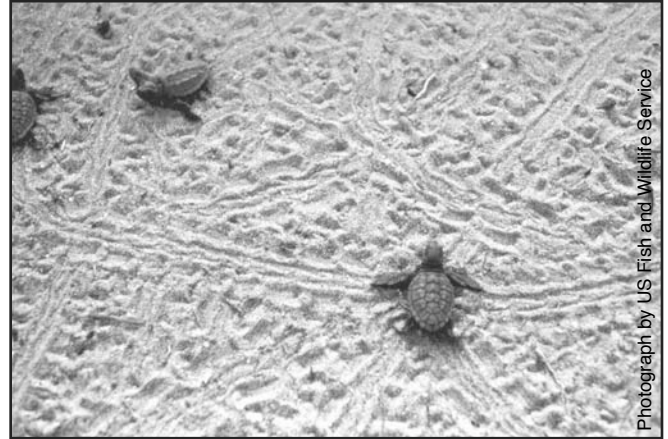


IDA Practical Guide



Photograph by Blair Witherington

Turtle trails that go straight to the ocean, as they should.



Photograph by US Fish and Wildlife Service

Turtles that are confused by light pollution (shown above with their erratic trails), are unable to find their way to the ocean.

Topic: *Effects of Artificial Light at Night on Wildlife*

FROM THE BEGINNING OF EXISTENCE, humans have controlled their immediate environment, building shelters to keep out the elements and fires to banish the darkness. As civilizations continue to develop, humans are able to affect dizzying change on habitats in all corners of the globe. Though agreeable to us, many of the comforts of advanced society are devastating to the creatures that share the earth. A growing body of data suggests that artificial night lighting has negative and deadly effects on a wide range of creatures, including amphibians, birds, mammals, insects, and even plants.

Humans have evolved as diurnal animals, biased toward the daytime and dependant on visual cues, so illumination of our nightscapes seems comfortable and necessary. All animals, including humans, depend on a regular interval of daylight and darkness for proper functioning of behavioral, reproductive and immune systems. Many of these animals need the natural night to survive. For thousands of species, the natural dark night of the evolutionary past is an integral component of their continued existence.

Artificial night lighting harms species directly by triggering unnatural periods of attraction or repulsion that lead to disruptions in reproductive cycles, by fixation, by

disorientation, or by interfering with feeding and sustenance. Light pollution has been shown to disorient migratory birds and hatchling turtles, disrupt mating and reproductive behavior in fireflies and frogs, and interfere with communication in species from glowworms to coyotes. Disruptions such as degradation of habitat, creation of artificial and dangerous habitat, and energy waste that may lead to climate change can all be linked to excessive artificial night lighting. Research biologists are warning that the negative synergy of such combinations can result in a cascade effect, with disastrous results for entire ecosystems around the world.

Climate characteristics vary from one year to the next; it is not uncommon to experience cool summers, dry springs, and slow falls. A season's photoperiod is the only consistent factor in the natural environment. Therefore, many species of plants and animals rely on the length of the day to indicate the proper season for mating, molting, and other life cycle activities. This photoperiodic sensitivity is often so acute that many species can detect discrepancies in natural light as short as one minute. Reproduction cycles are most often disrupted when artificial light at night interferes with species' natural detection systems. Trees have been known to bud prematurely; some flowers cease blooming. Artificial light also can cause animals such as squirrels and robins to mate out of season. Changes in plant and animal reproductive activity can create difficulty in finding food and increase chances of starvation.

- Diurnal**— active during daylight
- Photoperiod**—duration of sunlight as determined by season (photoperiodic—internal clock governed by how long the day is)
- Phototaxis**—movement in response to light
- Predation**—predatory behavior in animal relationships



Pine Barrens tree frog

Photograph by U.S. Fish and Wildlife Service

There is evidence that the use of high and low pressure sodium light in ecologically sensitive areas such as wetlands, woods, and coastal areas has less impact on habitat and life cycle behavior than use of other kinds of light. The relatively monochromatic wavelength emitted by the yellow tinted sodium vapor lights attracts fewer insects and can be more easily filtered to minimize negative effects.

Insects, frogs, toads, and salamanders have demonstrated both physical and behavioral disruptions as a result of artificial night lighting. A majority of frog and toad species are nocturnal and, because they must remain close to a water source, are less able to compensate for changes in the environment by relocating.

Like other amphibians, salamanders are currently suffering population declines around the world. Many species of pond-breeding salamanders show strong site fidelity to their home ponds, and studies to date have shown that artificial illumination can disrupt salamanders' ability to return to home ponds to breed.



Insects are attracted to the white light of floodlights.

