

# *Wildlife and Human Diseases: Symptoms of Endangered Marine Ecosystems and Climate Change*

Background for Congressional Briefing  
May 22, 2001

The coastal marine environment is being subjected to increasing pressures from residential, recreational, and commercial development. Spills, leaks and accidents associated with oil extraction and transport create additional disturbances. The combined impacts are altering coastal marine biology, while the new stresses posed by warming and a more volatile climate are contributing to the emergence of diseases across a wide range of species.

Diseases and adverse events affecting marine life are key indicators of environmental conditions and thus serve as sentinels of change in marine ecosystems. This briefing will examine diseases emerging in the coastal environment among marine mammals, marine birds, sea turtles, coral reefs and those directly impacting human health. We present these findings with the aim of educating the public about the growing consequences of human activities, compounded by a changing climate, in the belief that this knowledge will contribute to ecological preservation and restoration, and to policies that promote cleaner and healthier development.



Sponsored by The Center for Health and the Global Environment at Harvard Medical School, Wildlife Trust, The Consortium for Conservation Medicine and the Environmental and Energy Study Institute.

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

## Marine Mammals

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Central California is the range of the southern sea otter (*Enhydra lutris*

*nereis*), a species listed as “threatened” under the Endangered Species Act. The southern sea otter is also a keystone species in the kelp forest ecosystem and an excellent sentinel species for monitoring nearshore marine ecosystem health. The approximately 12% decline of the southern sea otter since the spring of 1995 has been viewed with some alarm by conservationists and indeed, if present trends continue, this “threatened” population may be a candidate for ‘endan-

gered’ status within 2-3 years.

Previous work suggests that contaminants (tributyltin and PCBs) may predispose sea otters to dying from infectious diseases. Indeed mortality rates appear to follow years of higher than normal runoff and subsequent release of a variety of contaminants into the nearshore environment. High runoff often follows multiple Pacific Ocean storms such as occur during El Niño events. Recent disease research shows that prime age adults are dying from a number of infectious diseases and parasites that may be related to introduced pathogens and pollutants. Please see the 19 February 2001 issue of *The Scientist* for further details.

## Marine Birds

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Marine birds serve as effective sentinel species for many ecosystem imbalances in the coastal

marine environment. Many seabirds nest colonially, often in large numbers, and in a variety of different ecological niches. Because of these characteristics, large numbers of these visible animals may be exposed to multiple threats to their individual and population health. In addition, because some species of marine birds are long-lived and are high in the food chain, these birds may exhibit the effects of cumulative exposure to pollutants, contaminants and other insults over their life spans.

Certain species have biological habits that increase the likelihood of encountering detrimental alterations to their environment. For example, sea ducks ingest filter-feeding mollusks that concentrate contaminants. Discarded trash, such as plastic “six-pack” rings, encircle the necks and bodies of marine animals, while plastic cigarette lighters are ingested by adult albatross feeding on squid and regurgitated to their young, which subsequently die from foreign body impactions. Many marine birds suffer morbidity (illness) and mortality (death) from entanglement in fishing lines and hooks left by recreational fishermen. On a

larger scale, fishing practices, such as gill netting and long line fishing, result in huge numbers of marine bird deaths each year.

Our dependence on fossil fuels and the fact that huge oil tankers regularly ply our coastlines means, inevitably, that oil pollution is another major factor in marine bird mortality worldwide. The Oil Spill Intelligence Report states that in 1999, approximately 32 million gallons of oil spilled worldwide into marine and inland environments as a result of 257 incidents. Other pollutants, coupled with global climatic change and rising ocean temperatures, contribute to larger numbers of harmful algal blooms or HABs, popularly known as “red tides.” These algal blooms produce a variety of biotoxins that are inhaled or ingested by marine birds and other marine species. The long-term effects of contaminants, such as PCBs and heavy metals, in marine birds are only now being documented. Reports of infectious disease outbreaks, such as Newcastle disease virus, vibriosis, and others, have risen in number, perhaps as a result of increased exposure to domestic animal and human population waste and/or immune suppression from contaminant exposure. Lastly, there are large-scale seabird mortality events that remain unexplained despite intensive investigation. The threats to marine bird survival should serve as a warning to us that our coastal marine ecosystems are undergoing dramatic ecological change.



