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A report for land managers on recent developments in forestry research at the three western Experiment Stations of the Forest Service, U.S. Department of Agriculture.

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Since the 1800's, non-native fish have been stocked in high-elevation lakes that dot the Sierras of California. Scientists with the Pacific Southwest Station have sampled more than 2,200 of these lakes, and found that, while the fishing may be good, these non-natives are impacting other wildlife, such as this mountain yellow-legged frog. Researchers believe the frog may be an indicator species whose absence can signal a loss of biodiversity in a lake. Read more about their research, beginning on the next page.

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Frogs or Fish???

by Connie Gill and Kathleen Matthews, Pacific Southwest Station

Mountain yellow-legged frog.

For more than 150 years, high elevation Sierran lakes have been stocked with non-native fish for recreation fishing opportunities. The long-term impacts of this action have not been known, and good information was necessary to assess the situation. For this reason, a comprehensive inventory of these lakes was initiated by the Pacific Southwest Region, with researchers from Pacific Southwest Research Station (PSW), and the University of California Santa Barbara's Sierra Nevada Aquatic Research Laboratory (SNARL) doing the sampling/data collection work. The inventory was funded by Region 5, Fish and Wildlife Program of the National Forest System.

Kathleen Matthews an aquatic ecologist with PSW, and Roland Knapp of SNARL are the main investigators conducting this arduous project which has been in progress for the last three years.

"It has been the most comprehensive survey that's ever been done in the Sierra at these high elevations," Matthews said. "I'd say probably the most comprehensive survey that's ever been done anywhere on the impacts of introduced fish at high elevations."

The survey was conducted high in the Sierras where snow can sometimes be found year-round. Initiated in 1995, each summer the work began as soon as the snow melted enough to hike in. Those conducting the field surveys packed in all of their supplies including sampling bottles, tents, nets, and personal supplies. This was no easy feat at 9,500 to 12, 000 feet elevation.

"It's really hard work carrying around heavy packs in thin air," said Matthews. "In the John Muir Wilderness we couldn't use helicopters or anything like that to drop in our supplies because the wilderness must be protected. However, in Kings Canyon National Park the park Service dropped off some of our equipment at ranger cabins. They even flew in some stuff for us and it really helped a lot."

In the John Muir Wilderness and in Kings Canyon National Park, data were collected from more than 2,200 lakes. The main focus of the study was to discover where the fish, invertebrates, and amphibians are, trying to get an idea of the impacts of fish stocking in these areas.

The large-scale sampling is completed and it appears that at present, there is an overwhelming amount of data, so much that when the computer file gets moved around it usually brings down the IBM system at PSW.

"The most dramatic result we've seen is the impact of introduced fish on mountain yellow-legged frogs," said Matthews. "Mountain yellow-legged frogs may be an indicator species whose absence can signal a loss of biodiversity in a lake."

It appears that trout and frogs cannot both live in the same lakes, for if there are trout in lakes there are rarely any frogs or tadpoles. The developmental stages of this frog are important, it remains a tadpole for up to four years, confining it to the same habitat as that of the trout, thus more vulnerable to being devoured. Actually, the fish eat tadpoles and adult frogs. During the sampling, fish caught in gill nets had tadpoles and adult frogs in their stomachs. These frogs are small, adults are about the size of a fifty-cent piece.

High elevation Sierra lake.

