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# Aquatic Ecosystem Stressors in the Sacramento–San Joaquin Delta

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# Summary

The native fishes of the Sacramento–San Joaquin Delta have been declining at an increasingly rapid rate for more than two decades. This decline has significant consequences for water resource management in the Delta, particularly for operations of the State Water Project (SWP) and the federal Central Valley Project (CVP). There is no single cause for the decline of these fishes. All facets of the Delta ecosystem have changed dramatically in the past century, and most changes have been detrimental to native fishes. The factors that cause harm to native species are broadly referred to as stressors. For any native species, many stressors affect both individuals and populations.

Stressors can be grouped in different ways, depending on the scientific, policy, or regulatory point of view. Here, we have grouped them into five broad categories. Each category contains stressors with similar processes, causes, or consequences. While overly simplistic for scientific purposes, this approach is straightforward enough to facilitate policy discussions regarding causes of stress, allocations of responsibility, and options for management. In alphabetical order, our five general categories of multiple stressors are:

- Discharges that alter water quality (through land and water use activities),
- Fisheries management actions (such as regulation of harvest and operation of hatcheries),
- Flow alteration (through a variety of water management activities),
- Invasive species that alter food webs or change physical habitat, and
- Physical habitat loss and alteration (through actions such as the draining and diking of tidal marshes and seasonal floodplains).

Climate change will likely exacerbate conditions associated with all five groups. Ocean conditions also affect anadromous fishes, such as salmon and steelhead, amplifying the effect of stressors. For each group of stressor, we identify the affected native species, assign historical and on-going responsibility, and consider a range of actions that may reduce effects of the stressors on the viability of native species populations.

## Companion reports

This report presents results from an analysis of the institutional and legal options for more effective ecosystem management in the Sacramento–San Joaquin Delta. It is part of a wide-ranging study on the management of multiple ecosystem stressors in the Delta. For a summary of overall study findings, see *Stress Relief: Prescriptions for a Healthier Delta Ecosystem* (Hanak et al. 2013). Several companion papers address related topics in greater depth: (1) *Costs of Ecosystem Management Actions for the Sacramento–San Joaquin Delta* (Medellín-Azuara et. al. 2013) provides cost estimates for a suite of management actions addressing various sources of ecosystem stress; (2) *Integrated Management of Delta Stressors: Institutional and Legal Options* (Gray et al. 2013) presents our proposals for institutional reform of science, management, and regulation; (3) *Scientist and Stakeholder Views on the Delta Ecosystem* (Hanak et al. 2013) presents the results of surveys of scientific experts and engaged stakeholders and policymakers on Delta stressors and management actions; and (4) *Where the Wild Things Aren't: Making the Delta a Better Place for Native Species* (Moyle et al. 2012) describes a realistic long-term vision for achieving a healthier ecosystem. All of these reports are available on PPIC's website at [www.ppic.org](http://www.ppic.org).

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