

Lesson Plan – Sea Turtle Life Cycle

Summary

This lesson explains the life cycle of sea turtles focusing on specific aspects of the loggerhead sea turtle life cycle. The Southeastern U.S. has the largest nesting aggregation of loggerhead sea turtles. Sea turtles are also charismatic megafauna that highlight many of the harmful environmental impacts that affect sea life. This lesson will address how these environmental impacts have been addressed through actions of concerned citizens and public policy.

Content Area

Marine Biology, Environmental Policy

Grade Level

3-5

Key Concept(s)

- Sea turtles are a great case study to examine how we must look at the entire life cycle of an animal to fully understand how to protect it.
- Loggerhead sea turtles nest on beaches in the southeastern U.S., travel thousands of miles and spend a lot of time in open ocean waters throughout their development and maturity, and feed in shallow nearshore waters.

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Key Concept(s)

- Sea turtles experience different threats from human activity in each stage of their life cycle. Examples include beach erosion and development threaten nesting areas and they are at risk of being netted and entangled in fishing gear.
- Federal fishing regulations and state/ local beach development guidelines can help protect sea turtles.

Objectives

Students will be able to:

- Name three different habitats in the ocean ecosystem that are essential to the life cycle of the loggerhead sea turtle.
- Explain threats to loggerhead (and other) sea turtles at different stages of their life cycle.
- Describe one policy implemented to help conserve sea turtles.
- Describe two things people can do to help protect sea turtles and other wildlife in our oceans and along our shorelines.

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Resources

NOAA Protected Resources Division: Information on biology, threats, conservation and management of sea turtles. This page also includes dozens of links to additional resources for sea turtles.

<http://www.nmfs.noaa.gov/pr/species/turtles/index.html>

GCOOS Model Forecasts: Information and graphics on ocean circulation in the Gulf of Mexico and Southeastern Atlantic Ocean to highlight migration routes of loggerhead sea turtles.

<http://gcoos.org/products/index.php/model-forecasts/>

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National Science Education Standard or Ocean Literacy Essential Principle	Learning Goals
Unifying Concepts and Processes 1. Systems, order, and organization	Order, the behavior of units of matter, objects, organisms, or events in the universe, can be described statistically. In science, reduction of uncertainty occurs through such processes as the development of knowledge about factors influencing objects, organisms, systems, or events; better and more observations; and better explanatory models.
Unifying Concepts and Processes 5. Form and function	Form and function are complementary aspects of objects, organisms, and systems in the natural and designed world. The form or shape of an object or system is frequently related to use, operation, or function.
Science as Inquiry A.2. Understandings about scientific inquiry	Scientists develop explanations using observations (evidence) and what they already know about the world (scientific knowledge). Good explanations are based on evidence from investigations.

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National Science Education Standard or Ocean Literacy Essential Principle	Learning Goals
Life Science C.1. Characteristics of organisms	<ol style="list-style-type: none">1. Organisms have basic needs. For example, animals need air, water, and food. Organisms can survive only in environments in which their needs can be met. The world has many different environments, and distinct environments support the life of different types of organisms.2. Each plant or animal has different structures that serve different functions in growth, survival, and reproduction.3. The behavior of individual organisms is influenced by internal cues (such as hunger) and by external cues (such as a change in the environment).
Life Science C.2. Life cycles of organisms	Plants and animals have life cycles that include being born, developing into adults, reproducing, and eventually dying. The details of this life cycle are different for different organisms.

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National Science Education Standard or Ocean Literacy Essential Principle	Learning Goals
Life Science C.3. Organisms and environments	<ol style="list-style-type: none">1. An organism's patterns of behavior are related to the nature of that organism's environment, including the kinds and numbers of other organisms present, the availability of food and resources, and the physical characteristics of the environment. When the environment changes, some plants and animals survive and reproduce, and others die or move to new locations.2. Humans depend on their natural and constructed environments. Humans change environments in ways that can be either beneficial or detrimental for themselves and other organisms.
Science in Personal and Social Perspectives F.4. Changes in environments	Changes in environments can be natural or influenced by humans. Some changes are good, some are bad, and some are neither good nor bad. Pollution is a change in the environment that can influence the health, survival, or activities of organisms, including humans.

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National Science Education Standard or Ocean Literacy Essential Principle	Learning Goals
<p>Principle 5 (3-5 A.) The ocean supports a great diversity of life and ecosystems. Diversity of Ecosystem</p>	<p>The ocean supports a great diversity of interconnected and interdependent ecosystems, each defined by the interaction of the physical environment and the community of organisms living there.</p>
<p>Principle 5 (3-5 B., B.1., B.5.) The ocean supports a great diversity of life and ecosystems. Diversity of Life</p>	<p>B. The ocean provides most of the Earth’s living space and supports a great diversity of life from the surface, through the water column, and down to the sea floor.</p> <p>B.1. The great diversity of ecosystems in the ocean provides opportunities for organisms to develop a great diversity of adaptations, many of which are unique to organisms living in the ocean.</p> <p>B.5. Organisms in the ocean exhibit an amazing variety of life cycles. Some undergo metamorphosis and have planktonic phases, some lay eggs and others nurse their young.</p>

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National Science Education Standard or Ocean Literacy Essential Principle	Learning Goals
<p>Principle 6 (3-5 C., C.7., C.10., C.12., C.13.) The ocean and humans are inextricably interconnected. Human impact on the ocean.</p>	<p>C. Humans impact the ocean in positive and negative ways. C.1. The trash and pollutants people put into the environment affects the ocean and life in the ocean. C.3. Marine debris entangles ocean life, introduces chemical pollutants and can become a hazard to navigation. C.7. Individuals can take actions to protect the ocean. C.10. Everyone can learn and influence other people about the wise use and protection of the ocean. C.12. National and international laws define how we protect the ocean. C.13. Laws create marine sanctuaries, reserves, and marine protected areas that are intended to keep these areas safe and healthy.</p>

