

LEARNING With LOGGERHEADS

Third graders analyze real-time data while contributing to the conservation of an endangered species.

By Christine Lener and Theodora Pinou

Kids tracking sea turtles? No, it's not a description for a new nature show on TV, it's a lesson, and it could be happening in your classroom! Sea turtle biologists worldwide are currently working together to track turtles to learn about sea turtle behavior and migration in an effort to conserve these endangered animals. We developed a unit using a modified version of published tracking activities (Sera and Eckert 2005) for third-grade students in which students develop and share computer-generated maps that are based on authentic data. With this information, students can evaluate sea turtle life history, behavior, and environmental hazards, just as scientists are doing today. Now, with only an internet connection, your students can engage in the global mission of sea turtle conservation while at the same time learn about the importance of technology in conservation and understanding of biodiversity.

Satellite Telemetry

Humans are able to track sea turtles across the world's oceans and follow their extensive migrations in real time through satellite transmission technology or telemetry. How does telemetry work? A biologist attaches a transmitter to the carapace (shell) of a sea turtle, usually at a nesting beach. When the turtle surfaces to breathe, the transmitter's antenna sends signals to satellite receivers that pinpoint the turtle's location and migratory pattern. A sea turtle can surface as often as every 10 minutes, sending multiple data points to satellite processing centers. Scientists translate these signals into points of latitude and longitude, which

help them monitor and map sea turtle movements. Scientists then post these data onto a collaborative sea turtle monitoring site, www.seaturtle.org, so they can communicate with colleagues globally about sea turtle movements throughout the world's oceans.

This sea turtle site is also accessible to educators on any basic internet server to teach students about sea turtle migration and mapping. In preparation for the activity, it's best if teachers reserve a computer lab ahead of time. In cases where computers are limited, teachers can group as many as three children to work cooperatively or rotate children between computer stations and manual mapping of the tracking points. Teachers are strongly recommended to prepare for this exercise by accessing the tracking data beforehand and modifying the points of latitude and longitude

by rounding off to the nearest whole number. It is our experience that if the data are not rounded it becomes confusing for the children to find the specific decimal places to plot.

Preparing to Track

On the first day of the unit, we begin by asking the class about migration: What animals do you know that migrate? Why? Responses are written on the board and typically include whales, birds, and butterflies. Children often explain that migration occurs because animals (e.g., whales) are following their food or are migrating in response to the changing of the seasons (e.g., birds). It is during this first day that students are introduced to sea turtles (*Caretta caretta*) and the idea that sea turtles also migrate due to seasonal changes that affect water temperatures and food supply. In

addition, sea turtles migrate to find a mate and to find appropriate beaches to build nests and lay eggs.

