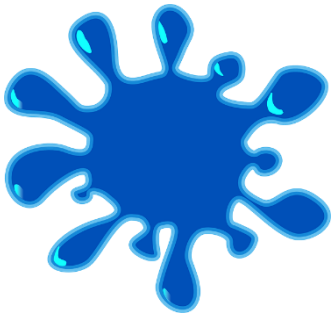
# Curious Little Classroom's

## Beach Science

Marine Themed Science Lessons!



Thank you for your interest in the Beach Science Enrichment lessons!

All of the lessons are concentrated around a marine theme; the ocean floor, tides, plankton and algae, marine invertebrates, sharks, birds, mammals, sand and dunes.

Each lesson will consist of fun, hands-on, science experiments followed by scientific explanations.

On the following pages you will find worksheets for each of the themed lessons.

We may get a little messy so don't wear your best clothes!

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# Theme 1

## Marine Science-

## The Ocean Floor and Tides

These experiments are focused on the ocean floor and tides.

Experiment 1- Sonar Boxes

Experiment 2- Cookie Tides

# Theme 1 Materials

## Sonar boxes

-Large shallow tray
-Sand
-Pencil
-String
-Scissors
-Tape
-5 small objects to hide, including a small toy boat

## Cookie tides

-Vanilla icing
-Blue food coloring
-1 plastic knife
-1 paper plate
-1 sandwich bag
-1 vanilla wafers
-4 Oreos
-Markers
-Scissors

# Sonar Boxes

## Objective: To simulate the use of SONAR to find objects on the ocean floor

## Materials Needed:

| |
|---|
| Large shallow tray<br>Sand<br>Pencil<br>String<br>Scissors<br>Tape<br>5 small objects to hide, including a small toy boat |

Directions:

1. Obtain a shallow tray filled with sand. This tray contains hidden objects under the surface of the sand.
The strings running across the tray represent lines of latitude and longitude in the North Atlantic Ocean.

2. Compare the grid on the next page of this lesson. It should look just like the strings running across your tray.

3. Choose a location to begin your search. Push the point of your pencil gently into the sand to see if you feel any objects.

4. If you feel an object, mark the location on your grid.

5. Gently dig to retrieve your object and write on your grid what you found.

6. If you do not find an object move on to another location. Mark an "X" on your grid so you do not check in the same place twice.

7. Keep probing the sand until you find all of the five hidden objects.

8. One of the objects is a small boat. This boat represents the Titanic, which was found in 1985 using Sonar technology.

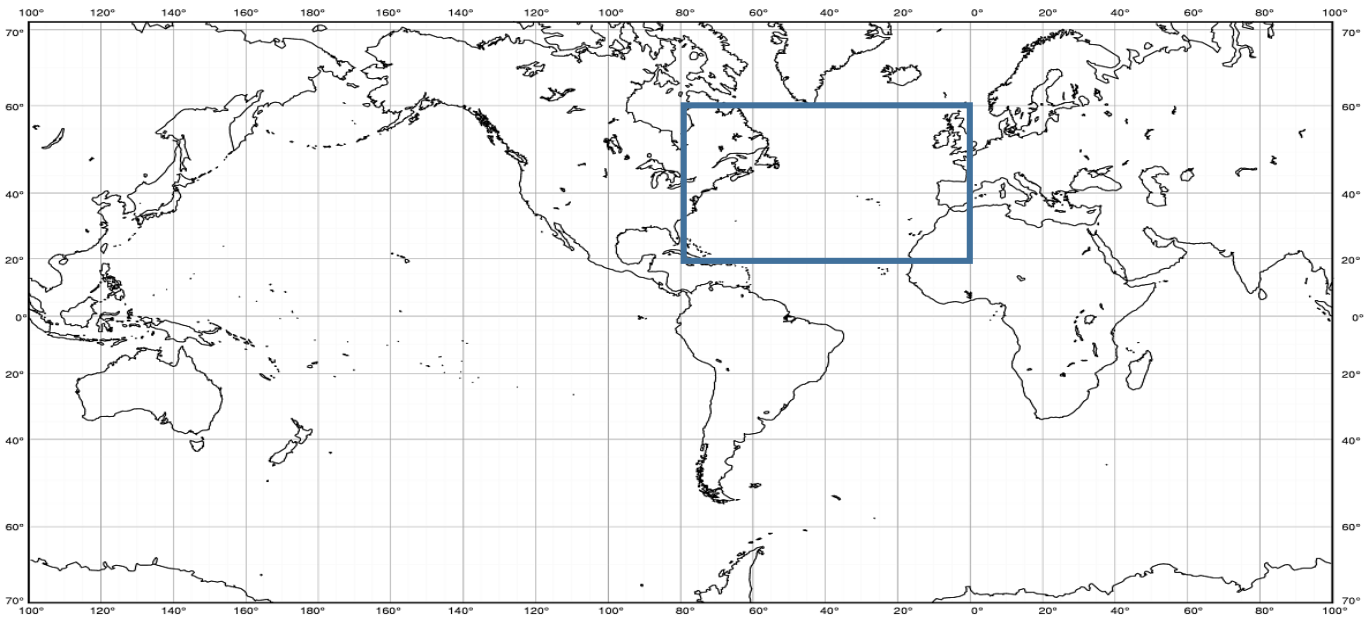
# Northern Atlantic Ocean

Lines of Longitude

| | 80 | 60 | 40 | 20 | 0 |
|---|---|---|---|---|---|
| 60 | | | | | |
| 40 | | | | | |
| 20 | | | | | |

Lines of Latitude

**World Map**



Teacher Notes:

The Titanic was found at 41.726931° N and -49.948253° W. The wreck was found at a depth of 12,000 feet.

# Explanation and Background info:

Sonar stands for *Sound Navigation and Ranging*. Sonar is used to locate underwater hazards and to search for objects on the seafloor, such as shipwrecks. It is also used to examine the seafloor and create underwater maps.

Sonar works by having a transducer send a sound wave into the water. Once the sound wave hits an object, it bounces off the object and returns to the Sonar transducer. The transducer can measure how long it took the sound wave to be emitted and travel back. It then turns this information into data regarding the depth and location of the object.

The Titanic sank on April 15, 1912, in the North Atlantic after hitting an iceberg. Over 1,500 passengers lost their lives in the accident. The remains of the Titanic were not discovered until 1985, when an international team of scientists used sonar and undersea robots to locate it.