Sea Turtles: An Example of Why Understanding Life Cycles Matters



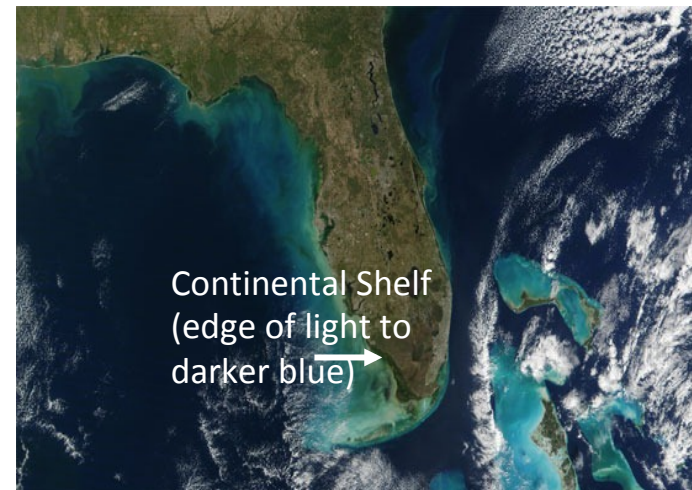
Science informs policy.

- **Policy** is the plan of action or **set of rules** people must follow.
 - What is one example of your teacher's classroom policy?
- Fishing nets were killing thousands of sea turtles.
- Scientists helped resource managers change the equipment used by fishermen.
- Now, fishing nets must have a Turtle Excluder Device (TED). It is an escape hatch for sea turtles.



Why are sea turtles hard to protect?

- There are landscapes and seascapes.
- When you studied Florida's landscapes, you looked at the coastal plains and the higher elevation uplands in the northern part of the state.
- When we study seascapes, one feature we look at is how the ocean bottom (bathymetry) changes.

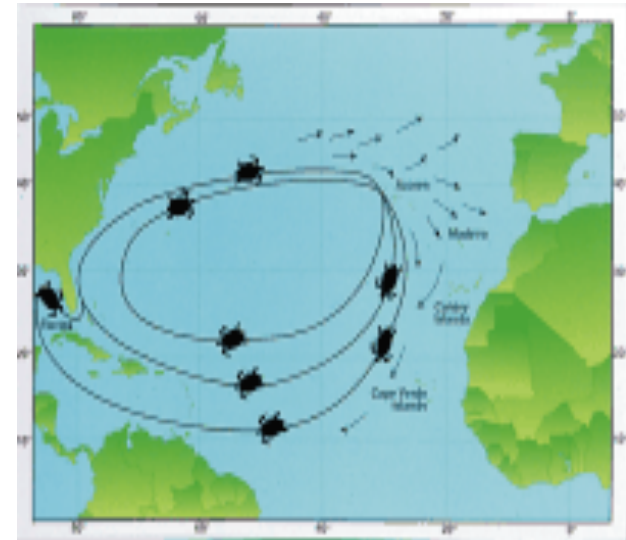


Sea turtles spend different parts of their lives in different places.

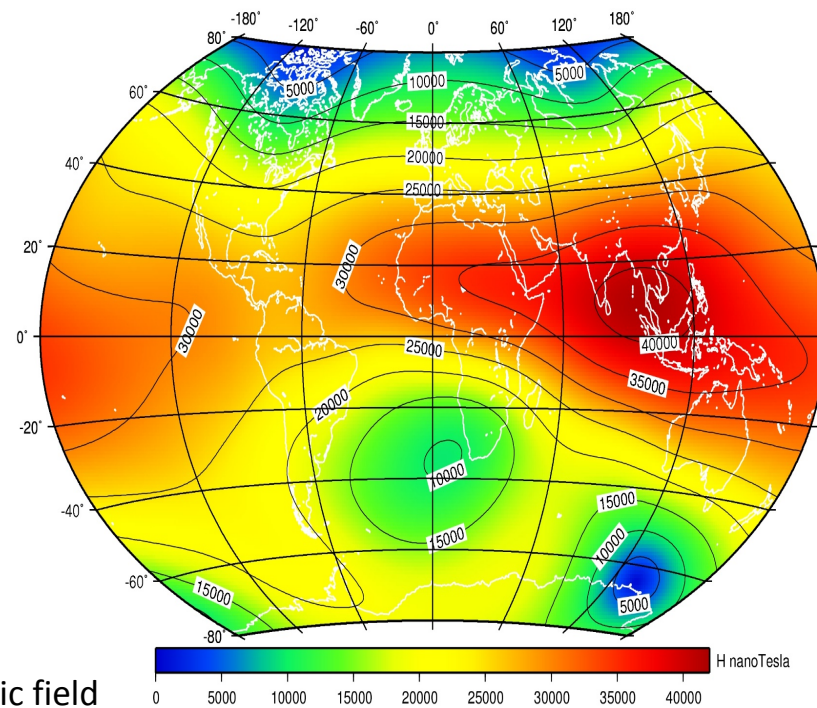
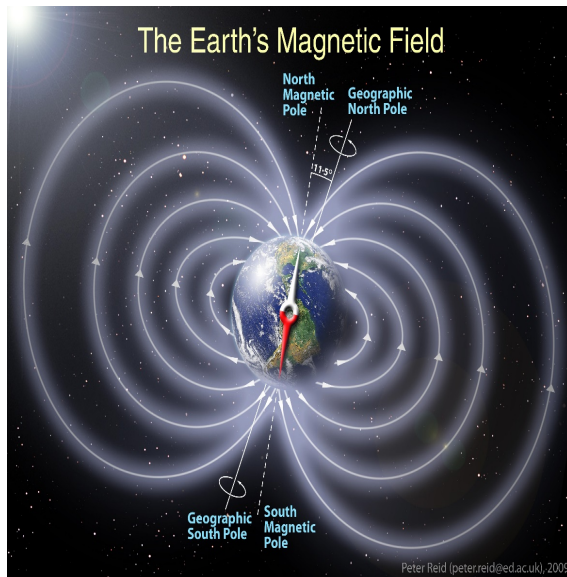
- They nest and hatch on the **beach**.
- They spend many years growing near the surface of the **open ocean**.
- They feed (forage) in **shallow coastal waters**.
- To protect sea turtles, ALL PARTS OF THEIR HABITAT must be healthy!



