

## Delta Dilemmas

Watch the segment online at <http://education.savingthebay.org/delta-dilemmas>

Watch the segment on DVD: Episode 3, 15:23–17:48

Video length: 2 minutes 46 seconds

### SUBJECT/S

**Science**

**History**

### GRADE LEVELS

6–8  
9–12

### CA CONTENT STANDARDS

#### Grade 6

*Ecology (Life Sciences)*

5.e. Students know the number and types of organisms an ecosystem can support depends on the resources available and on abiotic factors, such as quantities of light and water, a range of temperatures, and soil composition.

#### Grades 9–12

*Biology/Life Sciences – Ecology*

6.a. Students know biodiversity is the sum total of different kinds of organisms and is affected by alterations of habitats.

*Earth Sciences – California Geology*

9.c. Students know the importance of water to society, the origins of California's fresh water, and the relationship between supply and need.

### VIDEO OVERVIEW

Once built, the Central Valley Project and the California State Water Project had unforeseen effects on the Sacramento–San Joaquin Delta, particularly on its historic salmon runs. The Delta is the hub of the state's massive water distribution system, with much of the estuary's water supply pumped to other locations.



In this segment you'll learn that:

- engineering has forever changed the Sacramento–San Joaquin Delta ecosystem.
- dams and other components of the water projects interrupt the life cycles of salmon and other fish.
- managing the effects of California's water projects on ecosystems has cost billions of dollars.

### TOPIC BACKGROUND

Half of California's precipitation drains into the Sacramento–San Joaquin Delta, the largest estuary on the West Coast and the heart of California's water distribution system. Delta waters are distributed throughout the state via the Central Valley Project, the State Water Project, and other smaller systems. These engineering marvels have enabled California's huge agricultural industry to use water from the Delta to irrigate millions of acres of farmland. Twenty-five million Californians in the San Francisco Bay Area, Silicon Valley, San Joaquin Valley, the Central Coast, and Southern California rely on the Delta for their drinking water. The Delta also supports more than 500 species of wildlife, including 20 endangered species.

In the late 19th century, hundreds of miles of levees were constructed in the Delta to create farmland and control flooding, thus transforming the once-vibrant wetland habitat. Over time, these levees were raised and strengthened; they now protect Delta island tracts of farmland, small communities, habitat, and other land uses. The Central Valley Project, initiated by the U.S. Bureau of Reclamation in 1935, added dams and pumping stations to move supplies from the water-rich Sacramento River system to the San Joaquin Valley and then over the Tehachapi Mountains to Southern California.

The Central Valley Project and, later, the State Water Project further engineered controlled use of the Delta and its waters. Now railways, highways, and utilities cross the Delta. Ships use deepwater channels to transport goods to the ports at Sacramento, Stockton, and elsewhere. Agriculture remains the dominant industry of the area; recreational boaters also enjoy the benefits of the Delta.

This vast, rich region has been the center of controversy for 150 years. The many uses of the Delta often compete, leaving the region unable to effectively meet the needs of either water supply or habitat. Water exports are critical to California's economy, yet are considered by some to be the primary cause of ecosystem decline. Engineering fixes have addressed some problems while creating others. Many legislative acts have addressed water supply and ecosystem preservation issues. Almost all stakeholders

## VOCABULARY

### **Central Valley Project**

a system of dams, canals, reservoirs, pumping stations, and more operated by the U.S. Bureau of Reclamation to store and transport water in California

### **delta**

the alluvial (soil) deposits at the mouth of a river; the Sacramento–San Joaquin Delta is the region where two of California's major rivers meet and mix with the waters of San Francisco Bay.

### **estuary**

a semi-enclosed body of water where freshwater rivers flow into the ocean, mixing with seawater; San Francisco Bay is an estuary.

### **hydroelectric**

relating to electricity created using waterpower

### **salmon**

a large fish that is born in a freshwater river, spends much of its life in the ocean, and returns to its birthplace to spawn; salmon are popular game fish.

### **salmon run**

the time during which salmon swim from the ocean back up the rivers they were born in order to spawn

### **spawning**

producing or depositing eggs

agree that the Delta faces serious problems, and California's water issues are a central concern of state and local governments as well as business and industry representatives and the general public. Long-term, sustainable solutions acceptable to all parties have yet to be formulated, but are being actively addressed.