Sources:


Andrews, E. (2017, April 01). The Real Story Behind the Discovery of Titanic's Watery Grave. Retrieved January 29, 2018, from http://www.history.com/news/titanics-watery-grave-located

Matei, S. A., & Schneider, S. (n.d.). - Titanic Wreck Exact Location on Google Earth Map of North Atlantic (KMZ). Retrieved January 29, 2018, from http://matei.org/ithink/2012/01/09/titanic-wreck-location-on-north-atlantic-google-earth-map-in-kmz-format/

US Department of Commerce, National Oceanic and Atmospheric Administration. (2013, June 01). What is sonar? Retrieved January 29, 2018, from https://oceanservice.noaa.gov/facts/sonar.html

# Cookie tides

Objective: To examine spring and neap tides

Materials Needed:

| |
|---|
| Vanilla icing<br>Blue food coloring<br>1 plastic knife<br>1 paper plate<br>1 sandwich bag<br>1 vanilla wafers<br>4 Oreos<br>Markers<br>Scissors |

Directions:

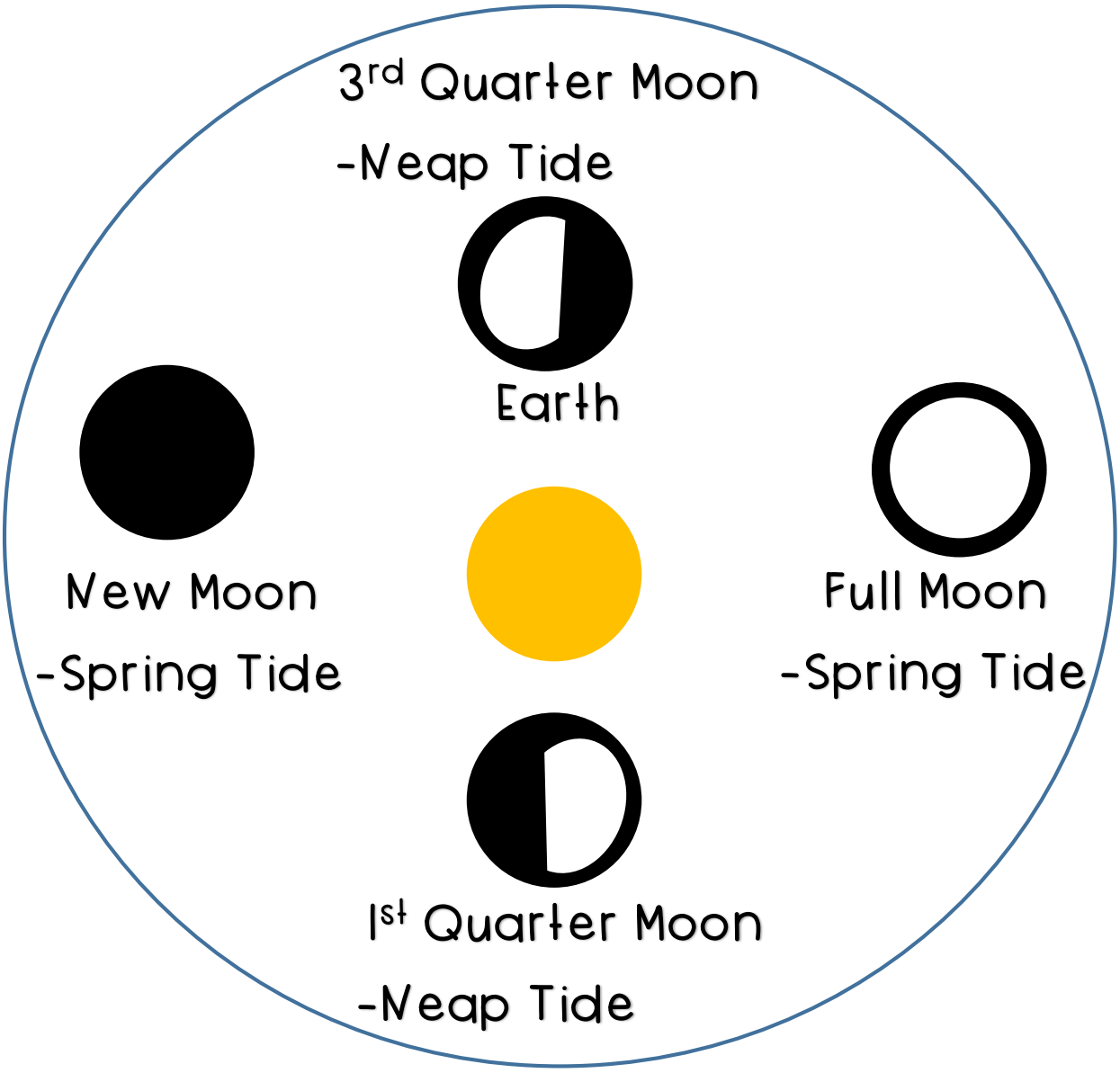
1. Obtain a tide plate, an icing bag, a plastic knife, 4 Oreos, and 1 vanilla wafer.

2. Set up the cookies on your plate to look just like the picture on the next page.

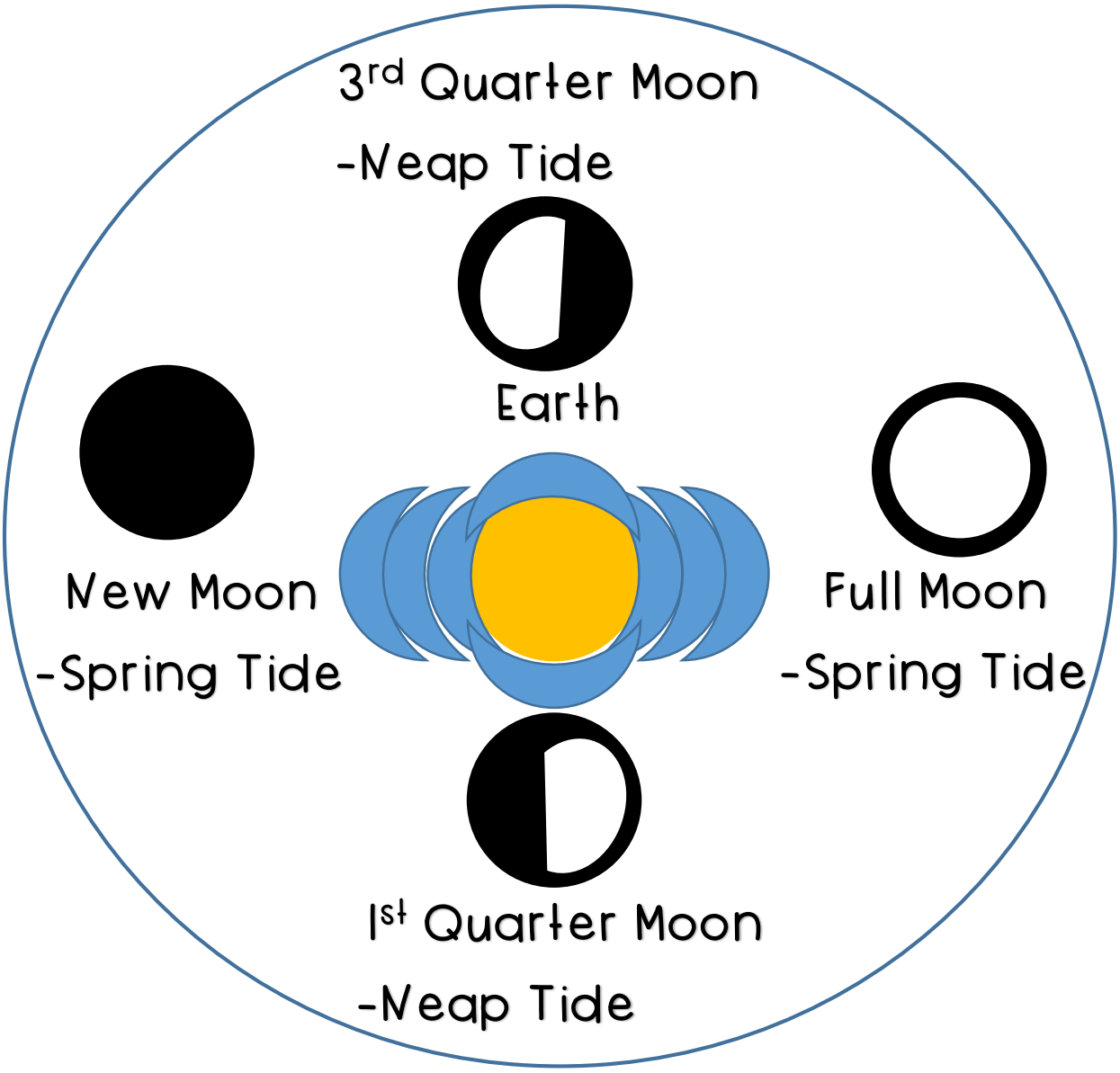
3. Carefully pipe some icing around the vanilla wafer to make the plate look like the final picture.

