/Homogeneous groups are recommended to complete lab in smaller group setting in separate location.
- Scaffolded verbal questioning/leveled questioning so that students may more readily grasp content. Questions and directions are re-phrased to help with understanding.
- Objectives are assessed both orally and written, as well as through teacher observations.
- Sentence structure and grammar will be overlooked for IEP students.
- Promethean ActivPanel is used to provide additional visuals for clarity for IEP students throughout the lab and lesson.
- IEP students will be expected to achieve at least a 5 out of 8 on the lab.

Assessment:

Formative:

- Participation in the Write/Pair/Share activity
- First whole-group assessment with electronic tool or thumbs up/down
- Whole-group discussion
- Observation of student notes, graphing, and analysis questions
- Teacher-student interactions with extending questions
- Closing activity

Summative:

- Lab packet thoroughness, accuracy, fulfillment of required information, and thoughtfulness of responses

Name: _____ Block: _____ Date: _____

Controlling the Lionfish Population Graphing Lab # ___

Introduction: Can we stop the invasion?

Most scientists agree, it is unlikely that the lionfish's invasion of U.S. waters can be reversed. Any large-scale attempts to remove the existing lionfish from U.S. Atlantic waters appear impractical and would be very costly, because of the large geographic range and depths that the fish now occupies. Lionfish are now found along the entire southeast U.S. coastline at depths between 1 and 1,000 ft, making their complete removal all but impossible. Scientists do believe, however, that lionfish can be controlled in some locations, such as some Caribbean islands and marine protected areas. The lionfish invasion highlights the complexity of managing introduced species in the marine environment. Lionfish now join the ranks of other aquatic invasive species that have taken up permanent residence in U.S. waters, such as European green crabs, snakeheads, and zebra mussels.

For now, scientists have five main suggestions:

• ***Track the lionfish population.*** Although more sightings in recent years sugg that more lionfish are present, that may not be the case. It could simply be that more public awareness has led to more reports. A monitoring program is needed to determine if the number of lionfish is actually growing.

• ***Conduct more research.*** Scientists' ability to predict the lionfish's future abundance, and its effects on the ecosystem is greatly hindered by a lack of knowledge. Research is needed to determine the lionfish's ability to survive, reproduce, and grow in the Atlantic Ocean.

• ***Educate the Public.*** People need to know that it can be harmful to release aquarium fishes into bodies of water. In the United States and throughout the Caribbean, people should be alerted to the presence of lionfish and encouraged to report sightings. At the same time, people should be cautioned against handling lionfish and made aware of the health risks from their stings.

• ***Notify physicians and other health care providers about venomous fish in U.S. waters.*** One study of reported lionfish stings, mostly involving aquarists, noted no fatalities. Most stings result in uncomplicated wounds with severe local pain that responds well to soaking treatment. A greater risk appears to be secondary infection resulting from the wound. In addition to medical personnel and health-care providers, boat operators and lifeguards also need to be advised about lionfish stings.

