Frequently Asked Questions:

Lactococcus garvieae and _Lactococcus petauri_ outbreaks in Southern California and Eastern Sierra fish hatcheries

Updated April 2022

California Department of Fish and Wildlife (CDFW) hatcheries in Southern California and the eastern Sierra continue to fight bacterial outbreaks of *Lactococcus garvieae and Lactococcus petauri* (*Lactococcus spp.*) among some fish stocks. Prior to 2020 this disease was previously unknown in California, and CDFW staff have been trying multiple treatments and strategies to try to resolve the outbreaks since 2020. Consequently, CDFW has decided on a scientific approach to stock fish in accordance with fisheries biologists' recommendations. Diseased fish will be euthanized.

What is this bacterium, and how does it harm fish?
Lactococcus spp. are similar to *Streptococcus spp*. The bacterium has caused disease in freshwater and saltwater aquaculture facilities around the world, although 2020 was the first time it was detected in California. *Lactococcus spp.* can cause a blood-borne disease with symptoms including anorexia, bulging eyes with hemorrhaging around the edges, lethargic or erratic swimming, darkening of the skin, swollen abdomens and increased mortality. Infected fish may also show no signs of infection depending on several factors, including water temperature and stress.

When was the bacterium discovered, and which CDFW hatcheries are affected?
The *Lactococcus spp.* bacteria is known to be present in the U.S. but to date has only been identified in a handful of aquaculture facilities. It had not been found in California, either in aquaculture facilities or in the wild, prior to its discovery at the Mojave River Hatchery in late April 2020. That hatchery was immediately placed on quarantine. CDFW pathologists and hatchery staff have been battling the outbreak from late April 2020 to the present. CDFW pathologists identified *Lactococcus spp.* in the Fish Springs and Black Rock Fish hatcheries on June 25, 2020. Fish Springs and Black Rock hatcheries were immediately quarantined. Due to its proximity to the positive Eastern Sierra hatcheries, Hot Creek Hatchery was also quarantined. Extensive testing at Hot Creek Hatchery revealed it to be free of the bacteria and the quarantine was lifted on June 25, 2020.

After depopulation and cleaning of the three hatcheries as well as development of a series of new vaccines, all three hatcheries were cleared to begin repopulating and planting fish fall of 2021. Unfortunately, *Lactococcus spp.* was again discovered in April of 2022 at Black Rock and Fish Springs hatcheries as part of the enhanced testing enacted at the two facilities for larger fish that had not yet received the injection vaccination. Fish at Mojave River Hatchery have received the injection vaccination and continue to test negative.

Do we know the source of the original outbreak? How might it have come to California?
Pathologists do not know the source of the original outbreak at the three hatcheries. DNA analysis revealed that the strain is an exact DNA match to one found in fish farms in Central Mexico. Our current hypothesis is that it was carried into the hatchery by birds that picked it up from an environmental source as they utilized the pacific flyway. The presence of the bacteria has been confirmed in bird feces at the hatcheries.

Are bacterial outbreaks common among fish?
Disease outbreaks of different types are not uncommon in fish hatcheries. Most fish pathogens are present in the lakes and rivers of the state and come into hatcheries with the water. They only cause infection and disease when conditions such as elevated water temperatures or crowding stress tilt in their favor. Hatchery staff are trained to recognize sick fish and consult with CDFW veterinarians to treat illnesses as needed. What is unusual about this outbreak is that this pathogen is new in California. Further complicating the treatment of the fish is that the bacteria is resistant to most of the few antibiotics approved by the U.S. Food and Drug Administration for treating fish in aquaculture.

We have developed a two-stage vaccine that has shown to be effective in preventing significant disease outbreaks. The first stage is an immersion vaccination that is used on small fish. The immersion vaccination provides low-level immunity and is intended to give the fish resistance until they are large enough to receive a vaccine dose through an intramuscular injection (the second stage). The immersion vaccination only provides immunity for a short period of time so both vaccinations are needed to provide the highest level of protection.

What is CDFW doing to monitor for outbreaks in other hatcheries?
CDFW has a comprehensive fish health program. Hatchery staff observe their fish multiple times daily for signs that they are not well. Signs of illness include loss of appetite, darkening of their skin, change in behavior or elevated mortalities. When these signs are observed, the hatchery managers will call the CDFW Fish Health Laboratory to have a fish pathologist or veterinarian come to the hatchery and perform a diagnostic examination to determine the cause of the illness. The Fish Health Lab pathologists also perform routine examinations to confirm the well-being of fish at all CDFW fish hatcheries, even when no illness is apparent. This is how the infections at Black Rock Hatchery and Fish Springs Hatchery were identified (the bacteria were cultured from fish showing no obvious signs of disease).

