FAQ for *Lactococcus garvieae* outbreak in Southern California fish hatcheries
June 30, 2020

Several California Department of Fish and Wildlife (CDFW) hatcheries in Southern California and the eastern Sierra are currently experiencing a bacterial outbreak in the fish stocks. Hatchery fish are currently quarantined and stocking efforts have been temporarily halted so the fish can be treated and staff can prevent the spread of the bacteria.

What is this bacteria, and how does it harm fish?
This is an outbreak of *Lactococcus garvieae*, which is similar to streptococcus. The bacterium has caused disease in freshwater and saltwater aquaculture facilities around the world, although this is the first time it has been detected in California. *Lactococcus garvieae* 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, or be asymptomatic and show no signs of infection depending on a several factors including water temperature and stress.

Which CDFW hatcheries are affected, and when was it discovered in California?
The *L. garvieae* bacteria is known to be present in the U.S. but to date has only been identified in a handful of aquaculture facilities. Its first discovery in California was at the Mojave River Hatchery in late April 2020 and the hatchery was immediately placed on quarantine. All sizes of rainbow trout at the facility have been affected, and total mortalities to date are approximately 50,000 with more likely to succumb to the bacteria. CDFW pathologists identified similar bacteria in in the Fish Springs and Black Rock Fish hatcheries on June 19 and they were confirmed as *Lactococcus garvieae* on June 25. All of the fish at these hatcheries are currently under quarantine and stocking efforts have been temporarily halted. As a precautionary measure, Hot Creek Hatchery, which is in the same vicinity as Black Rock and Fish Springs, was also placed under quarantine on June 19, until samples could be tested for the bacteria. On June 25, test results from Hot Creek Hatchery were found to be negative for *L. garvieae* and the quarantine at this facility was lifted.

Do we know the source of the original outbreak? How might it have come to California?
L. garvieae has not previously been found in California, either in aquaculture facilities or in the wild. Pathologists do not know the source of the original outbreak at Mojave River Hatchery. This bacterium is usually spread by movement of fish or eggs, but we do not believe that is the case for Mojave. Our current thought is that it was carried into the hatchery with birds that picked it up from an environmental source. We have quarantined the hatcheries out of caution until we can determine if the bacteria is also present in waters in the areas we plant.

How quickly, and through what means, is it known to spread?
Fish can be infected with the bacteria, but not be diseased by it, at water temperatures up to 59 degrees. At temperatures above 59 degrees, the bacteria can become pathogenic for fish. The bacteria can be spread between hatcheries or other water sources through movement of infected fish or eggs. Contaminated equipment (nets, buckets, boots, etc.) may also be capable of spreading it. Once it has spread into a hatchery and a fish becomes infected, it easily spreads from fish to fish.

How many CDFW hatchery fish have been infected to date?
There are approximately 860,000 rainbow trout at Mojave River Hatchery, ranging in size from fry and fingerlings to catchable fish. Currently, 10 of 16 groups representing the majority of fish onsite have been infected.

CDFW Fish Health Laboratory staff are currently assessing the prevalence of infection at Fish Springs Hatchery and Black Rock Hatchery. Early evaluations suggest most fish may be infected at those two facilities. Black Rock Hatchery has approximately 700,000 rainbow trout and Fish Springs Hatchery currently has approximately 1.5 million rainbow, cutthroat, brown and Eagle Lake trout. CDFW pathologists believe the lower water temperatures at Fish Springs Hatchery and Black Rock Hatchery are limiting the level of disease and mortality below what Mojave River Hatchery has experienced to date.

How is CDFW treating the infected fish? And what are the odds that the infected fish could recover?
CDFW fish pathologists and veterinarians are currently treating the fish at Mojave River Hatchery with antibiotics and immune-stimulating feed. We can't estimate the odds of recovery at this time, but staff are doing everything possible to aid in the recovery of these fish. Fish Springs Hatchery and Black Rock Hatchery were confirmed to have *L. garvieae* on June 25. We hope early treatment will help prevent an outbreak of disease (the fish there do not have overt disease at this time). They may be healthy carriers of the bacteria due to the cooler water temperatures at those hatcheries. Our hope is antibiotic therapy will effectively eliminate the infection.

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 they work with CDFW veterinarians to treat sick fish as needed. What's unusual about this particular 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 FDA for treating fish in aquaculture. The bacteria shows moderate susceptibility to one antibiotic available for use so we hope that it will help the fish clear the infection and recover.