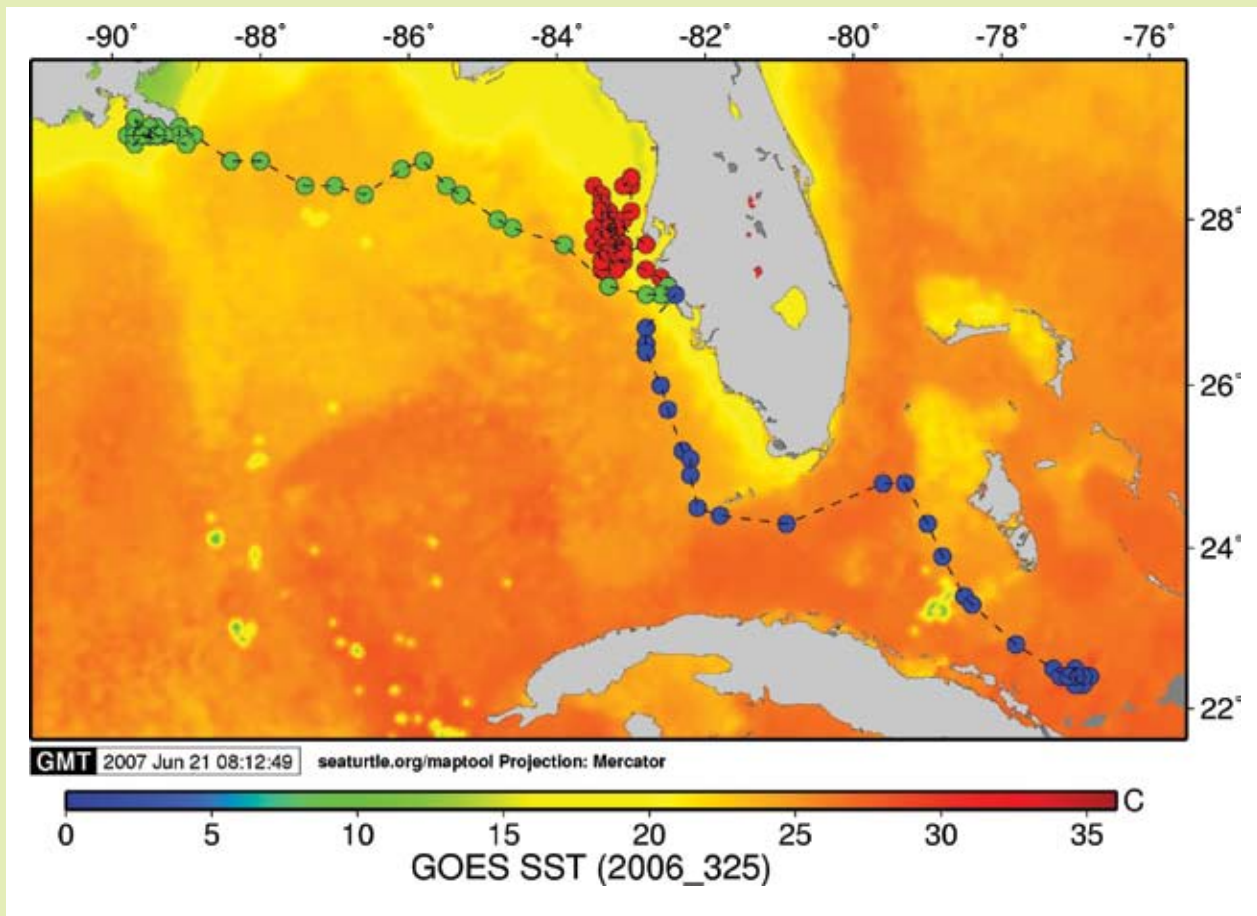
Background information on sea turtle life history, migration, and threats to sea turtle survival can be read together in class and discussed as a whole-group activity. Alternatively, the teacher may choose to send home reading materials for students to read as homework prior to the lesson. Such information can be found in the Sea Turtle Migration-Tracking and Coastal Habitat Education Program educator's guides (see Internet Resources). These readings introduce students to sea turtle tracking patterns. For example, tracking points recorded from land indicate nesting (laying eggs); tracking points recorded offshore of the nesting beach indicate internesting (a female can return to nest multiple times in one season, revealing a zig-zag pattern); and the foraging grounds where turtles feed are clus-



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Figure 1.

Tracking three female loggerhead turtles using Maptool.



MAPS COURTESY OF TONY TUCKER OF MOTE MARINE LABORATORY, SARASOTA, FLORIDA.

tered tracking points recorded at the end of the migration pattern. The migration pattern is the line drawn between the interesting and foraging grounds.

The next day, we establish a baseline understanding of mapping skills by giving students a graphing assignment called “A Pointy Turtle” (Prime 1997). This activity helps students learn how to find points on a table and then connect the points to draw a graph. This activity reinforces the importance of connecting points in a defined order by revealing the outline of a turtle only when points are connected sequentially. This graphing activity prepares students for connecting the sea turtle tracking points according to the date the signal was reported.

Next, students are introduced to a *tracking map* (Figure 1), which is a record of a turtle’s travels. Teachers can obtain samples of tracking maps in advance of the lesson through www.seaturtle.org. These maps can also be used to integrate geography, such as names of oceans, continents, compass rose, longitude, and latitude.