Where do hatchlings go when they leave the nest?



They use signals from Earth's magnetic field to catch ocean currents!



Magnetoreception

Examples of animals that navigate by Earth's magnetic field

Loggerhead sea turtles

Homing Pigeons

Mole rats

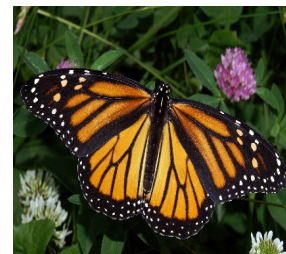
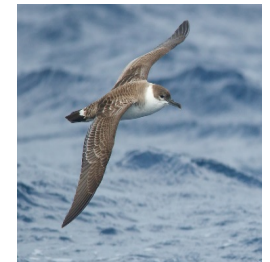
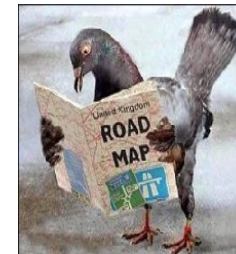
Shearwaters (sea bird)

Spiny lobsters

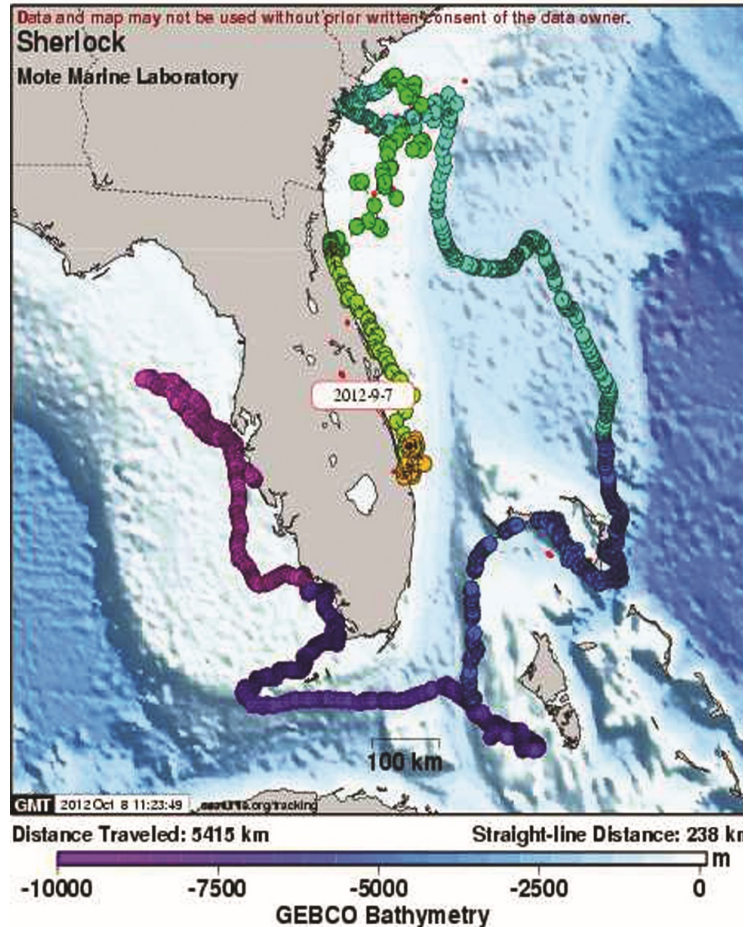
Honeybees

Monarch butterflies

Salmon



Mote Marine Lab tracked a loggerhead named Sherlock. This is his story!



Sherlock stranded near Anna Maria Island in 2004.

He was released on the east coast of Florida where he traveled across the fast-moving Gulf Stream current.

Even though the current was strong, by following Earth's magnetic field he navigated back to the Gulf.

Some facts about loggerheads

- Adult females start breeding at about age 20. They lay 80-120 eggs at a time. This is called a **clutch**.
- Breeding season lasts about 2 months. During this time, a female can lay from 2 to 5 clutches, one clutch every 10 to 15 days.
- Females return to feeding areas. It can take several months to travel. Females return to mate about once every 2 to 4 years.
- If a female lays 5 clutches of eggs and each clutch has 120 eggs, how many eggs did she lay?



Scientists estimate that only 1 in 1,000 to 10,000 babies survive to adulthood!

Loggerhead Hatchlings

Must dig their way to the surface. This can take a few days.

Most wait until night to head for the ocean to avoid predators.

Once in the water, they swim like crazy for a few days to reach **deep water**. During this time, they do not eat. They are fueled by leftover egg yolk.

Strong currents take them to the **open-ocean** where they live in flotsam, such as **Sargassum** mats (brown algae).