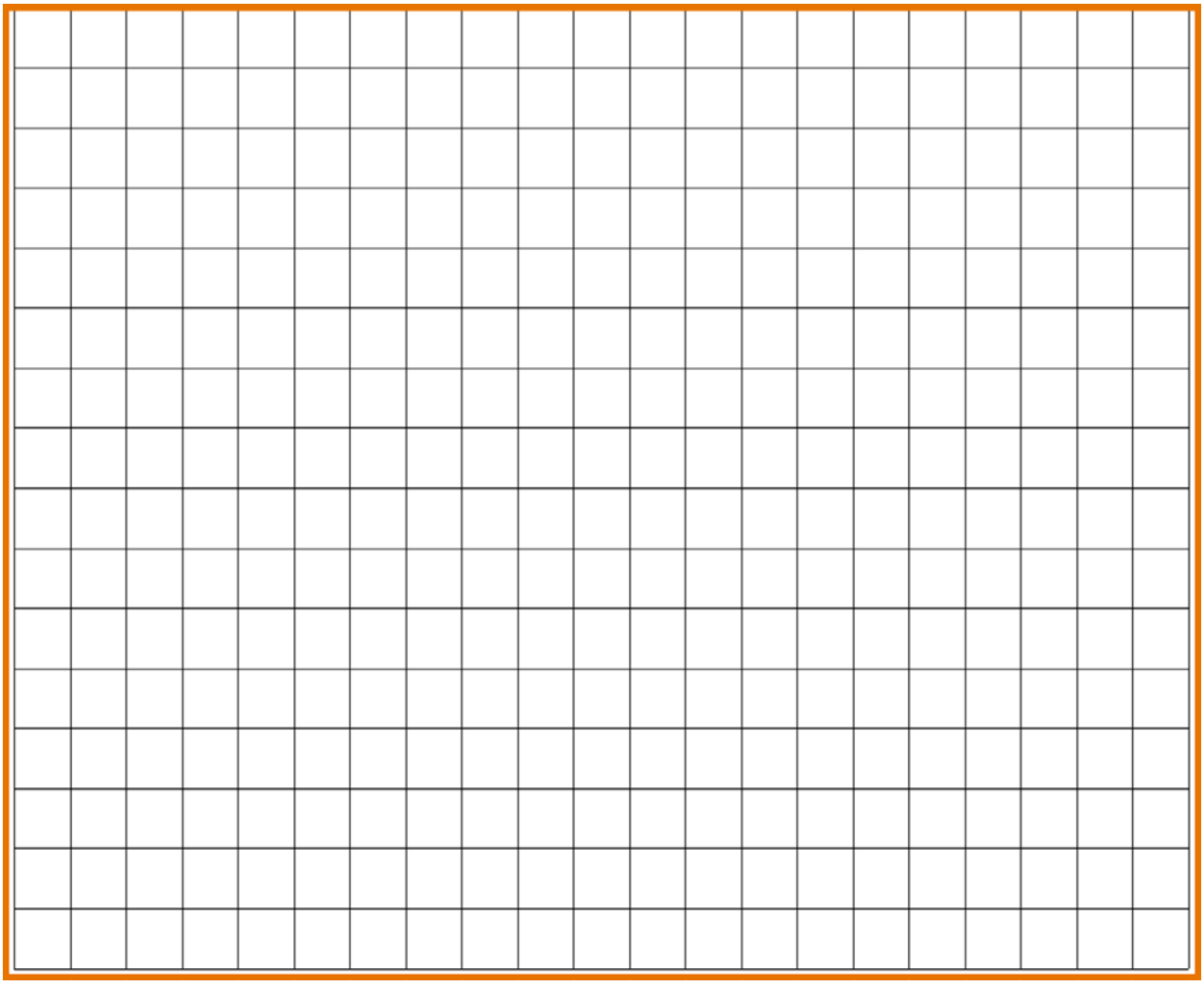
• ***Make regulations to control the introduction of non-native marine species.*** Bermuda's approach, which is to enforce a strict ban on the importation of live fish, is proving an especially effective way to reduce the risk of aquarium releases. But scientists caution that the issue is more complex than simply limiting imports of non-native species. Some believe that such efforts will fail unless we learn more about how these species disperse once they are introduced into non-native waters. Although the lionfish invasion is probably here to stay, this dramatic event may prompt the development of effective strategies to reduce the ill effects of other marine invaders.

In today's lab, you will be creating 2 ***bar graphs*** using real world data in order to determine whether or not the culling method of controlling lionfish populations is effective.

	# of fish caught at sites with active culling	# of fish at sites with sites without culling	TOTAL
2015	39	83	122
2014	83	119	202
2013	37	150	187
2012	56	129	185
2011	23	76	99

Source: CCMI

GRAPH TITLE: _____



Analysis Questions:

1. Based on your graphed data, has culling been an effective method at removing lionfish from the Caribbean? Support your answer with evidence.

_____

_____

_____

_____

2. How can we determine what techniques are best for controlling invasive species? What should you consider when creating a solution from controlling invasive species such as the lionfish and why? **Fully explain and use evidence.**

_____

_____

_____

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_____

_____

_____

3. Of the 5 suggestions made by scientists (see lab introduction), which suggestion do you believe is ***most*** effective and why? **Fully explain.**

_____

_____

_____

_____

_____

4. Of the 5 suggestions made by scientists (see lab introduction), which suggestion do you believe is ***least*** effective and why? **Fully explain.**

_____

_____

_____

_____

_____

_____

Lab Summary Sheet: Controlling the Lionfish Population Graphing Lab # ___

1) **Purpose (What was the point of this lab?)**

   _____

   _____

   _____

2) **Safety Precautions (if applicable)**

   _____

   _____

3) **Hypothesis ("If...then..." statement)**

   _____

   _____

4) **Materials Used: (What did you need for this lab?)**

   _____

   _____

5) **Procedure: (Explain what you did for this lab)**

   _____

   _____

   _____

   _____

   _____

6) **Analysis/Summary-Rank the following "I Can" statements (1-5, 1 being "I don't know this or understand this" and 5 "totally mastered this") for today's lesson and provide evidence for your ranking.**

Statement 1: I can fully explain one method scientists have been using to control the lionfish population. **Rank=** ____

Evidence:

_____

_____

Statement 2: I can assess the effectiveness of this method and fully explain my reasoning for this based on my graph in this lab. **Rank=** ___

Evidence:

_____

_____

_____