Threats to the Bay

Watch the segments online at http://education.savingthebay.org/threats-to-the-bay
Watch the segments on DVD: Episode 2, 45:29–46:24; Episode 4, 49:22–51:05
Video lengths: 2 minutes 39 seconds; 2 minutes

SUBJECT/S

Science

History

GRADE LEVELS

9–12

CA CONTENT STANDARDS

Grades 9–12

Biology/Life Sciences – Ecology

6.b. Students know how to analyze changes in an ecosystem resulting from changes in climate, human activity, introduction of nonnative species, or changes in population size.

VIDEO OVERVIEW

Segment 1:
Water quality in San Francisco Bay is affected by urbanization and industrialization of the Bay Area.

In this segment you'll learn:

- that mercury and other toxins still threaten the water quality of San Francisco Bay even though environmental standards have improved.
- about the five main threats to water quality in the Bay.

Segment 2:
The future of San Francisco Bay is undetermined. In this segment you'll learn:

- how climate change, sea level rise, and population are putting great stress on the fragile San Francisco Bay estuary.
- how San Francisco Bay is vulnerable to oil spills and other unpredictable events.
- that human actions in the coming years will affect what becomes of San Francisco Bay.

TOPIC BACKGROUND

Although San Francisco Bay is healthier than it was a half-century ago, it still faces threats from pollution and climate change. In 1972, the Clean Water Act made it illegal to dump untreated sewage, waste, and oil into "navigable waters." Water quality is still a great concern, however, and pollution continues to find its way into the Bay. The five main threats to Bay water quality are detailed below:

- *Agricultural pollution and runoff:* Pesticides used in agriculture flow into the Delta waterways and present a threat to the Bay.
- *Industrial pollution, including chemicals:* Active industries in the Bay Area release chemicals and toxins directly into the Bay and also into the air, where they then settle on urban surfaces and are washed into the Bay.
- *Legacy pollution from mines and hot sediments:* Pollutants such as mercury, DDT, and PCBs persist in San Francisco Bay from mining, agricultural, and industrial activities that were carried out in years past.
- *Urban stormwater runoff:* Pollution from everyday actions by Bay Area residents, such as pollution from yards, cars, and houses, represents a great threat to the Bay's water quality. This non–point source pollution often spills into storm drains that flow directly to the Bay.
- *Sewage:* Most wastewater from Bay Area homes and businesses is treated before it flows into the Bay. However, sewage spills still occur due to inadequate infrastructure and storms.

VOCABULARY

climate change
a change in our climate that lasts for an extended time, usually decades or longer

DDT
a pesticide commonly used for many years, but since 1972 has been banned in the United States

heavy metals
metals that are toxic in low concentrations, such as lead and mercury

hydraulic mining
a type of mining that uses water to move rock or sediment in order to expose the minerals / ore

industrialization
the introduction of industry

legacy pollution
pollution that is left over from past actions

mercury
a heavy, silver metal that is a liquid at room temperature

myriad
many, a variety

overexploitation
overuse

PCBs
polychlorinated biphenyls, chemicals used in industrial applications; toxic environmental pollutants

stormwater runoff
water that drains into the Bay after storms

toxin
a poisonous substance

urbanization
the growth of cities

Unpredictable events also threaten the San Francisco Bay ecosystem. On November 7, 2007, the *Cosco Busan* container ship struck the Delta tower of the San Francisco–Oakland Bay Bridge and spilled 58,000 gallons of fuel oil into the Bay. More than 2,000 birds were killed due to the oil spill, and this does not take into account the longer-term effects on birds and other marine life. The total lasting impact on wildlife due to oil spills is impossible to calculate.

How climate change will affect the Bay and its surrounding communities is another concern. The earth has warmed about 1° F in the last 100 years and is continuing to heat up. Global climate change due to human activity could lead to a rise in the sea level of three to five feet over the next 100 years, threatening shoreline communities, farms, and wetlands.

PRE-VIEWING ACTIVITIES

- How is San Francisco Bay important in your life?
- What will San Francisco Bay be like in 50 years? in 100 years? in 1,000 years? Will the population of the Bay Area have grown? How will the Bay look different? What kinds of plants and animals will live in the Bay and its wetlands? Will the Bay be healthier? How will the people of the future regard the Bay? Divide a piece of paper into three sections, one for each time period. In small groups, brainstorm answers to these questions for 50 years, 100 years, and 1,000 years in the future.

VIEWING ACTIVITY

- Take notes while watching both segments. Pause to answer the Segment 1 Post-Viewing Questions before watching Segment 2. After both segments have been viewed, proceed with the Post-Viewing Questions and Post-Viewing Activities.

POST-VIEWING QUESTIONS

Segment 1:

- Discuss the five threats to water quality in San Francisco Bay. Which threat is the most serious? Which threat is the easiest to address? the most difficult to address?
- How does urbanization affect water quality?
- How does population affect water quality?