Since the initial detections and repopulations of fish at the three hatcheries, CDFW has implemented an enhanced monitoring program to detect outbreaks prior to fish showing symptoms of disease.

How are you going to prevent reinfection of the fish you bring back to the hatchery?
The primary prevention method will be through implementation of the vaccination program. Fish at Mojave River Hatchery have received both the immersion and injection vaccine and have remained bacteria-free. The fish that tested positive at Black Rock and Fish Springs hatcheries had only received the immersion vaccine. Staff attempted to administer the injection vaccine this winter, however the cold weather caused difficulties with that process. With the warming weather juvenile fish that are slated for planting in 2023, and have already been given the immersion vaccine, will get the injection vaccine as soon as they are large enough.

What trout hatcheries do not have the bacteria?
There are currently seven other trout production hatcheries and two planting bases still in operation. These facilities mainly serve waters in the central and northern portions of the state from the west side of the Sierra Nevada mountains to the Pacific coast. Two of the seven hatcheries not currently under quarantine, Fillmore Hatchery and Mojave River Hatchery serve Southern California waters. However, Fillmore and Mojave are just coming back online after an extended closure due to infrastructure or *Lactococcus* issues, respectively. Fillmore and Mojave

are expected to have a limited number of fish to stockable size for the planting seasons in Southern California.

Where have scheduled fish plants been affected, due to this current outbreak?
Fish Springs and Black Rock hatcheries are responsible for stocking most of the waterways in the eastern Sierra and Southern California. The counties affected include:

- Inyo
- Mono

Fish will still be stocked in these counties in 2022 with the locations and stocking events dependent on availability, water temperature and connectivity.

Hot Creek Hatchery is conducting their normal plants to waters they serve in Inyo and Mono counties. Those waters include:

- Owens River Sections I, II and III
- Crowley Lake
- Pleasant Valley Reservoir
- Bishop Creek Lower
- Lone Pine Creek
- Diaz Lake

Can CDFW make up for the canceled plants with fish from non-infected hatcheries?
CDFW initiated a phased priority stocking plan for Eastern Sierra and Southern California. CDFW will focus on planting high-use hydrologically connected waters with surface water temperatures below 62 degrees F°. Over the last two years CDFW reallocated over one million fish to enhance angling opportunity, including planting over 30,000 sub-catchable brown trout and 125,000 sub-catchable rainbow trout from northern California hatcheries to Eastern Sierra waters. These fish are intended to be “put and grow” and available to anglers for the spring 2022 trout opener.

Why are some waters being stocked and some are not?
To prevent bacteria spread into new areas, CDFW will focus on planting high-use hydrologically connected waters with acceptably cool surface water temperatures from Black Rock and Fish Springs hatcheries. Waters that do not meet this criterion will be stocked from other facilities but on reduced basis based on priority and availability.

Are there concerns that infected hatchery fish could have been planted prior to detection of the bacteria?
While CDFW does not plant diseased fish, it’s possible some locations were planted with fish carrying the bacteria but not showing any outward signs or symptoms of bacteria from these hatcheries prior to the confirmation of *Lactococcus spp*. This pathogen is known to occur in the environment in the Pacific Northwest, including in the Columbia River. It has also been found in fish hatcheries in Indiana, Missouri, North Carolina, the Northeast U.S. and Mexico.

Can humans or other animals get sick from this bacterium? Should people take extra precaution if eating fish they catch?
There is limited evidence *Lactococcus spp.* bacteria has been passed to humans, but fish-to-human transmission is extremely rare. Freshwater fish, including wild and hatchery trout, can carry several pathogens that could cause illness in people and dogs if consumed raw. As

always, anglers should follow USDA recommendations on cooking fish to an internal temperature of 145 degrees F° and no trout or salmon should be fed to dogs.

What is the long-term plan for hatchery repopulation and stocking?
Mojave River Hatchery has fish on hand to begin limited planting. Both Black Rock and Fish Springs have juvenile fish at the hatcheries that will be ready for planting at their normal planting locations starting in 2023.