Figure 2.

Tracking map of the Gulf of Mexico with lines of latitude and longitude.



The Tracking Begins

On the third day, choose an ocean you want to concentrate your tracking activities on with students. Our class chose to study the Gulf of Mexico because they sponsored turtles through the Mote Marine Lab Sea Turtle Tracking Program in Sarasota, Florida. Their teacher traveled to Mote Marine Lab and attached the transmitters on several nesting female loggerhead turtles herself. When she returned to school, her students named and tracked these same turtles. Students were given a hurricane tracking map of the Gulf of Mexico (Figure 2) with pronounced lines of latitude and longitude to use for manual mapping. Maps can be customized for a desired area from the National Weather Service or from the *seaturtle.org* tracking homepage (see Internet Resources).

Teachers access tracking data by going to *seaturtle.org* and clicking the “tracking” icon. Next, find the “For Teachers” heading in the menu on the left. Then, under the “Tracking Data” heading, click “Access Data” and access the data by geographic project or sea turtle species. In this case, the teacher selected Casey Key Loggerheads (the sea turtle group the class was tracking in the Gulf), and then selected a specific animal (Talulah), hit “submit,” and all 48 tracking points were listed. To reduce confusion generated by the large number of data points, the teacher summarized the travel to 14 points (Figure 3) that when connected will reveal a pattern. If this is not done, students can get frustrated when plotting points in close proximity that when connected don’t show a trajectory of travel.

Recommended strategies for teachers include partitioning the data by seasons, so different groups can map the location of a turtle during different seasons and then come together to discuss the annual pattern. Alternatively, groups can compare different turtles that all start at the same nesting beach and examine if their migration is different, as shown in Figure 1 for Ariel, Talulah, and Genie. Completion of this manual mapping can take as much as three lessons. (Students are given approximately three seasons of data to plot over three class periods.)

Inquiring About Behavior

Once students have generated migration maps, we review terms like *nesting beaches*, *internesting behavior*, *foraging behavior*, and *migration*. Teachers can assess learning by recording student ability to label these behaviors and locations on their maps. Other information a teacher can assess is a student’s ability to add to their migration analysis project the location of where the sea turtle was tagged, number of days spent interesting, the direction of the migration, where the foraging ground is, and how they know this. Using a rubric, the teacher assesses a student’s ability to plot latitude and longitude on a map and connect these points by date and to describe movements of the turtle’s life history (Figure 4, page 28).

Figure 3.

Modified telemetry points for mapping by students.

TALULAH'S SATELLITE TRACKING DATA		
DATE	LONGITUDE	LATITUDE
7/19/2006	82.5 W	27.0 N
7/20/2006	83.0 W	27.0 N
7/22/2006	83.0 W	26.0 N
7/25/2006	82.0 W	25.0 N
7/30/2006	82.0 W	24.0 N
7/31/2006	81.0 W	24.0 N
8/01/2006	80.0 W	25.0 N
8/02/2006	79.5 W	25.0 N
8/03/2006	79.0 W	24.0 N
8/06/2006	78.5 W	23.0 N
8/07/2006	78.0 W	23.0 N
8/12/2006	77.0 W	22.5 N
9/13/2006	77.0 W	22.0 N
10/15/2006	77.0 W	22.0 N

Once students have had a chance to map by hand, they can spend another class period entering points of migration into *seaturtle.org*’s Maptool (see Internet Resources). Maptool also permits students to add layers of information, such as coastlines, country names, currents, and sea surface temperatures (SST). Here students can label land masses, oceans, and direction of migration. Then they can predict what factors may have influenced the migration; for example weather (e.g., Hurricane Katrina) may account for Virginia’s unorganized pattern. These maps can then be discussed together as a class. Ariel stopped transmitting signals after 94 days of being tagged. She was last tracked into an area with a high concentration of red tide (which was likely fatal), and Genie and Talulah migrated to different foraging grounds (Figure 1). Virginia’s transmitting signal continued after the storm, demonstrating that turtles can endure many natural disasters like hurricanes.

