California Salmon Educator Guide

A resource for using QUEST video, audio, blogs and maps in the classroom

QUEST SUBJECTS

Life Science	**Biology** Health **Environment**
Earth Science	Geology Weather Astronomy
Physical Science	Physics Chemistry Engineering

CA SCIENCE STANDARDS

Grade 4
Life Sciences
3. Living organisms depend on one another and their environment for survival. (a, c)

Grade 6
Ecology (Life Sciences)
5. Organisms in ecosystems exchange energy and nutrients among themselves and with the environment. (c, e)

Grade 7
Evolution
3. Biological evolution accounts for the diversity of species developed through gradual processes over many generations. (a, e)

Grades 9-12
Ecology
6. Stability in an ecosystem is a balance between competing effects. (a, b, c, e)

California Geology
9. The geology of California underlies the state's wealth of natural resources as well as its natural hazards. (a)

QUEST MEDIA FOR TEACHING ABOUT CALIFORNIA'S SALMON

Read and comment on the blogs for these stories by clicking on the story link and clicking on the blog post link below the video/audio.

Watch **California's Lost Salmon**
http://www.kqed.org/quest/television/californias-lost-salmon

- **QUEST** looks at Northern California's efforts to protect the endangered California Coho salmon and explores the important role these magnificent fish play in native ecosystems.

Watch **Saving California's Salmon**
http://www.kqed.org/quest/television/coho-salmon-in-muir-woods

- **QUEST** joins local biologists and volunteers who are working to restore Muir Woods' Redwood Creek and bring back the native salmon habitat after decades of human influence.

Listen to **Saving Coho**
http://www.kqed.org/quest/radio/saving-salmon

- Marine biologists say the future looks grim for Coho salmon and they're looking for ways to stop the fish from being sucked into what they call "the vortex of extinction."

Read **Producer's Notes: California's Lost Salmon**
http://www.kqed.org/quest/blog/2009/05/12/producers-notes-californias-lost-salmon/

- Chris Bauer discusses the environmental health of the Russian River and the work being done by biologists at the Don Clausen Fish Hatchery at Lake Sonoma.

TOPIC BACKGROUND

Once abundant, wild salmon populations in California, Oregon and Washington State peaked in the late 19th and early 20th centuries and have been in slow decline ever since. In California alone, roughly 90 percent of crucial riparian habitat has been lost to agriculture, mining, logging, ranching, water diversion, road building and urbanization. Overall, salmon have disappeared from more than 40 percent of their range in the West. While dams, logging, overfishing and development all pose serious problems to salmon on the West Coast, research shows that climatic and environmental changes in sea-level temperatures, sea-level pressure and wind patterns can also wreak havoc on fish populations.

One of the difficulties involved with salmon conservation is that these fish are anadromous, meaning that they hatch in freshwater, spend part of their life in the sea and then return to freshwater to spawn. Only about 10 percent of all spawning salmon stray from their home rivers, so salmon from one population very infrequently interbreed with salmon from other populations. Dams are thought to be a key issue in salmon decline. They often prevent salmon from migrating to and from their chosen breeding grounds. While some dams have "ladders" to help the fish negotiate passage, studies show that most fish must navigate at least one dam during their migration. In some cases, dams completely block access to waterways that would otherwise be used for spawning.

Additional background resources:

- EPIC: Coho Salmon http://www.wildcalifornia.org/pages/page-31
- CA Department of Fish and Game: Salmon Fishery Changes FAQ http://www.dfg.ca.gov/news/issues/salmon/
- State of the Salmon http://www.stateofthesalmon.org/

VOCABULARY

Anadromous
migrating from the sea to freshwater to spawn

Conservation
careful preservation and protection of a natural resource or environment

Ecosystem
a community of living organisms and its environment

Endangered
flora or fauna in imminent danger of extinction

Habitat
the type of environment in which an organism or group normally lives or occurs

Native
Local or indigenous; not having been introduced from elsewhere

Spawn
to produce young, especially in large numbers

Restoration
bringing back to a former position or condition

Watershed
the geographic area of land that drains water to a shared destination

INTRO QUESTIONS

- What do you know about wild salmon?
- Have you ever seen salmon in the wild?
- What manmade problems do you think salmon face?
- Why do you think it's important to save our salmon?

