The Seagrass Solution: In-Class Group Worksheet

Names: ____ Date: __________________

Introduction

During the pre-lab presentation, you learned about the two seagrass of Virginia: the eelgrass Zostera marina and the widgeon grass Ruppia maritima. The heat-sensitive eelgrass grows from the Arctic Circle down to North Carolina in the Atlantic Ocean. Meanwhile, the widgeon grass Ruppia maritima is cosmopolitan, meaning it grows in nearly every country in the world due to its adaptability to environmental conditions. Remember the marathon runner metaphor.

Learning Objectives

Students will be able to…

1. relate declining seagrass heat tolerance with decreased ability to provide shoreline protection.
2. be able to describe seagrasses and the role they play within the Chesapeake Bay regarding shoreline protection.
3. develop a hypothesis about how global climate change will affect other heat-sensitive habitats and some potential consequences for loss.

Vocabulary:

Cosmopolitan: a species that is present worldwide, often due to its highly adaptive nature to a variety of environmental conditions

Ecosystem: a community of organisms and habitats that interact with each other and the environmental conditions in which they live

Ecosystem services: the direct or indirect benefits humans gain from an ecosystem's natural resources and functions

Erosion: the loss or removal of soil and rock from one location through natural means (ex., water, wind) which are then transported to another location

Habitat: where an organism lives – the scale of a habitat can range in size from the individual (ex., a single dead log) to the group (ex., a forest)

Resilience: the ability of an ecosystem to maintain its structure and function during and after disturbances such as storms, fires, or heatwaves

Thermal resilience: the ability of an organism to withstand temperatures higher than those typical to the local environment

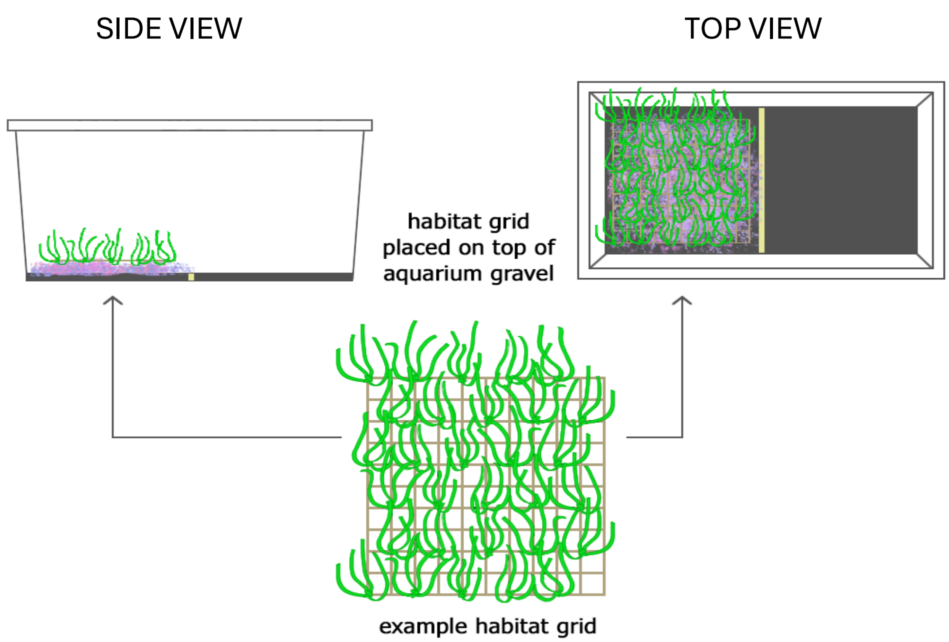
Background Information:

Seagrasses are flowering marine plants and form interwoven habitats along the intertidal to subtidal regions of 191 countries. The lush meadows contribute many direct and indirect benefits to humans, called ecosystem services. These benefits range from acting as habitat and food for many marine animals – including threatened species such as turtles and manatees – to providing ample fishing opportunities for humans, even to filtering many known pollutants out of our waterways. Unfortunately, seagrasses face a growing threat, putting our shorelines at increased risk.

Worldwide, many species of seagrasses are declining due to the rise in water temperatures caused by global climate change, including here in Virginia. Within the Chesapeake Bay, two species are present: the eelgrass Zostera marina and the widgeon grass Ruppia maritima. Where eelgrass exists in the Atlantic from the Arctic Circle to North Carolina, widgeon grass is cosmopolitan, growing along the shorelines of all continents except Antarctica. Over the last century in the Chesapeake Bay, the heat-sensitive eelgrass has seen major declines from warming waters and summertime marine heatwaves. Despite its cosmopolitan nature, widgeon grass has been unable to fill in the increasing number of gaps, resulting in an overall rate of loss.

Rising water temperatures aren't the only threat caused by climate change: rising sea level, storm surge, and wave action all threaten our coastal communities. Fortunately for us, seagrasses have been found to reduce wave intensity, trap sediment, and retain soil, causing an overall reduction in coastal erosion. While seagrasses are still experiencing some declines, researchers around the globe are working hard not only to restore seagrass habitats but to increase overall seagrass thermal resilience! With restored seagrass meadows on our side, we can reduce erosion to save our coastal communities from further loss.

This lab will use stimulated seagrass meadows that look like the figure below:



Form a hypothesis:

We will be running an experiment using 3 "habitat totes." Each tote contains an eelgrass habitat that either exhibits high, moderate, or poor thermal resilience (ability to withstand higher temperatures than those typical of the local environment). A heatwave recently rolled through the totes, causing high water temperatures and thus eelgrass loss. Now each tote contains a differing amount of remaining live eelgrass. You will simulate how coastal erosion can change following seagrass loss due to a heatwave.

Answer the following questions BEFORE your group uses the totes.

1. You will be creating waves in the totes, causing the gravel underneath to move (erode) if the eelgrass cannot break up the wave energy and retain the soil below. This will mirror coastal erosion. Do you think the 3 experimental totes will vary or stay the same in the amount of gravel they retain during wave action? How so? Explain your reasoning.

2. Write your prediction as a hypothesis using an "If-then" statement. Don't forget the rationale for your prediction.

During the activity:

Answer these questions while other groups are using the totes.

3. During the lecture slides, you learned about ecosystem services, including services provided to non-human animals. Many fish species that we like to eat use seagrass habitats as nurseries, meaning those fish lay eggs and raise young within the seagrass meadows. Why might seagrass provide good nursery habitat to young fish? Consider what resources fish need to survive.

