



The Night You Hatched

Grades: K – 5

Overview: **The Night You Hatched** is a science simulation that builds understanding in young learners about the effects of light pollution on the sea turtles during hatching. The lesson demonstrates animal behavior and the predator/prey relationship.

Students will observe and record behaviors of sea turtles during a hatching simulation, collect then map data, and participate in a critical thinking exercise related to the human impact on animal survival. *This lesson/lesson may be executed as a nighttime lesson with parent volunteers as the light sources and predators or in a semi-dark classroom with students as lights and predators.*



Scientific inquiry promotes critical thinking and analysis of data. Group processing of the simulation encourages students to use data to explain the impact of light pollution on animals (sea turtles) and serves as an introduction to the dynamics of a system. Refer to the NSTA Science Inquiry Continuum (attached) to adapt this exercise for your learners.

Purpose: *“The fundamental goal of life sciences is to attempt to understand and explain the nature of life.”* (NAEP 2000) Students will apply scientific inquiry skills, ability, & attitudes associated with science *and* expand their biological understanding of life and life cycles, and the interactions of living organisms with their environment.

Objectives:

- Ask a question about objects, organisms, & events in the environment
- Plan & conduct a simple investigation
- Employ simple equipment & tools to gather data & extend the senses
- Use data to construct a reasonable explanation
- Communicate investigations & explanations



Time – estimated:

Teacher set up - reserve area, gather volunteers, materials (30 minutes)

Lesson - depending on length of discussion (90 minutes)

Materials: paper, paper plates, pencils, flashlights/stronger lights, Follow the Moon book, volunteers

Preparation/prerequisites: This lesson is best when integrated with a unit on light or animal adaptations. Other than reserving the space, knowing the lesson sequence and collecting materials, there is no preparation.

Background Information -- teacher/students (online/offline)

All materials for this lesson and other light pollution lessons: <http://www.globeatnight.org>

Contact your local International Dark-Sky Association for support/class visits on the impact of lighting on astronomical observations, and animal behaviors/circadian rhythms.

Contact your local Scuba diving club for support/class visits related to sea turtles.

<http://www.darksky.org>

<http://www.youtube.com/watch?v=oNqKi2eUUio>

<http://www.seaworld.org/infobooks/SeaTurtle/sthatch.html>

http://en.wikipedia.org/wiki/Sea_turtle

http://www.nova.edu/ocean/seaturtles/sea_turtle_nesting_behavior.htm

<http://photo2.si.edu/turtles/nesting.html>

<http://www.cccturtle.org/sea-turtle-information.php?page=whycareaboutseaturtles>

<http://www.nmfs.noaa.gov/pr/education/turtles.htm> (great content reading)

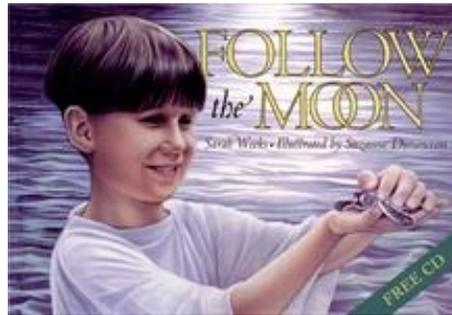
<http://www.seaworld.org/infobooks/SeaTurtle/home.html>





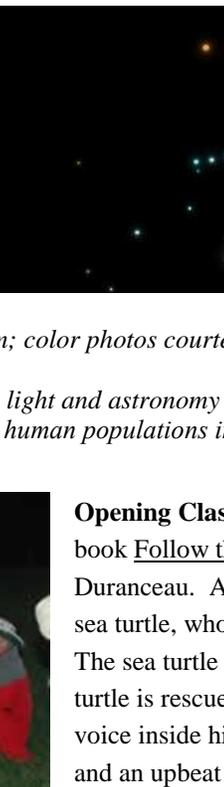
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Lesson Sequence (use the step by step lesson below by Chuck Bueter)
Activator: read/discuss with the class Follow the Moon (book)
Formative Assessment: Brainstorm facts about sea turtle hatching behaviors
Instructional Strategies: see lesson plan sequence below
Summative Assessment: Students survey home lighting for animal impact



Activity:
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A group of kids simulate turtles hatching on a beach.



Author: Chuck Bueter from *LetThereBeNight.com*; color photos courtesy of Kurt Kruggel.