4. Enjoy your tide cookies!

The COOKIES should be placed on the plates like this:



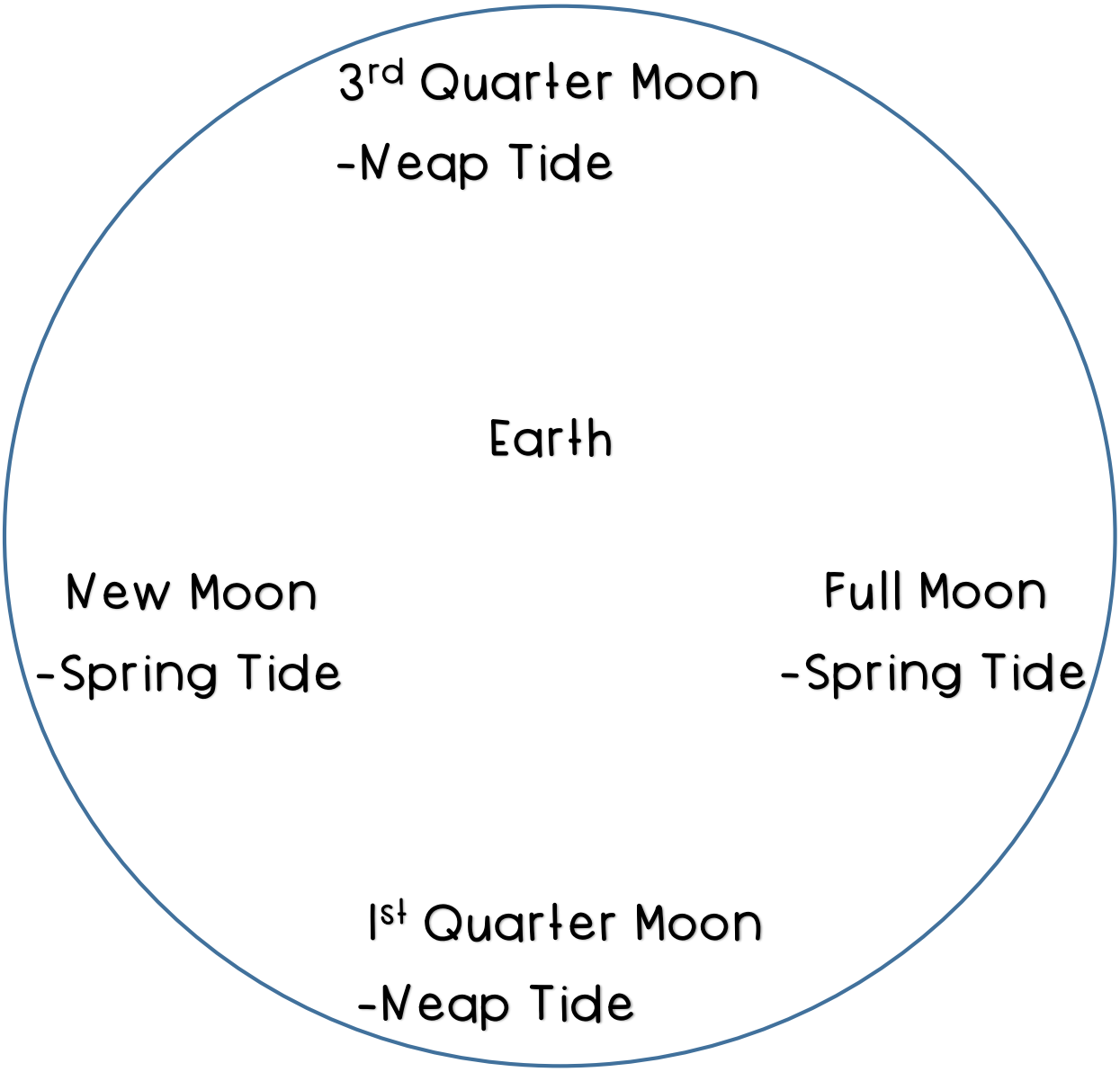
The FINAL plates should look like this:



Teacher Notes:

Mix the blue food coloring into the icing first and fill the plastic bags. Cut a very small piece off the end of the plastic bag so that it can be used to squirt out the icing.

Write all the information needed on the plates ahead of time. The plates should look like this:



# Explanation and Background info:

Tides occur when the gravitational pull of the moon and the sun cause oceans to bulge and "spring forth" onto the shore. The tides are then pulled back out into the ocean as the Earth orbits the sun and the moon orbits Earth.

When there is a full or new moon, the Earth, sun, and moon are in alignment. This causes water to bulge and pull back more than the average amount. Therefore "spring" tides are the highest high tides and the lowest low tides of the month. These spring tides occur during the new and full moons.

One week after a spring tide occurs, the sun and moon are at a right angle to each other. Their gravitational pull is not as large and therefore "neap" tides occur. Neap tides cause oceans to bulge a little lower than normal during high tides and water is pulled back a little less than normal during low tides. These tides occur when the moon is at its 1st and 3rd quarter, or half full.