4. With the help of your group, think of at least 2 ecosystem services that might be provided by each of the ecosystems listed below. Remember the 4 service types: provisioning (goods or products produced), cultural (non-material benefits for humans), regulating (natural resource processes that support humans), and supporting (natural resource processes that support other organisms).

    a. Forest

    b. Prairie

    c. River

    d. Desert

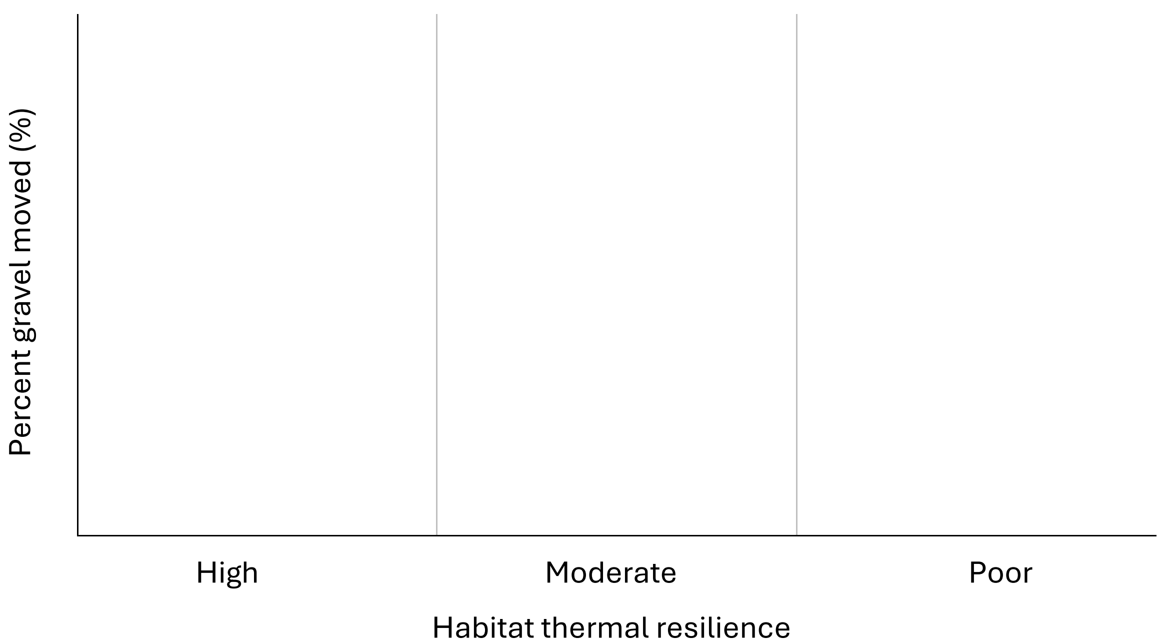
5. What other animals, plants, or ecosystems have you heard about that might be experiencing loss due to poor thermal resilience in our warming climate?

    e. What can we as humans do to increase the thermal resilience of the ecosystem(s) or species you listed above?

6. Record the following weights for your group, then copy it to the class table. Percent cover is already provided. To determine the density (# of shoots counted in ring), place the ring within the tote and count the number of shoots within the ring's area.

Habitat Type	Scooped gravel weight (g)	Total gravel weight (g)	Percent gravel moved (= (scooped/total) x 100)	Percent Cover	Density (# of shoots counted in ring area)
High thermal resilience				90	
Moderate thermal resilience				50	
Poor thermal resilience				15	

7. Using all of data from the class table, fill-in the bar graph provided. Don't forget titles and scales.



The Seagrass Solution: At-Home Worksheet

Name: ______________________________________ Date: _________________

1. Imagine a class of students, each with their own bag of colored candy, who were asked to split the candy up by color. The class was then asked to count the number of each candy to create a histogram. Each time a student had a number of red candies that fell within a certain range, called a bin, the class added 1 to the frequency column. The bins for this class were split into groups of 10, such that a student with 6 red candies in their bag would add 1 to the 0-10 bin but a student with 38 red candies would add 1 to the 30-40 bin. As a result, their class data looked like the following, with the table on the left and its corresponding histogram on the right:

Number of red candies per bag	Frequency (# of students)
0-10	2
10-20	5
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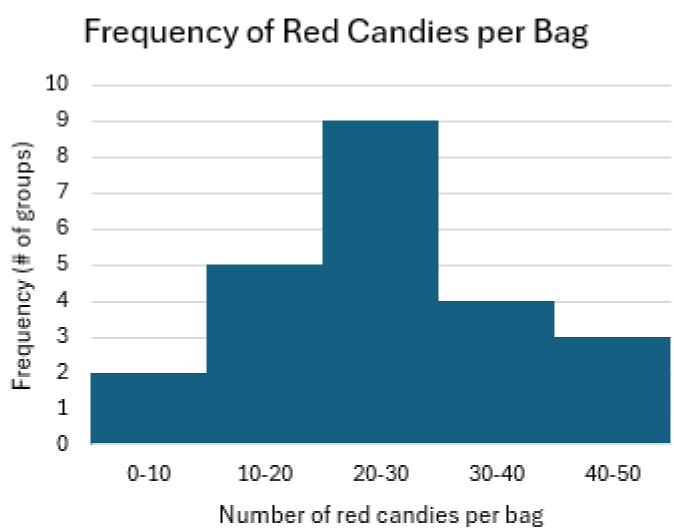
30-40	4
40-50	3

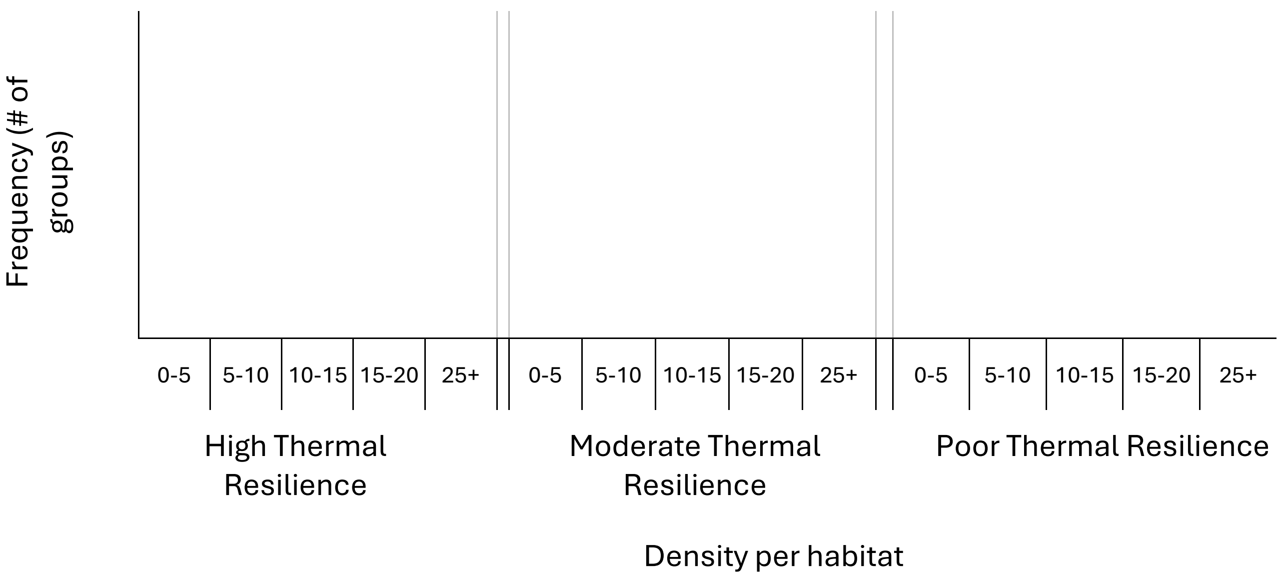


On the next page, you will create a similar table and histogram using the class data. This table and histogram will compare the density (# of shoots per ring) of each habitat with the frequency (# of groups).

2. Create a table similar to the one on the last page using the class data. Note that the bins for density are split into groups of 5.

Density (# of shoots counted in ring area)	Frequency (# of groups) in high thermal tolerance habitat	Frequency (# of groups) in medium thermal tolerance habitat	Frequency (# of groups) in poor thermal tolerance habitat
0-5			
5-10			
10-15			
15-20			
25+			

3. Using the table you created above, fill in the histogram below. Before you begin, make notes of its axes. The Y axis is frequency (# of groups). The X axis is density per habitat (the number of shoots counted within that habitat's density ring), split into bins of 5. Each time a group has a density that fits within a bin, +1 is added to frequency's bin. Use the example of the class counting red candies from problem #1 to guide you.

