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***Science Scope***
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Feature

# What Happens to Animals during Hurricanes?

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What happens to the animals? Students frequently pose this question in the aftermath of natural disasters such as last year's hurricanes, earthquakes, and tsunami. They have remarkable compassion for animals. Students want to know if dolphins, manatees, and sea turtles survive. Furthermore, they want to know what they can do to help. Hence, a variety of teachable moments emerge from these incidents. Student curiosity provides a springboard for discussions ranging from weather, to conservation, to biology. Teachers can use these real-world events that spark students' interest to integrate content and interdisciplinary activities. Additionally, students can learn about ways they can help the environment recover from natural disasters. Even if students don't live near the ocean, they likely live or vacation in a watershed where storm-drain, stream, and river waters eventually end up in the ocean.

Interest in how natural phenomena impact animals has intensified as the news related accounts of sharks swimming out to sea prior to hurricanes and elephants fleeing coastal regions during the 2004 tsunami. More recently, a heightened concern surrounded the plight of eight dolphins that were swept into the Gulf of Mexico after Hurricane Katrina damaged the Marine Life Aquarium in Gulfport, Mississippi last August. This subject commonly arises during the hurricane season. The following program of information and activities can help middle school teachers integrate various subjects into their weather lessons using students' concern for animals as a starting point. Additionally, by incorporating the information included about hurricane and tsunami impacts on animals, teachers can effectively address the *National Science Education Standards* in a meaningful way.

Undoubtedly, hurricanes and tsunamis have had devastating impacts. Oftentimes, the human toll and environmental damage take time to assess. Overall, hurricanes and tsunamis can cause an increase in ocean water turbidity, sedimentation, nutrient release, and low dissolved oxygen levels, all of which ultimately impact animals. Strong wave action has caused breakage and die-off of invertebrates such as corals and sponges. Generally, larger vertebrates have been minimally affected. However, there are long-term environmental hazards

associated with debris, oil pollutants, and disrupted nesting sites.

## Pollution effects

After Hurricane Andrew passed over southern Florida in 1992, deposited sediment smothered many sponges (Tilmant et al. 1994). Sea whips and lobsters were missing from hardbottom communities. Pollutants, including marine debris, fuel, and oil spills, were observed. Likewise, numerous pollutants were reported in the Gulf following Hurricane Katrina (NOAA 2005).

Similarly, the Asian tsunami of 2004, which claimed over 150,000 human lives, also caused extensive environmental destruction. While minimal reef damage was found in some areas, the long-term problem was debris (Leatherman 2005). For example, metal objects can leach into the water, thus promoting algae blooms that thrive on iron.

Additionally, debris such as fishing gear can entangle sea turtles and manatees. Debris can be accidentally ingested, including balloons, which sea turtles have mistaken as food. During the 2004 tsunami, one Sri Lankan researcher lost 200 hawksbill sea turtles when waves destroyed his tanks (Chew 2005). Scientists voiced concern that debris-strewn beaches could deter turtles from nesting there.

## Biological effects

A fascinating hurricane phenomenon is how sharks may sense pressure changes associated with storms. For example, at Terra Ceia Bay in Florida, 14 tagged blacktip sharks swam into deeper waters just prior to Tropical Storm Gabrielle's landfall in 2001 (Heupel, Simpfendorfer, and Hueter 2003). When Hurricane Charley approached in 2004, six out of eight radio-tagged sharks being tracked by underwater hydrophones moved to open water (Ichthyology 2004). The other two disappeared from the sensing equipment's range. The timing of the departure appeared to coincide with the decreasing air and water pressure. Scientists proposed that sharks respond to environmental cues (possibly sensing pressure changes in their inner ear).

Just three days prior to Hurricane Jeanne, researchers conducted a survey of the Indian River Lagoon dolphin population in Florida. They were unable to locate any dolphins. Scientists suspect that dolphins react to drastic salinity changes and decreased food associated with hurricane rainfall. Salinity changes may cause a dolphin's health to decline after about 72 hours of fresh water exposure (Harbor Branch Oceanographic Institution 2004).

Balloon debris found on Jupiter beach after Hurricane Wilma.

Fortunately, the eight dolphins swept from the Marine Life Aquarium were rescued following Hurricane Katrina (NOAA 2005). Although they were not wild, they survived in the debris-polluted Gulf for three weeks. While there was one account of a dolphin and her calf caught in a Thailand lagoon after the tsunami, many other dolphins may have sensed pressure changes and swum to safety (Onion 2005).