Source:

US Department of Commerce, National Oceanic and Atmospheric Administration. (2014, August 01). Why do we have spring tides in the fall? Retrieved January 29, 2018, from https://oceanservice.noaa.gov/facts/springtide.html

# Theme 2

## Marine Biology- Seaweed and Plankton

These experiments are focused on seaweed and plankton.

Experiment 1- Bioluminescent Plankton

Experiment 2- What's Hangin' on the Wrack Line?

# Theme 2 Materials

## Bioluminescent plankton

-Small 10 oz. water bottle
-Paint brush
-Small bathroom cup
-Newspaper
-Glow-in-the-dark paint
-Neon blue paint
-Black pipe cleaner
-Painting smock

## What's hangin' on the wrack line?

-Samples of wrack from a local beach
-Hand lens
-Ice cube trays
-Newspaper or towels

# Bioluminescent Plankton

Objective: To examine bioluminescence in marine organisms

Materials Needed:

| |
|---|
| Small 10 oz. water bottle<br>Paint brush<br>Small bathroom cup<br>Newspaper<br>Glow-in-the-dark paint<br>Neon blue paint<br>Black pipe cleaner<br>Painting smock |

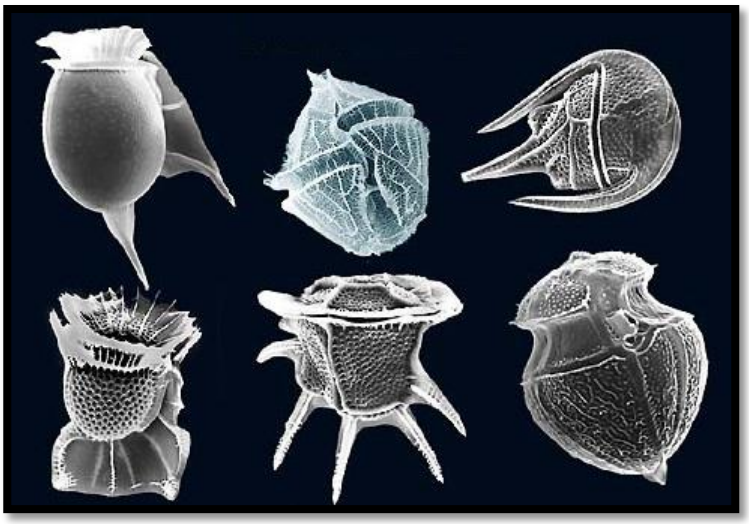
Directions:

1. Discuss bioluminescence by showing the pictures to the students and going over the Background Info.
2. Mix the glow-in-the-dark paint with the blue neon paint (unless you can find glowing blue paint, then you can skip this step).
3. Lay down newspapers to protect the area you will be painting in.
4. Pour some of the paint into a small bathroom cup.
5. Have the students put on their painting smocks.
6. Paint the entire bottle blue, except for the cap.
7. Tie a pipe cleaner around the neck of the bottle.
8. Allow your bottle to dry.
9. Look at your glowing "dinoflagellate" bottle in a pitch black room.

# Bioluminescence in the Ocean

# Marine Bioluminescent Organisms

## Dinoflagellates



## Comb jellyfish

## Anglerfish


## Shrimp

# Explanation and Background info:

Bioluminescence occurs when organisms produce their own light through a chemical reaction. Many bioluminescent organisms live in the ocean, but there are others, such as fireflies and fungi living on land. The compound these organisms use to produce light is called luciferin.

Dinoflagellates are a type of marine plankton which produce bioluminescence. The dinoflagellates of the genus *Noctiluca* grow in great numbers and make the sea look red or pink during the day. At night, they produce a bluish-green glowing light. Because of this, these blooms of plankton are also called "red tides."

Sources:

Rogers, K. (2017, May 11). Noctiluca. Retrieved January 31, 2018, from https://www.britannica.com/science/Noctiluca

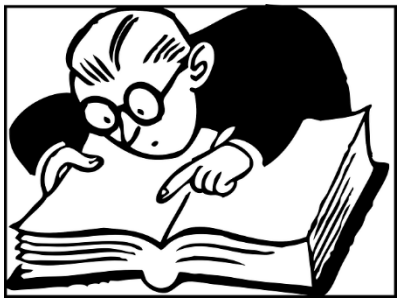
Society, N. G. (2012, October 09). Bioluminescence. Retrieved February 09, 2018, from https://www.nationalgeographic.org/encyclopedia/bioluminescence/

# What's Hangin' on the Wrack Line?

Objective: To examine shoreline wrack and the organisms found in it

Materials Needed:

| |
|---|
| Samples of wrack from a local beach<br>Hand lens<br>Ice cube trays<br>Newspaper or towels |



Directions:

1. Collect wrack from a local beach.

2. Spread the wrack samples out on newspaper or towels.

3. Examine the wrack samples closely. Put any small specimens into the ice cube trays.

4. Look more closely at the small specimens using the hand lens.

5. Can you identify anything you have found? What type of seaweed is in the wrack?

6. One of the most common organisms found in the wrack are tiny amphipods along with their cousins, the isopods.

7. Go on a treasure hunt using the hand lens and your wrack sample to see if you can find living, dead, or molts (shed skeletons) of amphipods and/or isopods.

8. If possible, return the wrack to where you originally collected it.

# Beach Wrack

# Organisms of the Wrack Line

## Sand hoppers

## Tiger beetles

## Wolf spiders

## Tree swallows

# Organisms of the Wrack Line

## Ghost crabs

## Greenhead flies

## Horse flies

## Seaweed

# Explanation and Background info:

The next time you are walking down the beach, take a closer look at the wall of debris found along the high tide line. This line is called "wrack" and provides a complex environment for many organisms to lie and feed.

The wrack line is an area of refuge at the high tide line on beaches. Without the protection of the seaweed, driftwood and other items found in the wrack line, it would be impossible for organisms to handle the extreme fluctuations of temperature and salinity in this environment.

Source:

Dune Manual And Sign. (n.d.). Retrieved February 08, 2018, from http://njseagrant.org/dunemanual/

# Theme 3

## Marine Biology-

## Marine Invertebrates

These experiments are focused on marine invertebrates.

