Life in the habitats of Great Bay

Like the descriptions of the different habitats found around Great Bay to understand the names of animals, let's here.

**Rocky Shore**
- Rattlesnake Island
- Mallard
- American Robin
- Bald Eagle
- Great Blue Heron

**Mud Flats**
- Common Snipe
- Killdeer
- Red Knot
- Western Sandpiper
- Least Tern

**Salt Marsh**
- Harlequin Duck
- Dowitcher
- Common Tern
- Golden Plover
- Black Skimmer

**Upland Fields and Forest**
- Peregrine Falcon
-矛
- Red-tailed Hawk
- Cooper's Hawk
- Sharp-shinned Hawk
**Creature Feature**

**Question:** What lives in Great Bay and has 10 eyes, a sharp tail, blue blood, and ancestors who lived on earth before the dinosaurs?

**Answer:** The Horseshoe Crab!

The horseshoe crab, Limulus polyphemus, has been around for over 450 million years. It is called a “living fossil,” an animal that has stayed basically the same as it was in pre-historic times. Its closest living relatives are spiders, scorpions and ticks.

Two of its eyes, tiny dots on either side of a ridge at the front of its shell, can only detect light and dark. Another pair, its compound eyes, look like insect eyes. They see multiple images, like a kaleidoscope.

**Garbage Collector**

The horseshoe crab crawls through the mudflats, shoveling up worms and clams with the front of its shell. As it moves, it mixes oxygen into the black mud that is buried just below the surface. A garbage collector of the estuary, the horseshoe crab also devours the remains of dead animals. It uses its long telson, or tail, to right itself when it gets stranded on its back.

Long ago, Native Americans used its tail for a spear tip and its shell for a boat bailer.

**Medical Marvel**

Today, the horseshoe crab is prized for its blue blood. Medical researchers use it to identify disease-causing bacteria in medicine, making it safe for humans. It has been useful in diagnosing meningitis, a deadly disease that attacks the brain and spinal column.

Horseshoe crabs in Great Bay reproduce May through July. If you visit then, you might see a large horseshoe crab dragging one or two smaller ones up onto shore. The large one is an adult female, probably at least 10 years old, and the smaller ones are adult males, at least 9 years old. On shore, the females will lay eggs in several holes and the males will follow to fertilize them.

You can often find horseshoe crab shells along the shore of Great Bay. The animals didn’t necessarily die. The empty shells are from young horseshoe crabs that crawled out of their old shells to grow into their new shells underneath. Once they are fully grown, horseshoe crabs do not shed or molt their shells.

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**Tales of Great Bay National Estuarine Research Reserve**

Make up your own stories using words from each list. Maybe one story could be something that might really happen in an estuary, and another could be a fanciful tale.

<table>
<thead>
<tr>
<th>Who</th>
<th>How</th>
<th>Action Word</th>
<th>Where</th>
</tr>
</thead>
<tbody>
<tr>
<td>great blue heron</td>
<td>hungrily</td>
<td>flew</td>
<td>under the marsh</td>
</tr>
<tr>
<td>red fox</td>
<td>hastily</td>
<td>crawled</td>
<td>through the channel</td>
</tr>
<tr>
<td>green crab</td>
<td>sadly</td>
<td>hid</td>
<td>into the mud</td>
</tr>
<tr>
<td>silversides fish</td>
<td>happily</td>
<td>chased</td>
<td>overhead</td>
</tr>
<tr>
<td>snowy egret</td>
<td>stupidly</td>
<td>burrowed</td>
<td>below the tideline</td>
</tr>
<tr>
<td>winter flounder</td>
<td>greedily</td>
<td>nibbled</td>
<td>among the eelgrass</td>
</tr>
<tr>
<td>raccoon</td>
<td>cleverly</td>
<td>flew</td>
<td>on the shore</td>
</tr>
<tr>
<td>deer</td>
<td>weakly</td>
<td>tiptoed</td>
<td>behind the rock wall</td>
</tr>
<tr>
<td>horseshoe crab</td>
<td>smugly</td>
<td>swam</td>
<td>between the islands</td>
</tr>
<tr>
<td>clam worm</td>
<td>eagerly</td>
<td>emerged</td>
<td></td>
</tr>
<tr>
<td>mud snail</td>
<td>sleepily</td>
<td>waited</td>
<td></td>
</tr>
<tr>
<td>bald eagle</td>
<td>silently</td>
<td></td>
<td></td>
</tr>
<tr>
<td>rainbow smelt</td>
<td>easily</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**Examples**

**Real life story:**
The green crab hastily crept beneath the seaweed, as the great blue heron flew silently overhead.

**Fanciful tale:**
The clam worm hungrily chased the winter flounder, which tiptoed behind the rock wall.
Great Bay Treasures

Temperature

Volume: 1 Tidal Water

Graphs: W. W. C. & Y. C. B.

