



## **Virtual Field Trip To SoundWaters Coastal Education Center Teachers Guide and Supporting Materials**

Welcome to the SoundWaters Virtual Field Trip to SoundWaters Coastal Education Center.

This Virtual Field Trip focuses on the coastal habitats of the Long Island Sound. The adventure begins with SoundWaters Educator Jess Castoro on the shore of Holly Pond, and Jess narrates the experience for students. Throughout the Field Trip other SoundWaters Educators present compelling videos about topics such as the coastal habitats, animal adaptations, ecosystem components, marine plants, tidal factors, and freshwater bioindicators. To help you organize your lesson plan the order of the presentation and the start and end time of each section, along with the relevant NGSS standards, are listed below.

Also below are resources that you may choose to use with your students. Specifically you will find:

- Video link: <http://bit.ly/swcc6-8>
- Worksheets to reinforce the material presented in the Field Trip.
- A sample quiz.
- A quiz answer key.
- Links to online resources that students can use to enhance their knowledge.
- Links to additional articles and readings to help your students learn more about the coastal ecosystem of Long Island Sound.

We trust you will find this Virtual Field Trip to be a valuable learning tool for your students and a terrific way to connect them with the natural world. If you would like to pursue this subject matter in a more significant way please reach out to us to discuss bringing a SoundWaters Educator into your classroom via videoconference. We can customize a program that will support your desired learning outcomes for your students. For more information please contact Olena Czebiniak at [olena@soundwaters.org](mailto:olena@soundwaters.org) or 203-406-3319.

## Content, Timing and NGSS Standards

### Coastal Habitats Video

- Start – 0:59
- End – 5:45
- NGSS – Ecosystems: Interactions, Energy and Dynamics: MS-LS2-5

### Adaptations Overview Video

- Start – 7:52
- End – 14:57
- NGSS – Natural Selection and Adaptations: MS-LS4-4

### Biotic and Abiotic Factors Video

- Start – 15:23
- End – 22:55
- NGSS – Matter and Energy in Organisms and Ecosystems: MS-LS2-2, MS-LS2-3; Growth, Development and Reproduction of Organisms: MS-LS1-5

### Coastal and Marine Plants Video

- Start – 23:20
- End – 29:00
- NGSS – Natural Selection and Adaptations: MS-LS4-4

### Tides Video

- Start – 29:33
- End – 36:34
- NGSS – Earth's Place in the Universe: MS-ESS1-2


### Freshwater Bioindicators Video

- Start – 37:00
- End – 42:26
- NGSS – Ecosystems: Interactions, Energy and Dynamics: MS-LS2-4, MS-LS2-5

# COASTAL HABITATS OF LONG ISLAND SOUND





During the virtual field trip, you learned about three coastal habitats of Long Island Sound. *Label the habitats and give specific examples of how they are important to the whole Long Island Sound marine ecosystem.*

<p><b>Habitat Name:</b></p> <hr/> 	<p><b>Why is this habitat important?</b></p>
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# COASTAL HABITATS OF LONG ISLAND SOUND

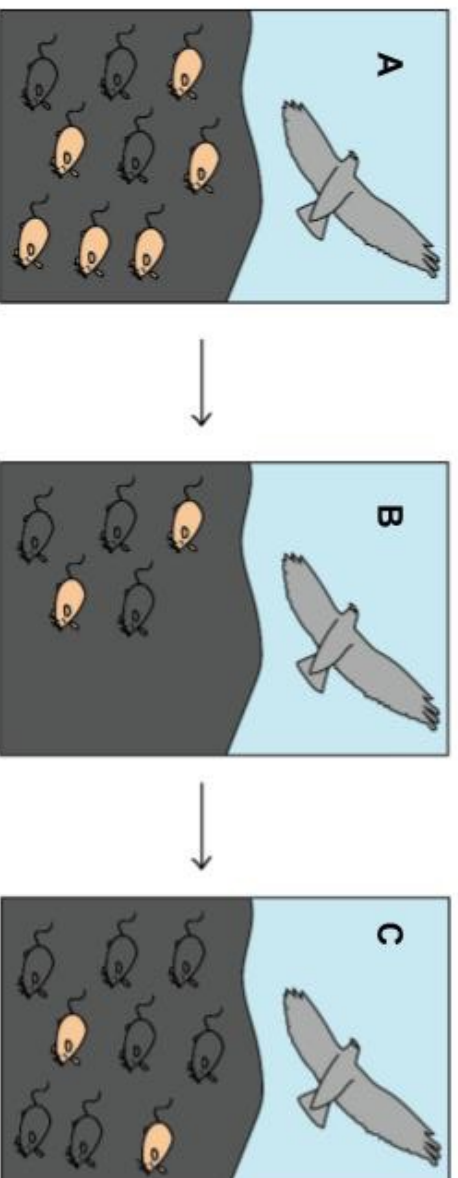


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## NATURAL SELECTION

What is natural selection? Give an example (not a giraffe) and explain.