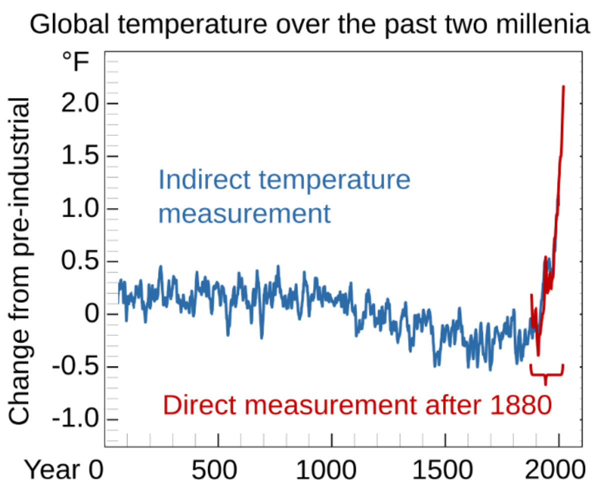


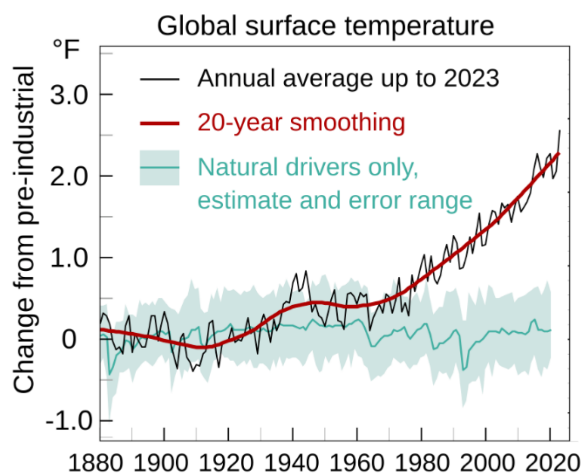
4. Was your original hypothesis supported or unsupported? Provide evidence.

5. Percent cover and density often work together to indicate the overall health of a habitat – when the values of both are higher, this typically indicates higher health. Which habitat tote appears healthier? Use evidence from the table and your histogram.

6. Why do you think seagrass prevents soil movement during wave action? Hint: there are 2 common answers. Provide at least 1 with consideration for physics and/or plant structure.

7. Global climate change shows evidence of increasing global temperatures, as depicted in the two graphs below.





a. Over what time scale and temperature scale does each graph take place?

b. Why is knowing the difference in scales important to understanding the messages of these two graphs?

c. Increased carbon dioxide levels are a major contributor to global climate change. Seagrasses, like many plants, require carbon dioxide to power photosynthesis. As a result of photosynthesis, oxygen is released back into the atmosphere. If global climate change causes temperature-sensitive seagrasses such as eelgrass to decline due to temperature, what happens to the carbon dioxide and oxygen levels?

d. What does this mean for the fish that live in seagrass meadows, especially those that use seagrass as nursery habitat?

e. What will this mean for fishermen, either commercially or recreationally?

f. What can we do to reduce the loss of temperature-sensitive species?

The Seagrass Solution: Combined Worksheet

Names: ______________________________________ Date: _________________

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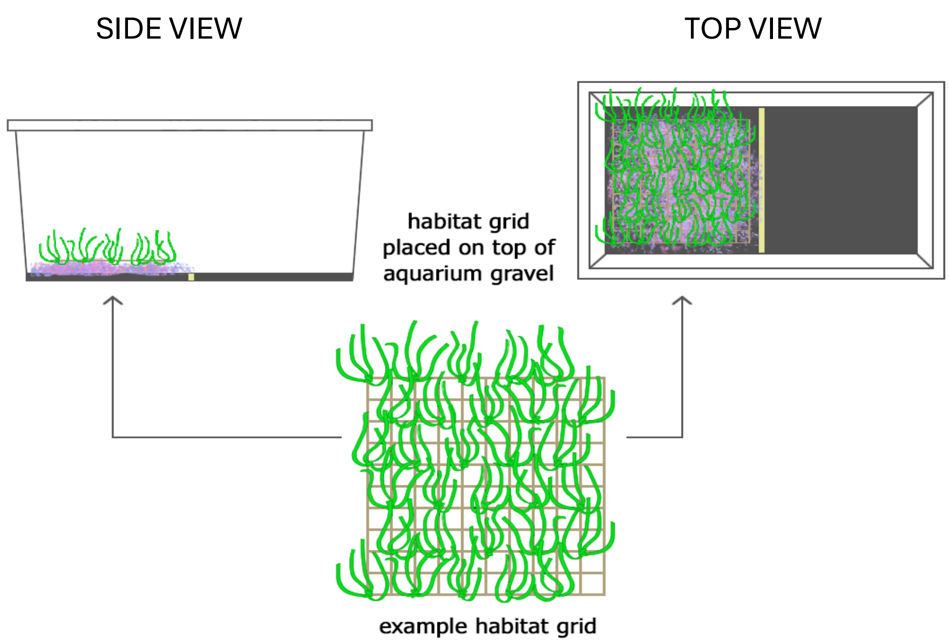

Form a hypothesis:

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2. Write your prediction as a hypothesis using an “If-then” statement. Don’t forget the rationale for your prediction.

3. During the lecture slides, you learned about ecosystem services, including services provided to non-human animals. Many fish species that we like to eat use seagrass habitats as nurseries, meaning those fish lay eggs and raise young within the seagrass meadows. Why might seagrass provide good nursery habitat to young fish? Consider what resources fish need to survive.

4. What can we, as humans, to increase the thermal resilience of seagrass meadows?

5. Record the following weights for your group, then copy it to the class table. Percent cover is already provided. To determine the density (# of shoots counted in ring), place the ring within the tote and count the number of shoots within the ring's area.

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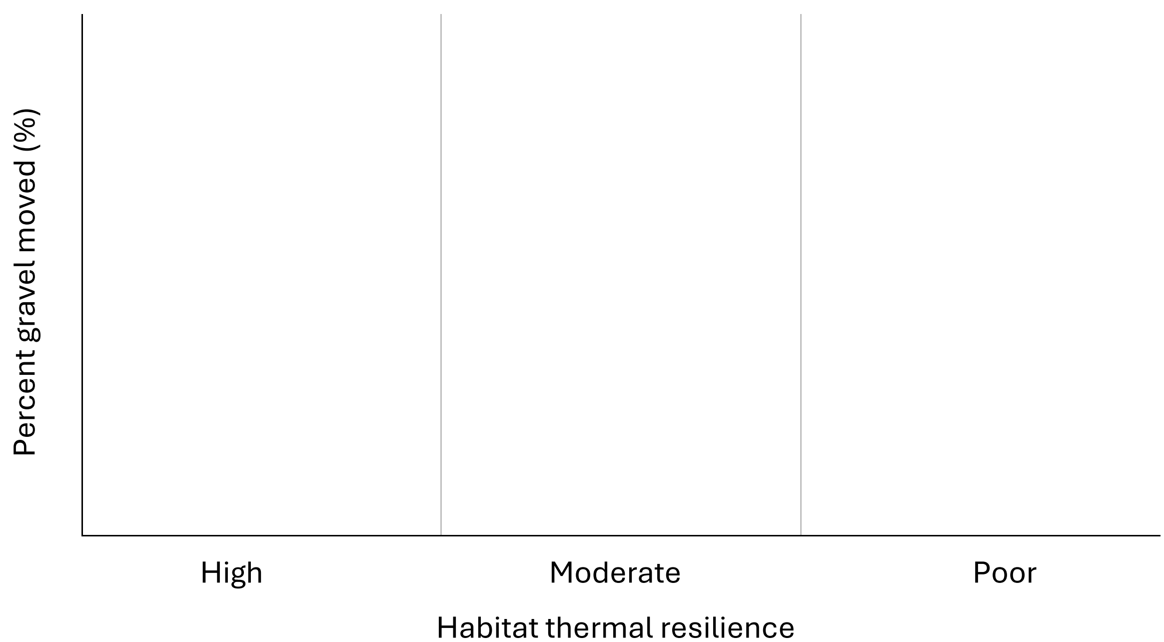