They are omnivores—eat plants and animals.

This **oceanic** stage can last from a few years to decades.



Loggerhead Juveniles

After the oceanic period, the juvenile turtles finish growing in **coastal areas** where food is abundant.

This can take a few years or as long as a few decades.

Because there are many predators in coastal areas, the young turtles wait to enter until they reach a larger body size.

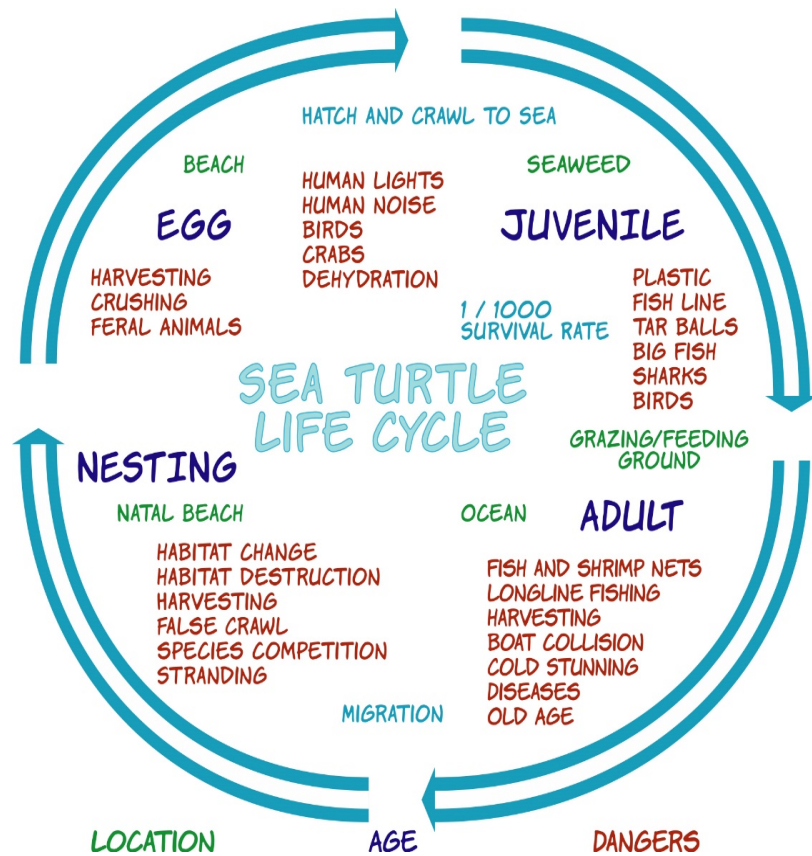
Juveniles and adults share the feeding areas.

Adult turtles stay in feeding areas until they have enough energy to migrate back to breeding grounds for reproduction. Distances can be tens of thousands of kilometers away.

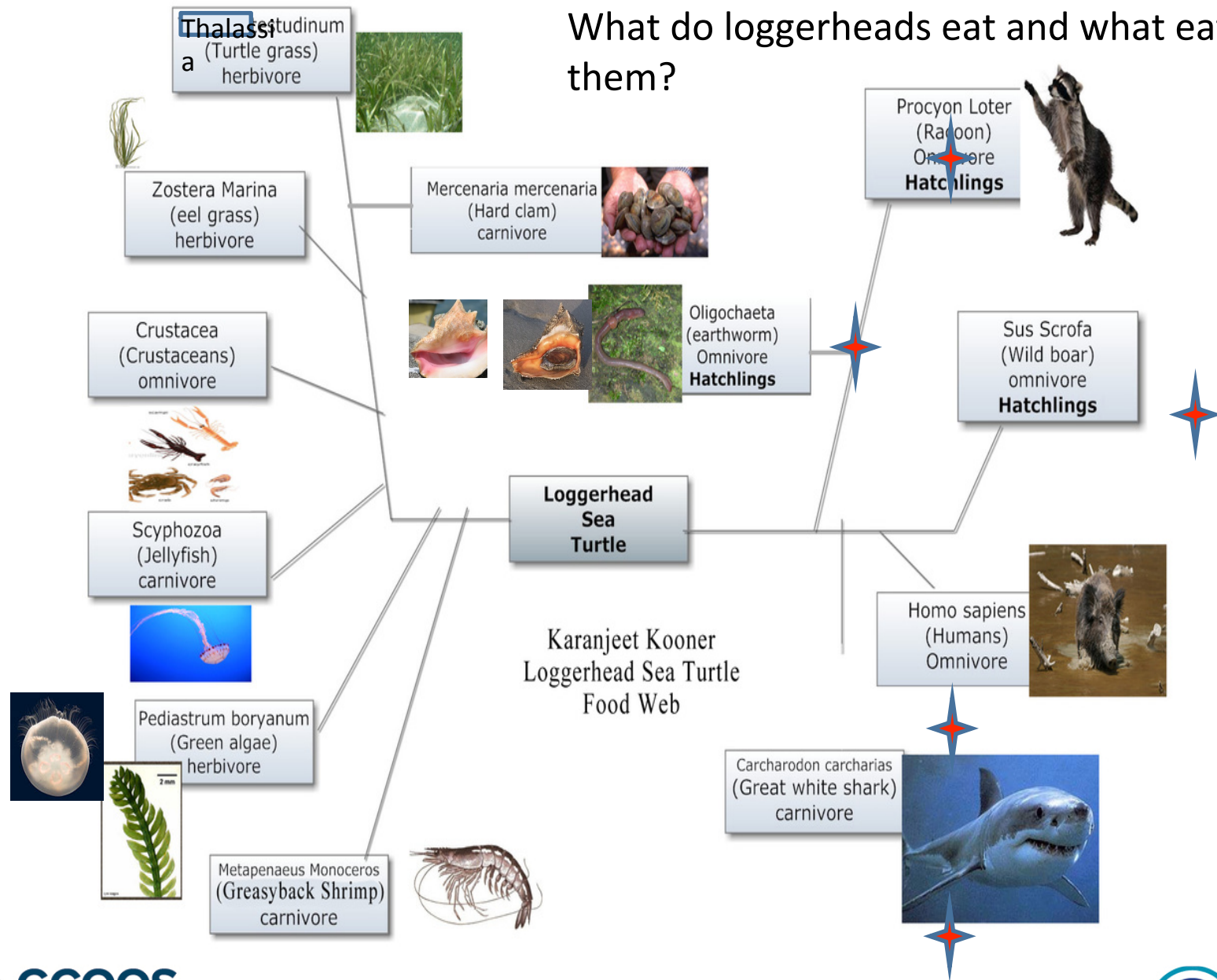
Most females lay their eggs on the beach where they hatched.