What other control methods may be employed?
If treatment is unsuccessful, we have two options:

- If we can demonstrate through eDNA survey work that this bacteria is already widespread in the environment in the Eastern Sierra Nevada and Southern California, healthy carriers of the *L. garvieae* bacterium could still be released without a negative impact on the environment.
- If widespread environmental presence of *L. garvieae* bacterium cannot be determined, then the hatchery fish will have to be euthanized.

What's the projected cost of treatment?
Total costs are difficult to project until we see how well fish at Fish Springs Hatchery and Black Rock Hatchery respond at their lower water temperatures. Treatment could include medicated and immune system boosting food and pathology sample analysis, with costs over several hundred thousand dollars. The cost of antibiotic feed at Mojave River Hatchery alone has

already exceeded $75,000 in less than two months; additional expenses, including laboratory analysis, are accumulating. Despite our best efforts the bacteria is still present and mortality at Mojave River Hatchery continues.

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 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).

What waterways were scheduled to be planted that aren't going to be planted due to this outbreak?
Mojave River Hatchery was scheduled to stock multiple waterways in Southern California's higher elevation waters, from now through October. The number of waterways affected, by county, include:

- Los Angeles (1)
- San Bernardino (8)
- Riverside (1)
- San Diego (2)
- Orange (1)
- Ventura (0)
- Santa Barbara (0)

An additional 63 lower elevation waterways that would normally be stocked in the winter months (November through April) will not likely receive their scheduled plants.

Also, between 59-67 roadside waters in Inyo and Mono counties that are traditionally stocked by Fish Springs Hatchery and Black Rock Hatchery are likely to not receive plants this year.

When did CDFW stop stocking fish from the affected hatcheries?
The last plants from the Mojave River Hatchery were on May 1. Stocking operations at Fish Springs Hatchery and Black Rock Hatchery were halted when those facilities were placed under quarantine on June 19.

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 appears 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 *L. garvieae*. This pathogen is known to occur in the environment in the Pacific Northwest, including in the Columbia River. CDFW fish pathologists are currently exploring the likelihood that the bacteria has been introduced to waterways outside of the hatcheries by an unrelated source (for example, avian transmission).

Can humans get sick from this bacteria? Should people take extra precaution if eating fish they catch?
The *L. garvieae* bacteria has been passed to humans in rare cases, but fish-to-human transmission is unlikely. As always, anglers should follow U.S. Food and Drug Administration recommendations on cooking fish to an internal temperature of 145 degrees.

Are there any hatcheries that are not quarantined?
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 westside of the Sierra to the coast. One of the seven hatcheries not currently under quarantine, Fillmore Hatchery, does serve some Southern California waters. However, the number of fish that facility can produce is low, and they are just coming back online after an extended closure due to infrastructure issues. Fillmore is not expected to have fish of plantable size until at least the end of summer.

Can CDFW make up for the canceled plants with fish from non-infected hatcheries?
In some cases, we can partially make up for a hatchery shutdown by diverting fish from another hatchery that were destined to be planted in a lower priority area. CDFW was in the process of doing just that by reallocating fish from Black Rock Hatchery and Fish Springs Hatchery to waters traditionally stocked by Mojave River Hatchery, when we had to quarantine those facilities as well. At this point, four of our largest production hatcheries in the state are unexpectedly shut down, along with a couple others that are not yet at full production due to recovery from infrastructure problems and a major flood. There is no way to make up that level of fish production. Diverting fish to these waters usually stocked by Mojave River Hatchery would mean not stocking fish in other high priority and high use waters in other parts of the state. In addition, the cost to move fish from the northern California hatcheries to Southern California and eastern Sierra waters would be exorbitant and require many overnight trips for staff while the state is still under travel restrictions due to COVID-19.

If large numbers of fish must be euthanized this year, what's the long-term projection for future year stocking?
Depending on water temperatures and fish density, rainbow trout can take anywhere from 10 months to two years to get to a catchable size of a half-pound. We typically have rainbow trout eggs available in the state December through March. If we have to totally depopulate and euthanize all fish at Mojave River Hatchery, for example, we wouldn't start having catchable size fish ready at that facility until this December or January of 2021. Based on previous experience in having to depopulate hatcheries in the Central Valley during the drought, we know that it can take up to three years to get the hatchery fully back up to pre-depopulation production levels and meeting their fish planting targets. We may have the potential to transfer small fish from other clean facilities to help give a jump start but that is something we will need to look into further.

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