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WILDLIFE AND HUMAN DISEASES:

Symptoms of Endangered Marine Ecosystems and Climate Change

MAY 2001

The Center for Health and the Global Environment, Harvard Medical School; Wildlife Trust; the Consortium for Conservation Medicine; and the Environmental and Energy Study Institute hosted a Congressional briefing entitled "Wildlife and Human Diseases: Symptoms of Endangered Marine Ecosystems and Climate Change." The marine coastal environment is being subjected to increased pressure from residential, recreational, and commercial development. The combined effects of spills, leaks and accidents associated with oil extraction and transport further weakens coastal ecosystems leaving them vulnerable to injury. These disturbances, in conjunction with new stresses posed by climate change, is adversely affecting the health of marine life. An increase in disease among marine species raises significant concern on the part of scientists, environmental researchers, and policymakers who believe such events herald heightened risk to wildlife and humans.

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year in the warmest decade in the warmest century in the last 1,000 years, according to a recent study of the United Nations. Atmospheric levels of carbon dioxide are the highest they have been in 420,000 years, and it is projected these levels will continue to increase. Records of past climate conditions indicate a close correlation between concentrations of carbon dioxide in the atmosphere and global temperature. We already are witnessing changes in our climate due to global warming that ultimately will affect human beings, stated Congressman Oberstar. For example, the zone at which the malaria-carrying mosquito larvae can live, which is above 62 degrees Fahrenheit, is widening due to warming trends. "Debate about global climate change will go on until people realize that their life and health is directly threatened – and then it will be too late," cautioned Congressman Oberstar.

PANELISTS

Representative James L. Oberstar (D-MN)

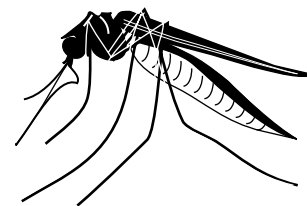
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Alonso Aguirre
Director for Conservation Medicine, Wildlife Trust

Raymond L. Hayes, Jr.
Assistant Dean for Medical Education, Professor of Anatomy, Howard University School of Medicine



We are facing two major global problems that are related: a rise in infectious diseases and global climate change, explained Dr. Paul Epstein, associate director of the Center for Health and Global Environment at the Harvard Medical School. Our biological systems are beginning to respond to the increase in intensity in extreme weather events associated with global warming. Warming of the atmosphere affects the water cycle, melting ice caps and accelerating the release of water vapor. For example, water vapor has increased 10 percent over the United States in the past few decades. Satellite data indicates the ocean has warmed three kilometers deep. The destabilization of ocean systems caused by climate change and other factors is affecting marine life through a rise in infectious diseases and mortality. Such factors also affect our planet's biodiversity as oceans compose 95 percent of the biosphere and are home to the greatest diversity. These adverse effects to marine life and biodiversity are crucial to understand because they are harbingers of increased risk to human beings.

MARINE MAMMALS FACE INCREASED MORTALITY RATE

Sea otters are considered a keystone species and are sentinels for monitoring the health of near shore coastal systems because their diet is toward the top of the food chain and they consume 25 percent of their body weight in shellfish. Since the spring of 1995, there has been an approximate 12 percent decline of the southern sea otter. Nearly 1,000 otters have been found dead along the California coastline in the past five years. If present trends continue, this "threatened" population may be moved to "endangered" within the next few years.

There are a number of possible factors that could be causing the relatively high mortality rate of adult sea otters, explained Dr. David Jessup, senior wildlife veterinarian with the California Department of Fish and Game. Of great significance is the fact that 40 percent of the fresh dead sea otters studied have died of parasites and infectious diseases. This includes infections in the brain and intestine and opportunistic pathogens that do not usually kill healthy adults.

Dr. Jessup stated that sea otter mortality is associated with peak river flows and storm events. Researchers believe that parasites are entering water bodies through untreated or partially treated sewage and terrestrial animal waste carried in storm water runoff. In addition to biological pollutants, oil refineries in San Francisco and Los Angeles discharge chemical pollution. Scientists believe that sea otters are more vulnerable to parasites and bacteria, such as *Toxoplasma gondii* and *Sarcocystis neurona*, because pollution and other disturbances have weakened their immune systems.

MARINE BIRDS ARE MONITORS OF MARINE HEALTH

Marine birds are good monitors of marine health, explained Dr. Flo Tseng, assistant professor at Tufts University School of Veterinary Medicine. The colonial nesting habits of sea birds make them particularly vulnerable to large-scale mortality events. Sea birds have fairly long lifespans and eat high up in the food chain, which exposes them to a significant amount of environmental contamination.

