

Plight of the Yellow-Legged Frog Educator Guide

A resource for using QUEST video in the classroom



Listen to it online <http://www.kqed.org/quest/radio/plight-of-the-yellowlegged-frog> | 5:47 minutes

QUEST SUBJECTS

Life Science **Biology**
Health
Environment

Earth Science Geology
Climate
Weather
Astronomy

Physical Science Physics
Chemistry
Engineering

CA SCIENCE STANDARDS

Grade 6
Ecology (Life Sciences)
5. (c) Populations of organisms can be categorized by the functions they serve in an ecosystem.

Grade 7
Evolution (Focus on Life Sciences)
3. (e) Extinction of a species occurs when the environment changes and the adaptive characteristics of a species are insufficient for its survival.

Grades 9-12
Ecology (Biology/Life Sciences)
6. (b) Changes in an ecosystem result from changes in climate, human activity, introduction of nonnative species, or changes in population size.

Evolution (Biology/Life Sciences)
7. (d) Variation within a species increases the likelihood that at least some members of a species will survive under changed environmental conditions.

PROGRAM NOTES

Similar to a canary in a coalmine, with its dwindling populations and diminishing genetic diversity the Foothill Yellow-Legged Frog is an early indicator of an ecosystem gone wrong. However, a new habitat management program to implement changed water release policies from local dams just might give this frog and other species like it exactly what they need to make a comeback.



In this segment you'll find...

- ⦿ information about changes in yellow-legged frog populations and their habitats.
- ⦿ how dams affect the yellow-legged frog and other amphibious species.
- ⦿ changes in dam operations to help save the yellow-legged frog and other important species.

TOPIC BACKGROUND

A small stream-dwelling amphibian, the foothill yellow-legged frog is listed as "near threatened" by the World Conservation Union and as a "species of special concern" by the California Department of Fish and Game. Originally inhabiting a territory spanning from northern Oregon all the way down the California coast and into Baja California, Mexico, this frog has disappeared from nearly 50% of its historic range in California and is no longer found in more than half of its traditional Oregonian habitat. Nearly all of the foothill yellow-legged frogs once found in Southern California and the southern Sierra Nevada region are gone and the species has been decimated in Baja California.

Many things threaten the remaining population of foothill yellow-legged frogs, with most of the problems stemming from human activities. Habitat loss due to human encroachment, competition and predation from invasive animal species, disease, and logging are a few of the issues that affect the species. Mining and livestock grazing in what were traditionally riparian zones are also problems for these animals. In addition, these frogs are particular about their living quarters--they prefer to live in rivers and streams where flowing water still runs rather than in standing ponds or lakes. As such, the operation of numerous dams where this species has historically lived creates major issues for the foothill yellow-legged frog. This amphibious species lays its eggs in large clusters attached to rocks underwater. It may be anywhere between five and 30 days before they hatch, depending on water temperatures and other conditions. Because of this, the eggs can be vulnerable to any changes in the river or stream for quite some time. Water releases can flood and destroy whole clutches of frog eggs in one fell swoop, causing low birth rates in certain areas. The damming of a river can also cause low water downstream from a dam, sometimes leaving frog eggs exposed to the elements and unable to survive before the tadpoles have hatched. Another problem for the frog can be seen in places like the Trinity River Basin, where water temperatures near river fisheries are sometimes kept artificially low. This delays the development of the yellow-legged frog, keeping the eggs and tadpoles from maturing as quickly as possible and leaving them much more vulnerable to predators.

VOCABULARY

Amphibian

a cold-blooded, smooth-skinned vertebrate of the class Amphibia such as a frog or salamander that characteristically hatches as an aquatic larva with gills

Clutch

the complete set of eggs produced by birds or reptiles at a single time

Extinction

the death of an entire species

Genetics

the genetic makeup of an organism, type, group, or condition

Genetic Diversity

the variety of different types of genes in a species or population

Habitat

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

Resilience

the ability to recover from or adjust easily to misfortune or change

Tadpole

the limbless aquatic larva of a frog or toad, having gills and a tail

Watershed

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

PRE-VIEWING

- What role do frogs play in an ecosystem?
- What kinds of human activities might negatively impact frog populations?

VIEWING FOCUS

NOTE: You may choose to watch the television segment twice with your students: once to elicit emotional responses and get an overview of the topic and again to focus on facts and draw out opinions.

- What does the number of tadpoles in a creek or river indicate?
- Why are amphibians seemingly more susceptible to the destructive environmental habits of humans than other kinds of animals?
- How come varied DNA within a frog population is a good indicator for survival?
- Why are dams such a problem for yellow-legged frog populations? How are local dam operators proposing to help better protect these and other animals in the river ecosystem?

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 QUEST, PBS, and NPR

Is The Planet Facing A Mass Extinction? NPR

<http://www.npr.org/templates/story/story.php?storyId=126831134>

Are Earth's ecosystems on the brink of major change? This May 14, 2010 broadcast from NPR's **Talk of the Nation** discusses new research on shifting habitats and changing frog and lizard populations.

Scientists Search for Endangered Amphibians NPR

<http://www.npr.org/templates/story/story.php?storyId=129171090>

Where did all the frogs and toads go? This August 13, 2010 story from NPR's **Morning Edition** discusses the global hunt for possibly extinct species of frogs and toads in the hopes that some may still remain and that there is still hope for their kind.

