

The Pacific Coastline



Edith's and Quino Checkerspot Butterflies

Visitors to California's Yosemite National Park might keep an eye out for a medium-sized butterfly with black, orange, and white patches on its wings flitting among the mountain wildflowers. What makes this species, known as the Edith's checkerspot butterfly, special is its extreme sensitivity to weather and climate, a quality that has turned it into an early warning indicator of climate change in North America.

For more than 40 years, researchers have been tracking Edith's checkerspot butterflies, even dusting off old museum records to determine where the species lived long ago. These investigations have revealed a large-scale shift of the butterfly's range both northward and upward in elevation—in concert with increasing temperature associated with climate change. Although the individual butterflies aren't migrating (they tend to stay in a small area their entire lives), the species' range has shifted as separate populations, one by one, go extinct—four times faster on the southern boundary of their range (Baja, Mexico) than on the northern boundary (in Canada), and nearly three times faster at lower elevations than at higher elevations.

The butterfly's sensitivity to climate is also threatening its survival. A subspecies, the Quino checkerspot, is a federally listed endangered species. Although the primary cause of its decline is habitat destruction, climate change poses problems for its recovery. The southern edge of its range, in Mexico, has the least amount of human development and would offer the best habitat for its recovery, but as a result of climate change, the area is becoming too hot and dry. The Quino checkerspot is the first endangered species for which climate change is officially listed as both a current threat and a factor to be considered in the plan for its recovery.



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Image courtesy of Dr. Gordon Pratt, www.quinocheckerspot.com.

Pacific Fisheries

Seafood is the primary source of protein for more than 1 billion people worldwide. With demand for seafood growing dramatically, the future of the world's fisheries is of critical importance. Currently, however, there is very limited understanding of how global climate change might affect whole ocean ecosystems.

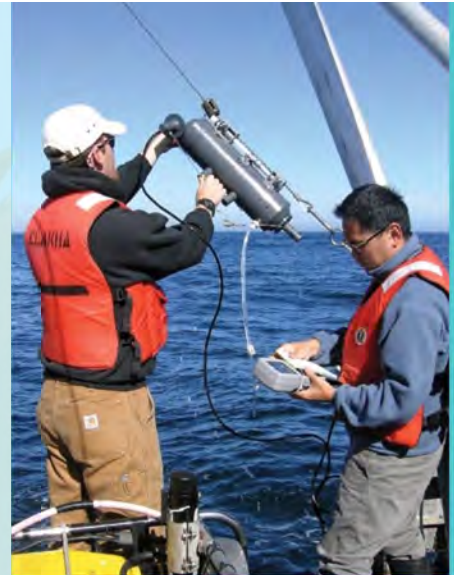
One effect that has already been observed is a shift in the types of species that are found in certain locations. Among the creatures that inhabit the rocky shorelines of central California, for example, formerly "southern" species have become more abundant since the mid-20th century, while many "northern" species have decreased as the shoreline warms.

Another abnormality that has been linked to climate change is a new “dead zone”—an area of seawater with insufficient oxygen to support most marine life—that has appeared off the coasts of Washington and Oregon. Dead zones suffocate and kill marine organisms that cannot swim or scuttle away fast enough. This dead zone, which has appeared every summer since 2002, is different from most of the other ones around the world because it is not caused by excess nutrients from fertilizer runoff or sewage discharges. Its ultimate cause is still under investigation, but several potential causes are linked to climate change. One possibility is that warmer ocean waters have directly affected the water’s ability to hold oxygen at the surface and resupply oxygen to deeper waters. Climate-related changes in coastal winds and ocean circulation may also be responsible.

Wine Quality in California

Some know California as the “Land of Wine and Food,” but its premium vineyards could be facing a difficult future. Climate change affects managed ecosystems like vineyards just as it affects natural ecosystems, with corresponding major economic and social implications.

Wine is one of California’s most important agricultural products: The industry earns billions of dollars per year and is a critical part of the state’s cultural fabric. Wine grapes can grow in a wide range of climates, but the quality of each crop depends on a subtle balance of climate, soils, and landforms. Climate changes during the second half of the 20th century generally improved conditions in California’s premium wine regions as the incidence of frost decreased and the growing season began earlier. Further warming, however, would be unlikely to help wine growers in this area. One study concluded that if current greenhouse gas emissions continued, the projected warming would degrade the state’s premium wine regions from “optimal” to “marginal” by the end of the 21st century. Another study concluded that the area with the potential to produce premium wines could decrease by up to 81 percent.



Scientists retrieve a water sample for research on a recurring “dead zone” off the coasts of Washington and Oregon. The potential causes of the dead zone are linked to climate change.

Image courtesy of Oregon State University.



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