Recent evidence indicates that marine turtles may be particularly vulnerable to a variety of environmental insults, such as

unusually high and low sea temperatures, pollutants, infectious agents and marine biotoxins. Harmful effects include compromised physiology, impaired immune function and an increase in disease prevalence. The high profile of sea turtles and the extensive sampling programs and stranding networks already in place offer an effective platform for monitoring the health of marine turtle populations. All species of marine turtles, especially green turtles (*Chelonia mydas*), are being threatened by an epidemic of fibropapillomatosis (FP). This debilitating disease, characterized by multiple cutaneous masses, is suspected of having a viral origin. Field observations support that high prevalences of tumors in turtles are associated with heavily polluted coastal areas, areas of high human density, agricultural



Although they are considered the most biodiverse, multi-functional, aesthetically pleasing, and eco-

nomically significant of coastal marine ecosystems, coral reefs are perilously threatened by stresses and diseases that portend their global collapse in the very near future. The coral reef is a highly significant and richly diverse ecosystem within the global tropical biome. That ecosystem is structurally, functionally and metabolically essential for sustaining the health and productivity of more than one hundred island nations and coastal zones of continental nations. The nearshore and shallow water domain of coral reefs exposes them simultaneously to oceanic, atmospheric and terrestrial processes. Environmental perturbations are now exacerbating threats to coral reef flora and fauna. Signs of reef health decline are appearing more frequently, over

## *Marine Turtles*

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runoff, and/or biotoxin-producing algae.

During the winter of 1999-2000, a major sea turtle “cold-stunning” stranding event occurred in Cape Cod Bay (6 fold over the 20 year average), when juvenile sea turtles of three species washed up alive, as water temperature dropped suddenly below 50°F (10°C). Another “cold-stunning” event occurred in Florida this winter (2000-2001). At low temperatures, turtles are unable to swim and maintain buoyancy, thus strand. Cooling in the North Atlantic Ocean, perhaps driven by anthropogenically-derived warming and melting of Greenland and North Polar ice, may have cooled the Labrador Current in the past several years.

The long-lived sea turtles are excellent sentinel species for coastal marine habitats. It is possible that FP will serve as a key, integrating indicator. Further research to identify the causal agent and its association with environmental variables would provide parameters to improve our measurement of the health of coastal marine ecosystems that serve as primary feeding areas for sea turtles as well as desirable sites for ecotourism.

## *Coral Reefs*

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broader areas, and for more prolonged periods.

Global climate change, with warming ocean temperatures, is now recognized as a triggering factor in coral bleaching. The impact of this change has been to increase the mortality and morbidity of keystone species of the coral reef. Also, coral reefs have become significant reservoirs for the growth and dissemination of several known human pathogens. These pathogens pose significant risks to public health because of their ease of transmission within the food chain and directly, through superficial wounds. As such, the infections represent threats to marine organisms as living natural resources, and to the health of people who live near, derive food from or merely visit that environment. The maintenance of public health depends upon the development of effective strategies to maintain stable, dynamic and viable reef ecosystems and to preserve marine water quality, especially given the new stresses imposed by a changing climate.



Unusually warm ocean temperatures and a wide variety of chemical pollutants can weaken host immune systems. Warmer

waters can also stimulate the growth of pathogens, while sudden changes in ocean temperature can present additional stress by increasing metabolism and food requirements. Heavy rain events can provide sudden pulses of nutrients, chemicals and viral and bacterial pathogens that contaminate the coastal marine environment.

Provided sufficient nutrients, higher ocean temperatures can also contribute to blooms of toxic or otherwise noxious phytoplankton, referred to as harmful algal blooms (HABs). HABs can have detrimental effects on a wide variety of organisms – fish, reptiles, birds and mammals, including humans. Such blooms are also associated with hypoxia (low oxygen) and "dead zones," where the productivity of coastal marine systems collapses.

Coastal contamination, loss of filtering wetlands, and climate change and extreme weather contribute to seafood-borne and swimming-related illnesses.

## *Conclusions*

We are witnessing the degradation of coastal marine habitat and excessive nutrient, chemical and pathogen loading from farming, coastal development, animal and human waste, and the burning of fossil fuels. Extreme weather events, such as heavy rainstorms and flooding, have increased in intensity, and are projected to increase in frequency with continued climate change. Together, these human-induced changes in regional and global environments are altering the productivity of bays and estuaries, and are contributing to a growing disease burden in marine wildlife. Some of the diseases can affect humans directly, while overall, this emerging trend threatens to alter the species composition and healthy functioning of coastal marine systems.

- Improved and coordinated monitoring of marine wildlife and humans exposed to the marine environment is needed to better understand the full scope of impacts and their ecological implications.

- Environmental policy options include stricter control of sewage and fertilizer inputs, maintenance and restoration of coastal wetlands, and restoration of flood plains along riverways that absorb contaminants and floodwaters.

- Finally, burning fossil fuels generates significant nitrogen inputs (acid rain) directly into coastal and aquatic systems, and the aggregate of emissions is altering the climate. Incentives for clean energy are needed to halt their contribution to the diseases now threatening humans, habitat and wildlife.

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