## PRE-VIEWING ACTIVITIES

- Ask students to find the definition of the word “anadromous” and suggest ways in which dams might affect the life cycle of anadromous fish such as salmon.

## FOCUS QUESTIONS FOR VIEWING

- How does the Central Valley Project affect spawning fish? *The dams block their runs up the river to the gravel beds where they were born. Little natural spawning occurs.*
- What does “serial engineering” mean? *the continuing cycle of using engineering to try to solve problems created by prior engineering*

## POST-VIEWING ACTIVITIES

- Study the history of the Delta and trace the changes to the region over time. Identify the role of engineering in both addressing and creating problems.
- Have students role-play different perspectives and conduct a debate or public hearing about how to address the decline of the salmon runs through the Delta, including the 2009 closure of the salmon fishing season.
- Explore current events regarding the California legislature's efforts to develop a new water plan for California.

## ABOUT THE AUTHOR

**Lori Mann** is an environmental education consultant with 30 years' experience at the local, state, and national levels. She has worked extensively with curriculum development and review, has taught numerous environmental education courses and workshops, and served for 15 years as education director at Coyote Point Museum for Environmental Education in San Mateo, California.

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## ADDITIONAL RESOURCES

**A Briefing on California Water Issues**, Water Education Foundation  
<http://www.watereducation.org/userfiles/CA%20Briefing%20Feb%2009.pdf>

Read an impartial briefing about issues related to the management of California's water supply and the competing interests of agricultural, urban, and environmental interest groups.

**California State Water Project Overview**, California Department of Water Resources  
<http://www.water.ca.gov/swp/index.cfm>

Obtain information from the State Department of Water Resources about the history, management, benefits, and issues of the State Water and Central Valley projects, their influence on the Delta, and future plans for both preserving habitat and meeting water needs.

**Delta Section**, *The Sacramento Bee*  
<http://www.sacbee.com/delta/>

Get current news, background information, an interactive map, and links to other resources related to the Sacramento–San Joaquin Delta.

**“Moving California’s Water Supply,”** *Saving the Bay*  
<http://education.savingthebay.org/moving-californias-water-supply>

Watch a related video segment about the history of the Central Valley Project and use the accompanying viewing guide to enrich students' understanding of the system and its importance to California.

**Sacramento Bay-Delta’s Troubled History**, Salmon Water Now!  
<http://salmonwaternow.org/about/delta-history>

Read about the history of the Sacramento–San Joaquin Delta's salmon runs and the effects of the Central Valley Project and the State Water Project, from the perspective of a nonprofit organization seeking to preserve salmon and salmon fisheries.

## CREDITS

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## VIDEO TRANSCRIPT

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**NARRATOR:** The Central Valley Project was built with four objectives: water supply, hydroelectric power, recreation, and flood control. Not until the system was in place would its impact on ecosystems become fully evident.

The dams blocked historic runs for fish returning to spawn, notably, salmon. Evolution guides them to return from the ocean to the same rivers, the same gravel beds, where they were born. Only now, in the wake of the water projects, the journey ends here.

Today, the survival of salmon is dependent almost entirely on an unnatural process. Fertilization no longer occurs in pristine rivers but instead, simply and unceremoniously, in a bucket.

**HATCHERY WORKER:** ... a boy and a girl ...

**NARRATOR:** Meanwhile, the huge pumping stations in the Delta actually reversed the estuary's inexorable flow toward the Pacific, often destroying vast populations of fish drawn into its own irresistible pull. The millions invested in two great engineering marvels would, by century's end, require billions to deal with the consequences.

**JEFF MOUNT:** We have committed the sin of serial engineering when it comes to the estuary. For every engineering effort or every engineering investment where we have tried to engineer a particular ecosystem service out of the Delta, there has been a cascade of effects, each one of those effects requiring a new investment of engineering. And that new investment of engineering begets the need for more engineering. And so we get locked in this cycle of serial engineering where we can't escape. The ecosystem is fundamentally changed. The Delta and the estuary is gone, it's gone. We're dealing with something new now—a new system.