Chemical pollution from a variety of sources has increased the vulnerability of marine birds to infectious diseases. Routine petroleum spills, such as pipeline breaks, oil platform accidents, and dumping of fuel waste, releases more oil into the ocean than the highly publicized tanker accidents. In 1999, for example, approximately 32 million gallons of oil spilled worldwide into marine and inland environments as a result of 257 incidents. Nitrogenous pollution, combined with rising ocean temperatures resulting from global climate change, has contributed to harmful algae blooms. Plastic waste, such as disposable cigarette lighters, is ingested by marine birds with harmful effects. In addition, scientists are seeing a rise in the emergence of infectious diseases, such as the West Nile virus and Newcastle disease virus, probably being caused by increased exposure to biological and chemical contamination and immune system suppression resulting from chemical pollution. Threats to marine bird survival should serve as a warning of significant ecological change to coastal marine ecosystems, stated Dr. Tseng.

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– Dr. Flo Tseng

SEA TURTLES ARE VULNERABLE TO ENVIRONMENTAL STRESSES

Sea turtles are ancient species and good sentinels of marine ecosystem health, explained Dr. Alonso Aguirre, director for Conservation Medicine at the Wildlife Trust. We currently dump 80,000 different pollutants into the environment. Tourists are another source of stress to sea turtles' habitat and lifecycle. Global climate change intensifies these effects by altering beaches, shifting nesting behavior, and even changing the sex of new turtle hatchlings. For example, slight increases in temperature can cause an increase in the number of females born. Of significant concern to scientists is the fact that all species of marine turtles are experiencing increased rates of microbial diseases and tumors, including an epidemic of fibropapillomatosis. Field observations indicate a high prevalence of tumors in turtles associated with heavily polluted coastal areas and regions of high human density. According to Dr. Aguirre, further research to identify causal agents of disease and the health of coastal marine systems that serve as the primary feeding grounds for turtles is needed.

CORAL REEFS ARE DYING



Figure 1. Black Band Disease, a coral disease caused by infection of a microbial consortium.

"The coral reefs of the world are dying," warned Dr. Raymond L. Hayes, assistant dean for Medical Education and Professor of Anatomy at the Howard University School of Medicine. Close to 30 percent of the world's reefs have been lost since the 1980s and studies suggest this damage will double without intervention. As coral reefs die, associated ecosystems – including human systems – are affected.

Tropical reefs have been in existence for 6,000 to 8,000 years, stated Dr. Hayes. Considered the most biodiverse ecosystem on the planet, reefs are home to an estimated 60,000 different species. Coral reefs are facing large-scale destruction due to an increase in coral bleaching and infectious disease.

The bleaching of coral tissue caused by the loss of pigmented algae is associated with warmer ocean temperatures. Reef building coral begin their lifespan as free-swimming organisms that settle down and begin to secrete calcium carbonate that form the reef framework. Tropical reefs function in a narrow range of temperature associated with tropical zones, and temperatures exceeding 30 degrees Celsius can cause serious damage to coral ecosystems.

"The coral reefs of the world are dying," warned Dr. Raymond L. Hayes

In addition to ghostly discoloration of coral, scientists are seeing an increase in the appearance of coral diseases, including black band disease (See Figure 1), red band disease and the plague. Stony coral is slow growing and has minimal capacity for self-defense against microbial invasion. Within a few days, a disease such as coral plague will denude coral of its soft tissue. The organisms affecting coral are also human pathogens and pose risks to human beings coming into contact with this environment. In addition, increased erosion of our coasts is introducing shoreline contaminants to coral ecosystems.

IMPLICATIONS FOR HUMAN HEALTH

According to Dr. Epstein, the marine environment is experiencing increased stress caused by the complex interaction of a number of factors:

- (1) An increase in nutrient deposits from farming, the burning of fossil fuels, and sewage
- (2) Over harvesting and loss of habitat, such as wetlands that help to filter pollution
- (3) Mutagens, such as chemical pollution, radioactive material, and viruses
- (4) Extreme weather events that flush more contaminants into marine ecosystems

These conditions have increased exposure to contamination as well as compromised the immune systems of marine species, according to researchers. According to Dr. Epstein, we are witnessing a growing disease burden in marine wildlife that ultimately can affect human health.

RESEARCH AND POLICY ASSISTANCE NEEDED

According to the panel, aggressive public policy is needed in the following areas to reduce damage to marine ecosystems and risks to human health:

- Reducing ocean sewage pollution through tertiary treatment requirements
- Monitoring chemical output to ocean systems
- Reducing petrol-chemical pollution and usage
- Mobilizing the international community to reduce petroleum spillage
- Installing double haul tankers worldwide
- Supporting research to identify the different causes of marine animal disease and coral reef destruction

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This briefing was made possible by the generous support from The Oak Foundation, The Educational Foundation of America, The Homeland Foundation, and The Richard and Rhoda Goldman Fund.