Experiment 1- Seashell art

Experiment 2- Horseshoe crabs

## Theme 3 Materials

### Seashell art

-Samples of local seashells
-Driftwood
-Glue gun (for adult use only!)
-String
-Pipe cleaners
-Pennies
-Markers
-Small magnets

### Horseshoe crabs

-Scissors
-Crayons or markers
-Tissue paper
-Stapler

# Seashell art

Objective: To examine the different types of seashells found locally

Materials Needed:

- Samples of local seashells
- Driftwood
- Glue gun (for adult use only!)
- String
- Pipe cleaners
- Pennies
- Markers
- Small magnets

Directions:

1. Use the supplies to create art out of the local seashells.

Suggestions include:
- Seashell magnets
- Jingle shell jewelry
- Driftwood snails
- Funny face clams

2. When you have completed your art, try to identify the types of seashells you used to make it.

# Common Seashells of the Mid-Atlantic

## Surf clam

## Quahog

## Oyster

## Blue mussel

# Common Seashells of the Mid-Atlantic

## Scallop

## Razor clam

## Slipper snail

## Moon snail

# Explanation and Background info:

Seashells are made by organisms called mollusks. There are two major groups of mollusks, univalves and bivalves. The univalves have only one shell, like snails, and the bivalves have two shells, like clams.

Most mollusks contain a soft, muscular foot. Snails have a tongue they use for scraping, called a radula and clams take in food by filtering the water using siphons. All mollusks create shells by secreting calcium carbonate from a mantle organ which surrounds the mollusk's body.

# Horseshoe crabs

Objective: To examine the anatomy of a horseshoe crab

Materials Needed:

| |
|---|
| Scissors<br>Crayons or markers<br>Tissue paper<br>Stapler |

Directions:

1. Discuss the horseshoe crab facts.

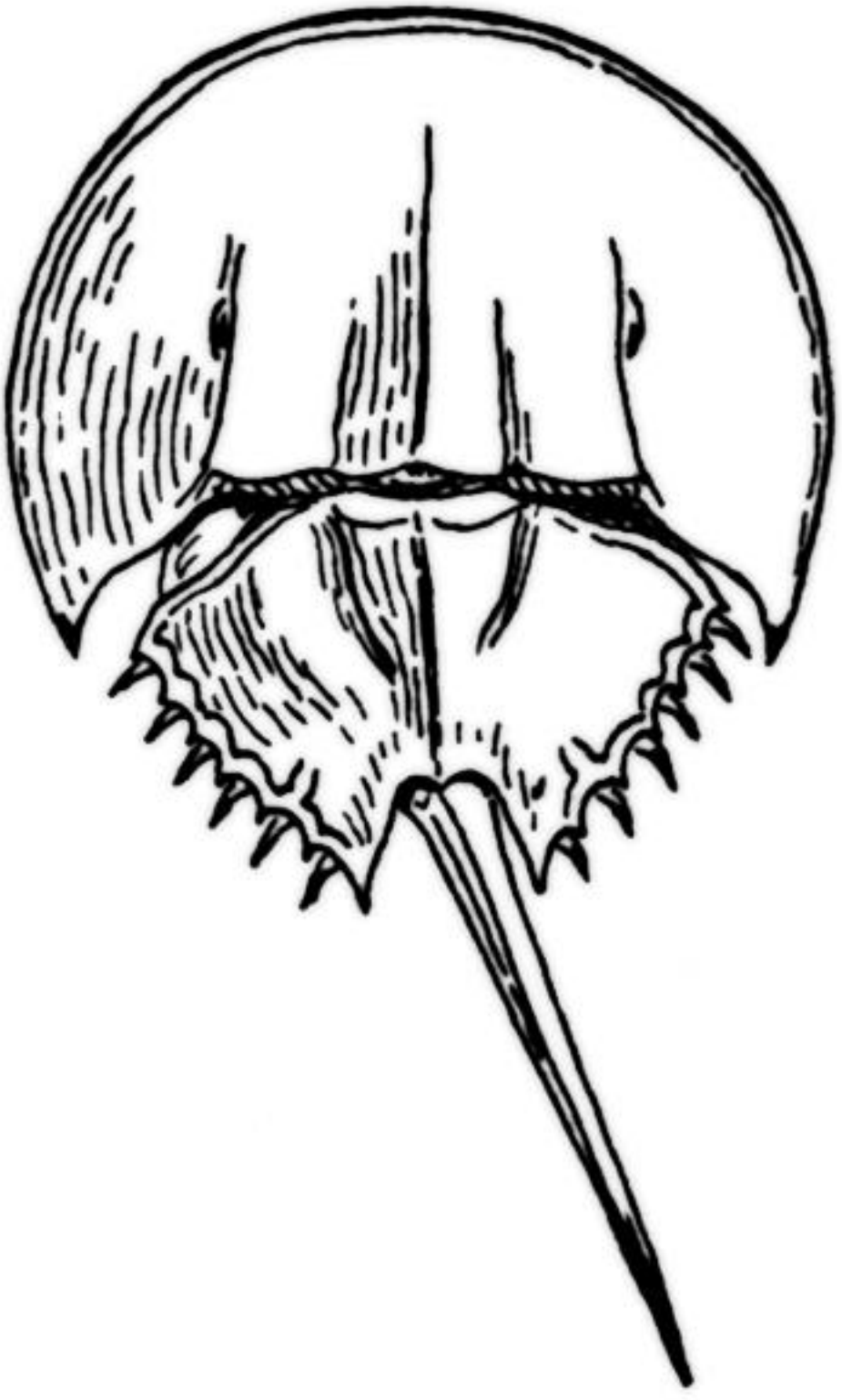
2 Color the dorsal (back) and ventral (belly) sides of the horseshoe crab.

