

# Coastal ocean temperature

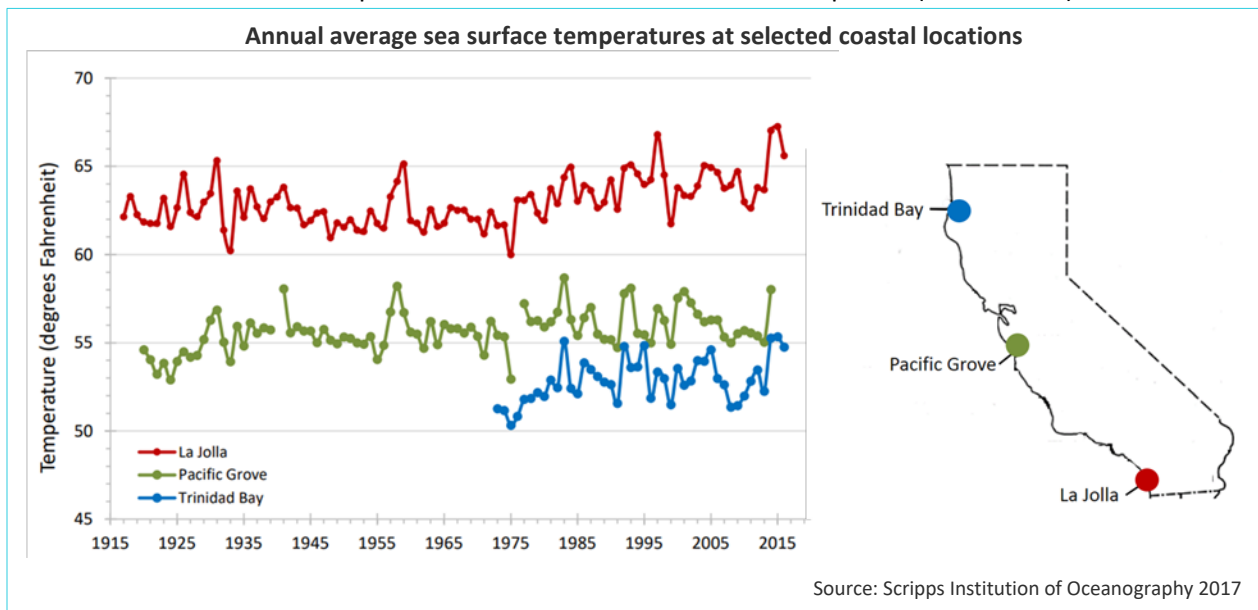
*Ocean waters along California's coast are warming.*



California's coastal water temperatures are rising. The oceans absorb and store large amounts of heat and play a central role in climate by transporting stored-up heat and exchanging it with the atmosphere. About 90 percent of the Earth's increased heat energy over the last 50 years has accumulated in the oceans. Globally, the transfer of heat from the atmosphere to the oceans has resulted in warming to depths of 3,000 meters over the past several decades. Ocean warming can disrupt marine ecosystems. It affects fisheries and other commercially important sectors in California that rely on marine productivity.

## What does the indicator show?

Sea surface temperature increased at the rate of 0.2 Fahrenheit (°F) per decade at Pacific Grove (between 1920 and 2014) and at La Jolla (between 1917 and 2016). Since 1973, however, warming at La Jolla occurred at a faster rate of 0.6°F per decade. At Trinidad Bay, sea surface temperatures increased at the rate of 0.4°F per decade over the same shorter time period (1973 - 2016).



Unusually warm waters occurred in the Pacific Ocean in 2014-2015, leading to widespread impacts on marine life, including shifts in species distribution, mass strandings of sea lions and sea birds, and fishery closures (further discussed below). This marine heat wave first appeared as a large area of exceptionally high sea surface temperatures in the Gulf of Alaska in November 2013 (nicknamed “the warm blob”). It later extended along the entire west coast of North America. While marine heat waves have occurred in the past, the magnitude and duration of the warming during this time period was unprecedented for the region.



*During the 2014-2015 marine heat wave, sea turtles swam farther north than normal.*

Photo: NOAA Fisheries





### Why is this indicator important?

Temperature can affect marine ecosystems by:

- *Influencing the timing of key life stages.* The timing of breeding, development of egg to larvae, and migration are affected by temperature.
- *Changing the abundance of prey, predators, parasites and competitors.* Temperature drives the production – and thus, the peak abundance – of phytoplankton. These organisms make up the base of the marine food chain. Changes in their availability can affect other organisms, altering interactions between species and their competitors, predators, parasites, and prey.
- *Initiating toxic algal blooms.* During the 2014-2015 marine heat wave, toxic algal blooms significantly curtailed the commercial and recreational crab fishing season.
- *Shifting the distribution of marine species.* During the 2014-2015 marine heat wave, a variety of marine animals including fish, sea turtles, and red crabs were found in waters farther north than their usual distribution. Mass strandings of some marine mammals and sea birds also occurred.
- *Altering ocean mixing patterns.* Warming increases stratification between layers of warmer and cooler seawater. Stratification reduces the normal mixing across layers of seawater – a process that transports nutrients, oxygen, carbon, plankton, and other material that support the marine ecosystem.

In addition, warmer water expands, contributing to global sea level rise. Warm ocean waters also accelerate the melting of ice sheets.

Warmer sea surface temperatures affect nearby weather and are associated with reductions in coastal fog, wind strength, and marine layer thickness. This layer is a primary factor controlling the extent to which cool coastal air reaches inland, thus affecting inland weather patterns. Warmer waters can increase the energy and moisture of the atmosphere, leading to more intense winter storms and coastal flooding.



*Toxic algal blooms during the 2014-2015 marine heat wave delayed the opening of the commercial Dungeness crab fishing season.*

Photo: U.S. National Park Service



*Large numbers of sea lion pups were stranded along the California coast during the 2014-2015 marine heat wave.*

Photo: NOAA

For more information about this and other climate change indicators, visit:

<https://oehha.ca.gov/climate-change/report/2018-report-indicators-climate-change-california>