The three pictures above demonstrate natural selection. Explain what is happening in pictures A, B, and C and how they relate to natural selection.

# BIOTIC AND ABIOTIC COMPONENTS OF AN ECOSYSTEM



Define BIOTIC:

Define ABIOTIC:

List the abiotic and biotic factors from the picture.  
Be as specific as possible

ABIOTIC	BIOTIC



Image credit NOAA  
<https://www.integratedecosystemassessment.noaa.gov/iemebm>

Give an example of how one of the abiotic factors interacts with one of the biotic factors from your lists above



# COASTAL AND MARINE PLANTS

Coastal and marine plants have different anatomical structures to help them survive in an environment like Long Island Sound.

For each of the structures below:

- Explain how it is important to coastal or marine plants.
- Compare it to the structures of an inland plant



## SALT GLAND

## HOLDFAST

# COASTAL AND MARINE PLANTS

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## TILLERING ROOT

## AIR BLADDER



## READING A TIDE CHART

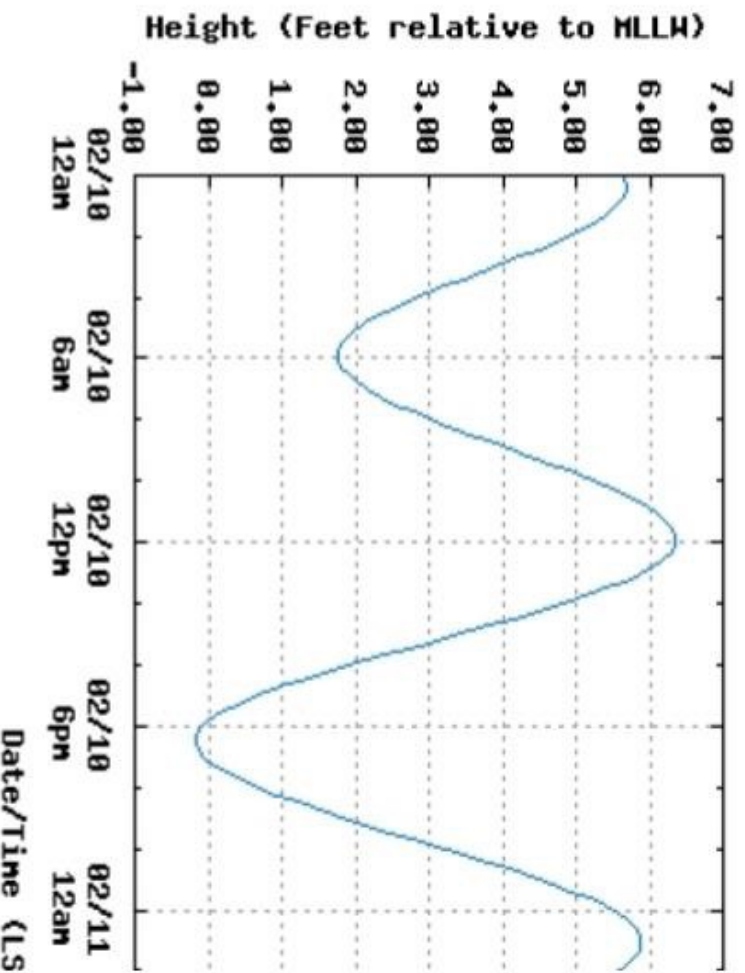
A tide chart is used to predict the tides in an area. The chart show the water levels on an hourly basis for a particular place. The vertical axis contains the tide height and the horizontal axis shows the time of day.

Using the tide chart, answer the following questions

How many high tides in one day?

How many low tides in one day?

At 9am, is the tide going towards high or low?



If a fisherman wanted to take his boat out at the highest tide of the day, what time would that be and how high is the tide?