This lesson integrates well with animal behavior, light and astronomy units. Students will be actively engaged as "sea turtles" in the real world where increasing human populations invade their nesting/hatching habitats.



Opening Class Procedure: Before the simulation, read the picture book Follow the Moon by Sarah Weeks ; illustrated by Suzanne Duranceau. A young boy protects and encourages a newly hatched sea turtle, whose instinct is to "follow the moon" to find the ocean. The sea turtle is drawn instead by a glittering mirrored ball. The sea turtle is rescued by a young boy who helps him learn to listen to the voice inside his head. Follow the Moon has an upswing tropical beat and an upbeat message about friendship and a child's deep bond with nature. ,

After the story, gather students and have them hold their arms around their knees as you describe this night and begin the simulation.



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Setting the Stage with the Turtles (tell the students)

Six months ago their mother deposited them into a hole in the sand on the shore of the ocean. Tonight they hatch.

Sea turtles generally hatch only at night. What are the benefits of hatching at night? How does the turtle hatchling, in an egg while buried under the sand, know that it's nighttime?

When a sea turtle emerges, it looks around the horizon, moves away from the dark silhouette of the dunes and vegetation, and scurries toward light.



Instructions to parents and students: In this demonstration, several parents equidistant from the group encircle the kids from afar while holding lights. On the count of three, the students look around the horizon, and then crawl on their elbows and knees to a source of light.

One caveat: the teachers are predators. The kids will not become prey if they first reach someone holding a light. If a predatory teacher does get them, the victim has to lie on his/her back while kicking feet and arms in the air. Look around first.

Begin the Simulation: One, two, three, go! They're off, scattering in every direction toward the lights all around. Predators descend.

Teacher Note: Hear the kids as they rush to the lights.
<http://uk.youtube.com/watch?v=-adYa8zrKCo>.)

Clusters of turtles are at the feet of people holding lights.

In the middle of the field are turtles that did not escape the clutches of the predators. While seemingly unfortunate, it reflects the natural order.





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Survey the scene with the kids. Collect data and map results.

When the giggling and screaming abates, take inventory of the turtles that reached the lights and of turtles in the middle of the field. Specifically count aloud how many turtles reached each light. On a paper plate, plot the positions of the turtles outward from the nest. Note what the respective lights might represent in the real world.

For example, this pair of lights held by two parents represents the stars and moon reflecting off the water. Under a pristine sky with no light pollution, sea turtle hatchlings naturally move away from a dark shore and toward the starlight and moonlight reflecting off the water.

In this trial 7/89 turtles reached the safety of the water, before they scrambled toward two lights randomly deemed the natural light.



Extend the data collection: What about the rest of the turtles? Those of you gathered by that light over there--that's a *streetlight*, so you might have gotten run over crossing the road while heading in the wrong direction. And, the turtles by the light over there? That's a *retail development*; so those half dozen turtles were overheated in the sun the next day. And what about the turtles by that other *beachside light*? They were disoriented by the unshielded *apartment lights*, and they won't have enough energy to finish life's jumpstart journey to sea. SO.... What is next for the sea turtle

Discuss the results and propose solutions.

Bring students into a large group and describe how sea turtles emerge and head for light. What can people do to improve the survival rate of these sea turtles? This group proposed turning shore side lights off. Note that we need outdoor lighting in our modern society. Yes, some lights can be turned off. What can we do about other necessary lighting? Guide the students to propose better lighting options. Shield the lights. Aim lights downward. Lessen the wattage of existing bulbs. Put lights on motion detectors or timers. Turn off unnecessary lights.



Rerun the turtle hatch.

After adjusting some of the lighting held by parents to reflect the suggestions above, rerun the turtle hatch. So that the kids are not preconditioned to run toward the same "seaward" direction, move the parents around. The "reflected moonlight and starlight" will then be in a new spot. The "shore side" lights are not all turned off, just altered per the kids' recommendations.

Remind the kids that they have to scan the horizon before they can take off, stay on their elbows and knees, and head for light. One, two, three, go!

When the giggling and piling on stops, re-survey the scene. There are still many who got nabbed by the predators. That's nature. However, now how many ended up at the shore side lights and how many made it to the safety of the water? Again have someone plot the positions of the turtles outward from the nest. Compare results and summarize.



The National Optical Astronomy Observatory's Dark Skies and Energy Education Program



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Teacher/Student Resources:

http://research.myfwc.com/features/view_article.asp?id=2156 - Artificial Lighting and Sea Turtle Hatchling Behavior ("Artificial lighting on marine turtle nesting beaches disrupts the ability of hatchlings to find the sea from their nest") from the Fish and Wildlife Research Institute.