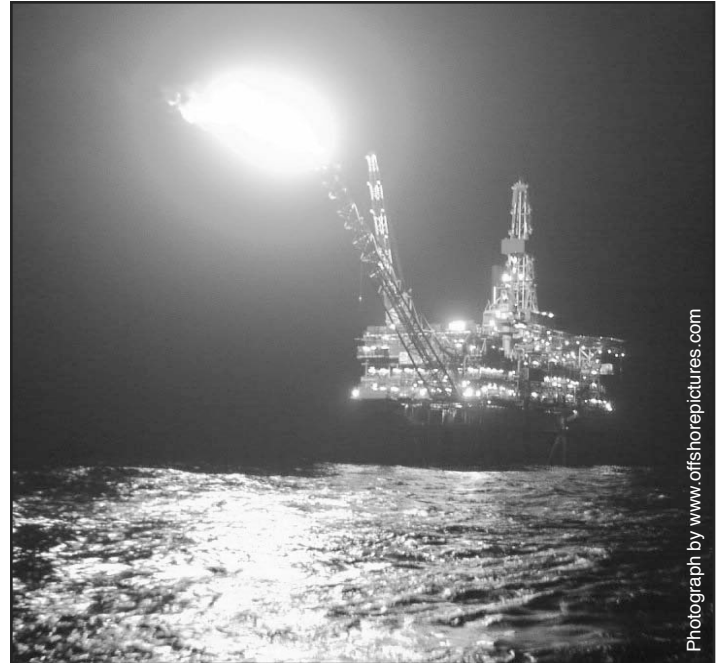
Photograph by Alexei Pace

Artificial light at night contributes to lack of food (starvation) by interfering with predator/prey relationships. For instance, moths and other night-flying insects are attracted to lights. This involuntary phototaxis leads to their easy capture. Their incessant gravitation toward artificial points of light not only makes them vulnerable as prey and subjects them to increased predation, but disrupts the normal nocturnal patterns of predator species by creating an artificial feed concentration around points of light. For some species of predators, such as bats or birds that are not repelled by light, this disruption means a change in the concentration and location of their feed, which can lead to imbalances in predator/prey ratio. For species repelled by light, such as horseshoe bats, long eared bats, and mouse eared bats, feed becomes scarcer and difficult to procure, as many insects swarm around lights, leaving fewer to be caught as they fly free. The decreasing amount of available food due to



Photograph by Cameron Hansen

Visible for miles, squid boat lights unnaturally attract species of fish and migratory birds.



Photograph by www.offshorepictures.com

Relentless lights are common on offshore oil platforms.

Upon discovering the magnitude of fatal bird collisions,

some cities are initiating mitigation procedures. The Lights Out Toronto campaign, established in 2006 in Toronto, Canada calls for residents to turn out any unnecessary lights for the protection of migratory birds. In addition, the city has issued bird friendly development guidelines for all new buildings, which include the control of unnecessary artificial light. In September 2008, Boston, MA, USA began a two-month initiative to conserve electricity by shutting off lights at 34 city skyscrapers. A stated purpose of this project was the protection of migrating birds. Chicago, IL and New York, NY USA also participate in a “Lights Out” during migration season.

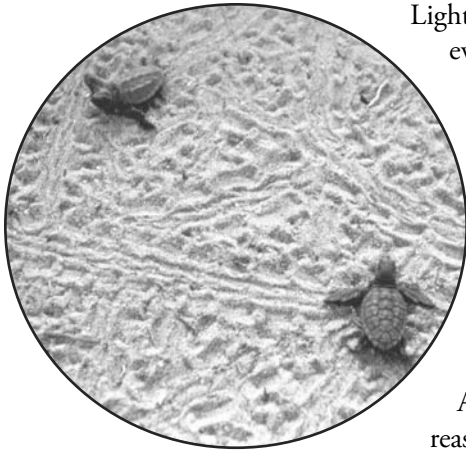
As awareness of the danger of artificial light to sea turtles grows,

an increasing number of communities are restricting coastal illumination. Countries all over the world have passed ordinances that control the amount and type of light used in coastal environments. As the list grows, hatchling sea turtles are starting to be able to find the sea without the help of human volunteers to guide them. Learn more about local and regional action by visiting www.seaturtle.org.

a combination of habitat loss and life cycle disruption is causing many bat populations, such as Europe’s horseshoe bat, to become threatened or endangered.

Since the eyes of nocturnal animals are specially evolved for foraging in low-light conditions, small changes in illumination can compromise strategies and profoundly alter their relationship with prey species. Even fish are affected by artificial light. Some species of fish, normally exposed only to natural light sources such as phosphorescence, can be temporarily blinded and left vulnerable by artificial light. Artificial light also inhibits normal anti-predation behavior such as schooling, and can affect migratory patterns in species such as salmon and sockeye fry.

Offshore, brightly lit oil and gas platforms and squid vessels that attract prey and affect numerous species of fish with lights pose both primary and secondary hazards to marine birds. The illumination and heat of offshore hydrocarbon platforms and squid fishing vessels also encourage algae growth, attracting fish and invertebrates. Marine birds are then killed around squid vessels by swallowing hooked prey or by feather contamination in oil-fouled water at hydrocarbon platforms. Marine birds that feed on bioluminescent prey may be particularly sensitive to light source attraction, many threatened and endangered species at great risk from artificial ocean lighting. Many species are susceptible to fixation—also known as “capture”—on artificial lights at sea; exhausted birds will circle for hours or days until they fall into the sea. Off eastern Canada in 1998, tens of thousands of seabirds were observed circling the newly operational Hibernia platform, fixated by an unrelenting point of illumination.