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## FRESHWATER BIOINDICATORS



**Many different rivers lead to Long Island Sound. Why is the river important to animals and humans?**

A group of scientists monitoring a river decided to look for insects because they are indicators of pollution. If an insect is considered sensitive, it means the insect cannot exist in polluted areas. The scientists studied the river for 2 years and found the following insects during each survey.

Year 1: Body Builder Mayfly, Common Stonefly, Dragonfly, Brush Legged Mayfly, Water Penny Beetle

Year 2: Scud, Black Fly, Aquatic Sow Bug, Non-Biting Midge, Snail

<u>Most sensitive</u>	<u>Moderately sensitive</u>	<u>Least sensitive</u>
Body-Builder Mayfly Free-Living Caddisfly Brush Legged Mayfly Common Stonefly Saddlecase Maker Caddisfly	Fingernet Caddisfly Dragonfly Water Penny Beetle Dobsonfly Damselfly	Scud Aquatic Sow Bug Non-Biting Midge Black Fly Snail

**What do the survey results tell us about the health of the river from year 1 to year 2?**  
*Use the survey results and the insect sensitivity guide above.*

# COASTAL HABITATS OF LONG ISLAND SOUND

## ANSWER KEY

During the virtual field trip, you learned about three coastal habitats of Long Island Sound. *Label the habitats and give specific examples of how they are important to the whole Long Island Sound marine ecosystem.*

Habitat Name     Salt Marsh    



**Why is this habitat important?**

- Nursery habitat to animals
- Feeding & nesting for coastal birds
- Peat absorbs pollution from the land

Habitat Name     Rocky intertidal Zone    



**Why is this habitat important?**

- Rocks are a hiding place for animals when the tide changes
- Rocks keep soft sediments and mud in place from eroding
- Soft areas allow animals to burrow in and stay damp when the tide changes

Habitat Name     Sandy Beach    



**Why is this habitat important?**

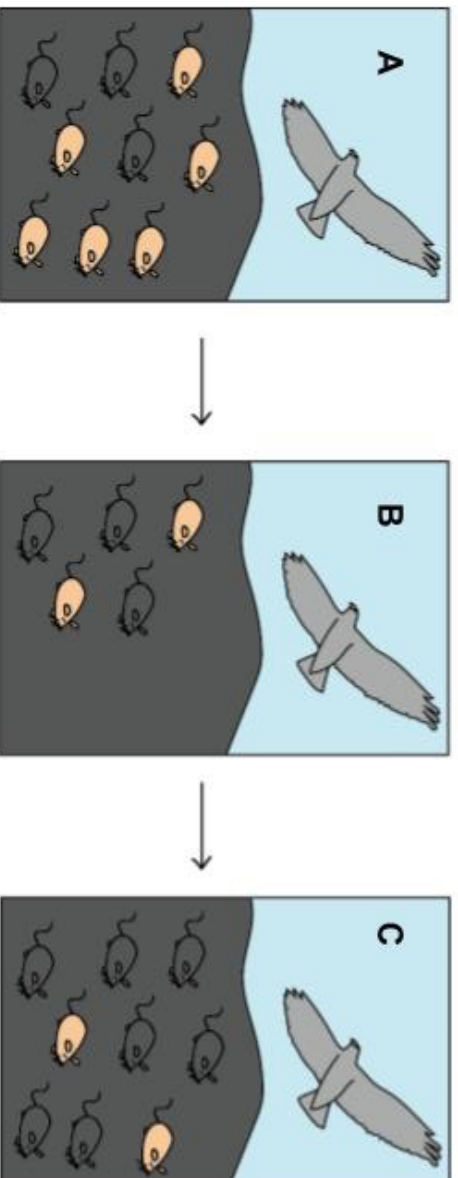
- Foraging grounds for migrating birds
- Wrack line - deposits of seaweed that micro-organisms can live in to stay damp
- Absorbs water, so animals can burrow into the sand and live underground



## NATURAL SELECTION ANSWER KEY

**What is natural selection? Give an example (not a giraffe) and explain.**

Over time, animals with certain traits are able to survive and pass on their genes so certain animals survive over others.  
*Examples may vary,*



**The three pictures above demonstrate natural selection. Explain what is happening in pictures A, B, and C and how they relate to natural selection.**

At the beginning, there are mice of 2 colors and the hawk can only see the lighter ones. Over time the hawks eat most of the lighter ones and the darker ones are able to reproduce. Eventually there are way more dark mice because they were able to reproduce and pass on their dark skin genes. The white mice were lower in number so they could not reproduce as much to pass on their genes.