Legend

A Delicate Balance

Or water and wind there are two forces that shape the bay where they can set where they can them make a difference for animals by causing change in the water or wind they influence, which is under the animals by changing the balance in the water or wind they influence.

An animal's habitat is a place where it finds its resources, including food, water, shelter, and space to live. The change in the balance of water and wind in the bay can make a difference to the animals that live there, including fish, birds, and other marine creatures. The balance of these elements is crucial for the ecosystem of Great Bay. When the balance is disrupted, the delicate balance can be affected, leading to changes in the water and wildlife.

Great Bay and Great Bay

Climate and Great Bay

Climate change is causing concern worldwide. How much water is enough? How much wind is too much? How do we balance these elements to maintain a healthy ecosystem in Great Bay? One thing is certain: water and wind are crucial for maintaining the delicate balance in the bay.
CONSTANTLY CHANGING TIDES

High or Low Tide?
You out on Great Bay at the end of a wonderful afternoon. You need to sail home before the sun sets, but you almost forgot about the tides! At low tide, half of Great Bay is mud. Luckily, you have a tide chart.

The tide chart or table is a calendar that predicts when high and low tide will occur. It also tells how many feet the tide will be above or below “mean low water,” an imaginary line that is exactly at sea level. The average tidal range for Great Bay (the difference between high and low tide) is about 6.8 feet.

Rhythm of the Moon
Tides follow the rhythm of the moon. High tide and low tide occur 52 minutes (on average) later each day than the day before. This is because the moon, which pulls the tides, passes its highest point overhead about 52 minutes later each day.

Because Great Bay is so far inland from the Atlantic Ocean, high and low tide are delayed about two hours as the water travels to and from the estuary. The tide chart below has already been adjusted for this condition.

See if you can answer these questions using the tide chart.

1. When does high tide occur on Saturday afternoon? ______________
2. What is the difference in height (depth of water) between high tide and low tide on Saturday afternoon? ______________
3. If your boat needs 3 feet of water beneath it in order to float, can you sail it at low tide on either day? ______________
4. When will high tide occur on Sunday morning? ______________
5. When will low tide occur on Sunday evening? ______________

Sample Tide Chart for Great Bay Discovery Center

<table>
<thead>
<tr>
<th>Day</th>
<th>High Tide in the am</th>
<th>High Tide in the pm</th>
<th>Low Tide in the am</th>
<th>Low Tide in the pm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sun 22</td>
<td>12:42</td>
<td>High</td>
<td>9.3</td>
<td>Height</td>
</tr>
<tr>
<td></td>
<td>6:53</td>
<td>Lo</td>
<td>0.6</td>
<td>Height</td>
</tr>
<tr>
<td>Sun 21</td>
<td>12:02</td>
<td>High</td>
<td>9.1</td>
<td>Height</td>
</tr>
<tr>
<td></td>
<td>6:20</td>
<td>Lo</td>
<td>0.8</td>
<td>Height</td>
</tr>
</tbody>
</table>

Answers on page 16
Art with Nature

But it's not all the same


3. What sample contains the most salt?

4. What is there a difference?

5. Which have mud of the sediment?

6. What does this mean for the animals and the

Between

Eutrophication

Food Chain

Ecology

A Rich Soup

are broken into smaller particles by wave action, water pollution and the loss of nutrients — water pollution and the loss of some of the nutrients needed by plants. Environmental cleanup is shown in some of the pictures on these pages.

American cranes along the shores. Their wings, When hungry, When the tide

...
**Estuarine Crossword Puzzle**

All the things shown here can be found in Great Bay.
See if you can find them in this crossword puzzle.

Choose from these words:
- bay
- oyster
- horseshoe
- ducks
- tide
- crab
- sun
- seagull
- eel
- snails
- eagle

**Across**
1. Indians once used the _______ crab's tail for a spear, but for modern humans, it's nothing to fear.
2. The _______ helps the bay's plants to grow, and the plants help slow the water's flow.
3. You have to be careful when you grab, to avoid the pinch of the feisty green _______.
4. _______ eat the eelgrass leaves and seeds. In fact, the estuary satisfies many birds' needs.
5. "Hark to the whisper of the seagull;
   He weeps because he's not an_______.
6. Suppose you were, you silly _______.
   Could you explain it to your she-gull?"