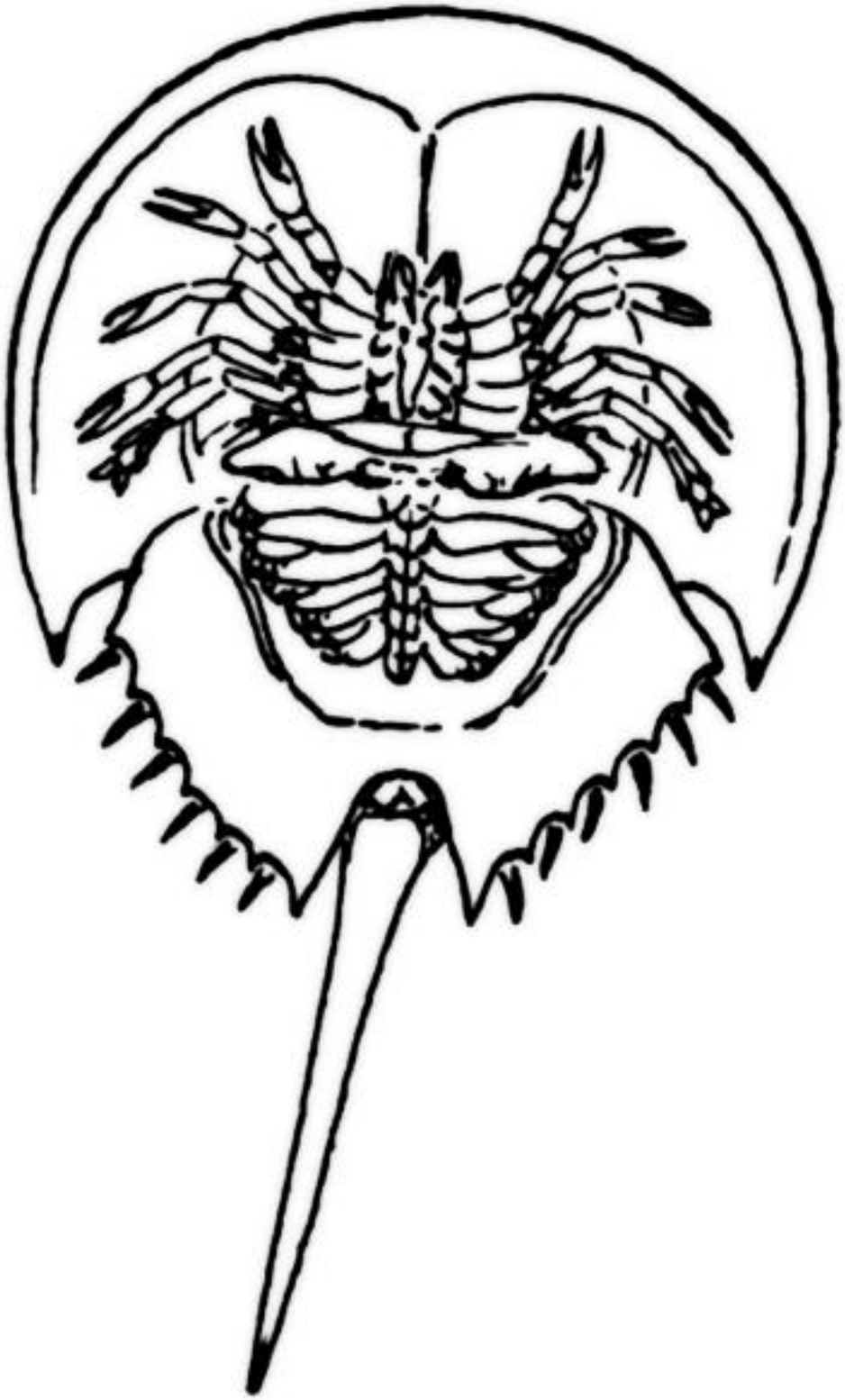
3. Carefully put out the two sides of the horseshoe crab.

4. Staple the entire crab together except for the rounded area on the top.

5. Carefully stuff 2-3 pieces of tissue paper into the horseshoe crab to make it 3-D.

6. Staple the top rounded part of the horseshoe crab.





# Horseshoe Crabs...

are 445 million years old

are related to spiders

are not dangerous!

are hurt if you pick them up by the tail!

# Horseshoe Crabs...

are found nesting on beaches in spring

turn themselves over with their tail

eggs are a food source for many birds

blood is used to sterilize medical equipment!

# Horseshoe Crabs...

have 10 eyes, plus compound eyes, and are sensitive to light

eat clams, worms, and algae

molt and leave a transparent shell behind

are declining in numbers

Source:

Facts About Horseshoe Crabs and FAQ. (n.d.). Retrieved February 09, 2018, from http://myfwc.com/research/saltwater/crustaceans/horseshoe-crabs/facts/

# Theme 4

## Marine Biology- Vertebrates-Sharks

This experiment is focused on marine vertebrates, specifically sharks.

Experiment 1- Dissect a shark

## Theme 4 Materials

Dissect a shark
-Preserved dogfish shark
-Dissection kit
-Gloves
-Apron
-Goggles
-Large pan
-Towels or newspaper

# Dissect a shark

Objective: To examine the internal and external anatomy of a dogfish shark

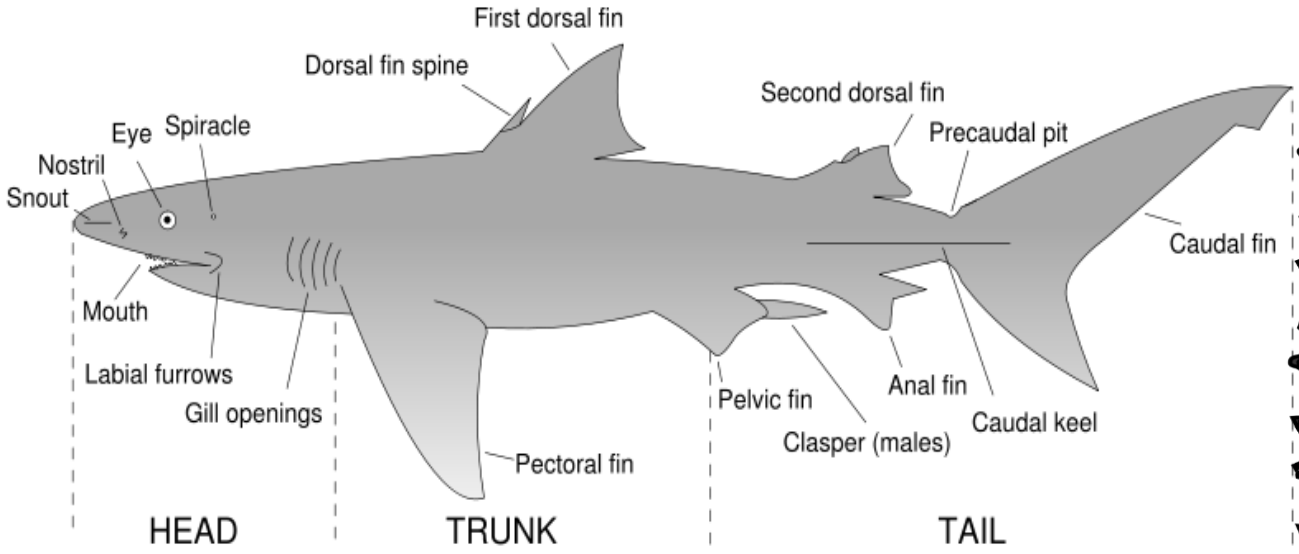
Materials Needed:

| |
|---|
| Preserved dogfish shark<br>Dissection kit<br>Gloves<br>Apron<br>Goggles<br>Large pan<br>Towels or newspaper |

Directions:

1. Put on the apron, gloves, and goggles and place the shark into a large tray or pan.

2. Examine the external parts of the shark.



3. Turn the shark to its ventral side and use the scissors to cut away the skin and muscle.

4. Cut horizontally just above the pectoral fins and the pelvic fins. Cut vertically down the middle and remove the excess skin and muscle. Remove and examine the large, oily 3-lobed liver.