# BIOTIC AND ABIOTIC COMPONENTS OF AN ECOSYSTEM ANSWER KEY



**Define BIOTIC:**

Anything living in an ecosystem (plants, animals)

**Define ABIOTIC:**

Anything non-living in an ecosystem (sediment, wind, rocks)



ABIOTIC	BIOTIC
Sun Wind Buildings (houses, factory) Roads Cars, Bus Boats Water Dirt Sand (if you interpret that as a beach)	People Plants (trees, plants in garden) Fish Shark Turtle Corals

**What is one way that one of the abiotic factors interacts with one of the biotic factors from your lists above?**

Answers vary

Image credit NOAA  
<https://www.integratedecosystemassessment.gov/education/EBM>

# COASTAL AND MARINE PLANTS ANSWER KEY



Coastal and marine plants have different anatomical structures to help them survive in an environment like Long Island Sound.

For each of the structures below:

- Explain how it is important to coastal or marine plants.
- Compare it to the structures of an inland plant



## SALT GLAND

- Found in coastal grasses like cordgrass (salt marsh)
- The marsh grass brings in brackish water but only uses fresh water so the salt gland allows it to expel the salt onto the leaves.
- Most inland plants do not have to deal with salt and do not need this structure

## HOLDFAST

- Found in marine plants like kelp
- They can't have roots like a land plant because they do not grow in the ground. Instead, they have a holdfast that allows them to attach to a rock or other hard surface.

## TILLERING ROOT

- Found in coastal grasses like cordgrass (salt marsh)
- This type of root allows the plant to grow new grasses from underground instead of just seeds. Also, if any damage happens to the blades of grass, the plant is not dead. These roots also make the ground very stable since the tide comes in and out throughout the day. Inland plants do not have the same risk of erosion so they do not need this type of root system

## AIR BLADDER

- Found in marine plants like kelp.
- They do not have rigid stems like inland plants so the air bladder holds them up in the water so they can get the sunlight to their "leaves".



## READING A TIDE CHART ANSWER KEY

A tide chart is used to predict the tides in an area. The chart shows the water levels on an hourly basis for a particular place. The vertical axis contains the tide height and the horizontal axis shows the time of day.

Using the tide chart, answer the following questions

**How many high tides in one day?**

2 high tides (12am and 12pm)

**How many low tides in one day?**

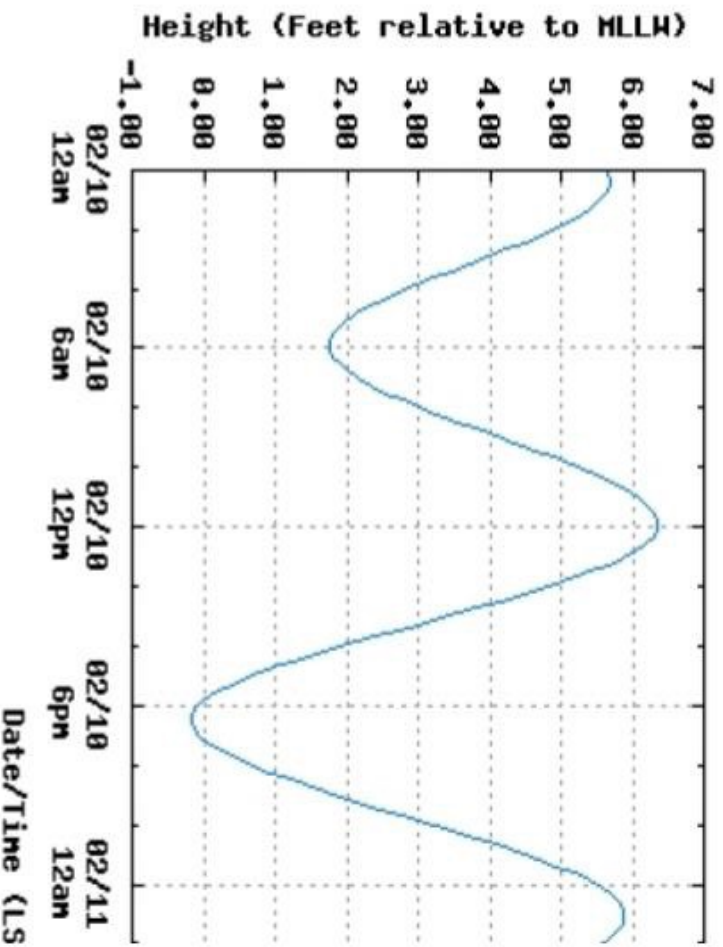
2 low tides (6am and 6 pm)

