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Sea-level rise, ocean acidification, ocean warming threaten Papahānaumokuākea Marine National Monument

Global climate change threatens fragile ecosystems and cultural resources

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Despite its remote location in the Northwestern Hawaiian Islands, Papahānaumokuākea Marine National Monument faces a looming threat of global climate change that will affect its land and marine ecosystems, as well as its cultural resources, according to a new NOAA report.

The Office of National Marine Sanctuaries Conservation Series [report](#), *Climate Change Vulnerability Assessment for the Papahānaumokuākea Marine National Monument*, finds that sea-level rise, ocean acidification, ocean warming, and other climate-related changes are expected to significantly affect the monument.

Projected sea-level rise, combined with likely increases in the strength of storms and ocean wave energy, means that low-lying islands within the monument will be flooded, harming endangered birds such as the Laysan duck and Laysan finch, as well as large populations of seabirds. Increased coastal erosion over the next 50 to 100 years will also deprive endangered Hawaiian monk seals and threatened sea turtles of beaches for nesting or haul-out areas. Coral reefs will also degrade because of increasing bleaching and coral disease.



A juvenile Hawaiian monk seal rests on a beach on Tern Island, French Frigate Shoals. Projected sea-level rise at Papahanaumokuakea Marine National Monument could threaten these and other marine mammals. (Credit: Mark Sullivan/ NOAA Fisheries)

Covering 139,797 square miles of Pacific Ocean (362,073 square kilometers), Papahānaumokuākea Marine National Monument is the largest contiguous, fully protected American conservation area, and one of the largest marine protected areas in the world.

"Climate change is a complex issue that not only affects natural ecosystems, but also the rich cultural resources of Papahānaumokuākea," said Daniel Wagner, Ph.D., the monument's research specialist and a co-author of the report. "In creating this climate change assessment, we looked not only to climate change scientists, but to everyone that we believe will be able to address the complex issues of climate change, including managers, scientists, policy makers, economists, historians, archaeologists, cultural practitioners and educators."

Based on a series of expert workshops, interviews with resource managers and scientists, and a thorough review of available literature, the report identifies how and why cultural and ecological resources across the monument are likely to be affected by future climate. It is one of the first holistic reports on climate change that discusses the bio-physical effects of climate change, and how these will affect cultural resources. It was developed with input from all agencies on the Monument's Management Board.

"Existing evidence suggests that the monument's northernmost atolls may be among the first ecosystems to be irrevocably impacted by global climate change, thus providing early indications of what we can expect to see in other locations going forward," said Dan Polhemus, Ph.D., who oversees the Aquatic Ecosystem Conservation team for the U.S. Fish and Wildlife Service in the Pacific Islands and co-author of the report. "In this regard, documenting climate change impacts in PMNM can provide important regional perspectives and help raise global awareness about this major threat."



A Laysan duck pair on Eastern Island on Midway Atoll. Sea-level rise could threaten these birds, as well as large populations of seabirds. (Photo: John Klavitter/USFWS)

As sea surface temperatures increase, areas that already are showing reduced ability to maintain sustainable levels of ocean life are expected to expand, limiting available prey for predator species like seals and large birds. Species of special significance to Native Hawaiians, like 'opihi, a Hawaiian limpet which grazes on algae, and other species that prey on plankton and crustaceans, will also see their sources of food decline. For some of these species unique to the Hawaiian Islands, the ability to alter their reproductive and feeding habitats may not occur quickly enough to keep up with climate change.

In addition to a decline in biodiversity in the Hawaiian Islands, the authors note that sea-level rise and ocean acidification will also harm aspects of Hawaiian cultural heritage. One example is that Hawaiian tradition considers corals to be source of all life, and damage to reefs could result in loss of sense of place for Native Hawaiians. Moreover, sea-level rise, stronger storms and higher waves could inundate religious, agricultural and other formerly inhabited archaeological sites on Nihoa and Mokumanamana islands.

To download a copy of the report, visit <http://sanctuaries.noaa.gov/science/conservation/pmnm-climate-change.html>.

Papahānaumokuākea is cooperatively managed to ensure ecological integrity and achieve strong, long-term protection and perpetuation of Northwestern Hawaiian Island ecosystems, Native Hawaiian culture, and heritage resources for current and future generations. Three co-trustees - the Department of Commerce, Department of the Interior, and State of Hawai'i - joined by the Office of Hawaiian Affairs, protect this special place. Papahānaumokuākea Marine National Monument was inscribed as the first mixed (natural and cultural) UNESCO World Heritage Site in the United States in July 2010. For more information, please visit www.papahanaumokuakea.gov.



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