5. Remove the j-shaped stomach and cut it open to see if there is any remaining food in it.

6. Remove and examine the 2-chambered heart, located between the pectoral fins.

7. Turn the shark to its dorsal surface again and carefully cut into the head to examine the brain.

8. Clean up all materials and dispose of them. Wash your hands very well with warm water and soap.

# Theme 5

## Marine Biology-

## Vertebrates-Birds and Mammals

These experiments are focused on marine birds and mammals.

Experiment 1- Blubber, fur, and feathers

Experiment 2- Marine debris

## Theme 5 Materials

### Blubber, fur, and feathers

-Vinyl gloves
-2 quart-size plastic bags
-2 rubber bands
-Cotton balls
-Butter or margarine
-Plastic knife
-Large bowl
-Ice cubes and water
-A towel

### Marine debris

-Rubber band

## Blubber, fur, and feathers

Objective: To examine how blubber, fur, and feathers keep marine birds and mammals warm

Materials Needed:

| |
|---|
| Vinyl gloves<br>2 quart-size plastic bags<br>2 rubber bands<br>Cotton balls<br>Butter or margarine<br>Plastic knife<br>Large bowl<br>Ice cubes and water<br>A towel |

Directions:

1. Fill a large bowl with water and ice and place it on a towel.

2. Use the plastic knife to spread butter or margarine onto the fingers of one side of one of the vinyl gloves.

3. Cover the butter or margarine in cotton balls.

4. Carefully turn the glove over and do the same on the other side.

5. Do not put anything on the other glove.

6. Place both gloves on your hands.

7. Cover the gloves with the plastic bags and hold them in place with the rubber bands at your wrists.

8. Place your fingers in the ice water.

Which hand feels warmer, the one with or without the butter and cotton balls?

## Explanation and Background info:

Birds have an oil gland which they use to spread oil onto their feathers. This makes their feathers waterproof and keeps them warm in cold waters. Penguins have a layer of fat under their skin which keeps them warm even under their waterproof feathers.

Most marine mammals have a thick layer of fat under their skin called blubber. This blubber keeps them warm in cold waters just like the penguins. Many marine mammals, such as polar bears and seals, also have a layer of fur which helps to keep them warm. Sea otters have some of the thickest fur in the world because they lack the layer of blubber that other mammals possess.

# Marine Birds and Mammals

Gull

Penguin

Seal

Polar bear

# Marine debris

Objective: To examine the effect marine debris can have on marine organisms

Materials Needed:

| Rubber band |
|---|

Directions:

1. Wrap the rubber band around one of your hands.

2. Attempt to perform some everyday activities using the hand wrapped in the rubber band.

Suggested activities include:
Tying your shoe
Writing your name
Eating a snack

3. Without using your other hand, or your teeth, try remove the rubber band.

3. Were you successful? The rubber band was acting as marine debris. What effect do you think this would have on a marine organism wrapped similarly in debris?

# Explanation and Background info:

Marine debris is any item found in a marine environment that does not naturally occur there. There are many items found in marine environments that may have blown there from somewhere else, such as plastic bags and other bits of garbage. Some of the debris may wash ashore from the ocean or it may be deposited in the street and make its way to the ocean via sewer drains.

Marine organisms often mistake marine debris, especially plastic, for food and they ingest it. This causes serious problems in their digestive system and often leads to death.

Marine organisms also accidentally become entangled in marine debris, such as plastic soda rings or fishing line. This causes them to not be able to move as freely as they need to for escaping predators and finding food. It may also cut off circulation to the area in which it is wrapped around and the animal will develop an injury. If the item is wrapped around their neck they may suffocate.

You can help to reduce marine debris by placing trash in the proper place. You can also reduce, reuse, and recycle to decrease the amount of trash produced. There are also many local beach clean ups you can participate in on a regular basis.

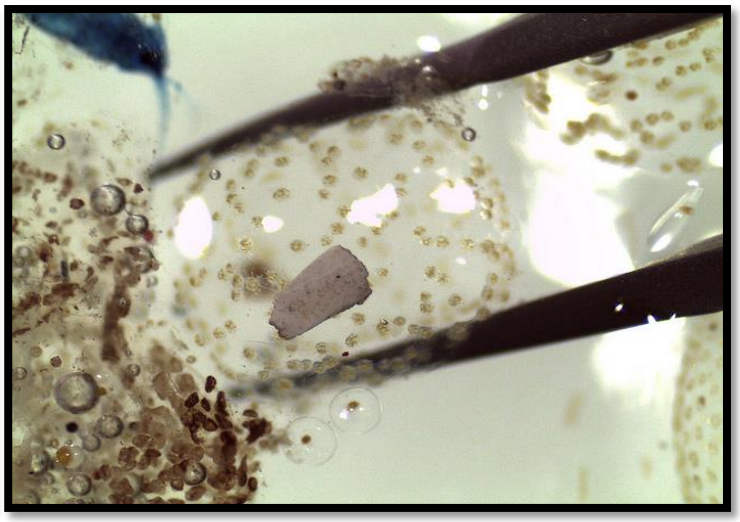
# Marine Debris

Juvenile bottlenose dolphin

Entangled Monk seal

North Atlantic Right Whale entangled in fishing line

Microchips of plastic float in the ocean



# Theme 6

## Marine Science-

## Sand and Dunes

These experiments are focused on sand and dunes.

Experiment 1- Magnetic sand

Experiment 2- Beach replenishment

# Theme 6 Materials

## Magnetic sand

-Sample of sand containing magnetite
-Hand lens
-Toothpick
-Sheet of white paper

## Beach replenishment

-sand
-large, shallow bin
-boughs from evergreen trees
-Lego Duplo blocks
-thick, wooden dowels
-bucket with water
-large, flat rocks

# Magnetic sand

Objective: To examine the elements that make up beach sand

Materials Needed:

| |
|---|
| Sample of sand containing magnetite<br>Hand lens<br>Toothpick<br>Sheet of white paper |

Directions:

1. Put a sample of the beach sand on the white paper. Carefully examine the beach sand for the minerals present in the Data Table. If you find one of the minerals, put a check mark in the box.

| Mineral | Present or not present? |
|---|---|
| Quartz | |
| Feldspar | |
| Magnetite | |

2. Slowly run the magnet across the sand. What do you see? Is there anything stuck to the magnet afterward?

_____

_____

# Sand of the Mid-Atlantic

Quartz

Feldspar

Magnetite

Mid-Atlantic beach

# Explanation and Background info:

Sand is made up of bits of broken down minerals and rocks. Sand is different all over the world because there are many different substrates which makes it up. For example, sand in tropical and subtropical environments may be more powdery and white because it is made up of a lot of calcium carbonate from broken down coral reefs.

Sand in the mid-Atlantic is made up of broken bits (eroded) parts of the Appalachian Mountains. The sand contains three major minerals, quartz, feldspar, and magnetite, which have been washed into the ocean via geologic processes and deposited on the shore as beaches.