Frogs: The Thin Green Line PBS

<http://www.pbs.org/wnet/nature/episodes/frogs-the-thin-green-line/introduction/4763/>

Recent discoveries show that more than a third of our planet's amphibians have already become extinct and more are headed that way. Explore the plight of frogs and their impact on the world's ecosystems in this episode from *NATURE*.

Hoover Dam and Hydroelectric Power Teachers' Domain

<http://www.teachersdomain.org/resource/phy03.sci.phys.energy.hooverelec/>

In this video segment adapted from *Building Big*, students will learn about Hoover Dam's hydroelectric capabilities and the environmental impacts of dams such as this one.

Ecosystem Teachers' Domain

<http://www.teachersdomain.org/resource/rr10.sci.living.eco.ecosys/>

This video shows how humans influence the delicate balance of nature in an ecosystem.

Discuss the Plight of the Yellow-Legged Frog story on the QUEST Blog QUEST

<http://www.kqed.org/quest/blog/2010/08/13/reporters-notes-a-frog-in-trouble-a-scientist-in-her-element/>

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www.exploratorium.edu

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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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This is the classic environmental story. A species in trouble because of what our species is doing. It's happening all over the world. But there are people tackling these problems one by one, coming up with simple ways of changing our behavior. This week we take a look at the plight of the foothill yellow-legged frog. Ari Daniel Shapiro reports.

On a sunny afternoon, biologists Jennifer Dever and Sarah Kupferberg wade ankle-deep into the Alameda Creek on the eastern side of the Bay. They're looking for foothill yellow-legged frogs. At the moment, all they're finding are tadpoles. Lots of tadpoles.

KUPFERBERG: Okay, got it.

How do you catch a tadpole?

KUPFERBERG: With your hands!

DEVER: Yeah, they'll just swim right into your hands if you're kind of patient; just put your hand in the right spot.

The team quickly captures about a dozen tadpoles.

All these tadpoles, they're a good sign that the creek's healthy, that the water's flowing just right, because this portion of the Alameda Creek isn't controlled by a dam. But the situation's much worse down-creek below the Calaveras dam and actually in many other rivers regulated by dams. A large water release can be disastrous for these frogs. Sarah Kupferberg.

KUPFERBERG: The frogs are pretty choosy; they'll find a rock that's kind of sheltered from flow to place their eggs. But if the volume of water comes up and it's moving too swiftly, the whole clutch can get detached from the rock.

The water can also wash away tadpoles. On the other hand, sometimes a dam is used to hold water, and so the river height drops. If this happens after the frogs have laid their eggs...

KUPFERBERG: The eggs can be left high and dry, and be stranded.

Foothill yellow-legged frogs have been wiped out from half of their historic range along the coast and in the Central Valley. It's an area that now contains 800 dams.

KUPFERBERG: Now the populations are just hanging on by a thread. The sizes are very small, the numbers are very few.

Finding out how many are left is where Jennifer Dever comes in. You see, she collects DNA from the toes and tails of frogs and tadpoles in rivers all over northern



California. And then she returns here, to her genetics lab at the University of San Francisco. Dever reaches into the fridge where she stores her samples and pulls out a tray with like a hundred tiny little tubes.

DEVER: Each one of these tubes represents a distinct frog. Its DNA is stored in here.

Dever looks to see how similar the DNA is between different individuals. The more varied the DNA, the bigger the population in a particular river. That's better for the frogs. Here's one way of thinking about it.

DEVER: If all of the shirts in your closet are short-sleeved white t-shirts, that's gonna be great if you're going to the beach and it's gonna be a hot day. But what happens when the fog rolls in? You're gonna be pretty cold.

Especially in San Francisco.

DEVER: Especially in San Francisco. So, it's nice to be able to have a jacket to put on or a sweatshirt.

The same goes for genetic diversity. The idea is that having options—having frogs that differ from one another genetically—gives the population a kind of resilience. So that if things do change in the environment, at least some of the frogs will survive.

And what Dever's found is that in rivers with dams, compared to those without, the frogs are more similar genetically. That means fewer frogs—less resilient populations.

But dam operators have a lot of things to consider.

RITCHIE: We can protect the environment and supply the needs of people. It can be done; it will be done.

Steve Ritchie is with the San Francisco Public Utilities Commission, which oversees the Alameda Creek watershed and provides drinking water to San Francisco and parts of the South Bay. He says the mindset is shifting away from dams only addressing the water needs of people.

RITCHIE: The yellow-legged frog is an important species in this watershed, but there are many others as well. We're looking at now structuring releases from our dam in the Alameda Creek watershed to benefit the species that inhabit the creek. There are different flow levels that benefit different species.

Under a new habitat management plan, Ritchie and his team intend to use 82 years of historic flow rates of the Alameda Creek to better mimic the natural ups and downs of the water level. It's a solution aimed at balancing the needs of both people and the ecosystem.



Back at Alameda Creek, the tadpoles cruise around our submerged feet. These little guys look plump and healthy. But the fate of frogs, toads, newts—that is, amphibians in general— isn't good. Again, biologist Jennifer Dever.

DEVER: We believe that amphibians are a little bit more sensitive to human impacts than, say, birds or mammals because, you know, they have to live part of their life in water and part of their life on land. The pace of extinction has accelerated to a point where it's in crisis mode. There's something disastrous going on and we're losing.

Dever sees the foothill yellow-legged frog as a canary in the coalmine, an early indication of an ecosystem gone wrong. But changing how dams release water could give this frog and other amphibians just the foothold they need to make a comeback.

For QUEST, I'm Ari Daniel Shapiro.