



TEN STRESSES ON THE PLANET

Ozone Hole

The effects of Earth's thinning ozone layer are far reaching. Increased ultraviolet radiation is linked to declining amphibian populations, increasing rates of skin cancer and cataracts in humans, and possibly serious interference with photosynthesis and metabolism in plankton—the base of the marine food chain. Chlorofluorocarbons (CFCs), previously perceived as harmless compounds, have turned out to be the driving force behind the growing ozone hole.

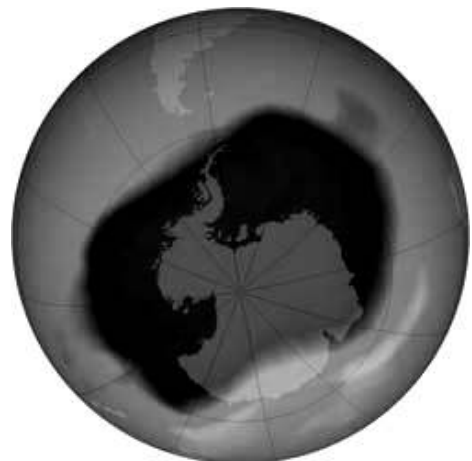
IMPACT ON WILDLIFE

Fourteen species of amphibians have disappeared from Australia in recent years, and frogs are endangered in the western US. Possible causes are the use of pesticides and nitrogen-based fertilizers and habitat loss from filling wetlands. However, some of the losses are occurring in high mountain lakes where none of these factors are present.ⁱ In 1994 Oregon State University zoology professor Andrew Blaustein took a team to examine toads at a lake in the Cascade Mountains. Instead of finding 500 paired toads, as Blaustein had in previous years, the team found only 147. They observed almost two million eggs being laid, but two days later the eggs began to turn white and disintegrate. A week after being laid, only half were viable. In further experiments, Blaustein found that ultraviolet radiation killed frog and toad eggs. He suspects that thinning of the ozone layer, with increasing ultraviolet (UV) radiation, is contributing to frog and other amphibian deaths.ⁱⁱ

THE EFFECTS OF CFCs

Chlorofluorocarbons (CFCs), the primary driver of ozone depletion, were considered miracle compounds when first discovered in 1928. They are chemically stable, inflammable, and nonpoisonous. Manufacturers used them as coolants for refrigeration and air conditioning, for propellants in spray cans, in plastic foam, and in cleaning solvents for circuit boards.ⁱⁱⁱ By the 1960s, international CFC production approached a billion pounds a year.^{iv} About four decades after they were introduced, University of California chemists Rowland and Molina began tracking CFCs. They hypothesized that CFCs would rise to the upper atmosphere (6-30 miles above Earth's surface) where UV radiation would break them down, releasing chlorine. One chlorine molecule can destroy up to 100,000 ozone molecules. In other words, CFCs could deplete the ozone layer that protects the planet from the sun's most damaging radiation—radiation that can cause skin cancer and cataracts and weaken the body's ability to fight disease.^v

In 1981 NASA satellites found a thinning of the ozone layer, confirming Rowland and Molina's hypothesis. In the 1980s, research indicated that UV radiation caused cell and tissue damage in many organisms, and concern was growing that it could have serious effects on the



photosynthesis and metabolism of plankton at the base of the marine food chain.^{vi} A Texas A&M researcher found that increased ultraviolet light induced a decrease in phytoplankton in Antarctic waters.^{vii} Public health officials cautioned people to wear sunglasses to protect against cataracts. In the US, the incidence of the most dangerous form of skin cancer, melanoma, doubled in the 1980s. Whereas a child born in the 1930s had a 1 in 1,500 risk of developing melanoma, a child born in 1988 had a 1 in 135 risk.^{viii}

While CFC use has decreased dramatically, the level of these chemicals in the atmosphere remains high because the molecules from previous emissions are still there. CFCs remain in the atmosphere for about a century before giving up their chlorine.^{ix} By 1992, the hole over Antarctica had grown to nearly three times the size of the US.^x In 2006, the ozone hole was the largest ever measured.^{xi} It may be decades before scientists detect an improvement in the ozone layer and at least the middle of this century before it returns to its 1970s' levels.^{xii} Scientists cannot predict the ultimate effect of increased ultraviolet radiation on ecosystems.^{xiii}

WHAT IS BEING DONE?

As a result of public pressure, the US banned CFCs in aerosol cans in 1978. In the Montreal Protocols of 1987 and 1990, 150 nations of the world agreed to phase out ozone-depleting substances by 2000.^{xiv} Although the treaty is not ideal—HCFCs (used in home air conditioning units and heat pumps) and methyl bromide (used to fumigate soil before planting crops such as strawberry plants) are still in use—it basically represents a success story.^{xv} Seldom has the international community reacted so quickly to an environmental threat.

ⁱ Hill, Richard, *The Oregonian*, 2/19/00

ⁱⁱ Blaustine, Andrew, "Amphibians in a Bad Light," *Natural History*, October 1994

ⁱⁱⁱ Hinrichsen, Don, *The Amicus Journal*, Fall 1996

^{iv} Peterson, Cass, *Sierra*, January/February 1988

^v Hinrichsen, Don, *ibid.*

^{vi} "A Gaping Hole in the Sky," *Newsweek*, 7/11/88

^{vii} Cole, Richard, The Associated Press, 1990

^{viii} Bender, Frederic, *The Culture of Extinction*, 2003

^{ix} Oppenheimer, Michael, Environmental Defense, September 1993

^x *Atmosphere*, February 1993

^{xi} *Technology News Daily*, 10/23/06

^{xii} www.NOAA.gov, accessed 3/28/06

^{xiii} Oppenheimer, Michael, *ibid.*

^{xiv} Hinrichsen, Don, *ibid.*

^{xv} Oppenheimer, Michael, *ibid.*