<http://www.urbanwildlands.org/Resources/LongcoreRich2004.pdf> - Ecological Light Pollution Travis Longcore and Catherine Rich paper summarizes ecological consequences of night lighting. See also their book Ecological Consequences of Artificial Night Lighting.

A Silent Cry for Dark Skies (<http://www.astrosociety.org/education/publications/tnl/74/74.html>) from the Universe in the Classroom series (No. 74-Winter 2008) presents examples of how the natural world is impacted by excessive outdoor lights.

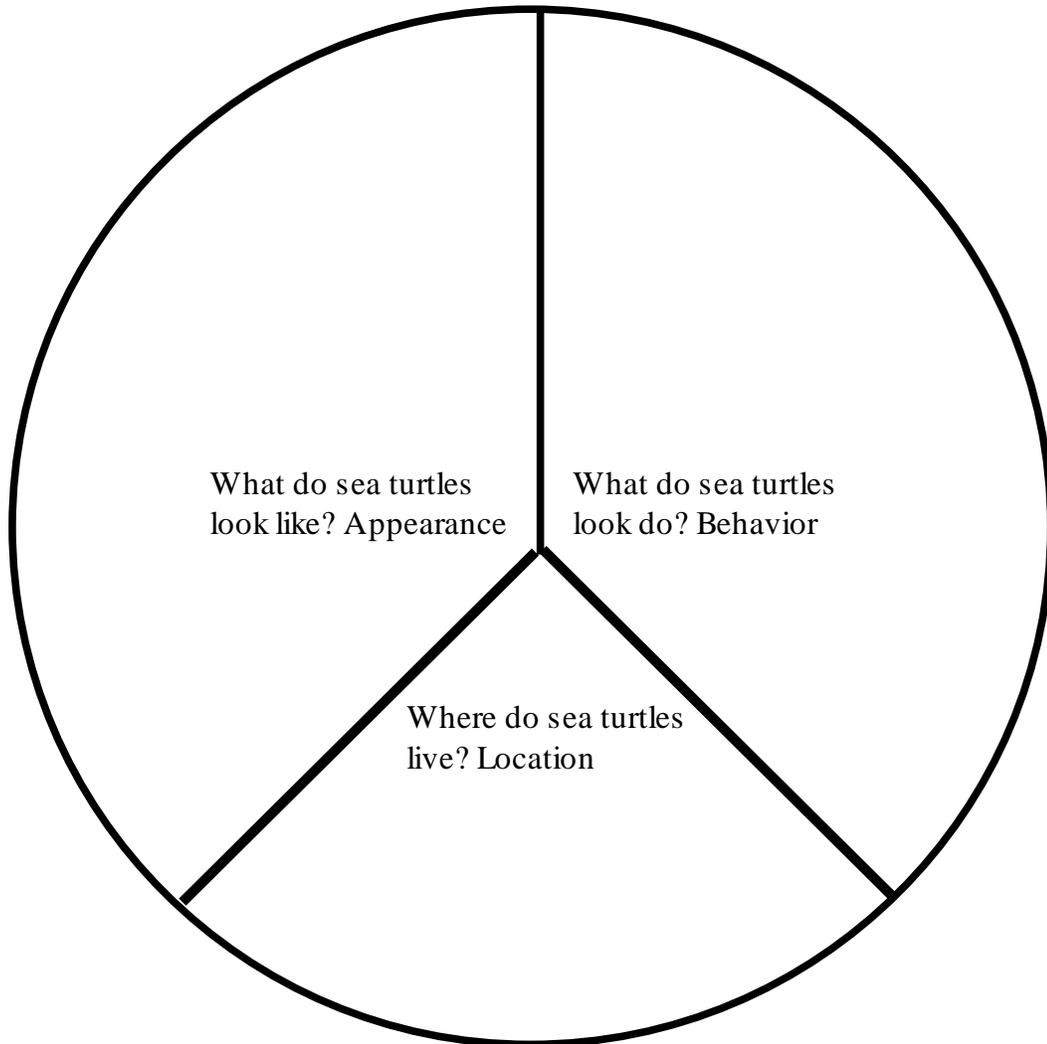
<http://uk.youtube.com/watch?v=Tl3yYd-4Rw8> - A real turtle hatch on a beach.

Student Materials: see below for student materials (required and optional).



