

NOAA National Ocean Service Education: The Moon Made Me Do It !

The Moon's Effect On Organisms / 9-12 / Life Science

Focus Question

What effects do lunar cycles have on living organisms?

Learning Objectives

- Students will explain forces that cause and affect tides.
- Students will discuss some of the effects in living organisms that have been attributed to lunar cycles, and explain in general terms how these effects might be produced.
- Students will describe investigations that could be done to determine whether lunar cycles affect specific phenomena in living organisms.

Links to Overview Essays and Resources Useful for Student Research

http://oceanservice.noaa.gov/education/tutorial_tides/ - Tides and Water Levels Tutorial and Subject Review.

<http://www.edusite.com/sci/tides.htm> - Links to internet sites with information about tides

Materials

(optional) Access to the Internet and National Ocean Service Tides and Water Levels Tutorial:

http://oceanservice.noaa.gov/education/tutorial_tides/

Audio/Visual Materials

None.

Teaching Time

Two or three 45-minute periods, plus time outside of class for research and preparation.

Seating Arrangement

Groups of 4 or more students.

Maximum Number of Students

32

Key Words

Tide
Tidal current
Ebb
Flood
Spring tide
Neap tide
Perihelion
Aphelion
Perigee
Apogee
Lunar cycle
Lunar effects

[\(top\)](#)

Background Information

Tides are the periodic rising and falling of ocean waters caused by the gravitational forces of the sun and moon. The vertical motion of tides is accompanied by a horizontal movement of ocean waters called tidal currents. Oceanographers say that tides rise and fall, while tidal currents ebb (during a falling tide) and flood (during a rising tide).

For a simple explanation of tides, it is sufficient to consider only the effects of the moon (the magnitude of the moon's effect is about twice that of the sun, since the moon is closer to the Earth). At any point in a day, one side of the Earth will be closer to the moon than the opposite side. Ocean waters on the closer side of the Earth will experience a greater gravitational pull from the moon than waters on the opposite side of the earth (tide-generating forces vary inversely as the cube of the distance from the tide-generating object). This causes a "bulge" in the waters closest to the moon, and creates a high tide. At the same time, inertial forces on the opposite side of the Earth causes a similar "bulge" creating another high tide. Low tides occur at longitudes that are 90° from the longitudes of locations that are experiencing high tides. The sun

also exerts a gravitational force on ocean waters. Depending upon the positions of the sun and moon relative to the Earth, the sun's gravity may enhance or diminish the tidal effect caused by the moon. When the sun and moon are aligned (at the time of full moon or new moon), their gravitational forces act in the same direction and produce more pronounced high and low tides that are called spring tides. When the sun and moon are at right angles relative to the Earth, the gravitational force of the sun partially cancels out the gravitational force of the moon. The result is less pronounced high and low tides that are called neap tides. The magnitude of tides is also affected by the actual distances between the sun, moon, and Earth: gravitational attraction is increased when the Earth is closest to the sun (perihelion) or moon (perigee), For more information on the causes and types of tides, visit http://oceanservice.noaa.gov/education/tutorial_tides/.

For centuries, people who live and work near seacoasts have understood the importance of being able to predict tides and tidal currents. Low tides may prevent ships from entering harbors, while high tides may make it impossible for ships to pass beneath bridges. Tidal currents may significantly increase the speed of a vessel, or may carry it into dangerous waters. Recreational boaters who anchor near shore may find themselves stranded by a falling tide. Fishermen throughout the world have learned that catches are likely to be much larger during certain portions of the tidal cycle than others.

Many people who live thousands of miles from any ocean also pay close attention to the same lunar cycles that produce tides. Traditional agricultural practices often prescribe planting and harvesting during times when the moon is at a specific location relative to the Earth. Some traditional forestry practices link lunar cycles with specific properties of wood including strength, resistance to decay, and resonance for musical instruments. Lunar cycles have also been linked with many aspects of human biology, behavior, and folklore including crime, suicide, mental illness, birthrates, fertility, werewolves, and vampirism. In this lesson, students will research and analyze various phenomena in living organisms that have been attributed to lunar cycles.

[\(top\)](#)

Learning Procedure

1. If they have not already done so, have students complete the Tides and Water Levels Subject Review at: http://oceanservice.noaa.gov/education/tutorial_tides/. If you choose to have students work in groups, you may want to assign different tutorial sections to each student. Have each student or student group answer questions in the Tides Subject Review. To save class time, you may want to assign this portion of the lesson as homework. Lead a discussion of students' answers to the questions, highlighting ways in which knowledge of tides can be useful and important.
2. Have student groups research and prepare written reports on at least three phenomena in living organisms that are allegedly affected by lunar cycles. Assign one of the following topics to each student group:
 - effects of lunar cycles on reproductive activity in marine animals;
 - effects of lunar cycles on behavior (other than reproduction) in marine animals;

- effects of lunar periodicity on the human reproductive cycle;
- relationships between lunar cycles and crime;
- relationships between lunar cycles and emergency room visits;
- biodynamic gardening;
- effects of lunar cycles on plants; or
- relationship between lunar cycles and farming practices.

Tell students that in addition to their assigned topic, they should identify and report on two additional phenomena in living organisms that are allegedly affected by lunar cycles. Reports should include hypotheses or discussions of the mechanism(s) through which lunar cycles might affect the phenomena being discussed. Direct all groups to review the discussion of lunar myths at: <http://skepdic.com/fullmoon.html>.