There are many threats to sea turtles!



What do loggerheads eat and what eats them?



Activity – Sea Turtle Life Cycle

In this activity, students will create a textured map illustrating the different parts of the vast areas utilized by loggerhead sea turtles at different parts of their life cycle. The creation of the map will help students understand the different ecosystems that sea turtles rely on during the phases of their life cycle, the great distances that sea turtles travel throughout the course of their lives, and set the tone for a discussion on the difficulties of protecting sea turtles as they move through the different parts of the Atlantic Ocean, Caribbean Sea, and Gulf of Mexico.

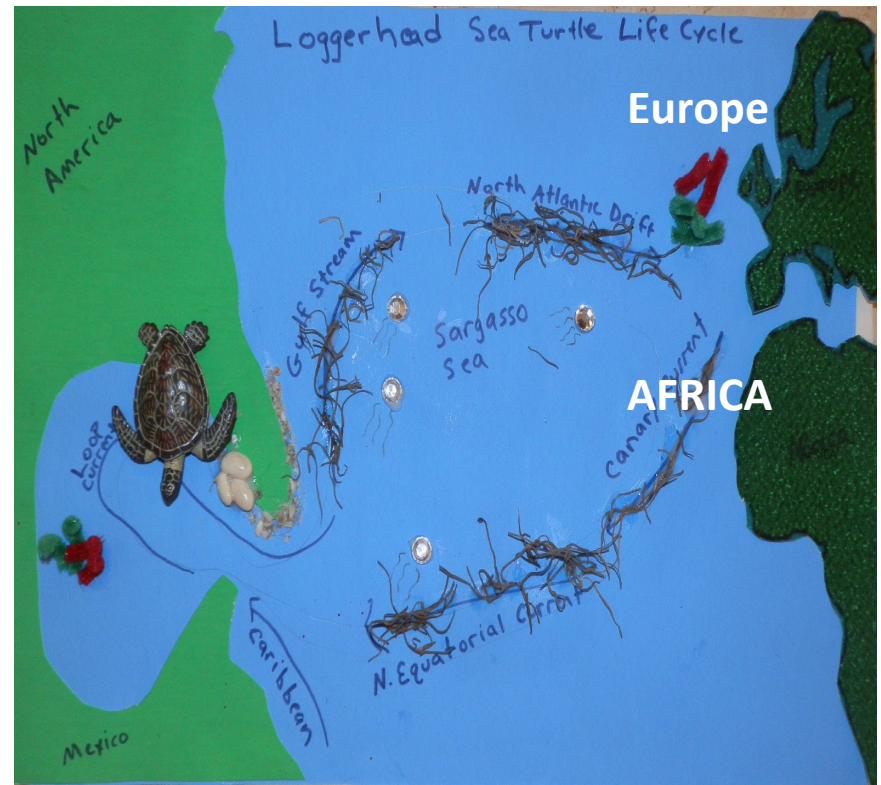
Materials:

- Foam board
- Green and blue construction paper
- Glue
- White beans
- Sand
- Spanish moss (or similar plant) to use for sargassum
- Red and green pipe cleaners
- Plastic gems, sequins or similar items (beads, small shells) to use for forage items

What are we going to do?

- We are going to make a map showing the parts of the habitat used by loggerhead sea turtles during their life cycle.
- Our map will show how they use three different habitats:
 - 1) Beach for nesting;
 - 2) Open ocean (oceanic zone) when they are juveniles and young adults;
 - 3) Shallow water coastal areas (neritic zone) when they are older juveniles and adults.

All of these habitats and the food sources in each must be considered in loggerhead management!



