Climate change effect on California delta is detailed in new study

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California's water problems and the ecological pressure on the West Coast's largest estuary will intensify in a warming world, according to a first-of-its-kind scientific study.

San Francisco Bay and the Sacramento-San Joaquin River Delta will get warmer, saltier and clearer if global warming continues over the next several decades. That will increase the risk of extinction for some kinds of fish and could help unwanted species, including a toxic algae, to flourish.

Flooding is likely to be more common upstream and along the coast, and water supplies will be stretched due to a shrinking snowpack, the researchers found.

In the delta, already seeing a broad ecological decline, the probability of further ecological surprises will increase.

"We're going to enter a new era of environmental conditions," said James Cloern, the study's lead author and a phytoplankton ecologist at the U.S. Geological Survey in Menlo Park.

Cloern said the seven-year study was the most complex research project he's undertaken in 36 years at the USGS. The researchers said their paper appears to be the first multifaceted assessment of how the estuary could respond to climate change.

"Everything that we looked at will change in response to global warming," he said.

The researchers took two climate change scenarios they considered reasonably likely and projected what would happen to the estuary given the way it is managed now for wildlife and water supplies. The delta watershed is a source of drinking and irrigation water for 25 million Californians and 2.5 million acres of farmland.

In the first scenario, greenhouse gas emissions would be curbed in the coming decades and the climate would turn out to be only moderately sensitive to the gases.

In the second, bleaker scenario, greenhouse gas emissions would continue to increase and climate would react strongly to them.

In either case, the researchers found, bay and delta salinity is likely to increase, the Sierra snowpack will shrink and less sediment will flow downstream. The decrease in sediment is important for fish such as delta smelt that evolved in turbid water and for replenishing marshes. Its decline is due more to a long-term decline in the upstream supply of sediment than climate.

In the worst of the two warming scenarios, California would have less rain and snow - precipitation would decline by 11 percent by about 2067 and the drying would accelerate after that. In the more modest scenario, the state would receive the same amount of precipitation but more of it would fall as rain instead of snow.

Other factors, including the temperature of air and water and the sea level rise are expected in either scenario but the degree of change is likely to be higher if emissions continue to increase.

The frequency of coastal flooding is expected to increase significantly, as is the frequency that river and delta temperatures reach lethal levels for delta smelt and salmon eggs.

"The big motivation for us was to develop some plausible scenarios for what will change and at what rate," Cloern said.

He said the researchers hoped the results would be used by those writing plans for the delta's future. Two high-profile plans are under way. One is the Bay-Delta Conservation Plan being pursued by the delta's biggest water users. It features a new aqueduct as its centerpiece. The other is the Delta Plan being written by a new state agency, the Delta Stewardship Council.

The researchers found that Californians will have to use water more efficiently and even if total precipitation is unchanged, it will be difficult to capture as much. That is because with more rain and less snow, runoff will come and go more quickly than slowly melting snow.

The state should be prepared for longer dry seasons, extended drought and more flooding, they found.

Meeting human needs could make it even more difficult to also meet environmental goals.

"These adaptations to maintain water supply for human consumptive uses will potentially constrain availability of water to meet objectives of habitat conservation plans, such as restoring natural flow and salinity variability to promote recovery" on native plants and animals, the researchers wrote.