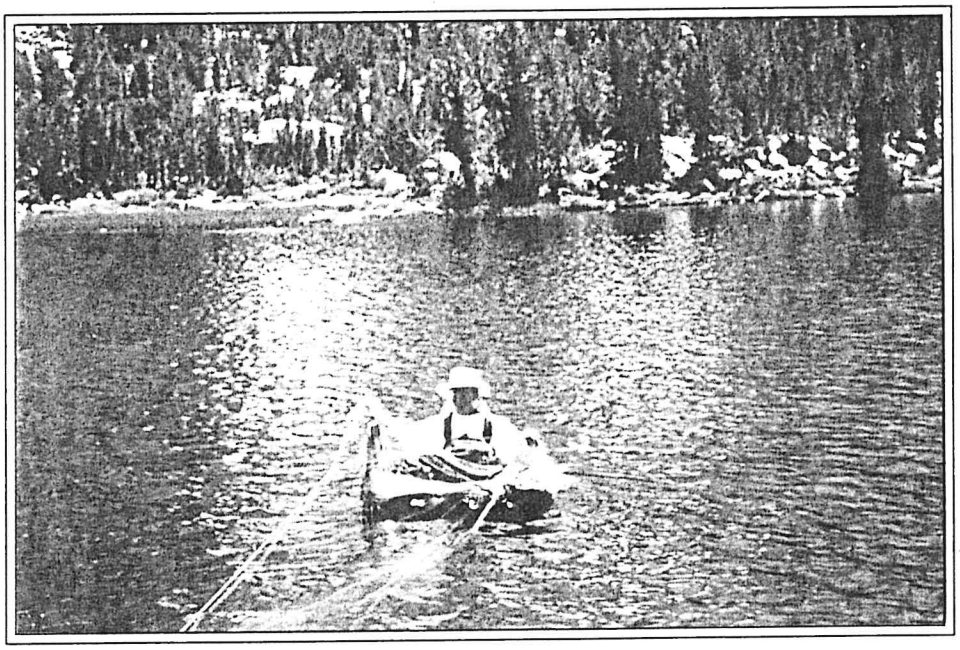
"There is no question that the decline of the mountain yellow-legged frog is dramatic, and there is no question that trout are playing an important role in mountain yellow-legged frog declines."

Many people mistakenly believe that fish in these lakes are native. However, there aren't any lakes in these areas with naturally occurring fish.

Some of the fish used to stock these lakes were also non-native to California such as the brook and brown trout. At first it was pretty experimental. The trout did survive quite well and for the most part are self-sustaining, reproducing in the lakes.

"If stocking was stopped tomorrow, there would still be fish in Sierra Nevada lakes for many, many years," said Matthews. "I suppose the second most dramatic result is that the majority of lakes support self-sustaining fish populations."

High Sierra lakes in the John Muir Wilderness are still being stocked with trout, and those in Kings Canyon National Park where stocking has been eliminated, were compared: 1,079 lakes were sampled in the John Muir Wilderness with mountain yellow-legged frogs in 56 lakes (5 percent); in Kings Canyon National Park, 1,083 lakes were sampled with frogs in 370 lakes (35 percent). Historically, frogs were common in both areas. In fact, early-recorded information indicated sightings of frogs in nearly every lake in the Sierra.



Today, in the John Muir Wilderness, the frogs have been almost eliminated because of stocking, and they have declined markedly in other places in the Sierra, especially in the Desolation Wilderness and other high elevation areas that are currently being stocked.

Setting the gill nets.

In Kings Canyon, fewer lakes were stocked than in Wilderness lakes, and in 1977 most stocking was stopped within the Park. With fewer lakes originally stocked and with the end of stocking in Kings Canyon, there are fewer fish. They are reproducing, but there are not as many to feast on the frogs.

Knapp said if nothing is done to prevent further decline, the mountain yellow-legged frog is likely to be listed under the federal Endangered Species Act, which would trigger federal actions.

"We believe introduced trout are playing a very significant role in the decline of the mountain yellow-legged frog," Knapp said. He also indicated that other elements were also suspect and being investigated such as acid rain, pesticide drift, and ultraviolet light.

An interesting fishery aspect is that there's fewer but larger fish in Kings Canyon, and in the John Muir Wilderness there are more stunted fish from years of continuing to stock without any real evaluation of whether they need to continue the practice or not. There's not enough food for the fish, they reproduce like crazy, and so there's a lot of tiny snake-like fish in the lakes.

There's a lot of sport fishing pressure in the high Sierras. More investigation into the effects of fish stocking is needed to determine what is necessary to sustain biological diversity in these areas. Currently, plans are underway to recommend management changes (fewer stocked lakes) that will be evaluated through an adaptive management project. Matthews and Knapp are proposing that, to protect frog populations, fish stocking should be terminated in some lakes, and fish should be removed through the use of gill nets. However, because stocking is controlled by the California Department of Fish and Game, it will have to approve any management changes.

Another proposal is a working conservation agreement for the mountain yellow-legged frog, to prevent its ESA listing.

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