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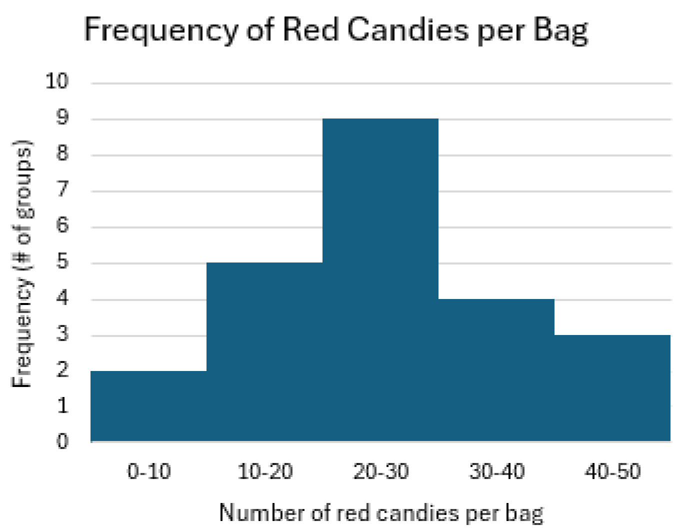

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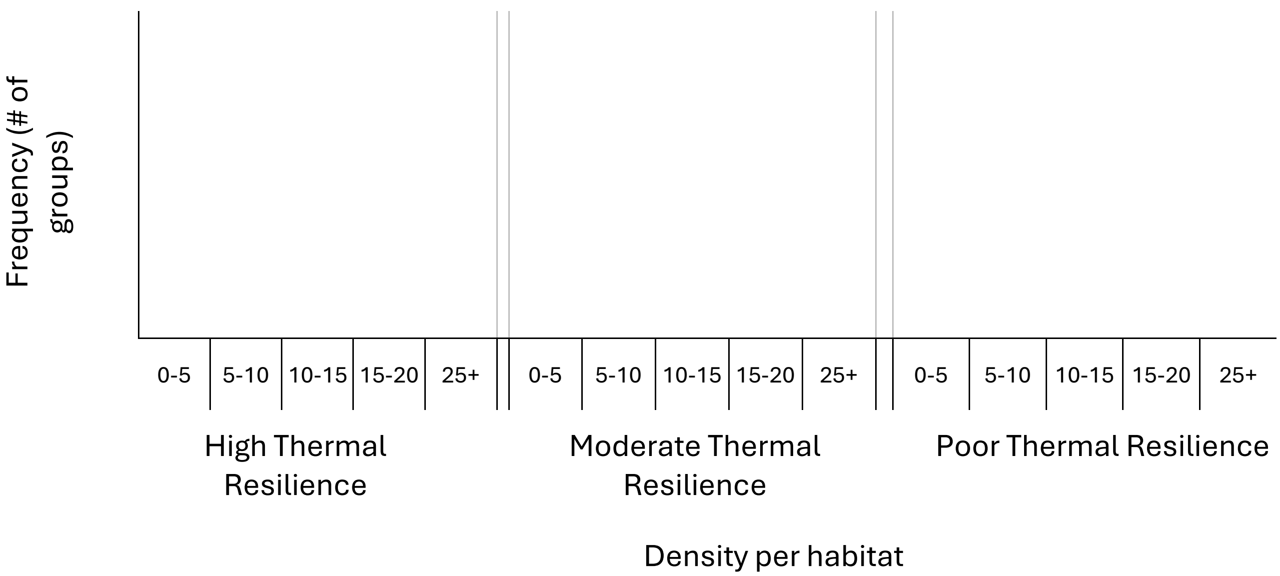


9. Was your original hypothesis supported or unsupported? Provide evidence.

10. Percent cover and density often work together to indicate the overall health of a habitat – when the values of both are higher, this typically indicates higher health. Which habitat tote appears healthier? Use evidence from the table and your histogram.

11. Why do you think seagrass prevents soil movement during wave action? Hint: there are 2 common answers. Provide at least 1 with consideration for physics and/or plant structure.

12. What does this mean for the fish that live in seagrass meadows, especially those that use seagrass as nursery habitat?

13. What will this mean for fishermen, either commercially or recreationally?

The Seagrass Solution: In-Class Group Worksheet

ANSWER KEY

Introduction

During the presentation, you learned about the two seagrass of Virginia: the eelgrass Zostera marina and the widgeon grass Ruppia maritima. The heat-sensitive eelgrass grows from the Arctic Circle down to North Carolina in the Atlantic Ocean. Meanwhile, the widgeon grass Ruppia maritima is cosmopolitan, meaning it grows in nearly every country in the world due to its adaptability to environmental conditions.

Form a hypothesis:

We will be running an experiment using 3 “habitat totes.” Each tote contains an eelgrass habitat that either exhibits high, moderate, or poor thermal resilience (ability to withstand higher temperatures than those typical of the local environment). A heatwave recently rolled through the totes, causing high water temperatures and thus eelgrass loss. Now each tote contains a differing amount of remaining live eelgrass. The amount of loss each tote experienced is reflected in the percent cover column of the table on the last page of this worksheet.

1. You will be simulating waves in the totes, causing the gravel underneath to move if the eelgrass cannot retain it. This will mirror coastal erosion. Do you think the 3 totes will vary or stay the same in the amount of gravel they retain during wave action? Explain your reasoning.

   The 3 totes will vary because they have differing levels of thermal resilience. The higher the thermal resilience, the more the eelgrass remains during and after the heatwave. As waves pass through eelgrass meadows, their intensity decreases as the blades/shoots/leaves break up the motion, preventing soil movement. The roots of the eelgrass provide additional stability to the soil. The less shoots in the water column and the less roots holding onto the soil, the more the gravel is exposed to wave action.

2. Write your prediction as a hypothesis using an “If-then” statement. Don’t forget the rationale for your prediction.

   If an eelgrass habitat has higher thermal resilience, then it will be able to retain more soil because the shoots will break up the waves and the roots will hold the soil in place.

During the activity:

3. During the lecture slides, you learned about ecosystem services, including services provided to non-human animals. Many fish species that humans like to eat use seagrass habitats as nurseries, meaning those fish lay eggs and raise young within the seagrass meadows. Why might seagrass provide good nursery habitat to young fish? Consider what resources fish need to survive.

   Any of the following: seagrass habitats provide oxygen to the water, hiding places for young fish to avoid predators, food for young fish in the form of smaller animals and/or seagrass shoots, and filtration of pollutants/diseases that might affect fish.

