

Lab: Hot or Not?

(adapted from NC Aquariums Education Section)
(MAKEUP VERSION)

Background: Sea turtle nesting is a crucial event in their life cycle. This activity explores the role of temperature on sex determination during the incubation period. As with many species of reptiles, when a female sea turtle lays her eggs, the developing embryo inside is neither male nor female. It is during the incubation period that exposure to certain temperatures will cause enzymes present within the embryo to convert hormones that will either produce ovaries or testes. The total incubation time varies, but averages 60 days in length for the loggerhead sea turtle. It is during the middle one-third (days 20-40) of incubation in which sex determination occurs. Each species of sea turtle has a pivotal

Species	°C	°F
Loggerhead	28.74	83.73
Green	28.26	82.87
Hawksbill	29.32	84.78

temperature (Table 1). The pattern for most turtles exhibiting temperature sex determination is “girls are hot and boys are not” – meaning temperatures above the pivotal temperature will produce females and temperatures cooler than the pivotal temperature will produce males. Eggs that are incubated at the pivotal temperature have a 50% chance of developing as male and a 50% chance of developing as female.

Temperatures of nests are influenced by (1) solar radiation; (2) color of sand; (3) metabolic activity of developing embryos; (4) shading by plants; and (5) position of egg within the nest.

There are a variety of ways in which climate change could influence sea turtle populations. According to the Sea Turtle Conservancy, nests from Costa Rica’s Pacific coast are already producing 70-90% female hatchlings, and some areas are too hot to be viable at all. Viability of eggs requires temperatures to be between 26°C - 32°C (79°F – 90°F). Other impacts of climate change on sea turtles include loss of nesting habitat due to sea level rise and loss of vital foraging grounds among coral reefs.

Prelab Questions:

1. How is sex determined in sea turtles?
2. When during incubation does this determination typically occur?
3. What is the general rule for sex determination in sea turtles?
4. How could sand color affect sea turtle sex determination?
5. How could plants on the beach affect sex determination in sea turtles?
6. How could an eggs position within the nest affect sex determination?
7. How is climate change influencing sea turtle populations in Costa Rica?
8. Considering that North Carolina is at the northern most range of some sea turtle species, why is North Carolina important to sea turtle populations?

What We Did in Class:

Students excavated a sea turtle nest! OK, not a real one. They recorded temperatures of the eggs found and completed the charts below. Use the data provided for the nest of a Hawksbill Sea Turtle to complete the charts then answer the questions.

Egg	Temp (°C)	Sex (M/F)
1	30.51	
2	29.72	
3	30.89	
4	28.52	
5	29.24	
6	29.30	
7	28.75	
8	29.08	
9	30.44	
10	29.92	
11	29.55	
12	30.25	

	Loggerhead	Green	Hawksbill
# total eggs	12	12	
# females	1	9	
# males	11	3	
% females	8.3	75	
% males	91.7	25	
temp range	26.21-30.41	23.41-30.55	
avg temp	27.8	28.87	

Analysis Questions:

9. What species were the turtle eggs in your nest?
10. What is the pivotal temperature for sex determination for your species?
11. Compare the percentage of females vs. males in your nest.
12. How does this difference influence sea turtle populations in the Atlantic?
13. Assuming this nest is from North Carolina, in which direction would you need to travel to find sea turtle nests with a higher percentage of females?
14. What could be done to help protect sea turtle nesting sites from the impacts of climate change?
15. Assess the pros and cons of attempting to implement your solutions from question 14.