Light fixation is a constant bird hazard that continues to kill thousands of birds in urban areas every year. Hundreds of terrestrial bird species fly and migrate under cover of night. While the mechanisms for birds' attraction to artificial night lighting are not well understood, its hazards to birds have been well documented. During the 1960s, it is estimated that over a million birds a year were killed in collisions with lighted television towers in the United States. Since that time, the number and height of communication towers has increased exponentially. Skyscrapers and other urban buildings also threaten birds, posing collision, fixation, and disorientation hazards.

Light and Sea Turtles

Artificial light at night is devastating sea turtle populations around the world for several reasons. Studies in Florida have shown that loggerhead, leatherback, and green turtle females choose the darkest beaches for their nest sites and will not nest at beaches lit by mercury vapor lights. On beaches subject to indirect light trespass, turtles will avoid the more brightly lit areas in preference to the dark. Nests are, therefore, more concentrated in the dwindling dark spaces, causing more hatchlings to succumb to predators and other site-specific hazards.

However, the most deadly problem facing these internationally protected sea turtles is disorientation from excessive and carelessly placed light. Many types of coastal illumination, including street, residential, and business lighting, confuses newly emerged hatchlings, which instinctively orient to the brightest light source. For thousands of years, this source was the reflection of moon and starlight on the sea. The turtles' natural programming allowed them to reach the water safely. Today, development along coastlines can cause hatchlings to head inland instead toward artificial lights, where they die of exhaustion, dehydration, predation, and road traffic. Each year, Florida alone loses hundreds of thousands of hatchlings.

Inappropriate artificial night lighting disrupts physiological as well as environmental functions. Hormone production in vertebrates, for example, is regulated by the circadian rhythm. Studies in humans and rats show a correlation between exposure to even low levels of illumination during normally dark hours and depressed levels of melatonin (a hormone produced in the retina), resulting in an increased risk of accelerated growth in breast cancer tumors. The effect of artificial night lighting on melatonin and other hormonal systems has yet to be studied in the wild, a study made more difficult by the scarcity of natural dark night conditions in most Western ecosystems.

While the wide range of potential damage caused by artificial light at night is still being discovered, steps to reset the natural balance between light and darkness are already being taken. To help preserve wildlife and minimize damage to ecosystems, start by following the steps listed in the Practical Actions to the right. A list of resources to increase knowledge of these topics and links to information on local and regional action groups can be found at the end of this practical guide.

Practical Actions:

- Turn off unnecessary lights around your house and yard.** Use timers and sensors to help put light only where and when it is needed.
- Use fully shielded fixtures to direct the light ONLY WHERE NECESSARY FOR COMFORT AND SAFETY.**
- See red:** Use red filters on house and street lights. Red lights emitting a low wavelength generally have less of an impact on wildlife. Sea turtles and other coastal creatures, as well as amphibians and many species of insects, react especially well to red light—by hardly reacting at all.
- ...or yellow:** Yellow lights such as high pressure sodium (HPS) or low pressure sodium (LPS) lamps attract fewer insects and moths (think of your typical yellow front porch bug light). If light is required, advocate for their use in environmentally sensitive areas such as coastal regions or forest preserves.
- Get educated:** field guides and nature walks will help identify vulnerable species in your area.
- Raise awareness:** Most people are blind to the impact artificial light has on wildlife. A presentation to a social club or activist group could increase interest and win supporters.
- Ask that any further development in your community include a report on ecological issues of light pollution in their environmental impact statement.**

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Cinzano, P., F. Falchi, and C.D. Elvidge. "The First World Atlas of the Artificial Night Sky Brightness." *Monthly Notices of the Royal Astronomical Society*. 328 (2001): 689-707.

Rich, Catherine, and Travis Longcore, eds. *Ecological Consequences of Artificial Night Lighting*. Washington: Island Press, 2006.

Related Practical Guides and Web Links:

Blair E. Witherington and R. Erik Martin. "Artificial Lighting and Sea Turtle Hatchling Behavior." *Florida Marine Research Institute Technical Reports*. TR-2 (1996)—http://research.myfwc.com/features/view_article.asp?id=2156

Cinzano, P., F. Falchi, and C.D. Elvidge. "The First World Atlas of the Artificial Night Sky Brightness." *Monthly Notices of the Royal Astronomical Society*. 328 (2001): 689-707. *Light Pollution in Italy*. 2006—<http://www.lightpollution.it/cinzano/download/0108052.pdf>.

FLAP—Fatal Light Awareness Program—<http://www.flap.org/>.

FWC—Florida Fish and Wildlife Conservation Commission—http://www.myfwc.com/WILDLIFEHABITATS/Seaturtle_Lighting.htm
[seaturtle.org](http://www.seaturtle.org)— <http://www.seaturtle.org>

For information on IDA membership and donations, visit our Web site at www.darksky.org.