4. With the help of your group, speculate on at least 2 ecosystem services that might be provided by each of the ecosystems listed below. Any of the following (2 each):

   f. Forest – timber, medicinal plants, hunting grounds, recreational activity, oxygen production, carbon storage (in soil or in photosynthesis), pollination/agriculture

   g. Prairie – hunting grounds, oxygen production, soil stability, carbon storage, insect habitat, fodder for livestock, pollination/agriculture

   h. River – fresh drinking water, fishing/recreation area, water cycle, fish/amphibian habitat, drainage/flood control, hydropower generation, transport/navigation

   i. Desert – more likely to preserve archaeological artifacts than other habitats, plants for food/drink (e.g., water-retaining cacti, figs, dates, olives, pistachios, acacia), mineral resources (e.g., salts, borates), habitat for endemic species, underground aquifers, excellent source of renewable solar energy

5. What other animals, plants, or ecosystems have you heard about that might be experiencing loss due to poor thermal resilience in our warming climate?

   Common examples include: corals, polar bears, Chinook salmon, sea turtles, dugongs, manatees, Adélie penguins, bees, whales, sharks, elephants, migratory birds, migratory insects (e.g., monarch butterflies), boreal/cold-weather forests

   j. What might we as humans do in an attempt to increase the thermal resilience of the ecosystem(s) or species you listed above?

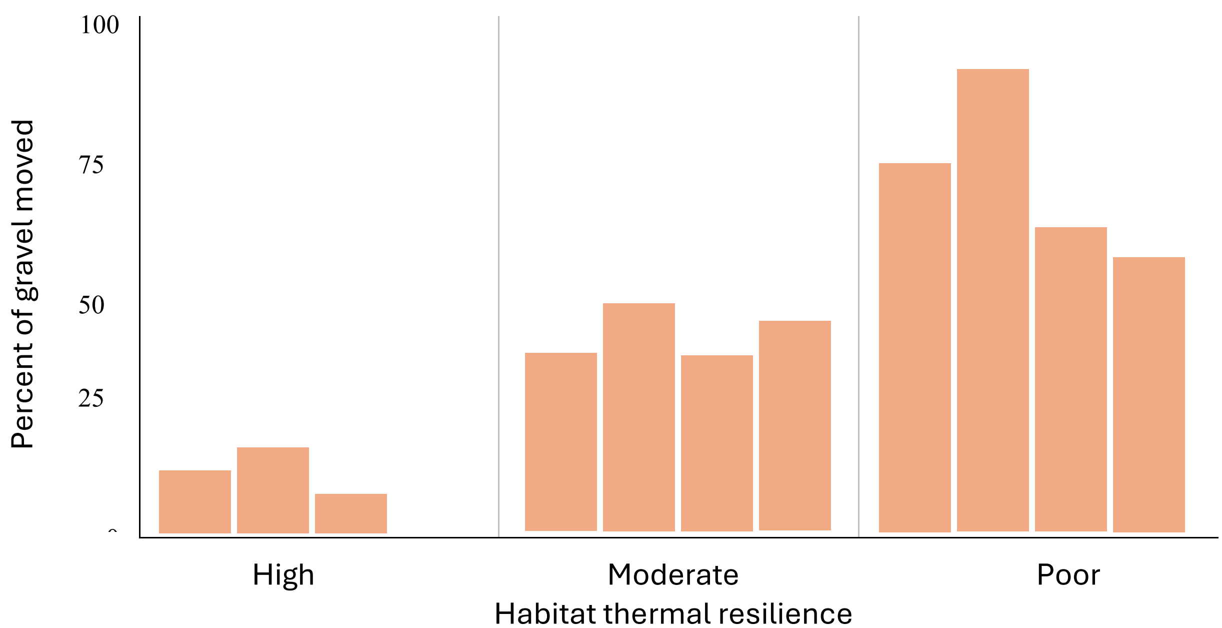
      Common examples include: find and breed organisms that have higher thermal resilience, engage in climate change-fighting actions (e.g., reduce reliance on fossil fuels, increase use of renewable energy sources, recycle plastics, regulate corporate heat waste disposal), assisted migration (this is controversial), increase environmental regulations, increase awareness of loss

6. Record the following weights for your group, then copy it to the class table.

The following data was fabricated for the purposes of this answer key. Results will vary.

Habitat Type	Scooped gravel weight (g)	Total gravel weight (g)	Percent gravel moved (= scooped/total x 100)	Percent Cover	Density
High thermal resilience	50	600	8.33	90	21
Moderate thermal resilience	130	600	21.66	50	18
Poor thermal resilience	250	600	41.66	15	6

14. Using the class table, fill-in the bar graph provided. Don't forget titles and scales.



ANSWER KEY

1. Imagine a class of students, each with their own bag of colored candy, who were asked to split the candy up by color. The class was then asked to count the number of each candy to create a histogram. Each time a student had a number of red candies that fell within a certain range, called a bin, the class added 1 to the frequency column. The bins for this class were split into groups of 10, such that a student with 6 red candies in their bag would add 1 to the 0-10 bin but a student with 38 red candies would add 1 to the 30-40 bin. As a result, their class data looked like the following, with the table on the left and its corresponding histogram on the right:

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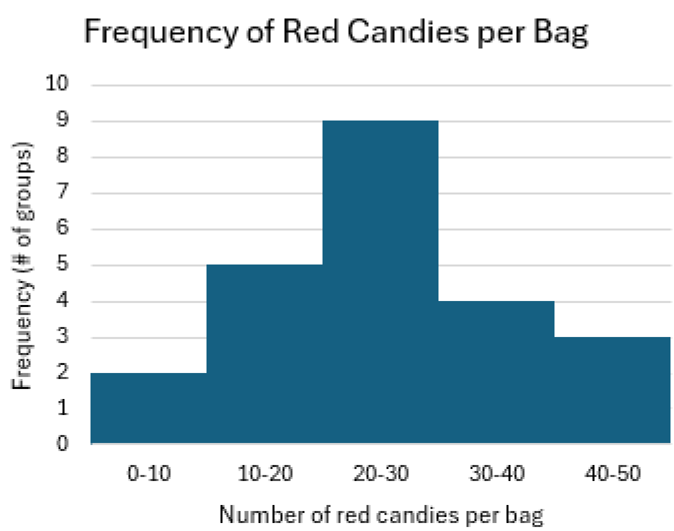


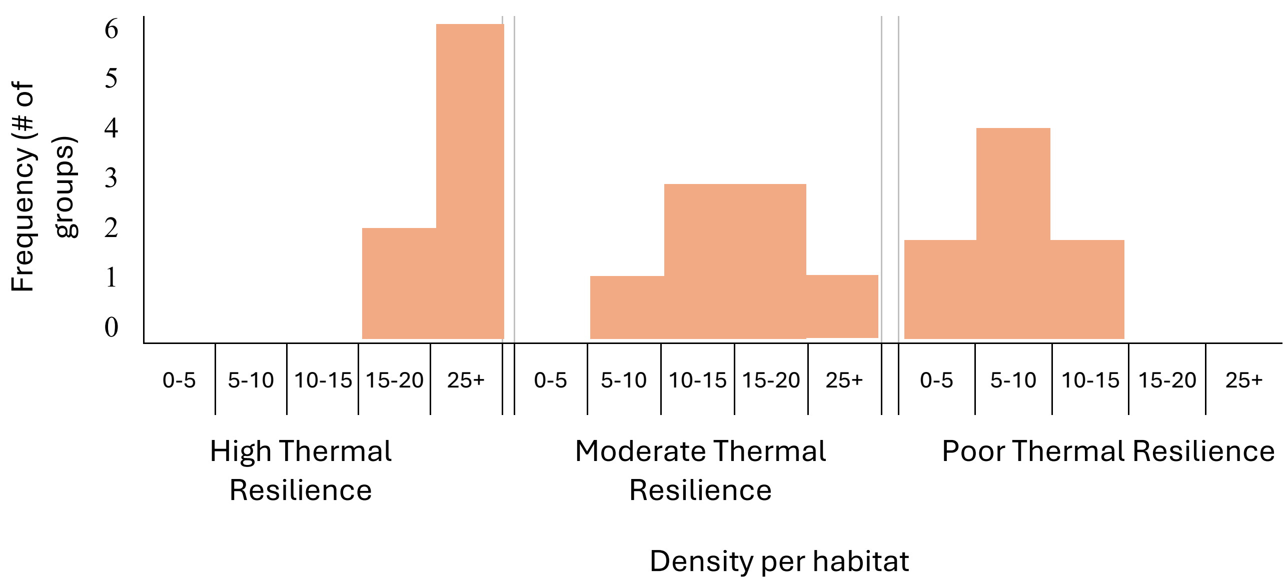
There are no answers here – this is just an example.