Segments 1 and 2:

- What effects will climate change have on the San Francisco Bay Area?
- In this segment, Jeff Mount discusses how the snow melt pulse is coming earlier and winter runoff events are coming more often and are bigger. What does this mean for San Francisco Bay?
- How can the Bay be made less vulnerable to unpredictable events like oil spills?
- In order for the Bay to become healthier even as the population of the Bay Area increases, what needs to be done?
- Discuss Sylvia Earle's comment: "The next 10 years are likely to be the most important in the next 1,000 years in terms of the actions we take or the actions we don't take."
- What can be your role in protecting San Francisco Bay?

ABOUT THE AUTHOR

Phaela Peck is a science teacher, environmental educator, and writer based in San Francisco. She has an M.A. in environmental education and has developed curricula for numerous science and environmental education organizations in the Bay Area.

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POST-VIEWING ACTIVITIES

- Divide the class into five groups, one for each major threat to water quality in the Bay. Each group prepares a presentation on the threat and what is being done to address the threat. Groups should include information on how individuals can help reduce the pollution that is getting into the Bay.
- Revisit the pre-viewing questions "What will San Francisco Bay look like in 50 years? in 100 years? in 1,000 years?" Students create their own visions for San Francisco Bay and discuss what needs to happen for their visions to become reality. Consider these questions: How are their visions different from what they brainstormed before? Who is in charge of the Bay? Who decides what should happen with the Bay?
- Investigate ways to address climate change at school. What can students do to reduce greenhouse gas emissions?
- Find out how to participate in a coastal, creek, or Bay shoreline cleanup. Alternatively, organize regular schoolyard cleanups that seek to address pollution issues at the school site.

ADDITIONAL RESOURCES

At School, Climate Change—What You Can Do, Environmental Protection Agency
http://www.epa.gov/climatechange/wycd/school.html
Find out what schools can do to reduce greenhouse gas emissions and learn more about climate change.

California Coastal Cleanup Day, California Coastal Commission
http://www.coastal.ca.gov/publiced/ccd/ccd.html
Learn how to get involved in California Coastal Cleanup Day. Information about the Coastweeks and Adopt-a-Beach programs is also available.

Climate Watch, KQED Public Broadcasting
http://www.kqed.org/news/climatewatch/
Climate Watch is a multimedia series on climate change with a California perspective. Links to additional climate change resources are also provided.

Environmental Contaminants Program, U.S. Fish and Wildlife Service
http://www.fws.gov/contaminants/Documents/CoscoBusan.pdf
This website provides information on oil spill preparation and response, including details about the *Cosco Busan* oil spill.

San Francisco Bay Conservation and Development Commission
http://www.bcdc.ca.gov
The BCDC is in charge of conservation and development of San Francisco Bay. The BCDC also provides maps of the rising sea level and information about the Bay's vulnerability to climate change.

San Francisco Bay Regional Water Quality Control Board, California Environmental Protection Agency
http://www.swrcb.ca.gov/rwqcb2/
Learn more about water quality control in the San Francisco Bay region, including information about wastewater and stormwater.

San Francisco Baykeeper
http://www.baykeeper.org
Find information on sources of pollution in the San Francisco Bay Area and on efforts currently under way to reduce pollution in the Bay.

CREDITS

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VIDEO TRANSCRIPT

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Segment 1
NARRATOR: Mercury remains the most pronounced among a myriad of toxins that continue to haunt San Francisco Bay. In the century following hydraulic mining, agriculture would introduce DDT; industry would introduce other heavy metals and PCBs. And though environmental standards today are vastly improved, the threats to water quality in San Francisco Bay have by no means passed.

SEJAL CHOKSI: There are five main threats to the Bay: agricultural pollution and runoff; industrial pollution, including chemical; legacy pollution from mines and hot sediments; urban stormwater runoff; and sewage. Those are the five biggest because of urbanization, industrialization, and population of the Bay Area.

Segment 2
NARRATOR: The future of San Francisco Bay is undetermined. Climate change, sea level rise, and the pressures of an ever-growing population will bring ever-greater stress to the estuary.

JEFF MOUNT: Climate change is having a real-time effect. Spring is coming earlier in this system. That is, the snow melt pulse that comes out of the Sierra Nevada is progressively coming earlier and earlier. Winter runoff events—the big floods—are coming more often, and they're bigger.

NARRATOR: A hundred years from now, San Francisco Bay will remain. The question is, "What will it be?" Despite decades of progress, San Francisco Bay remains a fragile ecosystem, still vulnerable to sudden unpredictable events.

REPORTER: From the air, the impact of Wednesday's tanker crash and subsequent oil spill in San Francisco Bay is easy to see. Plumes of oil, as far north as Marin County …

CHARLES CLIFFORD, KRON: And this type of heavy-duty bunker fuel oil is toxic stuff. Exposure even in small amounts could prove fatal for plants, fish, birds, or marine mammals.

LEO O'BRIEN: It's really important for people to understand that the fight is not over. The fish are not safe to eat. After storms, it's not safe to swim in the Bay, and our drinking water supplies are threatened by pollution and overexploitation.

SYLVIA EARLE: We don't have a lot of time. The next 10 years are likely to be the most important in the next 1,000 years in terms of the actions we take or the actions we don't take.