3. Have each student group present an oral presentation of their research results and analyses. When all groups have made their presentations, lead a discussion of the pooled results. Reports should reflect a mix of well-documented effects of lunar cycles, as well as "effects" that have no demonstrated factual basis. Discuss possible reasons for widespread belief in "effects" (such as emergency room admissions) for which there is little or no supporting evidence. The discussion at <http://skepdic.com/fullmoon.html> explores the influences of media, folklore, tradition, misconceptions, cognitive biases, and communal reinforcement. Encourage students to discuss how the same factors may affect other popular perceptions about natural phenomena and scientific investigations.

Be sure students realize that lunar cycles almost certainly are important in the timing of some phenomena (such as reproduction in many marine animals). Discuss possible mechanisms through which lunar cycles might affect these phenomena. In many cases these mechanisms are not well-understood, even when the cause-and-effect relationships are well-documented.

Neuro-endocrine systems are thought to be involved in many cases, but the precise ways in which these systems detect variations in lunar cycles are not known. Given the large gaps in our knowledge about these mechanisms, it is entirely possible that many biological phenomena are sensitive to lunar cycles. While skepticism for claims about lunar effects is certainly warranted, it is also important to keep an open mind. In an article about lunar influences on women's reproductive cycles, Winnifred Cutler and co-authors concluded, "Historical indication that fertility rites were scheduled with consideration for the phase of the moon may have been reflecting accurate perceptions which we have yet to discover."

[\(top\)](#)

The Bridge Connection

The Bridge is a growing collection online marine education resources. It provides educators with a convenient source of useful information on global, national, and regional marine science topics.

Educators and scientists review sites selected for the Bridge to insure that they are accurate and current.

www.vims.edu/bridge - Click on "Ocean Science Topics" in the navigation menu to the left, then "Physics." There are many resources on tides and currents in these pages.

The “Me” Connection

Have students write a short essay on why knowledge about tides and water levels is (or might be) important in their own lives.

Extensions

The rise and fall of ocean tides involve huge amounts of energy. Have students or student groups prepare a report on how this energy could be captured in a form that could be used by humans. Reports should include a plausible mechanism for converting tidal motion into useful energy, a strategy for transporting captured energy to potential users, and a rough estimate of the energy that might be available from tidal sources. A keyword search on "tide energy" will produce lots of starting points.

[\(top\)](#)

Resources

http://oceanservice.noaa.gov/education/tutorial_tides/supp_tides_roadmap.html – NOAA's National Ocean Service Web site's Roadmap to Resources about tides and water levels, with links to many other sources of tide data and background information

<http://www.navmetocom.navy.mil> – Naval Meteorology and Oceanography Command Web site with information on waves and tides and other oceanography topics.

<http://mdc.mo.gov/conmag/1998/11/50.htm> - Article about "Lunar Lore" on the Missouri Conservation Commission Web site

<http://skepdic.com/fullmoon.html> – Article about evidence and beliefs concerning full moon and lunar effects.

<http://www.athenainstitute.com/lunarmpl.html> - B., W. M. Schleidt, E. Freidmann, G. Preti, and R. Stine. 1987. Lunar influences on the reproductive cycle in women. *Human Biology*. 59(6).

<http://www.edusite.com/sci/tides.htm> – Links to educational resources on ocean science topics

<http://www.internet4classrooms.com/tide.htm> – Links to Internet resources dealing with tides

<http://school.discovery.com/curriculumcenter/oceans/> – Discovery Channel School resources on ocean science topics.

National Science Education Standards

Content Standard A: Science as Inquiry

- Abilities necessary to do scientific inquiry
- Understandings about scientific inquiry

Content Standard B: Physical Science

- Motions and forces

Content Standard C: Life Science

- Behavior of organisms

Content Standard D: Earth and Space Science

- Energy in the earth system

Content Standard E: Science and Technology

- Understandings about science and technology

Content Standard F: Science in Personal and Social Perspectives

- Personal and community health
- Natural resources
- Natural and human-induced hazards

[\(top\)](#)

Ocean Literacy Essential Principles and Fundamental Concepts

Essential Principle 1. The Earth has one big ocean with many features.

- Fundamental Concept c. Throughout the ocean there is one interconnected circulation system powered by wind, tides, the force of the Earth's rotation (Coriolis effect), the Sun, and water density differences. The shape of ocean basins and adjacent land masses influence the path of circulation.

- Fundamental Concept d. Sea level is the average height of the ocean relative to the land, taking into account the differences caused by tides. Sea level changes as plate tectonics cause the volume of ocean basins and the height of the land to change. It changes as ice caps on land melt or grow. It also changes as sea water expands and contracts when ocean water warms and cools.

Essential Principle 6. The ocean and humans are inextricably interconnected.

- Fundamental Concept f. Coastal regions are susceptible to natural hazards (such as tsunamis, hurricanes, cyclones, sea level change, and storm surges).

Essential Principle 7. The ocean is largely unexplored.

- Fundamental Concept b. Understanding the ocean is more than a matter of curiosity. Exploration, inquiry and study are required to better understand ocean systems and processes.
- Fundamental Concept d. New technologies, sensors and tools are expanding our ability to explore the ocean. Ocean scientists are relying more and more on satellites, drifters, buoys, subsea observatories and unmanned submersibles.
- Fundamental Concept e. Use of mathematical models is now an essential part of ocean sciences. Models help us understand the complexity of the ocean and of its interaction with Earth's climate. They process observations and help describe the interactions among systems.
- Fundamental Concept f. Ocean exploration is truly interdisciplinary. It requires close collaboration among biologists, chemists, climatologists, computer programmers, engineers, geologists, meteorologists, and physicists, and new ways of thinking.

[\(top\)](#)