Finally, we integrate literacy and writing by requiring each student to write a one-page journal entry explaining what the sea turtle may be experiencing while traveling. Students develop public-speaking skills by sharing their journal entries with their peers. Students are assessed by the correct usage of the behavioral terminology in their writing and speaking and in their ability to predict what environmental factors are influencing the migration (e.g.,

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Figure 4.

Learning with loggerheads rubric.

Objective #1: Upon completing this assignment, you will be able to record and graph sea turtle travels using research data. (1 point each)

1. Shows a beginning level of performance.
2. Shows development and movement toward mastery of performance.
3. Shows mastery of performance.

Objective #2: Upon completing this assignment, you will be able to describe movements of sea turtle life history (nesting, internesting, migration, foraging) by examining tracking data. (1 point each)

1. Shows a beginning level of performance.
2. Shows development and movement toward mastery of performance.
3. Shows mastery of performance.

Objective #3: Upon completing this assignment, you will be able to discuss environmental factors that may influence sea turtle migration. (1 point each)

1. Shows a beginning level of performance.
2. Shows development and movement toward mastery of performance.
3. Shows mastery of performance.

season and food, water temperature, disease, storms). Each of these factors can be examined empirically by visiting the National Oceanic and Atmospheric Administration (NOAA) website, which tracks, documents, and reports such data at NOAA.gov. In addition, Maptool permits migration maps to be constructed with overlaid sea surface temperature (SST), vegetation index, and other factors that can help explain turtle migrations.

Student Success

We found that when children are given an opportunity to map animal travels in real time—just like scientists—they independently inquire why the animals exhibit certain migratory patterns. Students began wondering if turtle movements observed were due to environmental dangers, such as commercial fishing, recreational boating, and pollution. They also considered changes in the turtle's food supply due to seasonal changes in sea surface temperatures and ocean currents. We believe that when satellite telemetry technology is brought into the classroom to investigate the phenomenon of migration, elementary students improve their conceptual understanding of science and technology, their personal and social perspectives of science, and their understanding of organisms and life history.

Connecting to the Standards

This article relates to the following *National Science Education Standards* (NRC 1996):

Content Standards

Grades K–4

Standard C: Life Science

- The characteristics of organisms
- Organisms and environments

Standard E: Science and Technology

- Understanding about science and technology

The students at our school look forward to this unit every fall with great anticipation and enthusiasm because they understand the real-time setting and are excited about where the turtles are moving. This active interest initiates much discussion about conservation in the classroom. Parents have reported that their children are excited to share maps, journal entries, and questions at home, engaging their family and friends in their science class experience. ■

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Resources

- National Research Council (NRC). 1996. *National science education standards*. Washington, DC: National Academy Press.
- Prime, C.S. 1997. A pointy turtle. In *Zoobooks: Turtles*, eds. T. Biel and J. Bonnett Wexo, p. B. Poway, CA: Wildlife Education.
- Sera, H., and K.L. Eckert. 2005. *Endangered Caribbean sea turtles: An educator's handbook*. Beaufort, NC: Wider Caribbean Sea Turtle Conservation Network.

Internet

- AccuWeather.com Hurricane Center
<http://hurricane.accuweather.com/hurricane/tracking.asp?partner=accuweather>
- Caribbean Conservation Corporation and Sea Turtle Survivor League Teacher's Guide
www.ccturtle.org/satellitetracking.php?page=educatorsguide
- Seaturtle.org Maptool
www.seaturtle.org/maptool
- Seaturtle.org Satellite tracking
www.seaturtle.org/tracking/index.shtml?project_id=67
- Seaturtle.org Teacher's Guide
www.seaturtle.org/documents/Educators_Guide.pdf
- Seaturtle.org Tracking Homepage
www.seaturtle.org/tracking/teachers