FOCUS QUESTIONS

- How do salmon help their habitat?
- What do Coho salmon need in order to survive?
- What are some causes of salmon decline in California?
- How are biologists trying to restore native salmon habitat in Northern California? What other things need to happen to save the salmon?

For all media see:

- Segment Summary Student Sheet
  http://www.kqed.org/quest/downloads/QUEST_SegSum_StudentSheet.pdf
- Personal Response Student Sheet
  http://www.kqed.org/quest/downloads/QUEST_PersResp_StudentSheet.pdf

LESSON PLANS and RESOURCES from PBS, TEACHERS' DOMAIN and NPR

NOTE: Resources from the Teachers' Domain collection require a fast and free registration.

What's Killing California's Salmon? NPR
http://www.npr.org/templates/story/story.php?storyId=102997037
As California's salmon fishing season is called off for a second straight year, this **Weekend Edition Sunday** broadcast (April 11, 2009) looks at the scientific struggle to identify why the Chinook salmon population has collapsed.

Surrogate Fish Could Produce Endangered Brethren NPR
http://www.npr.org/templates/story/story.php?storyId=15287000
This NPR **Day to Day** program (October 15, 2007) examines a new technique scientists are using to make one species of fish lay the eggs of another.

Salmon Streams' Struggle Continues 40 Years after Clean Water Act PBS
http://www.pbs.org/newshour/bb/environment/jan-june09/salmonwars_05-22.html
Online NewsHour special correspondent Hendrick Smith draws on research conducted for a **Frontline** project to present information about manmade problems in the Pacific Northwest's salmon streams and pollution's effects on salmon populations.

On the Yukon River Teachers' Domain
http://www.teachersdomain.org/resource/ean08.sci.ess.earthsys.yukonriver/
This video segment adapted from the Yukon River Panel explores the role of salmon in subsistence Native Alaskan cultures and the efforts being made to maintain healthy salmon stocks in the Yukon and Teslin Rivers.

Deep Crisis: Out West – Conquering the Columbia PBS
http://www.pbs.org/saf/1306/segments/1306-1.htm
This segment synopsis from **Scientific American Frontiers** details the history of the salmon population in the Columbia-Snake River system and discusses issues the fish face today.

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The Bay Institute
www.bay.org

California Academy of Sciences
www.calacademy.org

Chabot Space and Science Center
www.chabotspace.org

East Bay Regional Park District
www.ebparks.org

Exploratorium
www.exploratorium.edu

Girl Scouts of Northern California
www.girlscoutsnorcal.org

Golden Gate National Parks Conservancy
www.parksconservancy.org

The J. David Gladstone Institutes
www.gladstone.ucsf.edu

Lawrence Berkeley National Laboratory
www.lbl.gov

Lawrence Hall of Science
www.lawrencehallofscience.org

Monterey Bay Aquarium
www.mbayaq.org

Monterey Bay Aquarium Research Institute
www.mbari.org

Oakland Zoo
www.oaklandzoo.org

The Tech Museum of Innovation
www.thetech.org

UC Berkeley Natural History Museums
http://bnhm.berkeley.edu/

U.S. Geological Survey
www.usgs.gov

MORE EDUCATIONAL RESOURCES FOR USING QUEST MULTIMEDIA TO ENHANCE 21st CENTURY SKILLS IN TEACHING AND LEARNING

Why Use Multimedia in Science Education?
http://www.kqed.org/quest/downloads/QUESTWhyMedia.pdf
- Read about the importance of using multimedia in the 21st century science classroom.

How to Use Science Media for Teaching and Learning
http://www.kqed.org/quest/downloads/QUESTMediaTips.pdf
- A collection of tips, activities and handouts to actively engage students with multimedia.

Science Multimedia Analysis
http://www.kqed.org/quest/downloads/QUESTMediaAnalysis.pdf
- Give your students the tools to recognize the purposes and messages of science multimedia.

Create Online Science Hikes with Google Maps
http://www.kqed.org/quest/files/download/52/QUEST_ExplorationCreation.pdf
- Do you like the science hike Explorations on the QUEST site? Use this place-based educational guide to create similar science-based maps with youth.