One report of pygmy killer whales stranding in the British Virgin Islands was associated with Hurricane Marilyn (Mignucci-Giannoni et al. 2000). Five pygmy killer whales were stranded after the 1995 hurricane with chronically compromised respiratory systems. Scientists believed that the hurricane's waves caused the whales to become disoriented as they surfaced to breathe. However, they identified no other records of cetacean strandings

associated with meteorological disturbances. Fortunately, there were no dead manatees reported following Hurricane Andrew (Tilmant et al. 1994). Nonetheless, there were lower survival rates of adult Florida manatees in the panhandle and north Gulf Coast during the 1980s and 1990s when intense storms were experienced (Langtimm and Beck 2003). Massive fish kills were reported in Everglades National Park following Hurricane Andrew (possibly as a result of depleted oxygen levels). However, the impact on fish populations was minimal in many areas (Tilmant et al. 1994).

On coral reefs, varying degrees of impact have been reported all over the world. An assessment of Elkhorn coral conducted in Puerto Rico indicated that hurricanes and white-band disease reduced the coral by over 80 percent during the 1970s and 1980s (Mayer 2004). Consequently, Elkhorn coral was added to the Endangered Species Act candidate species–list. Heavy rainfall experienced during Hong Kong typhoons has profoundly affected corals. Released coral gametes died when surface salinities were drastically reduced in some regions (Morton 2002). In contrast, varied destruction was reported when Tropical Cyclone Ivor passed over the Great Barrier Reef in 1990 (Done 1992).

In Thailand, the Department of Marine and Coastal Resources coordinated an assessment of 174 coral reefs following the 2004 tsunami. It indicated that 13 percent were highly impacted (World Wildlife Fund 2005). Fringing reefs were damaged and many bottom-dwelling organisms disappeared. However, around the Surin and Similan Islands, fish, crabs, and shrimp were abundant. Overall, it will take time to determine the extent of the damage. Scientists have different views about marine ecosystem recovery.

## Conservation activity

Pollution entering animal habitats is an adverse hurricane impact. Prior to beginning conservation activities, have students research how marine debris harms wildlife through entanglement and ingestion or how long debris lasts in the environment (i.e., balloons and monofilament) by visiting websites (see Resources).

Vase sponges and marine debris found on Florida Keys beach after Hurricane Dennis.

To reinforce student thinking about how to care for animal habitats affected by hurricanes, have students discuss how they believe their community disposes of trash (i.e., burning, landfills, or dumping in oceans). Problems caused by dumping plastic in the ocean can be examined using the graphing activity “Plastic in the Sea” (see Resources). Students use actual data from a 1986 Texas beach cleanup to calculate the percentages of plastics, rubber, glass, foam, metal, paper, and wood collected. Students graph the results and answer questions using two other graphs that show an increase in U.S. plastic production and packaging over several years. Students predict what the graph will look like 10 years from now. As a follow-up, students brainstorm ideas for reducing the amount of plastics people use (i.e., alternative products). Once students have completed this activity, they can apply it by participating in a cleanup of a park, neighborhood, or school. This can be done as a class or individually. Students can document the types of debris found, estimate how long it would have lasted in the environment, and recycle or properly dispose of the trash.

Because oil pollution is another hurricane hazard, students can investigate how pollutants are contained, by comparing various methods in an “Oil Spill!” clean-up (see Resources). In this scenario, students are divided into small groups of Environmental Protection Agency teams that must clean up a grounded tanker spilling oil. They

are given materials (i.e., straw, detergent, wood, and string for making containment booms), and a basin of water and oil to create their own spill that they must clean up. They record their results and determine which cleanup method is most effective. (Because oil is a toxin, students should wear safety goggles and plastic gloves.) As an extension, students research using other cleanup techniques (i.e., fire used to burn oil; bioremediation—oil-eating bacteria that changes the oil into a fatty-acid compound that is decomposed by marine organisms).

To encourage students to think about how toxins can enter their environment, have them discuss how their families dispose of car motor oil. Begin by discussing the concept of recycling, why it is important, and what materials can be recycled. Students can research where recycling facilities are located and whether their local service station accepts waste motor oil. Have students survey five people about how they dispose of their motor oil. As part of the survey, students can provide participants with recycling locations and hazardous disposal sites. Discuss the findings of this survey as a class, emphasizing how everyone's actions have consequences.