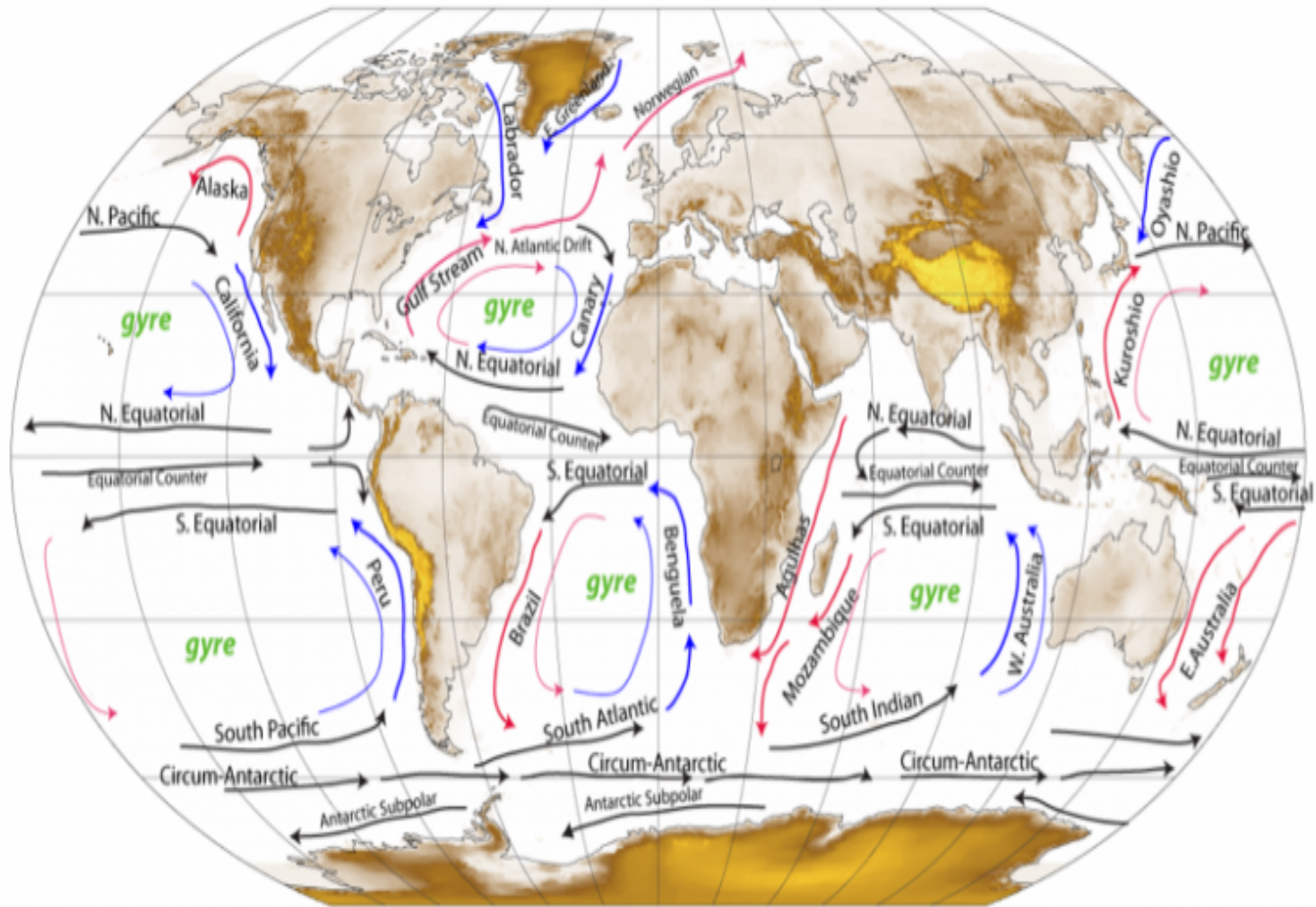
Procedure: Step-by-Step

1. Take one foam board and glue the “ocean” to it (rectangle of blue paper).
2. Glue the green paper continents on top of the ocean
 - North America is on the west side of the Atlantic Ocean
 - Europe is on the northeast side of the Atlantic Ocean
 - Africa on the southeast side of the Atlantic Ocean
3. Glue a narrow strip of sand around the edge of Florida to make a beach.
4. Glue and press into the beach a turtle nest. Use white beans for the eggs.
5. Using the loggerhead migration map in your data book, draw the ocean gyre that loggerheads follow on your map. Notice how the currents move clockwise to form the gyre. Label the currents that make up the gyre.

Procedure: Step-by-Step

6. Glue “Sargassum” (use the Spanish moss) on top of the lines you drew for the ocean gyre. The center of this ocean gyre is known as the Sargasso Sea.
7. Using the pipe cleaners (green for turtle grass and red for mollusks), create two feeding areas. Use about 3 green and 2 red pipe cleaners for each area.
 - Make one near the coast of Europe and one near the coast in the western part of the Gulf of Mexico.
8. If you have time, use the gems, sequins and other materials to add foraging items (food) that loggerheads like to eat (jellyfish, conchs, whelks, other mollusks, crabs, lobsters, shrimp...)

Ocean Surface Currents





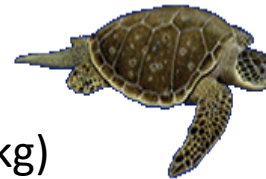
Kemp's Ridley--smallest of the sea turtles; nests only in northern Mexico and in Texas



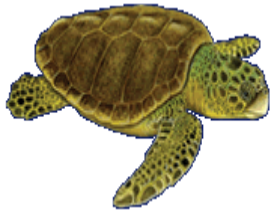
Flatback-- coast of Australia. Little is known about this species.



Leatherback--largest of the sea turtles, reaching 6 ft (1.8 m) in length and 1,500 pounds (680 kg)



Green turtle--most numerous and widely dispersed nesting sites of the seven species.



Loggerheads--named for powerful jaws that can crush an adult queen conch.



Hawksbill feeds primarily on reef glass sponges



Olive ridley—nest by the thousands in “arribadas” (Spanish for ‘arrival’)

Turtle Trivia

- Florida beaches are home to 80% of Loggerhead turtles in the U.S.
- Turtles can migrate thousands of miles, but usually return to lay their eggs on the same beach where they hatched
- Sea turtles have existed for over one hundred million years
- Sea turtles are reptiles. They breathe air, and can hold their breath for long periods of time.
- When its time to sleep, a loggerhead will wedge under a rock close to the shore, or take a snooze while floating on the surface of deep water
- Hatchlings weigh less than one ounce and are only two inches long. Adults can grow over 3 feet long and weigh 200 to 300 pounds!
- The nest temperature during incubation determines a sea turtle's sex. Boys like it cool - Girls like it hot.
- Sea turtles have great underwater vision, but are nearsighted out of the water.
- Although sea turtles do not have external ears, they are capable of hearing low frequency sounds and vibrations
- Sea turtles use their strong jaws to crush a diet of crabs, shrimp, mussels, and jelly fish.