**At 9am, is the tide going towards high or low?**

At 9am, the tide is rising, so it's going towards high

**If a fisherman wanted to take his boat out at the highest tide of the day, what time would that be and how high is the tide?**

He would have to go out at 12pm because the tide is almost 6.5 ft



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## FRESHWATER BIOINDICATORS ANSWER KEY



**Many different rivers lead to Long Island Sound. Why is the river important to animals and humans?**  
Rivers provide drinking water for people, a habitat for animals, breeding ground for Long Island Sound animals, and carry nutrients to different areas of the river and Long Island Sound

A group of scientists monitoring a river decided to look for insects because they are indicators of pollution. If an insect is considered sensitive, it means the insect cannot exist in polluted areas. The scientists studied the river for 2 years and found the following insects during each survey.

Year 1: Body Builder Mayfly, Common Stonefly, Dragonfly, Brush Legged Mayfly, Water Penny Beetle

Year 2: Scud, Black Fly, Aquatic Sow Bug, Non-Biting Midge, Snail

<u>Most sensitive</u>	<u>Moderately sensitive</u>	<u>Least sensitive</u>
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**What do the survey results tell us about the health of the river from year 1 to year 2? What should they do after year 2?**

*Use the survey results and the insect sensitivity guide above.*

In year 1, the insects that were found are mostly in the sensitive category which means the river is healthy. There are 2 species that are moderately sensitive, so it could mean that a source of pollution is possibly entering the river.

In year 2, all the insects are least sensitive to pollution, which means the scientists should do further testing on the water to figure out what could be polluting the water.

## TEST YOUR KNOWLEDGE

1. What is an estuary?
  - a. A coastal habitat that is only found in Long Island Sound.
  - b. A partially enclosed body of water where salt water and fresh water meet.
  - c. All the oceans of the world.
  - d. A type of plant found in brackish water.
  
2. Which of these statements is TRUE about coastal grasslands?
  - a. Their root systems hold the ground material in place so it will not blow away or shift with the wind.
  - b. It provides habitat for migratory birds and other nesting bird species.
  - c. The plants are very effective at utilizing and absorbing water.
  - d. All of the above.
  
3. What purpose does peat serve for the salt marsh?
  - a. It filters out the salt from the water so that the plants in the salt marsh only drink fresh water.
  - b. It absorbs the sunlight and photosynthesizes, creating extra food for the salt marsh grass during the winter months when there is less sunlight.
  - c. It is a rich organic layer that absorbs water and filters pollutants.
  - d. Trees can only grow in this special layer of substrate near the edge of the water.
  
4. In the rocky intertidal zone....
  - a. There is very little water because the tide never reaches this area.
  - b. Rocks hold the sediment in place, preventing erosion.
  - c. Migrating birds come here to nest.
  - d. The silty sediment filters the water, making it cleaner for Long Island Sound.
  
5. Which of these statements is FALSE about the wrack line?
  - a. The wrack line is always in the same place on the beach.
  - b. The wrack line provides food and nutrients.
  - c. The wrack line occurs because of the tide.
  - d. The wrack line can contain seaweed and dead animals.

6. Which of these is the correct pairing of a type of adaptation with an example of that adaptation?
- The body of a plant can bend towards the light using chemical reactions inside the body, which is a physiological adaptation to ensure they can make their own food.
  - Snakes create their own venom, which is a structural adaptation that they use to get their prey.
  - Diamondback terrapins have a beak to crush their food, which is an example of a behavioral adaptation.
  - Blue crabs have a back leg like a paddle to help them swim through the water, which is an example of a physiological adaptation.
7. \_\_\_\_\_ occurs when animals are better at surviving and are able to pass on genes to their offspring.
- Adaptation
  - Natural selection
  - Morphology
  - Genetic diversity
8. Which of these statements is TRUE about having variation within the same population of animals?
- There should be no variation, all animals should be exactly the same because they are best fit for that environment forever.
  - There should be no variation because if the environment changes, the animal should not be allowed to continue to exist.
  - There should be variation within a population because the conditions could suddenly change and then at least some of the animals would survive.
  - There should be variation so that each animal can choose the mate they like the best.
9. How is the horseshoe crab's telson an example of an adaptation?
- It uses the telson to sting predators that come near it.
  - It uses the telson like a rudder to steer through the water.
  - It uses the telson to taste the water and make sure the chemistry is right.
  - It uses the telson to flip over when it is upside down on the beach.
10. A(n) \_\_\_\_\_ is the combination of all living and non-living things in an area.
- Biotic factor
  - Abiotic factor
  - Ecosystem
  - Estuary

