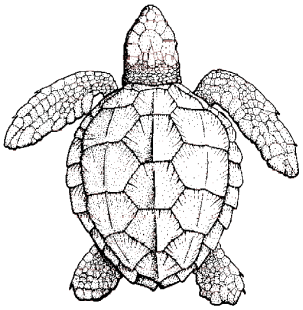

Image from USFWS

Estimating Loggerhead Hatchling Gender Ratios

5Es Lesson by Rachel Teller

National Science Standards

Content Standards: Level 5-8

Unifying Concepts and Processes

> Change, constancy, and measurement
> Evolution and equilibrium

Life Science

> Populations and ecosystems
> Diversity and adaptations of organisms

Background

Sea turtles, like many reptiles, exhibit a form of environmental sex determination called temperature-dependent sex determination (TSD). This means that the temperature inside the nest during a critical period of incubation determines the gender of the young. In sea turtle species, all of which exhibit TSD, warmer nest temperatures produce females and cooler nests give rise to males. Not all animals that exhibit this form of environmental sex determination produce females in warm nests and males in cooler ones– warm alligator nests produce males and vice versa.

There is a pivotal temperature at which the hatchlings that emerge are about half females and half males. In South Carolina, the pivotal temperature for nests is 29°C. If the average nest temperature during the critical period is above or below the pivotal temperature, the hatchlings will usually be mostly female or male, respectively. Humans can impact the hatchling gender ratio because, for example, moving a nest from an open area to an area with high vegetative cover (and therefore shading) can cause the nest to produce more males.

Activity

ENGAGE Ask the students to review the Life History PhotoDocumentary and fill out the accompanying worksheet as they do so. This presentation can be uploaded to a network and

accessed independently, in pairs, or it can be projected for an entire group. The slides could also be read aloud to promote discussion.

EXPLORE Provide the students with the nest temperature data. Ask them to estimate a reasonable ratio of female to male hatchlings from each nest and then determine the overall ratio of females to males from this nesting beach. Remind the students that the pivotal temperature for nests in South Carolina is 29°C, ±1°C for this exercise since 29°C is an average. Allow the students to work independently or in pairs.

EXPLICATE Ask the students to explain what impacts a nest management program could have on the population, in terms of gender ratios. Ask them to consider how humans might impact hatchling sex ratios by relocating nests or placing them in hatcheries.

ELABORATE Ask the students to consider how it was they came to be female or male. Ask them to think about what would happen if humans suddenly began exhibiting TSD like many reptiles do. Discuss the resulting distribution of girls and boys across the world and why this would occur. For example, very cold places, which would produce boys, do not have many people living there…what would this do to the population?

EVALUATE Ask individuals or pairs of students to assess the future of the world's sea turtle species if global warming were sudden and drastic, causing the earth's global temperature to rise 2 degrees Centigrade. If they predict the population would change; if they think it would have an affect on hatchlings; if they think it would affect nesting– ask them to be specific and explain *why* they think it would/would not have an affect and *how* they think it would occur. Remind them to think about what they already know about sea turtles– specifically, where they live, and where and how they reproduce. Ask them to produce, individually or in pairs, a scientific bulletin or public awareness commercial that addresses the issue of global warming and its possible impact on the world's sea turtle population.

Some things to think about in terms of effects of global warming on sea turtle populations:

- Nest temperatures would be warmer, so more females would be produced and very few males. This skewed sex ratio may not enough to support the population. This affect may not be noticed for many years since the abundance of female hatchlings would not reach

reproductive maturity for about 30 years. FYI: one hypothesis is that this is what happened to the dinosaurs!

- Their global distribution would increase because water closer to the poles would be warmer. As this happened, females may begin to nest in these cooler areas and males could be produced, which could help ensure the population could thrive.
- As the world's oceans expand with the rising temperatures, their nesting beaches would be destroyed. For instance the South Carolina beaches would become the sea floor and natal imprinting may deter them from choosing alternative nesting sites.