On the next page, you will create a similar table and histogram using the class data. This table and histogram will compare the density (# of shoots per ring) of each habitat with the frequency (# of groups).

2. Create a table similar to the one on the last page using the class data. Note that the bins for density are split into groups of 5.

Density (# of shoots counted in ring area)	Frequency (# of groups) in high thermal tolerance habitat	Frequency (# of groups) in medium thermal tolerance habitat	Frequency (# of groups) in poor thermal tolerance habitat
0-5	0	0	2
5-10	0	1	4
10-15	0	3	2
15-20	2	3	0
25+	6	1	0

3. Using the table you created above, fill in the histogram below. Before you begin, make notes of its axes. The Y axis is frequency (# of groups). The X axis is density per habitat (the number of shoots counted within that habitat's density ring), split into bins of 5. Each time a group has a density that fits within a bin, +1 is added to frequency's bin. Use the example of the class counting red candies from problem #1 to guide you.



4. Was your original hypothesis supported or unsupported? Provide evidence.

   Our original hypothesis was supported. As the thermal resilience decreased, the amount of gravel moved during wave action increased because the eelgrass could not retain the soil.

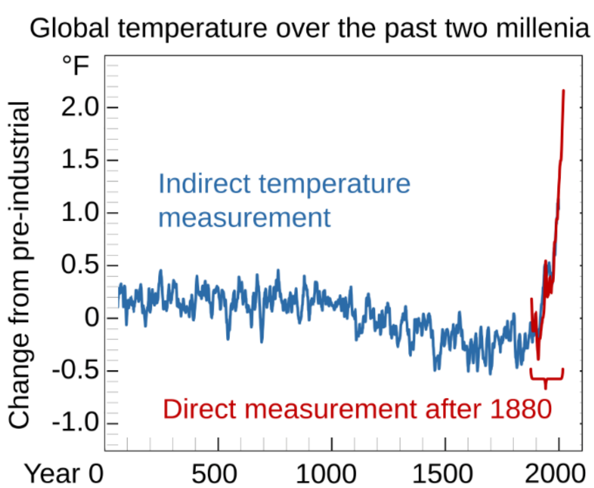
5. Percent cover and density often work together to indicate the overall health of a habitat – when the values of both are higher, this typically indicates higher health. Which habitat tote appears healthier? Use evidence from the table and your histogram.

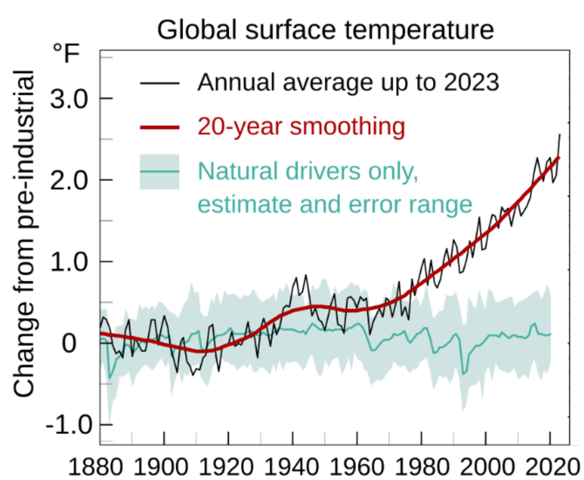
   The high thermal resilience habitat appears to be the healthiest. It has the highest percent cover and density.

6. Why do you think seagrass prevents soil movement during wave action? Hint: there are 2 common answers. Provide at least 1 with consideration for physics and/or plant structure.

   The shoots floating in the water column break up wave energy as the wave passes by, reducing wave intensity overall. The roots also physically hold soil in place.

7. Global climate change shows evidence of increasing global temperatures, as depicted in the two graphs below.





   g. Over what time scale and temperature scale does each graph take place?

      Left: from year 0 to year 2000. Right: from year 1880 to year 2020.

h. Why is knowing the difference in scales important to understanding the messages of these two graphs?

The left graph shows a broader timescale. The right shows more detail in recent years. This helps to establish just how much temperatures have changed recently.

i. Increased carbon dioxide levels are a major contributor to global climate change. Seagrasses, like many plants, require carbon dioxide to power photosynthesis. As a result of photosynthesis, oxygen is released back into the atmosphere. If global climate change causes temperature-sensitive seagrasses such as eelgrass to decline due to temperature, what happens to the carbon dioxide and oxygen levels?

Oxygen will decline while carbon dioxide increases due to lack of photosynthesis.

j. What does this mean for the fish that live in seagrass meadows, especially those that use seagrass as nursery habitat?

Fish will be less likely to live in seagrass meadows because there will be less oxygen available in the water. There will be less refuge/area to hide from predators.

k. What will this mean for fishermen, either commercially or recreationally?

There will be less fishing opportunities in seagrass habitats because there will be less fish available.

l. What can we do to reduce the loss of temperature-sensitive species?

Common answers include: find and breed individuals with high thermal resilience, increase awareness of loss, increase environmental regulations, reduce corporate polluting, assisted migration (controversial)

The Seagrass Solution: Combined Worksheet

ANSWER KEY

Introduction

During the pre-lab presentation, you learned about the two seagrass of Virginia: the eelgrass Zostera marina and the widgeon grass Ruppia maritima. The heat-sensitive eelgrass grows from the Arctic Circle down to North Carolina in the Atlantic Ocean. Meanwhile, the widgeon grass Ruppia maritima is cosmopolitan, meaning it grows in nearly every country in the world due to its adaptability to environmental conditions. Remember the marathon runner metaphor.

Learning Objectives

Students will be able to…

4. relate declining seagrass heat tolerance with decreased ability to provide shoreline protection.
5. be able to describe seagrasses and the role they play within the Chesapeake Bay regarding shoreline protection.
6. develop a hypothesis about how global climate change will affect other heat-sensitive habitats and some potential consequences for loss.