## Beach replenishment

Objective: To simulate shoreline protection measures

Materials Needed:

-sand
-large, shallow bin
-boughs from evergreen trees
-Lego Duplo blocks
-thick, wooden dowels
-bucket with water
-large, flat rocks

Directions:

1. Fill the container with sand evenly.

2. On one end of the container, place the Lego Duplo blocks. This is simulating a coastal town.

3. Create a small, wind-blown dune of sand in front of the town.

4. Simulate a storm surge from the ocean by dumping a bucket of water from the other end of the container toward the town.

What happened to the dune and homes?

5. Set up the town again but this time, raise the homes up on the wooden dowels.

6. Reinforce the dune by burying the evergreen boughs under it and add the flat rocks on top of the dune.

7. Simulate a storm sure again by dumping the bucket of water from the other end of the container toward the town.

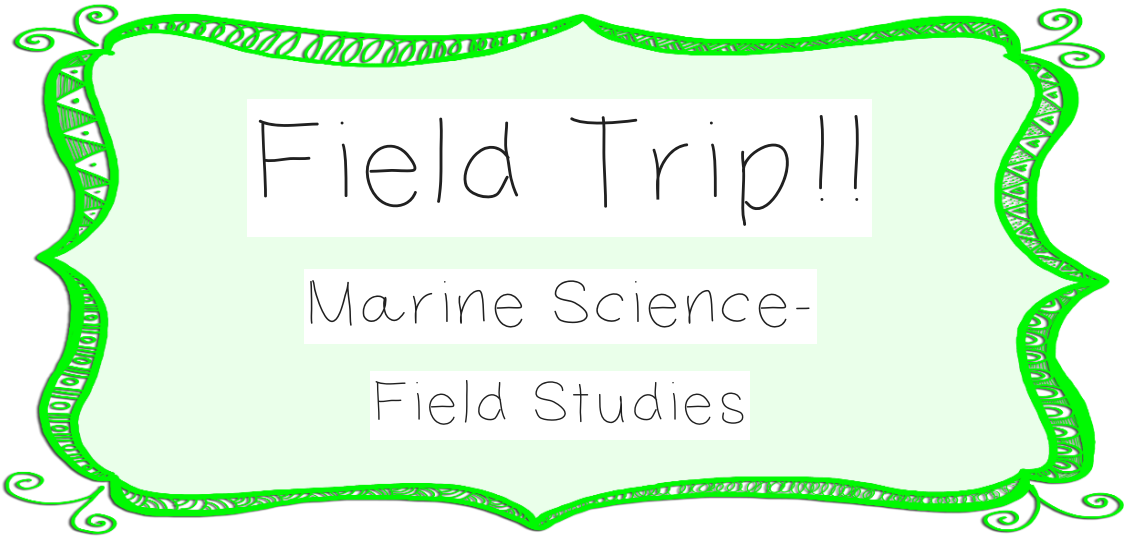
What happened to the dune and homes? Was this a different result than the last time? Why or why not?

# Explanation and Background info:

Beach replenishment, dune formation and protection, and the protection of coastal towns from storms is more important than ever. With a growing population living along the shore, we must take precautions to engineer the homes and land so that they can withstand the pressures of a changing coastal environment.

In your simulation, you likely saw that the costal homes and dunes were better protected from the storm surge when they were raised and reinforced. Discarded live Christmas trees and other organic materials are sometimes used to build a dune and provide a substrate for the sand. Native plants are then put into the sand to hold it in place.

Rock walls and other barriers are also used to block waves from hitting coastal towns. These measures also help to reduce the loss of sand from the beach. A long, stable beach provides another layer of protection for the towns and decreases the need for replenishing the lost sand.




These experiments are all focused around things about marine science field studies.

Experiment 1- Let's go seining!

Experiment 2- Plankton collection

Experiment 3- Shell collection

Experiment 4- Salinity study

## Field Trip Materials

Let's go seining
-Seine net
-Buckets
-Hip waders (optional)

Using the plankton net
-Plankton net
-Microscope (optional)
-Slides (optional)
-Coverslips (optional)
-Pipettes (optional)

Shell collection
-Collection bag
-Shell ID book or access to a trusted website which identifies and describes shells local to your area

Salinity study
-Hydrometer

# Let's go seining!

Objective: To examine the macro organisms living in a coastal environment

Materials Needed:

| |
|---|
| Seine net<br>Buckets<br>Hip waders (optional) |

Directions:

1. Fill
2. Add

# Using the plankton net

Objective: To examine microorganisms living in a coastal environment

Materials Needed:

| |
|---|
| Plankton net<br>Microscope (optional)<br>Slides (optional)<br>Coverslips (optional)<br>Pipettes (optional) |

Directions:

1. Fill

2. Add

# Shell collection

Objective: To examine the shells found in a coastal environment

Materials Needed:

| |
|---|
| -Collection bag<br>-Shell ID book or access to a trusted website which identifies and describes shells local to your area |

Directions:

1. Comb the shoreline to find EMPTY shells. Do not collect any shells that may have an animal living in it.

2. Put the shells in your collection bag and try to identify them using an ID guide or the Internet.

# Salinity study

Objective: To examine the level of salt in the coastal environment in parts per thousand (ppt)

Materials Needed:

- Hydrometer

Directions:

1. Fill
2. Add

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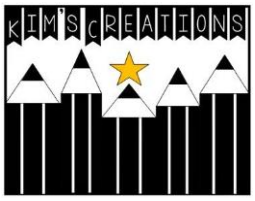


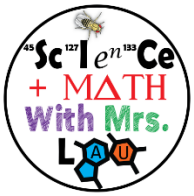




















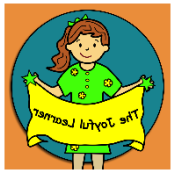


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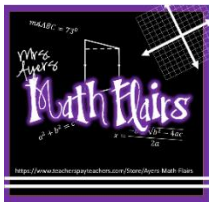
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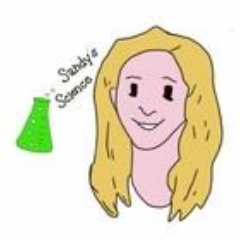


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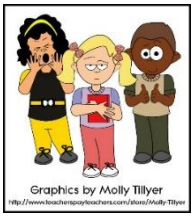
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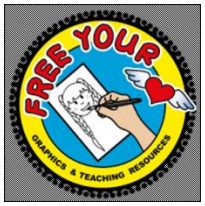
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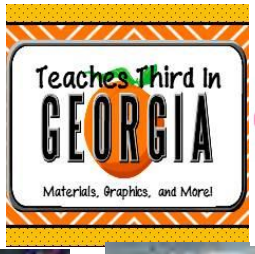
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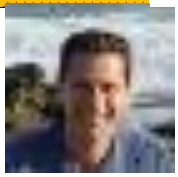


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