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Brainstorming Graphic Organizer: include prior knowledge and new knowledge from reading *Follow the Moon* or from content reading both online and offline.



Essential Features of Classroom Inquiry and Their Variations					
Essential Feature	Variations				
1. Learner engages in scientifically oriented questions	Learner poses a question	Learner selects among questions, poses new questions	Learner sharpens or clarifies question provided by teacher, materials, or other source	Learner engages in question provided by teacher, materials, or other source	
2. Learner gives priority to evidence in responding to questions	Learner determines what constitutes evidence and collects it	Learner directed to collect certain data	Learner given data and asked to analyze	Learner given data and told how to analyze	
3. Learner formulates explanations from evidence	Learner formulates explanations after summarizing evidence	Learner guided in process of formulating explanations from evidence	Learner given possible ways to use evidence to formulate explanation	Learner provided with evidence and how to use evidence to formulate explanation	
4. Learner connects explanations to scientific knowledge	Learner independently examines other resources and forms the links to explanations	Learner directed toward areas and sources of scientific knowledge	Learner given possible connections		
5. Learner communicates and justifies explanations	Learner forms reasonable and logical argument to communicate explanations	Learner coached in development of communication	Learner provided broad guidelines to use to sharpen communication	Learner given steps and procedures for communication	

More ← ————— **Amount of Learner Self-Direction** ————— → **Less**

Less ← ————— **Amount of Direction from Teacher or Material** ————— → **More**



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Sample BOTG (behavior overtime)



How has the sea turtle population changed overtime?

As the cities grow... The number of lights increase,

As the light pollution increases.... The turtle population decreases.

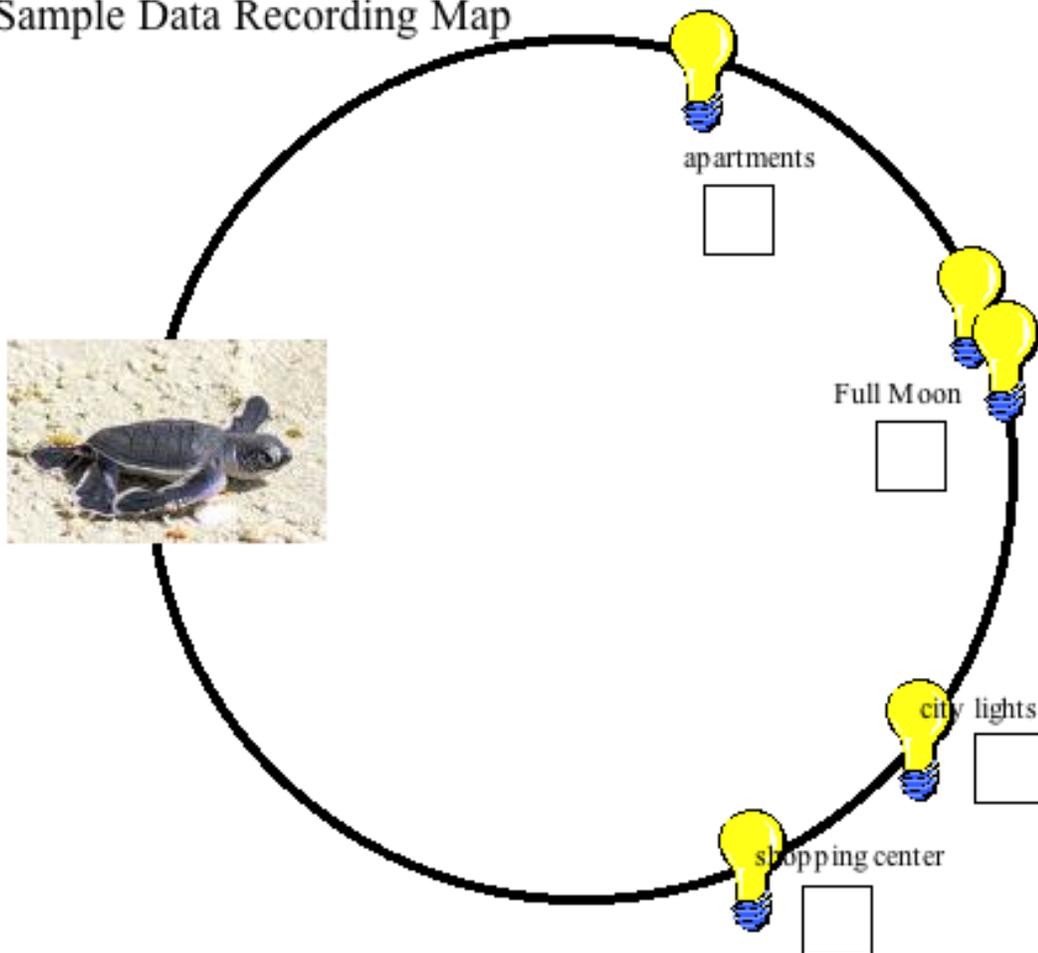
As the What other changes overtime occur because of the LP?