Vocabulary:

Cosmopolitan: a species that is present worldwide, often due to its highly adaptive nature to a variety of environmental conditions

Ecosystem: a community of organisms and habitats that interact with each other and the environmental conditions in which they live

Ecosystem services: the direct or indirect benefits humans gain from an ecosystem’s natural resources and functions

Erosion: the loss or removal of soil and rock from one location through natural means (ex., water, wind) which are then transported to another location

Habitat: where an organism lives – the scale of a habitat can range in size from the individual (ex., a single dead log) to the group (ex., a forest)

Resilience: the ability of an ecosystem to maintain its structure and function during and after disturbances such as storms, fires, or heatwaves

Thermal resilience: the ability of an organism to withstand temperatures higher than those typical to the local environment

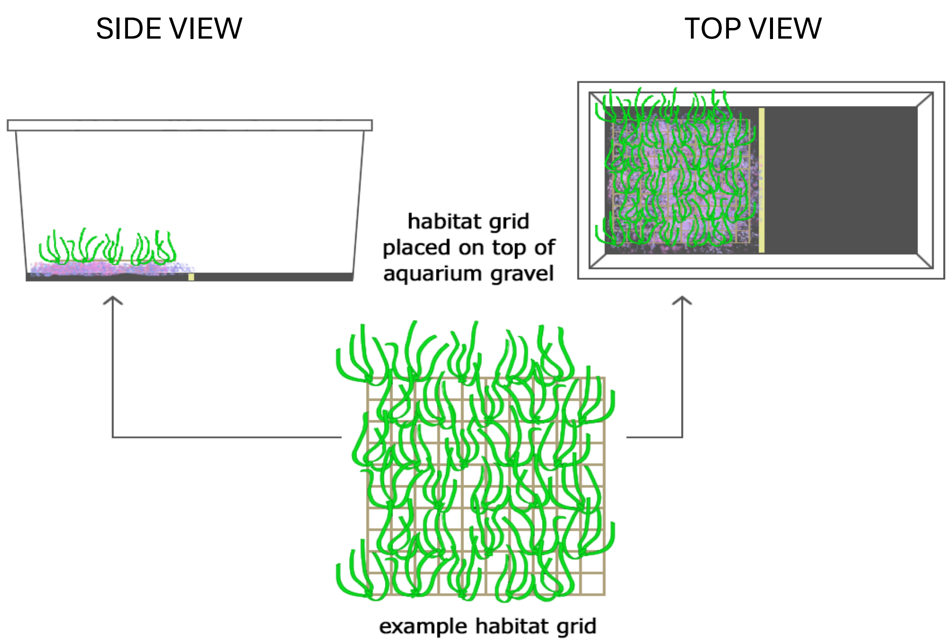
Background Information:

Seagrasses are flowering marine plants and form interwoven habitats along the intertidal to subtidal regions of 191 countries. The lush meadows contribute many direct and indirect benefits to humans, called ecosystem services. These benefits range from acting as habitat and food for many marine animals – including threatened species such as turtles and manatees – to providing ample fishing opportunities for humans, even to filtering many known pollutants out of our waterways. Unfortunately, seagrasses face a growing threat, putting our shorelines at increased risk.

Worldwide, many species of seagrasses are declining due to the rise in water temperatures caused by global climate change, including here in Virginia. Within the Chesapeake Bay, two species are present: the eelgrass Zostera marina and the widgeon grass Ruppia maritima. Where eelgrass exists in the Atlantic from the Arctic Circle to North Carolina, widgeon grass is cosmopolitan, growing along the shorelines of all continents except Antarctica. Over the last century in the Chesapeake Bay, the heat-sensitive eelgrass has seen major declines from warming waters and summertime marine heatwaves. Despite its cosmopolitan nature, widgeon grass has been unable to fill in the increasing number of gaps, resulting in an overall rate of loss.

Rising water temperatures aren't the only threat caused by climate change: rising sea level, storm surge, and wave action all threaten our coastal communities. Fortunately for us, seagrasses have been found to reduce wave intensity, trap sediment, and retain soil, causing an overall reduction in coastal erosion. While seagrasses are still experiencing some declines, researchers around the globe are working hard not only to restore seagrass habitats but to increase overall seagrass thermal resilience! With restored seagrass meadows on our side, we can reduce erosion to save our coastal communities from further loss.

This lab will use stimulated seagrass meadows that look like the figure below:



Form a hypothesis:

[Instructions from the handout; cut for space.]

Answer the following questions BEFORE your group uses the totes.

1. You will be creating waves in the totes, causing the gravel underneath to move (erode) if the eelgrass cannot break up the wave energy and retain the soil below. This will mirror coastal erosion. Do you think the 3 experimental totes will vary or stay the same in the amount of gravel they retain during wave action? How so? Explain your reasoning.

   The 3 totes will vary because they have differing levels of thermal resilience. The higher the thermal resilience, the more the eelgrass remains during and after the heatwave. As waves pass through eelgrass meadows, their intensity decreases as the blades/shoots/leaves break up the motion, preventing soil movement. The roots of the eelgrass provide additional stability to the soil. The less shoots in the water column and the less roots holding onto the soil, the more the gravel is exposed to wave action.

2. Write your prediction as a hypothesis using an "If-then" statement. Don't forget the rationale for your prediction.

   If an eelgrass habitat has higher thermal resilience, then it will be able to retain more soil because the shoots will break up the waves and the roots will hold the soil in place.

3. During the lecture slides, you learned about ecosystem services, including [...] Why might seagrass provide good nursery habitat to young fish? Consider what resources fish need to survive.

   Any of the following: seagrass habitats provide oxygen to the water, hiding places for young fish to avoid predators, food for young fish in the form of smaller animals and/or seagrass shoots, and filtration of pollutants/diseases that might affect fish.

4. What can we, as humans, to increase the thermal resilience of seagrass meadows?

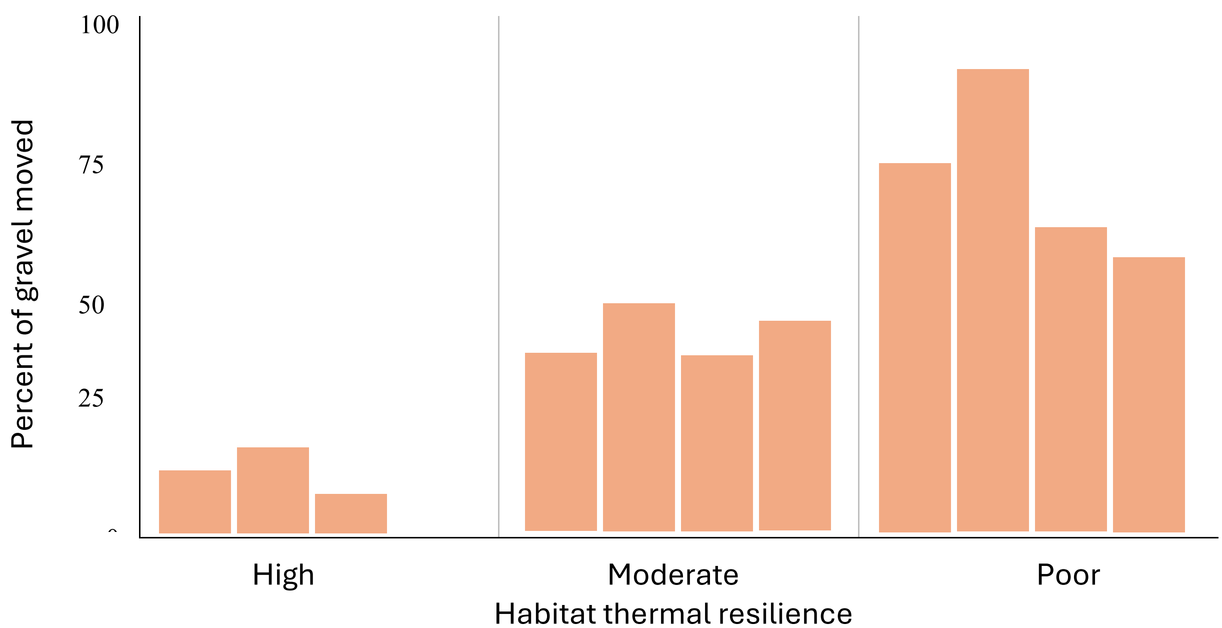
   Common examples include: find and breed organisms that have higher thermal resilience, engage in climate change-fighting actions (e.g., reduce reliance on fossil fuels, increase use of renewable energy sources, recycle plastics, regulate corporate heat waste disposal), assisted migration (this is controversial), increase environmental regulations, increase awareness of loss

5. Record the following weights for your group, then copy it to the class table. Percent cover is already provided. To determine the density (# of shoots counted in ring), place the ring within the tote and count the number of shoots within the ring's area.