Acknowledgements

Lesson developed by Dr. Chris Simoniello for Bay Point Elementary. Standards-cross-referencing and formatting by Grant Craig.

Questions, comments, edits? Contact Dr. Chris:
chris.Simoniello@gcoos.org

Appendix

1. Template for continents Europe and Africa
2. Step by step procedure cutouts for individual use
3. Sea Turtle Hurdle Game: This game can be set up in a schoolyard or field. It is recommended to play on a soft surface such as grass or sand. This game highlights the challenges sea turtles face at each stage of their lives.



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4. Glue and press into the beach a turtle nest. Use white beans for the eggs.
5. Using the loggerhead migration figure in your data book, draw on your map the ocean gyre that loggerheads follow. Put arrows in the direction the currents are moving, then label the currents.
6. Glue Sargassum (use the Spanish moss) on top of the lines you drew for the ocean currents. Label the Sargasso Sea which is in the center of the ocean gyre.
7. Use the pipe cleaners (green for turtle grass, red for mollusks and crustaceans) to create two feeding areas. Make one near the coast of Europe and the other near the coast in the Gulf of Mexico.
8. If you have time, use the gems, sequins and other materials to add foraging (food) items loggerheads like to eat (jellyfish, conchs, whelks, other mollusks, crabs, lobsters, shrimp...)

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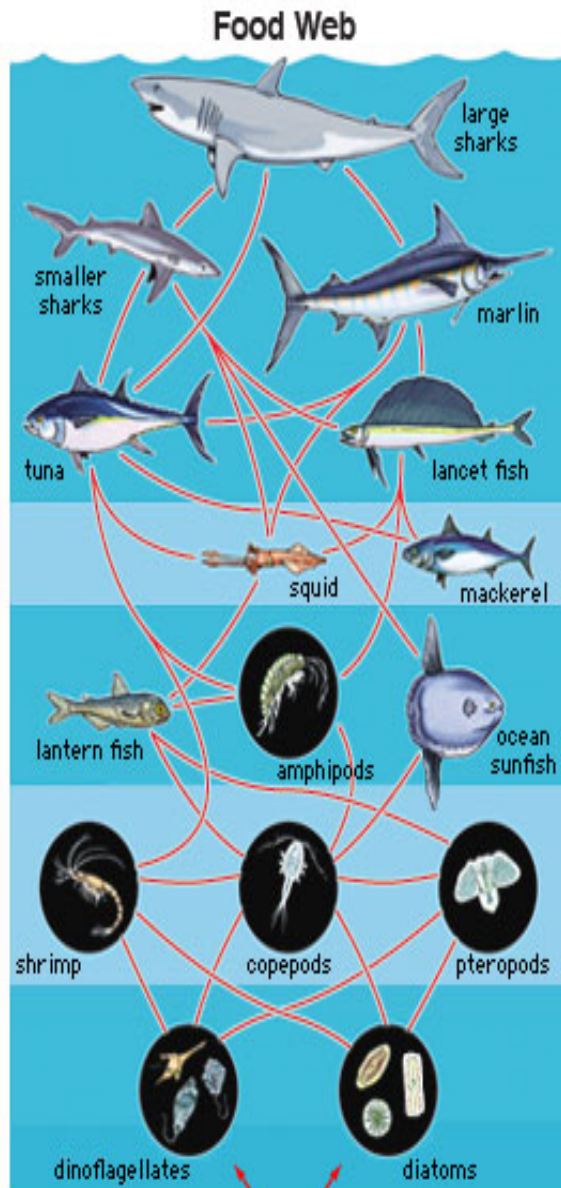


Turtle Hurdle



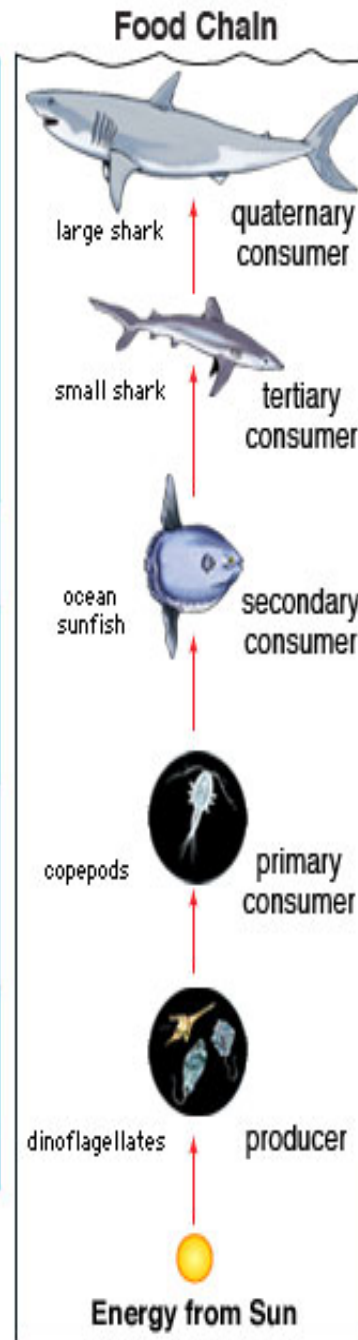
Run (swim) for your life!