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Sample Data Recording Map





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Standards/benchmarks/measurement topics/Goals/Objective:

Record your district and grade level connections here: data collection and analysis

Other Content Area Connections

Record your notes and ideas here: content reading

Integration:

ADE Strand 3 of the Reading Standard (Informational Text) can be taught or reinforced with all areas of the Science Standard. Teachers are encouraged to explore the extensive opportunities to integrate writing, math, social studies, technology and the other academic standards with the Science Standard.

Other content reading skills (cause/effect, main idea/details, or vocabulary) may be reinforced using either online or offline reading materials to increase the effectiveness of this lesson. This is a perfect opportunity to integrate with research standards. The teacher can model sea turtle research before individuals/groups complete a similar project.

This lesson/lesson is adapted to integrate science inquiry, link to district standards and connect with problem based learning for Dr. Connie Walker, NOAO and International Dark Skies classroom lessons by Caryl Jones, science educator.

Extensions: PROBLEM-BASED LEARNING (PBL) http://www.pbli.org/pbl/generic_pbl.html

PBL is a learner-centered educational method. In PBL learners are progressively given more and more responsibility for their own education and become increasingly independent of the teacher for their education. PBL produces independent learners who can continue to learn on their own in life and in their chosen careers. The responsibility of the teacher in PBL is to provide the educational materials and guidance that facilitate learning.

PBL is based on real world problems. PBL learning is based on the messy, complex problems encountered in the real world as a stimulus for learning and for integrating and organizing learned information in ways that will ensure its recall and application to future problems. The problems in PBL are also designed to challenge learners to develop effective problem-solving and critical thinking skills.



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THE MINIMAL ESSENTIALS FOR PROBLEM-BASED LEARNING IN EDUCATION In reviewing these essentials it is important to keep in mind the principle objectives of the method. The development of effective and efficient: Problem-solving and reasoning skills, Critical and Creative Thinking skills, Self-directed learning skills, Teamwork skills.... 21st Century Skills

- **Students have the responsibility for their own learning.**
- **The problem simulations used in problem-based learning structured to allow free inquiry.**
- **Learning is integrated with the range of content areas and may include science inquiry.**
- **Collaboration is essential.**
- **What students learn during their self-directed learning must be applied back to the problem with analysis and resolution.**
- **A closing analysis of what has been learned from work with the problem and a discussion of what concepts and principles have been learned is essential.**
- **Self and peer assessment should be carried out at the completion of each problem and at the end of every curricular unit.**
- **The sequence of lessons carried out in problem-based learning, and problems employed in problem-based learning, reflect real-world problems.**
- **Student assessment measures student progress towards the goals of problem-based learning and district learning goals/objectives/standards/benchmarks.**

Problem-based learning (PBL) is a student-centered instructional strategy in which students collaboratively solve problems and reflect on their experiences. Characteristics of PBL are: http://en.wikipedia.org/wiki/Problem-based_learning

- Learning is driven by challenging, open-ended problems
- Students work in small collaborative groups.
- Teachers take on the role as "facilitators" of learning.

Accordingly, students are encouraged to take responsibility for their group and organize and direct the learning process with support from a teacher "facilitator." Advocates of PBL claim it can be used to enhance content knowledge and foster the development of communication, problem-solving, and self-directed learning skill.

The list of reasons includes the fact that problem-based learning (PBL) ends up orienting students toward meaning-making over fact-collecting. They learn via contextualized problem sets and situations. Because of that, and all that goes with that, namely the dynamics of group work and independent investigation, they achieve higher levels of comprehension, develop more learning and knowledge-forming skills and more social skills as well. This approach to teaching brings prior knowledge into play more rapidly and ends up fostering learning that adapts to new situations and related domains as quickly and with the same joyous magic as a stone skipped over a body of water. http://www.ntlf.com/html/pi/9812/pbl_1.htm