The following data was fabricated for the purposes of this answer key. Results will vary.

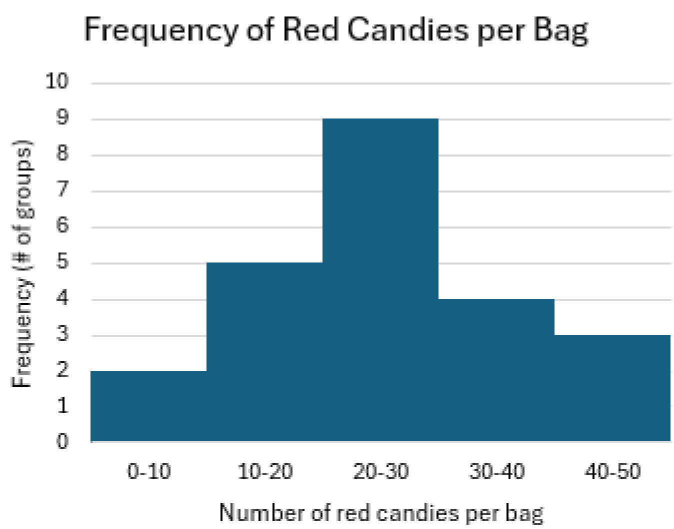
Habitat Type	Scooped gravel weight (g)	Total gravel weight (g)	Percent gravel moved (= scooped/total x 100)	Percent Cover	Density
High thermal resilience	50	600	8.33	90	21
Moderate thermal resilience	130	600	21.66	50	18
Poor thermal resilience	250	600	41.66	15	6

6. Using the class table, fill-in the bar graph provided. Don't forget titles and scales.



Imagine a class of students, each with their own bag of colored candy, who were asked to split the candy up by color. The class was then asked to count the number of each candy to create a histogram. Each time a student had a number of red candies that fell within a certain range, called a bin, the class added 1 to the frequency column. The bins for this class were split into groups of 10, such that a student with 6 red candies in their bag would add 1 to the 0-10 bin but a student with 38 red candies would add 1 to the 30-40 bin. As a result, their class data looked like the following, with the table on the left and its corresponding histogram on the right:

Number of red candies per bag	Frequency (# of students)
0-10	2
10-20	5
20-30	9
30-40	4
40-50	3



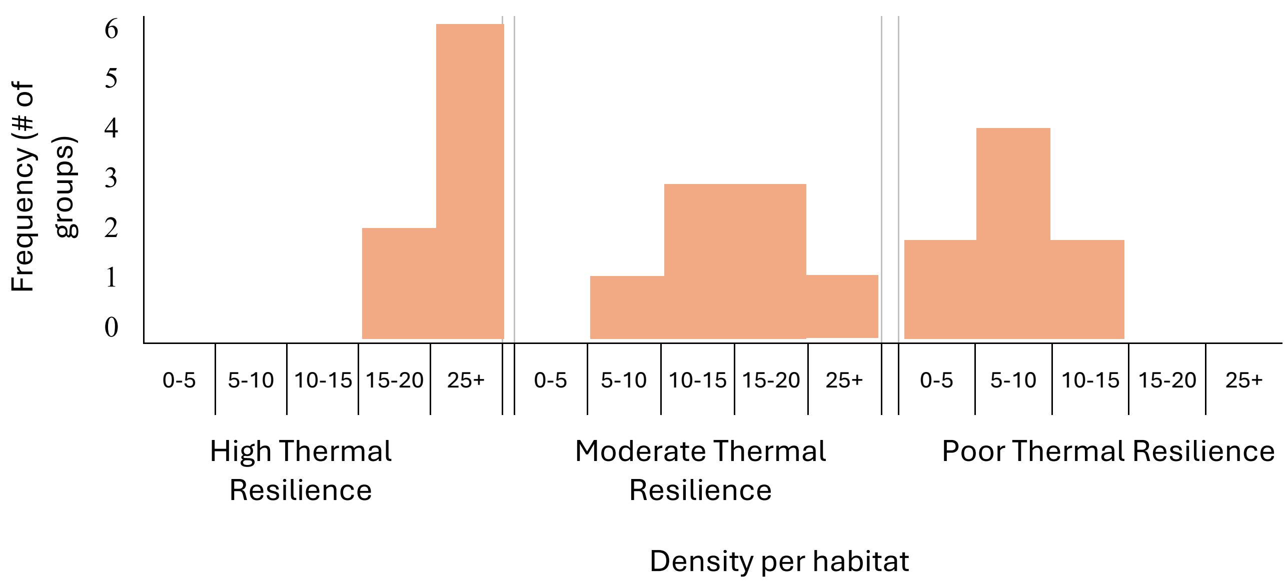
There are no answers here – this is just an example.

On the next page, you will create a similar table and histogram using the class data. This table and histogram will compare the density (# of shoots per ring) of each habitat with the frequency (# of groups).

7. Create a table similar to the one on the last page using the class data. Note that the bins for density are split into groups of 5.

Density (# of shoots counted in ring area)	Frequency (# of groups) in high thermal tolerance habitat	Frequency (# of groups) in medium thermal tolerance habitat	Frequency (# of groups) in poor thermal tolerance habitat
0-5	0	0	2
5-10	0	1	4
10-15	0	3	2
15-20	2	3	0
25+	6	1	0

8. Using the table you created above, fill in the histogram below. Before you begin, make notes of its axes. The Y axis is frequency (# of groups). The X axis is density per habitat (the number of shoots counted within that habitat's density ring), split into bins of 5. Each time a group has a density that fits within a bin, +1 is added to frequency's bin. Use the example of the class counting red candies from problem #1 to guide you.



10. Was your original hypothesis supported or unsupported? Provide evidence.

    Our original hypothesis was supported. As the thermal resilience decreased, the amount of gravel moved during wave action increased because the eelgrass could not retain the soil.

11. Percent cover and density often work together to indicate the overall health of a habitat – when the values of both are higher, this typically indicates higher health. Which habitat tote appears healthier? Use evidence from the table and your histogram.

    The high thermal resilience habitat appears to be the healthiest. It has the highest percent cover and density.

12. Why do you think seagrass prevents soil movement during wave action? Hint: there are 2 common answers. Provide at least 1 with consideration for physics and/or plant structure.

    The shoots floating in the water column break up wave energy as the wave passes by, reducing wave intensity overall. The roots also physically hold soil in place.

13. What does this mean for the fish that live in seagrass meadows, especially those that use seagrass as nursery habitat?

    Fish will be less likely to live in seagrass meadows because there will be less oxygen available in the water. There will be less refuge/area to hide from predators.

14. What will this mean for fishermen, either commercially or recreationally?

    There will be less fishing opportunities in seagrass habitats because there will be less fish available.