(Poem by Ogden Nash)

**Down**
7. The Great Bay Estuary is a quiet cloister for the tasty mollusk called the _______.
8. In the old days, farmers visited Great Bay to harvest the rich salt marsh _______.
9. Many estuarine animals get a ride to the ocean on the outgoing _______.
10. At low tide you can spy the slimy trails left in the mud by slow-moving _______.
11. This animal does not have a broad appeal. It can't help its slimy look and feel. It's just a humble American _______.

**Explore Great Bay**

Imagine you are an explorer of Great Bay. See how well you can get around the Bay by following this map.

Use the compass rose and scale to figure out the answers to these navigation questions.

1. Little Bay is _______ of Great Bay.
2. The Lamprey River is _______ of Adams Point.
3. The Atlantic Ocean is _______ of Great Bay.
4. How long is Great Bay from Adams Point to the shoreline directly south of it? _______.
5. Great Bay Discovery Center is _______ of the Squamscott River mouth.
6. Adams Point is about _______ miles upriver from Fort Constitution.

Answers on page 16
Write your answer below to solve the secret message:

- Example:
  - A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
  - A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

Below is the answer:

What makes life fun? Describe the secret message using the key:

The existence of Great Bay is no longer a secret. What makes it special is no longer a secret.

Solve the secret message.
Discussion for Water, Water Everywhere

You may find your experiment results were a little different from these, but in general:

The samples probably took about the same amount of time to evaporate. You could expect to find some salt and mud in the Great Bay sample, some mud and fine sediment in the pond sample, and little salt or sediment in your drinking water. Quiet bodies of water, such as Great Bay or a pond, collect finer sediments than a fast-flowing stream or the ocean.

Animals that live in a pond cannot cope with the salt content of the ocean or estuary, and ocean animals cannot live in fresh water. But the animals of the estuary have to adapt to water that changes from almost completely fresh, as in the spring when snow melt runs into the Bay, to very salty in the middle of summer when the hot sun evaporates the tidal waters.

A few fish, such as salmon and alewives, can change their metabolism to go from salt water to fresh, but most fish are adapted to only one kind of water. Many of the animals of the estuary are simpler animals without backbones, such as crabs, worms, and shellfish that are able to withstand big changes in their environment.

Answers

Answers to Great Bay Map (from page 3):
1. Little Bay is north of Great Bay.
2. The Lamprey River is west of Adams Point.
3. The Atlantic Ocean is east of Great Bay.
4. From Adams Point to the shore directly south is almost 2.5 miles.
5. Great Bay Discovery Center is east of the Squamscott River mouth.
6. Adams Point is about 10 miles upriver from Fort Constitution.

Answers to Who Doesn't Belong (from page 6):
Asterisk, Coral, and Great white shark

Answer to Rebus (from page 6):
Indians once camped on the banks of Great Bay. They ate fish and shellfish. Wouldn't you like to, too?

Answers to Word Scramble (from page 8-9):
chipmunk, woodchuck, muskrat, black duck, clam worm, herring gull, piping plover, Canada goose, harbor seal, barnacle.

Answers to Word Search (from page 11):

Answer to Tides questions (from page 12):
1. 7:31 p.m.; 2. 7:77 ft.; 3. no; 4. 12:42 a.m.;
5. 7:07 p.m.

Answers to Crossword Puzzle (from page 14):

Answer to the Secret Message (from page 15):
The sun, the rivers, and the tides.

CREATURES OF GREAT BAY

Safe Haven

Imagine yourself as a young sea creature. You might dream of a quiet, safe place where ocean waves and big fish can't reach you. Your safe haven would be a place where there was more food than you could possibly eat. Your day would be a feast from morning until night. If you knew where it was, wouldn't you swim, crawl, or slither to this place?

Dinner Is Served

Luckily for you, the tide has brought you up the Piscataqua River mouth into a secret, hidden bay. It's all you'd hoped for and more. You bask in the warm sunshine and dig in the soft mud. Mealtime is any time you feel like eating delicious crab larvae, decaying plants and animals, or a slippery worm.

Even here, though, there's no such thing as a free lunch. Your new home has some drawbacks. In summer, the water can be as salty as the open ocean, and in spring, when the snow melts off the land, you feel as if you are swimming in a freshwater river. It can get as hot as the tropics in summer, and it can freeze solid in winter.

Home for Many

But for adaptable animals like yourself, it's a great place to spend your childhood, to lay your eggs, or to just stop by for a good meal. Your new home has a variety of amazing habitats. This special place really does exist, and it's called Great Bay.

As you explore Great Bay, look for these residents:

- Horseshoe crab
- Green crab
- Osprey
- Great blue heron
- Mud snail
- Ribbed mussel
- Herring gull
- Black duck
- Bald eagle
- Oyster
- Raccoon
- Green crab
- White-tailed deer