OTHER WAYS TO PARTICIPATE IN QUEST

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www.kqed.org/quest

LISTEN

KQED 88.5 FM San Francisco &
89.3 FM Sacramento
Mondays at 6:30am and 8:30am

WATCH

KQED Channel 9
Tuesdays at 7:30pm

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From KQED Public Radio, I'm Andrea Kissack with QUEST, our weekly science and environment series. Coho salmon conservationists are losing hope they'll see large numbers of the endangered fish return to spawn this year, even after our recent rains. They say the future looks grim following three years of drought and they're looking for ways to stop the coho from being sucked into what they call "the vortex of extinction." Dan Brekke reports.

Winter rains swept Northern California for the last half of January, raising creek and river levels, and also raising hopes for a late surge in endangered coho salmon runs along the coast. But new sightings of the fish, which are drawn up their home streams by the high flows that follow heavy rains, have been few.

ISADORE: I'm not seeing any activity here where I might expect to see something.

That's Megan Isadore, a long-time volunteer naturalist with the Salmon Protection and Watershed Network, or SPAWN. After the first of the recent rains, she's looking for signs that new coho have arrived on Lagunitas Creek, a Marin County stream where SPAWN has been working since the late 1990s to restore healthy coho runs.

ISADORE: We're not seeing any tails flapping out of the water, we're not hearing tails. Sometimes the first thing you can hear are tails slapping the water as the females are digging their redds.

"Redds" are the streambed nests where female salmon deposit their eggs. Just a few years ago, hundreds of redds were sighted in Lagunitas Creek, which a century ago was home to one of the greatest salmon runs on the California coast.

But a host of factors have led to a series of disappointing spawning years. Water quality has been impacted by local development and agriculture. Then add drought, a disastrous flood, and changing ocean conditions which may have recently caused a decline in food supplies at sea.

This year coho watchers have seen just 50 or so redds. SPAWN's watershed biologist, Chris Pincetich:

PINCETICH: We've been counting on a second wave of migrating salmon coming into the system and that has not materialized. So we're looking at another devastating year for the endangered coho run here in the Lagunitas watershed.

The coho's endangered status means it's illegal to catch them, but the picture isn't improving. Lagunitas Creek is part of a much wider pattern in Northern California of crashing coho salmon populations.

Charlotte Ambrose is a biologist with the National Marine Fisheries Service in Santa Rosa. She's in charge of coho recovery planning for a section of coast stretching from Mendocino to Santa Cruz counties. Ambrose says the main causes for the coho's decline are easy to identify.

AMBROSE: The straightening, the channelization of streams, the removal of wood and the riparian canopy and our use of water have created a situation where fish are homeless.

And she says it's not hard to say what the coho need.

AMBROSE: You need to have a functional watershed to raise a fish. It's kind of like gardening. You need space, you need water, and you need time

But with coho facing extinction, biologists are working on a more extreme option, too.

WHITE: We anaesthetize them with M-S Triple 2 so we can handle them or these fish would not let us do what we're about to do to them. You'll see. Ready when you are.

The rain pounds down on an improvised shed outside Warm Springs Hatchery on Dry Creek, a tributary of the Russian River in northern Sonoma County.

WHITE: The first thing we do is scan the fish.

Since 2001, biologists here have been working with descendants of wild Russian River coho.

WHITE: She's really soft – she is ovulating.

They're trying to preserve the run's gene pool and rear fish to restore salmon to local streams.

The coho here are raised in tanks then spawned artificially. Ben White is the lead biologist for the "captive broodstock" program. He's examining female coho to see whether they're ready for the final act in their lives: reproduction.

WHITE: We go through these fish on a quarterly basis throughout their entire lives, ensuring adequate growth and health. When it comes time to spawn them, our geneticist constructs a breeding matrix for us, and it basically gives us a list of all of our females with a ranked list of males—the most preferable spawn partners for those females.

The offspring of these hatchery fish will be tagged, released into the wild, and tracked during their three-year life cycle.

Since releases started in 2004, more than 200,000 salmon smolts have been turned loose in creeks that flow into the Russian River. So far, just a few adults have made it back—this year a dozen or so, at last count. Charlotte Ambrose, the biologist coordinating the federal coho recovery effort, says that interventions like the broodstock program are important. But she adds that a coho comeback really depends on making creeks friendly for fish again.

AMBROSE: Salmon are very prolific and highly productive. And by a few simple acts in creating space and ensuring cool clean water in our watersheds, we can make huge changes to bring back the salmon.

Ultimately, she says, that's not a scientific choice based on fish biology, but a social decision about whether we can accommodate the needs of the coho.

For Quest, I'm Dan Brekke, KQED Radio News.