11. Which of these is NOT an example of a biotic factor in Long Island Sound?
- The sunlight that is used by producers to make food.
  - A producer that makes food from the sun.
  - A consumer that eats producers.
  - A decomposer that breaks down dead consumers.
12. Which of these statements is FALSE about the salinity in Long Island Sound?
- The salinity fluctuates throughout the year.
  - The salinity is the lowest in the spring due to all the extra fresh water.
  - The salinity is the highest in the winter due to all the direct sunlight on the water.
  - Animals that can't adapt to fluctuating salinities move out to the ocean where it is more consistent.
13. What is the crucial job of a mud snail in a mud flat substrate?
- Maintaining the salinity of the water so all the animals can live there.
  - Giving energy to producers like seaweed so they can photosynthesize.
  - Stirring up the mud to bring in oxygen to the lower levels.
  - Breaking down dead materials and releasing nutrients back into the environment.
14. Which of these is an example of how an abiotic factor has affected the lobster population in Long Island Sound?
- Rising water temperatures have caused the lobster to molt earlier than they are supposed to so they end up getting a shell disease more often.
  - Rising water temperatures have caused the lobster to migrate to shallow water later than they are supposed to and as a result the lobsters do not have enough food for the winter.
  - Rising water temperatures make the lobster less likely to get diseases, so the populations of lobsters are rising as the water temperature rises.
  - All of the above.
15. Why are tillering roots important to the salt marsh grass?
- Tillering roots remove the salt from the water before it gets into the leaves of the grass.
  - Tillering roots have rhizomes that help to create new root systems and create colonies of plants in an area.
  - Tillering roots have a single taproot and some lateral roots because there are so many nutrients in one area of the salt marsh.
  - Tillering roots help hold the salt marshes grasses to the rocks so they can move around under the water freely.

16. What purpose does the salt gland serve for *Spartina alterniflora*?
- It converts salt to nutrients for the plant.
  - It stores salt for animals that live on the plant.
  - It makes the plant immune to the salt in the water.
  - It removes salt and expels it on the leaf surface.
17. Compared to coastal plants, marine plants...
- Do not have to worry about sunlight because they are always floating at the top of the water.
  - Get their nutrients with a specialized structure called an air bladder.
  - Do not have root systems, instead they have a holdfast to attach to rocks or substrate.
  - Are not used by marine animals for habitat and food.
18. The tides are controlled by....
- The sun.
  - The moon.
  - The stars.
  - Mars.
19. What makes a semi-diurnal tide different than a mixed tide?
- A semi diurnal tide only has one high tide and one low tide each day and a mixed tide has two high tides and two low tides each day.
  - In a mixed tide, each of the two high tide is a different height and in a semi-diurnal tide, each of the two high tides is the same height.
  - A semi-diurnal tide only happens on a full moon and a mixed tide only happens on a new moon.
  - A semi-diurnal tide is only half the height of a regular tide height and mixed tide is double the size of a regular tide height.
20. Which tide has the lowest height difference (lower tidal range) between high and low tides?
- Spring tide
  - King tide
  - Neap tide
  - Fall tide
21. Why are tides important to areas like Long Island Sound?
- The tides bring in nutrients from other areas of Long Island Sound and the Atlantic Ocean.
  - The tides move animals around so predators can hunt smaller animals.
  - The tides help prey animals hide from large predators.
  - All of the above.