## Biology activity

Hurricanes cause changes in water salinity, turbidity, sedimentation, nutrient release, and dissolved oxygen levels. To reinforce concepts, students can research animal senses and anatomy using websites and learn how debris can affect algal blooms and dissolved oxygen levels.

Students can perform four scientific measurements—salinity, dissolved oxygen, turbidity, and pH—for water samples based on WOW! The Wonders of Wetlands (see Resources). Teachers take samples from ponds and canals near their school prior to the lab. Background information explains that sunfish in ponds cannot survive in salty water, while fish such as trout need a high level of oxygen to survive, i.e., fast-moving, cold water. Using the data, students discuss how salinity and temperature affect the amount of dissolved oxygen in the water. To tie this into animals, students discuss what is necessary for the survival of marine and aquatic life, and why silt and freshwater influx can cause corals' decline. A similar activity for algal bloom effects causing a lack of oxygen in water is also available (see Resources).

To help students use what they learned from these water quality activities in their everyday life, discuss how they can help prevent water degradation. For example, have students research how lawn fertilizer components (i.e., phosphorous and nitrogen) promote plant growth. They can learn how excess phosphorous and nitrogen entering waterways after it rains are a pollution source (phosphorous promotes algal blooms, which use up dissolved oxygen, thus causing anoxic conditions that are harmful to animals). Students can make sure their families use fertilizers responsibly and refrain from applying them just before it rains.

As a follow-up to all of the activities, reinforce the concept that human action can cause the environment to be more or less vulnerable to future storms. For example, a coral reef's ability to recover from hurricane effects is weakened when people touch living corals or break off pieces. Students can discuss the many ways they can help to protect natural resources, such as:

- learning more about conservation by reading the newspaper or participating in government- and agency-sponsored events;
- properly disposing of hazardous wastes like paint at special sites;

- participating in Arbor Day programs (planting trees to prevent erosion); and
- pulling weeds instead of applying herbicides, or using insects as natural alternatives to pesticides.

## Extensions

While the focus of these activities is marine life, students can also investigate how terrestrial animals are affected by weather around the world, including typhoons, cyclones, and monsoons, using the websites (see Resources). For example, all of the radio-tagged Florida panthers survived Hurricane Andrew in 1994 (Loope et al. 1994).

## Conclusion

Using students' natural curiosity and concern for what happens to animals during hurricanes, teachers can integrate a variety of lessons. While long-term impacts of severe weather are still being observed, the effects of debris and pollution pose an ongoing risk. When students understand how everyone can have an impact, and subsequently practice environmental stewardship, they can help to minimize the damage associated with future hurricanes.

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## Resources

Entanglement and ingestion—
www.epa.gov/OWOW/OCPD/Marine/colunit2.pdf
Debris in the environment—
www.reefrelief.org/printed_edu/index.shtml#signs
National Wildlife Federation. 1992. "Plastic in the Sea." *Nature Scope: Diving Into Oceans*. Washington, DC: National Wildlife Federation.
Event-Based Science module, Oil Spill!—
www.mcps.k12.md.us/departments/eventscience/ebs.OilSpill.html
WOW! The Wonders of Wetlands—
sslserver.com/wetland.org/shop/mainpub.shtml?id=pub
Algal bloom activity—
www.bigelow.org/edhab

## Extension resources

Did Animals Sense Tsunami Was Coming?—
news.nationalgeographic.com/news/2005/01/0104_050104_tsunami_animals_2.html
Tsunami may have dealt blow to marine life—
www.wildsingapore.com/news/20050102/050105-1.htm
Using animals to predict natural disasters like hurricanes, earthquakes, and tsunamis—
www.mongabay.com/external/2005/01_13-sun.html

Science news for kids: A sense of danger—
www.sciencenewsforkids.org/articles/20050413/Feature1.asp
Sharks avoided hurricanes; Animals fled tsunamis—
www.flmnh.ufl.edu/fish/sharks/innews/hurricanes2004.html
Neuroscience for kids: Amazing animal senses—
faculty.washington.edu/chudler/amaze.html
Hurricanes and Florida manatees—
cars.er.usgs.gov/Manatees/Hurricane_Effects/hurricane_effects.html
Animal biology links—
www.nmfs.noaa.gov

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abcnews.go.com/Technology/print?id=383497.

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