Rising temperatures and heatwaves have widespread effects on Delta species and communities

2025 State of Bay-Delta Science

Delta Science Program

DELTA STEWARDSHIP COUNCIL

What is a heatwave?

Increasing air and water temperatures are among the most recognized climate change trends. Higher temperatures and shifting temperature ranges are being observed across the world, with continued increases expected in the coming decades.

Within this context of higher temperatures, periods of exceptionally high temperatures, or **heatwaves,** are also anticipated to become more frequent and extreme.

Why is this important in the Delta?

As the hub of California's water supply, an important ecosystem providing habitat to threatened or endangered species, and the home of over 500,000 people, rising temperatures and extreme heatwaves are likely to have significant impacts on the Sacramento-San Joaquin Delta (Delta) in the 21st century.

Air and water temperatures in the Delta region strongly influence each other; as air temperatures rise, so do water temperatures. Phenomena such as the Delta breeze, wildfire smoke, inversions, fog, and atmospheric rivers have large influences on air temperatures in the region, while water temperatures can be strongly influenced by Delta inflows, reservoir releases, water movement in tidal marshes, and vegetation in or alongside rivers and channels.

Trends

Air and water temperatures in the Delta are rising, with heatwaves becoming more frequent and extreme.

Challenges

Climate change is a global issue and successful adaptation to rising temperatures and heatwaves requires actions at multiple scales.

? Uncertainties

Climate change and management actions both affect temperatures, which means how much change occurs and how impacts will be felt over time remain uncertain.

September 2025

What are we learning?

Air and water temperatures have increased in recent years, and these changes are most pronounced in the northern parts of the Delta. Heatwaves are also increasing in frequency, and they aren't just happening in hot summers. More heatwaves are occurring in winter and early spring. Across the year, higher temperatures and heatwaves can affect important seasonal cues for native species and crops.

Warmer temperatures and more frequent extreme heat events are also likely to reduce habitat quality for sensitive species, affect Delta food webs, and create habitat conditions that favor invasive species. For people living and working in the Delta, heat presents additional challenges that extend beyond impacts to ecosystems and water supply. Heat is the leading cause of death among climate change-related disasters, with indirect effects related to changes in pesticides, allergens, recreation, power, and many other factors.

Overall, there is widespread vulnerability to temperature increases in the Delta, and successful adaptation to future temperatures and extreme heatwave events will require actions and coordination at multiple scales.

Three key takeaways

Rising temperatures and extreme heatwave events will affect public health, alter species interactions, and reshape ecosystems.

Heatwaves during various parts of the year can affect important seasonal cues for native species and crops.

Warmer temperatures will likely harm native species that cannot migrate into cooler regions while allowing heat-tolerant invasive species to thrive.

About the State of Bay-Delta Science

The State of Bay-Delta Science is a synthesis and communication project coordinated by the Delta Science Program to summarize the scientific understanding, or "state of the science," of important topics in the Bay-Delta system. For more information, visit the SBDS website at https://sbds.deltacouncil.ca.gov.

This summary is based on the 2025 State of Bay-Delta Science article by Mahardja et al. (2025).

Mahardja B, Bashevkin S, Pien C, Khanna S, Pearson D, Davis B, & Basu R. 2025. Heatwaves and Rising Temperatures in the Upper San Francisco Estuary: Trends and Effects on Ecosystems and Humans. San Francisco Estuary and Watershed Science 23(1).

http://dx.doi.org/10.15447/sfews.2025v23iss1art4