



Effects of Climate Change on Marine Mammal Health and Disease

Temporally- and spatially-structured surveillance is needed to increase our understanding of the effects of climate change on marine mammals

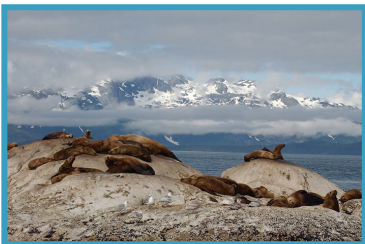
What We Know:

1. Examination of stranded marine mammals has detected biotoxins, infectious agents and pathologies that are influenced by climate change.
2. The distribution of some infectious agents that can cause disease in marine mammals, other marine wildlife, and people is changing with warming oceans.
3. Decreased coastal water salinity and increased inputs of land-based pollutants from extreme precipitation and storm events pose a risk to the health of coastal ecosystems, including marine mammals.
4. Harmful algal blooms (HABs) that produce toxins such as domoic acid, saxitoxin, and brevetoxin can poison marine mammals and humans and have become more frequent and extensive in U.S. waters since 1990.
5. Climate-induced changes in prey distribution and availability can affect marine mammal body condition, health, reproduction, and survival.

Vibrio parahaemolyticus, a harmful bacteria that only survives in water temperatures over 15°C has now been reported in marine mammals in Alaska.



Cetacean morbillivirus and avian influenza (“bird flu”) have recurred in various marine mammal species along the US east coast.



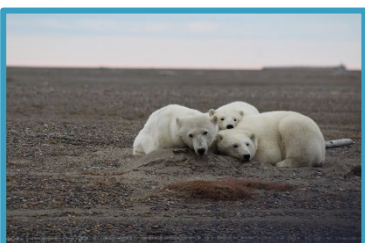
Climate-related freshwater discharge events may increase in frequency. In 2019, an event dropped salinity levels across the northern Gulf of Mexico coast, resulting in at least 337 bottlenose dolphin deaths.



Polar bears are increasingly reliant on land in the summer for food. In addition to changes in body condition, this may increase risk of exposure to terrestrial pathogens.



Brevetoxin-producing HABs are occurring every year over longer periods and in larger areas along the Florida coast, poisoning manatees and bottlenose dolphins.



Domoic acid poisoning of marine mammals is now a yearly event off California, causing deaths and reproductive failure in sea lions, seals and sea otters.



What We Don't Know

1. For most species, it is not well understood how changes in body condition or other health parameters translate to changes in population vital rates such as reproduction or survival.
2. While effects of HAB toxins on pinnipeds are well known, effects on cetaceans are less clear, and the relationship between exposure to saxitoxin, brevetoxin, and domoic acid and health effects is unknown.
3. Transmission and distribution of infectious pathogens in marine mammals are largely unknown, making it difficult to predict or prepare to respond to disease outbreaks. We need to expand our focus beyond clinical response to individual stranded animals to encompass population health surveillance and disease epidemiology.

What We Need

We need capacity to **detect** climate-related changes in health, **diagnose** underlying factors contributing to those changes, and be prepared to **respond and mitigate**. We can do this by:

Increasing population health surveillance

Catalog: Expand the National Stranding Database of the Marine Mammal Health and Stranding Response Program to include data on causes of disease and death.

Surveil: Develop temporally- and spatially-structured surveillance for specific pathogens and toxins in each region of the U.S. (e.g., avian influenza in the Northeast and *Vibrio* spp. in Alaska.). Expand assessments to include monitoring of population health.

Plan: Develop disease-specific response plans that include methods for prevention (e.g., vaccinations), mitigation, carcass disposal, and transmission control to other populations or species.

Integrating health data with observing systems

Monitor: Coordinate biotoxin and pathogen monitoring of marine mammal samples with regional public health programs to enhance detection capabilities.

Collaborate: Conduct collaborative research with academia and Science Centers to better understand health changes and disease epidemiology and quantify population level impacts.

Broaden: Link marine mammal health data to terrestrial wildlife health databases and the U.S. Integrated Ocean Observing System to understand spatial and temporal trends in disease prevalence and triggers for toxic events.

Connect: Studies of marine mammal health need to move away from single-case observations and focus on understanding disease pathogenesis and epidemiology (e.g., how pathogens cause disease and affect populations, and how they are spread), linking health changes to environmental variables and population vital rates.

So What? Without greater investment in marine mammal health and disease surveillance, climate change effects on ocean and human health could go undetected, and mitigation measures cannot be developed.