Energy from Sun

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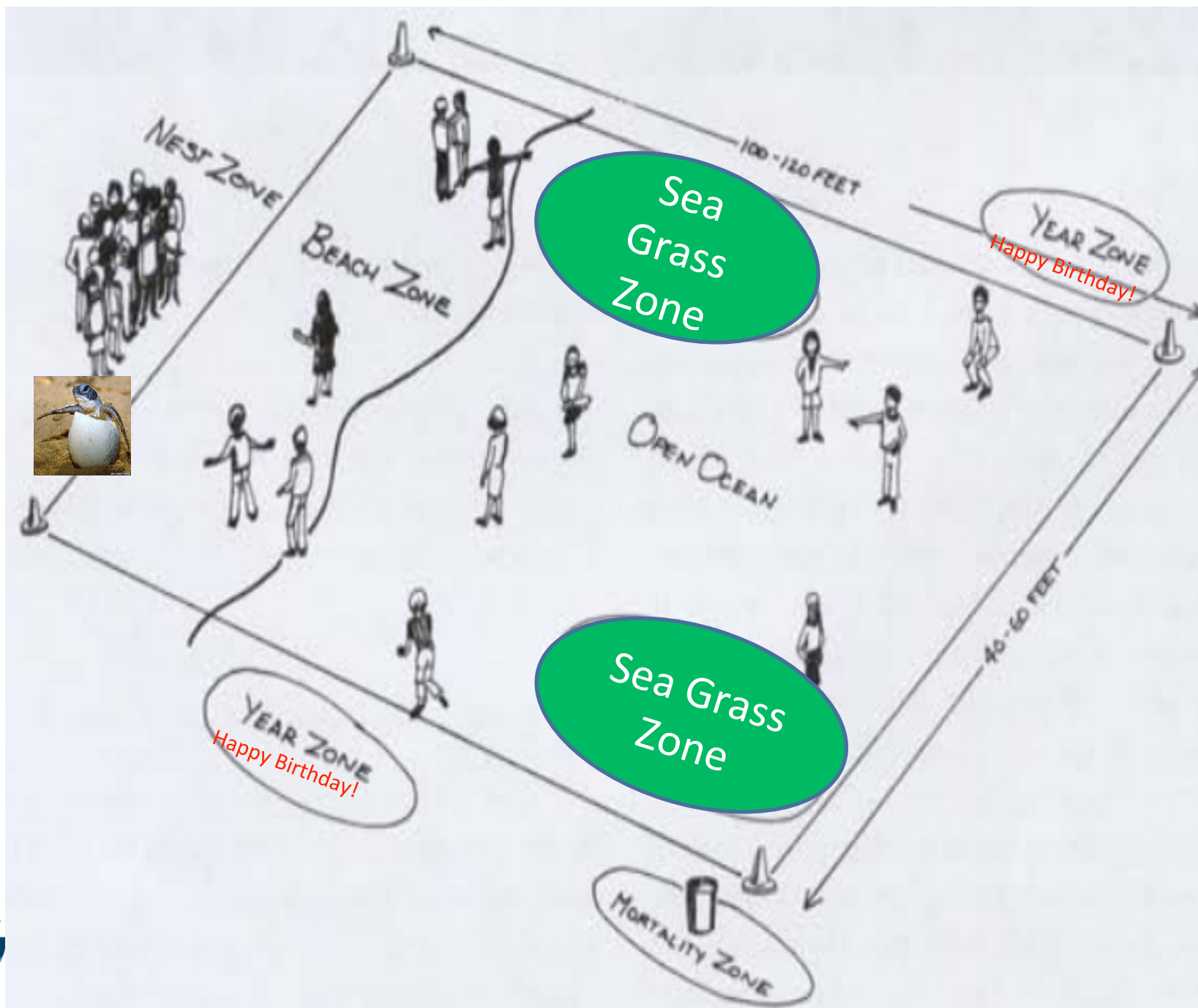


Energy from Sun

Animals do not always remain in the same TROPHIC level.

Flounder provide an example. Larvae feed on copepods. Adults feed on clams, snails and worms.





Sea Turtles at Risk

- Beach Zone: Predators
 - Raccoon
 - Dog
 - Fox
 - Ghost crab
- Open Ocean: Predators
 - Sharks
 - Orcas
 - Seabirds
 - Crabs



Game Rules: Sea Turtles

1. Safety first! No pushing, shoving, tackling!
2. Your goal: Run between the Year Zones to get birthday tokens.
 - Each birthday token is worth TWO years
 - You need five tokens to be 10 years old.
3. You must stay within the game field boundaries.
4. As you run between Year Zones, predators will be trying to get you! Every time you are tagged by a predator, you must give one “egg” to the predator that tagged you.
5. If you lose all your eggs, you must go sit in the Mortality Zone (you are dead!).
6. The sea grass zone is a Safe Zone. You may stay there for 3 seconds without being tagged. It is only a safe zone for turtles that are 0-4 yrs old. After age four, you are too big to hide in the grass and predators can tag you!
7. If you have eggs after reaching age 10 (five tokens), run back to the nesting zone and sit. You have survived long enough to start a new generation!

Game Rules: Predators

1. Safety first! No pushing, shoving, tackling!
2. Predators must stay in their own zone.
 - If you are a beach predator, you cannot tag anyone in the ocean.
 - If you are an ocean predator, you cannot tag anyone on the beach.
3. You cannot tag the same person two times in a row.
4. You cannot tag a turtle that has stopped to give an egg to another predator.
5. You must stay at least four steps away from a turtle that is giving an egg to another predator.
6. Try to get as many eggs as you can!