22. How do boaters know if an area is safe to drive in during high and low tide?
- They should only drive in areas they are used to because there is no way to know how deep the water will be at high or low tide.
  - Boaters can use a bathymetric chart or an app on their smartphone, which tells them the height of the water at high and low tide.
  - Boaters must have a depth sounder instrument on their boat so they know if the area is safe to drive in.
  - Boaters must use a special kind of anchor to measure the depth of the water as they are driving in a body of water.
23. Why are freshwater rivers important?
- They provide nutrients to bodies of water like Long Island Sound.
  - They provide drinking water to people living around them.
  - They provide habitat to plenty of invertebrates and other animals.
  - All of the above.
24. Which of these statements is TRUE about benthic macroinvertebrates?
- You must use a microscope to see them because they cannot be seen easily with your eyes.
  - They can be found at the bottom of the river, down in the sediment.
  - These animals have been introduced by humans to provide food for larger animals in the river.
  - They include animals such as small fish and turtles.
25. If scientists only find invertebrates with a tolerance value of 4 or higher during a survey of the river, it suggests that...
- They should do another survey because the results are inconclusive.
  - They should not be concerned because that means there is no pollution risk in the area.
  - They should be concerned because that means there could be a source of pollution in the area.
  - They should grow the invertebrates in the lab to make sure they identified them properly.
26. Which of these statements is true about monitoring the health of a river?
- Scientists should never monitor the health of rivers.
  - Scientists should only measure the benthic macroinvertebrates once because the health of the river will not change.
  - Scientists should monitor the river regularly because pollution can get into the river in a lot of different ways.
  - Scientists should only measure the benthic macroinvertebrates when adding new buildings directly along the river.

## TEST YOUR KNOWLEDGE ANSWERS

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  - Are not used by marine animals for habitat and food.
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22. How do boaters know if an area is safe to drive in during high and low tide?
- They should only drive in areas they are used to because there is no way to know how deep the water will be at high or low tide.
  - Boaters can use a bathymetric chart or an app on their smartphone, which tells them the height of the water at high and low tide.**
  - Boaters must have a depth sounder instrument on their boat so they know if the area is safe to drive in.
  - Boaters must use a special kind of anchor to measure the depth of the water as they are driving in a body of water.
23. Why are freshwater rivers important?
- They provide nutrients to bodies of water like Long Island Sound.
  - They provide drinking water to people living around them.
  - They provide habitat to plenty of invertebrates and other animals.
  - All of the above.**
24. Which of these statements is TRUE about benthic macroinvertebrates?
- You must use a microscope to see them because they cannot be seen easily with your eyes.
  - They can be found at the bottom of the river, down in the sediment.**
  - These animals have been introduced by humans to provide food for larger animals in the river.
  - They include animals such as small fish and turtles.
25. If scientists only find invertebrates with a tolerance value of 4 or higher during a survey of the river, it suggests that....
- They should do another survey because the results are inconclusive.
  - They should not be concerned because that means there is no pollution risk in the area.
  - They should be concerned because that means there could be a source of pollution in the area.**
  - They should grow the invertebrates in the lab to make sure they identified them properly.
26. Which of these statements is true about monitoring the health of a river?
- Scientists should never monitor the health of rivers.
  - Scientists should only measure the benthic macroinvertebrates once because the health of the river will not change.
  - Scientists should monitor the river regularly because pollution can get into the river in a lot of different ways.**
  - Scientists should only measure the benthic macroinvertebrates when adding new buildings directly along the river.



## ONLINE RESOURCES (Click on the title below to find out more!)

- [What is a Salt Marsh?](#)
- [What is a Kelp Forest?](#)
- [Estuaries](#)
- [Cooking Kelp with an Ocean Farmer](#)
- [A Bioindication of Water Quality](#)
- [NOAA Education Resource Collections: Freshwater](#)
- [Stream Ecosystem Field Activity](#)
- [Streams and Land Use Change](#)

## BOOKS

- *The Highest Tide: A Novel* by Jim Lynch
- *Marvels in the Muck: Life in the Salt Marshes* by Doug Wechsler
- *The Beak of the Finch: A Story of Evolution in Our Time* by Jonathan Weiner
- *The World We Live In* by Susan Pfeffer

## ARTICLES: Click on the title below to open the article

- [Marine plants](#) (Lexile level adjustable)
- [Freshwater insect indicators](#)
- [Shoring Up Long Island's beaches](#)
- [Stratford shoreline protection project gets national recognition](#)
- [As Long Island Sound warms, its fish species are changing](#)
- [Oregon Project Asks Citizens To Document King Tides For Climate Science](#)
- [Long Island Sound's Ecosystem Engineers](#)